



VIIth International Conference in
Hybrid Mode on

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GRISAAS-2022

Global Research Initiatives for Sustainable Agriculture & Allied Sciences

21-23 NOVEMBER 2022

Souvenir & Conference Book (GRISAAS-2022)

Chief Editor
Dr. S.P. Singh



Organized By

Astha Foundation, Meerut (U.P.) INDIA

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ISBN No. : 978-81-958010-1-5

A Souvenir & Conference Book Brought out on the occasion of
VIIth International Conference in Hybrid Mode on
**GLOBAL RESEARCH INITIATIVES FOR
SUSTAINABLE AGRICULTURE & ALLIED SCIENCES
(GRISAAS-2022)**

21-23 November 2022

Organized By

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In Collaboration with

Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (U.P.) INDIA

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Society for Scientific Development in Agriculture & Technology, Meerut (U.P.) INDIA

Chief Editor

Dr. S.P. Singh

Scientist (Plant Breeding)

CSA University of Agriculture & Technology, Kanpur (U.P.) India

Printing By : **Sudhakar Mudranalaya, Garh Road, Meerut (U.P.)**

Ph. : 0121-4035970, 4028969

Published by :



Astha Foundation, Meerut (U.P.) INDIA

Suman Villa, 85, Phool Bagh Colony, Main Road, Meerut-250002

Mob. : 08273775051, 09450068438

Composed and Compiled by : Yash Computers, Meerut (U.P.) Mob. : 08979897661

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SOUVENIR & CONFERENCE BOOK

Chief Editor

Dr. S.P. Singh

Scientist Plant Breeding, CSAUAT-ARS, Kalai, Aligarh (U.P.) India

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नरेन्द्र सिंह तोमर
NARENDRA SINGH TOMAR

कृषि एवं किसान कल्याण,
ग्रामीण विकास और पंचायती राज मंत्री
भारत सरकार
कृषि भवन, नई दिल्ली

MINISTER OF AGRICULTURE & FARMERS WELFARE
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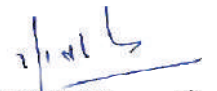


MESSAGE

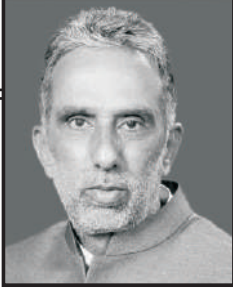
It gives me immense pleasure that the **Astha Foundation**, Meerut (U.P.) India is organizing a three days VIIth International Conference in Hybrid Mode on “**Global Research Initiatives for Sustainable Agriculture and Allied Sciences (GRISAAS-2022)**” in Collaboration with CSAUAT, Kanpur, U.P.; BAU, Ranchi, Jharkhand; SKRAU, Bikaner, Rajasthan; RLBCAU, Jhansi, U.P.; ICAR-CIFE, Mumbai, Maharashtra; AFU, Rampur, Chitwan, Nepal; NPU, Palamu, Jharkhand; RK (PG) College, Shamli, U.P. and Society for Scientific Development in Agriculture and Technology, Meerut (UP) India, during 21-23 November, 2022.

I hope the issues pertaining to various aspects of science and technology and their dissemination to the end user will be deliberated and discussed by the delegates, at length, during the conference in order to come out with certain adoptable low-cost, location specific recommendations for the benefit of the people at global level.

I convey my best wishes for great success of the conference and complement to organizers.


(Narendra Singh Tomar)

कृष्ण पाल गुर्जर
Krishan Pal Gurjar



सामाजिक न्याय और अधिकारिता राज्य मंत्री
भारत सरकार
**MINISTER OF STATE FOR
SOCIAL JUSTICE & EMPOWERMENT
GOVERNMENT OF INDIA**

MESSAGE

It is a great to welcome you all to the **VIIth International Conference in Hybrid Mode on Global Research Initiatives for Sustainable Agriculture and Allied Sciences (GRISAAS-2022)** which is being held during 21-23 November 2022 Organized by Astha Foundation, Meerut in collaboration with CSAUAT, Kanpur, U.P.; BAU, Ranchi, Jharkhand; SKRAU, Bikaner, Rajasthan; RLBCAU, Jhansi, U.P.; ICAR-CIFE, Mumbai, Maharashtra; AFU, Rampur, Chitwan, Nepal; NPU, Palamu, Jharkhand; RK (PG) College, Shamli, U.P. and Society for Scientific Development in Agriculture and Technology, Meerut (UP) India.

India has undergone a series of ups and down in agriculture production and food security playing havoc in the year of abnormality. Food Security in India can be achieved by playing higher attention to such as climate change, integrated water management, use the advanced agricultural techniques and pricing etc. New technologies will be make it possible for sustainable agriculture.

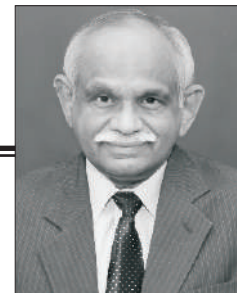
I express my sincere thanks to the organizers for organize such kinds of International Conference to exchange the idea for the growth of Agriculture.

Krishan Pal Gurjar



National Academy of Agricultural Sciences

Prof. Anil Kumar Singh
Vice-President



MESSAGE

It is a matter of great pleasure to know that **Astha Foundation, Meerut** in collaboration with CSAUAT, Kanpur, U.P.; BAU, Ranchi, Jharkhand; SKRAU, Bikaner, Rajasthan; RLBCAU, Jhansi, U.P.; ICAR-CIFE, Mumbai, Maharashtra; AFU, Rampur, Chitwan, Nepal; NPU, Palamu, Jharkhand; RK (PG) College, Shamli, U.P. and Society for Scientific Development in Agriculture and Technology, Meerut are organizing a three days VIIth International Conference in Hybrid Mode on **“Global Research Initiatives for Sustainable Agriculture & Allied Sciences (GRISAAS-2022)”** during 21–23 November, 2022.

Agriculture is no longer an activity for subsistence only it has to be considered as a commercial enterprise in which profitability and sustainability are both equally vital. Farming has to be technology driven with a clear cut focus on reducing cost of cultivation and enhancing productivity and quality of produce. It has to be knowledge based. Without application of science and technology in agriculture and allied fields, the sustainability would remain uncertain considering the challenges being faced by the Agriculture sector worsen by the climate change impacts. It requires a multi- pronged approach to manage natural resources sustainably, enhanced productivity link the production system to storage, processing & value addition and marketing in order to make the entire system, vibrant and employment oriented. I feel that in this conference, the learned delegates will deliberate on burning issues and challenges facing the farming community with emphasis on small and marginal farmers and come out with tangible suggestions. I hope that the outcome of the Conference will help in developing strategies and an action oriented road map to promote sustainable and profitable agriculture.

I wish the conference a grand success and congratulate the organizers for their judicious planning and hard work in making this kind of academic interface.


(A.K.Singh)



बिरसा कृषि विश्वविद्यालय BIRSA AGRICULTURAL UNIVERSITY

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Kanke, Ranchi - 834006, Jharkhand (INDIA)

डॉ. ओंकार नाथ सिंह
Dr. Onkar Nath Singh
कुलपति
Vice-Chancellor



Ref. No. :

Date :

MESSAGE

Innovations can only have the answers to plateauing yield stagnation in crop productivity levels. With Challenges in several fronts as reduced land availability and increased demand for food production, crop production is being intensified through higher fertilizer inputs and cropping. The increase in production has to be achieved under conditions of declining and deteriorating land, soil and water resources and at the same time preserving the environmental quality. It will be indeed difficult to meet these daunting challenges only with the application of conventional techniques and tools, as no headway is being made through these approaches. To address the emerging challenges opportunities have to be identified to meet crop production and productivity targets so that the novel variability can be created and harnessed across the species and kingdoms. It is in this context, the three days VIIth International Conference in Hybrid Mode on “**Global Research Initiatives for Sustainable Agriculture & Allied Sciences (GRISAAS-2022)**” organized by **Astha Foundation**, Meerut (U.P.) in collaboration with CSAUAT, Kanpur, U.P.; BAU, Ranchi, Jharkhand; SKRAU, Bikaner, Rajasthan; RLBCAU, Jhansi, U.P.; ICAR-CIFE, Mumbai, Maharashtra; AFU, Rampur, Chitwan, Nepal; NPU, Palamu, Jharkhand; RK (PG) College, Shamli, U.P. and Society for Scientific Development in Agriculture and Technology, Meerut (U.P.) during 21–23 November, 2022.

The conference will provide a common platform for all the stake holders to share their Innovations/experiences and expertise to better understand the challenges posed by emerging problems in agriculture and to fine-tune future strategies/approaches for addressing such stresses in different areas of agriculture and allied sciences. I convey my greetings and best wishes to organizers and delegates for their joint venture for the success of these three days International Conference.

(O.N. Singh)

नीलाम्बर-पीताम्बर विश्वविद्यालय



Nilamber-Pitamber University

प्रो. (डॉ.) राम लखन सिंह
कुलपति

Prof. (Dr.) Ram Lakhan Singh
Vice-Chancellor



Mobile : 8092870077 / 9415716591
Email : vcnpu09@gmail.com
website : www.npu.ac.in

Date:

MESSAGE

It is a matter of great pleasure to know that **Astha Foundation, Meerut** in collaboration with CSAUAT, Kanpur, U.P.; BAU, Ranchi, Jharkhand; SKRAU, Bikaner, Rajasthan; RLBCAU, Jhansi, U.P.; ICAR-CIFE, Mumbai, Maharashtra; AFU, Rampur, Chitwan, Nepal; NPU, Palamu, Jharkhand; RK (PG) College, Shamli, U.P. and Society for Scientific Development in Agriculture and Technology, Meerut are organizing a three days VIIth International Conference on “**Global Research Initiatives for Sustainable Agriculture & Allied Sciences (GRISAAS-2022)**” during 21–23 November, 2022 in hybrid mode at BAU, Ranchi, Jharkhand, India.

Agriculture is the most important sector of Indian Economy which employs more than half of the population in country. It is also known as the backbone of economy contributing about 16% of total GDP and 10% of total exports in India's economy. There are ample evidences available that relatively low productivity in our agriculture is due to suboptimal performance related to management aspects rather than low potential. Therefore, the developing countries like us, having optimal potential in the field technology and services will have to take strong step towards second green revolution. I am findings during the event will certainly make a far-reaching impact on our agriculture system.

I am sure that this event will open new facets and dimensions to bring solutions of the alarming issue before scientific community working to wards food security of India.

I express my warm greeting on the occasion and extend my best wishes to the organizers.

(Ram Lakhan Singh)



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भा.कृ.अनु.प.-केन्द्रीय मात्स्यिकी शिक्षा संस्थान, मुंबई
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कृषि एवं किसान कल्याण मंत्रालय, भारत सरकार, Ministry of Agriculture and Farmers Welfare, Govt. of India



डा. रविशंकर सी.एन.

निदेशक / कुलपति

Dr. Ravishankar C.N.

Director / Vice Chancellor



MESSAGE

Innovations can only have the answers to plateauing yield stagnation in crop productivity levels, with challenges in several fronts as reduced land availability and increased demand for food production, crop production is being intensified through higher fertilizer inputs and cropping. The increase in production has to be achieved under conditions of declining and deteriorating land, soil and water resources and at the same time preserving the environmental quality. It will be indeed difficult to meet these daunting challenges only with the application of conventional techniques and tools, as no headway is being made through these approaches. To address the emerging challenges opportunities have to be identified to meet crop production and productivity targets so that the novel variability can be created and harnessed across the species and kingdoms. It is in this context, the of three days VIIth International Conference in hybrid mode on “**Global Research Initiatives for Sustainable Agriculture & Allied Sciences (GRISAAS-2022)**” organized by **Astha Foundation, Meerut** in collaboration with CSAUAT, Kanpur, U.P.; BAU, Ranchi, Jharkhand; SKRAU, Bikaner, Rajasthan; RLBCAU, Jhansi, U.P.; ICAR-CIFE, Mumbai, Maharashtra; AFU, Rampur, Chitwan, Nepal; NPU, Palamu, Jharkhand; RK (PG) College, Shamli, U.P. and Society for Scientific Development in Agriculture and Technology, Meerut, U.P. during 21–23 November, 2022 at BAU, Ranchi, Jharkhand, India.

The conference will provide a common platform for all the stake holders to share their Innovation/experiences and expertise to better understand the challenges posed by emerging problems in agriculture and to fine tune future strategies/approaches for addressing such stresses in different areas of agriculture and allied science. I convey my greetings and best wishes to organizers and delegates for their joint venture for the success of these three days International Conference in hybrid mode.

Ravishankar C. N.

डा. रविशंकर सी.एन./ Dr. Ravishankar C.N.
निदेशक / कुलपति / Director / Vice Chancellor
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पंच मार्ग, ऑफ यारी रोड, वरसोवा, अंधेरी (प.) मुंबई - ४०० ०६१, भारत
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कार्यालय / Office : 022-26363404/26374306, Fax : 022-26361573
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Dr. Randhir Singh

Asstt. Director General (Agricultural Extension)



भारतीय कृषि अनुसंधान परिषद

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INDIAN COUNCIL OF AGRICULTURAL RESEARCH

Krishi AnusandhanBhawan, Pusa, New Delhi – 110 012

Ph.:91-11-25843277 (O), Fax : 91-11-25842968

E-mail: aksicar@gmail.com



MESSAGE

Investing in agriculture is one of the most effective ways of promoting agricultural productivity, reducing poverty and enhancing environmental sustainability. Making the transition to sustainable agriculture will not be possible without significant investment to protect and enhance the efficiency of natural resource use and to reduce waste at all stages of production, processing, marketing and consumption. However, rather than just advocating more government and donor funding, this conference calls for new strategies that puts agricultural producers at its centre and focuses public resources at all levels on the provision of public goods and the creation of an enabling environment for investment by farmers. We need to motivate farmers to make investments and also achieve public investments to make this world well fed and hunger free through appropriate resource management.

I hope that this conference, GRISAAS-2022 will be successful in stimulating the global community to put agricultural producers at the centre of investment strategies for agriculture and allied sectors.

Warm wishes for new year and good luck

(Randhir Singh)



Astha Foundation®

Dr. S.P. Singh
Chief Managing Director

85, Phool Bagh Colony, Main Road, Meerut (U.P.) INDIA

Email : dr.sp.singh24@gmail.in

Website : www.asthafoundation.in

Mob : +91-9450068438, 8273775051



MESSAGE

Our earth provide the basis for food production. The interaction of different enterprises with different cultures in different climates results in the need for unique approaches to sustainable agricultural systems in each situation. The transition to systems that are both sustainable and sufficiently intense to support the increasing density of human population will be faster or slower depending on the resources available. The renewed recognition of the sustainable resource management for assuring food security and the fundamental role in climate change adaptation and mitigation has triggered numerous projects, initiatives and actions on a global scale. But fertile soils are limited and are increasingly under pressure by competing land uses for cropping, forestry, and pasture/rangeland but also for energy production, settlement and infrastructure, raw materials extraction, etc. Sustaining and feeding the growing population of the world and meeting their needs for biomass (energy), fibre, fodder and other products will be the guiding principles and drivers of future research thrusts on a global scale.

Agriculture in India is highly diversified and crops are grown in diversified environments viz., water logged to rainfed uplands, jhums to deep water, high humid to arid temperatures and flood prone to dry lands. Frequent occurrence of abiotic stresses such as drought and submergence has been identified as the key to the low productivity of rainfed ecosystems. Value addition is the key coupled with rapid technological interventions will upscale the productivity of the small and marginal farmer's of India. It is not recent, significant changes are already happening even in the parched, hungry, degraded lands. The **Astha Foundation, Meerut, UP**, has played significant role in providing suitable forum for exchange of ideas, encouraging research and disseminating knowledge of sustainable agriculture and allied sciences to researchers.

Climate regulation as well as biodiversity conservation and other cultural services, increasing land use changes are threatening this resource and urgent action is needed to reverse this trend if we want to assure the necessary food production for future generations.

VIIth International Conference in Hybrid Mode on “**Global Research Initiatives for Sustainable Agriculture and Allied Sciences**” (GRISAAS-2022) during 21-23 November 2021. The thematic areas chosen for the conference will be very useful for the researchers, development agencies and farmers of the country to understand the practical problems in the agricultural development of our country. Scientists have been at the forefront of our agricultural development in past. They are required to play still more critical role in ensuring sustainable agriculture development. I am sure that conference will address various aspects related to increasing productivity and food & nutritional security. Technologies have helped wipe out malnutrition and hunger and reinvigorating the innovations will spearhead path. I am sure that the outcome of this conference would be very meaningful and will be of immense use for scientists, extension workers and farmers.

S.P. SINGH
Organizing Chairman
GRISAAS-2021

ABOUT GRISAAS

Global research initiatives for sustainable agriculture and allied sciences (GRISAAS), a brain child of **Astha Foundation** to bring scientists, researchers, academicians and all stake holders from throughout the globe for the betterment of humanity with the involvement of all the branches of sciences and related field is organizing the conferences since last six years. The eleven different themes of sessions were planned for the GRISAAS and these themes itself explains the vision of GRISAAS. These themes of sessions are:

1. Innovative technology for crop improvement, biotechnology and genetic engineering
2. Biodiversity and IPRs: issues and challenges
3. Global climate change: scenario and food security
4. New frontiers in disease and pest management
5. Food processing, value addition and post harvest technology
6. Policies and economics of profitable agriculture
7. Cropping system and indigenous technical knowledge
8. Integrated approaches in physical, chemical and biological sciences
9. Soil health management and practices: key factor for crop productivity
10. Animal health, animal husbandry and dairy technology
11. Social sciences, library, information science and humanities

The **first GRISAAS** conference was organized in collaboration with Rajmata Vijayaraje Scindia Krishi Viswa Vidhyalay, Gwalior (M.P.); Society for Scientific Development in Agriculture and Technology (SSDAT), Meerut (U.P.); Scientific Educational Research Society (SERS), Meerut (U.P.) and ALAKH-A Social and Public Welfare Organization, Gwalior (M.P.). It held during 12-13th December, 2015 at Rajmata Vijayaraje Scindia Krishi Viswavidhyalay, Gwalior (M.P.). During the conference, 36 lead papers were presented along with 529 oral and poster presentation in eleven different themes. It received overwhelming response with the registration of more than 1000 participants. All the lead cum invited papers and abstracts of oral and poster presentations were compiled in souvenir and conference book and published with ISBN number. The lead papers in the conference covered almost all the important areas of agriculture and related fields starting from global research initiatives for sustainable agriculture, plant molecular farming status, opportunities and challenges, association mapping in plants, forages as an alternative for diversification of agriculture to backyard poultry farming, strategies for enhancing organic farming profitability, molecular detection of animal diseases, yield gap analysis, newer approaches for weed management and livestock based integrated farming system. many new emerging topics were also delivered during the conference like nano-fertilizers, bio pest management, genome mapping, heavy metal tolerance and clearance, advancement in food processing technologies etc. Overall it was a great fusion of traditional to latest knowledge for the betterment of society.

The **second GRISAAS** International Conference was organized during 02-04th December, 2017 in collaboration of Maharana Pratap University of Agriculture & Technology, Udaipur (Rajasthan); Society for Scientific Development in Agriculture and Technology (SSDAT), Meerut (U.P.); Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (U.P.) and University of Agricultural Sciences, Raichur (Karnataka) at Rajasthan College of Agriculture, Udaipur (Rajasthan). This conference was bestowed with 20 lead papers and 1256 oral and poster presentations in eleven themes with more than 1200 registrations in the conference. All the lead cum invited papers and abstracts of oral and poster presentations were compiled in souvenir and conference book and published with ISBN number. This conference was poured with the knowledge and experience of scientific stalwarts and focused on the doubling the farmers income: a vision of new government of India. It had invited paper on “doubling farmers income through innovative agricultural and allied technology” and related topics like financial inclusion for developing nations, intellectual property rights on biodiversity conservation, advances in post harvest technologies and their applications, various strategies for the disease control in animals and vaccine developments with new generation diagnostics. Many of the crops like rapeseed, cowpea, maize and millets were on the focus of experts and duly addressed. The issues of breeding management for quality seed production, market security in contract farming, nutritional

management of soil for optimum output of crops and better management of natural resources e also discussed by the experts during their deliberations and accordingly recommendations were prepared and submitted to respective agencies.

The **third GRISAAS** International Conference was organized during 28-30th October, 2018 in collaboration of S.K.N. Agriculture University, Jobner (Rajasthan); Society for Scientific Development in Agriculture and Technology (SSDAT), Meerut (U.P.); Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (U.P.); Bihar Agricultural University, Sabour, Bhagalpur (Bihar), Indira Gandhi Krishi Vishwavidhyalay, Raipur (Chattisgarh) and Mahatama Phule Krishi Vidhyapeeth, Rahuri-Pune (Maharashtra) at Rajasthan Agricultural Research Institute, Durgapura, Jaipur (Rajasthan). This international conference involved the presentation of 24 lead papers in 11 different themes of the conference and 820 oral and poster presentations during the conference with more than 1000 participants. All the lead cum invited papers and abstracts of oral and poster presentations were compiled in souvenir and conference book and published with ISBN number. The eminent scientists from different field of sciences presented their researches and findings in respective sessions. The key topics covered during deliberations were global research initiatives for sustainable agriculture, doubling farmer incomes of tribal farmers, improving farmers socio-economic status, agro-forestry a source and media for income, sustainable integrated management approaches for better various plant and animal disease prevention and control through cost effective doorstep farmer friendly diagnostic assays, easy and effective treatment and effective long lasting vaccination programme. A topic of integrated disease management was very well presented with status of safe and effective mastitis vaccine to avoid loss of million dollars to animal and dairy owners annually. Some emerging topics like biosorption through fungi, crop waste management, role of biotechnology in combating abiotic stress and application of micro minerals in crop were also delivered and discussed. Agriculture IPRs related queries were also addressed in respective session and this session also outlined the need of more effective and conducive programme to educate scientific community. Focus was also brought on Plant breeding as it may act as key of success for doubling the farmers income with integrated farming and better coordination of allied departments.

The **fourth GRISAAS** International Conference was organized during 20-22nd October, 2019 in collaboration with Society for Scientific Development in Agriculture and Technology (SSDAT), Meerut (U.P.); Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (U.P.); Bihar Agricultural University, Sabour, Bhagalpur (Bihar); Indira Gandhi Krishi Vishwavidhyalay, Raipur (Chattisgarh); University of Agriculture and Horticulture, Shivamoga (Karnataka) and Mahatama Phule Krishi Vidhyapeeth, Rahuri- Pune (Maharashtra) at ICAR-National Academy of Agricultural Research Management (NAARM), Rajendranagar, Hyderabad (Telangana). This international conference involved the presentation of 26 lead papers in 11 different themes of the conference and 561 oral and poster presentations during the conference with more than 800 participants. All the lead cum invited papers and abstracts of oral and poster presentations were compiled in souvenir and conference book and published with ISBN number. Now the time has changed significantly likewise application of artificial intelligence based technology like drones, microRNA based diagnosis and nanoparticles based fertilizers, mineral mixtures and vaccines in agriculture and allied subjects with the target to improve the socioeconomic status of farming community. Various expert lectures from diversified fields from all over the India and abroad present lead cum invited papers focusing the respective themes and accordingly discussions were focused on the lab to field transfer of technology in farmer friendly mode so that these can easily demonstrated to farmers and they can also easily adopt the changes to get benefitted from the technologies developed by the scientific community. The integrated system of farming involving dairy, poultry, goatry, piggery and fishery appeared to be game changers and many of the farmers based farming system like mushroom production, beekeeping along with routine farming practices were recommended to increase their income in the system. The team efforts of scientific and farming community appeared to be baseline for next revolution with the adaptation of new technologies in agriculture and allied field. The detailed discussion on contract farming and its pros and cons suggested careful adaptation and through examination of contract conditions as majority of farmers are still not technically competent to know the aftereffects of contract. The government agencies should provide legal assistance to farming community to avoid any adverse consequences.

The **fifth GRISAAS** International Conference is being organized during 28-30th December, 2020 from the headquarter of Astha foundation, Meerut (U.P.). Considering the post pandemic effect and travel restrictions, it is being organized in collaboration with Society for Scientific Development in Agriculture and Technology (SSDAT), Meerut (U.P.); Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (U.P.); Bihar Agricultural University, Sabour, Bhagalpur (Bihar); Indira Gandhi Krishi Vishwavidhyalay, Raipur (Chattisgarh); University of Agriculture and Horticulture, Shivamoga

(Karnataka), Bihar Agricultural University, Ranchi, Jharkhand and Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan on online mode. In spite of corona pandemic it has received overwhelming response with more than 1000 registrations and presentation of more than 500 oral and posters during three days conference. As usual 11 themes will have lead cum invited papers of experts of national and International repute in respective themes during the conference. All the lead cum invited papers and abstracts of oral and poster presentations have been compiled in souvenir and conference book and being published with ISBN number. This time it will be also available on online mode at society website www.asthafoundation.in. This conference is going to address the current scenario on farmers bills and doubts of farming community on these bills. Many of the experts including some foreign experts are expected to deliver invited papers in different themes of conference. The presence of stalwarts from the different part of country is going to have excellent deliberations and outcomes to be recommended to responsible agencies for the betterment of farmers and dairy sectors.

The **sixth GRISAAS** International Conference was scheduled in hybrid mode during 13-15th December, 2021 from the Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan. However, due to COVID new guidelines and restrictions due to OMICRON variant of corona, university showed its inability to host it in physical mode so it is being organized from the headquarter of Astha foundation, Meerut (U.P.). The collaboration of Society for Scientific Development in Agriculture and Technology (SSDAT), Meerut (U.P.); Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (U.P.); Bihar Agricultural University, Sabour, Bhagalpur (Bihar); Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh); University of Agriculture and Horticulture, Shivamoga (Karnataka) and Bihar Agricultural University, Ranchi, Jharkhand is continued for online mode. GRISAAS-2021 has the highest number of registration in the conference with the registration of 1217 participants. It showed the linkage and faith of scientific community in the Astha Foundation and SSDAT. As usual, 11 themes are in the schedule. However 6th one has been merged and one new theme is launched based on the submission of research papers and abstracts. It is “*Agroforestry, livelihood and sustainable management practices*” and merged theme will be *Cropping system indigenous technical knowledge: Policies & economics of profitable agriculture*. All the lead cum invited papers and abstracts of oral and poster presentations were compiled in souvenir and conference book and published with ISBN number. It is also available on online mode at society website www.asthafoundation.in. This conference addressed the current scenario on farmers bills and doubts of farming community on these bills. Many of the experts including some foreign experts from Nepal, Bangladesh and Sri Lanka delivered key note address. The presence of stalwarts, scientists, students and extension workers in the conference and sharing their work, thoughts and visions was of use for students, emerging scientists and for farming community. The recommendation of the three days seminar have been submitted to all the major stake holders for desired applications in policy and farmer friendly setups to double the farmer's income.

The **seventh GRISAAS** International Conference is scheduled in hybrid mode during 21-23rd November, 2022 at the Birsa Agricultural University, Ranchi Jharkhand in collaboration of Astha foundation, Meerut (U.P.). This international conference has the partner organization like the Society for Scientific Development in Agriculture and Technology (SSDAT), Meerut (U.P.); Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (U.P.); Bihar Agricultural University, Ranchi, Jharkhand, Rani Laxmi Bai Central Agriculture University, Jhansi; Sri Keshwanand Rajasthan Agriculture University, Bikaner, Rajasthan; ICAR-CIFE, Mumbai, Maharashtra; Agriculture and Forestry University, Chitwan, Nepal; NPU, Palamu, Jharkhand and RK (PG) College, Shamli, Uttar Pradesh. Like the previous events, GRISAAS-2022 also has the overwhelming response with more than 1000 registration in the conference till date and more likely to be registered by 21st November in both off and on line mode. It has again proven the linkage and faith of scientific community in the Astha Foundation and SSDAT. Like sixth GRISAAS 11 themes are in the schedule. All the lead cum invited papers and abstracts of oral and poster presentations have been compiled in souvenir and conference book and will be shortly published with ISBN number. It will also be available on online mode at society website www.asthafoundation.in. This conference is going to address the current scenario on farmers, agriculture, animal health care and effect of climate change on both animal and agriculture practices. Many of the experts including some foreign experts from Nepal and Bangladesh will deliver key note address. The presence of stalwarts, scientists, students and extension workers in the conference and sharing their work, thoughts and visions will be useful for students, emerging scientists and for farming community. The recommendation of the three days conference will be submitted to all the major stake holders for their **attention** and perusal on the current issues affecting Indian rural economy.



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GLOBAL RESEARCH INITIATIVES FOR SUSTAINABLE AGRICULTURE (GRISAAS)

S.P. Singh¹, Barjendra², P.B. Singh³, Sudhir Kumar¹, Y.K. Singh¹, Rohit Rana⁴, Harish Pal Bhati⁵, Ravindra Kumar⁶, Amit Kumar⁷, Shashikant Divakar⁸ and B.S. Rajawat⁹, Anamika Das¹⁰, H. Nayak¹¹

¹Chandra Shekhar Azad, University of Agriculture & Technology, Kanpur, U.P.

²ICAR-IIHR, Rajendranagar, Hyderabad, Telanagna

³Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan

⁴Rashtrya Kishan Post Graduate College, Shamli, U.P. ⁵Government College (CCSU Meerut), Jewar, G.B. Nagar, U.P.

⁶Ranchi Veterinary College, BAU, Ranchi, Jharkhand ⁷S.V.P. University of Agriculture & Technology, Meerut, U.P.

⁸Bihar Agricultural University, Sabour, Bihar

⁹Krishi Vigyan Kendra, East Garo Hills, Meghalaya

¹⁰WCDDT, SHUATS, Prayagraj, U.P.

¹¹Odisha University of Agriculture & Technology, Bhubneshwar Odisha

Worldwide demands for food increases (population of over 8 billion by 2025) while land and water become increasingly scarce and human health issues rise and threaten food systems and their sustainability. There will be no sustainable future without eradicating poverty and hunger. Ensuring food security for all is both a key function of and a challenge for agriculture, which faces ever-increasing difficulties – as populations rise, urbanization increases and incomes grow; the agricultural sector will be under mounting pressure to meet the demand for safe and nutritious food. Agriculture has to generate decent jobs and support the livelihoods of billions of rural people across the globe, especially in developing countries where hunger and poverty are concentrated. Furthermore, the sector has a major role to play in ensuring the sustainability of the world's precious natural resources and biodiversity, particularly in light of a changing climate. Climate change will have an increasingly adverse impact on many regions of the world, with those in low latitudes being hit the hardest. Developing countries, in particular, will need support from the global community to facilitate their adaptation and mitigation efforts in relation to climate change and to transform their agriculture and food systems sustainably. As the migration crisis of recent years has shown, no country stands unaffected. What happens in one part of the globe will undoubtedly affect other parts, and domestic and foreign policies must take account of this.

Global Agriculture Research institutes

At global level only mandated international agricultural research organization is the CGIAR. The CGIAR Fund supports 15 international agricultural research centers such as the International Water Management Institute (IWMI), International Rice Research Institute (IRRI), the International Institute of Tropical Agriculture (IITA), the International Livestock Research Institute (ILRI), the International Food Policy Research Institute (IFPRI) and the Center for International Forestry Research (CIFOR) that form the CGIAR Consortium of International Agricultural Research Centers and are located in various countries worldwide (as of 2011). The centers carry out research on various Agricultural commodities, livestock, fish, water, forestry, policy and management. Some other international agricultural organizations include the United Nations Food and Agriculture Organization, Global Forum on Agricultural Research (GFAR), The International Agriculture Center (Netherlands), The World Bank, International Fund for Agricultural Development, The Center for International Food and Agriculture Policy at the University of Minnesota. The CGIAR (Consultative Group on International Agricultural Research) is a small but significant component of the global agricultural research system. With its limited financial resources, it has to be selective in its role and choice of research portfolio. An updated report on CGIAR priorities and strategies is produced every five years by TAC (Technical Advisory Committee to the CGIAR) to guide system-wide resource allocation taking into consideration an appropriate balance between centers, activities, commodities, regions and agro-ecological zones. In considering priorities, TAC is guided by several important factors such as the CGIAR mission and goal, emerging trends in world agriculture, and the evolution of scientific capacity in developing countries. The current approach has been modified to account for the expanded mandate of the CGIAR, greater emphasis on sustainability and resource management issues, allow for meaningful interactions with stakeholders, ensure transparency in decision making, and develop mechanisms which facilitate CGIAR priority setting as a continuing activity.

Research priorities decided by CGIAR

According to Nelson and Mensbrugghe (2013) CGIAR decided public sector agricultural research priorities for sustainable food security and agricultural strategies to support food security in climate change. The focus is on the vulnerable small holder agricultural households that do not consistently and fully meet household nutritional needs. Climate change poses great risks to this group because it is dependent on agricultural production to meet both income and nutritional needs. Climate change also poses additional challenges to meet the individual and collective ambitions of development. The responses to climate



change are varied, ranging from increasing resilience by development and adoption of new cultivars, maintaining eco-systems services such as soil health and water quality, diversification, and improved risk management tools. Climate change increases the value of “no-regrets” technologies that enhance flexibility and potentially enable transformative changes. Some technologies exist that can help with adaptation; others need to be developed. But while technology availability is a first step condition, adoption by farmers is the essential outcome. Adoption requires greater emphasis on building local institutions to support information dissemination, risk management and collective action. Two other important enabling conditions are building coherence across agriculture, food security and climate change policies and increasing the available financing, including from climate finance sources. Priorities include: Better links with the global climate change research community are needed to address the nature of the vulnerability and uncertainties. This has to include better understanding of the likely changes in climate variability in the coming decades and its impacts on food systems and food security at all levels. Therefore, improving tools and guidelines for risk management, including better knowledge of the role of assets (physical, human and social capital), role of collective action and increased engagement of civil society to improve participatory approaches and communication is important in present scenario. There was a lively debate on the relative priorities between technology development and improving systems for technology adoption, and the optimal division between the public and private sectors. How can we better use the new technologies available today for information dissemination? Allocation of water among various users, including agriculture, as well as competition for land use from biofuels merits greater attention. What should be the relative roles of mitigation *versus* adaptation? How much mitigation can be expected from small holder farmers? What are the equity concerns? How can development be made compatible with mitigation? Should we focused on a ‘climate justice’ approach (analogous to the ‘right-to-food’ approach) given the inability of the global community to take effective action to limit greenhouse gas emissions. Attention to gender differences in the way of information is absorbed and transmitted is important for technology adoption and mitigation. More collaboration is needed with a focus on data collection and dissemination and links across the different modeling platforms (across disciplines, e.g. climate to crop to economic, and across dimensions, household/farm to sub-region to country to global).

What is Sustainable Agriculture: Every day, farmers and ranchers around the world develop new, innovative strategies to produce and distribute food, fuel and fiber sustainably. While these strategies vary greatly, they all embrace three broad goals, or what SARE calls the three pillars of sustainability: Profit over the long term, stewardship of nation’s land, air and water and quality of life for farmers, ranchers and their communities. The phrase ‘sustainable agriculture’ was reportedly coined by the Australian agricultural scientist Gordon McClymont. Wes Jackson is credited with the first publication of the expression in 1980 in his book “New Roots for Agriculture”. The term became popular in the late 1980s. It has been defined as “an integrated system of plant and animal production practices having a site-specific application that will last over the long term, for example to satisfy human food and fiber needs, to enhance environmental quality and the natural resource base upon which the agricultural economy depends, to make the most efficient use of non-renewable and on-farm resources and integrate natural biological cycles and controls, to sustain the economic viability of farm operations, and to enhance the quality of life for farmers and society as a whole.

There are several key principles associated with sustainability in agriculture and important thing is the incorporation of biological and ecological processes into agricultural and food production practices. For example, these processes could include nutrient cycling, soil regeneration, and nitrogen fixation.

Using decreased amounts of non-renewable and unsustainable inputs, particularly the ones that are environmentally harmful.

Using the expertise of farmers to both productively work the land as well as to promote the self-reliance and self-sufficiency of farmers.

Solving agricultural and natural resource problems through the cooperation and collaboration of people with different skills. The problems tackled include pest management and irrigation.

Sustainable agriculture can be understood as an ecosystem approach to agriculture. Practices that can cause long-term damage to soil include excessive tilling of the soil (leading to erosion) and irrigation without adequate drainage (leading to salinization). Long-term experiments have provided some of the best data on how various practices affect soil properties essential to sustainability. In the United States a federal agency, USDA-Natural Resources Conservation Service, specializes in providing technical and financial assistance for those interested in pursuing natural resource conservation and production agriculture as compatible goals.



Initiatives by United Nations for sustainable development

The year 2015 signaled the arrival of two landmark initiatives that recognized the need for countries to take collective action to promote sustainable development and combat climate change: the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs), and the Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC). Both initiatives reflect evolving thinking around global issues, and both call for a fair and transparent international trade system. In food and agriculture, trade can play a role and contribute to meeting the targets of both the 2030 Agenda and the Paris Agreement.

In the meeting at the United Nations Headquarters in New York from 25-27 September 2015 as the Organization celebrated its seventieth anniversary, have decided on new global Sustainable Development Goals. UN adopted a historic decision on a comprehensive, far-reaching and people-centered set of universal and transformative Goals and targets and committed to working tirelessly for the full implementation of this Agenda by 2030.

The sustainable development goals : The sustainable development goals (SDGs) are a new, universal set of goals, targets and indicators that UN member states will be expected to use to frame their agendas and political policies over the next 15 years. The SDGs follow and expand on the millennium development goals (MDGs), which were agreed by governments in 2001 and are due to expire at the end of this year.

Need for set of goals : There is broad agreement that, while the MDGs provided a focal point for governments – a framework around which they could develop policies and overseas aid programmes designed to end poverty and improve the lives of poor people – as well as a rallying points for NGOs to hold them to account, they were too narrow.

The eight MDGs – reduce poverty and hunger; achieve universal education; promote gender equality; reduce child and maternal deaths; combat HIV, malaria and other diseases; ensure environmental sustainability; develop global partnerships – failed to consider the root causes of poverty and overlooked gender inequality as well as the holistic nature of development. The goals made no mention of human rights and did not specifically address economic development. While the MDGs, in theory, applied to all countries, in reality they were considered targets for poor countries to achieve, with finance from wealthy states. Conversely, every country will be expected to work towards achieving the SDGs.

Proposed 17 Sustainable Development Goals (SDGs)?

- End poverty in all its forms everywhere
- End hunger, achieve food security and improved nutrition and promote sustainable agriculture
- Ensure healthy lives and promote well being for all at all ages
- Ensure inclusive and equitable quality education and promote life long learning opportunities for all
- Achieve gender equality and empower all women and girls
- Ensure availability and sustainable management of water and sanitation for all
- Ensure access to affordable, reliable, sustainable and modern energy for all
- Promote sustained, inclusive and sustainable economic growth, full and productive employment, and decent work for all
- Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation
- Reduce inequality within and among countries
- Make cities and human settlements inclusive, safe, resilient and sustainable
- Ensure sustainable consumption and production patterns
- Take urgent action to combat climate change and its impacts (taking note of agreements made by the UNFCCC forum)
- Conserve and sustainably use the oceans, seas and marine resources for sustainable development
- Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
- Strengthen the means of implementation and revitalize the global partnership for sustainable development

The interlinkages and integrated nature of the Sustainable Development Goals are of crucial importance in ensuring that the purpose of the new Agenda is realized. If we realize our ambitions across the full extent of the Agenda, the lives of all will be profoundly improved and our world will be transformed for the better.

The Global Research Alliance (GRA) : It is an international network of nine applied research organizations that works to promote application of science and technology to solve large scale issues facing developing countries. The alliance was



formed in 2000 in Pretoria, South Africa. Today, the GRA has access to over 60,000 people across its membership. Vision is for a world where the application of innovative science and technology, through collaboration and co-creation, delivers access equality, improves lives, and solves global development challenges. The GRA uses the best science and technology to solve some of the biggest problems in the developing world. These global issues span borders, cultures and religions and require a cross-boundary response. They address these problems by :

Mobilizing the creative energy of our globally and culturally diverse researchers to address global development challenges through innovation

Sharing the breadth and depth of our science and technology resources and uniting with local partners, communities, industry and collaborators

Generating and implementing appropriate, affordable and sustainable solutions with positive and lasting impact

The GRA is a dynamic alliance of nine knowledge intensive research and technology organizations from around the world. Its goal is to create 'A Global Knowledge Pool for Global Good'. The focus is to apply science, technology and innovation in the pursuit of solving some of world's gravest challenges.

GRA and Inclusive Innovation : The Global Research Alliance (GRA) believes Inclusive Innovation requires a holistic and new way of approaching demand-driven projects and co-creation with partners such as end-users, technology organizations and both the private and public sectors. This includes: success through technical innovation (products), social innovation (interaction/co-creation), management innovation (business models); and chain innovation (relationships in the value chain). Inclusive Innovation is not new to the GRA. Over the last few years, the GRA has systematically addressed global challenges through the deployment of Inclusive Innovation initiatives.

Why do we need climate-smart agriculture: The UN Food and Agriculture Organization (FAO) estimates that feeding the world population will require a 60 percent increase in total agricultural production. With many of the resources needed for sustainable food security already stretched, the food security challenges are huge. At the same time climate change is already negatively impacting agricultural production globally and locally. Climate risks to cropping, livestock and fisheries are expected to increase in coming decades, particularly in low-income countries where adaptive capacity is weaker. Impacts on agriculture threaten both food security and agriculture's pivotal role in rural livelihoods and broad-based development. Also the agricultural sector, if emissions from land use change are also included, generates about one-quarter of global greenhouse gas emissions.

Practical adaptation options to improve food security and resilience: What practical steps can smallholder farmers take to adapt their agricultural practices to secure dependable food supplies and livelihoods? And can they do this while also decreasing greenhouse gas emissions or increasing carbon sequestration, thereby decreasing future climate change?

In a search for answers the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is working with a vast range of partners to test a range of interventions in climate-smart villages. This Flagship addresses the challenge of how to transition to climate-smart agriculture at a large scale. We work with partners at all levels to test, evaluate, promote and scale up integrated portfolios of technologies and practices that meet the needs of farmers - including women and marginalized groups. We help build adaptive capacity and resilience to climate variability and change, while increasing food availability and generating mitigation co-benefits. We integrate, and apply the best and most promising methods, tools and approaches for equitable local adaptation planning and governance, and develop innovative incentives and mechanisms for scaling out CCAFS identifies agricultural development options that reduce greenhouse gas emissions and increase carbon sequestration. Together with our partners, CCAFS produces research to improve estimates of farm emissions in smallholder systems, provides tools and information to agriculture decision-makers and supports the widespread implementation of low emissions agricultural practices and policies.

The Global Water Partnership's : The vision is for a water secure world. It's mission is to support the sustainable development and management of water resources at all levels. GWP was founded in 1996 by the World Bank, the United Nations Development Programme (UNDP), and the Swedish International Development Cooperation Agency (SIDA) to foster integrated water resource management (IWRM).

IWRM is a process which promotes the coordinated development and management of water, land and related resources in order to maximize economic and social welfare without compromising the sustainability of ecosystems and the environment. The network is open to all organizations involved in water resources management: developed and



developing country government institutions, agencies of the United Nations, bi- and multi-lateral development banks, professional associations, research institutions, non-governmental organizations, and the private sector. In the “Our Approach” section one can read about GWP’s global strategy - Towards 2020 - how GWP are currently pursuing vision of water security. Dealing with water issues requires commitment at the highest political level. Water security will only be reached when political leaders take the lead, make the tough decisions about the different uses of water and follow through with financing and implementation. GWP sees its role as having the technical expertise and convening power to bring together diverse stakeholders who can contribute to the social and political change processes that help bring the vision of a water secure world closer to reality. GWP regularly reports on outcomes at the national, regional, and global level. GWP is implementing its strategy and up-to-date information on activities across the globe.

The Global Water Partnership (GWP) has announced the launch of its new 2014-2019 global strategy. The strategy, Towards 2020, outlines a new direction for GWP with the goals of catalyzing change, sharing knowledge, and strengthening partnerships for a water secure world. The 2014-2019 Strategy builds on GWP’s previous work and achievements. It was developed through a year-long process of regional dialogues and consultations with GWP’s growing network of over 2,900 Partner Organizations across 172 countries. The strategy Towards 2020 stresses the need for innovative and multi-sectorial approaches to adequately address the manifold threats and opportunities relating to sustainable water resource management in the context of climate change, rapid urbanization, and growing inequalities.

Global Soil Partnership: Soil is under pressure. The renewed recognition of the central role of soil resources as a basis for food security and their provision of key ecosystem services, including climate change adaptation and mitigation, has triggered numerous regional and international projects, initiatives and actions. Despite these numerous emergent activities, soil resources are still seen as a second-tier priority and no international governance body exists that advocates for and coordinates initiatives to ensure that knowledge and recognition of soils are appropriately represented in global change dialogues and decision making processes. At the same time, there is need for coordination and partnership to create a unified and recognized voice for soils and to avoid fragmentation of efforts and wastage of resources.

Maintaining healthy soils required for feeding the growing population of the world and meeting their needs for biomass (energy), fiber, fodder, and other products can only be ensured through a strong partnership. This is one of the key guiding principles for the establishment of the Global Soil Partnership.

Responses to soils today :

Soil data : fragmented, partly outdated (fertility, SOC, etc.) heterogeneous and difficult to compare, not easily accessible, not responding to users’ needs

Soil capacities : increasingly a scarce resources (loss of soil expertise and skills)

Soil knowledge and research: fragmented (fertility, CC, ecology), domain of soil scientists, not accessible for use by various disciplines and for decision making, not tailored to address problems/development agendas of today

Awareness and investments in soil management : extremely low compared to the needs that soil is a precarious resource and requires special care from its users

Soil policy : Often received as a second tier priority; lack of international governance body to support coordinated global action on their management. Need for compatible and coordinated soil policies - a unified and authoritative voice is needed to better coordinate efforts and pool limited resources (for agriculture, forestry, food security, UNCCD, CBD, UNFCCC, disaster and drought management, land competition, rural and urban land use planning and development).

Intergovernmental Panel on Climate Change (IPCC) is the leading international body for the assessment of climate change. It was established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) in 1988 to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts. In the same year, the UN General Assembly endorsed the action by WMO and UNEP in jointly establishing the IPCC. The IPCC is a scientific body under the auspices of the United Nations (UN). It reviews and assesses the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change. It does not conduct any research nor does it monitor climate related data or parameters. Thousands of scientists from all over the world contribute to the work of the IPCC on a voluntary basis. Review is an essential part of the IPCC process, to ensure an objective and complete assessment of current information. IPCC aims to reflect a range of views and expertise. The Secretariat coordinates all



the IPCC work and liaises with Governments. It is established by WMO and UNEP and located at WMO headquarters in Geneva. Because of its scientific and intergovernmental nature, the IPCC embodies a unique opportunity to provide rigorous and balanced scientific information to decision makers. By endorsing the IPCC reports, governments acknowledge.

The Intergovernmental Technical Panel on Soils (ITPS) was established at the first Plenary Assembly of the Global Soil Partnership held at FAO Headquarters on 11 and 12 of June, 2013. The ITPS is composed of 27 top soil experts representing all the regions of the world. The main function of the ITPS is to provide scientific and technical advice and guidance on global soil issues to the Global Soil Partnership primarily and to specific requests submitted by global or regional institutions. The ITPS will advocate for addressing sustainable soil management in the different sustainable development agendas.

Functions of ITPS :

Provide scientific and technical advice on global soil issues primarily to the GSP and in relation to specific requests submitted by global or regional institutions.

Advocate for the inclusion of sustainable soil management into different development agendas.

Review and follow up on the situation and issues related to soils in the contexts of food security, use and management of natural resources, ecosystem services provision, climate change adaptation and mitigation, and other relevant areas.

Review and endorse from a technical view point the GSP Plans of Action.

Follow up on the implementation of these Plans of Action with due attention to their impact and contributions to different global policies and initiatives related to sustainable development, MDGs, food security, climate change adaptation and other subject matters.

In exceptional cases, when complex technical matters arise, request the Plenary Assembly and the Secretariat to form technical committees aiming to gather specific advice.

Intergovernmental Platform on Biodiversity and Ecosystem Services : The Intergovernmental Platform on Biodiversity and Ecosystem Services is a mechanism proposed to further strengthen the science-policy interface on biodiversity and ecosystem services, and add to the contribution of existing processes that aim at ensuring that decisions are made on the basis of the best available scientific information on conservation and sustainable use of biodiversity and ecosystem services. It was established in 2012 as an independent intergovernmental body open to all member countries of the United Nations. The members are committed to building IPBES as the leading intergovernmental body for assessing the state of the planet's biodiversity, its ecosystems and the essential services they provide to society.

Science-policy interface : Science-policy interfaces are social processes which encompass relations between scientists and other actors in the policy process, and which allow for exchanges, co-evolution, and joint construction of knowledge with the aim of enriching decision-making at different scales. This includes two main requirements: scientific information is relevant to policy demands and is formulated in a way that is accessible to policy and decision makers; and that policy and decision makers take into account available scientific information in their deliberations and that they formulate their demands or questions in a way that are accessible for scientists to provide the relevant information.

Need for IPBES : There are already several mechanisms and processes at national, regional and global level that are designed to ensure that scientific information is considered when designing policies or making decisions (examples of this are technical bodies/panels under the environmental agreements or national research institutions attached to ministries, among many others). However, there is no global ongoing mechanism recognized by the scientific and policy communities, that pulls this information together, synthesizes and analyzes it for decision making in a range of policies. Thus, we have listed some of the numerous global alliances which have been established to address the global research platforms. This is in brief and there are others also across the globe taking shapes : One of the fundamental lessons learned through the past half century of agricultural research is that there are no “one size fits all” sustainable management practices and a holistic approach is the need of the hour.

Sustainable development in Indian Agriculture

Agriculture is the main occupation in India as large population is living in the rural areas and having agriculture as their livelihood. Sustainable development in the agriculture sector aims to increase the productivity, efficiency and level of employment and further aims to protect and preserve the natural resources by the over utilization. Agriculture faces many challenges, making it more and more difficult to achieve its primary objective – feeding the world – each year. Agriculture



must change to meet the rising demand, to contribute more effectively to the reduction of poverty and malnutrition, and to become ecologically more sustainable India has been witnessing a blinding pace of growth and development in recent times. Experts are now calling for “sustainable development” and the term has gained currency in the last few years. In spite of fast growth in various sectors, agriculture remains the backbone of the Indian economy. Sustainable agricultural development seeks not only to preserve and maintain natural resources, but also to develop them, as future generations would have much more demand quantity-wise and quality-wise for agricultural and food products. Such goals should ensure a balance with the development of livelihoods enjoyed by the individuals concerned. Agriculture plays a crucial role in sustainable development and in hunger and poverty eradication. The challenges faced by agriculture in sustainable development is in working out ways of bringing about a society that is materially sufficient, socially equitable, and ecologically sustainable and one that is not obsessed by growth only, but motivated by satisfying human needs and equity in resource allocation and use. Sustainable agriculture must meet economic, social and ecological challenges. All 4 these challenges are closely related. Sustainable agriculture needs to protect the natural resource base, prevent the degradation of soil and water; conserve biodiversity; contribute to the economic and social well-being of all; ensure a safe and high-quality supply of agricultural products; and safeguard the livelihood and well-being of agricultural workers and their families. The main tools towards sustainable agriculture are policy and agrarian reform, participation, income diversification, land conservation and improved management of inputs. This policy document is an effort to identify the strategies, guidelines and practices that constitute the Indian concept of sustainable agriculture. This is done in order to clarify the research agenda and priorities thereof, as well as to suggest practical steps that may be appropriate for moving towards sustainable agriculture. Some tend to confuse sustainable agriculture with organic farming. But both are very different from each other. Sustainable agriculture means not only the withdrawal of synthetic chemicals, hybrid-genetically modified seeds and heavy agricultural implements (as in organic farming). Sustainable agriculture involves multiculture, intercropping, use of farmyard manure and remnants, mulching and application of integrated pest management. If this is followed then there is no reason why agriculture cannot be an economically viable activity in addition to being environmentally sustainable.

In India, the crop yield is heavily dependent on rain, which is the main reason for the declining growth rate of agriculture sector. These uncertainties hit the small farmers and laborers worst, which are usually leading a hand to mouth life. Therefore, something must be done to support farmers and sufficient amount of water and electricity must be supplied to them as they feel insecure and continue to die of drought, flood, and fire. India is the second largest country of the world in terms of population; it should realize it is a great resource for the country. India has a huge number of idle people. There is a need to find ways to explore their talent and make the numbers contribute towards the growth. Especially in agriculture, passive unemployment can be noticed. The sustainable development in India can also be achieved by full utilization of human resources. A large part of poor population of the country is engaged in agriculture, unless we increase their living standard, overall growth of this country is not possible. If we keep ignoring the poor, this disparity will keep on increasing between classes. Debt traps in country are forcing farmers to commit suicides. People are migrating towards city with the hope of better livelihood but it is also increasing the slum population in cities. Therefore, rural population must be given employment in their areas and a chance to prosper. India has been carrying the tag of “developing” country for quite long now; for making the move towards “developed” countries, we must shed this huge dependence on agriculture sector.

For promoting sustainable agriculture, following components can be considered :

Yield increase : India need to focus on improving its yields. Currently, yield level of food crops is 2,056 kg/ha, which is far below the yields of many countries. The current average yield of paddy in India is around 3.5 tonnes /ha, while China’s yield is more than 6 tonnes/ha. Similar is the case with wheat and other major crops. This is despite increase in fertilisers and pesticides by several folds.

Water-use efficiency : India is still focusing on supply side management of water. This is leading to major investments while causing degradation of ecosystems without any major benefit to farmers. The investments have to be clearly on reducing the water per unit of production. Currently, the focus of drip irrigation is only on material supply rather than the entire process and training. Creating specific incentives for using less water while improving the productivity have not even initiated. With modern technology, it is possible to create incentives to use less water and set up mechanisms to monitor water use at farm level. Budget should be allocated for creating well-designed projects with institutional mechanisms to implement and monitor. The goal is to use the existing infrastructure far more efficiently—both at system level and individual farm level.



Diversity of food grains: Consumers are aware of the benefits of eating coarse grains such as jowar and bajra. But there are no specific programmes to produce and market these food grains. Farmers need income, not just production. So, incentivizing farmers to produce these grains will not only save water and ecosystems but promote healthy eating habits.

Farm-based approaches: In India, farmers are receptive to experimenting with farm-based approaches. For example, the System of Rice Intensification (SRI), Sustainable Sugarcane Initiative (SSI), and System of Crop Intensification (SCI) of wheat, millets and mustard are very popular with farmers. It is time we had Centre-sponsored scheme to promote these approaches in large scale with large budget provisions and institutional mechanisms.

Organic agriculture: India needs to slowly move from chemical-based farming to organic farming. Phase-wise approach towards removing subsidies to chemical fertilizers and introducing incentives to organic agriculture through budget provisions is the way to go about it.

So, by conducting the conferences like GRISAAS we will be able to address these issues efficiently.



CLIMATE CHANGE : CHALLENGE OF AQUATIC RESOURCE MANAGEMENT IN BANGLADESH

Binay Kumar Chakraborty

Fisheries Scientist and Consultant, Former P. Director/Director

Department of Fisheries, Bangladesh and Supervisor, Bangladesh Agricultural University

Email : bborty@gmail.com

Abstract

Data and information sources are used from the direct interview with the individual, publication of the Department of Fisheries (DoF) and related non-published grey literature. The fisheries sector contributes 3.52% to the national GDP, 26.37% to the agricultural GDP and more than 2.0% to the total export earnings. The total production was 4.621 mil.mt fish in 2020-21. In contrast, inland open water (capture) contributes 28.16%, and inland closed water (culture) contributes 57.10% to total production. Fish contributes significantly to food security by providing safe and quality animal protein at 60% (62.58 g/day/capita) in daily. About 11% of the total population is engaged with this sector on a full and part-time basis for their livelihoods. Bangladesh is blessed with substantial open water resources with a wide range of enriched aquatic diversity, comprising almost 260 freshwater 740 marine fish species and other aquatic lives. However, due to the decline and degradation of wetland resources, the stock of inland capture and marine fisheries has been reduced remarkably. Now a day's fisheries sector has been facing challenges by natural and anthropogenic causes such as climate change, environmental pollution, industrialization, overexploitation, using destructive fishing gear, pesticide, and agrochemical etc. As a result, commercial important 03 species were extinct (E), 07 species critically endangered (CR), 30 endangered (EN), 27 vulnerable (VU), 29 not threatened (NT), 122 least concern (LC) and 42 data deficient (DD) position from the point of biodiversity. So, important national program and biological management technology is developed for aquaculture and fisheries management to restrict the declination of resources and enhance production.

Key words : *Beel nursery, biodiversity, conservation, critically endangered, endangered, extinct, hilsa fishery management, over exploitation.*

INTRODUCTION

The location of Bangladesh is in the north eastern part of South Asia between 88°01' and 92 ° 41' east longitudes and 20°34' and 26°38' north latitude. India bounds the country on the west; north and northeast while Myanmar on the south-east and the Bay of Bengal on the south. The alluvial soil enriched by heavy silts deposited by rivers during the rainy season. Winter, summer and monsoon are prominent. Winter begins in November and ends in February. In winter, the minimum temperature is recorded at 7°C and the maximum temperature recorded in summer at 37°C. The average annual rainfall varies from 1429 to 4338 mm.

Fish habitats in Bangladesh are primarily a deltaic country in the Ganges, Brahmaputra and Meghna (GBM) drainage systems. Important Rivers the Padma, Jamuna, Teesta, Brahmaputra, Surma, Meghna and Karnaphuli exists in the country. There are about 700 rivers, including 230 tributaries with a total length of about 24140 km. The country is blessed with huge open water resources with a wide range of enriched aquatic diversity, comprising almost 260 freshwater fish species (FSYB, 2020). Of the reported species, 104 are considered riverine species, 36 migratory (travelling rivers and floodplains), and the rest 113 are floodplain resident species (FAP 17, 1994). Besides, a total of 20 species of prawns, 4 species of crabs and 26 species of molluscs are known to occur in Bangladesh's freshwaters (Siddiqui *et al.*, 2008). However, due to mainly decline and degradation of wetland resources, the share of inland capture fisheries has been reduced remarkably during recent past decades. The natural migration and recruitment of fishes and other aquatic lives between rivers and floodplains have been blocked. As a result, many important fish, prawn species and other aquatic lives of rivers, floodplains and estuaries have become threatened and endangered (IUCN, 2000).

MATERIALS AND METHODS

The study was conducted in 64 districts of Bangladesh. A sampling plan was run for a long time to get an accurate picture of the catch and catch composition. A semi-structured questionnaire was developed. Primary data was collected by focus group discussion (FGD), local ecological knowledge (LEK) and direct interviews with the individual respondent. Questions were asked systematically, with the framed questionnaire. Being a rapid survey, the study gives only a broad picture of a stock of fauna that was recorded through fish landing centers, wholesaler, different market survey, directly from fishers', hatchery



owner and fish farmer. Secondary data were collected mainly from the Department of Fisheries (DoF) and internet sites. The data were analyzed through one-way ANOVA using SPSS program to find out whether any significant difference existed among different data (Duncan, 1955; Zar, 1984). Standard deviation in each parameter was calculated and expressed as mean $\pm$ S.D.

RESULTS

Fish Production

The fisheries sector contributes 3.57% to the national GDP, 26.37% to the agricultural GDP and more than 135% to the total export earnings (Fisheries Statistical Yearbook of Bangladesh, 21). Fish alone supply a per capita fish consumption of 62.58 g/day in daily dietary requirement. Bangladesh is one of the world's leading fish producing countries with a total production of 4.621 mill.mt in 2020-21 (Fig.-1).

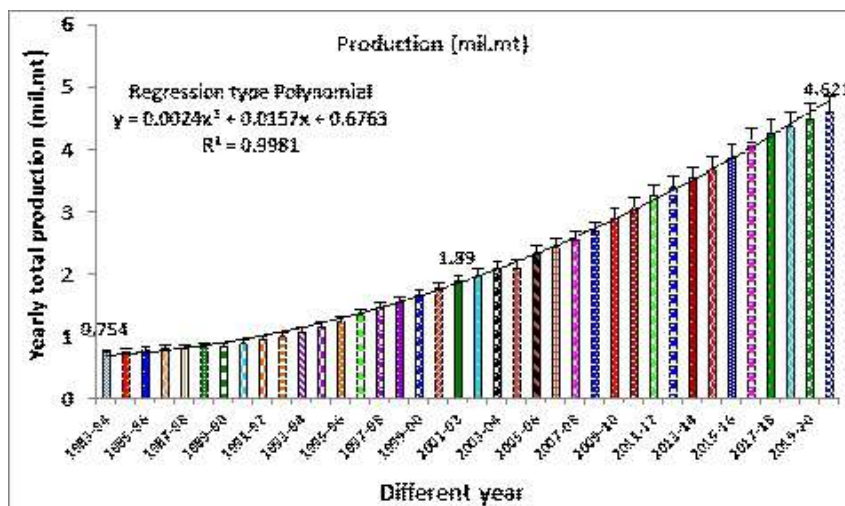


Fig.-1. Total fish production percentage (%) of last 36 years in Bangladesh.

Contribution of inland capture fisheries

Inland open water area belongs to 3.917 (mill. ha) which is included rivers and estuaries, Sundarbans water resource in the forest, beels, Kaptai Lake and floodplain. In 1983-84, the contribution of inland capture fisheries fish production was 0.472 mill.mt and production percentage was 62.59% and in 2007-08, inland capture fisheries fish production was 1.027 mill.mt and decreased at 41.36%. Finally, in 2020-21, inland capture fisheries fish production was 1.301 mill.mt. and total fish production was decreased sharply with a value of 62.59% to 28.16% during last 37 years (Fig.-2). The regression type was Logarithmic and the equation was $y = 31.26 \ln(x) + 62.709$ and where, R^2 is 0.9997.

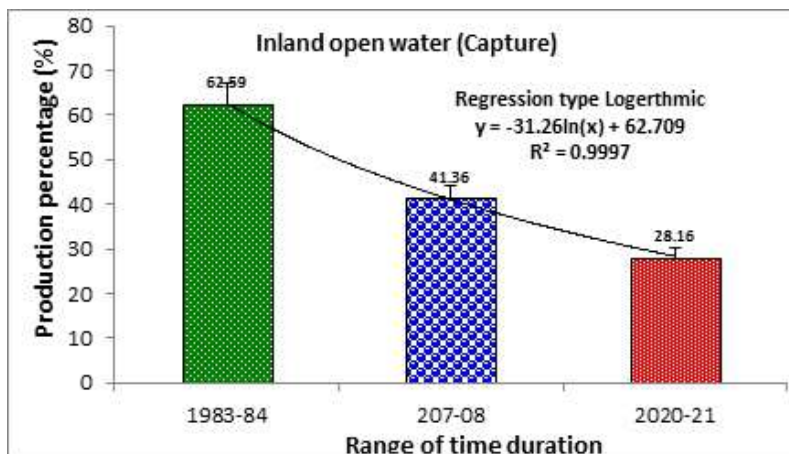


Fig.-2. Fish production percentage (%) of inland open water (capture) from 1983-84 to 2020-21.



Contribution of inland closed water (culture) fisheries

Inland closed water (culture) area belongs to 0.80 (mill. ha) which includes Pond, Seasonal cultured waterbody, Baor, Shrimp/Prawn /crab Farm, pen and cage culture. In 1983-84, the contribution of inland closed water fish production was 0.117 mill.mt and production percentage was 15.53% and in 2007-08, inland capture fisheries fish production was 11.006 mill. mt and was increased at 39.23%. Finally, in 2020-21, contribution of inland culture fisheries fish production was 2.639 mill.mt. and total fish production was increased sharply with a value of 15.53% to 57.10% during last 37 years (Fig.-3). The regression type was Polynomial and the equation was $y = -2.915x^2 + 32.445x - 14$ and where, R^2 is 1.00.

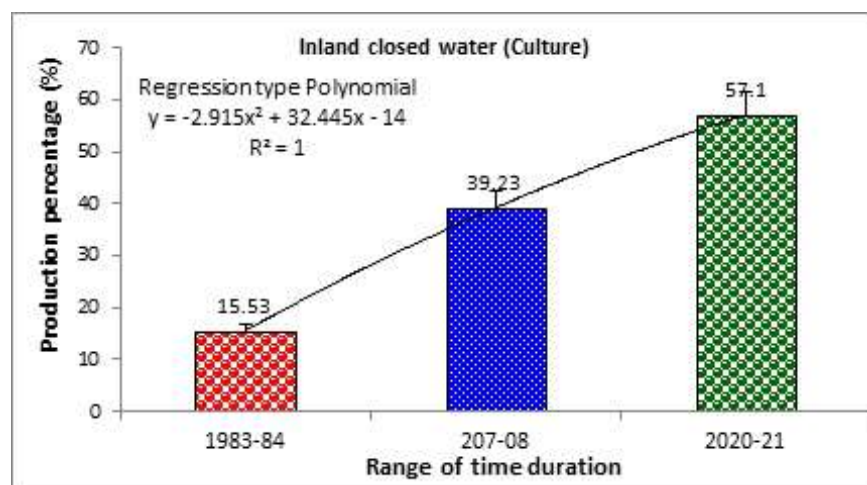


Fig.-3. Fish production percentage (%) of closed water (culture) last 37 years in Bangladesh.

Contribution of marine fisheries

The area of marine fisheries is included Industrial (Trawler Fishing) and Artisanal. In 1983-84, the contribution of marine fish production was 0.165 mill.mt and production percentage was 21.38% and in 2007-08, marine fish production was 0.498 mill. mt and was increased at 19.41%. Finally, in 2020-21, contribution of marine water fish production was 0.6812 mill.mt. and total fish production was decreased sharply with a value of 21.88% to 14.74% during last 37 years (Fig.-4). The regression type was Polynomial and the equation was $y = -1.1x^2 + 0.83x + 22.15$ and where, R^2 is 1.00.

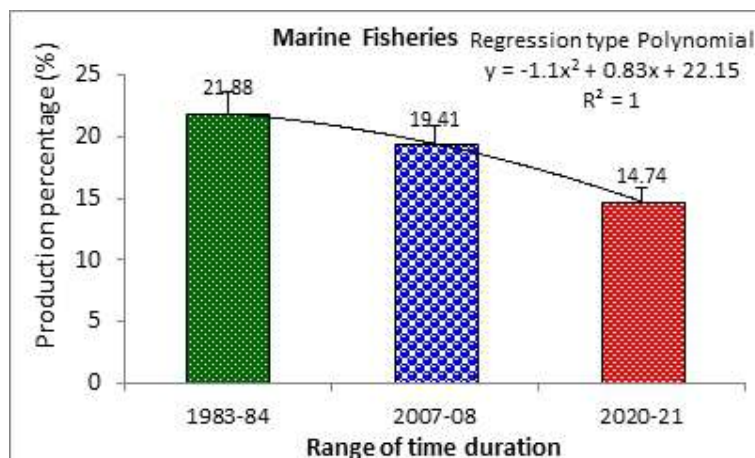


Fig.-4. The fish production percentage (%) of marine water last 37 years in Bangladesh.

Carp and cat fish hatchling

Carp hatchling production was recorded in different river at 2.152 mt and about 1056 government and private carp and cat fish hatcheries produced at 668.801 mt hatchling in the year 2020-21. Total production of hatchling was recorded at 670.953mt in 2020-21(FSYB, 2021).



Post larvae (PL) production

The number of PL production in government and non-government Galda hatcheries was recorded at 2.37 cores and the number of PL production in government and non-government Bagda hatcheries was noted at 721.04 cores in the year 2020-21. Total production of PL was recorded at 723.41 cores in 2020-21 (FSYB, 2021).

Current scenario of fisheries population

There are 162.18 million peoples live in Bangladesh. Near about 17.84 million (11%) people are somehow directly or indirectly related with different sectors of fisheries.

Enriched in fish biodiversity

Figure 5 showed that a well enrich fish biodiversity status is existing in Bangladesh. Fresh water fish species number is recorded 260, exotic fish species 12, marine fish species 486, fresh and marine shrimp species 48, tortoise 36 and crab 12, respectively. From biodiversity view point, figure 5 shows important 02 fishes were Extinct (E), 07 Critically endangered (CR), 30 Endangered (E), 25 Vulnerable status (V), 27 Not Threatened (NT), 122 Least Concern (LC) and 42 Data Deficient (DD) position (IUCN, 2020).

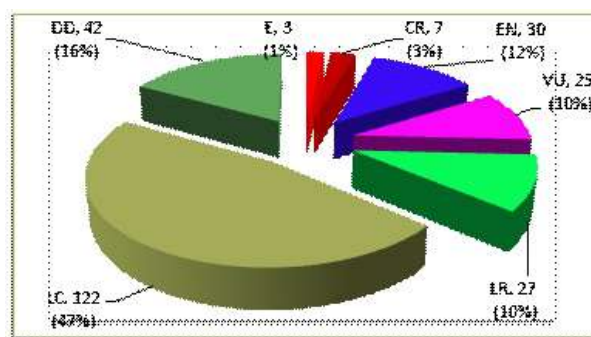


Fig.-5. Rich biodiversity status with 260 freshwater fish species.

Challenges of Fisheries resources

1. Structural Interventions

Flood control and irrigation structures-dams, barrages and embankments, serve as physical barriers to fish migration and destroyed the water ecosystem. Over 0.81 million hectares of floodplain habitat removed permanently from fish production presently and another 2.0 mil.ha will be lost by the year 2025. Before permanent construction several studies need to construct eco-friendly flood control and irrigation structures dams.

2. Pollution

Pollution damages to the loss aquatic habitats and species. About 425 major, 1175 moderate and 2200 minor polluting industries are in Bangladesh (DOE report). Wastes dump in the nearby river without any treatment. Annual emission into water by the industrial sector alone is about 50,000 tons of BOD and 106,000 tons of TSS. Most polluted rivers are Buriganga, Sitalakhya, Karnafuli and Rupsha. It should be regular monitored water quality and pollution of wetland and river. Organic and chemical pollutants are not drained into the wetland and rivers.

(a) Plastic : Between 1.15 and 2.41 million tons of plastic enter the ocean yearly. Plastic bags are mistaken for food by sea turtles and eat the bag which clogs their digestive system. Plastic continuously breaks down into “micro-plastic” and consumed by a variety of marine life and consume by humans.

(b) Agrochemicals : Farmers using fertilizer and 250 varieties of pesticides contaminate soil and water, enter into the food web. Cause bioaccumulation of toxic substances. Data used 48,690 tons pesticides yearly in the country and 25% of this eventually discharging into the Bay of Bengal. Pesticide residues kill fish at lethal dose. Enrich knowledge of using fertilizer and pesticides contamination aquatic habitat and prevention of habitat to save the fishes.

3. Aquaculture

Certain types of aquaculture contribute to the degradation of natural environments. Fish faces and uneaten fish feed create



pollution. To control fish disease, the use of antibiotics has increased. Antibiotics leave residual traces in uneaten feed and fish faces trapped in sediments and leading to toxic conditions for species. Antibiotic use in aquaculture leads to the development of bacteria, which is antibiotic-resistant. Aquaculture should be maintained fish feed act and Hatchery act.

4. Sedimentation

Physical structure of the of rivers, lakes, streams, and estuaries habitats changed due to increased sediment load, causes the shrinkage of wetlands, introduction of pollutants through sediment run off, creating respiratory and feeding problems by sediment settling over the bottom living organisms, especially coral reefs and covering of spawning habitats by the sediment settlement. Identify the target fisheries habitats and the fishermen communities. A strong action plan needs to face sedimentation by collaborating with the ministry of Land, forest and environment, water resource and Agriculture.

5. Irrigation

Irrigation resulted shrink in size, or completely dry out leaving no space for fish from beels, baors, river & canals. Excessive groundwater withdrawal has similar effect. Water from reservoir and ground water should be used eco-friendly during irrigation time. Beels, baors, river & canals never be dry up.

6. Open access fishing and lack of proper institutions

Open-water fisheries are considered “public property”. It results uncontrolled and indiscriminate fishing. State manages water bodies with the sole objective of revenue generation. No post-lease monitoring to ensure leased out wetlands according to terms and conditions of lease contract.

Leasing agreement is managed by the Ministry of Land as opposed to the Ministry of Fisheries and Livestock. It is another reason for lack of fish friendly management of the wetlands. Leasing agreement should be implant strongly and collaboration between ministry of land and Fisheries and livestock should follow strongly.

7. Over Exploitation and fishing practice

Overfishing is a serious threat of 50% of species fully or over-exploited. Bottom trawling destroys ecosystems and the food chains and captures many unwanted fish. Over exploitation affects the loss of genetic diversity and decreases species abundance. Using fine nets, bank to bank netting, Current jal and illegal catching of brood fish and fry have affected on fish. In the Padma and Meghna, bank to bank fishing has blocked the movement of anadromuos fish (Hilsa). Hilsa sanctuaries management policy, ban on fishing Jatka (juvenile), and fisheries laws and regulation should be implemented in all the rivers. Over exploitation should be stopped and maintain eco-friendly catch.

8. Alien species: Control of exotic/alien fish import

During the floods of 1987, 1988 and 1998, competitors and carnivorous species escaped from the ponds to wetland. Sucker fish of Thailand now cover 90% in Burigonga, Shitolokha and Turag River. Increased predation and competition, disease, habitat destruction, genetic stock alterations and even extinction. Species include plants, fishes, algae, molluscs, crustaceans, bacteria, and viruses. Since 1950s, about 24 species of alien fishes legally-illegally. Production in hatchery and culture any harmful alien harmful species must be banned in the country.

9. Ghost Fishing

Continuing Ghost fishing (Lost old fishing equipment) occurs a chain of injuries or deaths and smaller animals get caught in abandoned nets, and larger predators.

Prevent ghost fishing includes bio-degradable equipment and encourage fishermen to recycle gear or other incentives.

10. Natural, Human and transboundary attributes

Cross boundary issues are unauthorized fishing of own territory highly migratory species, oil spills, discharge of fossil fuel and raw sewage. The issue causes vulnerability to deep sea fish stock and resources. Unauthorized fishing in the Bay of Bengal and its dense areas are most common act of neighboring trawl fisheries. They use explosive and charge bomb to frightened the population for forcing migration out of the own zone for safe fishing. So, need to assess transboundary issues on river flow and fauna.

11. Aquatic Ecosystem Impacts

Metabolic rates of organisms and productivity of ecosystems are directly regulated by temperature. High water temperature



causes less oxygen in the water and less habitable in water column, high feeding requirements and high mortality in the hatcheries. Cold water temperature causes less metabolic activities of fish, low or no growth, loss in culture venture and causes death of fishes in high clod season. Salinity intrusion causes loss of habitat and more carnivore fishes intrude from the brackish water area, more diseases in shrimp and other culture fishes, increase atmospheric CO₂ and decreases pH. Increase dissolved organic carbon (DOC), altered biogeochemical cycles and changed net primary productivity. Influence the future status of inland freshwater and coastal wetland ecosystems.

12. Effect of Climate Change

Highly vulnerable to climate changes, are occurring and expected to continue over the next century. Climate change causes flood and cyclone, erratic rainfall, drought, river bank erosion, deeper penetration of saline water, changes in precipitation timing and affects water quality and quantity, and timing of flows. Species move up in altitude and latitude and change species composition, seasonality and productivity of plankton, and food web interactions. Climate change directly effects on fish habitat, physiology and behavior of fish and alters growth, reproductive capacity and change breeding season, mortality and distribution, effects on health and food security. Bangladesh is vulnerable to floods, droughts, hurricanes, cyclones and storm surges. Serious floods from the north and intense cyclone bring disaster regularly.

13. Institutional management

Conserving natural resources has many countenances depending upon Department of Environment (DoE) using EPA rule, while Department of Fisheries (DoF) use other rules to declare sanctuary in an area. DoF use fish conservation act to implement such ban and sanctuary for target fish. Avoid the establishment of industries, chemical plants and thermal power plants near the water resources as their discharge affect the loss of biodiversity.

14. Improvement of knowledge base Research

Enrich knowledge of fish status, conservation and prevention of aquatic habitat to save the fishes.

CONCLUSIONS

World population will be grown from 6.9 billion to 9.0 billion and Global cereal demand to feed such population will grow from 2.1 billion tons to 3.0 billion tons in 2050 (FAO, 2009). The population of Bangladesh will be risen up and would be a great challenge to secure the future dietary demand of the increasing population. The sustainability in aquaculture and fisheries in Bangladesh is under tremendous threat due to increasing population growth, changing climatic conditions, continuous decline in water area, vulnerable to the hazards of climate change-flood, drought, salinity, depleting water resources, declining production through indiscriminate use of agro-chemicals and poor research. The action plan efforts for saving the biodiversity and stock of fishes to implement hilsa fishery management policy, stocking fingerlings and established beel nursery in floodplain, enrich ecosystem of the river and wetland, declare the basins of the river as conservation including other's deeper wetland, upgrade management method for the conservation, enforce fishing rules, control over exploitation and illegal fishing, prohibition on harvesting of brood fishes, ensure sufficient water flow in the river, expansion of pen farming and cage culture in potential water bodies.

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NEPALESE FISHERIES AND AQUACULTURE IN THE FACE OF CLIMATE CHANGE

Dilip Kumar Jha

Faculty of Animal Science, Veterinary Science and Fisheries, Agriculture and Forestry University, Rampur, Chitwan, Nepal

Email : dkjha.ait@gmail.com

INTRODUCTION

Aquaculture has become a potential contributor to food and nutrition security over the years. But this sector is greatly affected by climate change. Climate change is an alteration in the normal distribution of weather over periods of time that range from decades to millions of years and it may be limited to a specific region or may occur across the world. In an aquatic system climate change is affecting the biological processes and the productivity of fish species. The consequences for sustainability of fisheries and aquaculture and the people that depend on them, are uncertain. It is now generally accepted that warming of the climate system is unequivocal, as evidenced from global increases in: average air and ocean temperatures; melting of snow and ice; and average sea levels. Unavailability of the proper amount of water may create problems in the near future. The fluctuation of minimum downstream release is found as the major cause for declining fish diversity. More anthropogenic disturbances and project structures are found creating impact on extinction of several protected species. Nepal, a landlocked mountainous country is blessed with a number of watersheds with different altitudinal variations from 60m-8848m represents a total of 252 fish species. Among them 236 species are indigenous while 16 species are exotic. These species belong to 15 orders, 40 families and 120 genera. Carps are the major fishes cultivated in Nepal. Aquaculture has great potential for future expansion. Inland capture fisheries and aquaculture are supported by the diverse agro ecological zones providing suitable habitat for different fish species which contributed 4.22% and 1.59% of the agriculture GDP and National GDP respectively. Annual fish production of Nepal is 104623 metric tons with the contribution of 83623 metric tons from aquaculture and 21000 metric tons from the inland capture fisheries, indicating per capita fish production 3.43 kg only. Nepal is deprived of any oceanic resources and most of its parts are overwhelmed by mountains and inland water resources. The three ecological zones from upper, middle and lower stretches are occupied by sacrophilic, mesophilic and thermophilic fish species respectively.

Climate change impact on fisheries and aquaculture

Nepalese fisheries and aquaculture are particularly vulnerable to climate change because of their abrupt ecological and climatic transitions. The climate ranges from subtropical in the south to Arctic in the north. Most precipitation in Nepal (around 80%) occurs during the Indian summer monsoon (June–September). Flooding is frequent during monsoon season while droughts are not uncommon in certain regions in other parts of the year. The natural disasters like floods, extreme temperature, erratic rainfalls, droughts, and erosion are caused due to climate change. Climate change worsened the situation of small-holder fish farming households through total stock loss, increased mortality, reduced fish yield, damage to rearing units, increased operating cost, and also affected their livelihoods. Climate change impacts, if any, are likely to produce more significant net effects on the aquaculture sub sector in subtropical Terai regions than elsewhere because production is more concentrated there. The general effects of climate change on freshwater systems likely increased water temperatures, decreased dissolved oxygen levels and the increased toxicity. In lentic systems, eutrophication may be exacerbated and stratification becomes more pronounced and stronger. This could alter food webs and change habitat availability and quality. Fish growers faced many challenges and consequences in aquaculture during drought periods. The lack of adequate precipitation can cause reduced soil moisture, diminished stream flow, crop damage, and a general water shortage in the fish rearing unit. Climate change is an additional pressure on the freshwater aquaculture and the impacts of climate change on freshwater aquaculture are more complex than those on terrestrial agriculture because fish is poikilothermic animal which is highly sensitive to various kind of biotic and abiotic stress that directly affect the growth, reproduction, physiology and behaviour of fishes. Abrupt changes in the raining pattern affected the production of fishes during summer. Generally, this is the high time for the growth of fishes. Some of the farmers adopted many local practices to cope with drought and flood impact on aquaculture.

In near future global hydroelectric capacity is going to be doubled and dam blocking of rivers degrading water quality, disturbance of aquatic and riparian habitat, migratory fish route blockage, economic impacts on fishery, and displacement of local communities. Further, there is a possibility of greater warming at higher elevation in the northern part of the country than at lower elevations in the south. Glacial lakes in the upper part may have disastrous effects in near future due to rise in



temperature. A general shift in cool and warm water fish species northward is expected. Growth conditions for such species should improve in high altitude well mixed lakes, small lakes and those with oligotrophic nutrient conditions. A number of lakes in the Terai region of the country have decreased in size during the last decades, mainly because of declining precipitation and excessive water extraction for irrigation purposes. The impacts on aquaculture from climate change, as in the fisheries sector, will likely be both positive and negative arising from direct and indirect impacts on natural resources required for aquaculture. Immediate impact of climate change is expected in the temperate climate zone; therefore adaptive strategies needed to prevent and counteract the potential impacts of climate change on aquaculture should initially be targeted in the climatic region.

Adaptive management to climate change impacts on fisheries and aquaculture

To overcome challenges certain adaptive measures should be adopted. Water stress and extreme climatic events would have a major influence on river basins and the possibility exists that land based and riparian agriculture may have to be abandoned and replaced by aquaculture as means of alternative livelihoods. Under such conditions capacity building needed to efficiently manage the changes to support livelihood patterns from agriculture to aquaculture. National policy and planning should be prioritised to address the effect of climate change. There are many gaps in the knowledge required to make sound projections about the likely effects of climate change on inland fisheries and aquaculture. Investments are needed to fill these gaps so that future assessments can be made with greater confidence.

CONCLUSION

It has been emphasized that the ways in which climate change may impact fisheries and aquaculture. Establishment and application of Geographic Information System would be worthy not only for the monitoring of changing variables but also for modelling future scenarios of climate change and its impacts on fisheries and aquaculture. Respective agencies of government need to prepare a plan of action and strengthen their institutional and technical capability which may require regional and international assistance. There is a need for a collaborative approach among different nations to cope with climate-related disasters.



POWER OF GENETICS AND CLIMATE CHANGE

Bijendra Pal¹ and S.P. Singh²

¹Bioseed Research India a Division of DCM Shriram Ltd., Hyderabad, Telangana, India

²CSAUAT-Agriculture Research Station, Kalai, Aligarh (U.P.) India

Email : bijendrapal127@gmail.com, dr.sp.singh24@gmail.com

Abstract

I have played with plant genetics and use the power of genetics to develop the improved cultivar, which can manage the current climatic situation and sustained their performance in change climate even after 10 year of introduction for commercial cultivation. This journey of crop improvement I have enjoyed in last 30 year give me more confidence that this world will never die because scarcity of food grain which was predicted by Malthus's in 1798. In recent past the concept of modeling and estimates for productivity, food demands, impact of climate change on the productivity has improved multifold. However if look at the prediction and estimate for productivity and food demands has made in 1990s many of them are far away from there prediction. This is because of 1) the power of genetics has been and will be enhanced multifold by the power of molecular breeding, gene editing base editing etc. These advance tools are evolving on a faster phase and making plant genetics more powerful and usable for crop improvements. 2) Development in other agricultural science such as irrigation , plant nutrition managements , mechanization and precession farming and site base nutrition management etc. 3) Use of genetically modified plant to minimize production loses and increase plant efficiency to produce more. In this research article I will try to explain what will happen automatically with less efforts and where need focus more in order to harvest the power of advance breeding told in more effective way to increase the precession in selection and number of breeding cycles per year.

Key words : Climate change, genetic power, molecular tolls, plant breeding, productivity.

INTRODUCTION

In 1798 Thomas Robert Malthus notably predicted that short-term gains is undermined as human population growth outstripped food production, He argued that the population to grow geometrically while food production would increase only arithmetically. For 220 years, economists have contended that Malthus overlooked technological advancement, which would allow human beings to keep ahead of the population curve and power of genetics and its use in crop improvement was not consider. The argument is that food production can indeed grow geometrically because production depends not only on land but also on know-how. With advances in seed breeding, soil nutrient replenishment (such as chemical fertilizers), irrigation, mechanization and more, the food supply can stay well ahead of the population curve. More generally, advances in technology in all its aspects—agriculture, energy, water use, manufacturing, disease control, information management, transport, communications—can keep production rising ahead of population. World leaders, policy maker and common people are worried for climate change and its effect on the productivity. Any untimely rain or rise in temperature always initiate the discussion, increase the anxiety, and invite many talks, discussion, conferences worldwide around the year. In contemporary use of advance tools for breeding such as marker technology , genomic section , GM technology , gene editing and base editing has help to augmented power of genetics which resulting the sustained the productivity growth under the climate change and its negative effect. In this article I will highlights how we can ordinate our self, continue fighting against climatic change, and make sure that no one will sleep with empty stomach in world.

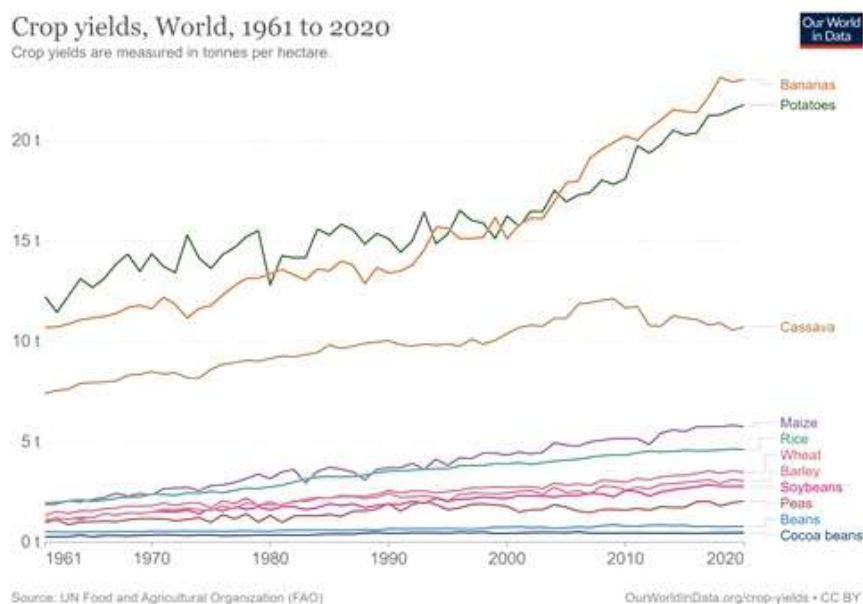
What had been done

Historical facts help to increase the trust on the tools and technique used in past and the result drive out these tools and techniques. If we pie the history of crop improvement just the use of better seed and its impact on harvest has generated the interest of farmers to use the good seed and plant scientist has started their effort to improve the seed quality. Mandel further help to understand the variability, inheritance and concept of recombination of traits, which finally become the basic driver for plant breeding even, hold significance in parent time also. The concept of hybrid vigor by shell 1905, which finally become one of the most significant tools in hybrid breeding has revolutionized the crop improvement efforts. Initially it was started in crop pollinated crop like maize and now its use many crop including self pollinated, often cross pollinated and cross pollinated , horticulture crop and vegetative propagated crops across the world. Concept of hybrid vigor / heterosis was so powerful which has force the scientific community to develops addition system such us cytoplasm male sterility, genetic male sterility thermo male sterility etc to exploit the heterosis. Which has enable develop and commercially use hybrids in crop like Maize ,



Sorghum, millet, cotton, mustard, rice, wheat, tomato, chili, melons, gourds crop and many others. Use of these techniques has helped to have continuous sturdy growth in the productivity of almost all the crops (picture 1).

A new chapter was started from 1990 where use of molecular tools and biotechnology approached such as GMO crops etc. increase which has helped to boost the yield further. Maize can be considered a good example where use of GMO and other molecular tools of plant breeding has helped to increase the productivity much better than all other crops and its close competitive crop rice and wheat.



What is happening now

Since last few years it is very common to see the formula to compute the genetic gain in most of the permeations where it's by breeder, molecular breeder or any other agriculturist (picture 2).

$$R_t = \frac{ir_A}{y}$$

R_t (genetic gain over time)

i (selection intensity)

r (selection accuracy)

A (genetic variance)

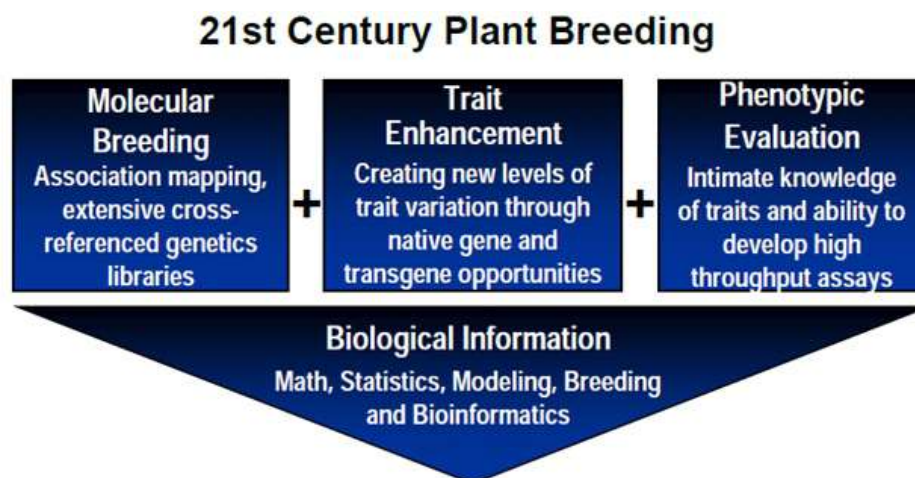
y (years/cycle)

This is nothing new : Lush (1942) capitalized on Wright's and Fisher's theoretical developments in quantitative genetics by defining the response to selection (denoted as R), which has become known as genetic gain (Hill, 2014). This measures the response to selection as a change in average breeding value of a population. Again Rutkoski, 2019a described the genetic gain as the expected or realized change in average breeding value of a population over at least one cycle of selection for a particular trait or index of traits. Now the breeding groups are engaged to improve upon the four major elements on this breeder equation, which is known as genetic gain. Number of techniques used to improve the useable genetic variability by using the elite by elite crossing, developing the multiple parent population, magic population, trait interrogation etc. Selection intensity and selection accuracy based on the phenotypic value is always a challenge as environmental noise influences selection and makes it more difficult especially in quantitative trait expression. Quantitative genetics has helped to estimate the genotypic value from the phenotypic expression. Through the years, scientists have investigated the confluence of the science of quantitative genetics and the process of plant breeding. The 1940s saw investigations of the genetic basis of heterosis (Comstock and Robinson 1948; Robinson et al. 1949) and the development of recurrent selection procedures (Jenkins 1940; Hull 1945;



Comstock et al. 1949) to address perceived limitations in line and hybrid development (Jenkins 1934). The 1950s and 1960s have been described as the golden era for quantitative genetics in plant breeding (Gardner 1977), given the research during these two decades on covariances between relatives (Kempthorne 1954; Cockerham 1956); mating designs to estimate VA, VD, and epistatic variance (Comstock and Robinson 1952; Cockerham 1963); empirical estimates of genetic variances in different plant species (reviewed by Gardner 1963; Matzinger 1963; Hallauer and Miranda 1988); genotype $\times$ environment interaction (Sprague and Federer 1951); stability analysis (Finlay and Wilkinson 1963; Eberhart and Russell 1966); and index selection for multiple traits (Brim et al. 1959; Pešek and Baker 1969). The 1970s saw the start of investigations of isozymes as markers for quantitative traits (Stuber and Moll 1972; Hamrick and Allard 1975). Long-overdue work started in the 1980s on formal methods to select parents in breeding programs (Dudley 1984). “Bandwagons” related to plant breeding from the 1990s to the present (Bernardo 2016) have included linkage mapping of QTL, association mapping, genomewide prediction (or genomic selection), phenomics, envirotyping, and gene editing, Genomic Selection (GS), Genomic Prediction (GP), whole-genome prediction (WGP) or regression often used synonymously Gblup (genomic blup) and rrblup (ridge-regression blup). And reduce the time by using speed breeding tool, repaid generation advancement(RGA) and/or double haploid (DH) technology.

What next : Climate change, unpredictable weather, narrow base usable genetic variability, complex disease, new races of insect and pest, mechanization, less farm labor availability, limited research budgets, highly educated farmers and yield plateau in many crops has opened a new challenge before the agriculture scientist and make it hard to sustain the production growth rate. It is very clear now that what has worked before will not be enough to sustain the growth in the future. Everyone in product development is in search of new tools to improve the selection accuracy and improve the cost effectiveness in every working stage. Variety turnover has reduced from 10-15 years to 4 to 5 years, which is demanding to have a faster breeding cycle. This has given birth to a concept called “breeding factory”. Crop improvement will be a game of genetic manipulation alone in the future and it will emerge as a complex science (picture 2). Machine learning, use of high-throughput phenotype, new tools supporting the below the surface selection, speed breeding, assimilation and production module, Bt technology will be new reality. This will help to develop new crops, new plant types and new crop rotations to achieve the more economic yield in less inputs and in lesser time.



Increased Rate of Genetic Gain for Desired Traits

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ENERGY CANE : IMPACTING CLIMATE CHANGE THROUGH RESILIENCY AND REDUCED CARBON FOOTPRINTS

Shiv Kumar¹, Anand Singh Jeena² and Sonali Gaur²

¹Department of Genetics and Plant Breeding, R.M.P. (P.G.) College, Gurukul Narsan, Haridwar, Uttarakhand

²Department of Genetics and Plant Breeding, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand

INTRODUCTION

Burning biomass has been a significant force in the development of human civilization throughout the previous two million years of evolution. Therefore, the discovery of fire was undoubtedly a pivotal point in human evolution. Then modern times arrived, and over the past century, owing to the utilization of fossil fuels, which is bioenergy that has been concentrated over millions of years, the human race has experienced its most momentous transition ever. However, considering its extensive use and misuse, humanity is up against a difficult challenge in trying to alter the energy system to counterbalance the harmful effects of fossil fuel usage, particularly on the Earth's atmosphere due to the build-up of greenhouse gases (GHG). As a result, it is believed that there is an urgent need for the development and widespread use of clean energy sources, as well as a shift in public perception regarding energy consumption (Lovins *et al.* 2011).

In recent decades, growing interest in bioenergy has compelled scientists to better comprehend the plant's physiological source-to-sink operation as a prerequisite for achieving efficiency in either the process of solar energy utilisation by plants or its subsequent accumulation of sugar and, ultimately, biofuel production for consumption by humans. Sugarcane (*Saccharum* spp.) is a well-known source of industrial sucrose that has been utilized for centuries in sugar production around the globe. Being a C4 crop, sugarcane is very effective in the photosynthetic process with high efficiency in the use of nutrients, water, and solar radiation, consequently, its dry matter accumulation ranks highest among the known plants. *Saccharum* spp. dry matter consists of sugars, primarily sucrose, fibre, cellulose, hemicelluloses, and lignin. *Saccharum officinarum* is characterized by its capacity to convert a remarkably high proportion of photo-assimilates to sucrose and store it in the culms. Several forms of clean energy have been studied, projected, or utilized as contributors to a cleaner and sustainable sphere. However, many of them entail high technology; consequently, they are not reasonable for developing countries. The sustainability of ethanol production from sugarcane as an alternative energy source was the most successful proposal for renewable energy from biomass first undertaken by Brazil (Leal & Da Silva Walter, 2010). Due to its favourable energy input/output ratio, sugarcane has been deemed an essential biofuel feedstock crop and accounts for around 40% of global biofuel production. (Lam *et al.* 2009). Sugarcane holds great potential to move towards sustainable bioenergy production, being one of the most efficient biomass-producing plants and, advantageously, its juice can be transformed into liquid biofuels to replace petroleum derivatives.

Sugarcane breeding brought a steady surge in yield over the years in a long-time span, though modest in comparison with other crops. However, in countries with a long history of sugarcane cultivation, there is an amplified claim that nowadays, both the yield and sugar concentration is relatively close to flat. A low fibre content (12 ± 2 % in fresh cane) is a pervasive trait that prevails in all the present-day commercial sugarcane cultivars grown throughout the world. According to (Matsuoka, 2017), the limited range of fibre content has been established as a paradigm in cultivars impeding the rise in yield. The genomic composition of modern sugarcane hybrid cultivars in the order of 80% from *S. officinarum* and 20% from *S. spontaneum* brings a balanced trade-off between fibre content and sugar content in the juice, both for good milling and sugar recovery in the industry, whereas sustaining the necessary set of agronomic characteristics. This composition has met the feedstock quality imposed by the industry, but the level of resilience is prejudiced. As a result, sugarcane productivity has levelled off worldwide, and the only chance of a leap forward is to break this captive rigidity with energy cane: a plant with a higher contribution to the genome of *S. spontaneum*. With this gene influx, the resulting plant is more resilient; the more the transfer of genes from wild relatives, the greater the plant's resilience. This new hybrid type bred for high tonnage, high fibre content, and relatively low sucrose can definitively upgrade the biomass agroindustry due to its higher resilience and heterosis for biomass productivity and other favourable characteristics, thus contributing to CO₂ mitigation.

Energy Cane

Sugar and ethanol production is the core concern in the traditional sugarcane industries, hence cane fibre levels had to be within a narrow range, with a minimum content generating electricity that would permit sugar and ethanol production to be processed and optimum content that would not cut down the industrial efficiency required to acquire these products. Breeders



exercise selection procedures to develop cultivars with high sugar content, irrespective of the fibre content. With the development of new technologies and the popularisation of renewable energy sources, sugarcane fibre is becoming an increasingly visible component of this raw material, encouraging sugarcane breeding initiatives to generate energy cane.

Alexander (1980, 1985) asserted provocatively that the most notable characteristic of sugarcane is its inherent ability to produce biomass, with some species demonstrating the potential to accumulate sucrose. A skilled sugarcane physiologist, he was the pioneer in conceptualizing the use of energy cane in the sugarcane mills of Puerto Rico at times when financial crisis due to various economic-structural-political matters, was resulting in very low sugarcane productivity in the field as well as low recovery of sucrose in the industry. He defined energy cane as a plant crop so developed to be harvested integrally as a growth commodity, utilizing all the lignocellulosic biomass for energy purposes (stalks, leaves, straw, and bagasse). Hence, Energy cane can best be defined as the lignocellulosic ethanol conversion technologies-based stress tolerant, high-biomass, and low-sucrose varieties of *Saccharum* bred to convert the fibre into bioethanol energy in contrast to sugarcane with high sucrose and low fibre typecast for sugar production. In the 1980s, Alexander's proposal was revolutionary for its time, but it is today a relevant subject that cannot be overlooked. He underlined that "energy cane" was a designation of a distinct cane management strategy and not the name of a particular plant species.

Lignocellulose (fibre) is nature's most abundant carbon-based product of photosynthesis (Chen, 2014). It consists of complex polysaccharides such as cellulose, hemicellulose, and polyphenol lignin; in varying proportions, in sugarcane, it reaches from 80% to 90% of the total dry matter (Chen, 2014). Moreover, the polysaccharides play a crucial role in strengthening and regulating the turgor pressure by enveloping the cells (Cosgrove, 2005; Frei, 2013; Jung *et al.* 2012; Stitt, 2013); besides that, polysaccharides also provide resistance to pests and diseases (Chen, 2014; Rutherford, 2014). Hence, fibre is essential for the overall performance of a plant; in short, they give resilience to it, complementing the dry matter accumulation property.

Energy cane as a dedicated bioenergy crop

How can a population that expands geometrically be fed by food production that grows arithmetically? Consequently, there is the threat of exhaustion of many natural resources that man is exploring in immeasurable ways, including energy resources. Resulting in irreparable environmental imbalance caused by the huge demand for food, energy, and welfare. Hence, the global quest for clean and renewable energy has reignited interest in biomass energy as a significant global concern. Specialized energy crops are considered the feedstock source for considerably substituting fossil fuel energy to address the enormous worldwide demand for bioenergy in the midterm, either as natural biomass or as liquid or gaseous biofuels. Climate is the fundamental determinant of crop selection, and tropical and subtropical regions have an advantage over temperate regions since C4 plants such as sugarcane thrive better in these zones. Sugarcane can be seen as an instrument of growth, a producer of biomass incomparable to any other plant when managed as a growth commodity.

A dedicated energy crop must satisfy a number of general requirements, as outlined below :

- (i) Availability year-round
- (ii) feedstock that efficiently and reliably transformed into valuable forms of energy
- (iii) biomass with high energy density
- (iv) well-established agronomic practices
- (v) favourable cost of production and transportation
- (vi) a perennial plant (renewable)
- (vii) ability to be produced under stress conditions and so as not to compete with land used for food production
- (viii) high favourable life cycle

To be broadly accepted and readily implemented as an energy feedstock, its direct use or the technology for transforming it into beneficial forms must be precise and economic. For the lowest total cost per unit of energy, it's ideal if the biomass has a high energy density, which in turn necessitates a high rate of dry matter produced per unit of land. Across both contexts, sugarcane is a reasonable choice. Another important factor is all year-round availability of the feedstock in order to be an economical alternative energy source in the long run. One of the limitations of annual crops contesting for energy crops is the seasonality and, consequently, short-term availability adding to its production. Even conventional sugarcane has a harvest



schedule in accordance with its sugar accumulation and maturity. Perennial growth habit but fast growth and long-term canopy to allow harvest during most of the year is desirable.

However, the main driving force of energy cane is its fibre concentration, or biomass, since fibre content does not fluctuate throughout the year unlike sugar does; biomass builds over time and is stored on crop stalks. A favourable cost of production and delivery is for any feedstock, which is influenced by a well-established agronomic production system, from planting to harvesting till its transport is significant. Many potential feedstock options still require much technological development, from breeding to end use, including production and harvest technologies. Sugarcane breeding, planting, agronomy, harvesting, and transportation are all well-established and well-understood practices that are another factor for energy cane's ideal candidature. It is advocated that energy crops must be grown in marginal lands for food production to not compete with food production. Energy cane fulfils all the requirements for a renewable bioenergy source. Therefore, energy cane may be the best alternative for bioenergy feedstock to produce biomass for biofuel production.

Characteristic features of Energy Cane

One of the most prominent traits of energy canes is the high number of tillers per stool, not only for the cane plant but also for the ratoons (Wang *et al.* 2008). The ratooning ability is closely related to the number of tillers, both being very important in total yield over the cropping cycle as well as significant with respect to economics and environmental terms (Matsuoka *et al.* 2012). Usually, the higher the number of tillers, the better the ratooning ability in energy cane. The energy cane variety generates a dense and robust root system that surpasses the ordinary cane in lateral extension, soil profile depth, and volume. The high tillering ability is associated with another attribute shared by energy canes, the potential to form rhizomes, a trait originating in *S. spontaneum*. Rhizomes are organs that contribute to the competitiveness of several grass species found in nature. They confer the ability to overcome abiotic stress conditions, such as water deficiency or cold temperatures, and primarily confer the capacity to regrow following the death of the plant's aerial parts due to any stressing agent, thereby providing resilience.

Researchers have put greater emphasis on energy cane during the past decade, conceptualizing it and comparing it to conventional sugarcane. Tew and Cobill (2008) presented three distinct types of cane :

Traditional sugarcane: constitutes approximately 75% water, 12% fibre, and 13% sugar. This raw material provides juice for sugar and ethanol production and fibre for energy generation. Therefore, the selection of genotypes with high sugar content is prioritized for developing traditional sugarcane cultivars.

Type I energy cane: a cane that is selected, and cultivated to maximize both its sugar and fibre components. Alexander abstracted this type of cane in 1985; it has lower water content (65%), fibre ranging from 13% to 17% (an increase of up to 40% concerning the traditional sugarcane variety), and a minor reduction or maintenance of the sugar content. Based on the principle of relaxing the strict standard set on fibre content, canes could be selected that were substantially more energy efficient than existing varieties. Thus this raw material, in addition to providing juice for sugar and ethanol production, contributes with more fibre for the better production of electricity, lignocellulosic ethanol, and other derivatives of economic value for the sugarcane industry.

Type II energy cane: a cane selected and developed to maximize fibre yield (fibre content above 30%), with insignificant sugar content and lower water content (60%). The contemporary sugarcane industry is not interested in this raw material because it is demanded by other agro-industrial sectors that require biomass for energy production. Usually utilized as a feedstock source for the production of electricity as well as cellulosic ethanol.

Based on these energy cane conceptualizations, breeding programs have adopted different criteria and strategies for developing new cultivars mainly with high fibre content and biomass yield.

Energy Cane vs Conventional Sugarcane

A field of energy cane seems comparable to a field of conventional sugarcane. However, upon closer inspection, at least three strikingly different traits are readily apparent: a narrower leaf blade, a thinner stalk, and a more profuse tillering.

Striking differences between EC and CSC are the higher fibre content and, conversely, the lower sugar content (Brix and pol) and purity of the former, added by a slightly higher content of simple sugars. Absolute numbers differ from some in the literature, as the components may vary according to several factors, especially the clones per se age, soil, and climatic conditions (Santos *et al.* 2016). Energy cane presents different characteristics from the sugarcane, such as a larger stalks population per area (between 130,000 and 210,000 stalks per hectare), plants with stalks of greater stature, thinner and more fibrous diameter, narrow leaves and abundant and deep root systems, with two to three times greater biomass yield (Diniz *et*



*al.*2019). The plants will be more vigorous and resilient if they produce more fibre in contrast to sugar, which has a number of economic and environmental benefits

The differences in biomass yields between sugarcane and energy cane are primarily perceived in ratoon crops. Increased biomass yield of energy cane is mainly associated with a higher stalk population, longer stalks, and greater NDVI (Normalized Difference Vegetation Index) values rather than leaf net photosynthetic rate or stalk diameter than sugarcane (Zhao *et al.* 2017). Energy cane, producing three to five times more stalks than conventional cane, accordingly gives a multiplication rate proportionate to the increased stalk number. Additionally, in the same conditions and yearly, a suitable energy cane cultivar produces at least 50% more internodes per stalk and, consequently, buds, which also have better sprouting capacity (Matsuoka, 2014). Once established, the crop could stand in the field for at least double the number of years as compared with sugarcane the productivity is sustained at a high level for a greater number of ratoons (Bischoff *et al.* 2008). Because it produces more stalks than sugarcane cultivars, energy cane allows for a larger multiplication ratio (1:30 or more, compared to the 1:10 standard rate of sugarcane cultivars), which is another significant economic advantage.

Genetic Base and Breeding for Energy Cane

Modern sugarcane cultivars are complex poly- alloaneuploids comprising the genome of *S. officinarum*, varying proportions of *S. spontaneum* chromosomes (10-23%), and 8 to 13% of recombinant or translocated chromosomes (Piperidis *et al.* 2020). In the germplasm exploited to develop novel sugarcane hybrids, there is a fair amount of viable genetic diversity for biomass productivity. These hybrids are complex aneuploidies that contain genes from the *S. officinarum* and *S. spontaneum* species.

These proportions probably depend on the selection pressures for adaptation to specific environments (Selvi *et al.* 2005). Genetic structure attained after several generations backcrossing the original F1 individuals derived from crosses between the ancestral *S. officinarum* and *S. spontaneum*. The new energy cane plant comes from the same germplasm pool already available in the traditional germplasm bank of the Saccharum Complex. Therefore, it is necessary to have significant genetic diversity, especially for sugar and fibre contents in the species of the Saccharum complex. This germplasm pool comprises conventional sugarcane cultivars, i.e., *S. officinarum*, *S. spontaneum*, *S. barberi*, *S. sinense* and *S. robustum*, and other genera like *Miscanthus*, *Erianthus*, *Ripidium*, *Sclerostachia*, and *Sorghum* as well. Genetic base broadening, or the use of wild Saccharum germplasm, particularly *S. spontaneum*, in sugarcane breeding programmes, is perceived by many geneticists as synonymous with the genetic improvement of sugarcane for increased energy efficiency and resilience to a wider range of environments.

Most breeding programmes have adopted a similar strategy to obtain energy cane cultivars within 6 to 8 years: maintaining a germplasm collection with high genetic diversity, performing hybridizations, producing many seedlings, selecting superior individuals according to the desired type, and obtaining energy cane cultivars for acceptance. Nevertheless, each breeding programme employs criteria based on its interests and regional environmental particularities. For example, unlike conventional sugar cane breeding, to minimize the chromosome number of *S. officinarum* and recover those of the more fibrous ancestral like *S. spontaneum*. As a result, the F1 population from those crosses will significantly vary in several traits. The selection is focused on those canes showing heterosis for yield and long ratooning, ultimately resulting in clones with a high fibre level. The hybrid vigour of the selected clones is very noticeable, and the best clones show a two- to three-fold gain in productivity. Conversely, changing the selection pressures toward varieties that produce high biomass with less emphasis on sugar is an excellent alternative for exploiting the wild germplasm. The energy cane breeding projects began in Puerto Rico with the establishment of a pioneering commercial venture to explore sugarcane as a biomass feedstock for several products besides just sugar. The growing interest in energy in recent decades pushed several sugarcane breeding programs worldwide to produce commercial energy cane varieties. Concerning commercial adoption of Energy Cane, it is in its infancy, whereas traditional sugarcane breeding programs eventually carry selections of biomass-type clones (Silveira *et al.* 2016).

Strategies to select energy cane

The application of precise selection procedures is critical for successful energy cane breeding. Principally selection strategies for developing different types of energy cane should be clearly defined at the beginning of any breeding programme. Most institutions have established strategies based on the desired sugar and fibre proportion. The first breeding attempt of developing energy cane was directed in Louisiana and Puerto Rico, where selection for high biomass was the specific objective. With the radical shift, it would be possible to add a substantial improvement with little effort in genetic breeding. In the mass selection of energy cane, clones should preferably be having following characteristics: high-statured pithless stalks,



intensive tillering clumps, erect growth habit, high unit weight, internodes with high mean diameter, absence of aerial rooting, narrow, erect and thick leaves, absence of flowering, good plant health (absence pests and diseases incidence), and fibre and sugar contents in accordance to the desired segment for the commercial biomass production. Moreover, the clone must be vigorous and resistant to mechanical damage. Genetically, the distinct outcome of the selection is probably a direct reflection of the partitioning of chromosomes between the parental *S. officinarum* and *S. spontaneum*, the more the contribution of this second species, the more the shifting for fibre and simultaneously for resilience with all consequent beneficial characteristics in terms of overall agricultural performance of the clone. If energy cane is the goal, the selection pressure is for final biomass productivity instead of sugar productivity. The fibre-only model of sugarcane comprises the utilization of germplasm outside the traditional sugarcane germplasm pool, specifically *Saccharum spontaneum*.

Advantages and challenges of energy cane

Energy cane has the following advantages concerning sugarcane :

- (i) Multiplication rate between two and three times higher
- (ii) Less susceptibility to pests
- (iii) More significant water and nutrients use efficiency.
- (iv) More excellent resistance to damage trampling, with a consequent increase in yields and longevity
- (v) Can be grown in marginal areas without competing with food production
- (vi) Integral harvesting system without burning, reducing harmful impact on the environment and generating more significant income opportunities for the growers

Many of these advantages contribute to a lower energy cane production cost with high biomass yields. Due to its lower sugar concentration, energy cane was not widely cultivated until recently, when lignocellulosic ethanol conversion technology was developed. However, there are significant problems associated with the selection of energy cane clones :

- (a) high incidence of smut disease (*Sporisorium scitamineum*)
- (b) high flowering rates and low unit stem mass.

Consequently, the most challenging part of genetic breeding for the commercial cultivation and consolidation of energy cane cultivars is the development of more valuable measures for these problems.

For the agro-industrial sector to adopt energy cane cultivars, there are still several technological obstacles, such as (1) the advancement of milling efficiency for juice extraction and (2). the development of mechanical harvesters for cultivars with high productivity and fibre content. Moreover, sugar crystallization becomes problematic in, energy cane cultivars with a low proportion of sucrose and a more significant concentration of reducing sugars (glucose and fructose). Last but not the least, farmers' adoption of energy cane will also depend on the commercial value of the final products being derived from the raw material (sugar, ethanol, electricity, biochemicals, and solid fuels, among others).

CONCLUSIONS

Biomass as a renewable energy source is one way to aid the world's significant and critical need to cease its reliance on fossil fuels. Slewinski, (2012) aptly remarked, "A dramatic change in crops is needed to keep pace with the demands of an increasing human population, exponential need for renewable fuels, and uncertain climatic changes. As productivity is the major motivation for the sustainability (economic, environmental, social, etc.) of any energy biomass source, energy cane has the potential to efficiently subsidise the world's demand for bioenergy. The exploitation of this crop will therefore permit a reliable reduction in the cost of production of biomass energy, whether in the form of a liquid combustible, heat, steam, or electricity, without significantly affecting the valuable agricultural land area. Moreover, it is a plant with the prospect to double the biomass production per unit of land area, essentially the fibre portion. The main objective is to improve the energy conversion efficiency of primary sugarcane energy, agricultural productivity and ultimately the total bioenergy per hectare.

Furthermore, it may be implemented with minor adjustments to the well-established production practices of traditional sugarcane, both in the field and in the industry. In the long run, it will be a suitable feedstock for future biorefineries. To the conventional sugarcane industry, Energy cane cannot be regarded as a competitor but rather as an add-in crop in a new



platform of production-industrialization intended to bring sustainability to this old and unstable crop-industry complex (Matsuoka, 2017)

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WALNUT (*JUGLANS REGIA* L.) : AN AMAZING HEALTH BENEFIT AND MULTIPURPOSE CROP TO BE UTILIZED FOR COMMERCIAL CULTIVATION

K.K. Pramanick, A.K. Shukla, Santosh Watpade, Madhu Patial and Jitender Kumar

ICAR-IARI, Regional Station, Shimla, H.P.

Email : kallolpramanick@gmail.com, head_shimla@iari.res.in

Abstract

Among the nut trees, walnut (*Juglans regia* L.) is one of the promising food resources but this potential is not adequately utilized world-over. They are not only delicious but also a complete functional food because they not only provide nutritional but also medicinal health benefits. Although the walnut has been appreciated since ancient times, commercial walnut orchards only started to be planted at the end of the last century. Nutritional security is a prime importance now-a-days. Walnut is the oldest fruit grown in the world. Nuts are nutrient dense foods and have been a regular constituent of mankind's diet since prehistoric times. In recent years there is a growing interest in nuts which provide health benefits and are alternative to medicine. They are unique among nuts because they are loaded with omega -3 and omega-6 fatty acids, and various other bioactive compounds, antioxidants, fibre, vitamins, minerals, tocopherols and phytosterols. It provides food, medicine, shelter, timber, dye, tooth cleaning, lamp oil and many more benefits to mankind. Walnut oil is used for edible purposes, artist oil colours, varnishes and soap making. Walnut shell flour is used as ingredient in plastic pillars, battery cases, molding resin forms, industrial tile and as insecticide spreader. Walnut timber is used for furniture, carving and making butts of guns. Therefore, walnut is an amazing health benefit and multiple uses crop and to be planted scientifically after judicious selection of cultivar/variety. Moreover, walnut is not only an agricultural commodity, but its leaves, barks, stems, pericarps, fruits, flowers and ligneous membranes are all applied for different medicinal uses. Older orchards in most traditional walnut producing countries consist of mature seedling trees characterized by a long juvenile period and poor, inconsistent bearing habits. A unique walnut plant, Sel-3 (Pusa Khor) is being evaluated at the ICAR-IARI Regional Station Shimla, Himachal Pradesh, India. It was collected from Chamba region of Himachal Pradesh which came into bearing in the second year of its grafting. The known varieties of walnut normally take 10 to 15 years to come into bearing. Sometimes it takes even more. The fruit appears to be borne in lateral position as well as terminally. This is a characteristic of newly evolved early, good quality and heavy bearing walnut cultivars. However, no such cultivar is reported in India so far. The leaf size and annual shoot increment is also differing from other walnut plants collected during the same survey. The nut is thin shelled, kernel colour is light yellow and good in taste. It is semi-vigorous in nature and suitable for high density plantation.

Key words: Walnut, health benefits, omega-3 fatty acids, functional food, bioactive compounds, antioxidants, cultivars, high density, thin shelled, bearing habit, precocity.

INTRODUCTION

Persian walnut (*Juglans regia* L.), also called the English walnut, is the most valuable commercial species in its genus belonging to the family Juglandaceae. Persian Walnut (*Juglans regia* L.) is known to be rich in oil, vitamins, minerals and proteins (Ozcan, 2009, Özcan, Yman, & Arslan, 2010). The establishment cost of walnut orchard is so high that the fruiting at an early stage is very much required. Nuts are one of the important and potent of all foods. They should be included regularly in our diet. Nuts are valuable food materials and have been used as such for a long time in many parts of world. Nuts are nutrient dense foods, rich in unsaturated fatty acids, bioactive compounds, high-quality vegetable protein, fibre, minerals, tocopherols, phytosterols, and phenolic compounds etc. Because of their low water content they are concentrated food and also have been kept and handled well for a long time. They can withstand transportation, rough handling and low temperature. If kept cool they rarely spoil; otherwise they may deteriorate by becoming wormy, rancid or musty. Nuts can be marketed in shell or shelled. By virtue of their unique composition, nuts are likely to be beneficial and excellent health outcomes. Walnut belongs to category of having high fat content (Hill and Sharma, 1988). Walnut (*Juglans regia* L.) is the most widespread tree nut distributed all over the world. The walnut trees botanical name *Juglans regia*, comes from the Romans. The word juglas, from the Latin, means 'the Acron of Jupiter' while regia refers to 'royalty'. Walnut has been described as 'doctrine of signatures', according to which the plants resembling various organs and features of the body made effective remedies especially for those parts of the body. The Greeks called walnuts karyon, or 'head', probably because the shell resembles the human skull and the kernel bears a resemblance to the brain. The Romans thought walnuts looked more like testicles. They consecrated the walnut tree to Jupiter, the king of the Roman gods, and called the nuts 'Glands of Jupiter' (condensed to



Juglans). This gave rise to the walnut's scientific name, *Juglans regia*, literally, 'royal nut of Jupiter' (Stephen *et al.*, 2006). *Juglan regia* L. is a promising functional food which not only provides nutrition, but also has additional health benefits.

There are three different species of walnut tree: (a) the most familiar variety being *Juglans regia*, known as the Persian or English walnut. The variety grows to a height of 40-60 feet high and has a life span of about 60 years or more; (b) *Juglans nigra* or black walnut can grow to a height of 150 feet; with a nut bearing a more rounded shape. The black walnut tree is known to be centenarian, living for 100 years or longer and used as rootstock in commercial cultivation; and (c) *Juglans cinerea* refers to Butternut, or white walnut. The butternut tree averages about 30-50 feet in height and bears an oval or egg shaped nut and its life span varies from 50-75 years (Hill and Sharma, 1988).

Many decades ago nuts were considered unhealthy due to their high fat content. However, this perception has changed over the past decade. Nuts are now often recommended because they have a healthy fatty acid profile and are high in protein, vitamins and minerals etc.

Walnuts are rich in fatty acids. Walnuts contain between 52 - 70 per cent oil. More than 90 per cent of this oil contains unsaturated fatty acids and the oleic acid (a monounsaturated fatty acid) content ranges from 12-20 per cent. Walnuts are exceptional source of alpha-linolenic acid (ALA). They contain both omega - 3 and 6 fatty acids. Most people do not get enough omega-3 fats in the diet. Being unique among nuts, walnuts contain the highest amount of ALA, the plant based omega-3 fatty acid required by the human body (USDA, 2010). Observational studies have shown that each gram of ALA you eat per day lowers your risk of dying from heart disease by 10%. Walnuts are a good source of the plant form of omega-3 fat, which may help reduce heart disease risk.

Walnuts, like many plant products, contain no cholesterol. Nuts are cholesterol-free, but their fatty fraction contains sizeable amounts of chemically related noncholesterol sterols belonging to a heterogeneous group of compounds known as plant sterols (PS) or phytosterols (Segura *et al.*, 2006).

A large proportion of the fatty acids in walnuts are unsaturated and the oxidation of unsaturated lipid is linked to the appearance of unpleasant odours and flavours. The oxidation of the polyunsaturated fatty acids occurs slowly even in nuts stored under favourable conditions (Savage *et al.*, 2001). The vitamin E isomers provide some protection against oxidation of the unsaturated fatty acids.

Walnuts are an excellent source of protein ranging from 13.6 to 18.1 g crude protein/100 g dry matter (Savage, 2001). Walnuts contain a relatively low content of lysine and high levels of arginine (Ruggeri *et al.*, 1996). The high levels of arginine in walnuts have already been identified as a positive feature as arginine can be converted into nitric oxide, a potent vasodilator, which can inhibit platelet adhesion and aggregation (Sabaté and Fraser, 1993).

The total dietary fibre content of 12 different cultivars of walnuts harvested in New Zealand ranged from 3.1 to 5.2 g/ 100g dry matter (Savage, 2000).

Walnuts are also a good source of magnesium (44.79 mg/oz) and phosphorus (98.09 mg/oz)—both important minerals involved in the body's processes and necessary for achieving optimal wellness. Walnuts provide more than 10 per cent of the daily recommendation of magnesium and phosphorus as well. Walnuts also contain 450 mcg of copper per oz., over 20 per cent of the daily intake of this mineral. Other micronutrients present in walnuts include vitamins C, E, B6 and K, folate, pantothenic acid, riboflavin, choline, betaine, niacin, calcium, iron, potassium, thiamin, zinc and selenium (Lavedrine *et al.*, 2000).

Juglans regia L. exhibits greater antioxidant capacity than any other nuts (Wu *et al.*, 2004; Pellegrini, *et al.*, 2006). According to an evidence-based review, antioxidants help to protect from certain chronic diseases of aging, including cardiovascular, neurological and anticarcinogenic ailments due to their ability to control free radicals—known to negatively influence healthy aging (Ferrari, 2004). Walnuts contain many antioxidants (13.126 mmol/100 g). Walnuts have higher antioxidant activity than any other common nut.

The activity comes from vitamin E, melatonin and plant compounds called polyphenols, which are particularly high in the papery skin of walnuts. A preliminary, small study in healthy adults showed that eating a walnut-rich meal prevented oxidative damage of "bad" LDL cholesterol after eating, whereas a refined-fat meal didn't. That's beneficial because oxidized LDL is prone to build up in your arteries, causing atherosclerosis. Walnuts are an excellent source of antioxidants that can help fight oxidative damage in your body, including damage due to "bad" LDL cholesterol, which promotes atherosclerosis.



Walnuts are being considered as excellent good mood foods. Walnuts have long been thought of as a 'brain food' because of their wrinkled, bi-lobed (brain like) appearance. Walnuts are an excellent source of omega 3 essential fatty acids. In addition, walnuts contain good amounts of uridine. Walnuts also contain some other compounds like vitamin B6, tryptophan, protein, and folic acid which contribute to a good mood. Higher blood levels of omega 3 fatty acids have been linked with better mood and lower rates of depression, while lower blood levels of omega 3 fatty acids have been associated with higher rates of depression and negative feelings. The standard dosage of omega 3 fatty acids recommended by many experts is one gram per day that may be obtained from about half an ounce of walnut (Thakur et al., 2012).

CONCLUSION

In the present scenario human beings are constantly in search of new food resources that can prove to be a complete health food as well as profitable. Walnut have been the first health food to receive a health claim from FDA. This is to explore all the health benefits and nutraceutical potential of walnut so that complete awareness can be generated. This nut has immense potential to contribute to nutrition, dietary, culinary and food sector diversification with income generation and nutraceutical potential. Health benefits of walnuts are being accentuated to rise in shell walnut consumption all over the country. In recent five years, consumption of in shell walnut has increased. As a result, walnut germplasm is open for international researchers. Collaborative researches could be implemented for collection and protection of walnut germplasm, determining the effects of walnut consumption on human nutrition and on human health. Owing to the increasing health benefits of nuts and the readiness with which nut-bearing trees can be grown in non-agricultural land, considerable attention is being directed to them with a view of improvement. Although nuts clearly have many health benefits but their potential is still not aware to each and every human being. Consequently, more research needs to be conducted includes in vitro, animal, and clinical studies to further add to our understanding of the health effects of walnuts and the underlying mechanisms involved.

Several factors are important to consider when selecting a walnut cultivar including local climate and pest conditions. Walnut requires a period of winter chill to break dormancy and initiate leaf and flower production. Because pollination is required to set a crop, growers should select a cultivar with overlapping male and female flower maturity or, if a suitable pollen source is not nearby, plant a few trees of a pollinizer variety. Early leafing and flowering varieties are more exposed to spring rains that contribute to bacterial blight.

High development costs for establishing a walnut orchard demand the planting of cultivars that bear large crops at an early age. Cultivars displaying lateral bud fruitfulness generally come into production well in advance of non-lateral bearing cultivars. Shell thickness and structure are the most important determinant of percent kernel and nut crack-ability. The highest quality walnuts have a thin outer shell with no internal convolutions protruding into the nut meat. The inner shell partition between kernel halves should be very thin to allow easy removal of kernel pieces. An ideal walnut cultivar must have late leafing, both terminal and lateral bearing, low incidence of pistillate flower abscission, high yielding nuts with large size, relatively smooth, 50 % kernel recovery, plump and light colored kernel and at least moderately resistant to pest and diseases (Cosmulescu et al. 2010; Botu et al. 2010; McGranahan and Leslie 2012). The nuts of the tree collected by scientists of ICAR-IARI, Regional Station, Shimla from Chamba District of Himachal Pradesh, India appear to meet this standard.

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ROLE OF PIG PRODUCTION IN NUTRITIONAL AND LIVELIHOOD SECURITY AMONG TRIBALS OF JHARKHAND

Ravindra Kumar*, Nirmala Minj, Pawan Kumar Verma and Sushvi Kumari

Department of Livestock Production and Management, Ranchi Veterinary College, Jharkhand, India

*Corresponding Author Email : ravindrarcvcbau@gmail.com

Abstract

Pigs are of great importance in India because of their contribution to human nutrition, their role in agricultural production systems and their economic function. India's pig herd is the largest in tribal populated states. This paper reviews the rural pig production sector. Starting with an overview of natural conditions concerning pig production, including a description of prevalent pig breeds and pig production systems, the paper then takes a systematic view of the pig production infrastructure, including the breeding and feeding as well as the veterinary and extension systems, and product marketing. Finally, the political and economic environment and state policies relevant to pig production are described. While focussing on the present situation, the paper also incorporates information on historical developments, which have led to the current state, and derives trends for future development.

Key words: Pig, production, husbandry, breeds, livelihood.

Pig Population and Production dynamics in India

Animal husbandry and livestock sectors are critical for rural livelihood and economic development of the country. India possesses one of the largest livestock wealth in the world and a quarter of the agricultural gross domestic product is contributed by the livestock sector. Among the livestock species, pig finds an important place as it being reared by socio-economically weaker sections of the society. Pig as compared to other livestock species has a great potential to contribute to faster economic return to the farmers, because of certain inherent traits like high fecundity, better-feed conversion efficiency, early maturity and short generation interval. Pig farming also requires small investment on buildings and equipments. It has immense potential to ensure nutritional and economic security for the weaker sections of the society. As per 20th Livestock census, India's pig population is 9.06 million which amounts to about 1.69 % of the country's entire livestock. Total population of exotic/crossbred was 1.9 million while indigenous pigs were 7.16 million. Total population of exotic/crossbreds in rural areas was 2.126 million while it was 0.329 million in urban areas. In case of indigenous pigs, population in rural areas was 7.099 million while it was 0.737 million in urban areas. The total pigs in the country have decreased by 7.54% over the previous census. In rural areas the decline was 7.37 % while it was -9.06 % in the urban areas. Highest share of country's pig population was found in Assam (15.89%) followed by Uttar Pradesh (12.96%), Jharkhand (9.35%), Bihar (6.31%) and West Bengal (6.30%). Highest percentage increase in pig population as compared to previous census was observed in Tripura (37.48%) followed by Jharkhand (31.38%) and Karnataka (8.59%). Number of Pigs per Thousand Households in rural Areas was highest in Arunachal Pradesh (2221) followed by Nagaland (1424), Mizoram (1220), Meghalaya (1124) and Manipur (657) (Livestock census 2012). This elucidates the extent of popularity and acceptance of pig rearing in N-E hilly region of India. Number of Households Enterprises and Institutions rearing pigs was 2.5 million while 5,000 Non Household Enterprises and institutions were having pigs. As per Department of Agricultural Research and Education (DARE) report, during 2012-13, domestic production of pork was 0.45 mt with an average meat yield of about 39 kg/ animal, which is lower than the world average (79 kg/animal). The share of pork is around 8% of total meat production. Most of pork consumption takes place in unorganized sector in form of locally raised fresh pork meat. The Pork is not widely distributed in the organized retail sector. Given cultural perceptions and consumer perceptions about pork meat, consumption of fresh local meat is more popular to north eastern and eastern India, tribal belts in Uttar Pradesh, Bihar and is also favoured in states of Kerala and Punjab. Swine production in India has remained somewhat unexploited despite the country having an established pig population. Absence of properly defined production practices and organized breeding programmes are among main hurdles in improvement. In subsistence-driven systems, insufficient feeding, ineffective health care and inbreeding are the major hindrance to pigs expressing their full performance. In order to effectively address constraints in pig production systems, holistic approach involving feeding, breeding, health, management and marketing infrastructure is the need of hour. The development of livestock would not only provide a supplementary source of income, but it would also provide protein rich food such as milk, eggs, meat, and organic manure for crop production (Ajala et al. 2007). Smallholder livestock production systems improve livelihood and food security for the poorest people (Dixon et al., 2001;



Keouboulapheth & Mikled, 2003). In addition to providing protein for human consumption, pigs are often one of the main sources of cash income in rural areas and provide manure for cropping (An et al., 2004). Swine rearing promotes better self-reliance along with greater food security to urban households (Mougeot, 2000) and increases incomes.

Salient features of Pig Farming in India :

Pig farming has been adopted by small and landless farmers, and in tribal areas.

Production is small-scale, backyard, marketed-oriented enterprise.

Pigs are mainly dependent on locally available feed resources/vegetations, crop residues and kitchen waste which are of low or no cost.

It is low-external input activity relying mainly upon women's labour for rearing

There is lack of proper housing and shelter under low-input traditional system thus exposing pigs to adverse weather conditions like high temperatures and rain.

Most of pig sty are located in backyard of house and the unhygienic conditions of these building predispose pigs to diseases.

Best breeding stock rarely goes to the market, resulting in the use of a foundation stock with poor breeding qualities.

There is non-utilization of improved breeds from government farms and increased use of own stock and that of neighbors, which gives rise to inbreeding and consequently low productivity (Nath et al., 2013).

A wide gap still exists between the need/demand and availability of pork. The major reason is that the pigs reared by the farmers are of the nondescript local breed, whose growth rate is claimed to be poor, and hence, their production is hardly adequate.

Producers have inadequate knowledge about feeding, health care and breeding management.

The commercial pig production system in India is characterized by improved crossbred/ exotic breeds of pigs that are bred and reared under confinement.

Jharkhand : Pig farming is traditional occupation

Jharkhand is one of the leading states in the country where piggery has been accepted by rural people as a traditional remunerative enterprise. Pig rearing is an old practice in Jharkhand particularly by weaker section in the society. Which provided tremendous employment opportunity to local people through integrated piggery development programme in most of the district of Jharkhand, total pig population in Jharkhand is twelve lakhs eighty thousand only out of which indigenous/ local/ desi is nine lakhs twenty thousand six hundred twenty five, which is about 95.6 % of total pig population of Jharkhand (census 2012). However, the information regarding the indigenous pigs of Jharkhand is meagre. Still there is no scientific evidence available regarding pig and pork production of indigenous pig in Jharkhand. The pig especially indigenous one is well adapted and tolerable to various tropical environments with high temperature and relative humidity. Further, the indigenous pigs are natural scavengers, size of medium to large with poor reproductive as well as productive performance and somewhat semi- wild in behaviour. The indigenous pigs possess good maternal ability and usually become aggressive during farrowing. Local pigs of Jharkhand are highly preferred by rural families might be due to black colour, better taste of pork, demand of desi pig in local market, religious importance, rearing of local pig under zero input system/ scavenging system these domestic breeds or non-descript indigenous pigs are reared on boiled rice, rice polish, rice husk, vegetables, boiled arum, fermented rice, garbage kitchen waste, hotel waste, Mahua etc. productivity of domestic breeds is low. As a result exotic breeds like landrace and Hampshire gaining popularity due to high growth potential. Most of the people who rear indigenous pig are not aware of scientific pig rearing and have limited information about rearing system, sanitation system, feeding and watering system, housing, breeding, disease prevalence, vaccination, bio- security, marketing and constraints of pig production under rural conditions (Safranski, 1999), which create hindrance in growth of pig production.

North-east India: Huge avenues for pig production

In states of North-East India, almost every household has a small piggery unit. There is a huge demand for pigs because people of this state prefer pork than other meats. Majority of the pigs in this hilly region are reared in intensive production system and fed with homemade cooked feed including kitchen waste and locally available plants (Kumaresan *et al.* 2009). Moanaro *et al.* (2011) reported pig rearing under a low-input production system in the Nagaland State of India where nonconventional feed resources contribute majority of the feedstuffs offered to the animals. Small land holders in Nagaland are adopting more profitable and less labour intensive backyard pig production to increase cash returns, and accumulate capital in banks. As per



2003 livestock census, Nagaland recorded highest human-pig ratio of 3:1 as compared to the national ratio of 76:1 (Njuki et al., 2010). Pig alone accounts for 55.38 % of the total livestock population in Nagaland, but still a wide gap exists between the demand and availability of pork mainly due to traditional production system. Families usually keep an average of 1-2 indigenous or crossbred pigs for fattening with zero to minimum inputs in terms of family labour and feeding (Patr *et al.*, 2014). In Mizoram and Sikkim, it has been reported that crossbred pigs were preferred for better growth performance, higher weight gain, larger litter size and greater back fat thickness (Nath *et al.*, 2013). 2092 Anuj Chauhan, B H M Patel, Rajveer Maurya, Sushil Kumar, Sanjeev Shukla and Subodh Kumar Inherent merits of Pig farming In comparison to other livestock species, pig rearing has higher potential to contribute to more economic gain for small, marginal farmers or rural poor belonging to the lowest socioeconomic strata due to its following advantages :

Better feed conversion efficiency of pigs i.e. they attain more unit weight gain per kg of feed consumed as compared to other meat producing animals except broilers.

Higher fecundity in pigs – Sows produce 6 - 12 piglets in each farrowing.

Pigs reach sexual maturity at an early age. A sow can be bred as early as 8 - 9 months of age and can farrow twice in a year under optimal management conditions.

Pigs have shorter generation interval as compared to other classes of livestock

Offers quick returns since the market weight of 60-90 kg can be achieved in a period of 7-10 months.

One of the few livestock animals where nearly all parts of the animal can be consumed by the farm family and/or sold

Converts damaged feeds which are either not edible or not very palatable to human beings into valuable nutritious meat.

Apart from providing meat, it is also a source of bristles and manure

Can survive and grow on wide variety of feed stuff viz. grains, vegetables, fruits, fodder, sugarcane, kitchen waste

Offers employment opportunities to seasonally employed rural farmers and supplement income to improve their living standards

Require little initial investment on building and gear.

Pigs can be raised for their entire lifetime in enclosure as they do not contribute to loss of grazing lands (Mpopfu and Makuza, 2003).

Pig products range from primary commodities such as pork, to processed food products such as sausages and smoked hams to cooked salted ears, eaten as snack foods.

Demand for pig's fat in poultry feed, soap, paints and other chemical industries.

The small scale pig sector has seemingly greater potential to reduce poverty (Lanada et al., 2005)

Pig germplasm in India

Different pig breeds have been adapted to the most diverse climatic conditions in country which however are low producers. The indigenous pig has been the basis used for pig production for a long period of time. Huge gap exists between the supply/demand and availability of pork especially in N-E India. The major reason is that the pigs reared by the farmers are of the nondescript local breed, whose growth rate is claimed to be poor, and hence, their production is hardly adequate for the fast-growing population (Nath et al., 2013). Exotic breeds are now being utilized for crossbreeding to augment genetic base for pig production in the rural areas.

Indigenous breeds of pigs

1. Ghungroo–Pigs of this breed are found along Indo-Nepal border, Jaipalguri and CoochBehar in West Bengal and North Assam. Animals are mostly black coloured with typical Bull dog face appearance. Breed is popular among the local people because of high prolificacy, good mothering ability, docile nature and ability to sustain in low inputs.
2. Jovawk–Breed is found in Mizoram and Manipur. Animals have small, compact body with long legs and weigh around 40 -50 kg at maturity.
3. Ankamali–This breed inhabits states of Kerala, Karnataka, Maharashtra and Tamil Nadu. Typical characteristics of this breed include black to brown coat colour, small, body with long legs and mature body weight of 40 to 50 kg.
4. Niang Megha–This breed inhabits states of Meghalya
5. Agonga Goan–This breed inhabits Goa and neighboring states



6. Tenyi Vo-This breed inhabits states of Nagaland
7. Nicobari-This breed inhabits Andaman and Nicobar
8. Doom-This breed inhabits Assam
9. Ghurrah-This breed inhabits Uttar Pradesh and neighboring states
10. Purnea-This breed inhabits Bihar and Jharkhand
11. Banda-This breed inhabits Jharkhand
12. Desi-It is found in all states of India. Animals have Brown to Black coat colour, small, compact body with long legs and weigh around 40 to 80 kg at maturity.

Exotic breeds of pigs

Several exotic pig breeds are available in India are as follows :

- 1. Large white Yorkshire** – It is most extensively used exotic breed in India. White coat colour with occasional black pigmented spots, erect ears, snout of medium length and dished face are typical characteristics of this breed. Mature body weight ranges from 300 to 500 kg.
- 2. Middle White Yorkshire** – Typical characteristics of this breed include white coat colour, long muscular neck and long back with a mature body ranging from 270 to 360 kg.
- 3. Landrace** – Pigs of this breed are typically white coloured with black skin spots. They have a long body, large drooping ears and long snout. Mature body weight ranges from 250- 350 kg
- 4. Berkshire** – Black coloured animals with white patches on feet, snout and tail. Small head, face depressed in middle and saucer shaped body with flexible ribs are typical characteristics of this breed. Mature body weight ranges from 280-350 kg
- 5. Hampshire** – Animals are black with white strip across forelegs to shoulder. Typical characteristics include small and erect ears, small and compact body. Sows have good mothering ability.

Crossbreds

Under All India Coordinated Research Programme (AICRP) on Pigs, breeding programmes were developed to generate the following genotypes/genetic groups :

- Improved indigenous pigs
- Crossbreds having 50:50 inheritance from Tamworth and indigenous pigs (Jharsuk)
- Crossbreds having 50:50 inheritance from Landrace and indigenous pigs
- Large White Yorkshire crossbreds having 50% indigenous inheritance
- Crossbreds having 75% Large White and 25% indigenous inheritance
- Landrace crossbreds having 25% indigenous inheritance
- Hampshire crossbreds carrying 25% and 50% indigenous inheritance
- Landrace X indigenous half-breds from reciprocal crosses

Presently, AICRP centers on Pigs follow a breeding plan to maintain crossbred animals of 75% exotic inheritance. Mega Seed Project on Pig and AICRP on Pig implemented by the National Research Centre on Pig enable regular supply of good quality pig germplasm, location-specific research on pig nutrition and breeding throughout India.

Central Sector Scheme on Pig Development

Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Govt. of India provides incentives in terms of capital subsidy for ensuring the viability of the pig breeding, rearing and related activities (Table 1). Goal of scheme is to encourage commercial pig rearing by farmers/ labourers to improve production performances of native breed through cross breeding by using selected animals of high performing breeds. Producer companies, partnership firms, corporations, NGOs, SHGs, JLGs, cooperatives and individual entrepreneurs are eligible for scheme.



Components	Subsidy
Commercial Rearing Units	25% of the outlay (33 1/3 %) in NE states including Sikkim and hilly areas) subject to a ceiling of Rs. 1.50 lac (Rs. 2.00 lac in NE states including Sikkim and hilly areas)
Pig rearing & fattening units	25% of the outlay (33 1/3 %) in NE states including Sikkim and hilly areas) subject to a ceiling of Rs.19000/- (Rs. 25300/- for NE states including Sikkim and hilly areas)
Retail outlets	25% of the outlay (33 1/3 %) in NE states including Sikkim and hilly areas) subject to a ceiling of Rs. 2.50 lac (Rs. 3.33 lac in NE states including Sikkim and hilly areas)
Facilities for live markets	50% of the outlay subject to a ceiling of Rs. 2.50 lac.

Jharkhand Scheme on Pig Development : Small scale pig farming promotion. Rs. 37000/- are being provided to farmers for starting with one unit pig ie. (4+2). Government of Jharkhand also providing 70% subsidy to the farmer for starting pig farm.

Opportunities for improvement

Pigs are potential source of animal proteins and avenues for additional income and employment that can improve the livelihood in a sustainable manner. Presently, our pig production system has many lacunae namely absence of sufficient number of breeder farmers, tendency of the pig grower to raise pig to marketable age on negligible inputs and lesser preference of the consumers for pork from the local pigs etc. Absence of sufficient number of breeder farmers throughout the country is also a major constraint leading to lesser availability of quality pigs for fattener farmers and market. Therefore, genetic improvement of indigenous pigs must be undertaken on priority for production of superior germplasm. Selective breeding and crossbreeding has to be expanded for improving production and productivity. There is need for strengthening the pork marketing mechanisms at the local level to the marketing channels, and integrate production programme with slaughterhouses to ensure better sustainability. Given its prospects, piggery has the potential to have a positive impact on the livelihood of millions of resource poor, under-privileged, landless and marginal farmers.

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LONG-TERM CONSERVATION-TILLAGE ENHANCES THE SOIL CARBON SEQUESTRATION

Dhinu Yadav^{1*}, Abir Dey² and Lela Wati³

¹Department of Microbiology, Schools of Sciences, Geeta University, Panipat, Haryana, India

²Division of Soil Sciences and Agricultural Chemistry, ICAR-IARI, New Delhi, India

³Department of Microbiology, College of Basic Science, CCS HAU, Hisar, Haryana, India

*Email : drdhinu@gmail.com

Earth's temperature has risen due to anthropogenic greenhouse gas (GHG) emissions, and it will likely reach 1.5°C by the end of this century (Baker et al., 2018). Around 10–12% of all anthropogenic global greenhouse gas emissions come from agriculture (GHGs) (Tubiello *et al.*, 2015). The direct and indirect emission of CO₂ induced soil respiration and by the production of agriculture inputs (fertilizers and pesticides), fuel combustion, and application of machinery on the farm, respectively. The change in temperature, precipitation, and CO₂ concentration all have a substantial impact on the net primary production C inputs to the soils as well as the rates of soil carbon decomposition. Altering climatic trends can hasten land-use change and affect terrestrial carbon (C) fluxes as a result (Zeng et al., 2019). A growing body of evidence suggests that agricultural production has increased on average by 2 to 4% annually over the past 50 years, while cropland area has only increased by 1% annually and the amount of arable land per person has decreased globally from 0.44 to <0.25 ha (Srinivasarao *et al.*, 2015). This suggests that agricultural intensification has been successful.

As a result, it's crucial to study the carbon balance in rain-fed fields in order to choose the best tillage practises for developing low-carbon agriculture and advancing the development of sustainable agriculture. Soils contain more than twice as much carbon (C) as the atmospheric, biotic, or land plant pools combined, making them the primary terrestrial source of C. (Figure-1). Since agriculture's inception, the atmospheric C pool has grown at the expense of the soil C pool. According to Post and Mann (1990), continuous or extensive cropping decreases the amount of soil organic matter and releases soil organic carbon (SOC) into the atmosphere. The rate of SOC mineralization may vary from approximately 20% in 20 years in temperate climates to approximately 50% in 10 years in tropical climates (Woomer *et al.*, 1994).

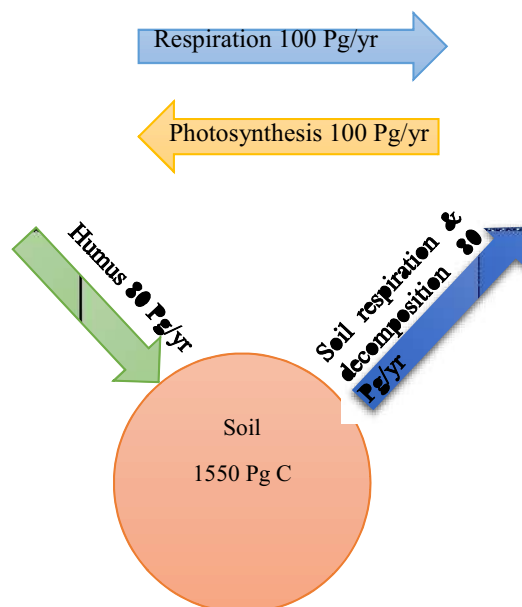


Fig.-1. Role of soil in C cycling (Post and Maan, 1990).

Mechanisms of carbon sequestration

The dynamics of SOC, which defines the equilibrium status, is influenced by a number of variables, including soil characteristics and particularly aggregation. The sluggish pool may be engaged in aggregation, and the increase in SOC in these pools is a significant element in the sequestration of carbon. Improved SOC reserves could therefore mean a larger slow or resistant pool. There are two approaches for carbon sequestration *i.e.* increasing the stable fraction of macro- and

micro-aggregates, and deeply burying SOC in the subsoil horizons while incorporating biomass below the surface (Figure 2). The creation of organo-mineral complexes provides the basis for the cementation of primary particles, clay domains, and micro-aggregates. By fusing clay into aggregates, these complexes immobilise and sequester the C. There are numerous ways to enhance micro-aggregation. These methods are, however, soil- and ecoregion-specific.

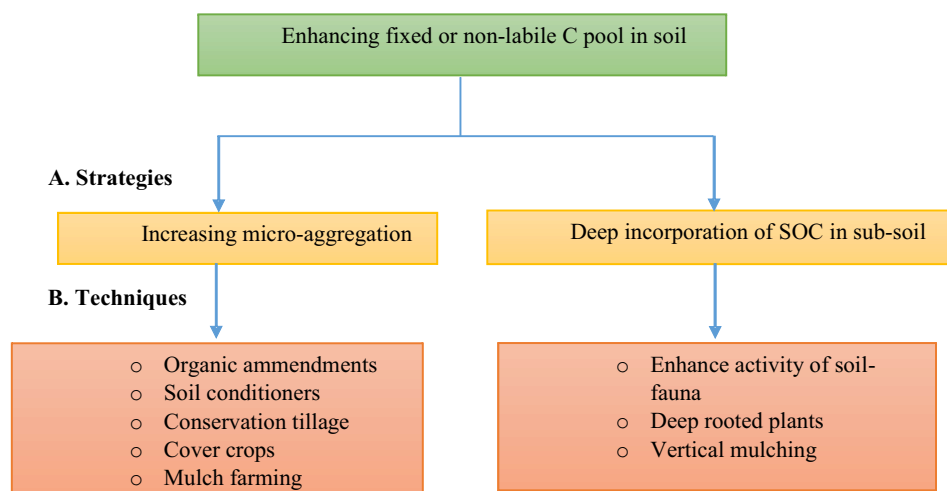


Fig-2. Effective mechanisms of C sequestration in soil (Lal and Kimble, 1997).

Carbon sequestration enhance with conservation tillage

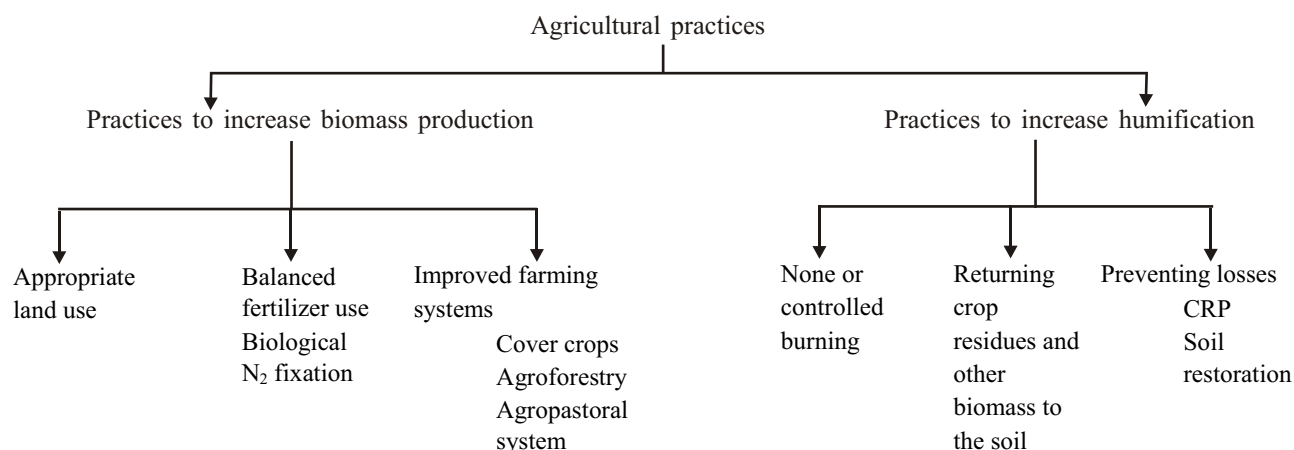
Conservation tillage, a frequently used agricultural technique, is known to maintain soil resources by boosting SOC and so promoting sustainable agriculture (Singh *et al.*, 2018). Conservation tillage practises (such as reduced tillage, no-tillage, and straw returning) are frequently advocated as a way to mitigate the potential negative effects of crop residue removal, which can include a decrease in SOC, an increase in soil compaction, the disruption of soil aggregates, and a decline in soil health (Wienhold *et al.*, 2013). Conservation tillage practises have frequently been shown to increase the soil's ability to store carbon while reducing the carbon emissions produced by agricultural inputs like fertilisers and on-farm fuels. SOC has a number of potential side effects aside from climate change, such as improved soil fertility, improved biological and physical soil features due to a decrease in bulk density, greater water holding capacity, and increased activity of soil microbes (although this may increase CO₂ emission).

According to Dijkstra *et al.* (2020), conservation tillage promoted root development and improved the release of root exudates into the soil, providing evidence for higher rhizosphere SOC and buildup of labile SOC fractions under decreased tillage circumstances (Shrestha *et al.*, 2015). Cover crops and fallowing, agroforestry and agropastoral systems, rotations with deep-rooted crops, and crop residue management or mulching are agricultural practises that have a significant positive impact on SOC content. Figure 3 depicts two categories of cultural practises that have been shown to have a favourable impact on SOC: (a) increasing biomass output, and (b) increasing humification.

(a) Increasing biomass production : SOC content may benefit from any mechanism that generates and returns biomass to the soil (Panwar *et al.*, 2022). If a cultivated or managed ecosystem generates and returns more biomass to the soil than the natural ecosystems, the SOC pool can also be significantly enhanced by a change in land use.

(b) Increasing humification : The SOC pool can be improved by increasing the slow C pool or humus content. The labile or active component decomposes readily (Naresh *et al.*, 2018). Avoiding or controlling burning, adding crop residual mulch and other biomass to the soil, and limiting losses through conservation-effective activities (such as the Conservation Reserve Program (CRP), afforestation, and soil restoration) are some management techniques to improve humification (Figure-3).

Nevertheless, conservational tillage (such as no-tillage) frequently minimises soil disturbance and soil erosion, improving soil aggregate formation and stability, which may then improve SOC accumulation (Zhu *et al.*, 2022), which is necessary to reach global targets for soil carbon sequestration (Minasny *et al.*, 2017). In order to increase SOC concentration, particularly in the topsoil, this method seeks to preserve organic matter on the surface or in the upper soil layer. The need for mechanised tillage



procedures decreases energy usage, carbon emissions from the burning of fossil fuels, and labour needs. However, this gain may be somewhat balanced by the increased use of pesticides, particularly herbicides. In addition, due to moister and denser soil conditions, increased N₂O emissions may happen with conservation tillage, which may eventually counteract the beneficial impacts on SOC balances.

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IMPLEMENTATION OF DRONE IN AGRICULTURE LIBRARIES : BOOKS IN THE AIR

Shilpa S. Upaloankar¹ and Machendranath S.^{2*}

¹College of Agriculture, Kalaburagi, UAS, Raichur, Karnataka

²University Library, UAS, Raichur, Karnataka

*Corresponding Author Email : drmsvidyasagar@gmail.com

Abstract

There has been a significant paradigm shift from traditional libraries to modern digital libraries made the way for more convenient and easy dissemination of information to the right user at the time. Drones or UAV (Unmanned Aerial Vehicles) earlier exclusively meant for military missions. But, now the small flying devices remotely controlled are other trendsetters, the libraries can benefit a lot from its use. Furthermore, drones can be used for delivery of books services for the users who don't have the possibility to go to the library or to be it because of special need or long distance of the library. This paper will focus on the steps to be followed for implementing library drone delivery services, pre-requisites for implementation, payload capacity of drones etc. It will also give the overview of the present status of library drone delivery service.

Key words : Drone technology, unmanned aerial vehicle, document delivery service, books in the air, library services, agriculture libraries.

INTRODUCTION

Agriculture is the backbone of India. It is one of the most vital sectors in India that controls the economy of the country. It supports directly or indirectly about 70 percent of the Indian population for their livelihood. The paradigm shift from traditional libraries to modern digital libraries made the way for more convenient and easy dissemination of information to the right user at the right time. Library and Information Center are places where various types of knowledge, information and sources of information are collected in various forms like print or electronic media and information is organized and made available to users through library services. It is very important to have good agricultural library and information centre in agricultural universities and research institutions. To provide agricultural information to people engages in agricultural sector, libraries and information centers are playing a vital role for transmission of agricultural knowledge to society since long.

Earlier libraries were known as store house of knowledge, but with the tremendous changes of ICT, Libraries have buzzed their services by adopting different new technological tools. With the emergence of information communication technology all the fields in society like Education, Medical, Social, Agriculture and Allied sciences etc., are tremendous changing to adopt new technologies. With the emergence of new ICT the library and information centers are also not lagging behind, as it is always competing with the changing environment. In 21st century people don't always have time to visit the library whenever they want. There are many new technological tools have been adopted like software for library circulation activity, acquisition process and document delivery services etc. for different functions of libraries. Drone technology is also one of them. Agriculture libraries can think of adoption of new technology like drones which can be used for various services in the libraries. With the use of Drone facility 'Books in the air' system can help the users to save their time by taking the required books to the door steps of the users.

Agricultural Libraries in India

Indian Council of Agricultural Research is a big network for agricultural education, research and extension in agriculture and allied subjects. In this network under ICAR umbrella more than two hundred libraries are working i.e. 4 Deemed University Library as National library, 3 Central University Library, 64 State Agricultural, Horticulture and Veterinary University Library, 65 central Institute Library, 13 Project Directorate Library, 14 National Research Centre Library and 6 Bureau Library are smoothly working in different places of India. More than two hundred college libraries in field of agriculture, horticulture, agricultural engineering, Veterinary and animal husbandry, fisheries are providing library services are also in country.

There are so many new technological tools, which are adopted by different library of the entire world for different library functions. Drone technology also one of those. Initially drones were used only for military purpose and these were very much expensive. Drone is considered as one of the 192 major upcoming technologies which find tremendous applications in all areas like agriculture, disaster management, medical field, defense, weather forecasting, waste management, mining and telecommunication. (Frey, 2014 and Mahashreveta, 2018).

Drones can cut short the time and distance and can deliver books wherever and whenever the patron requires it. Delivery



drones are no longer a sci-fi or a virtual dream. Companies like Fly Trex from Israel have created a fully operational drone delivery service that can deliver food and consumer goods to the people which is currently being used in Iceland. Similarly other companies such as Amazon's Prime Air, DelivAir, etc. have provided promising possibilities for the future.

REVIEW OF LITERATURE

Now a days, the application of drone has become the important technology in all areas like research, coverage of news, agriculture, etc. and it has become a area of interesting for research in library and information services. A large number of research studies are taking place in respective area and how drone started its journey in lending library services as well as academic activity is assumed here.

Marron (2013) explains the use of drones for data gathering by the journalism students while it is used for aerial surveying, field mapping, and monitoring by the pupils of geology (Jordan, 2016).

Joiner (2017) in her article "Is there a drone in your library's future?" discussed how drones are providing numerous opportunities in the library environment. She also stated that libraries can collaborate with different companies or organizations that can manufacture or supply drones for the library. She also mentioned about various libraries that are providing demonstration and imparting knowledge on new technology for the library.

Nath (2018) stated that the delivery feature of drone can prove immense potential in bringing information to the library users in the form of books or other documents. In the article, he also discussed on various elements like drone facility, the integration of such a facility in the library, the procedure of processing user requests via drone delivery, the advantages and limitations of using drone delivery service etc. Libraries Transform: An initiative of the American Library Association mentions the lending program of drones in Georgia Highlands College Library where the students and faculties can check out drones (Transform, 2019).

Evolution of Drone bring up with latest trends

The word drone has different meanings and it originates from the old English word "dran" which meaning is "male bee". The main aim for establishment of drone was for armed forces, especially as military weapons configured for aerial missiles control by remote control through radio waves. But today, drone have developed in a wide range of demand for civil use in the form of small quad copters, octo copters which are used for various functions such as climate change, for filming and photography and delivering goods such as food and water to people who are suffering after natural disasters.

In technological terms, drones are unpiloted aircraft or spacecraft that can fly autonomously or by remote control on the ground. It is formally known as Unmanned Aerial Vehicles (UAV) or Unmanned Aircraft System (UAS). Unmanned aircrafts are made of some composite materials that can increase the maneuverability while flying and reduce the weight. These are equipped with different state of the art technology including infrared camera, laser, GPS (Global Positioning System), navigator, sensor, different drone hardware and software etc. Drone is a kind of flying robot and these are controlled by remote ground control system (GSC) and referred to as a ground cockpit. It works in conjunction with GPS and onboard sensors.

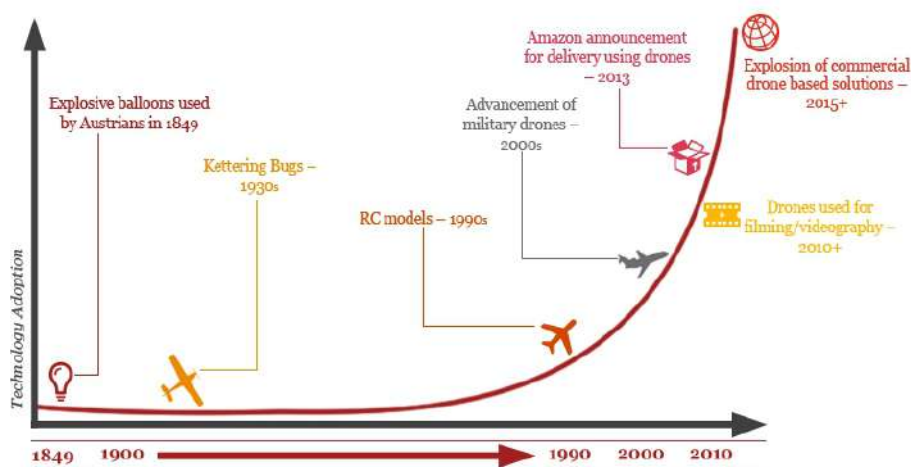


Fig.-1 : Evolution of UAV (Unmanned Aerial Vehicles)

Source : <https://www.pwc.in/consulting/financial-services/fintech/fintech-insights/data-onwings-a-close-look-at-drones-in-india.html>

Earlier these were used only for military purpose but at present, drones are used for different civilian purposes. **Figure-1** reflects the evolution of UAVs from the year 1849 as the very first year to plan a contraption that can fly on its own was 1849 and it was the year when Venice was fighting with Austria for its independence.

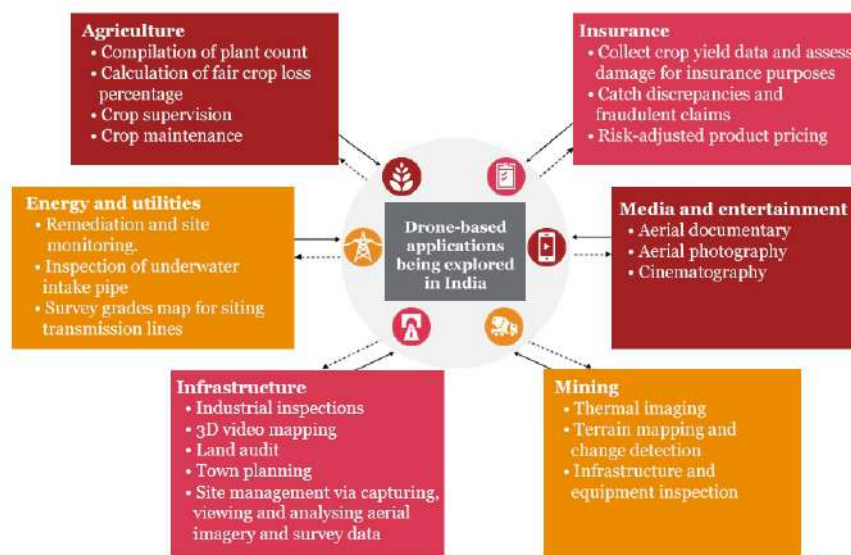


Fig.-2 Drone based application being explored in India.

Source: <https://www.pwc.in/consulting/financial-services/fintech/fintech-insights/data-onwings-a-close-look-at-drones-in-india.html>

In India, there are six segments across which we have seen drone-based solution being explored :

Different Types of Drones

Fixed Wing :



A fixed wing drone consists of one rigid wing and is designed to look and work like an airplane. Fixed wing UAVs are well known in the military, as they are often used when manned flight is considered too risky or difficult. They are usually used for commercial purposes such as aerial mapping, inspection, agriculture, construction, security and surveillance.

Single Rotor :



Single rotor drones are strong and look similar in structure and design to actual helicopters. They have one big rotor, which is like one big spinning wing, plus a small sized rotor on the tail for direction and stability. These are used for Research, Aerial LIDAR laser scan, surveying.



Multicopter :



The most popular type of drone for getting an “eye in the sky” is the multi-rotor drone; they carry several rotors on their body and can be further classified based on the number of them on the platform of the drone. There are tricopters (3 rotors), quadcopters (4 rotors), hexacopters (6 rotors) and octocopters (8 rotors) among others. Quadcopters are by far the most popular multi-rotor drones. These are used for Aerial photography and video aerial inspection, library activity, leisure, agriculture, construction and security etc.

Implementation of Drone in Agriculture Library Activities :

Drones in earlier days used only in military operations. Later drones have been deployed for commercial applications. Similarly, in the library also drone can be used in the best way to provide the required documents to that type of users who are staying far away from the library or who cannot manage the time to visit the library for different reasons whether it is personal or official. Library drone delivery service can be the best way to provide the circulation service to its patrons during the time of epidemic like corona virus or COVID 19 etc. Delivery drone's can easily overcome this disadvantage and open new possibilities for both libraries and its patrons by delivering books at the location desired. The idea here is to use delivery drones to deliver books and other documents either to the user's doorsteps or make use of drone GPS technology to deliver it right into the user's hands regardless of the location where the person might be.

The most important requirement for providing drone delivery service by agriculture library before that we should create a drone section for delivery of books. The ordered book being taken and further hand over to the users hand. For providing the drone delivery service by a library, the first and foremost requirement is library mobile app or a mobile friendly library website of that respective library. The most important requirement for providing the drone delivery services by library is library mobile friendly software can make use of the smart-phone's technologies such as the GPS. The user will use the library app to borrow books from the library. He/ She will browse through the library collection via the library app, select the document required and set it to borrow. There might be a requirement for a separate circulation section to process requests for drone delivery and return.

There might be the requirement of a different circulation section for processing library drone delivery service, however, it will depend both on the technical knowledge of the library staff and the library works. For implementing the service, a group of skilled or trained professionals will be needed who can handle the overall process of document delivery via drone. The staff of the ground control station will be the responsible for flying the drone and making safe delivery to the right library user. By using drone facility there are two ways (a) we can deliver the books to users to their address or (b) delivery of books based on real time location GPS.

(a) Delivery of books through drone to user to their address : Delivery of book through drone to user door step we need a drone with camera. The trained staff shall remote control the drones. The camera will provide the navigation system which is to show real time video feed on the computers in the control station controlling from a remote location i.e., the library. The staff responsible for overall drone delivery process or the staffs of ground control station will remote control the drone to making safe delivery in the patron's shared address.

(b) Delivery of books based on real time location GPS : The user will be required to keep GPS turned on before the library initiates the delivery process. A notification via the library app can be used to alert the user about the initiation of the delivery process and that he/she is required to turn on the GPS and keep it turned on until the delivery process is completed. Once connection is made with the user's smart-phone GPS the delivery can be then initiated via drone. However, user should keep in mind that the shared location should not be as a busy street or inside a public bus, etc.



Process of Document Delivery via Drone

The processes for providing right information to the right user in the right time by the library drone delivery programme is as follows :

1. User will request for a particular document via library website or library app.
2. The circulation section receives the request.
3. A list of requested books will be hand over to the concerned section staff for retrieving documents.
4. The concerned staff retrieves the document requested by users and handover to the circulation section.
5. After checking out the documents will be handed over to the drone control section.
6. The drone handling section will pack the documents into drone and make it ready to fly in the air.
7. The drone control staff will fly the drone after receiving green signal from the control centre and will handle the process to make it safe delivery.
8. Drone delivers the documents at users door steps and return with a received report signed by the borrower.

With the emergence of new information communication technology, the day today activities of each and every person have changed. To full fill the “Save the time of the reader” law of library science enumerated by Dr. S.R. Ranganathan, agriculture university library and information scientists have to adopt new technology by implementing drone facility in library for book delivery services. Now-a- day’s time is money for users, drone book delivery service is the best way for the people who do not have time to visit the library in their busy schedule or they don’t want to waste their time for borrowing a single book and even for users with special need.

Essentials for implementing drone delivery service in agriculture libraries

Following are some of the essentials for implementing drone delivery service in agriculture libraries :

Library website/ Mobile app : To provide the drone delivery service in agriculture library a library must have a library website or mobile library app through which the user will send request for the required documents.

Financial Requirement : For implementing library drone facility adequate fund will be needed.

Consultation with the Expert : IT professional is also necessary for a user-friendly as well as perfect app. The trained and skilled professionals are needed for providing such kind of library services through library website or mobile app.

Documenting Requirement: For flying a drone documents like permission approval, agreement, insurance, license will be required.

Creating awareness among the user: Creating awareness among the user is also a main factor after the implantation of a drone library document delivery service, since a new system is sometimes difficult to understand than the existing one. For that user orientation programme can be organized.

There are some essential points to be considered for the successful implementations of library drone delivery service in agricultural universities are as follows :

1. Evaluate the requirement of drone facility in the agriculture library, “Why it is essential?
Or What are the benefits of implementing drone facility in library?, etc.
2. Evaluate the type of drones, data storage and security as it can be misappropriated.
3. Evaluating the site or airspace issues such as wireless routers or devices suitable for flying the drones.
4. After evaluating, selecting the best drone for library book delivery service think on “which drone will be the best” for document delivery, its payload capacity, battery power, ability of avoiding collision and detecting obstacle etc.
5. Before implementing the drone book delivery facility, it has to be tested under different weather conditions, traffic and distance.

Limitations

1. Atmospheric pressure such as wind, rain may delay document delivery.
2. Possibility of hacking.



3. Lack of fund : For acquiring delivery drones for a library, a huge amount will be required as the delivery drones are expensive.
4. Lack of skill among professional staff and users knowledge about the drone technology can be a major barrier of document delivery service via drone.
5. Legal issues as many countries have their own rules and regulations for use of drone.

Drone Rules and Regulations in India

The ministry of aviation has given green signal to operate those drones in India which satisfy the following Civil Aviation Requirements (Section 3-Air Transport Series X, Part I) with effect from December 1, 2018 (India Drone Regulations, 2018).

1. All drones except 'Nano' should be registered and get a Unique Identification Number.
2. For commercial operations, separate permission should be obtained except for those in the Nano and Micro category which flown below 50 and 200 feet respectively.
3. Drones should not be flown above 400 feet vertically and also in restricted areas (No Fly Zones).
4. Drones are not permitted to fly in No permission no takes off – all the pilots should make a request through the mobile app specially designed for getting the permission for flying from the digital sky platform.
5. To get a drone to be flown, it should have the following equipment's- GPS, Return-to-home (RTH), RFID and SIM/NO Permission No Take off (NPNT) Anti-collision light, Flight controller with flight data logging capability, ID plate.
6. All UAVs should be handled by trained pilots only.

CONCLUSIONS

Technology is playing its important part in globalization and the drone technology is such a technology with a usage ever increasing in a vast range of disciplines such as agriculture, health and military. Drones can provide real-time data on farms that enable farmers to make informed decisions regarding farm inputs usage. Also, they can be used to aerially deliver medical supplies like blood, vaccines, drugs, and laboratory test samples during health emergencies to remote areas in developing countries. Military drones also help in security and surveillance on the enemies' movements which then helps select for target killings. However, drone can be used in library also for document delivery service. Though the adoption of drone technology is a new concept or it is still in nascent stage, it has been started to use in different libraries like Dubai Public Library, New York Public Library etc. to deliver the library document to the patron's doorstep. This technology needs more improvement in library applications. The LIS professionals should take the main initiative to adopt this technology in the library services and make their user to understand about this new service and waiting for the day to when we will that library drones of our library are flying in the sky to deliver our library documents way to go.

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BACKYARD POULTRY FARMING IN JHARKHAND : A TOOL FOR NUTRITIONAL SECURITY AND WOMEN EMPOWERMENT

Sushil Prasad Ravindra Kumar and Nishant Patel

Department of Livestock Production and Management, College of Veterinary Science and A.H., BAU, Ranchi, Jharkhand

Abstract

Rural chicken production in Jharkhand is generally characterized by little inputs for housing, feeding (scavenging is the only source of diet) and health care with high level of mortality. In most area of the state chicken owners do not properly examine their chicken and they do not vaccinate their chicken. Critical constraints for village poultry production in Jharkhand were identified as: diseases and predators, lack of proper health care, feed source and poor marketing information. Among diseases, Newcastle Disease was identified as a major and economically important health constraint that hinders the expansion of village chicken production in the country. Replacement of indigenous chickens by crossbred dual purpose varieties, commercial broiler varieties is also a major threat in eroding and dilution of the indigenous genetic resources. Although local consumers generally prefer egg and meat from indigenous breed rather than that of hybrid and exotic breed. The demand price of indigenous live chicken was observed as static round the year but the price of commercial strain varied between months of the year and was determined by a number of driving factors in the state. Some of these determinant factors affecting prices of chicken products in the country identified as: demand and supply of chicken, market day types (weekend, salary period, winter season, local market day etc) and fasting seasons. Demand and supply of chicken were highly related with religious festivals

INTRODUCTION

Jharkhand is a word developed from the origin tribal language meaning “The land of the jungle”. Jharkhand is considered as one of the potentially richest states in the world because of its awesome mineral reserve. Jharkhand is one of the states where most of the national economy depends on agriculture including livestock. Village poultry production based mainly on a scavenging system is of enormous socio-economic significance, in terms of contribution to family nutrition and household food security throughout the developing world. The poultry sector in Jharkhand can be characterized into three major production systems, namely the large-scale commercial, the small scale commercial and the village or backyard poultry production system (Singh et al 2007). In Jharkhand per capita availability of egg is 25 eggs per annum against the national average of 51 eggs per annum. The total requirement of eggs is 1143 million in Jharkhand. We are deficit by 426 million eggs i.e. 37.27% (BAHS- 2012). Jharkhand is growing state in poultry production, 20.73% growth was recorded since 2007-2012 (Livestock census 2012). Promotion of backyard poultry farming can help state to bridge the gap between demand and supply of eggs and poultry meat as well. Since majority of the rural households comes under landless or marginal farming category. The backyard poultry farming may emerge as a potent tool for poverty alleviation. Rural mass can generate their livelihood through backyard poultry farming because it is very less expensive, having lesser risk and high capital growth with lesser time. The farmer can do this farming even as their subsidiary or main occupation. Hence there is urgent need to promote the backyard poultry farming in the state like Jharkhand. It is also necessary to know the adoption level of rural farming committee with respect of backyard poultry farming so that a planned future strategy could be framed to enhance their knowledge level as well as exploring the constraints lying in the way of technological adoption of different scientific practices. This can also help in enhancing the productive potential from this sector.

According to Livestock census (2012) population of poultry in Jharkhand is estimated about to be 13.56 Million out of which 97.11% belongs to Rural areas. Total Backyard poultry in the state was reported to be 5.02 million out of which 91.38% population belongs to desi population. In Jharkhand, village chickens are an integral component of the farming system of nearly all rural families. Village chicken production fits quite well with the conditions of rural households due to small feed cost, space requirement and low price of the animals. In addition, the local chicken sector constitutes a significant contribution to human livelihood by being affordable sources of animal protein and contributes significantly to food security of poor households. Despite their low productivity, this prevailing production system are known to possess desirable characters such as thermo tolerant, resistant to some disease, good egg and meat flavor, hard egg shells and high dressing percentage. They do have also fast generation interval and high reproductive rate as they are prolific, easy to rear and their output can be generally expanded more rapidly and easily than that of other livestock. Even if, Jharkhand owned huge chicken flock; there are different factors like diseases, predators, lack of proper healthcare, feed source and poor marketing information that hinder the



productivity of the chickens in most area of the state. Among the above obstacles, the poultry diseases are the main constraints incriminated for reduction of total numbers and compromised productivity.

1. Village chicken production in Jharkhand

Village chicken production in Jharkhand is generally characterized by little or no inputs for housing, feeding (scavenging is the only source of diet) and health care with minimal level of bio-security, high off take rates and high level of mortality. As such, it does not involve investment beyond the cost of the foundation stock, a few handfuls of local grains and possibly simple night shades, mostly night time in the family dwellings. It can be used as a powerful tool for alleviation of rural poverty, eradication of malnutrition and creation of gainful employment in vast rural areas (Sharma and Chatterjee, 2009; Rajkumar *et al.*, 2010). Mostly, indigenous chickens are kept although some hybrids and exotic breeds may be kept under this system (Patel *et al.*). Majority of the backyard poultry owners were of middle age group (55.83 percent), had secondary education level (65.83 percent), belongs to ST (42.50 percent), had small family size (44.17 percent) and (72.50 percent) were from nuclear family. There was highly significant relationship between education and caste. Majority of the farmer had marginal land (63.33 percent), had medium flock size (40.00 percent), had medium poultry farming experience (61.67 percent) and had very low annual income (64.17 percent). There was highly positive significant association of occupation, land holding, flock size, annual income with adoption of backyard poultry rearing practices. Majority of the farmers preferred marketing at village market and selling through middlemen some also sell at their own doorstep although there was existence of local shopkeeper. Majority of farmers were unaware of improved backyard poultry varieties and they provide nest in quite place and very few provide insecticide and parasiticide to bedding material and brooding hen vice versa.

2. Breeds and Breeding practices

Farmers of rural areas of Jharkhand mostly rear local/desi birds traditionally. Now a days due to government schemes and intervention of NGOs, replacement of indigenous chickens by crossbred dual purpose varieties, commercial broiler varieties gradually diluting the of the indigenous genetic resources. In a study of rural areas of Ranchi districts of Jharkhand reported that 100 percent farmers hatch eggs at home, naturally and also make use of other source like middle man, neighbors, relatives and other poultry owners for procurement of chicks. No poultry owners procure chicks from Govt./private hatchery. Most the farmers adopt nondescript birds and only 8.33 percent backyard poultry owners adopt improved backyard poultry breeds (Jharsim, Vanaraja, Grampriya, Kadaknath, Assel). It is because people have a preference for eggs and meat of indigenous poultry. Dusting of broody hen with parasiticide was practiced by 8.33 percent of the poultry owners, 100% poultryowners made provision for the nest in quiet place and only 8.33% farmers apply insecticide to the nesting material (Gupta, 2003). There was also no provision of dipping the broody hen repeatedly in cold water to reduce broodiness and bring back to lay eggs and no respondent followed the turning of eggs kept for hatching (Saha, 2003). The reason behind it might be the interest of owner in fetching more production from the birds (Sethi, 2007).

3. Housing

Housing systems in village chicken production system is rudimentary and mostly built with locally available materials. In traditional free range, there is no separate poultry house and the chickens live in family dwelling together with humans. It is observed that all the farmers (100 percent) of Ranchi district of Jharkhand provide night shelter (100 %) to their birds whereas 83.33% farmers construct separate house for birds with locally available material viz. wooden material, mud, tin, wire net etc. remaining 16.67% keep their birds near their dwellings and share same houses with owners. The good ventilation arrangement was practiced by 100% of poultry owners and 41.66% of poultry owners keep waterers beside poultry houses but there is no supply of electricity in the poultry houses. Litter materials provided by the farmers were found to be 41.66 percent to the poultry houses. None of the backyard poultry owners provided feeder in poultry house. It is due to the owners no interest to expend money on housing because birds gives low production (Kumtakar, 1999b).

4. Feeding

Family poultry production in Jharkhand survives by scavenging and generally, no supplements provided except that some times, household waste fed to the birds and other circumstances the diet supplemented with grain. Similarly, the chicken production is characterized by keeping under free range system with some amount of supplementary feeds like broken rice, maize, sorghum, food leftover and the major feed sources are believed to be insect worms, seed and plant materials (Kumaret *al.*, 2018). However, the availability of the supplementary feeds was reported during the dry season (November to March) following the grain harvest while the grains/grain by-products were in short supply leading to feed scarcity during the rainy



reason (Patel et al. 2018). A study conducted in different districts of Ranchi reported that about 91.66 percent of the backyard poultry owners had knowledge about supply of feed three times in a day and about 87.5 percent of the farmers know that clean water supply is essential. Nearly 3.3 percent of backyard poultry owners know about daily feed requirement of the chicks and adult birds, and none of the respondent had knowledge about balance diet of poultry. It is evident from the finding that cent percent backyard poultry owners keep their birds free for whole day in the backyard to find their own feed (Mandal *et al.*, 2006). The birds ate insects, earthworms, grains, crop residue and vegetable. In addition to the material available, additional feed provision (41.66%) and kitchen left over (100%) are also followed (Rangnekar and Rangnekar, 1996). The 66.66% backyard poultry owners provide adequate and clean water to the birds whereas no poultry owners add KMnO₄ in the drinking water as a sanitizer. Providing readymade feed available in the market is not practiced (Saha, 2003).

5. Marketing

Poultry products in most developing countries, especially in Africa, are still expensive. The marketing system is generally informal and poorly developed (Dana, 1998). Poultry marketing structure has not well studied in Jharkhand. The market outlets or channels available to producers are diverse at all markets, although their importance differs across markets. The major channels through which producers/farmers sell their chicken in the markets are direct sold to consumers and/or to small retailers that take the chicken to large urban centers (Khare, S.P. 2003). Unlike eggs and meat from commercial hybrid birds (derived from imported stock), local consumers generally prefer those from indigenous stocks. A work in different blocks of Ranchi district of Jharkhand reported that majority of the farmers sale their birds & eggs at village market (66.66%), followed by middlemen (41.66%), selling at own doorstep (25%) and lastly local shopkeeper (16.66%). Time of selling their birds after specific weight gain (up to 1 to 1.5 kg) followed by sale to local shop keeper (21.67%), middleman (19.17%) and sale their birds on specific occasion, on demand from customers or religious function and requirement of money. None of the farmers used the poultry manure in agriculture land. Zero percent of the farmers under gone the poultry training. The reason might be respondent's interest in acquiring more profit from birds with minimum input of labour (Saha, 2003 and Sethi, 2007).

6. Poultry health management

The bio-security of the village poultry production system is very poor, as scavenging birds live together with people and other species of livestock. Poultry movement and droppings are very difficult to control and chickens freely roam in the household compound. There is no practice (or even viable means) of isolating sick birds from the household flocks and dead birds are left for either domestic or wild predators. Chickens and eggs are sold on open markets along with other food items. The current live bird marketing system represents a significant and potential hazard to both buyers and sellers, yet implementation of biosecurity and hygienic practices in such a system is generally difficult. The Newcastle Disease experience and the attitude of communities to handling sick birds (which are often sold) shows that marketing systems play a considerable role in the dissemination of disease over wide geographical areas in a relatively short period of time (Ali, 2001). Accordingly, it is very difficult to apply health and bio-security measures on full day scavenging birds in small flock sizes.

It is noted from the study in rural areas of Ranchi districts of Jharkhand that the backyard poultry owners had good knowledge about health practices like Cleaning of poultry houses (41.66%), control of Ectoparasites like ticks, lice, fleas, mites, etc. (8.33%), about diseases of poultry i.e. fowl pox 10 % Ranikhet (50.00%) and IBD (50.00%) Mandal *et al.* (2006). Very few farmers i.e. 4.16 percent had knowledge about regular vaccination of birds and treatment of birds should be done by Veterinarian/Experts. None of the poultry owners had knowledge about regular Deworming of birds and use of feed supplement Kumtakar (1999).

7. Disease control measures

Diseases were one of the major bottlenecks for village chicken productions in the studied areas. Newcastle disease was most widely distributed among the village chicken in Jharkhand. This was reported in several previous studies which employed different diagnostic methods such as virus isolation, sero-epidemiological investigations and molecular methods to confirm the presence of the disease in different village chicken productions (Sharma et al. (2015).

The wide use of traditional medicine was due to its low cost, local availability and easiness of application. Large flock sizes were obtained with those farmers that gave traditional medicine to their chickens. This indicates that traditional medicines do work and have the potential to improve the health status of village flocks. Hence, there is a need for research to determine their chemical properties, concentrations and mode of application.

The health care practices followed by poultry owners were deworming (8.33%), control of ectoparasite (8.33%), self



treatment of birds (16.66%), treatment by local expert (8.33%), by quack (4.16%), treatment by veterinary doctors (1.66%) and vaccination done by 8.33 percent of poultry owners. Only 8.33 percent of farmers maintain the cleanliness of the poultry house. It is because veterinary services were not available and lack of extension work (Kumtakar, 1999 and Saha, 2003).

8. Vaccination :

Vaccines are used to prevent or reduce problems that can occur when a poultry flock is exposed to field disease organisms. Vaccination has been considered the most effective means of controlling ND and has been used successfully throughout the world (Kumtakar, 1999b). Vaccine quality is commonly blamed when a disease occurs; however, there are usually other factors responsible such as lack of a cold chain. A comprehensive investigation is often called for to identify the causes and to resolve the problem. Village chicken vaccination particularly against NCD is more important than other management interventions; benefit-cost calculations done for the villages of Jharkhand indicated that ND vaccination was more economically beneficial than the provision of daytime housing, supplementary feeding, cross breeding and control of broodiness. In village production study in different parts of Jharkhand, no vaccination practice against poultry diseases was reported. The level of awareness about availability of vaccines for local chicken is low and the farmers do not have any experience of getting their chicken vaccinated against diseases. This is due to the fact that the farmers have no information about disease control and vaccination because of poor extension package of poultry production. Very few farmers i.e. 4.16 percent had knowledge about regular vaccination of birds and treatment of birds should be done by Veterinarian/Experts. None of the poultry owners had knowledge about regular deworming of birds and use of feed supplement (Mandal *et al.*, 2006).

Constraints for village poultry production

Indigenous chickens are good scavengers as well as foragers and have high levels of disease tolerance, possess good maternal qualities and are adapted to harsh conditions and poor quality feeds as compared to the exotic breeds. In Jharkhand, however, lack of knowledge about poultry production, limitation of feed resources, prevalence of diseases (Newcastle, Coccidiosis, etc) as well as institutional and socio-economic constraints remains to be the major challenges in village based chicken productions. According to Rangnekar and Rangnekar (1996), the primary problem cited by the village poultry farmers was high mortality of chicks. Insufficient and infected water was also one of the causes of mortality in chicks and older birds and a contributing factor to low productivity. The major constraints of village indigenous chicken production were partly due to poor management of the chicken (prevailing diseases and predators, lack of proper health care, poor feeding and poor marketing information). On the other hand attempt of replacing indigenous chickens by exotic chicken breeds was identified as a major threat in eroding and dilution of the indigenous chicken genetic resources.

Disease

The major causes of death for village poultry production were commonly disease (mainly New Castle Diseases locally followed by predation. High incidence of chicken diseases, mainly Newcastle Disease (NCD), is the major and economically important constraint for village chicken production system (Qazi, 2002). Mortality of village chicken due to disease outbreak is higher during the short rainy season, mainly in April and May. Also another reported that the NCD is one of the major infectious diseases affecting productivity and survival of village chicken. The major routes of contamination and spread of NCD from village to village are contact between chicken during scavenging and exchange of chicken from a flock where the disease is incubating and during marketing. In addition to Newcastle diseases, coccidiosis and fowl typhoid are the major cause for chicken mortality. In Ranchi district of Jharkhand seroprevalence surveys in village chickens have identified the presence of Ranikhet disease (50 %) infectious bursal disease (50 %), Parasitic diseases, including coccidiosis (8.33), have also been demonstrated to be highly prevalent in the country.

Predation

Predators were listed alongside diseases as major cause of premature death. The predation is strongly associated with the rainy season. The predators include primarily birds of prey such as vultures, which prey only on chicken and wild mammals such as cats and foxes, which prey on mature birds as well as chicks. Predators such as birds of prey (34%), cats and dogs (16.3%) and wild animals (15%) were identified as the major causes of village poultry (Kumari, 2007)

Feed source and Lack of proper housing

In Jharkhand, village chicken production systems are usually kept under free range system and the major proportion of the



feed is obtained through scavenging. The major components of Scavenging Feed Resource Base (SFRB) are believed to be insects, worms, seeds and plant materials, with very small amounts of grain and table leftover supplements from the household. Improving the diet of scavenging birds is difficult because it is not known what food they are eating. The amount and availability per bird of this SFRB is significantly dependant on season, grain availability in the household, time of the grain sowing and harvest, and the biomass of the village flock (Kumari, 2007).

Lack of organized market and poor access to main market

Even though chicken meat is relatively cheap and affordable source of animal protein, lack of organized marketing system and the seasonal fluctuation of price are the main constraints of the poultry market in Jharkhand. Variation in price mainly attributed to high demand for chickens for festivals, New Year and holidays. It also partly influenced by weight, age of chickens and availability. The plumage color, sex, combs types, feather covers are also very important for influencing price. A further constraint to the marketing of traditional household poultry and products is the fact that there is no packaging and weight standardization of market eggs and that traditional storage method can lead to deterioration of the quality of table eggs. According to Gausiet *et al.*, 2004, small holder village chicken producers tend to ignore new technology even when it appears to be better than their current practices due to market limitations.

CONCLUSIONS

Rural poultry in rearing in Jharkhand can play an important role in increasing socio-economic status of rural community and employment in these areas. Backyard poultry rearing can form an important part of the integrated farming system. Importance to be given equally on poultry as an income generating as well as it is very helpful to cover nutritional need of the resource poor farmers with very less input and minimum care. There is need to impart training for ruralpoultry owners and creating awareness for routine vaccination of poultry. The present investigation will be useful as a guideline for the backyard poultry owners, extension workers, policy maker, planners and other interested agencies of Jharkhand.

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*VIIth International Conference in Hybrid Mode on Global Research Initiatives for
Sustainable Agriculture & Allied Sciences (GRISAAS-2022)
during 21-23 November 2022*



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SEED PRODUCTION TECHNOLOGY OF RAPESEED AND MUSTARD

Mahak Singh¹, S.P. Singh¹ and Amit Tomar²

¹Chandra Shekhar Azad University of Agriculture and Technology, Kanpur-208002 U.P.

²Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, U.P.

Email: mahaksingh.csa@gmail.com

Mustard (*Brassica* sp.) is a well known condiment and an important oil seed crop of the family Cruciferae. The plant is also used as a vegetable, fodder and medicine. Seed production can be done in rabi (from September and October) in plains and in hills during kharif (June to July). The oil and protein content varies from 37 to 49% and 22-28%, respectively. The seed and oil are used as condiment in the preparation of pickles and for flavouring curries and vegetables. The oil is utilized for human consumption throughout the northern India in cooking and frying purposes. It is also used in the preparation of hair oils and medicines. It is used in soap making, in mixtures with mineral oils for lubrication. Rapeseed oil is used in the manufacture of grease. The oil cake is used as feed and manure. Green stem and leaves are a good source of green fodder for cattle. The leaves of young plants are used as green vegetable as they supply enough sulphur and minerals in the diet. In the tanning industry, mustard oil is used for softening leather.

Methods of seed production :

Mustard is a cross pollinated crop and seeds are allowed to set by open pollination and then multiplied. The crop should be raised in isolation to maintain varietal purity. The isolation distance maintained between the varieties is 50 metres for self compatible and 100 metres for self incompatible types for foundation seed production and for certified seed production it is 25 metres for self compatible and 50 metres for self incompatible types. The isolation distance maintained between the varieties not conforming to the varietal purity requirements for certification is 200 metres for self compatible and 100 metres for self incompatible types for foundation seed production. In Certified seed production, it is 50 metres for both self compatible and self incompatible types.

Seed production stages :

Breeder seed Foundation seed Certified seed.

Land selection :

The land selected should be fertile and free from volunteer plants. It should not be cultivated with the same crop in the previous season. The land should be tilled twice to make the soil smooth.

Seed selection and sowing :

Good quality certified seeds should be sourced from an authorised dealer. Seeds should be healthy with a good germination percentage. Seed rate is 4 – 5 kg/acre (10 - 13 kg/ha). Selected seeds should be treated with bio-control agents like *Trichoderma viride* @ 4 g/kg of seeds. Mix *Trichoderma* in rice gruel and mix the solution with seeds. Shade dry the seeds for 30 minutes before sowing. This will help in the control of root rot and *Fusarial* wilt disease. Treated seeds should be sown in ridges and furrows at 4 to 5 cm depth. The spacing maintained is 45 x 15 cm. After sowing planking is done to cover the seeds.

Nutrient management :

FYM or compost @ 4 tonnes/acre (10 tonnes/ ha) or vermicompost @ 1.6-2 tonnes/acre (4-5 tonnes/ha) should be applied and thoroughly incorporated into the soil before the last tilling. This will help to improve the texture as well as the nutrient content of the soil. Green manure crops like Sunhemp or Sesbania are grown in the field and ploughed into the soil after 40 – 50 days of sowing. This enhances the nitrogen, phosphorous and other nutrients in the soil. *Trichoderma viride* @ 1.5 kg/acre is mixed with 300 kg compost and kept as such for a week and then applied to the field as top dressing. It will protect the crop from root rot and pathogens like *Pythium* and *Phytophthora*.

Weed management :

In kharif crop harrowing is done 25 – 30 days after sowing. The first weeding is done 45 – 50 days after sowing. Weeding is repeated before budding stage followed by harrowing with hand harrow.

Pest and disease management :

Mustard aphid, painted bug, sawfly, *Alternaria* blight and white rust are some of the common pests and diseases affecting



mustard crop. For control of mustard sawfly, dust 5 per cent BHC dust (25 kg per hectare), for aphids spray one litre metasytox 25 E.C. or 250 to 300 ml dimecron 100 E.C. dissolved in 1000 litres of water per hectare and for control of cutworms drill into the soil 5 per cent dust of aldrin or heptachlor at 25 kg per hectare. For control of *Alternaria* blight, spray 2 kg dithane Z-78 or dithane M-45 dissolved in 1000 litres of water per hectare.

Irrigation :

Irrigation should be done once in 15 days. It is critical during flowering and pot filling stage.

Roguing :

Roguing should be done from the vegetative phase to the harvesting phase. Off-types are removed based on the branching type, capsule size and colour and colour of the seeds. Maximum percentage of off-types permitted is 0.10% for foundation seed production and 0.50% for certified seed production.

Field inspection :

A minimum of three field inspections should be done from pre flowering stage to maturity stage by the Seed Certification Officer. First inspection is done before flowering followed by second inspection during flowering. The third inspection is scheduled at maturity stage prior to harvesting.

Table-1: Field standard.

	FS	CS
Isolation distance	200	100
Off-types	0.10	0.50
Objectionable weed seeds	0.05	0.10

Harvesting :

Harvesting should be done when 75% of the pods become golden yellow in colour. The moisture content of the seeds will be 25% in this stage. Delaying harvest may result in yield loss. The crop is harvested at the level of lowest pods.

Threshing and drying :

The harvested plants are heaped and dried under the sun for 4–5 days to attain 12–13% of moisture level for uniform maturation of seeds. This is called swathing. During swathing the immature pods with green seeds mature. Threshing is done after 10–12 days by hand using stick. Threshed seeds are cleaned by winnowing and sieving using suitable size of sieve.

Seed storage :

Seeds are dried under the sun to attain 8% of moisture content. This is safe for mustard seeds and can be stored in gunny or cotton bags upto one year under open storage conditions.

Seed standards :

The minimum percentage of purity of foundation and certified seeds should be 97% with 85% of minimum germination capacity and 8% of maximum moisture content. Presence of other distinguishable variety in foundation seed should be 0.10% and that of certified seed should be 0.50%.

Hybrid seed production techniques of rapeseed & mustard crossing techniques :

In the selected plants racemes are to be selected in which flowers will be utilized for crossing. Keeping 6-8 flowers on the lower side the rest of the raceme is to be clipped off. Generally, 2-3 flowers open at a time. Selecting such buds which will open next day, the corolla is to be slit open by the fine tip of the pincer and the anthers will be removed just by jerking to achieve emasculation. Though pollen grains of the same flower will not be effective for pollination for the operation of self-incompatibility system, for the sake of ensuring purity of the cross, emasculation is necessary. The raceme with the emasculated flowers is to be covered by brown paper bags to save the flowers from contamination by unwanted pollen grains. The male parental plants from which anthers will be collected for dusting pollen grains on the stigmatic surface, are to be kept covered by fine cloth bags and flowers allowed to open under cover. Before taking up crossing programme, a study is to be made to know actually when the opening of the flowers and dehiscence of anthers take place. When in the morning the



flowers open, striking the time just before dehiscence of the anthers, these are collected in a watch glass or such anthers also can be collected which have just started dehiscing. If undehiscent anthers are collected, time has to be given for its bursting. When with the help of magnifying glass the dehiscence/bursting of the anthers is observed, the whole anthers are lifted with the help of the fine forceps and taken on the stigma to touch the surface for pollination. After touching the stigmas with the burst anthers, it is to be checked with the help of the magnifying glass (3 or 4 X will do) whether the pollen grains are found on the stigmatic surface. After pollination the paper bag is to be replaced, so also the cloth bag protecting the plants with flowers used as pollen source. After pollinating all the flowers retained in the raceme the bag may be removed giving a proper tag to identify the crossed flowers.

Reproduction and pollination :

Brassica juncea and *Brassica napus* are self pollinated species. yellow sarson (*Brassica campestris* var. yellow sarson) is also self pollinated. *Brassica campestris* viz., brown sarson and toria are self incompatible. *Brassica nigra* and *Brassica oleracea* are also self incompatible. Self incompatibility promotes cross pollination in these species which occurs by wind and honey bees. Rapeseed produces yellow nectar-bearing flowers, which are able of both self-fertilization and intra specific cross-fertilization. Honeybees are the primary pollinators of rapeseed. In India, isolation distance of 400 meters for foundation seed production is required.

Stigma receptivity :

The stigma become receptive 3 days before blooming of the flowers and remain so 3 days after anthesis. Breeder can hence plan their crossing work according to the convenience.

Anthesis :

Dehiscence of the anthers takes place around 8 AM in the morning depending upon the weather condition. If cloudy the anthers is delayed till the sun breaks. Warmth of the weather imparted by sun is necessary for dehiscence.

Pollen grains and viability :

Pollen grains are round in shape taking stain readily and remain viable for 24 hours after release from the anther sacs.

Blooming of the flowers and anthesis:

The flowers being to open by 8 AM with the rise in atmospheric temperature. The process continues till noon. Since it is a racemose type of inflorescence the flowers placed lower in the raceme open first continuing to proceed upwards each day. This continues for a week or so depending upon the growth of the inflorescence.

Synchronised flowering of male and female parents :

Oilseed *brassicas* have indeterminate flowering habit. Early onset of flowering in the female parent as compared to the pollen parents invariably results in female plants getting taller. This reduces the hybrid seed set as the access of the pollen to the stigma is reduced. Detopping of alternate plant of male parent (in 2M : 4F/2M : 6F) ratio coupled with additional application of N (@ 25 kg/ ha) between pollinator rows after flowering was found effective to ensure pollen supply for longer duration.

Maintenance of purity:

In *Brassica juncea* and yellow sarson maintenance of purity of the lines is not difficult. This is achieved by covering the whole plants with fine cloth bag and leaving them as such. Since both the species are self-compatible pollination brought about by the pollen grains of the same flower results in fruit and seed setting. It is found that if the bags are shaken in the morning the seed setting is better. By shaking the cloth bags along with the plants dusting of pollen grains liberated by the anthers, is ensured though by structure and biology of the flower, dusting is not necessary to ensure pollination. Further, keeping the plants open for some time after the pollination is over in the morning, ensures better pod setting.

Hybrid seed production :

Hybrid seed production based on CMS-FR system requires four isolations. These are : maintenance of CMS line (A X B), multiplication of maintainer (A) line, multiplication of restorer (R) line and hybrid seed (A X B) production. The production of hybrid seed by cross pollination is the most important factor affecting the bio-economics of seed set on female lines using various production techniques. Wind and insects have been reported to be the main agents for pollination, though only the pollen grains that are initially disturbed by insects may become truly air borne. The factors that can influence the extent of seed



setting on female lines include ; male-female ratio, synchronized flowering of male and female parents, nector production and bee foraging, yielding ability of CMS lines, pollen production of male parents.

A very wide variability in seed yield has been observed in different experiments. Genotype has been a major source of variation and selection of female parents suitable for cross-fertilization. Different kinds of row ratios for female vs. Male were found to be useful for commercial hybrid seed production. A study on Indian mustard (Banga *et al.*, 1995) has shown that the extent of hybrid seed set was maximum when the male rows were sown in higher frequency i.e., 2 : 4 ? 1 : 2 ? 1 : 3 ? 1 : 4. There was significant reduction when the male : female ratio was changed from 1 : 3 to 1 : 4. In addition to the reduced seed set, a sharp decline occurred in the number of successful pods on the male sterile plants as was evident from an increased frequency of empty or aborted pods. While greater production of female rows is desirable to enhance the production of hybrid seed, care must be taken to ensure adequate pollen supply to facilitate hybrid seed set on female plants. Orientation of rows against the direction of wind has generally been found useful to maximize out-crossing on female plants.

The block seed production method, using ogu CMS material has been found to be suitable in *B. Napus* (Hogarth *et al.*, 1995). Isolation distance depends upon several factors. These include location, wind direction, viability for air-borne pollen and extent of bee population. Production of hybrid seed should be carried out in crossing fields isolated from other plants of related species with a minimum distance of 500 to 3000m depending upon the species. Crucial role of nector production for bee foraging and seed set on male sterile plants has been established in various crops. Keeping beehives in the seed production plots of rapeseed-mustard has been found to be useful. Another factor, which has profound influence on the economics of hybrid seed production, is the synchronized flowering of male and female parents. It must be realized that nicking is the best isolation. Nicking can be improved by cultural manipulations or by selective application of growth regulators to delay or advance flowering in male/female lines. In oilseed rape, detopping of alternate plants of male parent coupled with application of N @ 25 kg/ha between pollinator rows after flowering was found to be effective to delay flowering in male parent besides ensuring pollen supply for longer duration.

Production of hybrid seed of synthetic variety in self-sterile rapes and mustards :

The method of isolating inbred lines and then crossing the best of these for the production of hybrid seed or synthetic variety as is being practiced in corn has not been exploited in case of cross pollinated rapes and mustards. Singh and Mehta (1954) as a result of varietal crosses in brown sarson obtained significant increase in yield in F₁. One of the hybrids gave an increase in yield of about 250 per cent over their parents and an increase of about 47 per cent over the highest strain. Certain hybrids showed great resistance to Aphids. For employing hybrid vigour to maximize yield, the following three steps are necessary:

1. Raising of inbreds.
2. Selection of the best inbred lines for crossing.
3. Utilisation of the best lines in crosses.

1. Raising of inbreds :

(a) Inbreeding : Inbreeding of toria, lotni brown sarson and taramira on account of self-sterility is more tedious and labour-consuming than corn where selfing can be done simply by bagging. Selfing in the self-sterile forms of *Brassica* oilseeds is done through bud pollination where buds two to three days before their opening are pollinated by pollen from flowers of the same plant. To avoid contamination of the pollen, the buds which are likely to open the next day, are covered by a muslin bag. Next morning, the stigma is touched by the dehiscent anthers and then covered by a muslin bag. The bud pollination on an inflorescence will be continued till the desired number of buds have been selfed. After this all the other buds from the inflorescence are removed.

(b) Effect of inbreeding : Mohammad (1935) reported that the plants raised from selfed seed in toria and brown sarson were usually found to be short stature and much less vigorous than those raised from seeds obtained by crossing. The following observations were made :

Similar observations with regard to loss and decrease in the average percentage of pod setting as a inbreeding were recorded by Alam (1938) in taramira. In the studies made at Kanpur the effect of inbreeding in brown sarson was found to vary in different varieties. In some cases, the loss of vigour is so great that after 4 to 5 generations of selfing the inbred lines eventually die. Though generally inbreeding is accompanied by a decrease in height, certain inbred lines were found to be as tall as the parent even after five generations of selfing. Such lines were, however, found to be highly sterile and were continued from



generation to generation with great difficulty. Inbreeding tends to isolate lines with varying degrees of self-sterility ranging from almost complete self-sterile lines to almost 100.0 per cent self-fertile. As a result of inbreeding it has been possible to discover new inherited characters in brown sarson.

2. Selection of inbred lines for crossing : Such inbred lines which are self-sterile but cross-fertile are selected for crossing. It is also essential to test their combining ability to select the best parents which will have the ability to transmit high yielding potentiality to their hybrids. Singh and Mehta (1954) from diallel crosses amongst six strains of brown sarson found that the extent of increase in yield in F_1 varied with different combinations. While the hybrid 4 x 3 gave an increase in yield of about 250.0 per cent over their parents, hybrid 2 x 1 showed negative heterosis. In order to test the combining ability of inbred lines, the methods used in case of corn are however not suitable. Polycross method suggested for testing the combining ability of open pollinated crops like perennial grasses may be profitably utilized in case of toria, lotni brown sarson and taramira as well.

In the polycross method the different inbred lines are grown randomized in a plot. The lines are allowed to cross by natural means. The assumption is that all the lines will have a common source of pollen, a mixture of all due to their random distribution. The seed is harvested from all lines and sown next year in a replicated trial. The lines giving the best performance with regard to yield are considered to be best combining ability.

In case of polycross method the number of inbred lines to be tested should not be very large otherwise the random distribution of pollen will not be possible. It will be quite safe to have about 25 inbred lines at a time. Besides this polycross plot should be in an isolated place so that the pollen from any other source may not be carried there.

3. Utilization of the combining lines : The best combining lines can be put into crosses either for the production of the hybrid seed in single cross or multiple crosses or synthetic variety. For hybrid seed production the best combining lines which should be self-sterile but cross-fertile may be brown side by side in an isolated plot. The seed harvested from the inbred lines will be the hybrid seed as a result of natural cross pollination.

In India there seems to be better scope for a synthetic variety where about 4 to 6 or even more high combining lines can be crossed with each other. For effecting crosses amongst the inbred lines, the use of insect proof cages and of bags as suggested by Mohammad and Sikka (1941) and already described, will prove very useful. The crossed seed can be multiplied in an isolated plot on an experimental farm and distributed to the cultivations as a synthetic variety.

Production of synthetics from short-term inbreds : Where it may not be possible to produce hybrid seed or synthetic variety on the lines described above, the method of producing synthetic variety from short term inbreds as suggested in corn may be profitably utilized with certain modifications. The essential steps may be outlined as follows :

1. Isolate one generation of selfed lines.
2. Half of the S_1 seed may be sown in as many replication as possible for testing their combining ability by the polycross method.
3. On the basis of the results of the polycross test the most desirable lines are selected and the remnant seed of such S_1 lines will be grown for letting them intercross freely to produce a synthetic variety.

This process will be repeated to produce a new wave of seed of a new synthetic variety after the first variety had a generation or two of mixing.

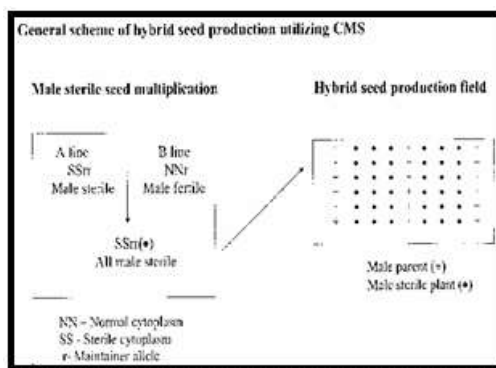


Fig.-1 : A general scheme of hybrid seed production utilizing CMS in rapeseed & mustard.



Production of hybrid seed in self-fertile oleiferous *brassicae* :

Attempt large number of crosses between several varieties of rai (*Brassica juncea*) and obtained increased yields in F₁ up to 25.0 per cent or more in certain combinations. The increase in yield, however, was not found to be due to any increase in the size of pods in F₁. The results of these experiments also clearly indicated the importance of selecting suitable parents for making crosses because increased yield in the hybrids is obtained only in certain combinations. Thus it is evident that seed yield in case of rai (*Brassica juncea*) can be considerably increased through production of hybrid seed but the difficulties involved in making crosses between parents are so great that hybrid vigour can never be commercially exploited unless some male sterile lines as found in tomato, onion, sorghum, etc. are obtained. Male sterility can either be induced through radiation or a search has to be made to discover some naturally occurring male sterile individuals. A mutant in rai which is almost 100.0 per cent cross-pollinated has been isolated at Kanpur and the possibilities of utilizing this mutant in the production of hybrid seed on a commercial scale are now being worked out.



EMERGENCE OF LUMPY SKIN DISEASE IN INDIA-NEED BETTER DIAGNOSIS, PREVENTION AND CONTROL STRATEGIES

Amit Kumar Verma*, Amit Kumar, Arbind Singh, Afroz, Surendra Upadhyay and T.K. Sarkar

Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh-250110, India

*Corresponding Author Email : drakverma79@gmail.com

Abstract

Lumpy skin disease (LSD) is caused by the lumpy skin disease virus (LSDV), which belongs to the Capripoxvirus genus of the Poxviridae family and clinically characterized by pyrexia (105-106⁰F), anorexia, and distinctive nodules on the skin and mucous membranes of the mouth, nostrils, udder, heart, mesentery, genitalia, and rectum. Abortion, infertility, and occasionally death may also occur. The disease is categorized as transboundary disease and leads to serious economic impact to dairy industry. The disease is having high morbidity and low mortality rate and transmitted through the arthropod vectors such as flies, mosquito and ticks etc. The disease is usually reported from African and Middle East countries but recently it has been reported in Asian countries including, Bangladesh, China and India with a mortality rate around 5-10% among cattle. The disease's epidemiological situation is currently unknown in India. It may be possible to prevent the spread of disease by vaccination with goat pox and lumpy pox vaccine and vector control. This paper aims to sum up the recent developments in the epidemiology, clinical signs, diagnosis, treatment, prevention and control of the disease.

Key words : Lumpy skin disease, epidemiology, india, prevention and control.

INTRODUCTION

Lumpy skin disease (LSD) also known as “Pseudo-urticaria”, “Neethling virus disease”, “exanthema nodularis bovis”, and “knopvelsiekte” (Al-Salihi 2014; Tuppurainen *et al.*, 2017) is a viral disease of cattle and buffalo, caused by caused by Lumpy skin disease virus (LSDV), which belongs to genus Capripoxvirus, family Poxviridae. The disease is transmitted by arthropod vectors including biting flies, mosquitoes and ticks (Tuppurainen *et al.*, 2011; Lubinga *et al.*, 2013a, b; Gupta *et al.*, 2020; Namazi *et al.*, 2021). The disease is mainly of cattle and buffaloes but no natural infection of sheep and goat have been reported, while experimental infection in sheep, goat, giraffe, Giant gazelles, impalas have been recorded (Davies 1991). The disease is having high morbidity and low mortality (Abutarbush *et al.*, 2013; Gupta *et al.*, 2020; Namazi *et al.*, 2021). The clinical signs of the disease are pyrexia (upto 106⁰), nodules on the skin, and other internal organs, swelling of lymph nodes, anorexia, emaciation, decrease in milk production, abortion and infertility (Constable *et al.*, 2017; Gupta *et al.*, 2020; Namazi *et al.*, 2021). The disease causes severe economic impact as it leads to drastic decrease in milk and meat production, reproductive efficiency, draft power of the animals and affect the international livestock trade also. The disease was first time reported from Zambia in the year 1929 (Morris 1931) and further spread to African and middle east countries but now it is spreading to new areas crossing the international boundaries (Tuppurainen *et al.*, 2015). Recently, it has been reported from Asian countries like Bangladesh, China and India. The present paper summarizes the recent developments in the epidemiology, clinical signs, diagnosis, treatment, prevention and control of the disease

Etiology :

The disease is caused by lumpy skin disease virus (LSDV) of Poxviridae family. The family poxviridae have two subfamilies viz., Chordopoxvirinae and Entomopoxvirinae. The subfamily Chordopoxvirinae has viruses that infect vertebrate host, while subfamily Entomopoxvirinae contains viruses that infect invertebrate hosts (Quinn *et al.*, 2016). There are ten genera in the Chordopoxvirinae subfamily, including Capripoxvirus. The genus Capripox virus has 03 different species viz., lumpy skin disease virus (LSDV), goat pox virus (GTPV), and sheep pox virus (SPPV), which infects cattle, goat and sheep, respectively (Buller *et al.*, 2005). Lumpy skin disease virus is a brick-shaped encapsulated virus with double-stranded DNA that has complex symmetry and replicates in the cytoplasm of the host cell. It is 230-260 nm in size. The genome size of this virus is 150 kilo base pairs (kbp) and has 156 putative genes and is made up of identical 2.4 kbp-long inverted terminal repeats that surround the central coding region (Gupta *et al.*, 2020). This virus has 30 structural and non-structural genes that are 97% nucleotide identical to sheep pox and goat pox virus (Tulman *et al.*, 2001, 2002). The virus is stable at ambient temperature and can survive in necrotic nodules for 33 days, crusts of dehydrated skin for 35 days, and air-dried hides for at least 18 days. Viruses can be promptly destroyed by sunlight and lipid detergents, but they can survive for several months in dim environments like feed warehouses and animal shelters. The virus becomes inactive at temperatures of 65⁰ for 30 minutes and 55⁰ for 2 hours. Although it is sensitive to extremely alkaline or acidic pH but it can maintain pH 6.6 to 8.6 for five days at



37°C without suffering a major loss in titres. The disinfectants like ether (20%), chloroform (1%), formalin (1%), phenol (2% for 15 minutes), sodium hypochlorite (2-4%), iodine compounds (1:33 dilution), and quaternary ammonium compounds (0.5%) are capable of killing the virus (OIE, 2013).

Epidemiology :

Lumpy skin disease was first reported in 1929 from Zambia and then spread to African continent except Libya, Algeria, Morocco and Tunisia (Tuppurainen and Oura 2012). With the increasing demand of food in Middle Eastern countries, the disease spread to Egypt in 1988. Then by biting flies (*Stomoxys calcitrans*) the disease spread from Egypt to Israel in 1989 (Yeruham *et al.*, 1995). In the year, 2012 and 2013, the disease reached to Syria, Jordan, and Lebanon and further spread to Turkey and Iraq in 2013 and Iran in 2014. LSD outbreaks were initially reported from the borders of Bangladesh, China, and India. In India, the first case of the disease was reported in Odisha in August, 2019, during the monsoon season, when there was a high density of mosquitoes. In first published report of LSD in India, it was found that out of 2539 animals, 182 were positive with no mortality but 7.1% morbidity. On phylogenetic analysis, the strain found in India was genetically more similar to South African NI2490/KSGP-like strains than to European ones (Sudhakar *et al.*, 2020).

Cattle and buffaloes are the most susceptible host. Exotic breeds are more susceptible in comparison to the indigenous breeds. The calves are more susceptible and develop lesions within 24 to 48 hours (Al-Salihi 2014). No natural infection of sheep and goat have been reported, while experimental infection led to clinical lesions in giraffes (*Giraffe camelopardalis*), impalas (*Aepyceros melampus*), springboks (*Antidorcas marsupialis*), Arabian oryx (*Oryx leucoryx*), and Thomson's gazelles (Davies 1991; Padilla *et al.*, 2005). The disease is not zoonotic (OIE, 2013).

The disease is mainly transmitted through vectors mechanically. The arthropod vectors such as ticks (*Amblyomma spp.*, *Rhipicephalus decoloratus*, *Rhipicephalus appendiculatus* and *Amblyomma hebraeum*), biting flies (*Stomoxys calcitrans* and *Biomyia fasciata*) and mosquitoes (*Culex mirificens* and *Aedes natrionus*), are considered as the mechanical vectors for the transmission of the disease (Ali and Obeid 1977; Lubinga *et al.*, 2013ab; Lubinga, 2014; Tuppurainen *et al.*, 2013). The advent of the seasonal rains and the summer months, which coincide with the peak activity of the vectors, dramatically increase disease rates in the majority of the endemic nations, such as sub-Saharan Africa, Egypt, and Ethiopia (Mulatu and Feyisa 2018). The incidence of the disease decreases in the winter and again increase in the spring and summer season (Nawathe *et al.*, 1982; Kondela *et al.*, 1984). LSDV is secreted in all the secretions of the body like milk, saliva, nasal discharge, blood and lachrymal secretions and may spread among animals sharing feed and water troughs (Ali *et al.*, 2012). The virus may also be transmitted through intrauterine route (Rouby and Aboulsoud, 2016), milk secretions and skin abrasions (Tuppurainen *et al.*, 2017), semen (Irons *et al.*, 2005) and Iatrogenic route during mass immunization using single needle that may get infection from skin scabs or crusts (Mulatu and Feyisa, 2018). Despite of the restriction on animal movements in Egypt, the disease spread to Israel crossing 80 to 200 kilometres through biting insects (AU-IBAR, 2013). Thus, the quarantine may not be the sole effective way to stop the spread of LSDV because vector mobility can cause the disease to spread rapidly.

Clinical signs:

The incubation period of disease is 7-14 days but may extend upto 5 weeks. The disease occurs in 03 forms viz., acute, subacute and chronic. Pyrexia, a few lumps of nodules, emaciation, lachrymal discharge, and agalactia are the clinical features of the mild type. Nodules may later extend to the skin of the muzzle, nares, back, legs, scrotum, perineum, eyelids, lower ear, nasal and oral mucosa, and tail (Babiuk *et al.*, 2008; Salib and Osman, 2011; Annandale *et al.*, 2014; Tasioudi *et al.*, 2016), generalized lymph node enlargement. When the disease is severe, there are numerous nodules on the skin all over the body, and this stage lasts for 7 to 12 days. The nodules are 2–7 cm in diameter, elevated from the skin and have a narrow haemorrhagic ring (Sevik and Dogan, 2017). The dermis, epidermis, nearby subcutis, and muscle are all affected by the nodules. The lesions then develop into papules, vesicles, pustules with exudate, and finally eventually develop into scabs. The healing is slow. Nodules may also develop on the the mucous membranes of the mouth, vulva, respiratory system, and nose. After 1-2 weeks, skin sores harden and becoming necrotic making the animals uncomfortable and reluctant to move. The characteristic lesion “sitfast” may slough, leaving holes that could invite invasion of bacteria and fly, which may lead to septicaemia (Constable *et al.*, 2017). The common sequela is pneumonia because of the inhalation of necrotic material by the animal itself, abortion due to pyrexia, infertility particularly anoestrus for long time, mastitis, keratitis, dysentery, lameness and myiasis (Radostitis *et al.*, 2006; Al-Salihi & Hassan, 2015; Tuppurainen *et al.*, 2017).



Diagnosis :

The differential diagnosis of the LSD should be with foot and mouth disease (FMD), insect bite, demodicosis and hypersensitivity. The clinical signs like skin nodules on face, eyelid, neck, muzzle, nostrils, udder, and limbs are suggestive of Lumpy skin disease. The preferred samples for laboratory diagnosis are skin biopsy in phosphate buffer saline and blood in EDTA. The isolation of virus and molecular tests like PCR are most efficient test for diagnosis of the disease (OIE, 2013).

Treatment :

Since, it is a viral disease, so there is no specific treatment. Only symptomatic treatment and administration of antibiotics to control the secondary bacterial infection and good nursing care are recommended. However, the use of vitamin and mineral mixture, antioxidants etc may help in improving the immunity of the animal. The use of non steroidal anti inflammatory drugs like meloxicam, paracetamol and flunixin meglumine are recommended to treat the pyrexia in the animals.

Prevention and Control :

Vaccination of the animals against a live attenuated Goat Pox virus and Lumpy skin disease virus are the most efficient way of the prevention of the disease. Based on different strains of LSD virus, different manufacturer prepared vaccines for example Neethling strain like Lumpy Skin Disease Vaccine for Cattle (Onderstepoort Biological Products; OBP, South Africa) or Bovivax (MCI Sante Animale, Morocco), or based on SIS Neethling type (Lumpyvax, MSD Animal Health-Intervet, South Africa). Recently, Indian Council of Agricultural Research (ICAR), New Delhi develops indigenous vaccine for Lumpy Skin Disease in cattle in India named “Lumpi-ProVac Ind”. Since the virus is closely related to sheep pox and goat pox, the vaccine for those diseases can be used to prevent LSD (Tuppurainen *et al.*, 2015). To stop the spread of the disease, it should be strongly forbidden to move animals, which have LSD infection. Affected animals must be isolated to stop the rapid spread of disease. The migration of vectors brought on by the dominant winds may spread disease. The disease can also be prevented by employing vector control techniques like the use of vector traps and pesticides.

CONCLUSION

Cattle and buffaloes have a significant role in the dairy industry and are susceptible to the lumpy skin disease. Before recently spreading to India and other previously disease-free Asian countries, the disease was confined to Africa and Middle East countries. This spread of the disease in India is a concern because, the animal husbandry contributes significant amount of agriculture gross domestic product. Due to trade restriction, LSD may also result in a decline in the export of cattle and livestock-related goods. Therefore, effective measures to stop further spread include accurate and prompt diagnosis in endemic areas, vaccination with the homologous strain of the LSDV, vector control and animal movement restrictions.

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CONVENTIONAL METHOD TO BREAK THE MALE STERILITY OF INTERSPECIFIC CROSS BETWEEN *CAPSICUM ANNUUM* AND *CAPSICUM BACCATUM* IN CHILLI

B.V. Tembhurne^{1*}, S.P. Singh¹, Rohit Kumar¹, Praveen Kumar¹, Manoj¹ and S.P. Singh²

¹Department of Genetics and Plant Breeding, University of Agricultural Sciences, Raichur, Karnataka

²CSAUAT-Agriculture Research Station, Kalai, Aligarh, U.P.

*Corresponding Author Email : bvtembhurne@gmail.com

Chilli (*Capsicum annuum* L.) is one of the most important commercial crops, grown in almost all parts of the world as well as in India. Anthracnose (*Colletotrichum capsici*) and powdery mildew (*Leveillula taurica*) are the major diseases of chilli. Among the various factors responsible for low yield of chilli, pests and diseases are of prime importance which affects the quality and production. Chemical method of managing anthracnose disease is not sustainable and is also associated with health hazards and environmental pollution. The use of systemic fungicides for control has not been effective. Besides, its indiscriminate use causes pathogen resistant strains development. Only the genetic resistance is economical and eco-friendly solution to keep these diseases away from the crop. The resistant source of powdery mildew is available in *C. annuum*. However, both powdery mildew and anthracnose disease resistant source is found in *C. baccatum* species. Use of bridge species and or embryo rescue are only the techniques to transfer the anthracnose resistant gene from *C. baccatum* to *C. annuum* due to cross incompatibility between these 2 species. But interspecific hybrids so produced may be sterile and complex in characteristics. Hence, very difficult to go for background selection. Therefore, the crossing programme was initiated to transfer resistant gene from *C. baccatum* to *C. annuum*. The large number of crosses were attempted to enhance the cross compatibility between *C. annuum* and *C. baccatum*. It was found that the interspecific cross was compatible when male sterility based hybrid between *C. annuum* and *C. annuum* used as female and *C. baccatum* as male parent. The population of interspecific hybrid so produced was completely sterile as well as partial fertile. After attempting large number of back crossing with partial fertile plants using male sterility based hybrid as male parent, we could able to get single fruit having 2 seeds with embryo and 2 seeds without embryo during kharif 2020-21. Both the seeds filled with embryo were germinated and grown well. Again out of two plants one was sterile and another was partial fertile. Partial fertile plant was cross compatible when sterility based F1 hybrid used as male parent. Out of 4 plants developed in BC2F1 population one plant was completely fertile, 2 were partial fertile and one was sterile. Among the 4 plants 3 plants were cross compatible with each other as well as any genotypes belongs to *C. annuum* as well as *C. baccatum*. Work for the development of large population is under progress to confirm the resistance to anthracnose, powdery mildew as well as murda complex. The fruits produced by all the 3 plants were found to be resistant to anthracnose and powdery mildew. However, one plant was resistant to anthracnose and powdery mildew as well as murda complex. Further confirmation for all the three diseases is under progress using molecular markers.

Methods :

The inheritance of *Colletotrichum* spp is monogenic dominance in nature (Qing-Lin *et al.*, 2002; Lin *et al.* 2002; Yoon and Park 2005; Mahasuk *et al.*, 2009). However some research reports showed recessive inheritance of anthracnose disease (Cheema *et al.*, 1984; Lin *et al.* 2007; Kim *et al.*, 2008;). While, resistance to powdery mildew is reported dominant and polygenic in nature (Murthy & Deshpande, 1997; Jinkwan *et al.*, 2017). Genotype PBC80 belongs to (*Capsicum baccatum*.) resistance to both anthracnose and powdery mildew but cross incompatible with *Capsicum annuum*. It was made possible to introduced resistance gene from PBC80 into *Capsicum annuum* via a trispecies cross by using *Capsicum chinense* as a bridge species (Yoon *et al.*, 2005; Juan *et al.*, 2015). *Capsicum chinense*, *Capsicum annuum* and *Capsicum frutescens* were crossed with each other and embryo rescue was done between 27-33 days after pollination (Debbarama *et al.*, 2013). It indicates that introgression of anthracnose as well as powdery mildew resistant gene is possible into the commercially cultivated varieties.

Identification of resistance source and Interspecific hybridization

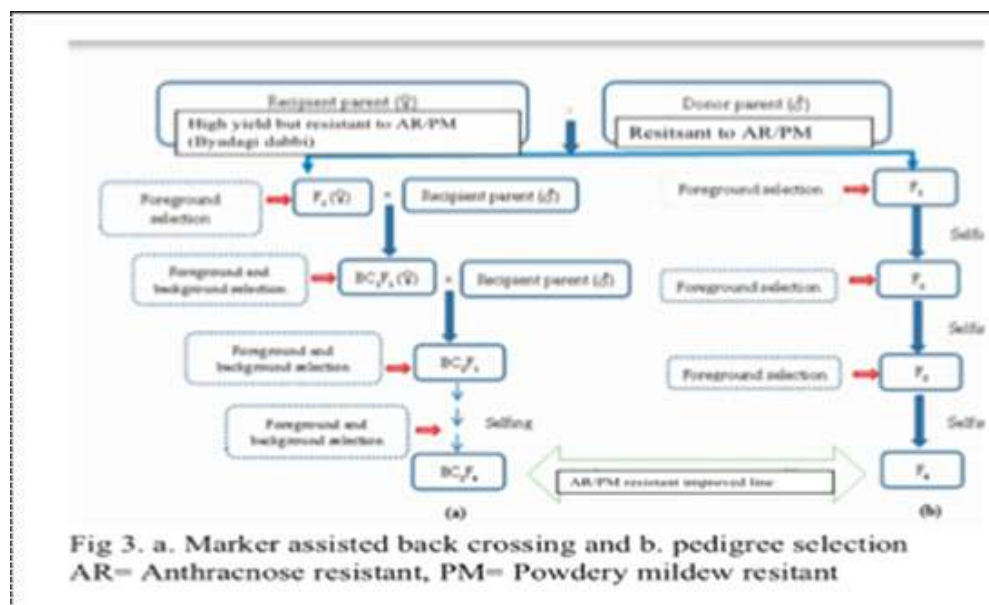
Based on preliminary studies of 2 years, we have screened the genotypes and confirmed highly resistance sources like PBC-80, G-4-L and M-421 to anthracnose and JNA1 and JNB1 to powdery mildew. We have identified resistance source from *Capsicum annuum* like G-4-L and M-421 resistant to anthracnose and JNA1 and JNB1 powdery mildew. Hence, introgression of these diseases to commercial cultivar is possible due to cross compatibility. These genotypes carrying highly resistance genes for anthracnose like PBC80 and powdery mildew resistant like, JNA1 and susceptible genotype for both the diseases like BVC42 were selected for interspecific crosse. The genotypes JNA1 and BVC42 were belongs to *C. annuum* and PBC80 was belongs to *C. baccatum*.

Development of resistant variety using resistance source from *Capsicum baccatum* gene pool :

The same scheme of back crossing and selection will be used to develop powdery mildew resistant F₁ hybrids. The molecular markers will be utilized for powdery mildew resistance for indirect selection of the resistant plants.

Development of resistant variety using resistance source from *Capsicum annuum* gene pool: We have resistance source from *Capsicum annuum* like G-4-L and M-421 resistant to anthracnose and JNA1 and JNB1 powdery mildew.

Varieties resistant to anthracnose and powdery mildew will be developed as per the procedure given below.



Modified breeding strategies for improving sterility of interspecific cross : We overcome the interspecific cross incompatibility between *C. annuum* and *C. baccatum* surpassing the use of bridge species and embryo rescue method and developed simple breeding strategies. The male sterility based F₁ hybrid (*C. annuum* x *C. annuum*) was used as female and crossed it with PBC80 (*C. baccatum*). The population of three way cross so produced was partial sterile as well as partial fertile. Partial fertile plant was cross compatible with Sterility based hybrid and we could able to get single backcrossed fruit. The single backcrossed fruit was harvested and seeds were extracted. We could able to get 2 plants in BC₁F₁ progeny. The same trend was observed in this population also i.e one plant sterile and one plant partial fertile. Again partial fertile plant was cross compatible with sterility based hybrid. Therefore, It was possible to produced BC₂F₁ population. In BC₂F₁ population we got 4 normal plants having vigorous growth with resistance to powdery mildew as well as anthracnose diseases. Out of these normal plant 2 were partial fertile and one each of complete fertile and sterile. The self fruits were recovered to produce large population. Hence, it is possible now to select fertile plants with resistance to anthracnose as well as powdery mildew by utilising large population of BC₃F₁ after improving the male fertility each generation of back crossing.

Acknowledgement

The authors are thankful to Science and Engineering Research Board (SERB), DST, Govt. of India as the work is funded by research grant EEQ/2019/000176

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BOVINE COLOSTRUM AS A POTENTIAL FUNCTIONAL INGREDIENT FOR VALORIZATION OF FOOD PRODUCTS

Anamika Das

Department of Dairy Chemistry, WCDT, SHUATS, Prayagraj, U.P.-211007

Email : anamikandri06@gmail.com

INTRODUCTION

Colostrum is the first lacteal secretion from the mammary glands after parturition and is secreted for 72 hours. It is a complex fluid rich in nutrients and is also characterized by its high level of bioactive components e.g. immunoglobulins(Ig), particularly IgG1, growth factors, i.e. insulin like growth factors I and II , transforming growth factor 2 and growth hormone in addition to lactoferrin, lysozyme and lactoperoxidase (Pakkanen,1998). It has been observed that cows and buffaloes produce colostrum in excess of calf's requirement. In many instances, this large volume of colostrum is discarded and its precious nutrients remains unutilized. In the recent years, there has been increased interest in consumption of bovine colostrum or its supplemented products by human, based on the prophylactic and immuno-therapeutic benefits of absorbed immunoglobulin especially IgG.

Historically in India, Ayurvedic physicians have used bovine colostrum for therapeutical purposes for thousands of years. In United States and throughout the world, conventional doctors used it for antibiotic purposes prior to the introduction of sulfa drugs and penicillin. In the early 1950's, colostrum was prescribed extensively for the treatment of rheumatoid arthritis and also as a source for antibodies against polio virus (Sabin and Fieldsteel, 1962). Colostral antibodies provide passive immunity to the new born calf and growth factors control some fundamental life processes such as cell division, cell differentiation or apoptosis and stimulate the growth and development of the gastrointestinal tract of new born (Xu, 1996).

Immune factors and Growth Factors in colostrum and their therapeutic role

Colostrum contains powerful immune factors (immunoglobulins, cytokines, lactoferrin, lysozyme, Lactoperoxidase etc.) that work to restore the immune function. Disease causing microorganisms present in infected foods enters the body through the mucous membranes in the GI tract. The majority of the immunoglobulins present in colostrum are not absorbed but remain in the intestinal tract where they attack pathogens before they can penetrate the body's defences. Growth factors present in colostrum like Insulin-like growth factors (IGF-I and IGF-II), Transforming growth factor, Epidermal growth factor etc. not only helps in building and restoring bone, muscles, nerve tissues, connective tissues, skin, cartilage but also helps in proliferation and differentiation of cells and tissues. These factors have also been shown to help increase lean muscle, helps the body in burning fat for fuel, and assist in wound healing. Growth factors have also been shown to help slow the signs of ageing. Immune factors and growth factors of bovine colostrum in combination are virtually identical to those in human colostrum. Bovine colostrum is upto 40 times richer in immune factors than human colostrum. Moreover, bovine colostrum is not species specific which means it can also work effectively in human and other mammals. As the person ages, it takes a little longer to fight off infectious diseases like cold or flu, the person becomes more vulnerable to disease, energy and enthusiasm lessens and shows symptoms of ageing. Humans especially elder people gradually lose immune and growth factors in the body which can possibly be replaced in the human body with bovine colostrum. Since colostrum is natural food, it can be consumed without experiencing side effects or drug interactions.

Colostrum based components for valorization of food products

In India, especially in Maharashtra, colostrums is used to prepare a popular sweet gel preparation called as kharwas (Kulkarni *et al.*, 1989). The diluted colostrum is mixed with sugar or jaggery and flavoured with cardamom and saffron. This mixture is then heated in a boiling water bath resulting in a gel formation. Kulkarni *et al.*, (1989) also reported a traditional practice in Konkan area of India to preserve colostrum by depositing it as a thin layer on a superfine muslin cloth. The cloth is soaked in colostrum and hanged in the sun for drying. When needed, the cloth may be resoaked in water and reconstituted colostrum may be obtained.

Jalonen *et al.*, (1995) described a nutritional drink improving physical performance and recovery based on colostrum. The product comprised a colostrum fraction obtained by separating the fat from the colostrum with a conventional method, involving precipitating and removing the casein of the defatted colostrum by microfiltration or ultrafiltration.



Liquid colostrum as dairy products was patented by Scamell (1997). He reported the processing for colostrum to reduce the bioburden of liquid colostrum while retaining the biological activity of proteins including the immunoglobulin fraction. Using process like bactofugation by which fat and casein were removed alongwith bacteria, followed by pasteurization and then colostrum can be concentrated by ultrafiltration and/or evaporation or reverse osmosis, it is possible to supplement liquid colostrum into pasteurized dairy products.

Fukumoto *et al.*, (1994) reported UHT-milk enrichment by reconstituting membrane sterilized immunoglobulin concentrate prepared from colostrum. Ig concentrate was aseptically injected into cartons of UHT milk. Concentration of IgG remained constant in milk stored at 4, 25 and 35°C over 5 months. Commercially colostrum based products are available in the form of powder, tablets, lozenges, beverages and dietary supplements.

Internationally, colostrum-derived products have become valuable niche products and are currently being sold into highly competitive markets with current focus on protein components because of their physiological effects and hence their commercial value. Colostrum based different products are available in the market like lozenges (A Pennysaved Enterprise, USA), dietary supplements (GreenBetter living company, Symbiotics, Intact, USA), beverages (Sterling Technology, Toronto) etc. but no dairy products has been fortified with colostrum that can reach the consumer as a part of their diet. Colostrum supplemented dairy products could be much more beneficial to health than traditional dairy products.

Health benefits of colostrum

Bovine colostrum is attributed with curative powers has been proved by clinical studies which helped in rediscovering the potential benefits of the bioactive components of colostrums. Bovine colostrums has a beneficial role in treating the leaky gut syndrome. Bovine colostrum contains a variety of antimicrobial factors and antibodies that bind to the pathogens and hold them until they are engulfed and destroyed by white blood cells arriving in the area.

Besides providing excellent immune support, colostrum has remarkable muscular-skeletal repair and growth capabilities. Studies (Ginjala *et al.*, 1998) revealed that colostrum is the only natural source of two major growth factors namely, transforming growth factors alpha and beta (TGF- α and β) and IGF-I and II. These growth factors have muscle and cartilage repair characteristics that are biochemically outstanding. IGF-I has pronounced anabolic and wound-healing characteristics. It slows catabolism and it is the only growth factor that can stimulate muscle growth and repair all by itself.

Proline rich polypeptides (PRP) present in colostrum, stimulates immature thymocytes to turn into functionally active T-cells. Colostrum contains components, such as cytokines, which are known to be responsible for regulating this inflammatory response, and has potential as an anti-inflammatory aid. Proline rich polypeptide (PRP) in colostrum can work as a regulatory substance of the thymus gland. Bovine colostrums contains a hormone like substance called leptin which regulates the incorporation and usage of fat in the body. Growth hormone alongwith IGF-1 was observed to play a role in the repair and functioning of heart muscles.

CONCLUSION

During the past two decades, colostrum has emerged as an excellent nutritional supplement especially for the elderly, who need to counteract the immune-suppressing effects of stress, illness, and anti-nutritional component in the diet. Colostrum has a therapeutic role to fight against AIDS, cancer, heart disease, diabetes, auto-immune diseases, allergies, herpes, bacterial, viral and parasitic infections, gingivitis and flu. The biomolecules of colostrum can be used to fortify different food products targeting different health issues. The biggest challenge to utilize colostrum is the processing of the product and the procurement of colostrum which is still in unorganized phase. The colostrum based product may provide more profit to the farmers if it can be collected hygienically and routed to appropriate agencies who may process it into value added products that will fetch higher returns.

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APPLICATION OF BIOSENSORS TECHNOLOGY IN MONITORING ANIMAL HEALTH CARE AND MANAGEMENT SYSTEM

Abhishek Kumar

Department of Veterinary Medicine, Ranchi Veterinary College, Ranchi, Jharkhand

The use of biosensor technology is becoming increasingly important for animal health management system. These devices if built precisely and used correctly can provide timely diagnosis of disease in animals, eventually decreasing economic losses. Instead of relying solely on farmer's senses and knowledge, on-site sensors can provide reliable data about the physical condition of the animals.

Apart from collecting useful data regarding animal health, general farm monitoring can also be made easier and more reliable by using biosensors integrated with cellphone and handheld devices instead of conventional methods, such as writing notes, keeping a farm diary or using simple equipment without data sharing functions. A number of systems have been developed on cellphone and handheld devices to reduce the effort of recording data manually. Solar powered receiver mounted on livestock can collect data that is transmitted to a central server. The final data can easily be viewed on a custom dash-board or office computer which can make this technology very convenient for farmers.

Another important use of biosensors is antibiotic detection. With the unhampered and frequent use of antibiotics in the animal industry, antibiotic resistance has become a major threat for farmers. Ecological instability is caused by the uncontrolled use of sub-therapeutic antibiotics in concentrated animal feed, which in turn causes antibiotic resistance in animals. The amount of antibiotics administered in the blood serum and muscle of farm animals should be kept in a certain range, and there should be a proper system to detect the antibiotic levels in the animal body. It is nearly impossible to put a ban on the use of antibiotics in the livestock health management, since antibiotics help cure the most common ailment, like enteric and respiratory infections. The use of antibiotics as antimicrobial growth promoters in sub-therapeutic concentrations is also well recognized for increasing development and growth of farm animals. To address this prevailing issue, maximum residual limits (MRLs) have been set up by European Union for those antibiotics that are still allowed to be administered in animals. Biosensors have been identified as being helpful in this regard; they can easily detect antibiotic levels and warn the farmers if the antibiotic level exceeds a maximum range.

The world organization for animal health (OIE) has warned that the zoonotic diseases from farm animals can have devastating impact on public health that puts a huge responsibility on the livestock industry to improve its biosecurity protocols and to enhance its animal traceability techniques for overall animal and public welfare. Therefore livestock industries and food safety inspection agencies are seeking tools and technologies that are enabling rapid, real-time and on-farm monitoring of diseases and record keeping.

Development and deployment of rapid and reliable tests allow us speedy and more specific treatment of disease, potentially resulting in reduced antimicrobial usage and improved animal welfare. Additionally, the biosensors and sensing technologies also alert producers even before their symptoms become obvious. This offers a major advantage in prompt disease diagnosis and thus helps in mitigating economic losses by way of poor animal health and productivity.

Early detection of diseases using biosensors allows for shifting of the epidemiological curve to the left by enabling rapid response, reducing the spread of the disease and associated production and social and economic consequences. Reducing the time to obtain results in diagnosing infectious disease biomarkers on-farm in a real time fashion provide an early warning system for smart livestock health management.

The integration of novel diagnostic and disease detection systems using biosensors keep livestock and agricultural industry one step ahead in their combat with endemic diseases by making use of Smartphone and satellites.

With the availability of internet even in rural areas, biosensing technology can help promote rapid, on-farm and real-time monitoring of farm animal diseases. The data thus collected serve purpose beyond farms as well. For example, allowing food manufacturing stakeholder's access to this information enables them to procure social license as well as makes them globally competitive.

A 'biosensor is an analytical device that can incorporate a biological molecule with a physical signal which can be readily translated into an indication to be used for precision livestock farming. Biosensor technology is equipping the livestock industry with a novel system of monitoring and measuring animal data plus, its ease of use exceeds the current technological practices.



Biosensing technologies like microfluidics, fluorescence resonance energy transfer, quantum dot, surface Plasmon resonance technology and hybrid technologies have been evolved for various purposes in livestock such as:

Sweat analyzers: real-time sweat monitoring by disposable potentiometric strips integrated with microfluidic chips have been developed by Gao et al, 2016. It is connected to a mini wireless system to detect levels of sodium, potassium, lactate, glucose in sweat and skin temperature simultaneously. Thus, biomonitoring of sweat in animal has potential for understanding animal health better because of its non-invasive nature.

Ketosis detector: Detecting sub-clinical ketosis using microfluidic biosensors is essential for management of dairy cattle health. On farm regular monitoring of β -hydroxybutyrate (BHBA) provides early diagnosis of subclinical Ketosis which helps in the prevention and control of ketosis. This technique has superior over conventional laboratory methods like chemistry analyzer and microplate readers because microfluidic biosensor had response time of 1 minute and detection limit of 0.05mM concentration and is a movable device.

Pathogen detection like influenza virus for example. Influenza virus is a highly contagious disease of birds. It can spread through saliva, nasal secretions and other excretions from infected birds. A homogenized and uniform fluorescence-quenching-based assay (FRET), miniaturized gold electrode biosensor and interferometric biosensor immunoassay has ability to detect influenza virus surface antigen hemagglutinins which is a very sensitive diagnostic tool. Normally used methods i.e. viral culture and RT-PCR is time consuming and labor intensive, immunoassays like ELISA are specific but less sensitive rendering them inconvenient for this purpose.

A label-free near-infrared surface-enhanced Raman spectroscopy (NIR-SERS) biosensing method is a rapid way allowing easy bacterial detection in biological components. This remarkable technology not only helps detect the pathogenic bacteria, but also enables the discrimination between different types of bacteria such as Methicillin-resistant, *Pseudomonas aeruginosa*, *E. coli*, *Staphylococcus aureus* and *Listeria* spp. The multi drug-resistant strain of bacteria can be detected using complex nanohybrid systems.

In direct detection method infectious agents can easily be detected in samples collected from animals either by culture technique or by immunofluorescence technique. Molecular technique includes Polymerase Chain Reaction (PCR) and loop-mediated isothermal amplification (LAMP). The occurrence of infections in host can also be diagnosed through identification of antibodies against various infectious agents. RT-PCR and its variant (FRET based assays, TaqMan assays, SYBR Green) is a highly sensitive assay that can diagnose infectious agents at molecular levels. Since every microorganism has its own unique genome, PCR enables amplification of the genetic material including DNA and RNA and emits fluorescence. PCR techniques are thus affordable and are put to use in light-weight portable device for on-site infection detection. Likewise use of novel isothermal amplification methods further facilitates the on-site diagnosis of infections in animals. For example, loop mediated isothermal amplification (LAMP) runs at a single temperature level and gives results readably by naked eye. Several FMD specific real-time RT-PCR like Cepheid Smart Cyber Real-time PCR machine and BioSeeq-Vet have been made into portable mobile platforms for in-field detection of FMD virus. Genie-I a portable platform, also allows on-site detection of viral RNA by using RT-LAMP technology. Automatic mastitis detector based on automated California Mastitis Test in milk, Bovine Herpes Virus-1 detector immunosensor, Bovine viral diarrhoea virus detector immunosensor, porcine reproductive and respiratory syndrome virus (PRRS) immunodetection based biosensors has been developed with high efficient easy tools within less detection time.

Movement and behaviour of farm animals gives information about their level of activity and well-being. Moreover, physical defects in limbs can be detected by abnormal movement. Therefore, top-view camera may be used to analyze motion and detect low weight in pigs. By using motion detection technology and video recording object areas are identified using Hue saturation values (HSV) colour information. This detection technology can identify a group of touching pigs standing close together. GPS and 3D collar mounted accelerometers can also be used to detect partially and fully moving pigs hence, low weight pigs can be identified without human intervention.

A technology named MoonMonitor and Silent Herdsman collar is also helping farmers determining physiological conditions of individual cows. This technology makes use of wireless sensors that allows the farmers to detect individual cow heats and health events with ease through data analysis. Another technology called Flockman can monitor the regular feed intake of living birds and allow farmers to alter the feeding system that determine the growth of body mass of chickens and control the feed intake.



Stress has deleterious effect on the productivity of chicken, so a quick stress measurement technology would be advantageous. Sound analysis is a reliable measure to indicate stress in chicken. A structure consists of three binary-classifier support vector machines has been developed which are capable to notify farmers regarding stress levels using sound data. This model has 96.20% accuracy and is very precise model. Amperometric biosensors have also gained popularity in stress detection, since they used lactate sensing in blood and tissue it can also be used as stress detector. Technologies like deploying cameras with sound sensors on pets or farm grazing animals and analyzing their sounds like barking and or coughing can be used efficiently to keep check on the animals so they don't go missing or wonder off. It can be helpful in evaluating whether the animal is under stress or not, distinguishing the screams of pigs from other sound and can also detect respiratory diseases easily. The sound data can help detection of oestrous of cows, hungry states of cows as well as emotional state of cows. Bird vocalizations can be used to estimate thermal comfort for chicks during the heating phase. In such situations sound analyzers may be important tools to determine the effect of environment on chick health.

Body temperature of animals is a very important indicator of their physiological well-being. For this purpose, thermistors, thermocouples and infrared radiation sensors can be used. Data obtained by studying the thermoregulation process in animals alongwith factors influencing the body temperature, like pregnancy, parturition and lactation can be used to get an idea of basic status of animal. Device like e-tag E-Pills which monitor body temperature and transmit data through cloud software are becoming common.

Biological fluids of living beings like tears, sweat and saliva can be used for testing health and detecting pathological conditions. Similarly, breath and intestinal fluids of the body can also be used for this purpose. Non-invasive monitoring of uric acid in saliva can be done using a saliva analyzer (mouth guard with an integrated screen-printed electrode system). This mouth guard biosensor is highly selective and stable for uric acid detection in saliva. Since it covers a wide range of concentrations and capable of transmitting information to laptops and Smartphone where information can be processed and stored, this real-time biosensor is being employed in different health applications like salivary uric acid biosensor, salivary cortisol biosensor as stress biomarker, salivary glucose biosensor and salivary alpha amylase stress biomarker biosensors.

Breath monitoring for clinical analysis and therapy is getting popularity among clinician and livestock handlers. The amount of oxygen, ammonia, pH and nitric oxide in breath provides better understanding of health conditions. Diseases such as liver cirrhosis, asthma, diabetes, lung cancers, chronic renal failure and airways inflammations or infections caused by organism like *Mycobacterium tuberculosis*, *Pseudomonas aeruginosa*, can easily be detected through breath analysis biosensors (E-nose) technology. Various wearable biosensors technologies that can attach to skin are quite success in detecting sweat metabolites (such as glucose, ammonia, pH and lactate) and electrolytes (such as sodium, potassium, chloride, zinc, and calcium ions), as well as skin temperature which helps in real time management of farm animals in different ways.

So, various emergent non-invasive biosensing technology discussed so far have ability to transform management system and work as a tools to assist in health monitoring and disease diagnosis, have ability to multiplex the bioassays on-site thereby eliminating the need for transportation of biological samples to centralised laboratory for analysis. Thus, application of biosensors not only reduce the incumbent costs for reagents, samples handling, analysis time and transportation costs, but also help in adapting and promoting ethical handling of livestock which ultimately help in saving animals lives as well as reducing expenses for the farmers.



TRADITIONAL METHODS OF INSECT PEST MANAGEMENT IN INDIA

Rohit Rana^{1*}, Ipsita Samal² and Tanmaya Kumar Bhoi³

¹Department of Entomology, Rashtriya Kisan (P.G.) College, Shamli, (U.P.), India

²Department of Entomology, Sri Sri University, Cuttack, Orissa, India

³Forest Protection Division, Arid Forest Research Institute, Jodhpur, Rajasthan, India

*Email: rohitrana.ent@gmail.com

INTRODUCTION

Agriculture is a crucial part of Indian economy and to feed the burgeoning population of India, farmers have to be dependent on various pest management tactics. Out of which, pesticides play a very important role in ensuring food security for more than 1.27 billion population. After the green revolution in 1966, the use of external inputs like chemical fertilizers and synthetic pesticides in agriculture increased more than hundred times¹⁷. Thus the injudicious and indiscriminate use of pesticides has resulted in tremendous loss to environment and human health. Furthermore, pesticides have also been reported to adversely affect the microorganisms in soil responsible for nitrification²⁷. Along with the target, pesticides also affect beneficial soil microorganisms, natural enemies to insect pests, fish, birds and other wildlife, thus adversely affecting the tritrophic interactions, food chains and food webs directly and indirectly. Even the produces i.e., the crops are not free of contamination because these crops retain some amount of toxins even after the harvesting is done and sometimes due to biomagnifications the concentration of the toxicants also increase in the higher trophic levels. These crops/animals act as the slow poison for us both human beings and animals. Upon consumption of such produces human suffer several diseases like fatigue, brain disorder, skin diseases, blood disorder, liver and kidney damage, nausea, reproductive damage, breathing problems and cancer. Farmers, the direct victim of this on contact to the pesticides at the time of using or spraying pesticides are at the greatest risk because there is every possibility of absorbing toxic level directly into their bodies. In this regard there is a necessity to use the old traditional practices in a suitable manner to prevent insect pest infestation³⁶. Traditional agriculture is the connecting step between the local hunt and gather practices which provide subsistence food to the growing population. It is basically a balance between our present needs, conserving natural resources and finally protecting the existing environment for the benefit of future generation¹. Thus identification, utilization and documentation of these traditional knowledge from the traditional and elderly people can essentially bridge the gap between advanced current science and the traditional age-old practices. Indigenous knowledge with various levels of refinements can effectively act as a source of sustainable agriculture. By using the traditional knowledge, the crop losses due to both biotic and abiotic stresses can be minimized without harming the environment and its ecological viability². Furthermore, various problems related to pesticide use, such as careless use of pesticides which leads to development of resistance, resurgence and residue problems, such problems can be minimized by using this traditional knowledge. Most of these traditional strategies are full proof and target pest specific²⁴.

Traditional pest management practices in rice

Rice is one of the most important crops in Indian economy and knowledge of these traditional practices are helpful in managing various major and minor pests of rice⁵⁴. For managing rice pests, the suspension of raw cow dung and water is used for spraying in rice field to control thrips (*Thrips oryzae*)¹⁸. Another method of erecting the bamboo sticks in the rice fields prevents infestation of rice yellow stem borer (*Scirpophaga incertulas*) and swarming caterpillar (*Spodoptera mauritiana*)²⁹. Bamboo sticks attract the predatory birds to take rest and ultimately the birds have been reported to feed both on the larvae and adults of swarming caterpillar and the yellow stem borer. Moreover, the sap of bamboo sticks has been observed to contain an antiseptic compound, hydrocyanic acid which has repellent properties against the sap feeders and various stem borers of rice. Apart from this the neem decoction (*Azadirachta indica* A. Juss.) of seeds, leaves and stem has been reported to control the rice yellow stem borer³³. The extract was prepared by mixing 1 to 3 gm of ground neem seed/leaf in 1 l of water (0.1-0.3% concentration) for 12 hrs. The azadirachtin in neem plant is having growth and feeding deterrent properties to insects⁴⁴. Furthermore, the kerosene dipped rope is dragged in rice field to control rice case worm, *Nymphulla depunctata* as kerosene acts as a toxicant against case worm. Moreover, raw cow dung is mixed with water to control case worm in rice as it creates an oxygen deficient condition in rice field, thus creates unsuitable condition for the insects to survive⁵. Proper sanitation of fields such as removal of grassy weeds from field bunds have been reported to control leaf folder, *Cnaphalocrosis medinalis* as the insects are unable to find any alternate host or microhabitat for their survival⁴. The slices of Pummello, *Citrus grandis* are kept in rice fields to control yellow stem borer. The chopped leaves of Indian rhododendron or phutuka (*Melastoma malabathricum* Linn.) has repellent activity against yellow stem borer. Hispa (*Dicladyspa armigera*) in rice fields can be



controlled by rearing ducks in paddy fields. Addition of cow dung which is a source of nitrogen in rice field controls the infestation of hispa¹⁶. The grounded bark of drumstick (*Moringa oleifera* Lam.) having medicinal properties also reported to reduce the yellow stem borer infestation. Placing branches of fern (*Cybotium* sp.) of fern and burying the barb fish (*Puntius* sp.) in the soil for 15-20 days and spraying water extracts and spraying of goat dung in the rice field controls pests of rice. Furthermore, burning of bicycle tyres in rice fields before the panicle initiation and use of fermented snail bait has been observed to repel the gundhi bug (*Leptocoris acuta*) population in rice⁴⁸. Putting of cycle tyre tube in the mouth of rodent burrow controls the rodent population in rice as the tyre appears like snake. Furthermore, pouring of vermilion water in the trapped rodent and releasing in the field also controls the rodent³⁹.

Traditional pest management practices for stored grain pests

Kothi is rectangular mud structure used for the storage of grains like wheat, maize, paddy. Kothies are covered from the top and have a small window of about 60 cm × 60 cm square from where grains are stored³¹. They have an opening at the base to take out grains. Kuthla is a small and cylindrical/ rectangular in structure is also commonly seen in this area. It is open from the top and generally covered with a lid. Kuthla may have partition in between to store two things at a time like wheat and maize flour⁵⁸. Kothies are fixed structures inside the room or in a courtyard whereas; kuthlas may or may not be fixed depending upon their size. These mud structures are prepared from loamy soil in which some amount of wheat straw is mixed which acts as a binding agent. The wheat straw and soil is soaked for two days after mixing properly to prepare uniform and thick mud mixture for construction of kothies and kuthlas. Lakolu is a fixed storage structure, which is planned at the time of construction of house. This structure is constructed in the centre of a wall of a room in such a way that it is out of reach of rodents and stored material is easily accessible. Peru is a traditional bamboo structure, which is used for storage of grains. Peru is cylindrical or oval in shape. The basic material used to make peru is a special variety of bamboo called Magar. It is preferred to harvest bamboo in the month of December and January to ensure durability of bamboo structures (Channal et al., 2004). Chabri is a basket with a lid, made of 2.5 cm wide bamboo strips interwoven in mat form and is circular in shape especially used for seed storage. Peti is a wooden box called Peti is used for the storage of grains in hilly areas of Shimla, Kullu. Kuthar is a traditional wooden outdoor structure locally called as Kuthar is used for the storage of multiple crops at a time³².

Indigenous practices for pulses

Certain post harvest practices such as sun drying of pulses, cleaning of harvested produce and packaging in gunny bags are done to repel the storage pests. Certain weed plants such as *Naithulasi* (*Ocimum* sp.) and chilli fruits (*Capsicum annuum* Linn.) are kept with pulse grains to get protection from storage pests like pulse beetle, lesser grain borer, flour beetles, etc. This type of practices are eco-friendly and effective in controlling storage pests up to 60%. Furthermore, shelf life of stored pulse grains has been observed to increase up to 2 years by this practice. This practice can also be widely practised by small and marginal farmers. In certain conditions dried neem leaves are used to store grains effectively. Moreover, neem leaves are having insecticidal properties that repel insects. This cost effective and environmental friendly methods is used throughout India especially in north-eastern parts. In some parts of India, bamboo baskets are used to store pulses in the layers of sand. Internally the bamboo baskets are plastered with mud to provide unaerated conditions. Prior to storage, the grains were properly sun dried. Sun drying increases the efficiency of grains up to 80%. In certain pockets, coconut oil is mixed with black gram and green gram and tin or plastic containers are used for storage. About 50 ml of oil for treating 1 kg of pulse seeds control the bruchid infestation up to 6-8 months. As major insects of pulses such as Bruchids and pod borers prefer whole grains so storage of splitted grains are more preferred. 3-4 mins frying of grains in iron pans prevent the Bruchid infestation. Apart from this, red earth treatment of pulses in 1:1 ratio followed by sun drying for 2-3 days is also helpful in preventing Bruchid attack. Small gravels present in red earth has been observed to injure the insects and they die. Mixing of grains with ash content before storage, also reported to prevent the storage pest infestation. The sap feeders, beetles and other borers can be prevented by sprinkling of ash in vegetable fields. This practice is very effective in okra, onion, brinjal, tomato and cucumber against the leaf defoliating insects, pumpkin beetle, hadda beetle, leaf miner, thrips and aphids³⁵. The mixture of cow urine, hing and nirgandhi in proper concentration has been reported to effective against insect pests of wheat. Leaf decoction of nirgundhi (30-40 leaves in 10 litres of water), was observed to have repellent properties against insects. This mixture is boiled properly to 1 litre and hing 10 gm is mixed with this and with the above mixture, 5 litre of cow urine is mixed and sprayed mainly in paddy and wheat crops. The fresh mixture of ash, soil and cow urine is used for the control of insect pests in cabbage. Dried cow dung and ash is used in field before sowing. Fresh cow urine is kept underground in earthen pots for fermentation for 8-10 days and it is mixed with 1 litre of water and finally sprayed in cabbage for control of cabbage aphid.



The mixture of *Aloe barbadensis*, *Nicotiana tabacum*, *Azadirachta indica* and *Sapindus trifoliatus* controls the mustard pests in various regions of India. Leaf decoction of 1 kg gwarpatha and 200 gms of nicotiana powder is prepared in 5 litres of water and it is boiled 2-3 hours to make 2 litre decoction. Neem leaf extracts of 200 gms is mixed after evaporation and 50 gm of aritha powder is added to the above solution. This mixture is sprayed in mustard crops for the control of pests in 2-3 weeks interval. The mixture of tobacco powder (200 gms), whey (2 litres) and aloe (2 leaves) are dissolved in 15 litres of water. The solution is left undisturbed for 15 days and finally sprayed in infested crops in 2-3 weeks interval. The brooms prepared by *Vitex negundo*, is used for sweeping in the paddy crop, which acts as an insecticide and enhance the paddy growth. The cattle litter (dung and urine) is used to control insect pests.

Traditional management practices for pests, nematodes and crop diseases

Termite is the major pest in sugarcane plantation. The dipping of sugarcane sets in *Calotropis procera* leaf extract used @ 15% and 20% solution by was found effective in controlling termite (*Odontotermes obesus* Rambur)⁴⁶. Furthermore, before sowing, the soil was sprinkled with 2.0 % solution of plant extract, and finally the setts were covered with soil was observed to be effective against the termite in sugarcane¹. Plant material was soaked in water for 24 hours and followed by filtration and pouring on the soil infested with termites was also observed to be effective against severe termite infestation. This traditional method of termite control was widely practised by 25-30% farmers of Gujarat¹⁵. Furthermore, chopped leaves of approximately 5 kg each of *Calotropis procera* and Keemp (*Leptadenia pyrotechnica*) were put into an earthen pot. This mixture was further added with about 1 kg of salt and 10 litres of urine. The final mixture was kept in an air tight container and stored in a manure pit for 15-20 days. The final mixture, after being stored for around 2 weeks the suspension was filtered by using a cotton cloth and the final filtrate was applied along with irrigation water as an insecticide. 10 litre of suspension is enough to control termites in 1 ha. This termite control practice is widely used in Rajasthan⁴⁷. another method of termite control is used in Pondicherry and Makarbili village of Nuapada district, Odisha. In this method, *Calotropis procera* leaves were soaked in water for two days, followed by dilution and filtration and is then finally applied at the place of termite attack^{55,56}. Furthermore, another cost effective method of termite control is soaking of about 8-10 kg plant material in water for 24 hrs and this soaked mixture is finally processed, boiled and filtered, and the final extract is poured on the infested soil to kill termites³⁷.

In certain pockets of Rajasthan, farmers keep the plant twigs along with about 50 gm urea and 1 l water in earthen pot, and the mixture is sealed airtight by plastering its mouth with clay soil. This container was stored in a manure pit for 2 months. Within 2 months period, the twigs were observed to decompose completely and the filtered extract is used for seed treatment of wheat, barley and chickpea. The infestation was observed to be minimised by this treatments. Furthermore, the same extract was also observed to control earthworms in ornamental plants⁴⁵. Moreover, the leaves of *Calotropis procera* when placed in paddy fields attract aphids. Long branches of the former plant were placed at a distance of 14.6 m in paddy fields; around 25-30 branches are required for 0.24 ha. The branches are changed thrice during which life span of aphids come to an end. This method was widely practiced in Gujarat⁴¹. In certain places of Karnataka, *Calotropis procera* branches are placed at the water inlet of paddy fields to control insect pests. There is an alkaloid present in the latex of this plant which is having repellent properties against the stem and root borers⁴. Furthermore, Whole *Calotropis* plant leaving the root part is ground and is placed at the irrigation channel. When the plant extract is flowed along with the irrigation water it controls the root and stem borers. In Mehsana area of Gujarat, farmers were observed to spread the whole leaves of the standing crops which was acting as an attractant for the army worm. The insects gathered on the broadcasted leaves are collected next day. This is also a cost effective method of pest control. Furthermore, leaves are replaced regularly and the collected leaves are destroyed⁴². Some farmers of Pudupatti, Tamil Nadu were observed to use the plant parts to control the brown plant hopper in the affected fields. This leaves are used both in nurseries and main fields to control brown plant hoppers. The latex of *Calotropis gigantea* was diluted with 15 parts of water and the final dilution was sprayed on cotton crops. This method controls caterpillars within three days. This is in practice of Bhavnagar area of Gujarat³⁰. Farmers from Medak and Nalgonda districts of Andhra Pradesh were used to spread twigs on field boundaries to control red hairy caterpillar migration in groundnut fields. The alkaloid emanating from this plant was observed to have repellent properties against the bands of red hairy caterpillar⁵². Furthermore the smell of the latex of twigs were also observed to have attractant properties against the red hairy caterpillar in groundnut, castor and sesamum in rainy season. Finally the larvae are collected and burnt. This method of vegetative trapping is more beneficial and economically feasible than the trapping methods by using pheromone traps and light traps³⁴. Furthermore, Galo disease of sugarcane which is identified by deposition of sticky droplets, semi-liquid honey like dew on the leaves and stems can be cured by using the leaf extracts. Before winter, the farmers used to collect the *Calotropis* twigs and



soak them in a tank for 1 month. The decayed extract was then sprayed on sugarcane plantation which has been observed to cure the galo disease within 2-3 days. But before consumption, the setts of sugarcane should be washed properly²³. In Surendra Nagar area of Gujarat, leaves of *Calotropis procera*, neem and aloe (*Aloe vera*) are ground in equal parts and a homogenous mixture is prepared. This mixture (500 ml of the plant extract with 5 gm of washing powder, diluted in 15 L water) is applied in 30 days old cumin crop, at 8–10 days regular intervals to prevent blight disease⁴¹. Ginger (*Zingiber officinale* Rosc.) can be protected from the attack of insect pests by planting *Calotropis* sp. randomly in the fields. The smell from the plant repels the insect pests. This is practised in parts of Gujarat³⁸. Moreover, the aqueous leaf extract of planting *Calotropis* sp. can be sprayed @ 1% within 40 days of germination (two sprays) was well reported to reduce the groundnut bud necrosis disease⁴⁹. The leaf powder was applied @ 50 kg/ha in mustard crop was reported to control mustard saw fly (*Athalia proxima*) effectively. Furthermore, soil application of leaf powder (@ 100 kg/ha) has been observed to reduce root knot nematode infestation in pigeon pea⁵⁰. To increase the arecanut and coconut yield, the *Calotropis* plant pieces (25-45 kg) were applied in soil in circular manner. There is a common belief among farmers that if natural oozing or gum secreting plants are applied to arecanut or coconut palms, it will naturally increase the palm yield⁴⁰.

Traditional pest management practices in southern India

Major pests of coconut plantations are from 3 species including 2 from Coleoptera and 1 from Lepidoptera. The *Rhinoceros beetle* (Coleoptera) causes major damage to coconut plant by boring into the unopened tender ponds, chewing the fibrous plant materials and sucking the juice from the fibrous material. The damage is observed as a sequential series of holes in the leaves when they open and ultimately the plant dries out. Another insect from Coleoptera, the red palm weevil in early stages was observed to feed on soft plant tissues and often cause serious damage in coconut plantations. Furthermore, the black headed caterpillar, a Lepidopteran pest was observed to feed on the green plant parts and affect the productivity of the plant adversely. Certain plant materials directly or indirectly are used as pesticides as well as fertilisers. Fly ash and lime are used as best remedies for pest control. Different types of traps such as firetrap, pot trap, meat trap, sand trap and plant trap are used for pest control in paddy fields and coconut plantations. For attracting moths, fly traps are used by indigenous farmers by using glowing flames. The moths which are attracted towards the flames are killed. These type of traps are very effective against stem borers. Meat baits are prepared by using fresh water crabs to prevent rodent infestation. The abdominal part of the female crab, thelycum region was filled with plant based poison such as (*Croton tiglium*) and used as meat traps. Apart from some natural attraction traps, bird perches are also used to attract predators such as birds. The attracted birds will kill the larvae and adults of various insects and rodents in field¹⁹. A bird scarer such as a white cloth hanging is used to scare away Egret that cause damage to paddy crops in fields. Furthermore, Palmyra palm leaves are used to repel the rodents in rice field and coconut plantations (*Borassus flabellifer* Linn.) scares away the rodents⁷. Mostly the traditional practices are used along with advanced methods of pest control. mostly lime and fly ash is commonly used for controlling insect pest in the agricultural fields⁸. Fly ash when dispersed in paddy field kills microbes and other insect pests. Fly ash along with lime dispersed on coconut plants^{9,10}, deters *Oryctes rhinoceros* and *Rhynchophorus ferrugineus* (Red palm weevil)^{11,12,13,14,20}. *Azadirachta indica* seed and leaf extracts are used to prevent yellow stem borer attack in paddy fields^{7,8,22}. *Pongamia pinnata* Pierre was also observed to have insect deterrent properties in paddy fields and coconut plantations. *Coleus amboinicus* Lour. Acts as a deterrent against *Oryctes rhinoceros* (Scarabaeidae: Coleoptera) beetles and prevent the insect from laying eggs on coconut plants especially in nurseries. So around coconut plantations in nursery it is necessary to plant certain *Coleus aromaticus* plants around coconut seedlings.

CONCLUSION

Indian farming, which is dynamic in nature, will slowly but surely adopt different pest management through using indigenous technical knowledge for sustainable agriculture²⁵. Adoption of ITK based crop protection measures can be an alternative to pesticides and this might help in restoring the biodiversity of natural enemies, thus it can shape the tritrophic interaction properly but as a knowledge-based and farmer driven approach, preliminary education to farmers should be given to utilise the IPM related control measures effectively.

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STRUCTURAL INDICES OF SOILS UNDER DIFFERENT CROPS AND MANAGEMENT PRACTICES

Himagirish K.M.¹, Balanagoudar S.R.¹, Ravi M.¹, Bhat S.N.¹ and Ananda N.²

¹Department of Soil Science and Agricultural Chemistry, UAS, Raichur-584104

²Department of Agronomy, University of Agricultural Sciences, Raichur- 584104

Abstract

A study was conducted for fifteen different profile sites where same crop was grown for several years under AICRP projects and under different managements practices at Main Agricultural Research Station, Raichur. The adjacent field was also studied for the same properties as control treatment for comparison for soil properties. The samples were analysed for different soil structural indices viz, mean weight diameter (MWD), percent aggregates > 0.25 mm, aggregate stability and along with physicochemical properties of soil at different depths. The results revealed that the MWD was significantly higher in organic-amended plots when compared to non-organic plots. Some crops like legumes viz, groundnut and pigeon pea were found beneficial in improving these properties. The per cent aggregates > 0.25 mm and per cent aggregate stability also varied to a greater extent. The mean weight diameter in the soil sites varied from 0.27 to 0.58 mm. The per cent aggregates > 0.25 mm and per cent aggregate stability varied from 61.16 to 89.62 per cent and 32.56 to 87.07 per cent respectively. The soils were medium to high in free calcium carbonate content.

Key words : Mean weight diameter, per cent aggregates > 0.25 mm, per cent aggregate stability.

INTRODUCTION

The physical properties of soils determine their adaptability to cultivation and the level of biological activity that can be supported by the soil. Soil physical properties also largely determine the soil's water and air supplying capacity to plants. Many soil physical properties change with changes in land use system and its management such as intensity of cultivation, the instrument used and the nature of the land under cultivation, rendering the soil less permeable and more susceptible to runoff and erosion losses. Indeed, soil physics plays a pivotal role in the human endeavor to sustain agricultural productivity while maintaining environment quality.

Soil aggregation has been considered as an important factor not only for increasing soil productivity and soil quality but also improving nutrient availability and water use efficiency (Byung *et al.*, 2007). Aggregate stability is often measured on a specific aggregate size class which is not a measurement of soil structure.

MATERIALS AND METHODS

The study was conducted at different sites of Main Agricultural Research Station, University of Agricultural sciences, Raichur, Karnataka lies between 16.20458 latitude and 77.33409 longitudes and having total area of 602.5 acres. The purpose of the study was to elucidate the effect of different cropping systems; management practices that done continuously on the same land for several years on soil physical and chemical properties. The effects of different agricultural practices like crop, irrigation and mechanical, biological and chemical methods of combating weeds, pests and diseases, application of chemical fertilizers and root exudates on soil properties were studied. This was achieved by studying morphological features (soil depth, soil texture, soil aggregates, maximum water holding capacity, porosity, soil reaction *etc.*) and of soil at different depths. In addition, physical, chemical and physico-chemical properties of soil were studied. (Klute, 1986)

The soil samples were collected when the field was fallow. Sixteen different sites were selected from the location. Three samples were amassed (0-15cm, 15-30cm, 30-60cm) from one profile pit and two samples (disturbed and undisturbed soil) were taken from each depth. Undisturbed sample was taken from the core sampler while the disturbed sample through mere collection.

Soil structural indices

$$\text{Mean weight diameter} = \frac{\sum_{i=1}^n d_i w_i}{\sum_{i=1}^n w_i}$$

Where n is the number of size fractions (the finest fraction that passes through the finest sieve inclusive), d_i is the mean diameter of each size range, w_i is the weight of aggregates in that size range as a fraction of the total dry weight of the sample (W) taken.



$$\% \text{ Aggregates } > 0.25 \text{ mm dia} = \frac{\text{Weight of aggregate } > 0.25 \text{ mm dia}}{\text{weight of soil sample}} \times 100$$
$$\% \text{ Aggregates stability} = \frac{\text{Weight of aggregate } > 0.25 \text{ mm dia} - \text{weight of sand}}{\text{weight of soil sample}} \times 100$$

RESULTS AND DISCUSSION

(a) Mean weight diameter :

Black soil profiles : In the study area, the MWD of soils at the surface (0-15 cm) ranged from 0.537 to 1.33 mm. The higher MWD of 1.33 mm was observed in soil samples of AICRP cotton while lowest of 0.537 in AICRP weed management. Here, we can observe that the soil samples of AICRP cotton had more MWD than that of control whereas, AICRP weed management has lower values than its adjacent control (Table-1).

The mean values of MWD in black soil ranged from 0.54 to 1.27 mm. The higher mean (1.27 mm) was observed in soil samples of AICRP Cotton and least (0.54 mm) in AICRP weed management.

It is observed that MWD in soil samples of AICRP cotton, AICRP sunflower, AICRP bio-control and IFS unit were higher than their respective controls. The AICRP weed management site was lesser in MWD than that of control. The higher values of MWD might be due to reduced tillage, increase in carbon content, due to crop management practices and root activity.

Red soil profiles : The MWD of red soils in surface layer ranged from 0.664 to 0.951 mm. The higher value (0.95 mm) was observed in soil samples of AICRP groundnut while least (0.66 mm) in groundnut control. Here, the MWD of AICRP groundnut was 43.07 per cent higher than that of control.

The mean values of MWD ranged from 0.58 to 0.92 mm. The higher mean MWD was observed in soil samples of AICRP Groundnut (0.92 mm) and least in groundnut control (0.58 mm). The AICRP on groundnut site had more MWD than its control while the horticulture site (Sapota orchard) had minimum MWD than its adjacent control. The higher value might be due to reduced tillage and increase in carbon content.

The order of MWD among the soil sampling sites was AICRP cotton > IFS unit > cotton control = IFS control > AICRP groundnut. The highest MWD of the AICRP cotton site might be due to timely application of organic manures and influence of roots and microbial activity. The IFS unit soils were alkaline in nature in the previous years while they were maintained well with organic manures. Hence, the MWD of IFS unit was less than the AICRP cotton. In cotton control and IFS control, grass crops were grown *i. e.*, reduced tillage, effect of canopy on upper layer and roots in the lower layer increases the stability of aggregates. The MWD of AICRP groundnut was due to application of gypsum, crop canopy on the surface and roots activity in the lower layers.

(b) Percent aggregates > 0.25 mm :

Black soil profiles : The data pertaining to percent aggregates > 0.25 mm of soils at surface varied from 62.79 to 90.38 per cent. The higher value was observed in soil samples of AICRP cotton (90.38 %) and lowest (62.79 %) in AICRP weed management.

The mean values of percent aggregates > 0.25 mm values of soil samples ranged from 65.89 to 89.62 %, where higher value (89.62 %) was observed in soil samples of AICRP cotton and least (65.89 %) in AICRP weed management.

Tisdall and Oades (1982) concluded that the stability of macro-aggregates (>0.25 mm) was controlled by soil management (such as tillage, rotations, etc.), but the stability of micro-aggregates (<0.25 mm) depends on the amount and stability of organic cementing agents and seems to be independent of soil management.

Red soil profiles : The mean values of percent aggregates > 0.25mm in profile ranged from 61.16 to 72.55 per cent. The higher value (72.55 %) was observed in soil samples of AICRP groundnut and lowest (61.16 %) in Horticulture control. Here, the AICRP groundnut plot is 6.45 per cent higher than that of control. But the horticulture plot is on par with its adjacent control.

The percent aggregates > 0.25 mm in red soil samples are higher than their respective controls. This might be due to the beneficial effect of balanced fertilizers and crops grown in the field on soil structure. The role played by the phosphate ions in



binding of soil particles or due to greater amount of organic residues produced in fertilized plots results in good aggregate formation. Ravindra *et al.* (1985) also observed that the higher values of fine and coarse aggregates were in treatments treated with manures and micro-organisms.

(c) Percent aggregate stability :

Black soil profiles : The percent aggregate stability of the soil samples at surface ranged from 42.05 to 87.81 per cent. The higher value (87.81 %) was observed in soil samples of AICRP on cotton and least (42.05 %) in AICRP on weed management.

The mean profile values of per cent aggregate stability ranged from 47.37 to 87.07 per cent. The higher value of about 87.07 % was observed in soil samples of AICRP cotton and least of 47.37 % in AICRP on weed management.

The percent aggregate stability was observed to be 22.84 per cent higher in AICRP cotton field compared to control. In the same way, the AICRP sunflower plot is 1.5 per cent less than sunflower control. The Bio-control plot is on par with its adjacent control. IFS unit is 2.67 per cent higher than that of control, and AICRP weed management is 4.81 per cent less than its adjacent control. Pigeonpea plot was observed to be having higher percent aggregate stability.

Red soil profiles : The percent aggregate stability of soils at surface ranged from 28.88 to 54.29 per cent. The higher value (54.29 %) was observed in soil samples of AICRP groundnut and least (28.88 %) in groundnut control.

The mean percent aggregate stability values of soil samples ranged from 32.56 to 55.50 per cent. The higher value (55.50 %) was observed in soil samples of AICRP groundnut and least (32.56 %) in groundnut control.

CONCLUSION

The mean weight diameter was significantly higher in organic-amended plots when compared to non-organic plots. The per cent aggregates > 0.25 mm and per cent aggregate stability varied to a greater extent. This might be due to the effect of balanced fertilizers on soil structure and role played by phosphate ions in binding soil particles or due to higher amount of organic residues produced in fertilized plots resulting in good aggregate formation. The soils with AICRP cotton, AICRP groundnut, IFS crops were found beneficial in improving soil aggregates compared to AICRP sunflower and AICRP weed management fields, may be because of intensive root distribution and canopy coverage over a long period of time.

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LOW COST PRODUCTION TECHNOLOGIES WITH SPECIAL REFERENCES TO ANIMAL NUTRITIONAL FOR IMPROVING LIVESTOCK PRODUCTION AND PRODUCTIVITY

Balbir Singh Khadda¹, Shashipal² and Parkash Singh Brar¹

GADVASU-Krishi Vigyan Kendra, SAS Nagar (Mohali) Punjab

²Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana

Email : khadda74@gmail.com

Adequate nutrition is important for maintenance, growth, and reproduction of animals. Indian livestock are under fed and undernourished. There is currently a net deficiency of 35.60% green fodder, 10.95% dry fodder and 44% concentrate feed materials in India (Singh *et al.*, 2021). This is due per se to the huge numbers of animals in relation to available feed and fodder resources. Animals largely derive their feed requirements from crop by-products and grazing on common lands. Further, a majority of livestock is owned by small landholders and the landless, which often face acute shortage of feed and fodder. Animal science research has yielded a number of biochemical and mechanical technologies that, besides improving the nutritional quality of feed, also help avoid wastage of these resources. The efficacy of many of these techniques has been proved, yet their adoption has remained restricted and sporadic due to a number of operating constraints. This paper describes different nutritional technologies and attempts a subjective assessment of their adoption and impact.

Chopping Green Fodder

Chopping of green fodder and unthreshed straws/ stover is a simple but effective technology. This has developed gradually from use of various hand operated chaffing blades to power operated mechanical mega-chaff cutters of varying capacities. Residues of crops such as rice, millets, and maize are long and need chopping before being fed to livestock. Ruminants reduce feed particle size by chewing. Energy spent on chewing reduces the amount of metabolic energy (ME) used for production, and can thus have a substantial negative effect on productivity. Feeding of chopped roughage reduces the energy wasted while chewing. Chopping green fodder, straws and stover helps in adopting strategic supplementation, improves the palatability of less-preferred roughages by mixing with highly palatable fodder, improves digestibility, and reduces wastage. The net biological value of the feed also improves. Chaffing of all varieties of green fodder including sugar tops, straws, and stover such as rice, maize, pearl millet (bajra), and sorghum (jowar) is practiced in most of northern India. KVK, Panchmahal was conducted an study on effect of chaffed dry and green fodder fed to dairy animals in different age groups in different villages of Panchmahal district of central Gujarat under front line demonstration programme during 2010-14. The results (pooled data) of study showed that when the animals were fed un chaffed fodder, the wastage of dry and green fodder was found to be 32.69 and 13.29 percent, respectively. The results also indicated that most farmers had an average of four livestock and saved Rs 100–120 per day by feeding chopped fodder to their livestock. The milk production of milch animals was increased 16.21% by used of chopped and mixed dry and green fed as compared to unchopped fodder.

Wetting and Soaking

Wetting and soaking of roughage and concentrates is also a simple and age-old technology. The straws, stovers, and concentrates (ingredients or mixtures) are either soaked in water or moistened just prior to feeding. This hydration of the particles facilitates their digestion in the rumen. Soaking of concentrate mixtures or ingredients is a common practice followed in most parts of the country. Soaking or wetting of straws and stovers is however not as common. During the hot-dry periods in some parts of the country the wheat straw (bhoosa) is soaked/ wetted before feeding to ruminants. Addition of soaked concentrate mixture or ingredients such as cakes, bran, churi, and flour to chopped straws and stover improves their palatability and the total dry matter intake of basal diets comprising dry roughage. Mixing of high density concentrates and low density roughages results in even distribution of nutrients and facilitates better microbial and enzymatic action in the rumen. Soaking or wetting of straws helps remove some of the undesirable elements such as excess oxalate in rice straw. Soaking roughage and concentrate is common where animals are fed gruel. Soaking of straws or stover for long periods however may result in the loss of some soluble nutrients, so care must be taken that the soaking is only for very short periods.

Grinding and Pelleting

Grinding and pelleting involve physical treatment that enhances the utilization of fibrous feed stuffs by ruminants. Grinding decreases particle size and increases the bulk density of leaf and stem fraction of forages. Ground roughage is further processed by pelleting or cubing before feeding to the animals. Pelleting helps increase the bulk density and decrease dustiness. This is a common practice wherever concentrates are fed. Commercial feed-manufacturing mills/ factories pellet the



concentrate mixture for different species of livestock. Preparation of a complete feed comprising of concentrate and roughages has not been adopted by commercial feed manufacturers mainly because of the high processing costs. Grinding and pelleting of roughages increase feed intake and reduce feed: gain ratio. Digestibility of ground and pelleted roughages is generally low compared to the original material fed in either long or chopped forms due to a reduction in fiber digestion. However, grinding and pelleting of forages dramatically reduces the time that ruminants spend on chewing the long coarse material, resulting in the increased availability of digestible energy for production. Although the performance of animals improves with processed feeds, net energy (NE) content of poor quality roughages still remains poor. Furthermore, the process of grinding and pelleting is energy dependent and, hence, the technology has not received much attention.

Conservation of Feeds and Fodder

Seasonal feed deficits can be reduced considerably or overcome through conservation and storage of feed resources during surplus seasons for use in lean periods. During the monsoon, plenty of green fodder is available in fields, on bunds, roadsides, and under forest covers. These can be profitably conserved for feeding. The surplus fodder can be conserved as hay in a dry form or as silage in a wet form.

Hay making

Haymaking is one of the best methods of preserving forages. Feeding hay to livestock helps reduce the amount of concentrate feeding, and thereby, the cost of feeding. The low moisture content of hay considerably reduces costs and efforts involved in transportation and handling. The surplus green grasses available during the monsoon in the forest go unused and could be put to the best possible use by this process. This involves reducing the moisture content of green forages to less than 15%, so that they can be stored without spoilage or further nutrient loss. Green forages with 80-85% dry matter preserve most of their nutrients. Crops with thin stems and more leaves are better suited for hay making as they dry faster than those with a thick, pithy stem and small leaves. Leguminous fodder crops should be harvested at the flowering stage or when crown buds start to grow, while grasses and other fodder crops should be harvested at the pre-flowering stage. They should preferably be harvested when air humidity is low. The harvested forage is spread in the field and raked a few times for quick drying. The dried forage is then collected and baled when the moisture concentration is low (<15%) which helps storage and requires less space. Crops with thick and juicy stems are dried after chaffing to speed up the drying process and to prevent loss of nutrients. Field curing is conducted during bright sunny weather but may result in bleaching of the forage and loss of leaves due to shattering. To avoid this, drying can be done in barns by passing hot air through the forage. Although artificial drying produces hay of good quality, it is expensive and beyond the reach of small and marginal farmers. The technology of haymaking is fully standardized and can be easily applied under favorable conditions. However slight carelessness could result in loss of quality or even complete spoilage. Conservation of fodder is not undertaken routinely by the average Indian farmer.

The reasons for the low adoption of this technology are :

- Lack of knowledge of the benefits of fodder conservation.
- High losses due to incorrect harvesting time and weather conditions.
- Lack of interest and skills for proper preservation and storage.
- Losses due to shattering and dropping of leaves, especially in legumes.
- Losses of soluble nutrients due to leaching caused by rain during the drying period.
- Storage of hay with high moisture content resulting in mold growth.
- Extra expenditure in terms of labor and materials for the processing of green fodder.

Silage Making

Silage is the product of controlled fermentation of green fodder retaining high moisture content. Naturally produced organic acids, chiefly lactic acid, preserve the green fodder. Silage making involves selecting crops and plant materials rich in soluble sugars with dry matter concentration of about 15-30%. The material is stored in pits under anaerobic conditions. Chaffing material for ensiling increases the compactness. The silo should be airtight after filling. Fermentation begins within hours of closing the silo and accelerates in the next two to three days. Molasses or jaggery is added to increase the fermentation. Organic acids (primarily lactic and acetic acid), ethanol, and gases such as carbon dioxide (CO₂), methane (CH₄), and ammonia (NH₃) are produced during the fermentation process. The pH of the biomass is reduced to below 4.0, resulting in the termination of all biological activities. The material remains conserved. This method preserves the forage material for a long



period with minimal nutrient loss. Crops rich in soluble carbohydrates, such as maize, oats, sorghum, pearl millet, and cultivated grasses are most suitable for ensiling. During abundant green fodder availability they can be converted to silage and stored for use in times of scarcity. The crops should contain about 30-35% dry matter at the time of ensiling. Sorghum and oats should be harvested at the flowering stage while maize has to be harvested at the milk stage. Large quantities of sugarcane tops rich in soluble carbohydrates are available in sugarcane growing areas during the crushing season. Only 30% of the available sugarcane tops is used for animal feeding as fresh feed and the rest is partly used as fuel. Conversion of these to silage would provide sufficient wet fodder during summer. Tall varieties of rice are grown in some traditional rice-growing areas in India. They are susceptible to lodging under conditions of high fertilization, to avoid which, one-third of the top portion is removed during the vegetative stage. Fresh straw of many dwarf varieties is quite succulent at maturity and contains about 50-65% moisture at harvest, making it suitable for ensiling. Silage making is not an established practice in most parts of India due to reasons such as :

Labor requirement for cutting, raking, collecting, chopping, pit construction, and materials (polyethylene, molasses) are a problem in some areas.

Some of these problems may be overcome if the milk cooperatives and state animal husbandry departments prepare large silos.

Preparing silage near reserve forest areas by harvesting the forest grasses at a proper stage and ensiling them, rather than drying and burning, would be useful.

Feeding Urea-treated Straws

Urea treatment of straws is so far the most accepted chemical treatment. Urea (fertilizer grade) available in all parts of the country is relatively safe, easy to store, and dissolves easily in water. Urea treatment is more feasible in tropical climates because it breaks down quickly into ammonia under higher ambient temperatures. The treatment is quite flexible, as it can be adapted to local conditions and preferences. The treatment process is simple, and 4 kg urea is the optimal amount to treat 100 kg of air-dried straw. Water is essential as it helps in the hydrolysis of urea and also acts as a carrier for the ammonia to penetrate the cell walls of the plant material. The moisture level is not very critical to the process but a 30 - 40% moisture level gives the desired effect. The total cost for treating one tone straw is approx Rs 800/. Feeding livestock with urea-treated straw can result in saving of concentrates to the extent of 1.5 kg per animal per day. The key factor that determines the economics and practicality of urea treatment is the method of storage. Cemented storage structures are ideal but not practical in the field. Pits or mud structures may also be used. Covering the stack is important and can be achieved by using polythene sheets, empty urea bags stitched together, or even dried grass/ leaves to keep it airtight.

Microbial growth in the rumen depends on the nitrogen supply, rumen- digestible energy, and sources of phosphorus and sulfur. The efficiency of microbial production depends on the amount of microbial biomass produced per unit of adenosine triphosphate (ATP) during fermentation of carbohydrates in the rumen to volatile fatty acids (VFAs). Cell wall carbohydrates are the major source of energy for rumen microbes on a straw diet. Insufficient energy from cell wall - rich crop residues is often a limiting factor to ruminant productivity in the tropics. Urea ammoniation, apart from being a source of nitrogen for microbial synthesis, also provides additional energy due to the weakening/ loosening of the lignocelluloses bonds in the treated straw. Urea-treated straw feeds save on concentrate feeding, increase milk yield by 1-2 litre animal-1 day-1, reduce the land area required for green fodder production, and offer better economic returns to the farmer. Treated straw can be fed to growing, lactating, and pregnant cattle and buffalo.

Despite acknowledging the benefit of the technology during demonstrations, farmers have not enthusiastically continued urea treatment. The most important reason for this is that in most cases the returns are marginal. Other constraints are :

Production of sticky dung complicates the preparation of dung cakes.

Pungent smell of ammonia.

Spoilage of straw in open stacks.

Urea-Molasses Treatment

Molasses is used to improve the palatability of the basal feed or as a source of readily fermentable energy, which may stimulate microbial fermentation in the presence of other nutrients such as nitrogen (urea) and phosphorus (phosphoric acid). Spraying of straw with 10% molasses and 2% urea is found to improve intake and digestibility of the basal roughage. Urea provides an additional source of nitrogen. A urea-molasses-mineral block (UMMB) has been developed recently, which contains soluble



and fermentable nitrogen from urea, highly fermentable energy from molasses, and essential minerals. Natural protein sources such as groundnut extract and cottonseed extract have also been added to provide preformed peptides and amino acids. The field application of urea-molasses by spraying is limited owing to difficulty in handling of the mixture and toxicity in cases of uncontrolled intake. The high cost of molasses is also a limiting factor. The method is particularly useful in situations where there is plenty of straw, medium to low animal production, and limited access to other supplements. The UMMB technology has been tested on-farm in Gujarat and was more popular with farmers maintaining buffalo. Modifications have been made to improve the nutrient balance and consistency for better acceptance by farmers. Supplementation of UMMB has been found to improve the dry matter intake of the basal roughage and the feed digestibility. The nutrients from the block are well utilized by the animals and UMMB supplementation improves reproductive performance of cows due to enhanced availability and utilization of nutrients, particularly micronutrients. Khadda *et al* (2014) reported that the UMMB supplemented cows produced 31.42 per cent more milk with significantly higher milk yield ($P<0.05$) in the animals of UMMB group as compared to control without any adverse effect on health of the animals. The postpartum oestrus period (81.9 ± 11.66 days) and service period (117.9 ± 8.50 days) was reduced significantly in UMMB group than the control group (132.6 ± 17.54 days and 169.4 ± 11.7 days). Reduction in cost of milk production/ litre was recorded 21.66 per cent in crossbred cows supplemented with UMMB. Kang *et al.* (2005), Ramesh *et al.* (2009), Madhu and Singh (2010) and Pankaj and Khadda (2017) also reported that the feeding of UMMB improved the feed efficiency, milk production and composition and reproductive performance of dairy animals under semi-arid ecosystem.

Calf Starter/Milk Replacer

Calf starter is a balanced concentrate mixture fed to calves from the 10th day of age to supplement the nutrients and raise them on a limited milk intake. This provides a balanced diet to the calf and cuts down the cost of milk feeding. Generally 16% digestible crude protein (DCP) and 70% total digestible nutrients (TDN) in the calf starter are sufficient for a satisfactory growth. The protein quality is important during the pre-ruminant stage. The calf starter should contain a major proportion of grains to provide readily soluble carbohydrates, protein-rich sources such as cakes, fat sources, and mineral mixture. The constituents of the calf starters can be altered according to the feed availability. Ingredients such as barley/oats/millet grains, groundnut cake/linseed oil meal/soybean oil meal, wheat bran/rice bran, fishmeal, and mineral supplements can be used to make a good quality calf starter. Good quality hay or leguminous green fodder given in addition to calf starters has been found to encourage the early development of rumen functions. The adoption of this technology has been limited because of the following reasons :

The farmer feels that he is unethically depriving the calf of milk.

There is a lack of awareness of the technology.

There is a (wrong) perception that the health of the calf would be affected.

Bypass Proteins

A high proportion of the soluble plant protein from roughage-based diets is deaminated and lost as ammonia during digestion in the rumen. This is because the rate of protein degradation is faster than the utilization of nitrogen for microbial growth. Thus, if part of the protein is not degraded in the rumen it can be utilized more efficiently in the small intestine. Several feed ingredients have been screened for their bypass protein value. Some of them such as cottonseed cake, fishmeal, solvent-extracted coconut cake, subabul leaf meal, soybean extract, sunflower extract, and maize gluten meal have bypass characteristics in their natural form. However feeds such as groundnut cake, wheat bran, gingelly cake, and horse gram have to be manipulated to reduce their rumen degradability for optimization of ratios between degradable and non degradable fractions in the diet. Chemical - or heat treatments are the main methods used for protecting proteins. Heat treatment of groundnut cake at 130°C for two hours or formaldehyde treatment at 1 % of crude protein (CP) significantly increases the bypass protein of the cake (up to 50%). Feeding bypass protein to high yielding animals (about 10 litres day⁻¹ or more) and fast growing calves (500 g day⁻¹) would offer better economic returns to farmers by way of increased milk production/growth rate. Lactating cows yielding 8 litres and above require about 50% of CP in the feed in the form of bypass protein particularly when fed on straw based diets. The economic returns of feeding bypass protein to animals are quite substantial because of increased production (1.5 kg animal⁻¹ day⁻¹). Use of bypass protein feeds by farmers is limited. Lack of awareness is a major constraint. In some parts of the country the farmers use natural high bypass protein sources and even heat treatment to a limited extent.



Bypass Starch and Bypass Fat

Starch can be protected from ruminal hydrolysis with formaldehyde or ammonia treatment. Encapsulating fats/ lipids with formaldehyde-treated protein is an effective method of protection against ruminal hydrolysis and bio hydrogenation of lipids. However, the method has its limitations due to the use of formaldehyde. A simpler approach is the conversion to calcium salts of free fatty acids removed from edible oils during refining. These are protected against rumen degradation. Feeding bypass starch reduces excess production of lactic acid in the rumen, which otherwise inhibits digestion of fiber. The starch left unfermented in the rumen is digested in the small intestine, producing glucose which, after absorption, is more efficiently used as an energy source by the animals. Feeding protected fats to high-yielding animals that receive low fat density diets increases milk yield and also efficiency of energy utilization. Providing higher fat supplements without protection affects the utilization of fiber in the rumen. Providing bypass fat is necessary to meet the energy requirements of high-yielding cows, especially in early lactation. Both the technologies are useful only for high yielding animals and thus have limited level of adoption. Savsani et al. (2017) and Khadda *et al.* (2022) reported that the buffaloes supplemented in group by pass fat produced more milk as compared to control without any adverse effect on the body weight and health of the animals. The postpartum estrus period and service period were reduced significantly in bypass fat supplemented groups than the control groups. The supplementation of Bypass fat supplementation economically improved the milk production and its composition and reproductive performance of lactating buffalo under field conditions. All the farmers readily accepted this practice of using Bypass fat and are also willing to continue. The technology is being commercialized.

Mineral Supplementation

Al though minerals are required in only small quantities, mineral deficiency can have a marked effect on productivity, reproductive performance, and health. Under farming systems, where straws/ stovers form the major source of roughage, the role of minerals becomes more pertinent as these roughages are low in many minerals and contain certain anti nutritional factors such as oxalates, tannins, and silica, which may affect mineral utilization. Mineral imbalances depend on the type of feed and where it is grown. Mineral needs depend on animal output and supplements are particularly important for high-yielding animals. Feeding of formulated mineral mixtures or pure ingredients, although simple, is not a cost-effective method. Besides, the bioavailability of minerals is greater from organic than inorganic sources. Selection is therefore based on the biological availability or release and absorption coefficient. In areas of acute mineral deficiency or where animals exhibit chronic symptoms of deficiency, providing chelated organomineral complexes with high bioavailability is a better approach. Providing region-specific mineral supplements based on mineral mapping is an alternative cost-effective approach. The best way of providing mineral supplements is through the feed or fodder / top feed sources, which are rich in minerals, without affecting the feeding practices followed by the farmers. Few farmers use mineral supplements, except on the advice of a veterinarian. Supplementation of the diet with a mineral mixture is an effective way of overcoming most reproductive problems such as repeat breeding, low fertility, infertility, delayed postpartum estrus, and silent heat. It is also essential for optimum level of production whether it be milk, meat, egg, or wool production. Khadda et al. (2016) reported that 16.38 per cent reduction in cost milk production/ litre in buffalo were due to the supplementation of mineral mixture and common salt under of hot semi-arid ecosystem. The supplementation of mineral mixture and common salt during experimental period indicates that benefit cost ratio 1:2.24 was recorded, which appears to be very lucrative over traditional system of feeding. Mineral mixture has potential to increase the viability, dry season milk supplies, improvement in the reproductive performance of dairy animals and increase household incomes. However, awareness needs to be done among the dairy farmers about the usefulness of mineral mixture and common salt and availability should be ensured at the village level milk collection centre or state animal husbandry department.

Strategic Supplementation

Feeding only straw does not provide sufficient nutrients to maintain the animals, although coarse straws (millets, sorghum, maize) give better results than slender straws (rice, wheat, barley). Feeding straw for a short period may be good for survival or for dung product ion, but to achieve higher levels of milk, meat, or draught power, straw must be either treated or supplemented with better feeds. Supplementation can be made with concentrates, roughage, or both. Supplementation of straws with deficient nutrients such as nitrogen and minerals to improve straw intake and digestibility is called catalytic supplementation. Use of small amounts of concentrate supplements, licks, kitchen waste, or green fodder may achieve this objective. Supplementation for increased straw intake is achieved through improved rumen function. The amount of supplement is small in this case, since higher levels of supplementation decreases straw intake through a substitution effect,



which may be inevitable when feeding high-producing animals as the level of supplement required is very high. Farmers generally feed cakes/bran or grass to their productive stock along with straw. This technology is viable and sustainable and does not greatly interfere with the existing farming system. Technical information available on the nutritive value of supplementary diets and strong extension support are required for increased adoption of this technology. For an animal to maintain body weight and produce 2-3 litres of milk day⁻¹ catalytic supplementation (provision of urea, small amounts of cake, bran, or green fodder) is recommended. For higher levels of productivity supplementation with concentrates, green forages, or compound feeds is required. The level and type of supplementation depend on the availability of supplements, their prices, and the desired level of production. For supplementation to be economically attractive, the value of increased output has to be greater than the cost of the supplement. The addition of small amounts of supplements increases the intake of poor quality roughage. Supplements such as urea, oil cakes, or green fodder improve the intake of crop residues by providing a more favorable rumen environment. Straw sprayed with 2% urea improves straw intake by about 10%; just enough for an animal to achieve maintenance. Groundnut cake fed at a rate of 20% of straw dry matter intake (finger millet straw-based diets) improves dry matter intake and digestibility. Furthermore, supplementing a diet of finger millet straw and wheat bran (75:25) with groundnut cake improves nutrient digestibility. Use of legumes or top feeds (*Sesbania*, *Gliricidia*, *Leucaena*) which supply nitrogen and minerals increases straw intake. Mixing local grasses/top feeds/green fodder with straw during chopping will enhance intake and digestibility and also helps in producing good quality dung. This technology is suitable where straw is cheap, supplements are expensive, and where only low product ion/growth is achievable.

Prebiotics/ Probiotics/Growth Promoters

Probiotics are defined as live microbial feed supplements that improve the health of livestock, or in other words, organisms or substances that contribute to intestinal microbial balance referred as probiotics. The main objectives of application of probiotics in the rearing of young animals are improved survival, inhibition of diarrhea, decrease mortality, superior growth and better feed conversion efficiency. Prebiotics enhance growth, decrease faecal coliform count, enhance immunity and are found to be most effective in times of stress or increased pathogen exposure throughout the calf's lifetime. Lactic acid bacteria compete with the pathogenic bacteria by competitive attachment and production of lactic acid which results in lowering of pH of large intestine. Mannan oligosaccharides (prebiotic) are cell wall products of *Saccharomyces cerevisiae* and inhibit pathogenic bacterial adhesion to mucous epithelium by blocking their fimbriae. Synbiotics are the combination of probiotics and prebiotics which work in supplementary to each other. Antibiotics and antimicrobials when used in low quantities (sub therapeutic) as growth promoters, increase feed and reproductive efficiency, and reduce mortality. However, their use has created much controversy on the possibility of drug residues in animal products that may be toxic to humans. The antibiotics are pure chemical compounds and are absorbed in the digestive tract. They improve growth and feed efficiency but can cause mutation of other microorganisms. Most probiotics are specific in their action and are used to improve feed utilization, uptake of nutrients, or feed efficiency by altering the rumen fermentation and/ or improving feed conversion efficiency. The most commonly used probiotics are yeast cultures (*Saccharomyces cerevisiae* and *Aspergillus*) and bacteria (*Lactobacillus* spp., *Bacillus subtilis*, *Streptococcus* spp.), which are available commercially in the form of water-soluble powders, liquids, or as feed additives. In addition to bacteria and yeast, some enzyme cultures are also being used as additives for improving the nutritional efficiency of feedstuffs. Some enzymes when added to the feed increase the availability of polysaccharides (starch) and proteins, partially hydrolyze viscous carbohydrates (beta-glucans, arabinoxylans) present in some grains, supplement the animal's endogenous enzymes, and hydrolyze fibrous materials that are not hydrolyzed by the endogenous enzymes. These effects are generally more evident in young animals whose digestive systems are not completely developed. Several manufacturers are now adding probiotics to their compound feed. Khadda *et al.* (2019) conducted a study and found that the supplementation of synbiotic (*Lactobacillus acidophilus* @ 0.5 gm (2 x 10¹⁰ cfu/ g) + 2 g Mannan oligosaccharide per calf/ day) was more beneficial in initial (pre-ruminant) stages of calves with special references to improving body weight gain, reduced mortality and are affordable to farmers.

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**VIIth International Conference in Hybrid Mode on Global Research Initiatives for
Sustainable Agriculture & Allied Sciences (GRISAAS-2022)
during 21-23 November 2022**



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AN OVERVIEW OF FORAGE CROPS SEED PRODUCTION IN INDIA

Vijaykumar N.* and Prakashkumar Rathod

Livestock Research and Information Centre (Deoni), KVAFSU, Bidar, Karnataka

*Email : vijaykumarecon@gmail.com

Abstract

Seed is the most critical input to enhance the productivity of fodder crops. To ensure supply of quality seeds to the farmers, production of seeds will be enhanced by establishing seven new seed processing units. The seed units involves production, processing & marketing of quality fodder seeds and comprises seed cleaning and grading machines, civil buildings and human resource. Forage crops are the important component of the livestock based farming system. Availability of the green fodder determines the productivity and profitability of the livestock rearing. Fodder and feeds constitutes about 60% of the total cost of milk production. Forage crops are either grazed directly or fed after harvest to the livestock. To support livestock enterprise, production of fodder crops is essential. Food for the animal comes from crop residues, green fodder from annual and perennial forage crops, certain tuber crops, tree leaves and grasslands. The production of fodder seeds depends upon cropping system, climate and soil besides the socio-economic conditions and quality of livestock. Green fodder based livestock production is economical and also highly nutritive for the livestock. That is why; it is preferred for a profitable and intensive dairy farming.

Key words : Forage crops, seed, livestock, production.

INTRODUCTION

Seed is the most critical input to enhance the productivity of fodder crops. To ensure supply of quality seeds to the farmers, production of seeds will be enhanced by establishing seven new seed processing units. The seed units involves production, processing & marketing of quality fodder seeds and comprises seed cleaning and grading machines, civil buildings and human resource. Forage crops are the important component of the livestock based farming system. Availability of the green fodder determines the productivity and profitability of the livestock rearing.

Forages are although not directly used for human consumption but they are the source of protein and fat i.e. meat, egg, milk and other dairy products that become available to human beings through intermediaries like cattle, sheep, goats, poultry etc. Since feeding alone accounts for 60-70% of the total cost of milk production, availability of adequate nutritious fodder coming from cheaper sources assumes greater importance.

Quality forage seed production and availability in sufficient quantity is very important. Several practices to increase the forage seed production have been fine tuned. In past 10 years, production of breeder seed production has been higher than indents received. Suitable agroecological regions favourable for forage seed production have been identified.

Agriculture and animal husbandry in India are interwoven with the intricate fabric of the society in cultural, religious and economical ways as mixed farming and livestock rearing forms an integral part of rural living. Although the contribution of the agricultural sector in the Indian economy is steadily declining (from 36.4% in 1982-83 to 15.4 % in 2019-2020) the agriculture and livestock sector still provides employment to 52% of the workforce. Livestock provides draught power, rural transport, manure, and fuel and milk. Most often, livestock is the only source of cash income for subsistence farms and also serves as insurance in the event of crop failure. Further, the global energy crisis will lead to the utilization of livestock-based bio-energy as well as waste recycling for organic manure and organic forage production for quality animal products. Livestock provides draught power, rural transport, manure, fuel, milk, and meat. Most often, livestock is the only source of cash income for subsistence farms and also serves as insurance in the event of crop failure. Further, the global energy crisis will lead to the utilization of livestock-based bio-energy as well as waste recycling for organic manure and organic forage production for quality animal products.

India supports nearly 20% of the world livestock and 16.8% human population on a land area of only 2.3%. It is a leader in cattle (16%) and buffalo (55%) population and has the world's second-largest goat (20%) and fourth-largest sheep (5%) population. The 20th Livestock Census (2019) has placed the total livestock population at 535.78 million and that of poultry birds at 851.81 million. The total population is expected to grow by 1.23% in the coming years.



The livestock population in terms of million adult cattle units is presented in Table 1.

Fig.1. 20th Livestock census 2019.

Live stock Population 2019-Share of major species

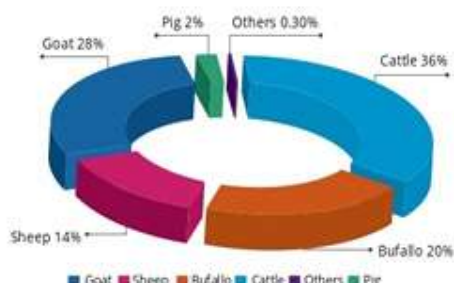


Table.1 projected livestock population estimates (million adult cattle units)

Year	Cattle	Buffalo	Sheep	Goat	Equine	Camel	Total
1995	180.5	82.8	4.0	9.2	0.5	0.9	278.0
2000	187.7	87.7	4.1	9.9	0.4	1.0	290.0
2005	192.2	92.6	4.2	10.5	0.3	1.0	301.0
2010	197.3	97.5	4.3	11.2	0.1	1.0	312.0
2015	202.3	102.4	4.4	11.8	0.1	1.1	322.0
2020	207.4	107.3	4.5	12.5	0.1	1.1	333.0
2025	202.5	112.2	4.6	13.2	0.1	1.1	344.0

Thus, to sustain this growth rate and for further expansion to meet the demands of ever-growing human population, livestock needs a sustainable supply of feed material. The area under fodder cultivation is estimated to be about 4% of the gross cropped area which remained static for the last four decades. The traditional grazing lands are gradually diminishing because of urbanization, expansion of the cultivable area, grazing pressure and industrialization etc. These factors resulted in a severe shortage of feed and fodder to the extent of 26% in dry-crop residues, 35.6% in green fodder, and 41% of concentrates. To reduce the demand and supply gap, the production and productivity of fodder crops need to be enhanced. The increase in the area of fodder crops is difficult because of severe competition from food crops.

The establishment of a uniform and vigorous stand is of paramount importance to the successful production of most crops. Without a good stand, the effectiveness of other agronomic inputs is drastically reduced, and usually such inputs can never compensate for the negative impact of a poor stand. With perennial forage crops, failure to achieve a dense stand at initial planting can have long-lasting consequences compared with annual crops.

Seed are the crucial input of agriculture and most essential component for enhancing the production and productivity of crops. Over the time man has acquired the skill to identify and store the good quality seed for further multiplication during the process of domestication of different crop species. The ancient Vedic literature (Atharvana Veda) supports this fact through the quote “good seed in good land yields abundant”. This is true for the fodder crops also even though vegetative parts are the end products in them. The maintenance of seed quality is one of the most crucial steps in realizing the fodder yield potential of the developed high yielding varieties. To maintain the quality of the large quantities of seed required by the end-users, the generation system of seed production is followed to minimize the loss of quality over generations by following standards at field and seed level throughout the world.

Rigorous seed quality control was seen as a key tool to achieve that goal, reflecting the evolution of regulatory systems in countries with a more industrialized agriculture. The strong influence of governmental organizations at that time also favoured the adoption of rather centralized systems of seed quality control. Consequently, quality control was often made compulsory for seed produced within the formal sector, while the proportion of seed actually supplied through those formal channels remained low.

Status of forage seed the fodder crops are represented by several cereals, legumes and grasses. Out of these only few crops are under proper seed chain. During Kharif season 7 crops and during rabi season 4 crops are under seed multiplication programs. Out of these 11 crops sorghum, berseem, lucerne, maize and bajra occupies more than 90 % of area under fodder cultivation. Even though there is huge demand for fodder and fodder seed it is not being transformed into breeder seed indent. The main reason for this low turnout is absence of organized market. The prevalence of niche markets for fodder seed resulted in low turnout of big companies in otherwise highly potential seed sector. The intrinsic problems in forage seed production ensued non inclination of both public and private sector resulting in reduced quality and competition. The absence of seed chain in range grasses and legumes hampers their multiplication. Only few public sector agencies like IGRI and SAUs are producing grass seeds that to under TL category. Even though there is huge demand from the forest department, difficult production and harvesting procedures are deterring the seed sector to capture it.

With the increased awareness on fodder value and enhanced importance of livestock the situation is slowly changing and is



reflected in the growth of fodder seed market. The interest shown by private players brings vibrancy to the forage seed sector. The government support through developmental schemes adds further sustenance to this sector. The seed requirement for the probable fodder crop area in the country estimated by taking into consideration of seed multiplication through standard seed chain shows that the breeder seed is not being produced as per the requirement.

CONCLUSION

Quality seed is important for increasing fodder crop production to feed this huge live stock population. To achieve sufficient quantity of quality seed, the quality assurance and quality control is most important practices to meet demand of quality seed. There is a need to develop appropriate guidelines for the production, quality control and evaluation of high-quality seeds of the range species.

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UNDERSTANDING HEAT TOLERANCE IN PEARL MILLET IN THE CLIMATE CHANGE SCENARIO

Nirupma Singh, Chandrika Ghoshal, Aarti Kumari, S.P. Singh and Chandan Kapoor

Division of Genetics, ICAR-IARI, New Delhi-110012

Email : nirupmasingh@rediffmail.com

Pearl millet is a climate resilient cereal grown for grain, stover, and green fodder. It is the staple crop in the semiarid and arid regions of Asia and sub-Saharan Africa. In India, major pearl millet growing states are Rajasthan, Maharashtra, Gujarat, Uttar Pradesh and Haryana accounts for more than 90% of pearl millet acreage. But drought and high temperature are the most yield limiting abiotic stress factors in hot arid region. The seedlings are most vulnerable to high temperatures during the first 10 days of sowing. The maximum air temperatures around 43 °C being observed in the arid zone during the rainy season with soil surface temperatures reaching 60–62 °C during germination. The erratic rainfall and high soil temperature during the germination leads to low population stand and ultimately low yields. The high temperature and drought has therefore, been an important breeding and genomics research objective for many decades. Rapid screening procedures for seedling survival under high temperatures and genotypes with tolerance have been identified earlier. However, there are no reports of using the identified heat-tolerant sources in the targeted breeding programme. Therefore, to develop or identify heat tolerant genotypes, knowledge of screening methods, heat tolerance mechanisms along with breeding techniques are important. Initially, germplasm was screened based on IR imaging. Later on, the identified genotypes were characterized for morphological, biochemical and physiological parameters viz, MSI, RWC, Chlorophyll content, enzymes, proline, sugars etc, for heat tolerance. The genotypes, PRPT 18/28, DTRLT 17/17, WSBLT 15/5, Raj LR-1, Raj LR-2, p 7-3, PPMI 1002 has been identified to be heat tolerant. In this study, we are focusing to understand these mechanism specially on production of anti-oxidants, maintenance of membrane stability. In further study, both conventional as well as molecular breeding techniques utilized for genetic improvement for heat tolerance. The protocol for screening seedlings for heat tolerance has been standardized.



INTEGRATED NEMATODE MANAGEMENT APPROACHES

Archana U. Singh

Division of Nematology, ICAR-IARI, New Delhi-110012

Email: arch_212@yahoo.com

Nematodes belonging to the Phylum–Nematoda are unsegmented, bilaterally symmetrical roundworms, usually microscopic in size. Large number of plant parasitic nematode like Root-knot nematode (*Meloidogyne* spp.), Reniform nematode (*Rotylenchulus reniformis*), cyst nematode (*Heterodera* spp.), lesion (*Pratylenchus penetrans*) etc. are reported by different research workers. In general, nematode bodies taper toward both head and tail, but females of some of species may be pear, lemon or kidney-shaped. They are obligate parasites which feed mainly on plant roots with common aboveground symptoms of stunting, yellowing, wilting and yield losses and belowground root malformation due to direct feeding damage. They cause severe losses to economically important crops like vegetables, cereals, pulses, oilseeds, fruit crops, etc. But, Farmer's are not so aware of the damage caused by these nematodes in their crop in field. Sasser and Freckman (1987) have indicated an annual crop loss due to phytonematodes on worldwide basis to the tune of \$100 billion. The degree of damage caused by nematodes depends upon population density of nematodes, environmental conditions such as soil fertility, moisture and also presence of other microorganisms i.e., fungi, bacteria and viruses. Hence, various management practices i.e., physical, chemical, cultural, biological, regulatory and IPM are under taken to minimize crop losses caused by nematodes. But, excessive use of pesticides in agriculture has played havoc in agro-ecosystem by polluting water, food chains and causing emergence of pesticide resistance both in target and non-target pests. Use of Chopped Toxic plants leaves along with judicious use of nematicide in integrated nematode management is an ecofriendly, efficient and affordable method of nematode control. A number of potential fungal bioagents namely *Paecilomyces lilacinus*, *Aspergillus fumigatus*, *Aspergillus niger*, *Trichoderma viride*, *Sepedonium maheswarium*, *Aspergillus terreus*, *Trichoderma harzianum*, etc. are effective in controlling root-knot nematode population. The combination of toxic and egg-parasitic fungus have been found more effective in controlling root-knot nematode population under microplot and field conditions in case of vegetables. Moreover, integrated nematode management approaches by the use of fungal bioagents, judicious use of nematicide and neem cake against *M. incognita* in case of pea, okra, tomato, brinjal, cucurbits, mungbean, chickpea, etc carried out in IARI & Farmer's field and found to be best in reducing nematode population and increasing crop yield. Farmers with their available resources could follow integration of cultural, biological, chemical methods and resistant varieties in suitable combination for each crop and can get better crop yield. Thus, integration of various suitable methods/approaches may be an eco-friendly, economically viable and practically feasible approach for managing pests and diseases in different agri-horticultural crops.



SUSTAINING THE CROP PRODUCTIVITY WITH WATER AND NUTRIENT MANAGEMENT STRATEGIES UNDER CHANGING CLIMATE SCENARIO

U. Surendran

Land and Water Management Research Group, Centre for Water Resources Development and Management, Kozhikode, India

Continuous intensive agriculture without adequate attention on rational soil management poses serious threat to the sustainability of agro-ecosystems. One of the consequences of irrational soil management under intensive cropping is the decline in soil fertility. Low crop productivity associated with high production costs is a great concern in agriculture. Additional stresses come from climate disruption, variability and change, resulting in impacts on water availability and temperature regimes over time and space. This paper describes about the Best Management Practices (BMPs) available. over time and space. This paper describes about the Best Management Practices (BMPs) available. To assess climate change related impacts on crop suitability and agro-ecologically attainable yield, the study applied the Agro Ecological Zonation (AEZ) methodology, which is jointly developed by Food and Agriculture Organization (FAO) and the International Institute for Applied Systems Analysis (IIASA). Range of scenarios for crop productivity for years 2041?2070 (2050s) and 2071?2100 (2080s) using the climatic condition based on four RCPs (2.6, 4.5, 6.0, and 8.5) adopted by the Intergovernmental Panel on Climate Change (IPCC) were generated using AEZ simulation modeling. Major crops grown in Kerala are coconut, arecanut, rubber, black pepper, coffee, tea, cardamom, paddy, tapioca, cashew and vegetables. The AEZ analysis for these crops showed that for ensemble mean of RCM outputs, under rain-fed conditions, yields of banana, arecanut, rubber, coffee, and black pepper show declines between 2.89 and 86.18 %. However, coconut and rice, under rain-fed conditions, show very minor increases of 3.17 and 0.99 % respectively. Under irrigated conditions, yields of coconut, arecanut, coffee, and black pepper show a decline between 3.83 and 86.18 %. However, if we look at all the models and different RCPs, results show that with few exceptions in most of the cases yields tend to decline with climate change. Drip fertigation was chosen as one of the BMPs and it was demonstrated across Kerala. Results from the project showed that the application of nutrients through drip fertigation improved the crop yield of all the demonstration plots and the increase in yield over control. Investments in climate smart agriculture, micro-irrigation practices especially drip fertigation, improved water conservation practices, development and management of natural resources through watershed and afforestation activities, conservation of crop biodiversity, etc. needs to be given focus to improve the production from farms. Besides, strategies needs to be adopted for improving the water and nutrient use efficiency were also discussed.

Abstracts



COMBINING ABILITY AND GENE ACTION ANALYSIS FOR YIELD AND YIELD ATTRIBUTING TRAITS IN KHARIF MAIZE (*ZEA MAYS* L.)

A.A. Patel¹, J.M. Patel², R.M. Patel³, K.D. Gajjar¹, D.R. Chaudhary⁴ and N.V. Soni¹

¹Department of Genetics and Plant Breeding, C.P. College of Agriculture, SDAU, Sardarkrushinagar-385506

²Wheat Research Station, Sardarkrushinagar Dantiwada Agricultural University, Vijapur-382870

³Maize Research Station, Sardarkrushinagar Dantiwada Agricultural University, Bhiloda-383245

⁴Agriculture Research Station, Sardarkrushinagar Dantiwada Agricultural University, Ladol-382840

Email: kgajjar31@gmail.com

Abstract

A diallel mating design excluding reciprocal was practiced among 8 diverse parents and their 28 crosses to access the gene action and combining ability in maize during *kharif* 2021. Analysis of variance revealed that, parents were found significant for all the characters under study except for leaf area, cob length, cob girth, number of kernel row per cob and 100 grain weight. This finding indicated the presence of sufficient amount of genetic variability in parents for grain weight and its component traits. The variance due to hybrids were found significant for all the traits except for cob girth and starch content indicating that genetic variation was existing in the hybrids. Further the variance due to parents vs. hybrids was found significant for all the characters under study except for anthesis silking interval, leaf area, starch content and protein content which suggested the existence of difference between parents and hybrids. Variance due to check vs. hybrids was found significant for days to tasseling, days to silking and grain weight per plant only, which indicates lesser difference between check and hybrid for remaining traits. Parent BLD 29 was found good general combiner for grain weight per plant and other yield attributing characters. However, the parents BLD 126 and WNC 40406 had favorable genes for flowering traits. The estimates of sca effects showed that top five hybrids viz BLD 29 × BLD 124, WNC 32867 × WNC 40449, WNC 32867 × WNC 40406, BLD 30 × WNC 32588 and BLD 29 × WNC 32867 were exhibited maximum positive significant sca effect for grain weight per plant and other contributing traits. Thus, best specific combiners should be exploited to develop commercially high yielding hybrids. The ratio of σ^2_{gca} and σ^2_{sca} was found less than unity for most the characters, which revealed prime role of non-additive gene action for expression of the characters under study.

AN ECONOMIC ANALYSIS OF MARKETING OF PINEAPPLE IN MEGHALAYA: A CASE STUDY OF RI-BHOI DISTRICT

A Roy^{1*}, N. U. Singh², C. Gowda³ and Pampi Paul⁴

ICAR Research Complex for NEH Region, Umiam, Meghalaya-793103

*Email: aniruddhaubkv@gmail.com

Abstract

A study has been conducted to know the seasonal price structure and marketing margin of pineapple in Meghalaya. Data were collected from different identified marketing channels of pineapple marketing prevailed in the State. During summer with the availability of the bulk of production, wholesaler bought the produce from farmers directly and disposed to the retailer in Nongpoh and Shillong markets. In the study area two main channels were identified for marketing of pineapple viz, (a) Producer Wholesaler/Traders Retailer Consumer and (b) Producer Retailer Consumer. It was observed that the preference of the channel by the producer depends upon the quantity of the pineapple produced during the season. In summer, out of 608.37 ton of total produce on small farms, 564.49 ton (92.79%) was disposed through Channel-I (Producer Wholesaler/traders Retailer Consumer) and 7.21 per cent of produce was disposed through Channel-II (Producer Retailer ? Consumer). Medium farmers disposed 96.10 per cent of the produced through Channel-I and remaining 3.90 per cent was estimated to be disposed through Channel-II. The cost incurred by the producer under channel-II in Nongpoh market was 726.98 and retailer cost was 969.98 with a margin share of 45.92 per cent. The producer's share in consumer rupee was found out to be 41.02 per cent. The producer's share was 33.13 per cent. The major constraints faced by the pineapple growers were the lack of extension services in the study area. The lack of capital investment was the second major problem faced by the pineapple growers. The third problem was the inability to go for market-oriented production due to lack of knowledge about the variety which is suitable for processing. Farmers lack the knowledge about value addition and processing of the produce and lack of capital makes it difficult to invest in machineries for post-harvest operation. The lack of credit



ability/financial linkage was the sixth problem faced by the growers as they were not aware of the various credit facilities that they can avail from the banks. The other problems faced by the pineapple growers are the inability to manage associated risk, financial resources/investment, and poor market price availability especially during the peak harvesting season, lack of market information regarding the prices in various local and outside markets. Lack of technical know-how, lack of irrigation facilities, lack of other inputs like manures and fertilizers, labor availability and the lack of good quality seed availability are also some of the limitations in going for commercial cultivation.

IDENTIFICATION OF *BRUCELLA MELITENSIS*, *CHLAMYDOPHILA SPP.*, *CAMPYLOBACTER SPP.*, *BRUCELLA ABORTUS* AND *COXIELLA BURNETII* BY PCR IN GOATS

Abhinav Singh, Anil Kumar Mishra*, K Gururaj, Ashok Kumar, Nitika Sharma, Chetna Gangwar and Vinay Chaturvedi

ICAR-Central Institute for Research on Goats (ICAR-CIRG), Makhdoom, Farah-281122, Mathura, Uttar Pradesh, India

*Email: anilmishradr@gmail.com

Abstract

Abortion in animals including goats inflicts heavy economic losses to the farmers. Both infectious and non-infectious agents may cause abortion, but infectious ones are the predominant cause of the abortions. The current study was planned to assess the presence of *Brucella melitensis*, *Chlamydophila* spp., *Campylobacter* spp., *Brucella abortus* and *Coxiella burnetii* in the genital tracts of goats, and foetal stomach contents. The genomic DNA from 260 biological samples (vaginal/preputial secretions and foetal stomach contents) was extracted, and species as well as genus specific polymerase chain reactions were done for the detection of the targeted infectious agents. Out of 260 samples, the presence of *Coxiella burnetii* was not detected in any sample. *Brucella abortus* infection was detected in two aborted goats, which indicates its potential to cause abortion in goats. Only 10 samples out of 260 (6 vaginal swabs from the aborted goats and 4 foetal stomach contents) were found positive for *Brucella melitensis*. A total of 117 samples were found positive for *Chlamydophila* spp., whereas 84 were found positive for *Campylobacter* spp. The present study concludes that *Chlamydophila* and *Campylobacter* spp. were found as the prevalent microbial agents, which may be associated with abortion in goats in the forthcoming pregnancies.

ZINC NANOFERTILIZATION ENHANCES THE WHEAT GROWTH AND YIELD

Achchhelal Yadav, Monika Kundu and P. Krishnan

Division of Agricultural Physics, ICAR-Indian Agricultural Research Institute, New Delhi-110012, India

Email: achchheyadav@yahoo.com

Abstract

Zinc plays a very important role in growth and yield of wheat. The appropriate application of zinc at different growth stages of wheat improves its growth, zinc content in different edible parts as well as yield. However, higher doses of zinc in crops effect wheat growth as well as its yield adversely. Thus, it becomes unavoidable need to have formulations of Zn that could improve its use efficiency so that crop performance could be enhanced with reduced inputs. Taking this in view we carried out a field experiment on wheat during 2020-21 applying zinc oxide nanoparticles (ZnO-NPs) as well as zinc sulfate (ZnSO₄) as conventional fertilizer in soil, at the research farm of ICAR-Indian Agricultural Research Institute, New Delhi. The rate of application of ZnO-NPs in the pot soil were 0, (Control), 20, 25 and 30 mg kg⁻¹. We also apply equal amount (equal to Zinc in ZnO-NPs) of ZnSO₄ in the pot soil separately. We compared and assessed ZnO-NPs and ZnSO₄ use efficiencies on wheat growth, yield and Zn uptake in grains. Results showed that photosynthetic rate and stomatal conductance were significantly ($p < 0.05$) more under 25 mg kg⁻¹ soil ZnO-NPs treatment over its counterpart of ZnSO₄. Among the crop yield parameters such as tillers (plant⁻¹), number of grains (spike⁻¹), grain weight (plant⁻¹), biomass (plant⁻¹) and yield were significantly ($p < 0.05$) more under ZnO-NPs at 25 mg kg⁻¹ treated soil as compared to any other treatment. Zinc (Zn) concentration in grains increased with dose of ZnO-NPs and it significantly more than ZnSO₄ treated soil at each treatment level. The increased crop growth, yield and higher concentration of zinc might be due to increased surface to mass ratio of ZnO-NPs and increased durability of absorption via roots as compared to the conventional ZnSO₄ fertilizer. The present study aimed at to assess and compare the potential impacts of Zn nanoparticles over the ZnSO₄ conventional fertilizer on growth, yield and zinc concentration in grains.



NUTRIENT STATUS AS AFFECTED BY DIFFERENT PRODUCTION SYSTEMS OF BANANA

A.R. Mendhe, J.S. Chaure, and C.V. Pujari

AICRP on Fruits (Banana), Banana Research Station, Jalgaon-425001(M.S.)

Email: armendhe@gmail.com

Abstract

Field experiment input use efficiency in banana was conducted at Banana Research Station, Jalgaon during 2014 - 2017 with objective to identify efficient combination of inputs for improving growth and yield of banana under. The experiment was laid out in Randomized Block Design (RBD) and comprised of five treatment combinations with four replications. The treatment combinations were T₁:a+b+c+d+e, T₂:a+b+c+d, T₃:a+b+c, T₄:a+b+d and T₅: control-Soil application of region specific RDF + flood irrigation, Where 'a' is Drip irrigation (80% ER at all stages), 'b' is Fertigation (based on STCR equation developed at NRCB -75 % of worked out NPK with 80 % ER), 'c' is Micronutrient foliar sprays at 4, 5 & 6 MAP in plant crop and 3, 4 & 5 MAP in ratoon crop, 'd' is Bunch spray of SOP (2 %) (I spray after male bud removal and II spray at 30 days after I spray) and 'e' is Polyethylene mulching. The treatment T₁ recorded superior organic carbon content (0.42 %), soil available N (199 kg/ha), soil available P (19.0 kg/ha) and soil available K (679 kg/ha). The percent increase in leaf nutrient concentration of N, P, K, Ca, Mg, Fe, Zn, Mn and Cu was to the tune of 14.7, 37.5, 10.8, 9.2, 20.1, 14.1, 42.1, 10.3, and 32.8 %, respectively, over control treatment (T₅).

IDENTIFICATION OF MOLECULAR MARKERS LINKED TO MALE STERILITY IN AFRICAN MARIGOLD (*TAGETES ERECTA* L.)

¹Akkalareddy Sumalatha*, ²Tejaswini Prakash, ²D.C. Lakshmana Reddy, ¹V. Vijaya Bhaskar, and ²Arivalagan M

¹Dr.Y.S.R Horticultural University, Venkataramannagudem, West Godavari,
Andhrapradesh, 534101, India

²ICAR -Indian Institute of Horticultural Research, Hessarghatta, Bengaluru, 560089

*Email: sumalathaakkalareddy@gmail.com

Abstract

Demand for hybrid varieties of African marigold (*Tagetes erecta* L.) is rising as the F₁ hybrids exhibit increased productivity and uniformity. Male sterility is the most sought-after mechanism for hybrid seed production. We have identified and stabilized male sterile lines of African marigold that are petaloid in flower structure and governed by single dominant gene. Molecular markers tightly linked to the male sterility will help to retain only male sterile plants in the seedling stage, thereby avoiding rouging of fertile plants later and saving in the cost of hybrid seed production. We attempted to identify a linked marker to male sterility and to use it in marker assisted selection and breeding programmes. Eleven microsatellite markers shortlisted in previous report on male sterility in marigold were used in the present study. The marker CPSSR-39 segregated very clearly and consistently fitting the Mendelian ratio of 1:1 ratio in accordance with the genes governing petaloid male sterility. This is the first report of linked marker to genic petaloid male sterility in marigold that can open up multiple opportunities in commercial hybrid seed production of marigold, an important advance in the breeding of marigold.

KISS-10 AND CHITOSAN AS PEPTIDE NANOPARTICLE CONJUGATE: PREPARATION AND CHARACTERIZATION AS A STABLE DELIVERY SYSTEM

Aishwarya Sharma^{1,2}, Rupam Sharma², Naresh Raj Keer^{1,2} and Lakan Meena¹

¹College of Fisheries, Bihar Animal Sciences University, Kishanganj-855107, Bihar, India

²ICAR- Central Institute of Fisheries Education, Mumbai- 400061, Maharashtra, India

*Email: aishwaryasharma974@gmail.com

Abstract

Being mindful of the role of kisspeptin as a master molecule in reproductive events and potency of chitosan nanoparticles in drug delivery applications, this study communicates the importance of kisspeptin and chitosan as peptide nanoparticle



conjugate. Based on dynamic light scattering (DLS) analysis, kisspeptin-chitosan conjugates with significant particle sizes [139.8 nm (Ch-KISS1) & 178 nm (Ch-KISS2)], stable zeta potentials (+40 mV & +24mV) and polydispersity index of 0.316 were synthesized. The presence of possible functional groups involved in the fabrication of chitosan nanoparticles was elucidated using FTIR spectroscopy. The entrapment efficiency parameter, as an indication of the percentage of drug entrapped in the nanoparticles, was calculated ranging from 70% to 84% using ultracentrifugation for two kiss decapeptides, KISS-1 & KISS-2 corresponding to different dosages: 50ig/kg b.wt. and 100ig/kg b.wt. Chitosan nanoparticles enhanced the stability of the kisspeptides owing to hydrophilicity and cationic charge of chitosan. The preliminary results presented herein indicate that the proposed new generation of kisspeptin (KISS-1 & KISS-2) decapeptides encapsulated with biocompatible chitosan nanoparticle represent a potential platform for targeted drug delivery. It may find suitable field applications in increasing the global production of late maturing fishes by inducing early maturation via up regulation of HPG axis.

PREVALENCE AND POTENTIAL RISK FACTORS ASSOCIATED WITH *CRYPTOSPORIDIUM* SPP. INFECTION IN BOVINES IN HIMACHAL PRADESH

Ajayta Rialch*, Bindu Devi, Shivani, Gauri Jairath, Devi Gopinath, Rinku Sharma, Birbal Singh, Gorakh Mal and Putan Singh

ICAR-Indian Veterinary Research Institute, Regional Station, Palampur, H.P.-176061

Email: ajaytarialch@gmail.com

Abstract

Cryptosporidium is the second leading cause of neonatal calf diarrhea across the globe. In comparison to other entero-pathogens, the bovine cryptosporidiosis outbreaks are rarely reported in cattle (Li *et al.*, 2019). This parasite is often under-reported due to lack of sensitivity of the routine fecal examination procedures. Despite its worldwide occurrence and zoonotic significance, the status of bovine cryptosporidiosis in Himachal is still unknown. Therefore, we conducted a cross-sectional study to detect the prevalence and potential risk factors associated with the parasite. We randomly collected 503 bovine fecal samples from various districts of Himachal Pradesh and transported them to the laboratory at 4 °C. Direct fecal smears stained with modified Ziehl-Neelson (MZN) stain were screened microscopically. The *Cryptosporidium* species oocysts were detected in 60 (11.92%) samples. Animal age, fecal consistency and rearing system were found to be the potential risk factors associated with the disease. High prevalence of bovine cryptosporidiosis is detected in the study area. Keeping in mind the zoonotic importance of two most species of bovine; *C. parvum* and *C. andersoni*, further studies targeting the detailed molecular characterization are needed. Proper sensitization and education of livestock owners, veterinarians and animal handlers are recommended to control the disease in bovine population and limit its spread to humans especially immunocompromised individuals.

ASSESSMENT OF BODY CONFORMATION AND APPEARANCE OF SAHIWAL COWS USING LINEAR CLASSIFICATION SYSTEM

Ajay Kumar, S.S. Lathwal, Mamta, D.N. Singh, Rajneesh Sirohi, Yajuvendra Singh

ICAR- National Dairy Research Institute Karnal- 132001(Haryana), India

Email: veterinodsingh@gmail.com

Abstract

Linear type scoring is key component in decision making process in the herd, as it focuses on the selection of animals with higher productive potential based on their body conformation/linear traits. The present investigation was carried out on 150 lactating Sahiwal cattle. Measurements on linear type traits were recorded before the evening milking at three different stages of lactation. Descriptive analysis of type traits was carried out by using standard statistical procedure. The mean±SE of ST, CW, BD, RW, RA, RLS, FA, FUA, RUH, UD, RUW, CL, FTL, RTL, TC, TD and UB in Sahiwal cows were, 125.35±0.26 cm, 25.96±0.15 cm, 64.06±0.22 cm, 16.92±0.11 cm, 12.94±0.22 cm, 159.78±0.43, 43.47±0.31, 123.23±1.29, 17.55±0.24 cm, 6.80±0.29 cm, 8.39±0.13 cm, 3.21±0.07 cm, 7.34±0.13 cm, 6.47±0.12, 10.00±0.11 cm, 3.18±0.03 cm and -0.22±0.16 cm, respectively. The average score point of objective linear type traits was viz., stature 5.77±0.08; chest width 4.59±0.10; body depth 5.24±0.10; rump width 5.56±0.09; rump angle 4.48±0.08; rear legs sets 4.81±0.12; foot angle 4.84±0.10; fore udder attachment 4.85±0.11; rear udder height 5.52±0.10; udder depth 5.31±0.08; rear udder width 4.27±0.09; central ligament



4.01±0.09; fore teat length 3.49±0.10; rear teat length 3.94±0.09; teat circumference 4.20±0.11; teat diameter 4.16±0.10 and udder balance 5.25±0.11. On the other hand, average score point of subjective linear type traits (1-9 scale) was viz., angularity 4.69±0.09; rear leg rear view 5.05±0.06; body condition score 6.53±0.08; locomotion 4.88±0.06; fore teat placement 4.41±0.07 and rear teat placement 6.28±0.08. Most of the body conformation traits in Sahiwal cattle were falling under intermediate category and of desirable type. However, some traits like stature, chest width, body depth, rump width, angularity, central ligament, rear udder height, rear udder width and fore udder attachment expressed scope for further improvement. Therefore, present studies gave overt clue to bring Sahiwal cattle at par with exotic breed, by incorporating type traits in selection programme.

PREPARATION, CHARACTERIZATION AND APPLICATION OF NANOLIPOSOME LOADED WITH CHITOSAN-EPIGALLOCATECHIN GALLATE CONJUGATE FOR SHELF-LIFE EXTENSION OF REFRIGERATED ASIAN SEA BASS (*LATES CALCARIFER*) SLICES

Ajay Mittal^{*1}, Avtar Singh¹, Sumit Singhal² and Soottawat Benjakul¹

¹International Center of Excellence in Seafood Science and Innovation, Faculty of Agro-Industry,
Prince of Songkla University, Hat Yai, Songkhla-90110, Thailand

²Centre of Excellence on Indigenous Breed, Piprakothi, Dr. Rajendra Prasad Central Agricultural University, Samastipur,
Bihar-848125, India

*Email: ajy.mittal@yahoo.com

Abstract

Chitosan (CS) is water insoluble, thus restricting its applications in various food systems. Therefore, CS-epigallocatechin gallate (EGCG) conjugate (CEC) was prepared to increase water solubility and bioactivities. However, EGCG present in CEC is converted into non-epicatechin isomer (gallocatechin gallate) induced by several intrinsic and extrinsic factors, leading to poorer bioactivities in various food systems. Nanoliposomes (NLs) loaded with CEC (CEC-NLs) were prepared to enhance the storage stability of CEC and the application of CEC-NLs for shelf-life extension of Asian sea bass slices (ASBS) 4 °C. NLs using lecithin and cholesterol at various concentrations were prepared for encapsulating CEC at different levels. Encapsulation efficiency (EE), particle size (PS), zeta potential (ZP) and poly dispersity index (PDI), storage stability, antimicrobial and antioxidant activities of resulting NLs were examined. NLs were applied on ASBS for shelf-life extension, in which microbiological, chemical and sensory properties were monitored during storage at 4 °C for 18 days. NLs prepared using LP (60 µmol/ml) and CEC (0.5% w/v) (LP-60-0.5) (had highest EE (76.96%) and possessed PS, ZP and PDI of 685.10 nm, -49.46 mV and 0.276, respectively (p<0.05). LP-60-0.5 retained their antioxidant and antimicrobial activities at a higher extent than free CEC during storage for 28 days at 4 °C (p<0.05). The SEM images of tested bacteria confirmed the antimicrobial activity of CEC-NLs. Treatment of LP-60-0.5 (0.05 g/100 g) on ASBS (ASBS-CENL-0.05) resulted in the lower microbial loads (<106 CFU/g) than other samples (p<0.05) up to 15 days. ASBS-CENL-0.05 possessed the lower oxidation of polyunsaturated fatty acids, which was mainly caused by free radical scavenging and antimicrobial activities of CEC-NLs. CEC-NLs effectively sustained the bioactivities more effectively than free CEC during storage. Furthermore, shelf-life of ASBS with sensory acceptability could be prolonged for at least 12 days at 4 °C.

MANAGEMENT OF GREEN MOLD OF OYSTER MUSHROOM (*PLEUROTUS OSTREATUS*) BY FUNGICIDES AND PLANT EXTRACTS

Ajit Kumar Jha and Arun Kumar Singh

ICAR-Research Complex for Eastern Region, Farming System Research Centre for Hill and Plateau Region,
Ranchi – 834 010, Jharkhand, India

*Email: ajitrnc2020@gmail.com

Abstract

The cultivation of edible mushrooms is regarded as a biotechnological process for conservation of various lignocellulosic, agricultural, industrial, forestry, horticultural waste or their by-products into proteins, especially in developing countries. Mushroom cultivation is a viable alternative venture for minimizing the ever-increasing protein malnutrition gap and multitude of allied problems in these countries. Mushrooms which are commercially grown in India, include *Agricus bisporus*



(white button mushroom), *Volvariella* spp. (paddy straw mushroom), and *Pleurotus* spp. (oyster mushroom). Oyster mushrooms are rich in proteins, vitamins and minerals. Oyster mushrooms contain about 85-95% water, 3% protein, 4% carbohydrates, 0.1% fats, 1% minerals and vitamins. *Pleurotus ostreatus* (Jacq.) Kumm., commonly known as oyster mushroom, is one of the most commercially important edible mushrooms grown in Jharkhand. The cultivation of Oyster mushroom has increased in Jharkhand due to easy availabilities of paddy straw as a substrate and it's easy cultivation process. Oyster mushroom cultivation in Jharkhand has great potential since it requires limited space, low initial investment and the raw materials used are cheap and easy to acquire. Thus, its cultivation is the most affordable to small scale farmers in order to generate extra income during the dry months. But the major constraint in the speedy popularization of this crop is diseases and pests. The diseases and pests happen to be devastating and perpetuate easily from one season to another. *Trichoderma* spp. is responsible for causing a serious disease called as green mold which is a major fungal problem for mushroom growers. The pathogen inhibits the growth of mushrooms and hinders the production of fruiting bodies. It is a common contaminant, badly hindering the production of mushrooms. To manage the green mold disease of *Pleurotus ostreatus*, different fungicides and plant extracts were tested *in vitro*. Among the fungicides, maximum growth inhibition of *Trichoderma* spp. was recorded in Azoxystrobin 18.2% + Difenconazole 11.4% SC followed by Carbendazim, Tebuconazole 50% + Trifloxystrobin 25% WG and Carbendazim 12% + Mancozeb 63%. Growth inhibition of *Pleurotus ostreatus* was observed maximum in Mancozeb followed by Metalaxyl and Propiconazole. Least Growth inhibition of *P. ostreatus* was observed in Azoxystrobin 18.2% + Difenconazole 11.4% SC followed by Carbendazim, Tebuconazole 50% + Trifloxystrobin 25% WG. Among the plant extracts, maximum growth inhibition of *Trichoderma* spp. was recorded in Neem leaf extract followed by Karanj leaf extract and Garlic extract. Maximum yield of oyster mushroom was also recorded in case of Neem leaf extract (689.4 g/kg dry substrate) followed by Karanj leaf extract. In case of fungicides, maximum yield was recorded in Azoxystrobin 18.2% + Difenconazole 11.4% SC followed by Carbendazim treated bags.

FERTILIZER PRESCRIPTION THROUGH TARGETED YIELD MODEL FOR GROUNDNUT AND RESIDUAL EFFECT OF NUTRIENTS ON SUCCEEDING WHEAT GROWN IN NORTH WESTERN INDIA

Akshay Shrivastav^{1*}, Ajaya Srivastava¹, Satya Pratap Pachauri¹, Veer Singh¹ and Amit Bhatnagar² and Raj Bahadur¹

¹Department of Soil Science, ²Department of Agronomy: College of Agriculture;

G.B. Pant University of Agriculture and Technology, Pantnagar, US Nagar, Uttarakhand (India)

*Email : shrivastavakshay1994@gmail.com

Abstract

Field experiments were conducted as per technical programme of AICRP on STCR at Norman E. Borlaug Crop Research Centre, Pantnagar during 2021-2022. The experimental area was divided into three equal strips and soil fertility gradient created artificially by applying graded doses of nutrients in these strips and oat was grown as an exhaust crop. Test crop of groundnut was grown dividing each strip in 24 plots (21 treatments and 3 controls). Crop response to selected combinations of four levels of nitrogen (0, 10, 20 and 30 kg N ha⁻¹), four levels of phosphorus (0, 15, 30 and 45 kg P₂O₅ ha⁻¹), four levels of potassium (0, 22.5, 45 and 67.5 kg K₂O ha⁻¹) and three levels of FYM (0, 5 and 10 t ha⁻¹) in different fertility strips was studied. Chemical analysis was performed to estimate soil pH, OC, available nitrogen, phosphorus and potassium status in the soil. Nutrient requirement to produce one quintal of groundnut pod yield was found to be 4.31 kg, 1.42 kg and 2.15 kg of N, P and K, respectively. Percent contribution of N, P, K was 34.96, 32.93 and 22.71 from soil and 13.68, 6.75 and 12.28 from FYM, 84.27, 68.34 and 53.15 from chemical fertilizer and 111.48, 88.38 and 60.77 from combined use of chemical fertilizer with FYM. Fertilizer prescription equations were developed with and without FYM with help of basic data. Coefficient of determination (R²) was found highly significant (0.7921**) between pod yield, soil test values, added fertilizers and interaction between soil and fertilizer. In residual study with wheat, residual fertility of N₃P₃K₃ treatment shows highest yield followed by N₂P₂K₃ and N₁P₁K₂. Grain yield was significantly and negatively correlated (r) with straw yield of wheat. Verification trial of groundnut has been ongoing. Use of these findings for North Western India as a roadmap for optimum fertilizer management by reducing cultivation costs, improving FUE, and controlling pollution in the environment. Therefore, soil test-based fertilizer recommendation is a useful tool for balanced fertilization of nutrient.



IDENTIFICATION OF GENE INVOLVED IN DEFENSE SYSTEM USING DE NOVO TRANSCRIPTOMES ANALYSIS IN LENTIL (*LENS CULINARIS* L.)

Anil Kumar^{1*}, Ravi Ranjan Kumar², Pankaj Kumar¹ and Haroon Rashid¹

¹Department of Plant Breeding and Genetics

²Department of MBGE

Bihar Agricultural University, Sbaur-813210

*Email: dranilbau@gmail.com

Abstract

Fusarium wilt is a destructive soil-borne disease that threatens the production of Lentil. Lentil lines L7920 show high resistance and, IPL-526 high susceptibility to Fusarium wilt, respectively. Transcriptome analysis was carried out to identify candidate genes involved in Fusarium wilt resistance using L7920 and IPL-526 at 09-, 11-, 13- and 15-days post inoculation (dpi). A De novo transcriptomic analysis of resistance and susceptible lentil leaves was conducted using the Illumina sequencing platform. Approximately 4 GB clean data were generated from resistance and susceptible samples that assembled into 30,465 and 35,797 transcripts (combined 50,630), and 30,180 and 32,333 CoDing sequences (CDS) (combined 43,637), respectively. A total of 80 KEGG pathways were identified in Lentil. Differential expression analysis showed that 3,254 genes responded to pathogen infection and were differentially expressed in the resistant and susceptible lines.

PROPORTION ESTIMATION UNDER GEOGRAPHICALLY WEIGHTED LOGISTIC REGRESSION MODEL FROM SURVEY DATA

Ankur Biswas

ICAR-Indian Agricultural Statistics Research Institute, New Delhi

Email: Ankur.Biswas@icar.gov.in

Abstract

Due to extensive use of technologies in survey data collection, survey data often contain geographical information like geographical location which is expected to be useful in survey data analysis. However, the commonly used survey estimation methodologies often ignore such information. Some researchers have explored the use of spatial information in estimation of finite population parameters but they are mostly limited to continuous survey variables. In many real-life applications, the variables collected from surveys are binary in nature. When the variable of interest is binary, it is appropriate to use a logistic model instead of the standard linear model. When sample is drawn using a complex survey design, the simple logistic regression model may not be suitable. Under this study, a new estimator for population proportion has been proposed considering spatial logistic model for geo-referenced binary survey data. The spatial logistic model based on location specific Geographically Weighted Regression (GWR) model at the population level has been considered for the binary study variable. Modification of model calibration technique under geographically weighted logistic model is also attempted. The performance of the proposed estimator was evaluated based on a spatial simulation study. Simulation results suggest that the proposed estimator outperforms usual estimators of the population proportion.

A HIGH YIELDING, DISEASE RESISTANT LENTIL VARIETY VL MASOOR 148 FOR WIDER CULTIVATION IN NORTHERN HILL ZONE OF INDIA

Anuradha Bhartiya*, G. Singh, J. P. Aditya and Sher Singh

Crop Improvement Division, ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan, Almora 263 601 (Uttarakhand)

*Email: anuradha.bhartiya@icar.gov.in

Abstract

A high yielding lentil variety VL Masoor 148 was released by “Central Variety Release Committee” and notified by “Central Sub-Committee on Crop Standards, Notification and Release of Variety” for commercial cultivation under timely sown rainfed conditions of Northern Hill Zone (Uttarakhand, Himachal Pradesh, J&K and NE hills). Lentil variety VL Masoor148 (1,148 kg/ha) has shown significant yield superiority of 18.32% over the best check PL 4 (970 kg/ha) under timely sown



rained conditions. It is superior in nutritional quality with 30.46% protein in its seeds and also found moderately resistant to wilt, rust and aphids. The profitable seed production in hills and plain districts of Uttarakhand and a huge acceptability of lentil variety VL Masoor148 among the farmers has paved the way for the spread of this variety in Northern Himalayan Region for enhancing the productivity and profitability of lentil in the region.

BIOCHEMICAL CHARACTERIZATION OF ENDOPHYTIC BACTERIA ISOLATED FROM SUGARCANE VARIETIES BO-91 AND CO-P 16437

Aman Jaiswal^{1*}, Geeta Kumari¹, Himani Priya², Anupam Amitabh³ and Vikas Kumar Rai⁴

¹Department of Microbiology, CBS&H, RPCAU, Pusa, Samastipur, Bihar

²ICAR-Indian Agricultural Research Institute, Hazaribagh, Jharkhand

³SRI, RPCAU, Pusa, Samastipur, Bihar

⁴Department of Soil Science, RPCAU, Pusa, Samastipur, Bihar

*Email: amanjaiswal1989@gmail.com

Abstract

Endophytic bacteria colonizing internal parts of the plants benefit the crop plants by enhancing their growth and development. These beneficial organisms are documented in almost all plants. Sugarcane also colonizes diverse endophytic bacteria and these bacteria benefit the sugarcane crop through plant growth promoting activities. Therefore, a study was conducted to isolate endophytic bacteria from different parts of two sugarcane varieties, BO-91 and Co-P 16437, and to examine them for their morphological characterization and biochemical behavior. Sugarcane samples, roots, stems and leaves were collected and further subdivided into upper, middle and lower portions. One gram of the sample from each sub portion was surface sterilized and subjected to an isolation process on nutrient agar and Luria Bertani agar plates. A total of 71 endophytic bacteria of different morphotypes were isolated from roots, stems and leaves of both varieties, out of which 45 isolates were obtained from BO-91 and 26 isolates from Co-P 16437. Isolates were subjected to morphological characterization on the basis of colony morphology and microscopic features. Most of the isolated colonies were of small size, circular shape with regular margins, smooth texture and yellow or orange color colonies on nutrient agar and Luria- Bertani agar plates. 41 isolates were identified as Gram-negative and 30 isolates as Gram-positive bacteria, out of which 17 were endospore producers based on Gram staining, endospore staining and microscopic observations and most of the isolated cells were of rod shape. Isolates were further tested for biochemical activities, in which most isolates were able to utilize citrate and showed positive response to the oxidase test, whereas few isolates showed positive response to the methyl red test and Voges-Proskauer test. Future work will be done on nutrient solubilization and biocontrol activities of promising isolates.

SOIL ENZYMATIC ACTIVITIES RESPONSE TO DIFFERENT NUTRIENT MANAGEMENT PRACTICES AFTER GARDEN PEA (*PISUM SATIVUM*) CULTIVATION

Apurva¹, Dhram Prakash², Sunita Sheoran², Manju Kumari³ and Ankit²

¹Forage Production Section, ICAR-NDRI, Karnal- 132001

²Department of Soil Science, CCS Haryana Agricultural University Hisar-125004

³Division of Soil Science and Agricultural Chemistry, ICAR-IARI, New Delhi-110012

Email: bhimaniya7680@gmail.com

Abstract

A field experiment conducted in Rabi, 2019 with eight treatments i.e. FYM₁₀₀, vermicompost₁₀₀, FYM+ CUBOF, vermicompost+ CUBOF, FYM₅₀+ CUBOF, vermicompost₅₀+ CUBOF, RDF (NPK:: 30:50:0 kg ha⁻¹) and control and three replications at Research Farm, Department of Vegetable Science, CCS Haryana Agricultural University, Hisar was selected to determine the response of soil enzymatic activities to different nutrient management practices after garden pea cultivation. The results indicated that the dehydrogenase, alkaline phosphatase, urease and arylsulfatase activity in the soil varied from 17.58 to 38.92 µg TPFg⁻¹ 24h⁻¹, 142.72 to 357.85 µg PNP g⁻¹ h⁻¹, 11.2 to 20.07 µg NH₄⁺-N g⁻¹h⁻¹ and 4.82 to 10.84 µg PNP g⁻¹ h⁻¹, respectively. The highest dehydrogenase, alkaline phosphatase and urease activity were reported with the application of RDN through vermicompost combined with CUBOF, however, the highest arylsulfatase activity was reported with the application of RDN through FYM combined with CUBOF. Addition of RDN through vermicompost observed numerically higher



dehydrogenase activity in soil as compared to RDN applied through FYM but did not differ significantly. Application of half RDN through FYM or vermicompost along with CUBOF (270.38 and 288.25 $\mu\text{g PNP g}^{-1} \text{h}^{-1}$, respectively) recorded significantly higher alkaline phosphatase activity as compared with the application of RDN through FYM or vermicompost (223.54 and 230.47 $\mu\text{g PNP g}^{-1} \text{h}^{-1}$, respectively). Incorporation of recommended dose of fertilizers (17.66 $\mu\text{gNH}_4^+-\text{N g}^{-1} \text{h}^{-1}$) in soil observed numerically higher urease activity as compared to RDN applied through FYM or vermicompost (15.92 and 16.8 $\mu\text{gNH}_4^+-\text{N g}^{-1} \text{h}^{-1}$, respectively) but did not differ significantly. Incorporation of RDN through FYM or vermicompost along with CUBOF recorded significantly higher alkaline phosphatase and arylsulfatase activity in soil as compared to 50% RDN applied through FYM or vermicompost.

THERAPEUTIC MANAGEMENT OF OTITIS EXTERNA IN BULL MASTIFF DOG

Arbind Singh*, Aditya Kumar, Amit Kumar Verma, Afroz and T.K. Sarkar

Department of Veterinary Medicine, College of Veterinary and Animal Sciences, SVPUAT, Meerut, U.P.

*Email: arvindsingh80279@gmail.com

Abstract

A male bull mastiff dog of age approx. 1.5 years and having weight 25 kg was presented to veterinary clinical complex, COVAS, SVPUAT, Meerut with a history of itching, head tilt towards affected side, foul smelling and severe inflammation for five days. Tentative diagnosis was observed as otitis externa. Skin scrapping from ear pinnae and swab from ear was taken for laboratory diagnosis and culture examination test. There were no mites and fungus present on the dog but culture test revealed *Moraxiella spp.* (gram negative rods). Dog was treated with Amoxicillin and potassium clavulanate @ 20 mg/kg body weight once daily for 10 days, Meloxicam @ 0.2 mg/kg bwt twice daily for 5 days to overcome infection and inflammation, respectively. Animal owner was advised to clean the ear using epiotic ear cleanser (salicyclic acid) twice daily for one week. The dog was followed up after 10 days, and then there were no itching, foul smell and inflammation. It was concluded that the above treatment was found successful in the treatment of otitis externa.

TO STUDY THE RESISTANCE MECHANISM OF DIFFERENT CITRUS GENOTYPES TO *XANTHOMONAS CITRI* PV. *CITRI* INCITED CITRUS CANCER SEVERITY UNDER ARTIFICIAL INOCULATION CONDITIONS

Ashok Kumar Mahawer¹, R. M. Sharma¹, Dinesh Singh², Jagdish Yadav²

¹Division of Fruits & Horticultural Technology, ICAR-Indian Agricultural Research Institute, New Delhi -110012, India

²Division of Plant Pathology, ICAR-Indian Agricultural Research Institute, New Delhi 110012, India

*Email: ashokmahawer2012@gmail.com

Abstract

In the present study, 19 different citrus genotypes, including 13 acid lime, 4 lemons, and 2 grapefruit, were screened out against *Xanthomonas citri* pv. *citri* (*Xcc*) under artificial inoculation. Moreover, all the lemon and grapefruit genotypes showed a high level of resistance. However, acid lime cultivars exhibited a variable reaction to *Xcc*. The range of the average percentage of disease incidence (PDI) for two years varied from 0.00% to 62.33%. ALC-35 expressed the maximum average PDI (61.50%), followed by the genotypes ALC-107 (55.17%) and ALC-111 (51.83%). Kagzi Kalan showed immune to the canker disease, while Pusa Lemon-1, LS-3, Konkan Seedless, Marsh seedless and Redblush grapefruit had minimum PDI under artificial inoculation. On the basis of average PDI, ALC-35, ALC-107, and ALC-111 were categorized as highly susceptible, whereas 10 genotypes were classified as susceptible to *Xcc*. The average of two years area under disease progression curve (AUDPC) ranged from 0.00 to 1300. The genotype ALC-35 proved highly susceptible to *Xcc* with 1281.67 AUDPC, followed by ALC-107, ALC-111, and ALC-83. The present investigations also studied various physiological responses of *Citrus* spp., including, photosynthetic rate (*A*), transpiration rate (*E*), stomatal conductance (*g_s*), intrinsic water use efficiency (*iWUE*) and stomatal observation. *Xcc* inoculation significantly decreased *A*, *E*, *g_s*, while increasing *iWUE*. The highest reduction rates of *A* (-41.16%), *E* (-41.26%) and *g_s* (-55.26%) were found in ALC-35, and the lowest reductions of *A* (-6.31%), *E* (-10.78%) and *g_s* (-15.38%) were registered in Kagzi Kalan after inoculation. ALC-35 exhibited highest stomatal density, stomata pore (length and width), stomata area, stomata complex area, stomatal conductance index and lowest was in Kagzi Kalan. Konkan seedless had highest stomata complex (length and width), and stomatal index. The PDI showed



significantly positive correlations with stomatal area (0.98), stomata pore length and width (0.96 and 0.95), stomata complex index (0.95), stomatal index (0.71) and stomata complex length (0.67).

OCCURRENCE OF CHICKPEA WILT CAUSED BY *FUSARIUM OXYSPORUM* F. SP. *CICERI* IN VINDHYAN PLATEAU ZONE OF MADHYA PRADESH

Ashish Shrivastava¹ and Rajmohan sharma²

¹Department of Plant Pathology, College of Agriculture, Ganjbasoda, (Madhya Pradesh), India

²Department of Plant Breeding and Genetic, College of Agriculture, Ganjbasoda, (Madhya Pradesh), India

Email: ashishshrivastava1971@gmail.com

Abstract

Chickpea (*Cicer arietinum* L) is one of the important *rabi* pulse crop grown in vindhyan plateau zone of Madhya Pradesh. The productivity of chickpea is lowered due to high incidence of wilt in Madhya Pradesh. *Fusarium oxysporum* f. sp. *ciceri* is one of the most destructive pathogens, causing wilt disease in chickpea and thereby inflicting accountable quantitative as well as qualitative losses. The survey studies indicated that, overall wilt incidence was comparatively higher in *rabi* (2018-2019) grown chickpea crop, as compared to that of *rabi* (2019- 2020) grown crop. In all the six districts of vindhyan plateau zone surveyed, the disease was found to be widely distributed and regular occurrence with moderate to severe incidence and it's average incidence was found maximum in the district of Sehore (17.87%) followed by Rajgarh (17.00%) and Bhopal (15.20%) districts in the years 2018-2019 and 2019-2020. The average incidence of wilt disease was found more in 2018-2019 (15.63%) as compared to 2019- 2020 (14.99%). Present study showed that chickpea wilt is highly distributed in all the surveyed areas of vindhyan plateau zone of Madhya Pradesh.

ASSESSMENT OF INFLUENCE OF NICRA INTERVENTIONS OF KVKs ON BENEFICIARIES' INTERMS OF THEIR KNOWLEDGE AND ADOPTION OF CLIMATE RESILIENT TECHNOLOGIES IN TELANGANA STATE

G. Acharitha and B. Savitha

Department of Agricultural Extension, College of Agriculture, Rajendranagar, Hyderabad.

Email: savitha.bogaram@gmail.com

Abstract

Climate change is a global issue now-a-days. It has shown impact mainly on agriculture, economy and livelihood of the developing countries like India. Climate resilient practices of NICRA (National Innovations on Climate Resilient Agriculture) project, is a strategy to increase farmers income as well as agricultural sustainability. The present investigation was conducted erstwhile Nalgonda and Khammam districts of Telangana State, purposively as NICRA interventions were implemented by KVKs in these districts. A total sample of 120 NICRA beneficiaries were selected for the study at the rate of 60 from each selected district by adopting random sampling method. *Ex-post facto* research design was used. In this study, an attempt was made to study the profile of the respondents and their relationship with dependent variables viz., Knowledge, Extent of Adoption and Improvement in Livelihood by calculating correlation coefficient (r) value. The results of correlation analysis of independent variables with Knowledge revealed that training undergone and information seeking behaviour had positive and significant relationship at 1 per cent level of significance. Education, risk orientation and innovative proneness showed positive and significant relationship at 5 per cent level of significance. Farming experience, occupational status, land holding, cropping intensity, achievement motivation, economic motivation, deferred gratification and attitude towards NICRA interventions were found to be non-significant. Age was found to be negatively significant. The results of correlation analysis of independent variables with Extent of Adoption found that innovative proneness had positive and highly significant relationship at 1 percent level of significance. Education, training undergone, risk orientation, economic motivation and attitude towards NICRA interventions had positive and significant relationship at 5 percent level of significance. Farming experience, occupational status, land holding, cropping intensity, information seeking behaviour and deferred gratification were non-significant. Age was found to be negatively significant. The results of correlation analysis of independent variables with Improvement in Livelihood inferred that economic motivation had positive and highly significant relationship at 1 per cent level of significance. Cropping intensity, risk orientation, achievement motivation, innovative proneness and attitude



towards NICRA interventions had positive and significant relationship at 5 per cent level of significance. Age, education, farming experience, occupational status, land holding, training undergone, information seeking behaviour and deferred gratification were found to be non-significant.

HOST RANGE STUDIES OF *ERYSIPHE CICHORACEARUM* CAUSING BHENDI POWDERY MILDEW

Ashwini R, AmareshY. S., Yenjerappa, S.T., Sunil Kulkarni, Shekhargouda Patil and S.G. Hanchinal

Department of Plant Pathology, University of Agricultural Sciences, College of Agriculture, Raichur

Email: ashupatil158915@gmail.com

Abstract

An attempt was made to know the host range of *Erysiphe cichoracearum* under glasshouse conditions. The host range study was conducted to know the survival ability of *E. cichoracearum* on different hosts in the absence of main host. This would help to locate the source of initial inoculum of the pathogen in the disease cycle and to develop suitable management strategies. Seventeen different crop plants consisting of cultivated field crops and weed plants were examined for their reaction to *E. cichoracearum* under artificial. It was noticed that, among the different crop plants tested, *E. cichoracearum* was found to infect and produce powdery mildew symptoms on cucumber, ridge gourd, black gram, green gram, cowpea and weed plants viz., *Parthenium hysterophorus* and *Euphorbia geniculata*. Initially, white powdery specks were observed on the infected leaves of these host plants later on as the disease progressed specks enlarged and the leaves were covered with white powdery mass of the fungus. The period between inoculation and appearance of symptoms on cucumber, ridge gourd, black gram, green gram, cowpea *Parthenium hysterophorus* and *Euphorbia geniculata* was seven, seven, ten, ten, ten, eight and nine days respectively. The crop plants which were inoculated and did not show the powdery mildew symptoms included cotton, fenugreek, pigeon pea, chickpea, chilli, cluster bean, coriander, *Alternentra sessalis*, *Euphorbia hirta* and *Phyllanthus niruri*.

BIOPROSPECTING OF *GARCINIA XANTHOCYMUS* HOOK. F.: AN UNDERUTILIZED AND NEAR-THREATENED FRUIT SPECIES.

Ph. Baleshwar Sharma

College of Agricultural Engineering and Post-Harvest Technology, (Central Agricultural University, Imphal)
Ranipool-737 135, Sikkim, India.

Email: bale_sharma@yahoo.com; bale22sharma@gmail.com

Abstract

Garcinia xanthocymus Hook. f. is a medium-sized evergreen tree whose fruit is known as gamboge. It is sporadically distributed in the moist sub-tropical forests at an altitudinal range of about 700-900 m. The ripe fruit is eaten raw and used as jams and jellies. The deep yellow color of the fruit is used for dyeing fabrics and can be used as a food color. It is used in various folk medicines such as bark extract for liver and abdominal complaints, and seeds for laxatives and gastrointestinal disorders. Several derivative compounds of benzophenones, bioflavonoids, triterpenes, and xanthenes were reported in the fruit with well-documented bioactivities, such as antioxidative, antileukemic, antitumor, antiulcer, antimicrobial, antihepatotoxic, analgesic, and depressant properties. The species in Manipur is facing alarming threats due to the loss of natural habitats, and failure of seedling formation due to various physiological and environmental factors. A study was thus conducted for the conservation and propagation of the species. The seed was found to be recalcitrant (moisture content, ca. 35 %) and desiccation sensitive. The seedling pattern exhibited both primary root and adventitious tap root systems. Through tissue culture, axillary shoots initiated from the nodal segment responded to a viable means of micropropagation. Woody plant medium supplemented with benzyl adenine (3 mg/l) gave the maximum response of axillary bud initiation and multiplication. Root induction was responded to in half-strength WPM supplemented with 2 mg/l NAA. To ensure the genetic stability of the tissue culture plantlets, clonal fidelity was checked by specific 12 ISSR primers. The average scorable bands per primer were found to be 7.91, out of which 7.41 were monomorphic and 0.5 was polymorphic. ISSR profiles generated indicated a uniform pattern among the TC plantlets with its mother plants. This technique can be used for conservation and needful propagation for bioprospecting.



MARKETING ANALYSIS OF APPLE FARMING IN HIGH HILLS OF HIMACHAL PRADESH

Bharti¹, P.K. Mahajan² and Smriti Bansal²

¹ICAR- Indian Agricultural Statistics Research Institute, New Delhi

²Dr YSP University of Horticulture and Forestry Nauni – Solan, HP

Email: bharti.bharti@icar.gov.in

Abstract

Apples are the most important temperate fruit crop in North Western Himalayan region of India. Although, these areas do not fall in the true temperate zone of the world, yet the prevailing temperate climate of the region is suitable for apple farming due to high altitude and heavy snowfall, which help to meet chilling requirements of the apple. Marketing is the process of transferring goods from producers to consumer at the appropriate time, place and form. The marketing pattern of apple is a complex phenomenon and any carelessness at any stage in the marketing channel will result in lower prices. The produce is first sent to the terminal market before being distributed to the primary and secondary markets and thus involving a large number of intermediaries. In present investigation, an attempt was made to analyse the marketing aspect of Apple crop in Shimla district of Himachal Pradesh. Multistage random sampling technique was employed for the selection of units. The primary data on various aspects of production and marketing of apple were collected from the selected households using well designed schedules by adopting a personal interview method. Marketing efficiency was examined and retailers channel (Channel V) was found to be most efficient, followed by the commission agents channel (Channel III). It leads to a conclusion that if there are fewer intermediaries in the route, marketing efficiency will be higher.

MOLECULAR CHARACTERIZATION OF *SALMONELLA* TYPHIMURIUM FROM DIVERSE SOURCES

Blessa Sailo*, N. Grihalakshmi Devi, Chongtham Sonia, Menalsh Laishram and Lalmuankimi

Animal Science Section, ICAR Research Complex for NEH Region, Imphal, Manipur-795004, India.

*Email: drblessavet@gmail.com

Abstract

A total of 208 *Salmonella* Typhimurium isolates from diverse sources (Chicken meat=69, Pork meat=15, Beef=5, Poultry caecal contents=43, Poultry blood=9, Poultry droppings=26, Chicken egg=4, Poultry diarrhoea=17, Pig faeces=5, Cattle faeces=2, Raw milk=8, Green chilly=1, Tap water=2, Mastitic milk=1, and Sewage=1) collected between the year 2015 to 2020 were characterized for their *bla*_{ESBL}, virulence genes and other resistant genes respectively. A total of 81 isolates (38.94%) were confirmed as *bla*_{ESBL} producers, where, isolates 78 (96.29 %) for *bla*_{TEM}, 22 (27.16 %) for *bla*_{CTX-M}, and 3 isolates for *bla*_{SHV} were positive for *bla*_{ESBL} genes. Other antibiotic resistant and virulent genes tested revealed, *aac*(6')-Ib (n=11), *aac*(3)-IIa (n=13), *tetA* (n=17), *tetB* (n=8), *sulA* (n=13), *qnr* (n=7), *int* (n=44) and *SpvC* (n=11). Antibiotic sensitivity test of all the isolates revealed that 133 (63.94 %) isolates were resistant to cefotaxime, and 177 (85.09 %) isolates were susceptible to tetracycline. Genotyping using Enterobacterial Repetitive Intergenic Consensus-Polymerase Chain Reaction (ERIC-PCR) of the *bla*_{ESBL} isolates showed a distinct and similar clonality.

MODULATION OF SUPEROXIDE DISMUTASE AND ASCORBATE PEROXIDASE WITH EXOGENOUS SPERMINE UNDER SALINITY INDUCED OXIDATIVE STRESS IN WHEAT (*TRITICUM AESTIVUM* EM THELL.)

Midathala Raghavendra¹, Dommalapati Sudhakara Rao^{1*}, Naresh Kumar¹, Shashi Madan¹, Renu Munjal² and Gadelli Ramesh³

¹Department of Chemistry and Biochemistry, CCS HAU, Hisar-125 004, Haryana

²Department of Genetics and Plant Breeding, CCS HAU, Hisar-125 004, Haryana

³Department of Statistics, Mathematics and Computer Applications, ANGRAU-Agricultural College, Rajamahendravaram

Email: sudhakara.raobio@gmail.com

Abstract

Soil salinity is a serious concern in arid and semi-arid regions that impairs yield potential of cereal crops. The present research



experiment was conducted in pot culture with four wheat varieties viz. DBW 88, HD 3086, Kharchia 65 and KRL 210 with two different salinity conditions such as 8 dSm⁻¹ and 12 dSm⁻¹. Spermine (spm) treatments at concentrations of 0.5 and 1.0 mm were given at 21 and 90 days after sowing (DAS). Antioxidant enzymes such as superoxide dismutase and ascorbate peroxidase were measured in wheat flag leaves at 0, 5, 10 and 15 days after treatment (DAT) with spermine. At 21 DAS superoxide dismutase (SOD) activity of 9.20 units g⁻¹ FW was observed at 12 dSm⁻¹ and highest SOD activity was observed with spm of 0.5 mm than spm 1.0 mm at 10 DAT. At 90 DAS, the highest SOD activity of 14.50 units g⁻¹ FW observed with 1.0 mm of spm at 12 dSm⁻¹ salinity. The SOD activity was highest in Kharchia 65 and lowest in DBW 88. At 21 DAS, low ascorbate peroxidase (APX) activity was noticed in DBW 88 and HD 3086 at 8 dSm⁻¹ and higher activity was recorded in Kharchia 65 and KRL 210 at 12 dSm⁻¹. Spm treatment increased APX activity, and it was higher at 10 DAT in Kharchia 65. At 90 DAS, APX activity decreased at 12 dSm⁻¹ in DBW 88 and was increased in Kharchia 65 and KRL 210. Spm treatment on salt stressed plants was found to be effective at 5 and 10 DAT.

STUDIES ON THE EFFECT OF DIFFERENT LEVELS OF DRIP IRRIGATION AND PLASTIC MULCH ON GROWTH, YIELD AND WATER USE EFFICIENCY OF CAULIFLOWER (*BRASSICA OLERACEA* VAR. *BOTRYTIS*)

Daleshwar Rajak¹, Gondra Mardi², Prasad Pradeep³ and Nazurssalam⁴

¹Agricultural Engineering, Zonal Research Station, Darisai (BAU), Barakurshi, East Singhbhum, Jharkhand-832304

²Plant Protection, K.V.K., East Singhbhum, Jharkhand

³Agronomy, Zonal Research Station, Darisai (BAU), East Singhbhum, Jharkhand

⁴Entomology, Zonal Research Station, Darisai (BAU), East Singhbhum, Jharkhand

Email: drajak76@rediffmail.com

Abstract

A field experiment was conducted on sandy loam during rabi season of 2019-20 to 2020-21 at Zonal Research Station, Darisai, East Singhbhum, Jharkhand to study effect of different levels of drip irrigation and plastic mulch on growth, yield and water use efficiency of cauliflower (*Brassica oleracea* var. *botrytis*). The experiments were laid out in randomized block design with eight treatments viz; T₁- drip irrigation with 100% ET (Evapo-transpiration), T₂- T₁ + silver black polyethylene mulch, T₃- drip irrigation with 80% ET, T₄- T₃ + silver black polyethylene mulch, T₅- drip irrigation with 60% ET, T₆- T₅+ silver black polyethylene mulch, T₇- surface irrigation, T₈- T₇ + silver black polyethylene mulch and were replicated thrice. The experiment revealed that higher yield (255.83 q/ha) was recorded in treatment T₄- Drip irrigation at 80% ET + Silver black polyethylene mulch with maximum plant height, plant spread and diameter of curd and was significantly superior over rest treatment. The water use efficiency of 142.01 kg/ha/mm was recorded in drip irrigation at 80% ET+ Silver black polyethylene mulch. The maximum net income (193764.68 Rs/ha) and benefit-cost ratio (3.12) was also noted in T₄- Drip irrigation at 80% ET + Silver black polyethylene mulch and minimum net income (Rs 75818.50/ha) and benefit cost ratio (1.77) was recorded in T₇- Surface irrigation.

ASSESSING EFFECTIVENESS OF DEFOLIATION FOR INDUCING OFF-SEASON FLOWERING IN SUGAR APPLE IN EASTERN TROPICAL REGION OF INDIA

Deepa Samant* and Kundan Kishore

ICAR-IIHR-Central Horticultural Experiment Station, Bhubaneswar-751 019, Odisha

*Email: horti.deepa@gmail.com

Abstract

Of late, the sugar apple (*Annona squamosa* L.) is gaining due importance in Indian horticulture by virtue of its hardy nature, wide adaptability, delicious taste, and nutritional and processing values. However, the problem of low fruit set is creating hurdles in expanding its area under commercial cultivation. In sugar apple, the period of flowering is very long. Under Odisha's hot and humid climate, flowering commences in March and continues up to June with a peak in April-May (65-70%). The peak flowering season coincides with the period of stress characterized by high air temperature and low moisture content in the soil profile. This natural period of stress is one of the major causes of poor fruit set, dropping of flowers and fruits, and low yield of substandard quality because abiotic stress not only interferes with the various factors of pollination (stigma



receptivity, pollen production, pollen viability, and pollen germination) but also creates hormonal imbalance (low auxins and gibberellins, high ethylene and abscisic acid) in the plant. Since sugar apple bears flowers on the new shoot, the problem of low fruit set in sugar apple could be managed by defoliating the plants in October and inducing off-season flowering in relatively cooler months (November-January). Therefore, a field experiment was conducted at the Central Horticultural Experiment Station, Bhubaneswar, Odisha during 2019-21 on a six-year-old sugar apple orchard of variety 'Arka Neelachal Vikram' spaced at 5 m x 5 m to evaluate the efficacy of some chemicals for crop regulation. The experiment was laid out in a randomized block design with 14 treatments consisting of ethephon (200, 400, 800, and 1200 ppm), KI (1, 2, and 3 %), NAA (250, 500, 750, and 1000 ppm), and urea (5, 10, and 15 %). Though the application of KI (1-3 %), urea (5-15 %), and ethephon (1200 ppm) were effective in inducing defoliation, the new shoots that emerged after defoliation could not maintain their growth and abscised with the onset of the natural period of leaf shedding (December-January). New shoot growth on manually defoliated plants followed a similar phenomenon of abscission during winter. Therefore, it could be concluded that both chemical and manual defoliation are ineffective for inducing off-season flowering in sugar apple under Bhubaneswar conditions.

CONSTRUCTION OF SURVEY WEIGHTED FOOD CONSUMPTION INDEX

Deepak Singh¹, Pradip Basak², Raju Kumar¹ and Tauqueer Ahmad¹

¹ICAR-Indian Agricultural Statistics Research Institute

²Uttar Banga Krishi Viswavidyalaya, Cooch Behar, West Bengal, India

Abstract

An index is constructed when variables are assembled into a single index on the basis of a basic model. Normally, the indices are constructed based on simple average/weighted average method which does not consider the effect of multicollinearity among the variables used for index construction. In addition to this, generally, the index developed using survey data does not incorporate the survey weights which leads to erroneous ranking of the survey units like household, district etc. Therefore, a Survey Weighted Food Consumption Index has been developed which incorporates the available survey weights information and removes the effect of multicollinearity among variables. The food consumption index has been developed using the "household consumer expenditure" surveys of National Sample Survey (68th round) data on twelve variables related to household expenditure on twelve food items like cereals, pulses, milk, egg etc. Ranking of the states of India has been done on the basis of the constructed food consumption index and it has been found that there is significant improvement in the ranking of the states in terms of food consumption in comparison to the existing indices. The developed methodology for construction of food consumption index has also been evaluated empirically through a simulation study and the results are found to be satisfactory.

ASSESSMENT OF ZERO TILLAGE TECHNOLOGY IN WHEAT AND LENTIL THROUGH ON FARM DEMONSTRATIONS : EVIDENCES FROM GAYA, BIHAR

Dhiraj K. Singh¹, Abhay Kumar¹, Ujjwal Kumar¹, M. Monobrullah¹, Rakesh Kumar¹, R.K. Raman¹ and Rajeev Singh²

¹ICAR Research Complex for Eastern Region, Patna-800014, Bihar, India

²Krishi Vigyan Kendra, Manpur, Gaya East Champaran-823003, Bihar, India

Email: dhirajextension@gmail.com

Abstract

Conservation of Natural resources is key to sustainable development of agriculture sector in India. Zero tillage technology is a proven method for soil and water conservation along with additional benefit of labour saving. Current study was conducted in five selected villages of Gaya district of Bihar to assess the impact of zero tillage in productivity and profitability of wheat and lentil crop. Large scale demonstrations on zero tillage wheat and lentil were laid out at farmers' field during rabi season in the year 2019-20, 2020-21 and 2021-22 under climate resilient agriculture programme. Quality seed of wheat (Var. HD-2967) and lentil (var. HUL-57) were provided to farmers along with other necessary inputs like weedicides and pesticides. Planting was done using zero tillage machine and technology backstopping as well as monitoring was done time to time. Observations on yield and income of both demonstration plots and local check were taken for all three years and averaged to make comparison.



Results revealed that average yield of zero tillage wheat was 4.42 t/ha which was 14.5% higher than control plot. In case of zero tillage lentil, grain yield was recorded at 1.12 t/ha, 20.4% higher than control plot. Comparison was also made on the basis of net income generated from zero tillage wheat and traditional practice. It was observed that net return was 36.4% higher in zero tillage wheat. This was due to both higher yield and reduction in cost of cultivation under zero tillage technology. Thus, zero tillage technology coupled with quality seeds of high yielding varieties are beneficial to farmers and need to be popularized for large scale adoption.

CUMULATIVE INTERACTION OF SILICON AND 24-EBL IN MITIGATING LEAD METAL TOXICITY IN FENUGREEK (*TRIGONELLA FOENUM-GRÆCUM* L.) PLANTS

Dhriti Sharma

School of Bio-Engineering and Bio-Sciences, Lovely Professional University, Phagwara, Punjab

Email: sdhriti.311@gmail.com

Abstract

Heavy metals (like Cd, Pb, Ni, Fe, Zn, As, etc.) reside naturally in the soil and water in greater proportions than in the atmosphere. However, anthropogenic interventions like urbanization and industrialization, have escalated their levels in the entire biosphere. Some of the heavy metals are considered essential for plant metabolism in minimal concentrations as they take part in redox reactions and enzyme activation, and quite aptly termed as micronutrients. But they turn toxic in excess, contributing in the defiling of environment plus negatively impacting the health of plants and human beings. Plants, in particular, face the heavy metal toxicity when their roots uptake these metals from the contaminated soil or the metal ions simply get deposited onto their leaves. Such stressed plants show reduction in biomass and growth along with major alterations in their metabolic reactions. Severe agricultural losses are incurred by a country's economy if crop plants, specifically, get subjected to this heavy metal contamination. Lead (Pb), is one such heavy metal, which is evaluated to be the second major hazardous metal in the "Substance Priority List" released by the US public health agency ATSDR (Agency for toxic substances and disease registry) in 2017, on account of its ubiquitous distribution and lethality. Though the plants resort to a diverse range of defensive strategies to battle out Pb induced toxicity but these defensive strategies fall short of their efficacies under prolonged stress conditions, therefore a variety of other external procedures are opted for. Therefore, in this research work, the monitoring of ameliorative effects of exogenously supplemented phytoprotectants Silicon and Brassinosteroids (24-EBL) (individually as well as in combination) on Lead (Pb) induced toxicity in *Trigonella foenum graecum* L. plants in terms of morphological and biochemical aspects have been experimentally worked out.

NEPALESE FISHERIES AND AQUACULTURE IN THE FACE OF CLIMATE CHANGE

Dilip Kumar Jha

Department of Aquaculture, Faculty of Animal Science, Veterinary Science and Fisheries, Agriculture and Forestry University, Rampur, Chitwan, Nepal

Email: dkjha.ait@gmail.com, dkjha@afu.edu.np

Abstract

Climate change is an alteration in the normal distribution of weather over periods of time that range from decades to millions of years and it may be limited to a specific region or may occur across the world. In an aquatic system climate change is affecting the biological processes and the productivity of fish species. The consequences for sustainability of fisheries and aquaculture and the people that depend on them, are uncertain. It is now generally accepted that warming of the climate system is unequivocal, as evidenced from global increases in: average air and ocean temperatures; melting of snow and ice; and average sea levels. Unavailability of the proper amount of water may create problems in the near future. The fluctuation of minimum downstream release is found as the major cause for declining fish diversity. More anthropogenic disturbances and project structures are found creating impact on extinction of several protected species. Nepal, a landlocked mountainous country is blessed with a number of watersheds with different altitudinal variations from 60m-8848m represents a total of 252 fish species. Among them 236 species are indigenous while 16 species are exotic. These species belong to 15 orders, 40 families and 120 genera. Carps are the major fishes cultivated in Nepal. Aquaculture has great potential for future expansion. Inland capture fisheries and aquaculture are supported by the diverse agro ecological zones providing suitable habitat for



different fish species which contributed 4.22% and 1.59% of the agriculture GDP and National GDP respectively. Annual fish production of Nepal is 104623 metric tons with the contribution of 83623 metric tons from aquaculture and 21000 metric tons from the inland capture fisheries, indicating per capita fish production 3.43 kg only. There is a need for a collaborative approach among different nations to cope with climate-related disasters.

EFFECTS OF BOVINE SERUM ALBUMIN DURING PRESERVATION OF BOAR SEMEN AT 17°C

Murasing D.K.¹, Lalrintluanga K.¹, Ahmed F.A.¹, Talukdar D.J.¹ and Sharma M.²

¹CVSC&AH, CAU, Selesih, Mizoram, ²CVASc, GBPUAT, Uttarakhand

Email: ghanumurasing8794@gmail.com

Abstract

Bovine serum albumin (BSA) has been reported to improve sperm quality, primarily by enhancing sperm motility, viability, membrane integrity, and acrosome integrity. In this study, crossbred (75 % Large White Yorkshire x 25 % Zovawk – the indigenous pigs of Mizoram) boars' semen samples were collected and diluted with GEPS extender containing different concentrations (control, 5, 10, and 15 %) of BSA at 0, 24 and 48 hours of preservation and recorded for sperm motility, percent live sperm, membrane integrity, and acrosome integrity. The results revealed that the sperm parameters improved ($P < 0.01$) on supplementation of BSA compared to the control. Interestingly, the sperm motility, percent live sperm, membrane integrity and acrosome integrity were higher ($P < 0.01$) with 10% BSA conc. followed by 5%, 15% and the control groups, up to 48 hours of preservation at 17°C. Taken together, these results suggested that BSA had a positive role in the regulation of crossbred boar sperm quality.

ROOT ARCHITECTURE PHENOTYPING FOR SCREENING MAIZE LINES TOLERANT TO WATERLOGGING

E. Lamalakshmi Devi^{1*}, Krishnappa R², Ayam Gangarani³, Harendra Verma⁴, Konsam Sarika⁵,
B.U. Choudhury², R. Laha¹, Chongtham C. Meetei¹ and V. K Mishra²

¹ICAR-RC-NEH Region, Sikkim Centre, Tadong, Sikkim, India;

²ICAR RC NEHR, Umiam, Meghalaya, India,

³ICAR RC NEHR, Tripura centre, Lembucherra, Tripura,

⁴ICAR RC NEHR, Nagaland centre, Medziphema, Nagaland,

⁵ICAR RC NEHR, Manipur centre, Lamphelpat, Manipur

*Email: elanghamlama@gmail.com

Abstract

North- Eastern regions of India are often exposed to adverse climatic conditions like flood, drought, cold, soil acidity, etc. The seedling and flowering stages are considered as the most critical period affected under waterlogged conditions. In maize, it is promising to manipulate RSA towards distribution of roots to optimize water and nutrient uptake under stressful condition. Keeping in view the existence of different local landraces of maize adapted in highly rainfall areas of the region, the present study was undertaken to phenotype and screen the diverse landraces of maize collected from different parts of North-Eastern region of India based on root architecture for their tolerance to waterlogged condition both, at seedling and flowering stages. A total of 20 local landraces of maize collected from different parts of NE India were used for the present study. The evaluation of landraces for waterlogging tolerance at seedling and flowering stages was undertaken separately under two different experimental set ups i.e., microcosm (pot) experiment and field experiment conducted at Lamphelpat farm of ICAR-RC-NEH Region, Manipur Centre during 2018-20. For screening at the seedling stage, all the pots were filled with water to a level of 4-5 cm above the soil surface at 6-8 leaf stage and the water level was maintained for 15 days continuously. The "Response Coefficient" (RC) as phenotypic plasticity index and Waterlogging Tolerance Index (WTC) were calculated using the formula as given below :

$$RC = V_C/V_T$$

Where, V_C and V_T are the average values of traits obtained under control and treatment (waterlogging) conditions.



If the RC value is equal to 1, it has indicated no response to the treatment; while RC>1 and RC<1 indicated the tolerance and susceptibility to the treatment, respectively.

WTC = Mean value of treatment/Mean value of control

For screening under field condition, artificial flooding was provided at the time of flowering to a depth of 20-25 cm above the soil surface continuously for 10 days and data are recorded based on maize Shovelomics. For the root length ratio, most of the genotypes used in the present study have showed RC value less than 1, which indicated that most of the genotypes showed adaptive nature towards WL stress for this particular trait. The genotype RCM-13-19 showed the highest WTC (5.28) for the root length ratio and for root mass ratio the maximal WTC was exhibited by RCM-45-19 (5.01). For the trait root:shoot ratio the genotype RCM-45-19 showed highest value of WTC (8.47) followed by RCM-26-19 (3.22) and RCM-3-19 (3.10). The visual scoring of root traits studied under artificial flooding for continuously 10 days at flowering stage exhibited the score range of numbers of above-ground whorls occupied with brace roots (BW) from 0-6 with RCM-34-19 recording the highest score. In case of the trait number of brace roots (BO), the score varied from 0-9 with RCM-1-19 and RCM-47-19 obtaining the highest score. For the traits, the branching of brace roots (BB) and the numbers of crown roots (CN), the score varied from 0-8.0 and 4.5-8.0, respectively. RCM-21-19 and RCM-31-19 have recorded the maximum score for BB while RCM-1-19 and RCM-16-19 witnessed the highest score for CN. For the traits angles (CA) and branching (CB) of crown roots, the score varied from 4.0-7.5 and 5.0-8.0, respectively. The highest score for CA was found in RCM-34-19. For CB, the score was the highest in genotypes like RCM-11-19, RCM-9-19 and RCM-1-19. Some promising lines having high visual score for different root traits under WL condition were RCM-11-19, RCM-34-19, RCM-1-19, RCM-13-19, RCM-12-19 and RCM-26-19. The genotype RCM-8-19 showed the lowest score for root characters, showing its susceptible nature to WL.

CASTOR INSECT PEST'S DYNAMICS IN RELATION TO THE WEATHER PARAMETERS OF SOUTHERN TELANAGANA ZONE

G. Madhuri^{1*}, V. Divya Rani¹, K. Sadaiah¹, G. Neelima¹, N. Nalini¹ and P. Duraimurugan²

¹Regional Agricultural Research Station, PJTSAU, Palem, Nagarkurnool District-509 215, Telangana

²ICAR-Indian Institute of Oilseeds Research, Rajendranagar, Hyderabad-500030, Telangana

*Email: madhurigorege01@gmail.com

Abstract

Castor (*Ricinus communis* L.) is an important non-edible oilseed crop grown in arid and semiarid regions. Castor is grown in areas where mean monthly temperature across the growing season ranges from 22.7 to 34.3 °C. These temperatures are favorable for the castor insect pests. More than 60 species of insects and mites were reported to cause damage to the castor crop and the yield losses were estimated to be about 40-89%, to explore the population fluctuation pattern of insect pests on castor in relation to the weather parameters a field experiment was carried out during *khari*f, 2020 at Regional Agricultural Research Station, Palem. The relationship between pests and weather parameters revealed that leafhoppers have shown positive significant association with maximum temperature ($r=0.48$) and negative significant with minimum temperature ($r=-0.59$), evening relative humidity ($r=-0.56$) and rainfall ($r=-0.60$). Thrips has negative significant association with rainfall ($r=-0.65$). Semilooper has a positive correlation with maximum temperature ($r=0.17$). *Spodoptera litura* exhibits positive significant relationship with maximum temperature ($r=0.24$), Percent capsule damage by capsule borer had a negative significant relation with maximum temperature ($r=-0.49$) and minimum temperature ($r=-0.55$).

INFORMATION SEEKING BEHAVIOUR OF DAIRY FARMERS UTILIZING DIGITAL AND TRADITIONAL SOURCES OF INFORMATION IN ANDHRA PRADESH

Mithun G*, Triveni G, Sharma G.R.K, and Ravindra Reddy Y.

Department of Veterinary and Animal Husbandry Extension Education, College of Veterinary Science, SVVU Tirupati. 517502

*Email : urstrulymithun1432@gmail.com

Abstract

Information and communication technologies (ICT) have the potential to act as an efficient medium for disseminating information and aid dairy farmers and other stakeholders stay connected over time. The objective of this study was to



investigate the information-seeking behavior and other socio-economic characteristics of dairy farmers who utilized various information sources. The districts with the highest milk production in each region of Andhra Pradesh were chosen for this research. Two mandals and one village were chosen at random from each of the three districts (Visakhapatnam, Prakasam and Chittoor). Based on the extent of exposure to both traditional and digital media, twenty dairy farmers from each chosen village were selected and divided into two groups of ten. Farmers who predominantly use WhatsApp and YouTube for information were placed in the digital media group, while others were placed in the traditional media group. 60 traditional media farmers and 60 digital media farmers constitute the sample. The findings revealed that approximately 65 percent of the digital media group and 26.67 percent of traditional media group farmers had medium personal cosmopolite sources of information, 48.33 percent of digital media and 13.33 percent of traditional media group farmers had high impersonal cosmopolite sources of information, and cent percent of digital media and traditional media group farmers had medium personal localite sources of information. When overall information-seeking behavior is considered, almost 28.33 percent of digital media farmers and 5 percent of traditional media group farmers had high information-seeking behavior. Based on the findings, educated and literate farmers are more acquainted with digital media and therefore exhibit a higher information-seeking behavior, whereas illiterate and less educated farmers are less comfortable with digital media and still rely on traditional information sources. This research delves deeply into the information-seeking behavior of Andhra Pradesh's dairy farmers and how they relate to farmers' educational levels, which in turn facilitates the dissemination of information via chosen media.

CHARACTERIZATION OF ISOLATES FOR THEIR NUTRIENT SOLUBILIZATION ACTIVITY AND COMPATIBILITY TO DEVELOP A CONSORTIUM

Geeta Kumari^{1*}, Aman Jaiswal¹, Dinki Jamatia¹, Viabhav Kr. Upadhyay¹ and Navnit Kumar²

¹Department of Microbiology, CBS&H, RPCAU, Pusa, Samastipur, Bihar

²Department of Agronomy, SRI, RPCAU, Pusa, Samastipur, Bihar

*Email: geetasri.kumari5@gmail.com

Abstract

PGPR is a community of root – colonizing bacteria that found in the root of several plant species, and have the ability to maintain root health and promote nutrient uptake and environment stress tolerance which improve plant growth and commercial yield. In the present study a total of 19 PGPR-based bacterial isolates viz. six *Bacillus* spp. (BS1, BS2, BS3, BS4, BS5, BS6), four *Azotobacter* spp. (AZT1, AZT2, AZT3, AZT4), nine *Rhizobium* spp. (RZM1, RZM2, RZM3, RZM4, RZL1, RZL2, RZL3, RZL4, RZP1) were taken from the stock culture of the Microbiology department, CBS&H, Pusa. These PGPR isolates were tested for their ability to solubilize nutrients, specifically phosphorus, zinc, siderophore synthesis, and IAA production. Out of 19 bacterial isolates, 5 isolates i.e. AZT4, BS2, BS5, RZL1, RZM2 were found promising one and were further used for developing PGPR consortium. It was found that all the 5 promising one were compatible with each other. The developed consortium was screened for plant growth promoting characters and found the PGPR consortium showed PSI – 3.82, ZnSI – 3.45, siderophore production efficiency - 267 % IAA – 122 µg mg⁻¹ protein of IAA production. Hence, a single formulation containing consortium of agriculturally beneficial microorganisms could be an excellent multifunctional biofertilizer for sustainable agriculture. Future studies should include field trials, in order to improve the growth and performance of pulse crop the developed consortium of *Rhizobium* + *Bacillus* + *Azotobacter* can be used as a (biofertilizer) for the soil of North Bihar state.

STUDIES ON INOCULATION OF *MESORHIZOBIUM* FOR ENHANCING THE NODULATION AND GRAIN YIELD OF CHICKPEA

Geetanjali Kamble¹ P.S. Wakte² and G. K. Giri³

¹Microbiology, Pulses Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, M.S.

²Department of Microbiology, DSM College, Parbhani, M.S.,

³Department of Plant Pathology, Dr. P.D.K.V, Akola-444 104, M.S.,

Email: gitakola09@gmail.com

Abstract

A field experiment was carried out during *kharif* 2017-18 at Pulses Research Unit, Dr. Panjabrao Deshmukh Krishi



Vidyapeeth, Akola (M.S.) to evaluate the performance of various *Mesorhizobium* on nodulation and grain yield of Chickpea (JAKI-9218). The *Mesorhizobium* were isolated from saline track of Purna River from Vidarbha regions of the India. The experiment comprising of thirty-three treatments including uninoculated control. The experiment was laid out in randomized block design with three replications. The carrier-based cultures of *Mesorhizobium* were inoculated @ 25 g/kg seed. The seed inoculation with *Mesorhizobium* (ACR-10) isolate resulted in higher grain yield (1579 kg/ha) and maximum nodulation (28.33 nodules /plant) among all the treatments.

PREVALENCE OF ASCOCHYTA BLIGHT OF CHICKPEA (*CICER ARIETINUM* L.) IN BUNDELKHAND REGION OF UTTAR PRADESH AND ITS MANAGEMENT IN STANDING CROP CONDITIONS

Utkarsh Upadhyay¹ and Durga Prasad^{2*}

¹Department of Plant Pathology, College of Agriculture, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur-208002 (U.P.), India

^{2*}Department of Plant Pathology, College of Agriculture, Baytu-344034, Agriculture University, Jodhpur, Rajasthan, India.

Email : dp.coabaytu@gmail.com

Abstract

The chickpea (*Cicer arietinum* L.) is well adopted crop in Bundelkhand region due to limited use of soil moisture and nutrients more efficiently than cereals. About 50% of the total chickpea production of the state is produced from this region. It is the third most important food legume in the world and the major source of protein in human diets. It maintains soil fertility through biological nitrogen fixation, and contributes to the sustainability of cropping systems. This crop is affected by fungi, bacteria, viruses, nematodes and abiotic stresses. Ascochyta blight disease caused by *Ascochyta rabiei* is one of the most important fungal diseases of chickpea. The investigations were conducted during two cropping seasons i.e. Rabi 2020-2021 & 2021-22 (October to March) to find out the occurrence of Ascochyta blight disease in 4 districts of Bundelkhand region of Uttar Pradesh and its fungicidal management in standing crop conditions. The survey result revealed that the Maximum disease severity (17.50%) of Ascochyta blight was recorded in Mahoba district followed by 17.05% and 16.67% obtained in Chitrakoot and Banda districts, respectively. The least severity (15.82%) of Ascochyta blight was noticed in Hamirpur district. Out of 5 fungicides viz., three levels of combination of Tebuconazole + Trifloxystrobin, Tebuconazole, Trifloxystrobin, Chlorothalonil and Sulphur evaluated against Ascochyta blight disease of chickpea under field conditions; spray of combination of Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.1% gave the maximum reduction in disease incidence (47.05%) and disease severity (63.86%) along with maximum enhancement in grain yield (35.4%), pod per plant (55.56%) and 100 grain weight (62.28%) followed by its spray @ 0.08% and spray of Tebuconazole @ 0.1%, respectively. Among the all 5 fungicides, spray of Sulphur 80%WP was found to be least effective to reduce the Ascochyta blight as well as to increase the yield and its components.

CONSTRUCTION AND EVALUATION OF COST EFFECTIVE GUARDED HOT PLATE ANALYZER WITH NATURAL FIBER REINFORCED BIO-COMPOSITES FOR MEASUREMENT OF INSULATION PROPERTIES

Gorla Gayathri and Jayant Singh

College of technology, G.B. Pant University of Agriculture and Technology, Pantnagar,
U.S. Nagar 263 145, Uttarakhand, India.

Email: gorlagayathri004@gmail.com

Abstract

A cost-effective guarded hot plate (GHP) apparatus that uses a heater element with PID control and thermocouples to measure heat flux through samples was constructed of inexpensive materials. The apparatus can be used for thermal conductivity measurements range from 70 to 450 °C and calibrated with reference materials like glass wool based on the standards. This instrument was created to assess the insulation characteristics (thermal conductivity, specific heat and thermal diffusivity) of bio composites which were used in the many engineering applications that consists of natural fibers and fillers embedded in a resin matrix. In the current study, bio composites were made with three distinct kinds of natural fibers (bamboo, banana, and



coir) at three different compositions (4%, 8%, and 12%) in general purpose polyester resin matrix and they were then tested using GHP apparatus. In comparison to bamboo and banana composites, and the coir composites have medium K-values when statistically examined. The thermal conductivity (K) was lower for 12% bamboo composites with 0.048 W/mK, higher for 4% banana composites with 0.0744 W/mK, and intermediate for the remaining 6% of composites. 4% banana composites had a high specific heat (1188.31 J/kg.K), while 12% coir composites had a low specific heat (804.33 J/kg.K). The thermal diffusivity was found to be high for 4% banana (0.0698 m²/s) and low for 12% coir composites (0.302 m²/s). Conductivity, diffusivity, and specific heat all linearly decline as fibre loading in the matrix rises to 12%. According to the data, all bio composites were insulating materials and could be applied in a variety of techniques depending on the situation.

ELECTRONICALLY ASSIST PRECISION SEED METERING DEVICE

Gourav Sahu¹, Uttam Kumar¹ and ²Vikas Pradakar

¹Birsa Agricultural University, Ranchi, Jharkhand

²Scientist, Mahatma Gandhi Integrated Farming Institute, Motihari Bihar

Email: gouravsahu007@gmail.com

Abstract

Mechanically assists seed metering devices currently performing efficiently and are a good solution to the problem of metering rates as seed is planted, but there are many problems such as seed missing, multiple and uniformity of seed spacing along and across the rows. The seed metering void could be filled with a substantial change to the metering unit. Electronically assist seed metering and singulation devices can tackle many of the inefficiencies experienced in a mechanically driven seed metering device and have the potential to increase productivity and yield. This research involves the process of designing, developing, and testing the feasibility of an apparatus used to precision place single seeds in a furrow during a planting operation. The metering unit consist of a linear solenoid metering device, forward distance sensing device, and microcontroller. The solenoid was actuated by an electronic device to forth movement and back movement being accomplished by a spring. The seed was picked by holes provided in seed metering device. An electronic device was developed to trigger forward distance sensing device and the solenoid. This prototype gives a uniform seed spacing and singulation.

ANALYSIS OF THE PRODUCTION AND PRODUCTIVITY TRENDS FOR PUNJAB'S MAIN CROPS

Gurleen Kaur, Sreethu S. and Vandna Chhabra

Department of Agronomy, Lovely Professional University, Phagwara-144411, Punjab

Email: gurleenrandhawa15@gmail.com

Abstract

Among the Indian States, Punjab is particularly proud of itself for its great contributions to agricultural growth. The total land area of Punjab is 5.036 m ha with 82% of net sown area. Despite comprising just 1.54 percent of the nation's total land area, the Punjab state accounts for 13–14% of the nation's overall production of food grains. Concerning to area, production, and productivity of major crops in Punjab, we gathered time series data from secondary sources of information between 2011-12 and 2020-21. Among various districts of Punjab, an overall increase in terms of area for Rice was observed. A maximum area reduction of 16.79 thousand hectares was observed in Pathankot while the highest rise of around 9.74 thousand hectares occurred in Bathinda. Production trends for rice were somewhat similar by area as the highest production was found in Bathinda (47.79 thousand metric tons). Fazilka (50.15 thousand metric tons) but Pathankot (51.61 thousand metric tons) observed decline in rice production. A decline of 7.76 kg ha⁻¹ in productivity was observed in Fazilka district, whereas an increase of 104.85 kg ha⁻¹ was recorded in Gurdaspur district. Pathankot and Fazilka districts experienced similar trends in wheat production and area. Pathankot recorded a major decline in area as well as production, while Fazilka recorded the most growth (4.81 thousand hectares and 24.56 thousand metric tons). Amongst the regions, Mansa accounts for the maximum productivity, 69.90 kg ha⁻¹, and Fatehgarh Sahib accounts for the minimum productivity, 21.52 kg ha⁻¹. For potato in Punjab, overall area, production, and productivity increased. Ludhiana region (0.893 thousand hectares) experienced an increase, while Pathankot district (0.117 thousand hectares) experienced a decline. In terms of production, Ludhiana had the largest increase of 27.02 thousand metric tons, and Fazilka had the highest productivity (885.09 kg ha⁻¹).



ESTIMATION OF VARIABILITY PARAMETERS IN F₃ GENERATION OF THE CROSS GKVK6 × KCG2 IN GROUNDNUT (*ARACHIS HYPOGAEA* L.) FOR YIELD AND WATER USE EFFICIENCY RELATED TRAITS

H.C. Sowmya

Department of Genetics and Plant Breeding, UAS, Raichur, Karnataka

Email: hc.sowmya@gmail.com

Abstract

Groundnut is one of the important edible oilseed crops of the world and also in India. Recent climatic change has lead to low productivity of the crop. In order to cope up with changing climate conditions, there is a need to develop climate resilient genotypes especially drought tolerant genotypes. In order to identify drought tolerant genotypes, estimation of Water Use Efficiency through its related traits is one of the ways. Variability study is required to know the variability existing for different traits in the segregation generation and for further selection and to develop water use efficient genotypes. The F₃ generation of the cross GKVK6 × KCG2 and their parents were evaluated. Observations were recorded on F₃ generation for days to first flowering, plant height, primary branches per plant, SCMR, SLA, pods per plant, pod yield per plant, kernel yield per plant, Shelling *per cent* and SMK *per cent*. Variability analysis was carried out in F₃ generation using the recorded data. High GCV and PCV values were recorded for pods/plant, pod yield/plant, kernel yield/plant, moderate values for Plant height, SLA and low values for days to first flowering, primary branches per plant, SCMR and Shelling percentage. There is low heritability for almost all the traits except Days to first flowering. Sufficient amount of variability exists for yield related traits but not for WUE related traits in the F₃ generation of the cross GKVK6 × KCG2 and further selection will be effective based on yield related traits but not on WUE related traits.

EMPOWERMENT OF FARM WOMEN THROUGH VALUE ADDITION OF HORTICULTURAL CROPS

Jayalaxmi B. Pawar, Nandini B., Pushpa P. and Surekha Sankanagoudar

College of Horticulture, Kolar, UHSB, Karnataka-563103

Abstract

India is the second largest producer of vegetables in the world next to china. India ranks first in the world production of ginger, okra and second largest producer of potatoes, green peas, tomatoes, cabbage and cauliflower. As 40% of the horticultural produce is wasted after harvesting due to short shelf life. But it can be enhanced by processing/ preservation/ packaging. Any product can be considered value added if it is grown by farmers increased in value by labour and creativity. As horticultural crops are gaining importance owing to their commercial, nutritional and export potential, the role of women is likely to be changed who are creative in nature. Women contribute around half of the total world population and play a vital role in the farm activities and household management. Efforts are needed to modify the role of women from labour to entrepreneur which can lead to good health of the family ultimately prosperity of farming community. Women can take up the value addition of Jackfruit, Amla, Tomato, potato easily at household level and on small scale. However, they often deprived from decision making process due to lack of independent source of income. Therefore, to uplift financial conditions of the rural women value addition of horticultural crops can offer tremendous opportunity. Empowering women with economically productive work will enhance their contribution to agriculture development.

EMPOWERING FARM WOMEN THROUGH PULSE PRODUCTION

Indra Jeet, Dushyant Kumar Raghav, Dharamjit Kherwar, and Virendra Kumar Yadav*

ICAR-RCER, KVK, Ramgarh, Jharkhand

*ICAR-RCER, FSRCHPR, Plandu, Ranchi

Email: indrakvk80@gmail.com

Abstract

Women are the backbone of the development of national economy. They comprise 43% of the world's agricultural labour force. In rural India, 84% of women population depends on agriculture the percentage of women who depend on agriculture



for their livelihood, out of this 50% women are being discriminated on all fronts. Entrepreneurship development through skill development is one of the possible ways to empower women group. KVK Ramgarh has given focus on decision making and leadership development through training program on kharif pulse (pigeon pea) production technique for the benefit of women group. Demonstration was conducted in two villages Jobla and Budhakhap of Mandu block in Ramgarh district of Jharkhand during the year 2016-2019 to understand impact in terms of empowering farm women with improved pulse production technologies. A total of 65 rural farm women were selected for the study and their level of knowledge regarding various pulse production techniques studied. Their level of knowledge was increased as a result of training and demonstration in seed treatment with bio fertilizer (rhizobium) before sowing pulses 25 to 61%, sowing method 42 to 64%, Manure application 36 to 55%, fertilizer management 31 to 58%, micronutrient application 18 to 27%, insect and pest management 32 to 49% and harvesting/threshing method 41 to 63% among rural women. Majority of women farmers expressed cause as responsible for low production and productivity of pulses are unavailability of quality seeds and lack of information on improved production technologies as the major constraints. By conducting regular training program, follow-up, crop production related advisory, diagnosis of problem through field visit, improving participation of farm women in agriculture participation is decision making, change attitude and behavior for adoption of technology, drudgery reduction in farming activities with the help of farm mechanization and providing gender-oriented technology for crop production are major suggestion for increasing production and productivity of pulse crop. The women farmers could receive very good yield 29.5% increase as compare to previous year yield of pulse crop.

CONSTRAINTS FACED BY POSTGRADUATE SCHOLARS IN ACHIEVING EMPLOYMENT

Jitendra Kumar

Department of Extension Education, Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan

Email: coa.jitendra@gmail.com

Abstract

In simple terms employability is about capability of getting and keeping fulfilling work. More comprehensively, employability is the capability to move self-sufficient within the labour market to realize potential through sustainable employment. This paper analyses and discusses different constraints faced by post graduate in achieving employment “Lack of expected level of realization to develop employability among the scholars by the teachers was perceived as most important constraint by the postgraduate scholars and next important constraints reported by the postgraduate scholars were Less number of computers and internet facilities in the campus and Higher agricultural education more theoretical and less practical oriented, Course curriculum not meeting the diversified needs of the prevailing agricultural situation, Courses are not completed within semesters, Lack of expected level of well qualified teaching staff with expected teaching skills, Improper learning situation provided to the students, Inadequate language competency in English among the scholars, Inadequate hostel facilities for the students, Lack of needed updated competency in using IT and related components by the scholars, Lack of medical facilities in the college/universities campus, Education system does not provide platform to build necessary confidence among the scholars to face the job competition and Improper orientation from academic institutions about the job opportunities.

EVALUATION OF PERFORMANCE OF TURMERIC (*CURCUMA LONGA* L.) VARIETIES IN DHARMAPURI DISTRICT OF TAMIL NADU

K. Indhumathi*, P.S. Shanmugam and M. Sangeetha

Horticultural College & Research Institute for Women, Tamil Nadu Agricultural University, Tiruchirappalli, Tamil Nadu, India

Email: indhumathi.k@tnau.ac.in

Abstract

Turmeric is an important spice crop cultivated in various states of India and Tamil Nadu is one of the leading producers of Turmeric. The productivity of Turmeric in Tamil Nadu was 3.80 MT/ha (cured rhizome yield) which is lower than the national productivity. Though there are various factors affecting productivity, choice of varieties was one of the important factors among them. On farm trials were conducted to study the performance of Turmeric varieties viz. BSR 1, BSR 2, CO 2, Allepey Supreme, PTS 10 and Roma at Krishi Vigyan Kendra, Pappapattay of Dharmapuri district. The experiment was conducted in randomized block design with three replications. The crop management practices are carried out as per Crop Production Guide



2020 of Tamil Nadu Agricultural University, Coimbatore recommendation. The yield data revealed that there was significant variation among the turmeric varieties in various growth and yield determining parameters. Among the varieties CO 2 performed better than the other varieties with highest yield per plant (468.99 g), cured rhizome yield per hectare (6.82 tonnes/ha) followed by BSR 2. The results of the study show that CO 2 performed better in Dharmapuri district when compared to other varieties and hence can be preferably recommended to the farmers for better yield. The yield attributing factors viz. plant height, leaf size, weight of mother rhizome, weight and number of primary and secondary fingers are positively correlated with the yield per plant and hence can be used as criteria for varietal selection.

AN ELITE RAINFED UPLAND RICE VARIETY ‘VL DHAN 211’ FOR CULTIVATION UNDER ORGANIC CONDITION OF UTTARAKHAND HILLS

J.P. Aditya*, P.K. Agrawal, Anuradha Bhartiya, Rajashekhar H., V.S. Meena, L. Kant, J.K. Arya, Devendra Lal, P.C. Verma and D.S. Panchpal

Crop Improvement Division, ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan,
Almora 263 601 (Uttarakhand)

*Email: Jay.Aditya@icar.gov.in

Abstract

Rice is one of the major kharif crop of Uttarakhand grown in 2.54 lakh ha area with production 7.14 lakh tones and productivity 2,814 kg/ha (DES, 2020). The difference in production and productivity of rice between hill and plain region are huge mainly due to availability of irrigation facilities and improved varieties. Out of 40% rice grown in hills of Uttarakhand, about 67% is grown under rainfed upland condition therefore, development of improved varieties of rice for rainfed upland ecosystem is essential for yield stabilization and fulfilling the requirement of rainfed upland rice growers in hills. Keeping this in mind, a concerted effort has been made to develop high yielding varieties of rice for rainfed upland hill regions under organic conditions. An elite variety VL Dhan 211 is suitable for spring sown rainfed upland organic conditions of Uttarakhand hills. This has exhibited stability, found promising and shown significant superiority over the checks in spring sown rainfed upland hill rice state variety trials. This was developed by ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan (VPKAS), Almora, Uttarakhand and released by the State Seed Sub Committee (SSSC), Uttarakhand subsequently notified by the Central Sub-Committee on Crop Standards Notification and Release of Variety for Agricultural Crops vide S.O. No. 8(E) dated 24.12.2021. VL Dhan 211 has been derived from cross between VL Dhan 209 and VL 30424. It is resistant against leaf & neck blast (score 1-3), brown leaf spot (score 3-5), sheath rot (score 1), leaf scald (score 3-5), false smut (score 0-1), stem borer and leaf folder (score 0-3) under natural condition. This variety has intermediate and semi-erect plant type, compact and well exerted panicle, awnless and straw apiculus colour. It also had excellent quality characteristics such as high hulling (80%), milling (69%), HRR (60%) and amylose content (24.8%). It has short bold grain kernel length (5.62mm), kernel breadth (2.68mm), L/B ratio (2.09). VL Dhan 211 has full potential to increase spring rice production and productivity of under organic cultivation in the Uttarakhand hills.

SEASONAL OCCURRENCE OF LEAF CURL DISEASES OF TOMATO UNDER FIELD CONDITIONS

K.N. Koshale¹ and C.P. Khare²

¹Kumari Devi Choubey College of Agriculture and Research Station, Mohgaon, Saja, IGKV, Distt. - Bemetara (C.G.)-491993,

²Department of Plant Pathology, CoA, IGKV, Raipur (C.G.)-492012

Email: koshalekamalnarayan@gmail.com

Abstract

Tomato, *Solanum lycopersicum* L. is one of the most popular and extensively grown vegetables in India as well as in Chhattisgarh. The tomato plant is known to susceptible for more than 200 diseases throughout its life span. Among them leaf curl disease caused by *Tomato leaf curl virus* is one of the important diseases of tomato. Therefore, a study was undertaken in Kharif season of three consecutive years (2015, 2016 and 2017) at Horticulture Instruction cum Research Farm, College of Agriculture, Raipur (Chhattisgarh) to know the occurrence pattern and extent of infection of tomato leaf curl disease. The first appearance of leaf curl was observed in first fortnight of August in 2015 and 2017 while in 2016 first symptom of the disease was observed in second fortnight of August and appeared up to first fortnight of November. Initially the occurrence of the



disease started with very low percent disease incidence of 1.00, 3.70 and 2.66 percent and percent disease index of 0.24, 1.49 and 1.14 percent in *Kharif* 2015, 2016 and 2017 respectively. The percent disease incidence and percent disease index increased with increase in age of the plant and reached maximum in first fortnight of November with percent disease incidence of 68.48, 62.36, and 69.64, percent and percent disease index of 49.58, 45.56 and 51.30 percent in *Kharif* 2015, 2016 and 2017 respectively.

ROLE OF HEAT SHOCK PROTEINS IN CROP IMPROVEMENT

K. Shamini and R. Sudhagar

Department of Forage Crops, TNAU, Coimbatore-641 003

Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore-641 003

Email: kshamini93@gmail.com

Abstract

Heat stress as well as other stresses can trigger some mechanisms of defense such as the obvious gene expression that was not expressed under “normal” conditions. Response to stresses on the molecular level is found in all living things, especially the sudden changes in genotypic expression resulting in an increase in the synthesis of protein groups. These groups are called “heat-shock proteins” (Hsps), “Stress-induced proteins” or “Stress proteins”. Historically, the observation of the Italian Scientist R. Ritossa on gene expression of the puffing in the chromosomes of *Drosophila melanogaster* after exposure to heat was the start of discovering the heat-shock proteins. Changes in the expression of the heat shock proteins are controlled by a set of transcription factors referred to as heat shock factors (HSF). In plants, general reviews suggested five principal classes of Hsps characterized by their activities as molecular chaperones according to their approximate molecular weight: (1) Hsp100 (2) Hsp90 (3) Hsp70 (4) Hsp60 and (5) small heat-shock proteins (sHsps). Most notable role as molecular chaperones, that facilitates the synthesis and folding of proteins throughout the cell. Increased levels of heat shock proteins after stress plays a central role in cellular homeostasis. Heat-shock proteins have some kind of related roles under abiotic stress by solving the problem of misfolding and aggregation, also as chaperones. Until now, there are more than 52 plant species that have been genetically engineered for different traits such as increased yield, herbicide, and insecticide resistance, and some metabolic changes. Finally, it is very important to study stress combinations to end up with tolerant plants. Comprehensive quantitative comparative studies of dynamic protein profiling during developmental or stress responses, and functional analysis and characterization of regulatory processes are now needed to understand plant physiology and how plants interact with and adapt to the environment.

DEGRADATION PATTERN OF HERBICIDES IN ACID SOILS OF ASSAM

^{*1}Kaberi Mahanta, ¹J. Deka, ²D. J. Rajkhowa and ²Harendra Verma

¹Assam Agricultural University, Jorhat, Assam-785013

²ICAR Research Complex for NEH Region, Nagaland Centre, Nagaland, India

*Email: kaberi.jorhat@gmail.com

Abstract

Herbicides are toxic xenobiotics, which have been used for managing the weeds in agricultural lands and aquatic bodies. Farmers often used the herbicide(s) without considering either long or short-term effects on soil, water, and food chain as well as on its natural habitats. The residual effect of herbicides in the environment is mostly influenced by their degradation pattern and their half-life ($T_{1/2}$). However, the half-life is not absolute because it depends on the soil type, temperature, and concentration of the herbicide applied. Microbes play an important role in degradation as well as counteracting the residual effect of herbicides. In cognizance of the above, a laboratory study was undertaken to evaluate the degradation pattern of five commonly used herbicides. The soils under study were sandy loam in texture with p^H - 5.2, CEC - 6.28 c mol(p^+)/kg, Organic Carbon - 0.92 %, available N-260 kg/ha, available P_2O_5 - 19 kg/ha and available K_2O - 86 kg/ha. Six kg soils were taken in each earthen pot and moisture was maintained at 40% water holding capacity. The recommended rate of application of herbicides was viz. metribuzine - 500 g/ha, quizalofop – ethyl - 50 g/ha, Butachlor – 1000g/ha, Pretilachlor – 750g/ha, and Pendimethalin – 1500g/ha. Herbicides were applied at single and double the recommended doses. Soil samples were collected periodically from the day of herbicide application (within 4 hours of application) till 30 days after application (DAA) of



herbicides and detection of herbicide residue was done in GC-1000 with Electron Capture Detector (ECD), The degradation of the herbicides in soil followed a first-order kinetic. Out of five herbicides, butachlor, pretilachlor, and pendimethalin recorded significantly higher degrees of residues from the 0 DAA to the 30th DAA of the herbicides over metribuzine and quizalofop-ethyl owing to a reduced rate of degradation at higher initial concentration. It was also evident from the degradation pattern that the single herbicide doses degraded slower at the beginning of the experiment over the doubled herbicide dose and can probably be explained by the microorganisms' adaptability to the higher doses. From this study, it can be concluded that butachlor, pretilachlor, and pendimethalin retain significantly higher residues with longer $T_{1/2}$ and metribuzine and quizalofop – ethyl with fewer residues and shorter $T_{1/2}$ in soil.

IN-SILICO ANALYSIS OF BIOACTIVE COMPOUNDS FROM MILLETS AGAINST DIABETES, HYPERTENSION, AND ATHEROSCLEROSIS

Kajal Nagre, Chandrika Ghoshal and Nirupma Singh

Division of Genetics, ICAR-IARI, New Delhi-110012

Abstract

We all know that plant secondary metabolites or bioactive compounds have a variety of health benefits, such as anti-inflammatory, anti-fungal, anti-cancerous, antiviral, etc. After the global COVID-19 pandemic, the value of plant bioactive components as an antiviral was more understood. Due to the diversity of secondary metabolites, researchers are keen to learn more about their antiviral, anti-cancerous, antifungal, etc. properties. A less time-consuming and non-expensive method to find a plant underlying defense against major diseases is “**Molecular Docking**”. Millets are grown in arid and semi-arid areas of Africa and Asia (India & China). Millets are easily available at a cheap price and contain all vital nutrients, including protein, carbs, fat, minerals, vitamins, and bioactive substances are abundant in millet, making them a great food source. The bioactive compounds from millets that have antidiabetic, antihypertensive, and anti-atherosclerotic effects were examined in our *in-silico* analysis of millets. In our current study, 50 compounds were screened using Autodock 4.2 and the interaction between the potent docked compound was visualized by the discovery study visualizer. The bioactive compounds were identified by their potential binding energy with their target. The flavan-4-ol show better binding energy with all the targets chosen from the literature against the disease. The binding energy of flavan-4-ol to the diabetes-related enzyme human Dipeptidyl Peptidase IV (DPPIV) and Sodium-Glucose Cotransporter-2 (SGLT2) is -5.94 kcal/mol and 6.49 kcal/mol respectively, the Human Angiotensin-converting enzyme which plays a significant role in hypertension and Proprotein convertase subtilisin Kexin type 9 (PCSK9) in atherosclerosis shows binding energy -6.31 Kcal/Mol and -4.67 Kcal/Mol respectively. This bioactive compound may be used as a potential inhibitor for these diseases.

IMPROVING RURAL NUTRITIONAL AND LIVELIHOOD SECURITY THROUGH TAMARIND DIVERSITY

Kanupriya C^{1*}, Karunakaran G¹, Pritee Singh¹, Venugopalan R¹ and Deepa Samant²

¹ICAR-Indian Institute of Horticultural research, Hessarghatta, Bengaluru-560 089, Karnataka, India

²ICAR-IIHR-Central Horticultural Experiment Station, Bhubaneswar-751 019, Odisha, India

Email: kp.kanu@gmail.com

Abstract

In the subtropical and semi-arid tropical regions of the world, the tamarind tree (*Tamarindus indica* L.; 2n=2x=24; family Fabaceae; subfamily Caesalpinioideae) has become a naturalised species. It is an evergreen, slow-growing, multipurpose tree. Through human intervention, it spread from its African origin to Asia, America, and Australia. In India, it grows on village common lands, alongside rivers, on the sides of roads, and in forested grasslands. These four states—Tamil Nadu, Kerala, Maharashtra, and Madhya Pradesh—contribute more than 90% of production (APEDA, 2021). Fruit pulp, seeds, flowers, leaves, and wood are all useful parts of the tree that can be used for industrial processing, construction, trade, and medicine as well as for humans and other animals. The tamarind fruit's sticky, sweet-sour pulp, in particular, is used to flavour beverages, syrups, sauces, and curries as well as to produce tamarind juice concentrate, tamarind pulp powder, tartaric acid, pectin, tartrates, and alcohol. The seeds are grounded to manufacture tamarind kernel powder (TKP) and tamarind seed gum or flour, which acts as stabilizer, thickener, and gelling agent in a variety of processed foods. The high nutritive value of fruit



(100g pulp provides good amount of energy (239 kcal), dietary fiber (5g), minerals such as Ca (74 mg 100g⁻¹), Mg (92 mg 100g⁻¹), P (113 mg 100g⁻¹), K (628 mg 100g⁻¹), Fe (2.8 mg 100g⁻¹) and vitamins Thiamin (0.428 mg 100g⁻¹), Riboflavin (0.152 mg 100g⁻¹) and Niacin (1.94 mg 100g⁻¹) makes it one of the cheapest sources of multivitamins and minerals for the poor. The mature pods are harvested between February and May, when employment in rural areas is scarce and wages are low. To supplement their income, women and children in the village pick, clean, and de-seed the pods before packing the pulp for sale. As a result, trees are critical for the nutritional and livelihood security of local communities.

WATER USE EFFICIENCY, YIELD, NUTRIENT UPTAKE BY SPRING MAIZE (*ZEA MAYS* L.) AND SOIL PROPERTIES UNDER DIFFERENT TILLAGE AND MULCH PRACTICES IN MOLLISOLS

Kirti Bhatt*, Veer Singh, Ajaya Srivastava and Swayam Prakash Gangwar

Department of Soil Science: College of Agriculture, G.B.P.U.A.&T., Pantnagar, US Nagar, Uttarakhand (India)

*Email: bhattkirtisoil@gmail.com

Abstract

A field study was conducted in the *spring* seasons of 2021 at the N. E. Borlaug Crop Research Centre of G.B. Pant University of Agriculture and Technology, Pantnagar to study the effect of tillage and mulch practices on water use efficiency, yield, nutrient uptake by maize and soil properties in Mollisols. The experiment comprised of three tillage practices viz., conventional tillage (CT), zero tillage (ZT) and half ridge slope planting (RSP) in the main plots, while the two mulch treatments viz., no mulch and maize straw mulch applied @ 6 t ha⁻¹ in the sub-plots tested in factorial randomized block design with 3 replications. Results showed that tillage practices significantly affected the growth, yield attributing characters, yield, nutrient uptake and soil properties. However, mulch application had significant impact on all soil properties and growth and some yield attributing characters. Among different tillage practices, maize grown on the half slope of the ridge recorded higher values of growth, yield attributes and yield of maize over other tillage practices. However, zero tillage sustained the favourable condition for most of the soil properties. Soil properties like bulk density, water stable aggregates, water holding capacity, mean weight diameter, organic carbon, mineralizable N, extractable K were higher from 6.2-7.6, 4.1-20.2, 15.3-22.3, 10.5-24.9, 5.0-16.6, 7.7-29.6 and 0.5-2.4%, respectively, under ZT than CT and half RSP. However, half RSP treatment increased soil porosity, electrical conductivity and extractable P while soil pH in CT. The maximum 100 grain weight (36.86 g) and grain yield (7084 kg ha⁻¹) were produced under RSP due to the higher root weight, later emergence of tassel and silk, water use efficiency (WUE) and nutrients uptake. As compared with no mulch, application of mulch yielded 3.04% more grain yield by increasing 6.1% WUE. However, adaptation of ZT along with mulch improved the soil properties while RSP with mulch gave higher growth, yield attributing characters and grain yield (7130 kg ha⁻¹). The saving of water was found in order of ZT with mulch (32.74%) followed by RSP with mulch and ZT without mulch (24.55%) and least under CT with mulch (8.18%). Application of half ridge-slope planting with mulch for growth and productivity of *spring* maize while zero tillage with mulch to sustain soil properties.

DEVELOPMENT AND CHARACTERIZATION OF EST-SSR MARKERS IN WINGED BEAN

Kishor U. Tribhuvan¹, Twinkle Mishra¹, Sampatirao Dilip¹, Avinash Pandey¹, Jay Lal Mahato², Hanuman Lal Raiger³, A. Pattanayak¹, Binay K. Singh¹

¹ICAR-Indian Institute of Agricultural Biotechnology, Ranchi 834 003, Jharkhand, India

²Department of Plant Breeding & Genetics, Birsa Agricultural University, Ranchi 834 006, Jharkhand, India

³ICAR-National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi 110 012, India

Email: kish.tribhuvan@gmail.com

Abstract

Winged bean (*Psophocarpus tetragonolobus* L.) is a high-protein, high-oil orphan tropical legume. We developed a comprehensive set of genic-SSR markers in the winged bean from the publicly available RNAseq data sets. Fifty-eight thousand eight hundred eleven unigenes were assembled from the winged bean RNAseq data sets, and 4,107 perfect SSRs were discovered. Seventy-eight of the 166 SSRs amplified into a single band, of which 22 were polymorphic, in 79 germplasm accessions of winged bean constituting eight populations from India, Thailand, Nigeria, Indonesia, Taiwan, the Philippines, and Papua New Guinea. We found 60 alleles at the 22 polymorphic SSR loci, with a mean value of 2.73 per locus. With a mean of 0.36, the PIC values for the SSR loci ranged from 0.11 to 0.64. The analysis of molecular variance (AMOVA) indicated that



within-population variation was significantly higher (85%) than between-population variation (15%). The pairwise Nm values between the populations ranged between 0.69 -3.41, indicating the varying level of gene flow between them. The analysis of the population structure revealed two distinct groups among the eight populations with different levels of introgression. The NJ - based clustering grouped the 79 germplasm accessions of the winged bean into four main clusters with significant clustering of geographically proximal accessions. The genic-SSR markers discovered in the study would speed up breeding for modern varieties and help develop effective conservation strategies for the species.

CLIMATE CHANGE EFFECT ON BIO-PESTICIDES AND SYNTHETIC INSECTICIDES

Krishna Chaitanya Tirunagaru* and Suseelendra Desai

School of Agricultural Sciences & Technology, Narsee Monjee Institute of Management Studies–Deemed to be University, Shirpur 425405, Dhule District, Maharashtra.

*Email: kcagriento@gmail.com

Abstract

As a result of climate change, insect damage will become more variable. Current concerns about environmental contamination, human health risks, and pest recurrence are the result of irresponsible usage of synthetic insecticides. Natural plant products, entomopathogenic viruses, fungi, bacteria, nematodes, and synthetic insecticides are all extremely environmentally sensitive. Temperature has a significant impact on pesticide toxicity, whether positive or negative, and consequently efficacy. Temperature and effectiveness response relationships have been observed to differ based on an insecticide's mechanism of action, target species, method of application, and amount of pesticide swallowed or touched. Some pesticides will become more active when the temperature rises. Diflubenzuron (an insect growth regulator (IGR)) caused rapid mortality at higher temperatures and was more efficient at 35°C, however, the biological activity of the entomopathogenic fungus, *Beauveria bassiana* (Balsamo), is reduced at temperatures >25°C (Amarasekare and Edelson, 2004). Increase in temperature and UV radiation, and a decrease in relative humidity, may render many of the pest control tactics to be less effective, and such an effect will be more pronounced on natural plant products and the biopesticides. Entomopathogens used as biocontrol agents suffer from instability after exposure to solar radiation, especially in the ultraviolet (UV) portion of the spectrum. Several studies have reported a significant decrease in biological activity of entomopathogens, viz. NPV, GV, *Beauveria* and *Bt* (up to 90%) within a few days (Jones and McKinley, 1986). Larvae continue to feed and damage crops until shortly before death. Therefore, there is a need to develop appropriate strategies for pest management that will be effective under situations of global warming in the future. Farmers will need a set of pest control strategies that can produce sustainable yields under climatic change.

MICROWAVE HEATING OF WHOLE MUNG BEAN GRAINS: EFFECTS ON THE PHYSICOCHEMICAL PROPERTIES, IN VITRO PROTEIN DIGESTIBILITY, AND GERMINATION POWER

Kulwinder Kaur*, Satish Kumar and Preetinder Kaur

Department of Processing and Food Engineering, Punjab Agricultural University, Ludhiana, India (141004)

*Email: kulwinder.verma@gmail.com

Abstract

It is a massive challenge for developing countries to formulate functional foods using local food resources. In this context, mung bean grains could be used to develop protein enrich legume-based functional foods. The application of microwave (MW) processing has gained special attention for preserving or modifying the physicochemical aspects of processed food products. This study investigates the impact of microwave heating on physicochemical characteristics, such as moisture content, in-vitro protein digestibility (IVPD), phytic acid, grain hardness, and greenness change (ΔO), as well as seed germination. Mung bean seeds were exposed to a variety of power levels between 180 and 800 W over 48 s (8 on/20 off). Product temperature was taken into account when selecting the exposure time. According to the results, microwave power level variation has a significant effect ($p < 0.05$) on the parameters under study. The increase in microwave power not only reduced the moisture content (13 ± 0.23 - $9.5 \pm 0.33\%$, wb) but also reduced the anti-nutritional factor (phytic acid, from



1230.74±46 to 754.49±19 mg/100g) while retaining some of the natural green colors of the seed. In-vitro protein digestibility (IVPD) of the control (untreated) sample was 71.3 ±1.86 %, which was increased to 78.7±2.69 % up to 450W but declined afterward. The germination power of MW-heated mung-bean seeds was also improved (62±1.22 to 92±1.49%) demonstrating the potential of microwave processing. Overall, microwave heating of mung-bean seeds at 450 W for 48 s provided the most favourable nutritional and physiological results. In conclusion, microwave heating of whole mung beans could be an effective and low-cost technology for formulating functional foods with high protein content.

DEVELOPMENT OF CLIMATE RESILIENT HEAT STRESS TOLERANT MAIZE FOR FOOD SECURITY

Kumari Rashmi¹, Sanjay Sahay², S.S. Mandal¹, B. Singh¹, Sweta Sinha³, Sima Sinha¹ and Satyendra¹

¹Deptt. of Genetics and plant breeding, Bihar Agricultural College, Sabour, Bhagalpur

²Deptt. of Horticulture, Bihar Agricultural College, Sabour, Bhagalpur-813210

³Deptt. of Molecular Biology and Genetic Engineering, Bihar Agricultural College, Sabour, Bhagalpur

*Email: versatilerash@rediffmail.com

Abstract

Achieving global food security for rising global population under limited arable land is a major challenge in the twenty-first century. Maize plays an ever more vital role in the growth of global grains. Maize being a C4 plant has a high yield potential as witnessed from highest compound annual growth rate over last decade. However, in many countries maize production has been plateaued due to full exploitation of hybrid and manufacturing technologies. Therefore, maize ideotypes with favourable traits architecture need to be developed for increased stress resistance and higher yield under changing climate. In maize abiotic stress such as heat leads to tassel blast, leaf firing, low pollen viability and delay in silking that result in an increase in the anthesis-silking interval, which is a major cause of yield losses. With the advent of recent advances in omics approaches including genomics, transcriptomics, proteomics and metabolomics, great opportunity exists for development of elite climate resilient maize cultivars. Climate-resilient maize has been specifically bred for increased tolerance to traits associated with a variable and changing climate, along with yield potential, defensive traits and consumer preferred traits. To increase genetic gains through maize breeding in the stress-prone tropics, and for enhancing the precision and efficiency of breeding progress, judicious and effective integration of modern tools/strategies, especially high-density genotyping, high throughput and precision phenotyping, DH technology, molecular marker-assisted and genomic selection-based breeding are vital.

SOCIAL NETWORK STRUCTURES AMONG THE VEGETABLE GROWERS : EVIDENCE FROM HILL FARMERS OF UTTARAKHAND

Kushagra Joshi and Jyoti Rawal

ICAR VPKAS, Almora-263601

Email: Kushagra.Joshi@icar.gov.in

Abstract

Information sources play a pivotal role in the diffusion of innovation, practices and technologies to the ultimate users. Farmers use various traditional and modern information sources to access and receive information from different sources. Thus, there is a need to analyze and understand the functioning of this communication network in order to successfully manage and improve information flow between the researchers and farmers. The present study applied Social Network Analysis (SNA) methodology to explore the nature of communication and information exchange networks prevailing among vegetable growers of Uttarakhand. The study sample comprised of 320 vegetable growers spread across four villages in two districts of Kumaon region of Uttarakhand. SNA properties (Nodes, Edges, Measures of Centrality) were used to describe and visually represent the collected data. GEPHI 0.9.6 software was used for data analysis and interpretations. Results revealed the predominance of informal communication sources such as relatives, friends, neighbors, progressive farmers and shopkeepers along with formal information sources i.e. state horticulture and agriculture department in the study locale. To understand the factors determining information source usage by farmers across gender, a simple linear regression analysis was done. Education, farming experience, hours dedicated to farming, group membership, extension contact were the factors that are significantly associated with information source usage by the female farmers. For male farmers, the factors significantly



determining their information network usage were extension contact, income, landholding size and access to mobile. The study findings will help the policymakers, technology developers, extension scientists and field extension agents learn about the existing social networks among the vegetable growers and help in designing and developing appropriate extension strategies according to the convenience of the farmers so that they could get maximum benefit out of it.

EFFECT OF DRYING TEMPERATURE ON PROXIMATE COMPONENTS OF TURMERIC RHIZOME IN TRAY DRYER

Ravina G. Parmar¹, Mukesh N. Dabhi^{2*} and Pankaj J. Rathod³

¹Department of Processing and Food Engineering, JAU, Junagadh-362001, India

²AICRP on PHET, Department of Processing and Food Engineering, JAU, Junagadh-362001, India

³Department of Biochemistry, JAU, Junagadh-362001, India

*Email: mndabhi@jau.in

Abstract

Freshly harvested turmeric rhizomes of Salem variety were procured from a farmer's field. Turmeric rhizomes were cleaned, peeled, and dried in a tray dryer at 60, 70 and 80 °C temperature. Effect of drying temperature on proximate content viz. moisture content, carbohydrate, protein, oil, crude fiber and ash were evaluated. Completely Randomized Design was used for statistically analysis. Drying of turmeric rhizome at 60 °C temperature in tray dryer resulted with moisture content 10.81 %, carbohydrate 46.54 %, protein 9.58 %, oil 6.70 %, crude fibre 4.51 % and ash content 6.94 % in the dried turmeric powder.

COUPLING EFFECT OF ORGANIC AND INORGANIC NUTRIENT SOURCES ON GROWTH, YIELD AND QUALITY OF SUGARCANE IN CALCAREOUS SOILS OF BIHAR

Lalita Rana¹, Shiv Poojan², Navnit Kumar¹, Sunita Kumari Meena¹, Jitendra Rajput³, Anil Kumar¹, S.N. Singh¹, Roop Narayan Bairwa² and A.K. Singh¹

¹Sugarcane Research Institute, Dr. Rajendra Prasad Central Agricultural University, Pusa, 848125 Samastipur, Bihar

²Department of Agronomy, PGCA, Dr. Rajendra Prasad Central Agricultural University, Pusa, 848125 Samastipur, Bihar

³Division of Agricultural Engineering, ICAR- Indian Agricultural Research Institute, New Delhi 110012

Email: lalita@rpcau.ac.in

Abstract

A field experiment carried out during spring season of 2021-2022 at Kalyanpur farm, Dr. Rajendra Prasad Central Agricultural University, Bihar on the calcareous soil having pH 8.23, organic carbon 0.46%, available N 234.6 kg/ha, available P 22.5 kg/ha and available K 130.3 kg/ha. The experiment was laid out in randomized block design (RBD) having 8 treatments 100 % Button mushroom spent substrate (BMSS), 75 % BMSS + 25 % RDF, 50 % BMSS + 50 % RDF, 25 % BMSS + 75 % RDF, vermi-compost (6 t ha⁻¹), compost (5 t ha⁻¹) + 100% RDF, 100% RDF and control (unfertilized) replicated thrice. A perusal of data revealed that plant height, tiller population (x 10³ ha⁻¹), number of millable cane (x 10³ ha⁻¹), cane yield increased by 21.6, 68.2, 40.8 and 42.8 % in the plots receiving 25% BMSS + 75% RDF which was at par with the treatments having compost (5t/ha) + 100 % RDF and RDF alone. While there was no significant difference on single cane weight (cm), cane diameter, commercial cane sugar (%), brix, pol and purity percent. On the basis of growth attributing characters, yield application of 25% BMSS + 75% RDF recommended for achieving higher productivity on sustained basis.

GERMINATION AND INITIAL SEEDLING GROWTH PERFORMANCE OF *ALBIZIA SAMAN* (JACQ.) MERR. ON FLY ASH SUBSTRATUM

M.C. Behera^{*}, A.K. Acharya, T.L. Mohanty, H. Nayak, S.G. Nair and S.K. Das

College of Forestry, OUAT, Bhubaneswar, Odisha, India-751003

*Email: madhab32@gmail.com

Abstract

Impact of fly ash (FA) on germination and initial seedling growth performance of *Albizia saman* (Jacq.) Merr. was studied.



Growing media was prepared by mixing FA to forest soil (S) at five concentrations 20%, 40%, 60%, 80% and 100% (w/w). The experimental design was CRD with six treatments and three replications. Freshly collected seeds were treated with warm water followed by cold water and sown at 5.0-7.0 cm depth in germination trays containing media of different treatments. Significant ($P<0.05$) variation in germination (G) period, G. rate, G. capacity and G. Index with respect to FA concentration in media was observed ($n=100$). Maximum G. rate (91.00%) and G. index (28.90) were found in media having 40% FA (T_1) after 30 days of sowing. After 90 days of transplanting in poly pots containing the mentioned substrates, significant difference ($P>0.05$) in seedling survival rate, plant height, diameter growth, leaf number, nodules per plant and seedling quality index were observed. The survival rate (94.37%), plant height (74.14 cm), collar diameter (0.72cm), root length (44.50cm), nodule number per plant (66.00) and seedling quality index (0.75) were at maximum in growing media having 20% FA (T_1). It is concluded from the present investigation that FA can be admixed @ 40% (w/w) in forest nurseries for improving germination and @ 20% for promoting seedling growth and quality improvement of *Albizia saman*.

CUMULATIVE EFFECTS OF IRON WITH POTASSIUM AS FOLIAR APPLICATION ON THE GROWTH OF OKRA (*ABELMOSCHUS ESCULENTUS*) WITH *PANGASIANODON HYPOPHthalmus* IN AN AQUAPONIC SYSTEM

Lakan Lal Meena¹, Ajit Kumar Verma¹, M.H. Chandrakant¹ and Naresh Raj Keer²

¹ICAR-Central Institute of Fisheries Education, Versova, Andheri (W), Mumbai-400 061, India

²College of Fisheries, Bihar Animal Sciences University, Kishanganj, Bihar-855107

Email: lakhanbiotechmfsc@gmail.com, lakan.agcpa807@cife.edu.in

Abstract

A 90-days experiment was conducted to evaluate the cumulative effects of foliar application of iron with potassium on the growth of okra and *Pangasianodon hypophthalmus* in a media-based aquaponic system. The 0.50, 0.75, 1.0, and 1.25 g/L doses of iron were applied in treatments T1, T2, T3, and T4, respectively along with potassium at 5g/L in all the treatments twice a month. No significant variation ($P>0.05$) was observed in the water quality parameters in all the experimental groups. The okra showed significantly better growth in the treatments than control, especially in T3 and T4. The yield was significantly higher in T4 (36.67 ± 0.81 g/plant) compared to the control (17.16 ± 0.47 g/plant). The proximate and mineral composition analysis of the okra pod revealed a considerably higher crude protein, potassium, and iron content in T3 and T4 and leaf potassium and iron content was observed to be highest in T4. The growth performances, haematological and antioxidant enzymes analysis of fish exhibited an insignificant variation ($P>0.05$) among control and treatments. From the findings of the present study this can be concluded that the foliar application of iron at the rate 1.0 g/L in combination/combined with 5 g/L potassium could improve the growth and yield of okra without any adverse effect on fish growth in aquaponics.

RELATIVE EXPRESSION OF ZINC-RESPONSIVE GENES IN CONTRASTING RICE (*ORYZA SATIVA* L.) GENOTYPES

¹Madan Kumar*, ²Rupesh Kumar Nag, ¹Sujit Kumar Bishi, and ¹Shambhu Krishan Lal

¹ICAR-Indian Institute of Agricultural Biotechnology, Ranchi, Jharkhand-834 003

²Shaheed Mahendra Karma Vishwavidyalaya, Bastar, Jagdalpur, Chhattisgarh

*Email: madan.9577@gmail.com

Abstract

Zinc deficiency is one of the major problems across the world for the growth and development of both plants and animals. Soil zinc content has decreased due to intensive farming practices causing low yield and productivity of rice. Here in this study, two contrasting rice genotypes (BKS-41 and Sadabahar) differing in their seed zinc content were first grown in distilled water for six days followed by uniform-length seedlings were transferred to the hydroponic solution having two different doses of zinc ($5\mu\text{M}$ and $0.005\mu\text{M}$) for one week and the effect of Zn deficiency was evaluated at morpho-physiological, biochemical and molecular levels. Under zinc deficiency conditions, a slight decrease in shoot length, relative chlorophyll content and total dry weight was observed in both germplasm whereas root length, root hair density, crown root number and the activity of superoxide dismutase, ascorbate peroxidase and glutathione reductase were increased in BKS-41 as compared to Sadabahar.



The activity of glutathione reductase significantly increased in both root (3-fold) and shoot (1.5-fold) of BKS-41 as compared to its control. Further, tissue-specific transcripts of three zinc-responsive genes (OsbZIP48, OsbZIP53 and Os03g22810) were quantified, out of which gene OsbZIP48 was significantly upregulated (13-fold) in BKS-41 root and another gene Os03g22810 showed significantly higher expression (3-fold) in BKS-41 shoot under zinc deficit condition. The present study reveals that zinc deficiency leads to the activation of several genes and gene networks, indicating how plants cope with zinc deficiency at the seedling stages of rice.

INSECT POLLINATOR DIVERSITY AND CLIMATE CHANGE

Mahender Singh Thakur*

Chairman Department of Environmental Science, Himachal Pradesh University, Summerhill, Shimla-171005, H.P., INDIA

Email: drmahender74@gmail.com

Abstract

Of the total pollination activities, over 80% is performed by insects. Many experiments proved that increased temperature has effect on plants, pollinators and their interactions. Changing climate may cause changes in the time of growth, flowering and maturation of crops with consequent impacts on crop-associated biodiversity, particularly on pollinators. Key biological events such as insect emergence, their foraging behavior and date of onset of flowering need to occur in synchrony for successful pollination interactions. On a large scale, changes in temperature, disturbances on rainfall pattern and other many environmental changes over the entire season may alter the abundance, diversity, and foraging behavior of pollinators. Hence climate change causes very serious impacts on insect pollinators and flowering plants. By facilitating plant reproduction, pollinators perform a crucial ecological function that supports the majority of the world's diversity and associated organisms and a significant fraction of global agriculture. Thus, pollinators are simultaneously vital to supporting both natural ecosystems and human food security, which is unique position for such a diverse group of organisms. The past two decades have seen unprecedented interests in pollinators and pollination ecology, stimulated in part by concerns about the decline of pollinator abundance and diversity in some parts of the world. This review synthesizes what is currently understood about the taxonomic diversity of organisms that are known to act as pollinators; their distribution in both deed time and present space; the importance of their diversity for ecological function (including agro-ecology); changes to diversity and abundance over more recent timescales, including introduction of non-native species; and a discussion of arguments for conserving their diversity.

IMPACT OF PARENTING PRACTICES ON BEHAVIORAL PROBLEMS OF RURAL AND URBAN PRESCHOOL CHILDREN

Malavika V. Mokashi

Department of Human Development and Family Studies, College of Community Science

UAS, Dharwad

Email: malavika.m17@gmail.com

Abstract

To investigate the impact of parenting practices on behavioral problems among preschool children, a study was conducted on rural and urban locality preschoolers of Dharwad district of Karnataka. A multi stage random sampling method was employed where three talukas out of five were randomly selected from Dharwad district and from these selected talukas, two villages each were selected. A total of ten anganwadi's from five villages with 213 children and from six urban anganwadi's from three cities of the selected talukas with 121 children formed the sample. The occurrence of behavioral problems was studied on 334 preschoolers while the impact of parenting practices on behavioral problems was carried out on a sub sample of 206 children nominated by teachers and peers. The occurrence of behavioral problems was assessed by administering the Child Behavior Checklist, revealed that, 47.0 percent of preschoolers were in the borderline and 13.8 percent were in the clinical range for behavioral problems. To assess the parenting practices, the Parenting Relationship Questionnaire was administered on parents. As per the results, the significant association was observed between parental attachment and involvement among parents of both rural and urban localities where majority of rural parents exhibited average attachment and involvement than urban parents. Significant association was found between rural parents' disciplinary practices with preschool child's behavioral



problems but not with parental attachment, involvement, confidence and relational frustration while among urban parents, parental involvement was significantly associated with behavioral problems of their children but not with parents' disciplinary practices, parental attachment, confidence and relational frustration. Hence, the parental attachment and involvement can be utilized as a mitigating factor for management of behavioral problems among young children. The parent counseling sessions and awareness programmes can help parents to manage their child's negative behavior and also to establish a strong bonding with their children.

EFFECT OF ACUTE HEAT STRESS ON OXIDATIVE STRESS PARAMETERS IN ECONOMICALLY IMPORTANT CATFISH *CLARIUS MAGUR*

Mamta Singh*, Ved Prakash Saini & Lakan Lal Meena

Department of Fish Biotechnology

College of Fisheries, Kishanganj, Bihar Animal Sciences University, Patna

Email: mamta0131@gmail.com

Abstract

The 5th Intergovernmental Panel on Climate Change (IPCC) Assessment Report (AR5) concluded that climate change is unequivocal especially the rise in earth's surface temperature. Climate change especially the rising temperature caused severe damage to the aquatic ecosystems. Due to the adverse effect of rising temperature, aquaculture industry faced significant losses worldwide causing major setback in achieving the global fish production goal. But, till date comprehensive reports on the adverse effect of heat stress in aquaculture species are scanty which is a major hindrance in developing the climate resilient package of practices for aquaculture of economically importance fishes. Therefore, the present study was conceptualized to investigate the effect of heat stress in economically important catfish *Clariusmagur*. Firstly, the highest tolerated temperature was determined and it was found 35°C, post 96 hrs of exposure. To evaluate the effect of heat stress, fishes were exposed to 34, 32, 30, 28 and 26°C in 50-liter glass aquarium fitted with thermostat and continuous aeration where 26°C temperature was considered as control. Tissue samples of the control & exposed specimens were sampled at the intervals of 24, 48, 72 and 96 h to assess alterations in oxidative stress and histological parameters. Significant changes in lipid per-oxidation, antioxidant enzyme activity (super oxide dismutase, catalase and glutathione reductase) was observed in the exposed fish. Histological examination of gills, liver, kidney, spleen and rosette (accessory air breathing organ) showed severe tissue injury and histological alterations. The observed patho-physiological changes in the present study provide the detail insight of heat stress in *C. magur*.

GENERATION OF FECX^{GR} MUTATION IN CAPRINE EMBRYOS USING CRISPR/CAS9

Manoj Kumar Tripathi, Bosco Jose, Shivani Khanna, Amit Kumar, Vijay Yadav, Vikrant Singh Chauhan, Mihir Sarkar and Gyanendra Singh

ICAR-RCER, Patna

Email : tripathimanoj123@rediffmail.com

Abstract

Considering the future nutritional demand of our country the goat sector needs to be further strengthened. Improving the reproductive efficiency by scientific manipulation may be one of the ways to achieve this. Increasing the ovulation rate in goats may lead to increased litter size. The idea that there is increase in the ovulation rate in some breeds of sheep occurring due to specific mutations in fecundity genes, the same mutation if introduced in goats may lead to increase in litter size in goats also. Mutations in BMP15 (FecX) gene are one such gene responsible for increase in litter size in sheep. FecX^{Gr} mutation is found in the exon 2 of BMP 15 gene. In case of FecX^{Gr} mutation C to T change occurs at nucleotide 950 leading to conversion of threonine to isoleucine in exon 2 of BMP-15 in the French Grivette sheep causing increased mean ovulation rate. The structure of BMP15 gene is almost similar in both ovine and caprine but no such mutations are reported in goats. In order to achieve caprine embryos containing FecX^{Gr} mutation, the same mutation was introduced in the in-vitro matured oocytes of the goats with the help of the CRISPR/Cas9 genome editing tool. For this FecX^{Gr} specific primers were designed to synthesize DNA template of sgRNA followed by in- vitro transcription and purification of sgRNA. Asymmetric ssODNs for FecX^{Gr} was designed to be used as HDR template. CRISPR components in the RNP formats along with ssODNs were electroporated in the



in- vitro matured oocytes followed by in-vitro fertilization and culture for 7 days for further embryonic development. Genomic DNA were isolated, amplified and subjected to T7E1 assay to determine the genome editing. The editing efficiency for FecX^{Gr} edited goat embryos were 58.90%. The mono and bi-allelic percentage as revealed in in-vitro cleavage assay for FecX^{Gr} edited embryos were 79.17% and 20.83% respectively. In conclusion, the caprine embryos containing FecX mutation were produced and the mutation detection was done by T7E1 assay. The experiment paves a pathway for the production of caprine species containing FecX^{Gr} mutations in future.

ALLELOPATHIC EFFECTS OF FRUIT PLANTS ON GERMINATION AND GROWTH OF BARNYARD GRASS AND GREEN AMARANTH OF NEH REGION

M.S. Sachan^{1*}, P. Michui², S.K. Sachan² and R. Mezhatu³

¹Krishi Vigyan Kendra, (Divyodaya), Khowai, Tripura-799207

²Krishi Vigyan Kendra, Mon (Aboi), Nagaland-798603

³Krishi Vigyan Kendra, Kohima (Teshophenyu), Nagaland-797109

*Email : sachankvkmon@gmail.com

Abstract

Aqueous extracts of seven fruit plant species viz., banana (*Musa paradisica*), Indian gooseberry (*Phyllanthus emblica*), jack fruit (*Artocarpus heterophyllus*), guava (*Psidium guajava*), mango (*Mangifera indica*), litchi (*Litchi chinensis*), wood apple (*Aegle marmelos*) were tested for germination, radical and plumule growth of barnyard grass and green amaranth. The lowest germination percentage (9.5 and 14.4%), plumule (3.94 and 0.92 cm) and radicle length (0.825 and 0.495 cm) of barnyard grass and green amaranth seedlings was obtained in seed treated with wood apple aqueous extract due to presence of some toxic compounds or other inhibitory materials in the species. One of these plant extract which performed the best i.e. wood apple have potential for use as alternative crop as herbicide (protectants) against a number of weed species.

FUNCTIONAL INTERFERENCE IN SUNNHEMP: A LATE-ACTING SELF-INCOMPATIBLE CROP

Maruthi R.T.^{1*} A. Anil Kumar² and Jiban Mitra

ICAR-Central Research Institute for Jute and Allied Fibres, Barrackpore, Kolkata 700121, W.B.

¹ICAR-Sugarcane Research Institute, Coimbatore 641007, Tamil Nadu, India

²ICAR-Indian Institute of Oilseeds Research, Hyderabad 500030, Telangana, India

*Email: maru7806@gmail.com

Abstract

Sunn hemp (*Crotalaria juncea* L.) is an annually renewable lignocellulosic non-wood bast fiber crop. The complex breeding behaviour of the crop restricts the progress in sunnhemp varietal development program. Sunnhemp is a late-acting self-incompatible species, where pollen after self-pollination germinates and reaches the ovules, but failed to fertilise the egg cell. LSI crop species with hermaphrodite flowers often encounter the problem of sexual interference. Sexual interference potentially reduces both male and female fitness through wastage of pollen and ovules. Since cross-pollination is the preferred mode of reproduction and often found mediated by large bees. The behavior of pollinators and the quality of pollen carried by the pollinators determine the reproductive success in the crop. Hence, the present study was undertaken to address the consequences of different type of pollination that could occur in sunnhemp (*C. juncea*) crop under natural conditions and the role of pollinator behaviour on sexual interference in the crop. For convenience of the study, two sunnhemp cultivars namely K 12 Yellow and K 12 Black with contrasting seed coat colour involved. Selfing (1.92%) and geitonogamy (2.31%) led to poor pod setting in comparison to sib-mating (46.12%) and open-pollination (47.50). The finding indicates possibility of multiple alleles of self-incompatibility present in equal frequency in sunnhemp population maintained over generation through sib mating that ensured compatibility *vis-a-vis* pod setting upon mating between individuals with different allele combinations in a population. Significant difference for pod setting between cross-pollinated (54.59%) and open-pollinated flowers were observed that highlighted importance of pollen quality deposited on the stigma instead of quantity *per se* for determining reproductive success. Differential pistil longevity expressed in unpollinated and self-pollinated flowers despite of the fact that the species is a Late Acting Self-Incompatible species underscored importance of pollen tube growth inside pistil in initiating chemical cross talks and signalling for preventing early pistil abscission. Finally, out of a total of nine different



hymenopteran pollinators found visiting flower of the species, *Xylocopa auripennis*, *Xylocopa fenestrata* and *Xylocopa ruficornis* identified as the most effective pollinators owing to their significant greater body weight and length compared to others. Overall, scheme of pollination also hypothesized for the species considering floral development and principal pollinators.

PHYSICOCHEMICAL CHARACTERISTICS AND MINERAL STATUS OF SOME UNIFLORAL HONEY'S FROM HIMACHAL PRADESH

Meena Thakur*, Rohini Sharma, H.K. Sharma, Kiran Rana, M.R. Bajjiya and Priyanka Thakur

Department of Entomology, College of Horticulture, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, HP-173230

*Email: mnthankur15@yahoo.com

Abstract

The present investigation entitled “Physicochemical characteristics and mineral status of some unifloral honeys from Himachal Pradesh” was conducted during 2021-22. Honey's were collected from different zones of Himachal Pradesh and characterized as unifloral on the basis of melissopalynological studies. On the basis of pollen spectrum and pollen density of the pollen of a particular species, four unifloral honey's were identified viz., *Adhatoda*, honey from Una district of Zone-I, *Eucalyptus* honey from Kangra district of Zone-II, *Robinia* honey from Shimla district of Zone-III and *Thyme* honey from Lahaul and Spiti district of Zone-IV. The quality of these honey's was ascertained on the basis of physical (pH, EC, optical density, moisture and density), chemical (glucose, fructose, F: G ratio, sucrose, acidity, Vitamin C, ash content, hydroxymethylfurfural (HMF), diastase content, phenol, proline and 2,2-diphenyl-1-picrylhydrazyl (DPPH) content) and mineral content (Mg, Ca, P, K, Zn, Na, Fe and Mn) which were analysed by following standard procedures. *Robinia* honey was lowest in pH (4.09), moisture content (14.60 %), HMF (25.42 mg/kg) indicating freshness of *Robinia* honey. *Thyme* honey had highest phenol content (106.07 mg/100g) and DPPH content (77.45 %) indicating good antimicrobial and antioxidant properties. *Adhatoda* honey was highest in calcium (104.63 mg/kg), phosphorus (69.50 mg/kg), zinc (8.30 mg/kg), sodium (193 mg/kg) and iron (6.08 mg/kg) content indicating good nutritional value of honey. Though variations in physicochemical properties of all the unifloral honeys could be seen within the standard limit of FSSAI (2020).

EXPLORING BENEFICIAL MICROBES FROM HALOPHYTES FOR PLANT GROWTH PROMOTION IN BLACK GRAM

N. Karthikeyan^{1*}, G.C. Wakchaure² and U.M. Bitla¹

¹School of Soil Stress Management,

²School of Water Stress Management,

ICAR-National Institute of Abiotic Stress Management, Malegaon Khurd, Baramati, Pune, Maharashtra-413115

*Email : K.Nanjappan@icar.gov.in

Abstract

Microbial interventions for plant growth promotion have invited significant attention due to the promising impacts of interactive associations on the intrinsic mechanisms of plants. We report the impact of microbial bioformulation developed from halophyte-associated microbial strains isolated from saline areas. For the development of bio-formulation plant samples collected from salt-affected areas of the Sambhar lake region of Rajasthan, India. Endophytic Bacterial strains isolated from different regions of plants like Shoot, Root, and Root nodules, and some bacterial strains isolated from rhizospheric soil. After the study of PGP characteristics seven bacterial strains (*Bacillus* sp. NIASMS, *Klebsiella* sp. NIASMY10N2, *Nocardioideis* sp. NIMMe6, *Kocuria* sp. NIMMe5, *Pseudomonas* sp. NIASMX, *Bacillus* sp. NIASM32_6, *Rhizobium* sp. NIASMY7) were screened for the development of bioformulation. The bioformulation was formulated by amending a variety of synthetic and semi-synthetic components including plant growth hormones, carbohydrates, amino acids, and peptides with the addition of bacterial biomolecules. To study the influence of this bioformulation, field experiment with Black gram was carried out during Kharif season of 2021-22. This experiment investigated the performance of microbial biomolecules-based bio formulation towards enhancement in crop productivity and yield. Bioformulation was applied on the black gram through the foliar method for 60 days in 15 days intervals till flowering started. Bioformulation significantly enhanced the plant height to 48.62 cm over



the untreated control of 44.9cm. Black gram has resulted in substantial impact of bioformulation on yield to 8.1 qa/ha compared to control 6.9qa/ha. Test weight also improved by 44.7 gm higher than the control 42.2gm. The overall results showed that bioformulation is possible to use in field conditions for crop enhancement it can further potential to alleviate abiotic stresses in crops to achieve sustainable farming.

EVALUATION OF FRENCH BEAN AGAINST RUST IN EASTERN PLATEAU AND HILL REGION OF JHARKHAND

Meenu Kumari, R.S. Pan, Ajit Jha, J.S. Choudhary and A.K. Singh

ICAR-Research Complex for Eastern Region, Farming System Research Centre for Hill and Plateau Region, Ranchi-834 010 Jharkhand, India

*E-mail ID: meenu10iari@gmail.com

Abstract

French bean (*Phaseolus vulgaris* L.) is one of the most important legume crops directly used for human consumption as a vegetable in the immature stage and dried seed as the pulse. *Uromyces appendiculatus* produces rust pustules on beans foliage which causes significant losses of the economic yield of green pods as well as dried seeds due to the reduction in photosynthetic activity and premature defoliation. In this study, with the objective of identifying rust-resistant accessions or lines, 71 F_{2:3} progenies and 72 variable genotypes of French beans have been evaluated for rust resistance under field and controlled environment conditions through artificial inoculation. The disease was initiated in the second week of March and reached a peak in the second week of April under Jharkhand conditions. Most of the accessions were susceptible to highly susceptible, however, 9 accessions and 8 F_{2:3} progenies showed tolerance or resistance under field conditions. These lines were validated for rust reaction through artificial inoculation by the leaf coating method. Based on disease severity, disease reaction, apparent infection rate, and incubation period; 2 accessions (VLBFB-130 and HAFB-14) and three progenies F_{2:3}23, F_{2:3}41, and F_{2:3}62 showed resistance to rust. These rust-resistant accessions of beans have the potential to be utilized as parents in a crop improvement program. All three progenies were recorded for early and high-yielding traits apart from rust resistance and may be developed as a variety after their stable performance evaluation in advanced generations.

EFFECT OF PLANT GROWTH REGULATORS ON YIELD PARAMETERS OF CULTIVATION OF TARO [*COLOCASIA ESCULENTA* VAR. *ANTIQUORUM*(L.) SCHOTT.]

Navin Kumar Ranjan^{1*}, S. Sengupta¹, Sanyat Mishra¹, Pramod Kumar², Kamal Kartik and Kenny Kundra³

¹Department of Horticulture, Birsa Agricultural University, Kanke, Ranchi, Jharkhand-834006, India

²Department of Agrometeorology and Environmental Science, Birsa Agricultural University, Kanke, Ranchi, Jharkhand, India

³Department of Agril. Entomology, Birsa Agricultural University, Kanke, Ranchi, Jharkhand-834006, India

*E-mail: navin.ranjan62@gmail.com

Abstract

Colocasia [*Colocasia esculenta* var. *antiquorum* (L.) Schott.], which is also known as Taro, Arvi, Katchu and eddoe belongs to the family Aracea is an important edible aroid. Africa ranks first in area and production of colocasia and in India colocasia is favourite among Gujarat, Konkan region of Maharashtra and several other parts of south India. The cormels, corms, leaves and petioles are used as a vegetable and considered as rich source of carbohydrates, proteins, minerals and vitamins. Due to increasing demand of taro, there is a need to increase its yield. Foliar application of plant growth regulators is reported to improve growth and tuber yield. Plant growth regulators are the chemical compounds which have given favourable impact on growth, yield and quality of crops. Hence, the present investigation has been carried out in the Horticulture Research unit, Department of Horticulture, Faculty of Agriculture, Birsa Agricultural University, Kanke, Ranchi during Kharif season of 2017. There were eleven treatments used namely T₁- Naphthalene acetic acid (25 ppm), T₂- Naphthalene acetic acid (50 ppm), T₃- Indole Acetic Acid (25 ppm), T₄- Indole Acetic Acid (50 ppm), T₅- Maleic hydrazide (50 ppm), T₆- Maleic hydrazide (100 ppm), T₇- Gibberellic acid (100 ppm), T₈- Gibberellic acid (200 ppm), T₉- Ethrel (75 ppm), T₁₀- Ethrel (150 ppm) and T₁₁- Control (water spray only). To find out feasibility of increment in growth and yield of taro by means of application of plant growth regulators on the till date most accepted variety of taro, Muktakeshi by the growers in the state of Jharkhand. Number of cormels/plant, length of cormel and girth of cormel was observed in T₈ [GA₃(100 ppm)] (17.51 cm, 7.94 cm & 11.45 cm



respectively) followed by treatment T₇ [GA₃ (200 ppm)] (15.98 cm, 6.69 cm & 10.68 cm) in comparison on to others treatments including (water sprays). Maximum length of mother corm, girth of mother corm and yield/ha (tonnes) was observed in T₈ [GA₃ (100 ppm)] (7.64 cm, 13.43 cm & 15.38 tonnes respectively followed by treatment T₇ [GA₃ (200 ppm)] (6.78 cm, 12.61 cm & 14.52 tonnes) in comparison on to others treatments including (water sprays). Among the eleven treatments used GA₃ at 200 ppm was found to record maximum yield parameters in cultivation of taro.

TRAIT BASED SELECTION FOR GENETIC IMPROVEMENT OF KERNEL YIELD IN MAIZE (*ZEAMAYS* L.)

N. Sabitha* and D. Mohan Reddi

Department of Genetics and Plant Breeding, S.V. Agricultural College, Tirupati 517502 AP.

*Email : nsabitha84@gmail.com

Abstract

Correlation and path analysis carried in inbred lines clearly indicated that SPAD chlorophyll meter reading, ear length, ear girth, number of kernel rows per ear, number of kernels per row and 100 kernel weight had positive and significant associations with kernel yield and among themselves. SPAD chlorophyll meter reading, ear length, number of kernel rows per ear, number of kernels per row and 100 kernel weight showed higher and positive direct and indirect effects on kernel yield. Hence, simultaneous selection of these traits would help in bringing genetic improvement of kernel yield in maize. Ear girth and number of kernel rows per ear though had positive and significant association with kernel yield but showed negative direct and indirect effects through other yield components. Days to maturity, plant height and anthesis-silking interval had either negative or positive but non-significant associations with kernel yield and low direct or indirect effects. Hence, a genotype with higher SPAD chlorophyll meter readings, ear length, number of kernels per row and 100 kernel weight coupled with medium plant height, days to maturity, ear girth, number of kernels per ear and low anthesis-silking interval is desirable to realize higher yields in maize. There is a need to strengthen maize (*Zea mays* L.) breeding strategies based on multivariate selection to obtain high-yielding hybrids that are more stable and resilient to contrasting environmental conditions.

EVALUATION OF MUSHROOM PRODUCTION TRAINING AMONG WOMEN SHG MEMBERS OF DURG DISTRICT OF CHHATTISGARH

O.P. Parganiha, N.K. Toorray and A. Qureshi

IGKV, Raipur, Chhattisgarh

Email : extensionop@gmail.com

Abstract

SHGs are informal group of people with similar socio-economic background having a desire to achieve common goal through collective performance. Women SHGs perform various economic activities for income generation and their empowerment. Mushroom production in groups can play a significant role to eradicate malnutrition, alleviate poverty and create income generation among women in rural area. In this way, hands on trainings were conducted for women SHG members with a goal that the trainee becomes an entrepreneur based on the acquired knowledge and skill. The present investigation was conducted among the participants of training programme on “Oyster Mushroom Production” organised by College of Agriculture and Research Station, Marra (Patan) in the year 2021. Hand on training for the period of 7 days was imparted to 80 randomly selected women from 20 SHGs of Durg district of Chhattisgarh. In order to evaluate the trainees, a well-designed schedule was prepared and they were asked to fill up the schedule without prejudice preconceived notion. The schedule was filled twice, at the beginning and just after completion of training programme. Findings of the study revealed that most of the trainees (57.50%) stated that they were participated in training to adopt mushroom production as source of extra income generation. The training utility index worked out to be more than 80 per cent, therefore training utility rated as ‘Excellent’, similarly, the training effectiveness worked out to be more than 75 per cent, which also found to be ‘Excellent’. Based on the pre-training evaluation, majority of the participants had either no or partial knowledge, whereas, few of them had medium level of knowledge and very little number of participants belonged to complete knowledge category on training topics viz., mushroom cultivation, its processing and marketing. However, 43.75 to 88.75 per cent of the trainees attained complete knowledge about various aspects of mushroom production. It was found that majority of the respondents (73.75%) had low level of overall



knowledge before training programme, which converted with 67.50 per cent had high level of overall knowledge followed by 23.75 and 8.75 per cent were having medium and low level of overall knowledge regarding mushroom production. It can be concluded that training programme was quite beneficial for capacity building of rural women on mushroom production. The training facilitated to significant improvement on overall knowledge level and skills on mushroom production among SHG members.

STABILITY ANALYSIS OF DIFFERENT SUNFLOWER HYBRIDS (*HELIANTHUS ANNUUS* L.)

N.D. Sarode* and A.M. Langhi

MPKV-Agricultural Research Station, Savalivihir, Ahmednagar-423109, M.S

*Email : namadeosarode@gmail.com

Abstract

A field experiment was carried out at Agricultural Research Station, Savalivihir, Tal: Rahata, Dist: Ahmednagar-423109.(M.S) during *kharif-2021* and other two location in the jurisdiction of Mahatma Phule Krishi Vidyapeeth, *Rahuri-413 722* (MS), India. In present study eleven hybrids along with two check hybrids for seed yield per plot (g), head diameter (cm), plant height (cm) and 100 seed weight (g) over three environments. The Genotype x environment interaction was found significant for all the characters suggesting the presence of genetic variability in the hybrid population. The genotype and environment were found significant for all the traits studied. The environment indices revealed that E₁ was the favourable environment for seed yield per plot (g), for 100 seed weight (g) E₂, for plant height (cm) and head diameter environment E₃ was favorable. For stability parameter, the hybrids SVSH-488, SVSH-514, SVSH-517 and check Phule Raviraj found stable for seed yield per plot (g); SVSH-520 for head diameter (cm); SVSH-488, SVSH-512, SVSH-517, SVSH-519 and check Phule Raviraj were found stable for 100 seed weight (g) were indicate high mean, bi value nearer to unity (bi=1) and non-significant S²di. For plant height (cm) SVSH-512, SVSH-513, SVSH-514 and SVSH-517 showed stable performance.

EFFICIENCY OF NITROGEN AND PHOSPHATE REMOVAL FROM DAIRY EFFLUENT BY AN ACIDOPHILIC CHRYSOPHYTE

Nisha Dhillon*, Sanjay Gupta and Vivek Kumar

Himalayan School of Biosciences, Swami Rama Himalayan University, Jollygrant, Dehradun, Uttarakhand, 248016 India

*Email: nisha.dhillon8@gmail.com

Abstract

In the present study, autochthonous chrysophyte, *Poteriochromonas* sp. was isolated from dairy effluent which screened for an integrated approach of phycoremediation and bioenergy production. Due to its metabolic flexibility, microalga achieved high percentages of nutrient removal rate from the dairy effluent. The highest biomass productivity recorded was 1.43 g/L, by *Poteriochromonas* sp. at the 14th day of the experiment, in the 3:1 ratio of dairy effluent. The *Poteriochromonas* sp. has effectively reduced the BOD by 87.61%, COD by 80.42%, nitrate by 89.52% and phosphate by 88.46%. In this study, the highest specific growth rate was observed at the 5th day of the experiment, i.e., 1.34mg/ d/L by *Poteriochromonas* sp. The biochemical characterization revealed that the protein content was 36.46% while the lipid content was 19.53% of dry matter of biomass in *Poteriochromonas* sp. after 14days of cultivation in the 3:1 ratio of dairy effluent. The results showed the achievability of an integrated approach of phycoremediation and accumulation of potential bioenergetic compounds, has verified applications by using an acidophilic microalga in dairy effluent.

SOCIO-ECONOMIC STUDY OF FISH FARMERS OF KISHANGANJ DISTRICT OF BIHAR

Narendra Kumar Verma* and V.P. Saini

Department of Fisheries Extension, College of Fisheries, Kishanganj-855107 (Bihar Animal Sciences University, Patna)

*Email: fishenarendra@gmail.com

Abstract

For social and economic upliftment of fish farmers, the prerequisite is to know the socio-economic status of fish farmers of area under consideration. Considering this, the present study was conducted to assess the socio-economic status of fish



farmers of Kishanganj (Bihar). Pre structured interview schedule was used to collect the data and four blocks namely Bahadurganj, Kochadhaman, Pothia and Thakurganj were purposively selected keeping in view the highest numbers of fish farmers and fisherman available. 45 respondents from each block, altogether 180 respondents from all four selected blocks were selected by using simple random sampling. Present study revealed that more than 50 percent respondents (32.22% up-to 35 years and 27.22% 35 to 45 years) belonged to young and middle age group, 86.11 per cent respondents were male and 13.89 per cent were female. It was observed that 80.56 per cent respondents were Hindu whereas 19.44 were Muslim. It was observed that literacy rate of the respondents was very poor and almost 70 per cent (35.56% illiterate and 35% functionally literate) were illiterate to functionally literate and only 17.78 per cent respondents went to middle school followed by 3.33 percent to high school, 3.89 per cent to inter and only 4.44 percent respondents to college. It was also observed that 59.44 per cent respondents had their own pond and 22.78 per cent respondents had pond on rent. It was also revealed that 23.22 percent respondents got the training related to fisheries and 50.56 per cent of the respondents had fishery as primary occupation and 41.11 per cent had agriculture as primary occupation. Almost all respondents had low income from fisheries activity and only 2.78 per cent respondents had income of 1 to 2 lakh from activities related to fisheries. The information collected from the study will help the policy makers for formulation of location and target specific strategy for socio-economic upliftment.

DIETARY MUCUNA (*MUCUNA PRURIENS*) SEED EXTRACTS PROMOTES GROWTH PERFORMANCE, DIGESTIVE METABOLIC AND HAEMATOLOGICAL RESPONSES OF SARSİ, *LABEORAJASTHANICUS* (DATTA AND MAJUMDAR, 1970)

Naresh Raj Keer^{1,2*}, Narinder Kumar Chadha¹, Ved Prakash Saini², Manohar Lal Ojha³, Chetan Garg¹, Showkat Ahmad Dar² and Lakan Lal Meena¹

¹ICAR-Central Institute of Fisheries Education, Mumbai 400 061, India

²College of Fisheries, Kishanganj, BASU, Bihar 855 107, India

³College of Fisheries, MPUAT, Udaipur, Rajasthan 313 001, India

*Email : nareshrajkeer@gmail.com

Abstract

The present study was aimed to access the effects of *Mucuna pruriens* seed extract on growth performance and digestive metabolic responses of Sarsi, *Labeorajasthanicus*. For this purpose, one hundred and eighty fingerlings of an average size (10.90±0.04) were design into control and three treatment and stocked randomly into 12 FRP tanks of 1000 L capacity followed by complete randomised design (CRD). Based on the available literature four different iso-nitrogenous diets were prepared with incorporation of ethanolic extract of *Mucuna* seed viz. 0.00 (C), 2.00, (T1) 3.00 (T2), 4.00 (T3) g/kg and fed for 90 days. The water quality parameters were favourable to the fish throughout the study. At the end of the experiment the responsible parameter were observed and the best growth performance (WG% and SGR), feed utilisation (FCR, PER and LER), digestive enzyme activities (Protease and amylase), metabolic enzyme activities (ALT;L, AST;L and M, LDH;L, MDH;L and G6PDH;L), serum-protein biochemistry (serum protein, albumin and globulin), serum glucose, RBA, lysozyme activity and haematological parameters (Hb, RBC, WBC and Hct) were observed in T2 diet fed group (3.0 g/kg). From the present study it can be suggested that *Mucuna* seed extract at the rate of 2.00 g/kg in the diet of *L. rajasthanicus* could improve the growth performance and health status.

MANAGEMENT OF MUSTARD APHIDS, *LIPAPHISERYSIMIKALT*. IN WESTERN PLATEAU REGION OF JHARKHAND SUB ZONE - V

Nazrussalam*, Ekhlague Ahmad and D.N. Singh

Zonal Research Station, Chianki, Palamau-822102, Jharkhand (Birsā Agricultural University, Ranchi, Jharkhand, India)

*E-mail: nazarsalam62@gmail.com

Abstract

An experiment was conducted during *rabi* season of 2019-20, 2020-21 and 2021-22 in a Randomized Block Design with three replications and eight treatments at the experimental farm of Zonal Research Station, Chianki in Western plateau region of Jharkhand Sub Zone V. The neonicotinoid group of insecticides viz., Thiamethoxam 25 WG, Imidacloprid 17.8 SL and Acetamiprid 20 SP @ 30, 30 and 25 g.a.i. /ha, respectively were applied alone and in combination of NSKE @ 5% as foliar



sprays twice or thrice at 10 days intervals. From the statistical analysis of pooled data of three years, all the treatments were recorded significantly superior over control. The treatment foliar spray of NSKE 5 % in combination with imidacloprid 17.8 SL @ 30 g.a.i. /ha at 15 days intervals twice found the best treatment for management of mustard aphid which produced the highest seed yield (10.04 q/ha) and received the lowest number of mustard aphids (4.93) per 10 cm. central shoot per plant with highest percent reduction (93.72 %) over control with highest CBR (1:9.36) and followed by NSKE @ 5 % in combination with Acetamiprid 20 SP @ 25 g.a.i. /ha at 10 days intervals thrice, which produced seed yield of mustard (9.47 q/ha) and received the population of mustard aphids (7.24) per 10 cm. central shoot per plant with percent reduction (90.78 %) over control with a CBR of (1:6.22) While the control plot produced the lowest seed yield (4.20 q/ha) and recorded highest aphids damage (78.52 aphids) per 10 cm. central shoot per plant. This is recommended for management of mustard aphids in Western plateau region of Jharkhand Sub Zone V.

STUDIES ON SHELF-LIFE OF STUFFED DOUGH BALL (LITTI)

Nitu Sourya¹ Sushma Kumari^{1*}, Sanjay Kumar² and S.P. Sahu²

¹Department of LPT, BVC, Patna

²Department of LPM, BVC, Patna

*Email: drsushma97@gmail.com

Abstract

A study was conducted to assess the shelf -life of stuffed dough ball under different conditions. Three types of oven cooked stuffed dough balls were prepared and properly packed under aerobic packaging in HDPE pouches and were kept at ambient temperature (room temperature at $25 \pm 1^{\circ}\text{C}$) and were evaluated for pH, microbial and sensory qualities daily for three days and under refrigerated condition on alternate day upto seven days. The mean values of pH of stuffed dough ball varied from 6.17 to 6.20 on 1st day, 6.31 to 6.40 on 2nd day and 6.54 to 6.73 on 3rd day among all the three formulations during storage at ambient temperature ($25 \pm 1^{\circ}\text{C}$) and was found to be highest on 3rd day. Mean values of Total Plate Count varied from 2.23 to 4.80 log₁₀cfu/g and sensory quality (overall acceptability) ranges from 7.45 to 5.93 under 8-point Hedonic scale upto 3rd day of storage at ambient temperature. The mean values of pH of cooked dough ball (litti) stored at refrigeration temperature varied from 6.17 to 6.66 upto 7th day in all the three formulations during one week of refrigerated storage ($4 \pm 1^{\circ}\text{C}$). The mean values of Total Plate Count varied from 2.23 to 4.85 log₁₀cfu/g. mean values for sensory quality overall acceptability ranges from 7.45 to 5.95 under 8-point Hedonic scale upto one week of storage at refrigeration temperature. Shelf life of T₂ was also found to be better at ambient and refrigeration temperature both followed by T₃ and T₁.

MOLECULAR CHARACTERIZATION AND GENETIC DIVERSITY ANALYSIS IN INDIAN MUSTARD (*BRASSICA JUNCEA* L. CZERN&COSS.) VARIETIES USING SSR MARKERS

Nehanjali Parmar*, K.H. Singh and Ajay Kumar Thakur

ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur-321 303, Rajasthan, India

*Email: nehanjalibt@gmail.com

Abstract

In this study, we evaluated genetic diversity in a panel of 87 Indian mustard varieties using 200 genomic-SSR markers. A total of 189 SSRs resulted into positive amplification with 174 (92.06%) SSRs generating polymorphic products and 15 (7.94%) SSRs producing monomorphic amplicons. A total of 552 alleles were obtained and allele number varied from 2–6 with an average number of 3.17 alleles per SSR marker. The major allele frequency ranged from 0.29 (ENA23) to 0.92 (BrgMS841) with an average value of 0.58 per SSR locus. The polymorphic information content (PIC) value ranged from 0.10 (BrgMS841) to 0.68 (BrgMS519) with 0.39 as mean PIC value. The gene diversity per locus ranged from 0.13 (BrgMS841) to 0.72 (ENA23 & BrgMS519) with a mean value of 0.48 per SSR primer pair. Both Unweighted Neighbor Joining-based dendrogram and population structure analysis divided all the 87 varieties into two major groups/subpopulations. Analysis of molecular variance (AMOVA) inferred the presence of more genetic variation (98%) among individuals than among groups (2%). A total of 31 SSRs produced 36 unique alleles for 27 varieties which will serve as unique DNA-fingerprints for the identification and legal protection of these varieties. Further, the results obtained provided a deeper insight into the genetic structure of Indian mustard varieties in India and will assist in formulating future breeding strategies aimed at Indian mustard genetic improvement.



PRODUCTION POTENTIAL OF MAIZE (*ZEA MAYS* L.) AS INFLUENCED BY LEGUME RESIDUE INCORPORATION IN LEGUME-CEREAL SEQUENCE—A REVIEW

P. Ammaji

Acharya N.G. Ranga Agricultural University, Agricultural College, Rajamahendravaram, Andhra Pradesh

Email: ammajiagronomy@gmail.com

Abstract

Maize is an exhaustive feeder of nutrients particularly nitrogen. The nutrient removal by the crop is far beyond the addition through different nutrient sources. Intensive cultivation of nutrient exhaustive crops like maize leaving the soil impoverished. Hence, development and adoption of low-cost agronomic practices, which will increase the production potential of the crop without impairing native fertility of the soil is the prerequisite in the era of intensive agriculture. Crop residues- the harvested remnants of the previous crop can be utilized for meeting the nutrient requirements of the crop taken in succession. Legume crops when grown as preceding crops to the cereals as well as incorporation of legume crop residues after harvesting the economic yield were found to be very much beneficial in meeting the nutrient needs of the succeeding cereal, besides improving the soil physical, chemical and biological properties. This review provides an update of research under taken across different locations, soil types and conditions. The improvement in growth parameters, yield attributing characters and yield of maize was observed when maize crop was preceded by legumes than a cereal or fallow in sequence. Further, the nitrogen contribution of the legume crops in the system depends on the species selected and climatic conditions of the region. Legume crops besides providing protein for human beings and animals, also supply nitrogen to the succeeding crop as well as improves the soil physical and chemical properties. Fertilizer responsiveness of maize preceded by a legume is lower than maize followed by maize or any other cereal or fallow in succession. Nutrient uptake in terms of N, P and K was more when preceded by legumes compared to fallow. Incorporation of legume crop residues can contribute to the nitrogen economy of the succeeding cereal besides sustaining soil fertility.

EFFECT OF NITROGEN LEVELS, ROW RATIO AND ROW DIRECTION ON GROWTH, YIELD ATTRIBUTES AND YIELD OF PIGEONPEA (*CAJANUS CAJAN* L.)

Pradeep Prasad*, DaleshwarRajak, Shambhu Saran Kumar and Nazrussalam

Zonal Research Station, Darisai, Jamshedpur, Jharkhand

*Email : pradeepsg310@gmail.com

Abstract

A field experiment was conducted at Crop Research Farm, Department of Agronomy, SHUATS, Allahabad (UP) during Kharif season of 2014 and 2015 to study the "Effect of nitrogen levels, row ratio and row direction on growth, yield attributes and yield of pigeon pea (*Cajanus cajan* L.). The experiment was laid out in RBD (factorial) with 18 treatments each replicated thrice. A perusal of the pooled data of both the years revealed that treatment T₁₃ (Pigeonpea+ baby corn in 2:2 ratio + 100% RDN to pigeonpea + 75% RDN to baby corn in East-West direction gave maximum values of growth and yield of pigeonpea viz., Plant height(165.71 cm), and post harvest observation viz., number of pods /plant (122.99), grain yield (18.04 q/ha) and harvest index (30.04 %) while dry weight/plant (157.34 g), number of nodules (11.23), total no. of branches /plant (45.00), no. of grains/pod (3.63), test weight (72.48 g), stalk yield (45.63 q/ha) and protein content in grain (23.26 %) was recorded in treatment T₄- (Pigeonpea + baby corn (1:1) + 100 % RDN to both crops + East-West row direction).

EVALUATION OF FUNGICIDES FOR THE MANAGEMENT OF STEM ROT OF RICE CAUSED BY *SCLEROTIUM ORYZAE* CATT

P. Madhusudhan*, I. Paramasiva, U. Vineetha and C.P.D. Rajan

Agricultural Research Station, Acharya N.G. Ranga Agricultural University, Nellore- 524003

*Email: p.madhusudhan@angrau.ac.in

Abstract

In Andhra Pradesh, Stem rot of rice caused by *sclerotium oryzae catt* is becoming major problem in different locations both in Kharif and Rabi. The disease causes considerable yield losses. In the present investigation different fungicides were evaluated



against the stem rot of rice under field conditions in Randomized Block Design. Among the treatments evaluated tryfloxystrobin 25%+ tebuconazole 50% WG @0.8 g/l recorded least incidence(28.90%) of the disease which was at par with isoprothiolane 40 EC @ 1.5ml/l + tebuconazole 25.9% EC @1.5 ml/l (37.40%). Krysoxymethyl 44.3% EC recorded highest incidence (74.03%) of the disease among the fungicides tested. In untreated control the disease incidence was 80.70%. Rest of fungicides recorded disease incidence in the range of 44.07 to 69.63% : Isoprothiolane 40EC @ 1.5ml/l (44.07%), kasugamycin3L@2.5ml/l + tebuconazole 25.9% EC@1.5ml/l (44.47%), kasugamycin 3L @ 2.5ml +propiconazole 25EC @ 1ml/l (50%), tebuconazole 25.9%EC (52.60%), Propiconazole 25%EC(56.97%), Isoprothiolane 40 EC @ 1.5ml/l + propiconazole25EC @1ml/l (57.03%), Kasugamycin 3L @ 2.5ml/l(69.63%). Among the treatments highest grain yield recorded(5784kg/ha) in Propiconazole 25 EC @1ml/l which is at par with tebuconazole 25.9%EC @ 1.5 ml/l (5819 kg/ha) and tryfloxystrobin 25% + tebuconazole 50% WG @ 0.8g/l(5465kg/ha).

OPTIMAL ENERGY UTILIZATION AND GREENHOUSE GAS EMISSIONS FOR PEAR PRODUCERS OF NORTH-WEST INDIA USING DATA ENVELOPMENT ANALYSIS

¹*Pankaj Das, ²Jaswinder Singh Brar and ²Trina Adhikary

¹ICAR-Indian Agricultural Statistics Research Institute, New Delhi.

²Punjab Agricultural University, Ludhiana, Punjab.

*Email: pankaj.iasri@gmail.com

Abstract

The world is becoming increasingly aware of the need to conserve energy and reduce greenhouse gas emissions. The pear is a popular fruit that is enjoyed by many people around the world. In order to produce this fruit, growers must use a variety of inputs including water, fertilizer and pesticides. Each of these inputs has an associated environmental impact and therefore it is important for growers to consider how to use them in an optimal way to minimize the impact on the environment. In this study, the effectiveness of pear orchardists in North-West India was examined using data envelopment analysis (DEA). The investigation's key objective was to distinguish between efficient and inefficient orchardists, as well as to understand exactly where both types of orchardists were wasting energy and emitting greenhouse gases. To optimize the energy use, the energy input and output were audited by using data collected from 31 orchardists by face-to face interviews. The results demonstrated that pear cultivation was energy efficient with specific energy (E_s) of 1.567 and net energy (E_N) of 11090.9 MJ ha⁻¹. Chemical fertilisers (about 35%) and irrigation water (23.2%), two contributory factors, had the highest effects on total energy input (E_I). The DEA identified that 19 decision-making units (DMUs) were ineffective, while 12 were considered effective. The average technical efficiency (TE), pure technical efficiency (PTE) and scale efficiency (SE) of pear orchards were 0.880, 0.977 and 0.897, respectively. It was found that efficient units typically emit 37.4% fewer greenhouse gas (GHG) emissions than inefficient ones.

COMBINING ABILITY STUDIES FOR YIELD TRAITS AND BACTERIAL WILT RESISTANCE IN BRINJAL

P. Bhavana¹*, A.K. Singh¹, A.K. Jha¹, N. Anjum¹ and C. Aravindh²

¹ICAR, Research Complex for Eastern Region, FSRCHPR, Ranchi-10 (Jharkhand), India

²ICAR-IARI, Barhi, Hazaribagh, Jharkhand.

*Email: bhavanaraj2311@yahoo.co.in

Abstract

Brinjal is the most popular vegetable crop cultivated throughout India in an area of 0.74 million hectares with a production of 12.8 million tons (NHB, 2020). Bacterial wilt incited by *Ralstonia solanacearum* Yubuuchi is a serious disease which limits egg plant production from 4.24 to 86.14 percent (Sabita et al. 2000). Study of general combining ability (GCA) and specific combining ability (SCA) effects facilitates the selection of suitable lines or testers and hybrids, respectively. Parent selection according to their combining ability is essential in every plant breeding programme to get a superior hybrid, and combining ability is a crucial and effective way of choosing the perfect combiners that can be utilized in crosses for managing hybrid vigour. Hence the present investigation was taken up to study the mode of gene action and identify best genotypes and hybrids for resistance breeding. Line x Tester crosses have been developed among eleven parents which include bacterial wilt resistant



screened germplasm as testers viz., HAB-901, IC-545901 and IC-261786. Swarna Avilamb, HAB-792, HABR-6, HAB-913, HABR-21, Swarna Pratibha, Swarna Shyamli and HAB-917 with desired fruit quality characters were used as lines/female parents. Combined ability analysis revealed significance additive and non-additive gene action for the studied traits. The parent HAB-792 performed well and found significant for yield and yield related traits based on the general combining ability effects. The combining ability analysis of hybrids showed that, the cross combinations Swarna Shyamli x IC-261786 and HAB-792 x IC-261786 were best and performed well for majority of the yield attributing traits and it had positive specific combining ability effects for percent plant survival against bacterial wilt. Bacterial wilt resistant germplasm developed under this programme will certainly help in improving yield levels.

GENOTYPIC VARIATION IN FRUIT CHARACTERISTICS OF BAEI (*AEGLEMARMELLOS CORREA*) GENOTYPES IN JAMMU REGION

Prabhddeep Singh* and Akash Sharma

Division of Fruit Science, Sher-e-Kashmir university of Agricultural Sciences and Technology, Jammu-180009

*Email: dhaliwaldeep08@gmail.com

Abstract

Variability in fruit characteristics of bael genotype was studied in Jammu region. Eighty two genotype of bael were selected. Data was recorded as per the norms of PPV&FRA and analysed with statistical methods. Wide genetic diverse genotypes of bael were found over different location of Jammu viz. Jammu, Samba and Kathua districts. Results showed that styler end cavity were widely diverse in fruit characteristics from shallow, depressed and highly depressed types and stem end cavity from shallow, depressed and flattened. Fruit surface of bael genotype varied from smooth to rough in different bael genotypes. Immature fruit colour of the bael genotype differs from each other and it varied from light green, green to dark green. Mature fruit colour of genotype was varied from green, greenish pale yellow and yellowish green. Fruit shape of bael also varied from globose, ovate, elliptical and round. Environmental condition greatly influences the fruit characters of the plants. The tree nature was affected by genotypic constituent of plant along with environmental and latitude/ longitude of plant location. however, some superior genotype were found during this research work on basis of fruit characters and this will be used for future breeding programs to develop most suited cultivar for Jammu region.

NATURAL ENEMY COMPLEX IN RICE ECOSYSTEM OF NELLORE, ANDHRA PRADESH

Paramasiva I.^{1*}, Madhusudhan P.², Vineetha U.³ and Sreelakshmi Ch.⁴

¹Department of Entomology, Agricultural Research Station, Nellore

²Department of Plant pathology, Agricultural Research Station, Nellore

³Department of Agronomy, Agricultural Research Station, Nellore

⁴Department of Plant breeding, Agricultural Research Station, Nellore

Acharya N. G. Ranga Agricultural University, Guntur-522034 Andhra Pradesh, India.

*Email: paramasiva.reddy@gmail.com

Abstract

Rice (*Oryza sativa* L.) is the most important single food crop of the world importance and staple food for nearly half of the world population. The rice crop is attacked by more than 100 species of insect and 20 of them cause serious economic loss. There is a rich complex of natural enemies in rice ecosystem and is being contributed to keep the pest species below damaging levels. In present study predatory and parasitoid complex from rice ecosystem of Agricultural Research station, Nellore (ANGRAU, Guntur) were collected and identified during Kharif season (August, 2017 to January, 2018). The sample of predators were collected by sweep net and the population of mirids and spiders were counted on 20 hills. Numbers of adult populations per unit area were counted for predators like Carabids, Coccinellids and Hemipterans. For parasitoids, stem borer egg masses and dead hearts and leaf folder larvae along with folded leaves were collected at weekly intervals and kept for parasitoid emergence. It was found that, predators like *Microveliadouglassi* Bergroth (Hemiptera: Veliidae), *Micraspis crocea* (Mulsant) (Coleoptera: Coccinellidae) and *Cyrtorhinus lividipennis* Reuter (Hemiptera: Miridae) and Spiders were most abundant in nature. *Ophioneanigrofasciata* (Schmidt-Goebel) (Coleoptera: Carabidae), Earwigs (Dermaptera: Carcinophoridae) and, *Limnogonus* sp. (water striders) (Hemiptera: Gerridae) were common in nature where as *Polytoxus* sp.



(Assasian bug) (Hemiptera: Reduviidae) and *Mesovelia* sp. (Water treaders) (Hemiptera: Mesoveliidae) were less common in nature in rice ecosystem. Coming to the parasitoids, prevalence of stem borer egg parasitoid, *Tetrastichus* sp. was ranged from 22 to 92 per cent, two per cent of stem borer larval parasitoid, *phanerotomasp* (Hymenoptera: Braconidae) was recorded. In case of leaf folder two larval parasitoids viz., *Macrocentrusphilippinensis* and *Temeluchaphilippinensis* were prevailed with 2.5 and 3.5 per cent parasitisation, respectively.

ESTIMATION OF SOIL ORGANIC CARBON STOCK ACROSS PROTECTED FOREST ECOSYSTEMS OF NORTH-WESTERN SIWALIKS, INDIA

Pardeep Kumar^{1*} and Anand Narain Singh

Soil Ecosystem and Restoration Ecology Lab, Department of Botany, Panjab University, Chandigarh

*Email: Pardeepmor989@gmail.com

Abstract

Soil organic carbon (SOC) is one of the most promising elements for ecosystem carbon storage. As it houses three times more carbon than the atmosphere and vegetation, therefore, serves as a potential sink for atmospheric CO₂. In the present study, we aimed to understand SOC's behaviour and existing stock along an altitudinal gradient in three contrasting and protected ecosystems in the subtropical, temperate and alpine environments. We established five permanent plots of 1 hectare each for soil sampling, covering various aspects and vegetation types. In each plot, soil samples were collected from the centre and at four different corners. Soil samples were analysed for multiple soil physicochemical parameters following standard methodology. The study's results revealed a comparatively higher SOC stock under temperate-subalpine forests (112.7 t C ha⁻¹), followed by sub-temperate mixed forests (100.6 t C ha⁻¹) and lower mixed broadleaved forests (53.23 t C ha⁻¹). SOC stock increases up to a certain altitudinal range after that it decreases substantially. The present findings highlighted the role of protected areas in ecosystem carbon storage and emphasised that better management of Siwaliks can maximize soil carbon sequestration potential and its ecosystem recovery.

EFFECT OF NITROGEN LEVELS ON PERFORMANCE OF FINGER MILLET IN EASTERN GHAT HIGH LAND ZONE OF ODISHA

Parshuram Sial^{1*}, Himangshu Das² and Lalatendu Nayak¹

¹Regional Research and Technology Transfer Station, OUAT, Semiliguda, Koraput, Odisha-764039, India

²Regional Research and Technology Transfer Sub-Station, OUAT, Malkangiri, Odisha-764045, India

*Email: parsuramsial@gmail.com

Abstract

Finger millet (*Eleusine coracana* L.) is important crop under small millet group in India. It plays a significant role for socio-economic condition of the small and marginal farmers including tribal community. Nitrogen is one of the most yield limiting nutrients for crop production. So, an experiment was conducted to find out performance of finger millet varieties to different levels of nitrogen under rainfed ecosystem during Kharif season of 2019 to 2021 at Regional Research and Technology Transfer Station (Odisha University of Agriculture & Technology), Semiliguda, Koraput, Odisha. In this present experiment, four varieties (Kalua, OEB 602, Bhairabi and Arjun) and three different nitrogen levels (40, 60 and 80 kg N ha⁻¹ along with 30 kg ha⁻¹ each of P₂O₅ and K₂O) were taken in split-plot design with three replications. The variety was assigned to the main plots and different nitrogen level was assigned to the sub plots. The results revealed that, the highest number of tillers (6.1 plant⁻¹), fingers (8.3 ear head⁻¹), finger length (8.8 cm) along with maximum yield (2491 kg ha⁻¹), net return (Rs. 39464 ha⁻¹) and B: C ratio (1.94) were obtained with finger millet variety Arjun followed by Bhairabi. The application of nitrogen fertilizer significantly affected the different studied characters and application of 80 kg N ha⁻¹ gave highest number of tillers (5.7 plant⁻¹), fingers (7.7 ear head⁻¹), finger length (8.4 cm) and yield (2399 kg ha⁻¹) with highest net return (Rs. 36237 ha⁻¹) and B: C ratio (1.86). Interaction effect showed a significant variation and application of 80 kg N ha⁻¹ along with 30 kg ha⁻¹ each of P₂O₅ and K₂O to Arjun variety of finger millet gave highest yield (2733 kg ha⁻¹) with maximum B:C ratio of 2.11. From the present investigation, it can be concluded finger millet variety Arjun can be grown with application of 80 kg N ha⁻¹ along with 30 kg ha⁻¹ each of P₂O₅ and K₂O as it has resulted in maximum yield and economic return.



ASSESSMENT OF ORGANIC FARMING FOR PEST AND DISEASE MANAGEMENT IN TOMATO

Prasanna Lakshmi Ravuri*, Sahaja Deva and A.V. Nagavani

District Agricultural Advisory and Technology Transfer Centre, Chittoor, Acharya N.G. Ranga Agricultural University, Guntur

*Email: pras.agrico@gmail.com

Abstract

Tomato is the major vegetable crop in Chittoor district of Andhra Pradesh and it is grown throughout the year in an area of 36000ha. Pests and diseases are the major problems in tomato production as it is grown throughout the year. Farmers used to spray 8-10 times during entire cropping period if the market prices are high which causes severe health hazards to farmers as well as consumers. Keeping this in-view trial was conducted on organic farming in tomato to create awareness about different pest management tactics to control pests and diseases. Bordercropping with maize, use of Arka microbial consortium, pheromonetraps @10/acre, stickytraps @5/acre, neem soap spray and Bordeaux mixture spray were evaluate in farmer field along with tomato hybrid Arka Abhed against farmers practice *i.e.*, use of pesticides. In organic farming plots, late blight and *Tuta absoluta* damage was not observed whereas it was 10% and 8.33% in farmers practice despite of five sprayings. Due to heavy rainfall during November, 2021 farmers were able to harvest 35.25t/ha in organic method and 40.1t/ha in farmers practice. Due to high market price, farmers got net returns of Rs.4,00,000 per hectare and B:C ratio of 2.3 in organic method whereas in farmers practice it was Rs.4,50,000 per hectare and B:C ratio of 2.04 respectively.

A SCENARIO OF BREEDING VARIETIES AND SEED PRODUCTION OF FORAGE CROPS IN NORTH EASTERN REGION OF U.P.

Piyusha Singh¹, Akanksha Tiwari¹, Shambhoo Prasad² and Rajesh Kumar³

¹Department of Genetics and Plant Breeding, College of Agriculture, Acharya Narendra Dev University of Agriculture and Technology, Kumarganj, Ayodhya

²Department of Biotechnology, College of Agriculture, Acharya Narendra Dev University of Agriculture and Technology, Kumarganj, Ayodhya

³Department of Agronomy, College of Agriculture, Acharya Narendra Dev University of Agriculture and Technology, Kumarganj, Ayodhya

*Email: piyusha_singh@yahoo.com

Abstract

Forages have never been given importance in agriculture by farmers as the area devoted to fodder crops is either neglected or almost constant since many decades and it is about 3% of the total cropped area in the state. About 0.94 m ha area is under forage production and there is no scope of its further expansion because of small land holdings and existing pressure for food and cash crops on agricultural land. However, possibility exists for improvement of productivity through appropriate management practices suited to different ecosystems. As world population is increasing at alarming rate, agricultural land is shrinking due to industrialization and habitat use. Hence, there is a need to utilize salt affected land to meet the food requirement. Although some success has been achieved through conventional breeding but its use is limited due to reproductive barrier and scarcity of genetic variations among major crops. However, there is a further need of improvement for successful release of salt tolerant cultivars at field level. There are Some Varieties of Forage Bajra (NDFB-2, NDFB-3 NDFB-5) and Oat (NDO-1, NDO-10, NDO-711, NDO-1101) which perform better in Salt Tolerant area.

BIOCHAR PRODUCTION FROM AGRICULTURAL CROP RESIDUES USING TRADITIONAL DRUM KILN

Pradip D. Narale

Department of Renewable Energy Engineering, College of Agricultural Engineering and Post-Harvest Technology, Ranipool, Gangtok-737135 (Sikkim) Email: pdnarale@gmail.com

Abstract

Biochar is the solid, carbon-rich material obtained from the biomass through pyrolysis process. Biomass with high carbon



content is thermo-chemically converted into high-energy biochar. Due to carbon-enriched and porous properties, the biochar has been studied as a low-cost sorbent, as a soil amendment to improve crop growth and as a means of mitigating global warming by carbon sequestration. Yield of the biochar depends upon the biomass composition like moisture content and presence of cellulose or lignin. Pyrolysis product distribution and their quality strongly depend upon the process parameters such as temperature, heating rate, residence time etc. In this study, a traditional drum kiln was used for the production of biochar from five distinct agricultural biomass residues viz. Paddy straw, mustard stalk, corn husk, broom-grass stem and bamboo residues. All of these biomasses were subjected to slow pyrolysis under similar conditions. Before loading the samples into the kiln, biomasses were pre-configured and seasoned to facilitate uniform combustion process. The temperature attained by the carbonization process ranged from 350 to 400 and lasted for a time period of 7 to 8 hours. The biochar yield from bamboo residues (36.6%) was the highest, followed by broom-grass stem (36.4%), mustard stalk (33.33%), paddy straw (32.9%) and corn husk (29.03%) with the lowest yield. The varying yield among the derived biochar may be attributed to the feedstock type used and the pyrolysis condition.

FODDER QUALITY, FIBRE FRACTION AND ENERGY BALANCE OF OATS (*AVENA SATIVA* L.) AS INFLUENCED BY NANO UREA APPLICATION

Rajesh, Rakesh Kumar, Hardev Ram, Rajesh Meena, Manoj Kumar^{*1}, Shakuntala, Vijendra Kumar², Sandeep Kumar² and Satpal Singh³

ICAR-National Dairy Research Institute, Karnal, Haryana

¹ICAR-AICRP on Pearl Millet, Agriculture University, Jodhpur

²ICAR-Indian Agriculture Research Institute, New Delhi

³ICAR-Central Institute of Research on Cotton, Regional Station Sirsa, Haryana

*Email: mkagro86@gmail.com

Abstract

The experiment was carried out during *rabi* season 2020 at the Agronomy research farm, ICAR-NDRI, Karnal in Randomized Block Design with 4 replications. The treatments comprised of T₁: Absolute control; T₂: 100% RDN through Urea; T₃: 75% RDN + 25% N through Nano-N; T₄: 50% RDN + 50% N through Nano-N; T₅: 25% RDN + 75% N through Nano-N and T₆: 100% RDN through Nano-N with four replications. Application of 100% RDN through Urea recorded the maximum dry matter contents 16.20 and 16.03%^{1/2}, crude protein content 10.78 and 10.48%^{1/2}, ether extract contents 2.66 and 2.46%^{1/2}, total digestible nutrients 60.65 and 59.88%^{1/2}, digestible dry matter 64.34 and 63.87%^{1/2}, dry matter intake 2.29 and 2.17%^{1/2}, relative forage quality 113.10 and 105.50%^{1/2}, digestible energy 12.65 and 12.57 MJ Kg⁻¹^{1/2}, net energy for lactation 6.17 and 6.10 MJ Kg⁻¹^{1/2} and lowest organic matter 89.65 and 90.08%^{1/2}, neutral detergent fibre 52.30 and 55.40%^{1/2}, acid detergent fibre 31.53 and 32.13%^{1/2}, and cellulose contents 27.30 and 27.59%^{1/2} at the first and second cut, respectively. The findings would help choosing the better source of nitrogen for higher fodder yield of oat.

EFFECTIVENESS OF BOTANICALS ON MORTALITY OF PULSE BEETLE, *CALLOSOBRUCHUSCHINENSIS*. L (COLEOPTERA: BRUCHIDAE) IN STORED BLACK GRAM

Persis Herald* and Anoorag R. Tayde

Department of Entomology, SHUATS, Prayagraj-211007, India

*Email: persisherad777@gmail.com

Abstract

The Effectiveness of botanicals on mortality of pulse beetle, *Callosobruchus chinensis* L. in stored black gram was studied invitro at Department of Entomology, SHUATS, Prayagraj, India during 2020-2021. The experiment was conducted at ambient room temperature of 28±2°C and relative humidity of 65 to 70% and was laid in Completely Randomized Design with twelve treatments (Neem oil, Castor oil, Pungam oil @2ml/100gm of seeds and plant powders Neem leaf powder, Neem seed kernel powder, Vasambu rhizome powder, Turmeric powder, Custard apple leaf powder, Eucalyptus leaf powder, *Lantana camara* leaf powder, Notchi leaf powder @2g/100gm of seeds, insecticide (Rynaxypyr) @0.01ml/kg of seeds) and untreated control. All the treatments were found to be significant in recording percent mortality of *Callosobruchus chinensis* L. as compared to control. Among the different treatments used, maximum percent mortality of *Callosobruchus chinensis* was



observed in the black gram treated with plant oils: Neem oil, castor oil and Pungam oil (100%) after 96hours. Among the plant powders Vasambu rhizome powder (100%) recorded highest percent mortality of *Callosobruchus chinensis* followed by Neem leaf powder (96.67%), Turmeric powder (90.00%), insecticide (Rynaxypyr) (73.33%), *Lantana camara* leaf powder (66.66 %), Notchi leaf powder (61.67 %), Neem seed kernel powder (60.00%), Eucalyptus leaf powder (58.33%) and Custard apple leaf powder (56.67%) after 96hours. The least percent mortality was observed in seeds treated with Custard apple leaf powder (56.67%). However all the plant oils: Neem oil, castor oil and Pungam oil and plant powder: Vasambu rhizome powder proved best in giving 100% mortality of *Callosobruchus chinensis* after 96hours of treatment.

SPATIO-TEMPORAL VARIATION OF RAINFALL IN EASTERN AGRO-ECOLOGICAL REGIONS OF INDIA BY INNOVATIVE POLYGONAL TREND ANALYSIS METHOD

Pradosh Kumar Paramaguru

National Institute of Secondary Agriculture (Formerly ICAR-IINRG), Ranchi

Email: pradoshparamaguru@gmail.com

Abstract

Climate change and its negative effects on biodiversity are a major concern in current scenario. To mitigate its harsh effects, a clear understanding about the regional variation of climatic parameters is required. For this, trend analysis is a useful tool which is commonly used for study the variation of meteorological factors and their long-term changes. The eastern agro-ecological zone of India is highly vulnerable to climate change because it has experienced more extreme weather events and tropical cyclones than other parts of South Asia. Furthermore, this zone is very critical environmentally and agriculturally since it is India's highest rice-producing region and the world's highest lac-producing region. So, it is crucial to analyse rainfall variation in this zone in order to understand and plan future mitigation plans for sustainable agriculture and lac production. In this study, gridded rainfall data for a period of 101 years (1920-2020) was analysed using a new trend analysis method, IPTA (Innovative Polygonal Trend Analysis) for eastern agro-ecological regions. Study revealed that, in the IPTA graphics, there was no regular polygon in all agro-ecological regions. It means that the precipitation over these areas is non-homogeneous and unstable during the study years. While analysing the arithmetic mean and standard deviation data, reciprocated increasing and decreasing trends in various months and regions were observed. The majority of the months in a year in all regions show rising trends. The results were then compared to the other two classical trend analysis approaches, the Mann-Kendall test (MK) and the Bias corrected Pre-Whitening Man Kendall test (BCPW-MK), and all methods agreed well. This study demonstrates that IPTA is a better approach for trend analysis of climatic variables, and these findings will help researchers and policymakers in managing the intense effects of climate change on agriculture and lac production in this zone.

IN VITRO CLEAN CULTURE ESTABLISHMENT IN DRAGON FRUIT (*HYLOCEREUS POLYRHIZUS* (F.A.C. WEBER) BRITTON & ROSE) USING EXPLANTS FROM ORCHARD

Prakasha¹, D.P., Raghavendra G.², Kulapathi H.³, Ratnakar M.⁴

¹College of Horticulture, Sirsi-581401, Uttarakannada (Dist), Karnataka, India

²Directorate of Research, UHS, Bagalkot, Karnataka, India

³Directorate of Research, UHS, Bagalkot, Karnataka, India

⁴College of Horticulture, Sirsi-581401, Uttarakhand (Dist), Karnataka, India

*Email: prakash.dp@uhsbagalkot.edu.in

Abstract

Pitaya (dragon fruit) (*Hylocereus polyrhizus* (F.A.C. Weber) Britton & Rose) is a perennial, epiphytic, climbing cactus native to southern Mexico, Guatemala and Costa Rica. It belongs to Cactaceae. Unlike the majority of fruit crops, pitaya plants begin to produce significant crops 2 to 3 years after planting and reach full production after five years. Micropropagation require a small quantity of explant material for production of large quantity of quality planting material in short time. Hence, the present research is being taken up towards standardization of *in vitro* clean culture establishment as a pre-requisite step for micropropagation of Dragon Fruit. Healthy matured stem cuttings were collected from orchard, washed and treated with Bavistin and citrimide, cleaned, removed unnecessary parts and taken for further treatment in the laboratory. The shoot tip, root tip (Aerial), auxillary bud and leaf was used as explants. They were sterilized for different time period using sodium



hypochlorite (4%, 3, 5, 7, 10 and 15) and mercuric chloride (0.05%, 3, 5, 7, 10 and 15) for clean culture establishment. The experiment was carried out in CRD design with three replications and experiment is repeated for four times for authentication. Among NaOCl levels explants treated for 15 minutes was best with 50% clean cultures, among HgCl₂ levels, explants treated with 0.1% for 10 minutes and 15 minutes was significantly best with 100% clean cultures. However, as there was blackening of explants in explants treated for 15 minutes and hence, 10 minutes treatment was is considered as best for future establishment of clean cultures. Among various type of explants employed, shoot tip was best with highest initiation responses (83.5%) followed by leaf (38.45%) and other two explants did not respond. In this presentation, methodology of experiments conducted, results obtained will discuss.

RATIONAL USE OF SMART PHONES IN AGRICULTURE

Pranita Kohli* and S.P. Singh

Division of Agricultural Economics & ABM, SKUAST-J

**Email: prntakohli1@gmail.com*

Abstract

India is an agriculture based developing country. This sector provides employment to 58% of total Indian population (Mehta et al., 2019). Indian agriculture is undergoing transformation due to technological revolution, increasing urbanization, modern cultivation techniques, and climate change. These changes offer unique challenges and opportunities to transform agriculture to smart, more productive, economically remunerative, socially equitable and environmentally sustainable through adoption of smart technologies. India has 120 million farmers, out of which 30 million use smart phones and have a basic sense of understanding about digital marketplaces. Many apps are being utilized for different kind of functionality regarding the farming activities like cropping information, pesticides, fertilizer, seed, selling of crop, irrigation information, estimation of crop production, weather information, market prices and information regarding the best practices of farming. In 2020, India has around 700 million internet users, and the numbers are expected to grow to over 970 million users by 2025 (www.globaldata.com). There are many digital Initiatives taken by Government of India like Kisan Call Centres, Kisan Suvidha App, Agri Market App, Soil Health Card (SHC) Portal, etc (pib.gov.in). Smartphones have become a useful tool in agriculture as they are technologically equipped with various types of physical sensors which make them suitable for diverse farming tasks. Results showed that 23.7 % farmers had “moderate awareness” on use of ICT in farm practices while 60 % and 12.7 % of the farmers had “low” and “very low awareness” on use of ICT based facilities in their farm practices (ICT farm practices). In the post-pandemic era, mobile apps for farmers are expected to not just help farmers with delivery services or trading but also in employing science to produce sustainable crops and gain profitable yields.

MANAGEMENT OF SLUGS IN TOMATO

Prasanna Lakshmi Ravuri*, K. Raghavendra and A.V. Nagavani

District Agricultural Advisory and Technology Transfer Centre, Chittoor, Acharya N G Ranga Agricultural University, Guntur

**Email: pras.agrico@gmail.com*

Abstract

Slugs are major pests in horticultural crops especially vegetables and flowers Slugs are gastropods, close relatives of snails - essentially snails without a shell. They are legless, soft-bodied creatures with four front tentacles and a covering of slimy mucus all over the body. They secrete this mucus wherever they go, leaving a characteristic “slime trail” that can be a valuable clue of their presence. Slugs inflict most of their damage during crop establishment and early growth during winter season. Damage to seedlings often results in the death of the plant. Slugs hide under weeds, plastic mulching sheets during day time and cause damage to crops during night time. Hence trials were conducted to assess different management practices like salt application, use of metaldehyde 2.5%DP @2kg per acre and poison baiting with thiodicarb in farmers fields. Among these practices, use of metaldehyde pellets gave quick control of slugs *i.e.* within 2days slugs mortality was observed followed by poison baiting with thiodicarb *i.e.* 3-4 days after bait application. Use of common salt was also found to be cheap and effective in controlling slugs but it is not recommendable continuously as it affects soil fertility. Cost incurred to manage slugs by using poison baiting was Rs.2500/- per hectare followed by metaldehyde bait *i.e.* Rs.3000 per hectare. Overall farmers preferred metaldehyde as it is easy to apply and gave good control of slugs in lesser time.



GEOSPATIAL TECHNOLOGY FOR PRIORITIZATION OF MAHI RIVER SUB BASINS

Pravin Dahiphale

Punjab Agricultural University, Ludhiana

Email: pravin.dahiphale59@gmail.com

Abstract

Analysis of morphometric parameters is important for understanding the hydrological characteristics of the basin. In this study morphometric analysis was carried out using Arc GIS software and Digital Elevation Model (DEM). The parameters were computed by using standard methods and formulae. The present study included computation of stream order, stream length, stream frequency, bifurcation ratio, drainage density, form factor, circulatory ratio, elongation ratio, relief ratio, ruggedness number etc. Then prioritization of sub basins of the Mahi basin was carried out for the application of soil and water conservation measures and preparation of watershed plan. The total stream length in the sub basins of 1, 2, 3 and 4 are 4575.52, 12634.66, 2368.40 and 623.21 km respectively. Out of four sub basins, sub basin 1 and sub basin 2 are seven order basins. The mean bifurcation ratio values ranges from 1.81 to 2.09 indicating that all the basins are falling under normal basin category. The drainage density of the study area shows variation from 1.77 to 2.78 km km⁻². Form Factor (R_f) values of sub basins varies from 0.17 to 0.27 which indicates that they are sub circular and elongated in shape. The relief of sub basins varies from 132 to 507 m. The low relief found in sub basin 3 and the high relief in sub basin 2. The sub basin 2 was given the highest priority for application of conservation measures. The next priority was given to sub basin 1 and sub basin 3 then the last priority was given to sub basin 4. Therefore, immediate attention towards sub basin 2 is required for application of soil and water conservation measures to preserve the land from further erosion.

INCREASING LEVEL OF ATMOSPHERIC CO₂ AFFECT ON PLANT PHYSIOLOGICAL PARAMETERS

Princi, Shahid Umar and Md. Salik Noorani

Jamia Hamdard, New Delhi-110062

Email: princisharma984@gmail.com

Abstract

Increasing concentrations of atmospheric CO₂ over the next decades can be expected to have important implications for plants. In general, two plant types C3 & C4 are more effected to atmospheric carbon dioxide (CO₂), C3 plant species are more responsive to CO₂ enrichment then C4-plants, relative growth rate increase at elevated CO₂ primarily relates to increased Net Assimilation Rate (NAR). Many plant species are likely to exhibit higher rates of net photosynthesis, growth rate and more CO₂ level reduced photorespiration and decreased level of water consumption and changes in tissue chemistry, but higher CO₂ level including decreased concentrations of protein and mineral, most likely threats to ecosystem services as a result of increased atmospheric CO₂ are (1) decreased crop and forage food values due to decreased concentrations of protein and minerals (2) undesirable changes in plant community composition, including increases in populations of some major weed species. The Energy & Environmental Research Center has conducted an analysis of formation water extraction from carbon dioxide (CO₂) storage reservoirs under joint sponsorship from the IEA Greenhouse Gas R&D Programme and the U.S. Department of Energy. The work included a survey of geologic and water quality conditions of deep saline formations, selection of four case study sites representing a wide range of these geologic and water quality conditions, and a study of the impacts of formation water extraction on CO₂ storage and the potential for the beneficial use of extracted water at these sites.

WATER STRESS MEDIATED AMELIORATION OF BIOACTIVE COMPOUNDS (ANDROGRAPHOLIDE) IN *ANDROGRAPHIS PANICULATA* (KALMEGH)

Pritee Singh*, V.K. Rao, R.H. Laxman, and K.S. Shivashankara

Division of Basic Sciences, ICAR-Indian Institute of Horticultural Research, Hesaraghatta Lake post, Bengaluru-560089

*Email: pritee.siingh@gmail.com

Abstract

Andrographis paniculata (kalmegh) is one of the most important and popular medicinal plants of India and is widely used as a



medicine in countries like India, China and Thailand. It exhibits anticancer, antidiabetic, anti-HIV, antibacterial, anti-malarial, anti-inflammatory, anti-angiogenic, hepatoprotective and cardioprotective properties, which are credited to diterpene lactone compounds such as andrographolide, 14-deoxyandrographolide, neoandrographolide and andrograpanin. This work aimed to investigate the potential of water stress to enhance the accumulation of bioactive compounds in *Andrographis paniculata*. For this purpose, a pot experiment was carried out to identify the right stage of plant for stress imposition and level of water stress to enhance the contents of bioactive compounds. Plants of different stages (vegetative, flowering and fruiting) were used for water stress imposition by withholding water supply, and after the stress treatments plants were irrigated for recovery from stress conditions. The stressed, stress recovered and control plants were harvested and four terpenoid compounds, including andrographolide, 14-deoxyandrographolide, neoandrographolide and andrograpanin were analyzed. Flowering stage was found to be best for stress imposition for better bioactive compound production. Andrographolide content could be increased by 40-50% through water stress imposition. Stress recovery resulted in decline in the metabolic content of secondary metabolites to the level of control. Effect of water stress on different physiological and biochemical parameters were also studied. Significant difference was observed for different physiological and biochemical parameters like photosynthesis rate, stomatal conductance, transpiration rate, relative water content, plant biomass, chlorophyll content, MDA content, proline content and various antioxidant enzyme activities. The expression profiling of key andrographolide biosynthetic pathway gene (HMGR and GGPS) have been performed and both the genes were found to be overexpressed under stress as compared to control. Water deficit stress could be a good tool for amelioration of bioactive compounds.

GENETIC STUDIES FOR FATTY ACID PROFILE AND PREDICTION OF HETEROSIS IN SESAME (*SESAMUM INDICUM* L.)

Prema R. Manapure*, P.V. Shende, Vandana S. Madke and Sapna B. Baviskar

College of Agriculture, Nagpur (Dr. P.D.K.V., Akola)

Email: prmanapure@gmail.com

Abstract

The investigation involving fifteen male lines and three females (testers) were undertaken to estimate the genetic variation, diversity for fatty acid profile and to estimate and predict the heterosis in sesame. Forty-five crosses along with eighteen genetically diverse parental lines were used for this study. Data were recorded on days to 50% flowering, days to maturity, plant height (cm), number of branches plant⁻¹, number of capsule plant⁻¹, number of seeds capsule⁻¹, seed yield plant⁻¹ (g), 1000 seed weight (g), oil content (%) and fatty acid content (%). The significant genetic variation and genetic diversity was recorded for important yield contributing traits and fatty acid profile. The testers AKT-64, JLT-7 and Phule Til-1 and lines SI-11, Swetha Til, JCSC-8, SI-7-2, Shekhar, Tarun, RT-46, NIC-16207 and T-13 were identified as the promising parents on the basis of relationship between heterosis and genetic divergence and per se performance for getting high heterotic cross in F₁. The significant amount of heterosis and useful heterosis present in the study material. High magnitude of heterosis (115.74%) and useful heterosis (79.52%) was obtained for number of capsules plant⁻¹. The most heterotic crosses for important economic traits were JLT-7 x Swetha Til and JLT-7 x RT-46. The hybrid performance can be predicted on the basis of mid-parent value. The postdictive model based on GCA was useful in prediction of heterosis for all six traits under study. The parents SI-11, JCSC-8, SP-1162-B, NIC-16207, Tarun, RT-46, Hima, SI-7-2, JLT-7 and crosses AKT-64 x NIC-16207, JLT-7 x RT-46, JLT-7 x Swetha Til and JLT-7 x GT-1 had high positive significant SCA effect with involvement of either or both parent with significant GCA effect and may be used in sesame breeding program for improvement of economic traits.

SOIL HEALTH MANAGEMENT AND PRACTICES W.S.R.T. *VRIKSAYURVEDA*

Priya Gupta

Department of Dravyagunavijnana, Shri Dhanwantry Ayurvedic College and Hospital, Chandigarh

Email: pg.priyagupta98@gmail.com

Abstract

A fully functioning soil produces the maximum amount of products at the least cost. Managing for soil health is mostly a matter of maintaining suitable habitat for the myriad of creatures that comprise the soil food web. Ayurveda explains the importance of soil and land selection for the good quality and growth of medicinal plants. Vriksayurveda explains about



different types of fertile soil with different composition in Bhumi Nirupanam i.e., Land profile, that can be used for better yield and good quality of medicinal plants. Six different types of soils according to colour- Asita, Pandu, Syamala, Lohita, Sveta, Pita and taste- Madhura, Amla, Lavana, Tikta, Katu and Kasaya has been classified in it and Examination/ Investigation of land is considered to be the primary important, which also includes Mrttika pariksanavislesana i.e., testing/ analysis of soil. Condemnable soil is to be avoided. Prasasta Bhumi Mrda i.e., the ideal land with the characteristics of Sukapaksa komala, Kanuka vat sveta, Kamuda- kunda sannibha, Indu sannibha, Taptasvarnabha etc are considered under best category. Soil disturbance can be the result of physical, chemical or biological activities. Also, research and progress made over the past years regarding soil health, sustainability, and soil health management practices, with an emphasis on their implications and effects on plant disease and disease management. Managing organic matter, minimizing disturbances, diversifying soil biota, maintaining living plants, and maintaining soil cover as much as possible are improving the quality of medicinal plants. This helps medical practitioner to use herbal medication of best quality which is responsible for curing the patient and helping the medical health system to grow further.

STUDY ON EFFECT OF WORM MANAGEMENT PRACTICES ON ANTHELMINTIC RESISTANCE IN GI NEMATODES OF GOAT IN PATNA, BIHAR

R.K. Sharma¹, Veer Singh², Pankaj Kumar³, Ajit Kumar⁴, Pankaj Kumar¹ and Anil Kumar⁴

¹Deptt. of Veterinary Parasitology, Bihar Veterinary College, Bihar Animal Sciences University, Patna

²Dean PGS, Bihar Veterinary College, Bihar Animal Sciences University, Patna

³Department of Vety. and A.H Extension Education, Bihar Veterinary College, Bihar Animal Sciences University, Patna

⁴Department of VCC, Bihar Veterinary College, Bihar Animal Sciences University, Patna

Email: drksharmabvc@gmail.com

Abstract

In present study guidelines were formulating for goat farmers for control of anthelmintic resistance of GI parasitism in goats. In this context, initially the awareness and other informations on worm management practices were gathered. For which 100 farmers were selected and interrogated for various questions on Worm management practices to assess the need of control measures of anthelmintic resistance. During questionnaire survey it was observed that among the goat keepers of Patna and its surrounding area, use of anthelmintics is the only measure adopted to control problem of gastro-intestinal parasitism in goats. The frequency distribution analyses revealed that in majority of flocks the goats received three drenches of anthelmintics in year followed by two drenches per year. Only about 10 % of the goat keepers were found to practice three drenches in a year. But majority of goat keepers drench their goats only twice in a year. For the control of ecto-parasites use of acaricides in goat flocks is very limited, only 18 % of goat farmers used ectoparasitic drugs at regular interval. The data related to selection criteria use for anthelmintics showed that around 60% goat farmers select anthelmintics based on their own perception or seek advice of chemist, whereas only 37.9 % of goat farmers consulted government or local veterinarian for anthelmintic types. Usually no set criteria were used by the goat keepers in village areas for determining the dose of anthelmintics for goats. During survey it was also observed that about 48% of farmers formulate the dose according to the information in literature/bulletin supplied with anthelmintics in consultation with chemist.

BREEDING APPROACHES FOR SUSTAINABLE GROUNDNUT PRODUCTION FOR THE NORTH EASTERN ZONE OF TAMIL NADU

R. Kanchanarani*, S. Thiruvarasan and R. Lathe¹

*Oilseeds Research Station (TNAU), Tindivanam, Tamil Nadu, India

¹Agricultural Research Station, Thirupathisaram, Tamil Nadu, India

E-mail: rani.kanchana@yahoo.com

Abstract

India ranks third in oilseed production and first in groundnut. In India, groundnut occupies around 40% of area under oilseeds. It contains 47-53 % oil and 26% protein. In Tamil Nadu, it is cultivated in about 6.19 lakh hectares with the production of 10.98 lakh tonnes. Rainfed cultivation is about 70% and remaining under irrigated condition. In the Southern districts such as Madurai, Virudhunagar, Sivaganga, Ramanathapuram and Pudukottai groundnut is cultivated in around 56000 hectares. Out



of this, 84% area is under dryland cultivation. Around 90% of the varieties are of Spanish bunch type, while some like TMV 10 and ALR 1 belong to Virginia bunch type. Spanish bunch type varieties fair well under rainfed conditions, tolerant to drought and assured minimal yield even under stress conditions. Compared to other countries our country and Tamil Nadu showed lower average yield of 1400 kg/ha. In Tamil Nadu groundnut is cultivated in all districts during early *kharif* season (June-July) and late *kharif* (July- August). Most of the breeding approaches centered on pod yield improvement and tolerance/resistance to diseases and drought. Pod yield under stress conditions such as diseases and drought is measured and used as selection criteria in breeding. The breeding programs should also focus on value-added traits, including high oleic content for adding to nutrition and shelf-life. Focus to be bestowed on increased micronutrient density for iron and zinc, high oil content for good cooking oil and butter and large seeds for market preference. With the above contemplations, some of the varieties like TMV 2, TMV 7, TMV 10, TMV 13, TMV 14 developed at oilseeds Research Station, Tindivanam have the potentials of biotic and abiotic stresses and assured yield with quality. The latest variety TMV 14 released from Oilseeds Research Station, Tindivanam has potentials of earliness (95-100), high yield to the tune of around 2000 kg/ha in *kharif* and 2200 kg/ha in *Rabi* seasons of this tract shelling turnover of 70% and moderate resistance to late leaf spot and rust diseases. Even the older varieties released from this station are suited for need based situations. TMV 7 and TMV 12 with 105 days duration give assured yields of 1400 kg/ha in *Kharif* and 1250 kg/ha under rainfed conditions. TMV 9 with 110 days duration yields around 2000 kg/ha in *Kharif* season. TMV 10, Virginia type semi spreading variety yields around 1700 kg/ha in duration of 130 days under rain fed conditions in sandy loamy soils. Oil seed production can be contemplated with breeding for promising and sustainable varieties for need based situations to specific regions.

IMPACT OF DROUGHT STRESS ON BACTERIAL LEAF BLIGHT IN RICE

Rahul R. Bakade¹ and M.K. Prasanna Kumar²

¹Indian institute of Natural Resins and Gums, Ranchi

²University of Agricultural Sciences, Bangalore

Email: rahulpathology@gmail.com

Abstract

The bacterial leaf blight in rice caused by *Xanthomonas oryzae* pv. *oryzae* (*Xoo*) affects crop losses worldwide. Plant response to one type of stress can be affected by simultaneous exposure to a second stress, for example when abiotic and biotic stresses occur together. In this study, two genotypically contrasting genotypes were challenged inoculated under different drought levels (based on field capacity). In compatible interaction, the susceptible genotype TN-1 showed great response to infection and expressed highly under all drought conditions. Symptoms appeared firstly at 6 DPI (day post inoculation) and gradually increased up to 14 DPI. Maximum lesion length was observed at drought level of 60% field capacity (12.02 cm) and minimum (5 cm) was recorded at no drought condition (100% field capacity) on 14 DPI. Same in case of bacterial multiplication rate, maximum CFUs (colony forming units) were recorded at drought level of 60% field capacity and minimum were recorded at no drought condition. In incompatible reaction, BPT5204 genotype showed no symptoms, on the contrary bacteria multiplied in the host and observed maximum numbers of colonies at drought level of 60% field capacity. This study has shown the direct responses of the two contrasting genotypes under different drought stress.

POLYMORPHISMS OF THE KALLIKREIN-RELATED PEPTIDASE 4 (KLK4) GENE AND THEIR ASSOCIATION WITH REPRODUCTIVE TRAITS IN LUMSNIANG (*HAMPSHIRE X NIANG MEGHA*) PIG

Rakesh Kumar^{1*}, G. Kadirvel², Erica L. Lyngdoh², G. Khargharia², Meena Das², Ragini Kumari³, S.S. Kullu⁴ and V.K. Mishra²

¹ICAR-Research Complex for Eastern Region, Patna-800014 (Bihar), India

²ICAR-Research Complex for North Eastern Hilly Region, Umiam-793103 (Meghalaya), India

³Assistant Poultry Officer, Chhapra, Saran (Bihar), India-841301

⁴Faculty of Veterinary Science & Animal Husbandry, Ranchi (Jharkhand), India -834006

*Email: rakesh05vet@gmail.com

Abstract

Kallikrein-related peptidase 4 (KLK4) is a gene that is associated with cancer and encodes a member of the kallikrein



subfamily of serine proteases. These proteases are involved in a wide variety of physiological processes. It has also been shown that the KLK4 gene was associated with reproduction-related traits in the porcine. This indicates that KLK4 might be a promising candidate gene for litter size in pigs. In this study, we studied the effect of Ava II polymorphism in the KLK4 on reproductive traits in populations of Lumsniang pig. Detection of the KLK4-Ava II genotypes was performed by PCR-RFLP method. All genotypic distributions of the SNP1-Ava II locus were in Hardy-Weinberg disequilibrium, which implies significant differences ($p < 0.05$) in genotypic and allelic distributions within the locus in the studied population. H_e , N_e , and PIC were used to measure genetic variation in the population, with PIC and H_e having higher values indicating significant levels of genetic variation. It was an intermediate polymorphism ($0.25 < PIC < 0.5$) at the SNP1-Ava II locus in the studied breed. Three genotypes were obtained and associated with litter size traits in Lumsniang pig. In association analysis revealed that sows with the AA genotype had a higher total number of piglets born (TNB) and number of piglets born alive (NBA) as compared to GG and AG genotypes in the first parity and multiparities ($P < 0.05$). The AA genotype significantly differed from GG or AG genotypes ($P < 0.05$) for TNB and NBA in Lumsniang pig. Thus, KLK4 was shown to have a significant influence on litter size. Therefore, the SNP1-Ava II locus of KLK4 may be a potential marker-assisted selection tool for enhancing litter size in swine production.

EFFECT OF COMBINED APPLICATION OF MINERAL FERTILIZERS AND ORGANIC MANURES ON YIELD AND MICRONUTRIENT UPTAKE IN FRUIT OF TOMATO CROP

Ragini Kumari, Bipin Kumar, Rajeev Padbhushan, Rajkishore Kumar, B.K. Vimal*, Geeta Kumari¹ and Sunita Kumari¹

*Department of Soil Science and Agricultural Chemistry, Bihar Agricultural University, Sabour, Bhagalpur

¹Dr.RPCA, Pusa, Samastipur

*Email: binodvimal099@gmail.com

Abstract

Tomato (*Lycopersicon esculentum* Mill) is one of the prime vegetable crops in world and also in India. It is rich source of ascorbic acid, sugar, calcium, and vitamins, making them an important ingredient of the human diet. Tomato yield and quality can be improved by applying organic manures along with mineral fertilizers. Use of recommended dose of inorganic fertilizers with certain organics, such as farmyard manure and pressmud compost can reduce the harmful impacts of chemical fertilizer on soil, environment, and human health as well as to enhance the yield and micronutrient concentration in tomato crop. Keeping these things in view, a field experiment was conducted to understand the effect of combined use of mineral fertilizers and farmyard manure (FYM) and pressmud compost on availability of yield and micronutrient uptake in fruit of tomato crop at Bihar Agricultural University's Vegetable Research Farm in Sabour, Bhagalpur. This study was done using split plot design with two main plots (farmyard manure and pressmud compost) and five subplot levels of treatment (0, 5, 10, 15, 20 MT ha⁻¹ organic manure along with 100% NPK) replicated thrice. Result showed that significantly higher uptake of iron (0.838 kg ha⁻¹), copper (0.087 kg ha⁻¹), manganese (0.579 kg ha⁻¹) and zinc (0.206 kg ha⁻¹) in tomato plant was observed in the treatment T4 (T0+ 20 MT ha⁻¹ organic manure) which was at par with treatment T3 (T0+ 15 MT ha⁻¹ organic manure). The lowest uptake of micronutrient was found in the treatment receiving no organic manure. Also, significantly higher uptake was found in case of pressmud compost treated plot as compared to farmyard manure treated plot. Overall, this can be concluded that combined application of recommended dose of inorganic fertilizers and organic manure at the rate 15 MT ha⁻¹ can improve the tomato yield, micronutrient uptake in tomato crop and soil quality.

TEMPORAL DYNAMICS OF CHICKPEA STUNT DISEASE

Ramesh Nath Gupta^{1*}, S.B. Sah² and Himanshu Rai³

¹Department of Plant Pathology, Bihar Agricultural University, Sabour, Bhagalpur, Bihar -813210

²Department of Entomology, Bihar Agricultural University, Sabour, Bhagalpur, Bihar -813210

³ANDUAT, Kumarganj, Ayodhya, Uttar Pradesh

*Email: rameshnathgupta@gmail.com

Abstract

Chickpea is an economically and nutritionally important *Rabi* pulse crop. The area, production and productivity of chickpea



are declining day by day in our state. Chickpea stunt disease is an emerging problem for chickpea production in Bihar state. Temporal dynamics study of chickpea stunt revealed disease progression was influenced during three different dates of sowing. The disease is vectored by black aphid and transmitted by chickpea stunt virus. Disease progression during early sowing disease incidence was recorded between 5.50 - 52.65 per cent. The disease incidence was initiated on first December and increased rapidly 48.75 per cent later on increased slow reached up to 52.65 per cent at the time of harvesting. The incidence of disease was gradually increased from first week of December to last week of February. During this period aphid population was found maximum. In mid date of sowing disease progression was recorded 4.18 - 45.25 per cent and aphid population was lesser than early date of sowing. In late sown crop disease incidence ranged from 2.56 - 26.42 per cent while aphid population was observed minimum. The incidence and progression of chickpea stunt disease was found positively correlated with aphid population. Early sowing of chickpea showed maximum incidence of stunt disease followed by mid date of sowing and it was found minimum during late sown conditions.

CHRONIC ARSENIC TOXICITY AND ITS BIOACCUMULATION IN CATTLE FROM GEOGENIC GROUNDWATER CONTAMINATION IN BIHAR

Ravi Kumar, Nirbhay Kumar and Rashmi Rekha Kumari*

Department of Veterinary Pharmacology and Toxicology, BVC, Bihar Animal Sciences University, Patna-800014

*Email: rrkvvet@gmail.com

Abstract

Groundwater arsenic contamination in Bihar is an emerging threat to the human and livestock population. Several studies regarding the extent and magnitude of groundwater contamination suggest that out of 38 districts of Bihar, 18 are affected by groundwater arsenic poisoning. The present study was performed to determine the arsenic concentration in feed and water and its residue level (bioaccumulation) in different biological samples of cattle such as blood, milk, hair, urine, and faeces. A pilot study was performed for the selection of cattle of contaminated (Test group) and uncontaminated zone (control group). Based on the pilot study's findings, ten cattle from the village of Akabarpur were randomly selected as the control. Another ten cattle from Kasimchak village of Patna district were selected as the test group. Feed, water, and other biological samples such as blood, milk, hair, urine and faeces were collected from each group. Samples were digested and analysed by AAS. The level of arsenic in water and feed of the test group of Kashimchak village were 0.0785 ± 0.004 ppm and 1.046 ± 0.076 , respectively, which was significantly greater than the control group and above the permissible level of WHO. Residue arsenic concentration in blood, milk, hair, urine and faeces of test group were 0.286 ± 0.008 , 0.08 ± 0.003 , 1.692 ± 0.173 , 0.083 ± 0.004 , and 0.440 ± 0.011 respectively which was significantly higher than control group (0.011 ± 0.003 , 0.013 ± 0.006 , 0.103 ± 0.0191 , 0.032 ± 0.003 , and 0.073 ± 0.009 respectively). The study thus indicates the bioaccumulation of arsenic in cattle of contaminated areas, consequently impacting livestock's health and production. Government attention is required to mitigate arsenic bioaccumulation in the endemic districts of Bihar.

ROOT ARCHITECTURE, PLANT GROWTH AND PRODUCTIVITY OF DIVERSE RICE GENOTYPES

Ravi Saini*, K.M. Manjaiah, Kapil A. Chobhe R. Dhandapani¹

Division of Soil Science and Agricultural Chemistry,

¹Division of Plant Physiology,

ICAR-Indian Agricultural Research Institute (IARI), New Delhi -110012, India

*Email: ravisaini09121998@gmail.com

Abstract

The roots can be targeted to increase plant production because they are essential for nutrient and water uptake and perform a number of other necessary functions, including developing symbiotic relationships with microbes in the rhizosphere, anchoring the plant to the soil, and serving as storage organs. But due to their underground location, beneficial root traits are difficult to study and characterize. Therefore, in present study, a greenhouse experiment was conducted to study the root architecture, plant growth and productivity of five different rice genotypes *ie.*, Swarna, Pusa Basmati-1, Pusa-44, MTU1010 and Nagina-22 at IARI, New Delhi. The plant height and leaf area of all selected rice genotypes was recorded by RGB



imaging. At harvesting stage maximum plant height was recorded in Nagina-22. Whereas, maximum leaf area was observed in Pusa Basmati-1 which was statistically similar with Swarna. Among the varieties maximum grain yield as well as total nitrogen uptake was obtained in Swarna. The overall analysis of root morphological parameters (*i.e.* Root length, surface area, diameter and volume) at three different growth stages, reveals that root growth and morphology changes throughout the growth period but maximum overall root growth was observed at anthesis stage in Pusa Basmati-1 genotype of rice among the selected genotypes. On critical analysis of root morphological parameters, yield and nutrient uptake by different genotypes, we can conclude that it is not always necessary that a genotype with denser and distributed root system will be more productive and nutrient use efficient because some of the varieties may be genetically nutrient efficient or resistant to stress.

PRODUCTION PERFORMANCE OF DUCKS UNDER EXTENSIVE SYSTEM OF MANAGEMENT IN MIDDLE GANGETIC PLAIN (MGP) OF BIHAR

Reena Kamal, P.C. Chandran, Amitava Dey, Rajni Kumari and P.K. Bharti

ICAR-RCER, Farming System Research Centre for Hill & Plateau Region, Plandu, Jharkhand, Ranchi

Email: dr.reenakamal@yahoo.com

Abstract

An experiment was conducted to compare the performance of Khaki Campbell and Maithili ducks under extensive system of management in middle gangetic plain (MGP) of Bihar where small water bodies are available. Brooding of ducklings for one month was managed with commercial feed after which they were exposed to free range management system. Leftover feed material and kitchen wastes were provided and vaccination against duck plague was done in subsequent period. Growth and production performances, mortality and egg quality data were recorded. The study revealed that Khaki Campbell ducks gained significant body weight as compare to Maithili duck from day old to 24th week of age due to variation in genotype. Attainment of early sexual maturity with significantly more egg production up to 40th week was observed in Khaki Campbell whereas egg weight and other egg traits were better in native ducks. Egg production rate of local native ducks (21.46 %) was found significantly lower ($P < 0.001$) compared to Khaki Campbell duck (32.05%). The age at sexual maturity (female) of different genotypes of ducks were 178.92 (Khaki Campbell) and 191.12 (native ducks) days which differed significantly ($P < 0.05$). Maithili ducks laid eggs of thinner shell (0.41mm). The mortality rate in local duck was significantly lower ($P < 0.05$) compared to Khaki Campbell duck ducks. Economics of duck rearing between the varieties revealed a non-significant difference. Signifying that both Khaki Campbell and native ducks are suitable under extensive system of management.

PATHOLOGY OF SUBCUTANEOUS ACUTE SHATAVARIN-IV TOXICITY IN SWISS ALBINO MICE

Arivukarasu Palanisamy, Rinku Sharma*, Rajendra Damu Patil¹, Gorakh Mal and Birbal Singh

ICAR-Indian Veterinary Research Institute, Regional Station, Palampur 176061, Himachal Pradesh, India

¹Department of Veterinary Pathology, DGCN COVAS, CSK HPKV, Palampur 176062, Himachal Pradesh, India

Email: rinku.sharma@icar.gov.in

Abstract

The ability of saponins to stimulate the immune system has led to significant interest to study and use them as adjuvants in vaccines. For this, knowledge about their acute toxicity is a pre-requisite. Therefore, the present study was aimed to assess the subcutaneous, acute toxicity of Shatavarin-IV saponin isolated from fruits of *Asparagus adscendens* in Swiss albino mice. The Shatavarin-IV saponin was extracted and characterized by thin layer chromatography, NMR spectroscopy, and mass spectroscopic analysis. An experimental study of 14 days duration was conducted as per the OECD-425 guidelines. Three single doses of Shatavarin-IV saponin (100, 200 and 500 µg) were subcutaneously administered to mice (n=6). Equal number of animals were euthanized on 7 and 14 dpi. The animals were evaluated for the mortality pattern, behavioural changes, body weight index, organ to body weight index, haematology and serum biochemistry. Microscopically, in the liver, mild (S-IV-200 µg) to moderate (S-IV-500 µg) changes characterized by micro and macro vesicles (fatty changes) were observed in the hepatocyte cytoplasm at 7 dpi only. No pathological changes were observed in kidneys of all groups and spleen at the lower doses of S-IV (100 µg and 200 µg) at both 7 and 14 dpi. In the S-IV (100 µg) treated group, mild lymphoid depletion in the germinal centre of follicles was observed at 7 dpi which correlated with the findings of haematology. It was concluded that Shatavarin-IV saponin didn't induce any *in vivo* acute toxicity by subcutaneous route up to the dose of 100 µg in mouse model.



Thereafter, further doses lower than 100 µg can be used to study the adjuvant potential of Shatavarin-IV in combination with sub-unit or inactivated vaccines.

UNDERSTANDING THE SOC FOR SUSTAINABLE SOIL HEALTH

Ruby Saha^{1*}, Anil Kumar¹, Tapan Gorai¹, P.K. Yadav¹, Sangeeta Shree² and Ram Pal³

¹Bhola Paswan Sashtri Agricultural College, BAU, Sabour, Bhagalpur

²Bihar Agricultural College, BAU, Sabour, Bhagalpur (Bihar)

³K.V.K, Begusarai

*Email: ruby_58@rediffmail.com

Abstract

Study of soil in terms of soil quality and soil health in a changing world is critical to address the future food security concerns. It is very crucial to monitor the changes occurring in soils as a result of various crop management practices over the years. The crop residue which gets transformed into soil organic C is an important factor in improving soil fertility, its productivity and hence soil health. Green revolution has increased crop production but at the cost of soil health and possible risk of soil degradation. Soil health and its fertility is the basis of crop production and maintaining soil organic carbon (SOC) is important for sustainable agriculture. SOC is an important component of the three main aspects of soil fertility: helping release of major nutrients such as nitrogen and phosphorous, binding soil mineral particles together for increased water holding and infiltration capacity and providing a key food source for flora and fauna. Increasing and restoring SOC content is therefore an important mechanism for improving soil 'health' and for sustaining the crop productivity. We must explore various methodologies and different conservation technologies which targets on enriching the soil organic carbon and hence sustaining the crop productivity. A long-term experiment has been taken under the project entitled "NPMSH& F" (National Project on Management of Soil Health and Fertility), launched during 2008-09. Under this a total number of 115 surface soil (0-15 cm) samples were collected with GIS (Geographical Information System) from different locations of Bikramganj block on Grid basis. It has been observed that over the years more number of soil samples fall under the low category of organic carbon (according to criteria for assessment of organic carbon in soils) than in the initial year in Bikramganj block under Rohtas District and this is mainly due to excess use of chemical fertilizers and burning of crop residues in the field. Farmers in Rohtas district especially in Bikramganj disposes a large part of rice straw by burning in situ.

CHARACTERIZATION AND ROLE OF GHRELIN HORMONE IN GROWTH REGULATION OF LABEO ROHITA SUBJECT TO FEEDING ALTERATIONS

Showkat Ahmad Dar*, Prem Prakash Srivastava¹, Susmita Rani, Tapas Paul, Naresh Raj Keer, Abhiman P and Sarvendra Kumar

College of Fisheries Kishanganj, Bihar Animal Science University- 855107

¹College of Fisheries Dohli, RPACU, Bihar

*Email: Showkatdar53@gmail.com

Abstract

Ghrelin is a peptide hormone secreted primarily by the stomach and is involved in controlling growth by governing different functions in vertebrates including feed intake and metabolism in vertebrates. The full-length cDNA sequence of ghrelin is 453 bp including 50 -untranslated region (UTR) of 65 bp, 30 -UTR of 76 bp with a poly-A frame. An open reading frame (ORF) is 312 bp, which encodes a peptide of 103 amino acid residues. A secondary structure of GHSR protein consists of alpha helix 66.0%, 16% disordered and 43% transmembrane helix. . 60 days feeding trial was conducted with five treatment groups, Control (3% bw), T1 (alternate days), T2 (0.5% bw), T3 (1% bw) and T4 (2% bw) and feeding was done for first 30 days of the trial. For next 30 days, all the treatment groups were fed at a rate of 3% bw as in the control group. There was significant (p<0.05) difference in the weight gain among the treatment groups with lowest FCR and highest PER was found in T2 group. Ghrelin gene mRNA levels along with GHS-R, GHRH and IGF-1 were upregulated during first 30th days of the trial with highest expression levels in the T2 group. The expression levels of leptin gene mRNA were found significantly different (p<0.05) among the treatments, which was down-regulated during initial 30 days and upregulated as the experiment progress towards 60th day. The dynamics of AST and ALT in serum revealed a progressive increase till the 7th day and decreased upon



refeeding, cortisol level also has shown significant increase up to 7th day of starvation and sharp decline on refeeding. The present study describes the regulation of starvation, restriction feeding and compensatory growth by energy homeostasis and growth regulating genes such as ghrelin, leptin, GHS-R, GHRH and IGF-1.

MOLECULAR CHARACTERIZATION OF GARDEN ROSE GERMPLASM USING SSR MARKERS

Shephalika Amrapali^{1*}, Sunil Archak², Namita³ and Ambika B. Gaikwad²

¹ICAR-National Bureau of Plant Genetic Resources (NBPGR), Regional Station Ranchi- 34003

²ICAR-National Bureau of Plant Genetic Resources (NBPGR), New Delhi-110012

³ICAR-Indian Agricultural Research Institute (IARI), New Delhi-110012

*Email : shephalika.amrapali@icar.gov.in

Abstract

A set of 205 garden rose germplasm consisting of 87 hybrid tea, 111 floribundas, and 7 wild species were evaluated using 20 SSR primers. A total of 109 bands were generated from 205 rose cultivars. The average polymorphism for 205 cultivars tested with 20 SSR primers was 88 percent. On average, 1.78 unique alleles (N_a) and 1.46 expected number of alleles (N_e) were discovered. The genetic diversity analysis showed an excess of observed heterozygosity over expected. AMOVA revealed that 98 percent of total molecular variance occurred within groups, with only 2 percent occurring between groups. Principal Coordinate Analysis and Cluster analysis were carried out to investigate the genetic relatedness of crops. The scatter plot did not reflect the grouping of cultivars used for analysis, indicating that the cultivars of different garden rose class are related to each other. A dendrogram is also produced to better understand the presence of a grouping pattern and three major clusters were found. However, the clustering pattern does not correspond to the horticultural classifications used to group the accessions. The study suggests higher genetic similarity among the rose cultivars across different class of garden rose and a need to broaden the genetic base is needed. There is unexploited rose germplasm which has the potential to broaden the overall gene pool of rose breeding programs in general. The wild species of roses used in the study showed considerably higher dissimilarity with almost all the cultivars and can be used to broaden the genetic base.

STUDY ON LAND CONFIGURATION AND NUTRIENT MANAGEMENT IN GREEN GRAM UNDER SODIC SOIL

S. Anandha Krishnaveni *and ¹N. Karikalan

*Department of Agronomy, Tamil Nadu Agricultural University,

¹TRRI, Aduthurai, Thanjavur, Tamil Nadu, India.

*Email: agroveni@gmail.com

Abstract

Field experiment was conducted at Anbil Dharmalingam Agricultural College and Research Institute, Tiruchirappalli during *kharif* season of 2019 to study the effect of land configuration and nutrient management on growth, yield, quality and economics of green gram in sodic soil. The experiment was carried out in Factorial Randomized Block Design (FRBD) with three replications. Treatment consists of combination of two factors viz., three land configurations (Flat bed, ridges and furrow and broad bed furrow) and five nutrient management practices (100% RDF + 2% DAP, 100% RDF + 1% MAP, 75% RDF + 2% MAP, 100% RDF + 1% MKP and 75% RDF + 2% MKP). The results revealed that broad bed furrow method registered significantly higher plant population, growth parameters, yield attributes, yield, quality parameters, nutrient uptake and chemical properties of post-harvest soil than flatbed method. This was followed by ridges and furrow method. Regarding the nutrient management practices, application of 100% RDF + 1% MKP registered significantly higher plant population, growth parameters, yield attributes, yield, quality parameters and nutrient uptake of green gram and this was on par with 100% RDF + 1% MAP. This was followed by the farmer's practice of 100% RDF + 2% DAP. Treatment combination of L_3N_4 (broad bed furrow method with 100% RDF + 1% MKP) showed its superiority by achieving maximum net return and B: C ratio. This was followed by L_3N_2 (broad bed furrow method with 100% RDF + 1% MAP). From this study it is concluded that sowing in broad bed furrow along with soil application of 100% RDF + 1% MKP as foliar spray twice at flower initiation and 15 days later may be recommended to enhance the productivity and profitability of green gram under sodic soil condition.



INCIDENCE OF RICE LEAF ROLLER *CNAPHALOCROCIS MEDILLALIS* GUENEE (PYRALIDAE: LEPIDOPTERA) IN KOSHI REGION OF BIHAR

Shyam Babu Saha^{*1}, Tamoghna Saha², B.B. Singh³, R.N. Gupta⁴ and Shivrath Das⁵

¹Department of Entomology, Mandan Bharti Agriculture College, Agwanpur, Saharsa (BAU, Sabour)

²Department of Entomology, Bihar Agriculture College, Sabour, Bhagalpur

³Department of Entomology, N.C.O.H, Noorsarai

⁴Department of Plant pathology, Bihar Agriculture College, Sabour, Bhagalpur

⁵Betelvine Research Centre, Islampur, Nalanda (B.A.U., Sabour)

*Email: shyamento@gmail.com

Abstract

Rice is one of the chief food grains of India. Moreover, this country has the largest area under rice cultivation. As it is one of the principal food crops. It is, in fact, the dominant crop of the country. India is one of the leading producers of this crop. Rice is the basic food crop and being a tropical plant, it flourishes comfortably in a hot and humid climate. Rice is mainly grown in rain-fed areas that receive heavy annual rainfall. Therefore, it is fundamentally a kharif crop in India. In India, rice is grown in an area of 43.79 million ha with a production of 116.42 million tonnes and productivity of 2659 kg/ha, stands second next to China (Anonymous, 2019). The major rice producing states of India are West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab, Tamil Nadu, Bihar, Orissa, Assam, Karnataka and Haryana. In India insect pest cause 25 percent loss in rice (Mondal et al., 2017). About 300 species of insect pests attack the rice crop at various stages of crop growth and among them 23 species cause remarkable damage (Pasalu and Katti, 2006). Rice leaf roller *Cnaphalocrocis medillalis* Guenee (Pyralidae: Lepidoptera) is one of the most serious/important pests of rice. An experiment was conducted at MBAC, Agwanpur, Saharsa to observe the population trends and the impact of abiotic factors on *C. medillalis* infestations in rice crop during Kharif season (August to October) of 2019. Moths measured about 2 cm, long wings brownish yellow with black wavy bands. Eggs are laid singly on the lower surface of the leaves. Caterpillar dull white light greenish yellow in colour. They fold the leaf margins often longitudinally by gluing the leaf margin at certain intervals and feed inside the rolled leaves by scraping the epidermis. The affected leaf look brownish, which subsequently dries up. Sometimes 2 or 3 leaves are folded together. Pupation takes place inside the leaf fold. During 2019, average temperature, relative humidity and rainfall contributed 14.69% in rice leaf folder infestation. This information can be helpful as a key component for implementation of integrated management of rice leaf folder.

STUDIES ON GROWTH AND INACTIVATION KINETICS OF A LUMPY SKIN DISEASE VIRUS (LSDV) INACTIVATED VACCINE CANDIDATE STRAIN FROM INDIA

Shashi Bhushan Sudhakar^{*}, Niranjana Mishra, Semmannan Kalaiyarasu, Khushboo Ahirwar and Vijendra Pal Singh

ICAR-National Institute of High Security Animal Diseases, Anand Nagar, Bhopal-462 022 M.P., India

*Email : sudha.vet@gmail.com

Abstract

Lumpy skin disease (LSD) of cattle is caused by LSD virus (LSDV) which belongs to the genus *Capripoxvirus* within the family *Poxviridae*. LSD inflicts huge economic losses in dairy farming in addition to trade and animal movement limitation, and hence is listed as a notifiable transboundary disease by the World Organization of Animal Health (WOAH). Vaccination is the only economically feasible way to control this vector-borne disease. So far, live-attenuated homologous and heterologous vaccines are commercially available and are being used for the control of LSD across the globe. However, they suffer from several disadvantages following vaccination (e.g., loss of the disease-free status of the country, the possibility of vaccine virus shedding and transmission as well as the risk of recombination with field strains during natural outbreaks). Therefore, innocuous and efficacious inactivated vaccines against LSDV would provide an alternative tool for control of LSD. Recent studies on inactivated LSD vaccine efficacy suggest that inactivated and adjuvanted LSD vaccine formulation provides good clinical protection following cattle challenge trials. Hence, in an effort to develop an inactivated LSD vaccine for cattle in India, we conducted studies on growth characteristics and inactivation kinetics of a LSDV inactivated vaccine candidate strain derived from an Indian LSDV wild-type strain and characterized the seed virus stock. MDBK cells were used to propagate a



genetically characterized Indian LSDV wild-type isolate (NI-2490 like) to obtain the optimum virus titer. The growth kinetics of the LSDV isolate was carried out and optimum multiplicity of infection (MOI) was determined before further propagation to obtain a vaccine virus seed stock. After observation of CPE, LSDV infected cells were harvested at 5 days post infection (dpi) by freezing–thawing of the cells. After centrifugation of the infected cell lysate for 10 min at 7000 rpm, the supernatant was collected and tested. Purity of the LSDV isolate was tested by TaqMan real-time PCR using LSDV wild-type strain specific primers and probes targeting the LSDV EEV gene (LSDV126). The seed virus stock and MDBK cells were tested for the presence of extraneous agents such as bacteria, fungi, mycoplasma and other adventitious bovine viruses (BVDV, BHV-1, BTV, BPV, Bovine Adeno viruses, BRSV) by PCR. Inactivation kinetic study was carried out using different concentrations (10 mM, 20 mM, 40 mM and 80 mM) of binary ethylenimine (BEI) at 37°C temperature and various time intervals (12h, 24h, 36h and 48h). Inactivated virus stock was neutralized with sodium thiosulfate solution and residual infectivity of the preparation was checked by passaging thrice on MDBK cells. Based on the genetic characterization of circulating LSDV strains in India, a LSDV isolate from 2019 outbreaks in cattle was selected for further study. In the growth kinetics study, it was found that highest titer of LSDV was achieved by culturing at 0.1 multiplicity of infection (MOI) on MDBK cells. Purity testing by molecular tests (PCR/qPCR) revealed that the selected LSDV isolate and the virus seed stock contains only LSDV wild-type strain without any cross contamination and adventitious bovine viruses. Inactivation kinetics study revealed that 10 mM of BEI for 12 h at 37° C is optimum for complete inactivation of LSDV as evident by no residual infectivity on MDBK cells even after three serial passages. The master virus seed stock showed a titer of $10^{6.75}$ TCID₅₀/ml, an early CPE and complied with the quality control testing. An inactivated LSDV vaccine candidate strain was selected and the master virus seed stock has been developed in this study for the future development of inactivated LSD vaccine in India following assessment of its immunogenicity, safety and efficacy in cattle.

PLANTING METHOD, NUTRIENT MANAGEMENT, TOPPING AND IRRIGATION ON GROWTH AND YIELD OF SUGARCANE (*SACCHARUM OFFICINARUM*.L)

S. Thiruvavarassan¹, M. Jayachandran¹, E. Jamuna³, R. Kanjanarani⁴ and V. Vijaya Geetha⁵

^{1,3&4}Oilseeds Research Station, Tindivanam, Tamil Nadu Agricultural University, Coimbatore, T.N.

²Sugarcane Research Station, Cuddalore, Tamil Nadu Agricultural University, Coimbatore, T.N.

⁵Vegetable Research Station, Palur, Tamil Nadu Agricultural University, Coimbatore, T.N.

*Email: thiruvavarassan@rediffmail.com

Abstract

Field investigations were carried out during early seasons at Sugarcane Research Station, Cuddalore to ascertain the effect of intra-row spacings for chipbud raised sugarcane seedlings, doses of NPK, addition of bio- inoculants in combination with the practice of topping under conventional method of flooding irrigation. Even though, the adoption of 30 cm intra-row spacings + 100% dose of NPK+ topping treatment registered significantly maximum number of tillers per hectare, the maintenance of 45 cm intra- row spacings + 100 % recommended dose of NPK + topping registered the maximum values of varied growth, yield parameters viz., cane length (289 and 282 cm), cane girth (2.79 and 2.66 cm) individual cane weight (2.06 and 1.97kg) and millable canes (1,27,600 and 1,23,600) cane (140.43 and 129.94t/ha)and sugar yield (16.86 and 15.67t/ha).

IDENTIFICATION OF FIELD SOIL SALINITY TOLERANCE RESOURCES IN INTERNATIONAL BARLEY PANEL

S.K. Bishnoi*, R.P.S. Verma, Dinesh Kumar, Chuni Lal, G.P. Singh and Omvir Singh

ICAR-Indian Institute of Wheat and Barley Research, Karnal

Email: skbishnoi.ars@gmail.com

Abstract

Barley is the fourth most important cereal and a highly salt tolerant crop that can tolerate a soil salinity upto 25 dS/m. However, the salinity tolerance has not been systematically bred into the high yielding varieties released for commercial cultivation mainly owing to non-identification of the salinity tolerance resources. The field identification of salinity tolerance is cumbersome because of the lack of uniformity in salinity and thereby high experimental error. In the present study we evaluated for the second year an international panel of 320 lines received from ICARDA, Morocco which consisted of 2 row,



6 row, feed and malt barley landraces and released cultivars under 8.33 pH and 13.33 dS/mEC. The germination percentage ranged from 0 to 100%, indicating presence of high genetic diversity for salinity tolerance. The experiment was laid down in ABD in hill planting with 10 plants per hill. The recently released and agronomically superior DWRB137 was used as check after each five hills. The scale used for tolerance score was 0-5 where 0 was failure of germination and 5 was considered to be normal growth and maturity under saline conditions. Whereas in the previous year (2020-21) in the same salinity sick plot 75% of the genotypes were found either highly susceptible, susceptible or moderately susceptible, in the current year (2021-22) 69.31% (222) of the genotypes exhibited a salinity score of 4 or 5 i.e. highly tolerant or tolerant. 42 genotypes (13.12%) failed to germinate i.e. very highly susceptible and 48 genotypes (15%) could be categorized as moderately susceptible, susceptible or highly susceptible. The salinity tolerance score of the check ranged from 0-5 with an average of 3.58. The study concluded that repetition of the screening for salinity over the years is a must for reaching to conclusive inferences.

MULTIPLE SHOOT REGENERATION IN *INDICA* RICE (*ORYZA SATIVA*) GENOTYPES

Shambhu Krishan Lal^{*1}, Riya Kumari¹, Prahlad Potam^{1,2}, Arunava Pattanayak¹, Avinash Pandey³, Krishna Prasad⁴, Sudhir Kumar³, Madan Kumar³

¹School of Genetic Engineering, ICAR–Indian Institute of Agricultural Biotechnology, Ranchi, Jharkhand, India

²Shaheed Mahendra Karma Vishwavidyalaya, Bastar, Dharampura, Jagdalpur, Chhattisgarh, India

³School of Genomics and Molecular Breeding, ICAR–Indian Institute of Agricultural Biotechnology, Ranchi, Jharkhand, India

⁴Department of Genetics and Plant Breeding, Birsa Agricultural University, Ranchi, Jharkhand, India

*Email: shambhumku@gmail.com

Abstract

The regeneration of *indica* rice cultivars is difficult as compared to *japonica* rice due to their recalcitrant nature. Also, the transformation in *indica* rice is limited to few genotypes due to low transformation efficiency. Therefore, the establishment of efficient and reproducible protocols for regeneration is a prerequisite in transformation and rice improvement. Efficient regeneration of *indica* rice, IR-64 and CO-39 was carried out from shoot basal region (direct regeneration) and also through callus (indirect regeneration) on Murashige and Skoog media containing different concentration of cytokinin and auxin. A total of 9-16 and 9-15 shoots regenerated at 6 mg/L and 8 mg/L of 6-Benzylaminopurine (BAP) from germinated single rice seed of CO-39 and IR-64 rice genotypes respectively. Moreover, 10-18 and 9-16 shoots regenerated at 3 mg/L and 4 mg/L of BAP along with 0.5 mg/L 1-Naphthaleneacetic acid (NAA) through callus in CO-39 and IR-64 respectively. The regenerated shootlets were transferred to the rooting media and in about 10 days, the root developed. The generated plantlets were transferred in a small pot for hardening in the Plant growth chamber for 10 days followed by transfer into the field for further growth and analysis. *In vitro* rice plantlets developed through direct and indirect regeneration are homogenous and there is no somaclonal variation was seen. The homogenous plantlets developed using this method could escapes the environmental stresses in the field.

BIOEFFICACY OF CHLORPYRIPHOS (CHLOROCIL 20EC) AGAINST WOOLLY APPLE APHID, *ERIOSOMA LANIGERUM* (HAUSMANN) INFESTING APPLE

Sangita Sharma

Dr Y.S. Parmar University of Horticulture and Forestry, Regional Horticultural Research & Training Station, Mashobra, Shimla-171007(HP)

Email: sangitasharmaento@gmail.com

Abstract

The woolly apple aphid, *Eriosoma lanigerum* is a key pest of nursery and young trees in orchards of Himachal Pradesh. Bioefficacy of chlorpyrifos (Chlorocil 20EC) was evaluated against aerial form of woolly aphid in apple orchards of Regional Horticultural Research & Training Station, Mashobra at post-harvest stage i.e. October-November, 2017. Two concentrations of Chlorocil 20EC viz. 1ml and 2ml/L of water along with standard insecticide chlorpyrifos (Dursban 20EC) @ 2.5 ml/L of water were evaluated. The results of the experiment revealed that all the concentrations of test chemical were effective in suppression of the pest up to 21 days with 98.61% kill in lower dose (1ml/L of water) and cent percent control was



recorded in highest dose (2ml/L of water) and were statistically at par with each other and standard Dursban (2.5ml/L of water) where complete control of aphid was achieved. All the concentrations proved safe to the apple trees as no phytotoxic symptoms were observed and there was no adverse effect on any of the growth parameters. However, the activity of natural enemies during the study period was found to be very negligible.

EFFECT OF WHEY SUPPLEMENTATION UPON GUT MORPHOLOGY OF BROILER BIRDS

Sanjay Kumar, S.P. Sahu and Sushma Kumari

Dept. of LPM, BVC, Patna

Abstract

A study was conducted to provide liquid whey to the broiler birds in drinking water at 5 (T2), 10 (T3) and 15% (T4) level in three groups separately to 120 Day old Chicks for 42 days period and their comparison were done with control group (T1). Gut morphology of duodenum in 42 day old broilers birds were assessed upon slaughter of birds from each group. The mean value for duodenal villus height varies from 162.56 to 212.46 μm , duodenal Villus crypt varied from 42.44 to 72.43 μm and for Villus surface area varied from 24973.40 to 42200.53 μm^2 in different treatment groups. All the treatment groups differed significantly ($p < 0.05$) from each other and highest value was obtained in T3 group followed by T4, T2 and T1. This showed that whey fed gr. had larger surface area of villus over control gr. A significantly ($p < 0.05$) higher value for villus height of ileum was obtained in T3 (264.77) followed by T4 (247.13), T2 (179.43) and 176.77 μm (T1). Villus width, villus crypt and villus surface area also followed the same pattern. The values for jejunum villus height varied from 235.70 to 287.02 μm and villus width varied from 8.64 to 12.43 μm . while villus surface area of jejunum was found to be 6129.70, 9316.31, 11146.88 and 9625.65 in T1, T2, T3 and T4 respectively. For all the parameters, significantly ($p < 0.05$) higher value were obtained in T3 followed by T4, T2 and lowest in control T1. It showed that best effect of whey feeding on jejunum morphology were obtained at 10% level in broiler birds and revealed that villus height, width, crypt increases in treatment group than control. This indicated that the absorptive function in the ileum of these chickens was higher compared with control treatments.

EFFECT OF INM ON SOIL HEALTH AND POOLS OF ORGANIC MATTER

Shankar Lal Sunda* and D.P.S. Dudi

Department of Soil Science and Agricultural Chemistry, RCA, MPUAT, Udaipur

Email: shankarlalsunda5@gmail.com

Abstract

The INM supply system, by which we can apply the nutrients in balanced form, is emerging as the most logical concept for managing and sustaining long term soil fertility and productivity. Continuous use of only chemical fertilizers in intensive cropping system is leading to imbalance of nutrients in soil, which has an adverse effect on soil health and also on crop yields. On the other hand, continuous use of organics helped to build up soil humus and beneficial microbes besides, improving the physico-chemical properties of soil. Our hypothesis is that integration of organic and inorganic nutrient sources may provide an efficient use of resources for maintaining higher productivity and available pool of organic matter.

INVESTIGATION ON SOIL MICROBIOME PROFILE OF COAL MINE AQUATIC ECOSYSTEM OF RAMGARH, JHARKHAND

Sanjay Kumar Gupta*, Mohd. Mobin Khan, Shivani nage and Rajan Gupta

*Email: SANJAY.GUPTA@icar.gov.in

Abstract

Mining activities adversely affect the fertility of the soil. A large number of heavy metals present at the mining site alter the microbial activity of the soil resulting from significant changes in the microbial diversity. In present study, two different sites namely the Ramgarh coal void and Getalsud reservoir were selected as the test and control sites, respectively to investigate the soil microbial community structure. The concentrations of heavy metals present in the soil and water samples were analysed by inductively coupled plasma mass spectrometry (ICP-MS). In the soil samples, it was found that there was no significant



difference in Li, Be, V, Co, Cu, Zn, Se, Ag and Fe, but significant difference was found in the concentrations of Cr, Mn and Ni. Similarly, no significant differences were found in the heavy metal concentrations of Be, V, Mn, Co, Se and Ag in the water samples, however, significant differences ($p < 0.05$) were found in Li, Cr, Ni, Cu, Zn and Fe. The concentration of heavy metals was found to be higher at the test site than the control. Bacteria and *Archaea* were found to be most abundant domains at both the experimental sites. However, the contribution of *Archaea* was significantly higher in the soil sample of test site. Though, *Proteobacteria* contribution was dominant in both the experimental group, the percentage abundance was higher from the coal void site. Among the *Proteobacteria*, *Deltaepsilon* and *Beta proteobacteria* were observed to be major class in both groups with higher percentage contribution at the coal void site. The *Euryarchaeota* was recognized as the major phylum of the *Archaea* domain followed by *Track group*, with higher abundance at the control site. No significant ($p > 0.05$) difference was observed in the *Shannon* and *Fischer* alpha-diversity indices of soil samples collected from Ramgarh coal void whereas significant impact was seen in terms of Simpson index. Further functional metagenomics approaches might shed light to decode genes responsible for heavy metal resistance in the soil microbiome.

ADVANCES IN BREEDING OF AONLA

Sanjay Sahay, Kumari Rashmi¹*, M. Feza Ahmad, H. Mir, S. Sengupta, Ravindra Kumar, M. Kundu, Pawan Kumar, Ruby Rani and Kumari Karuna

Deptt. of Horticulture, Bihar Agricultural College, Sabour, Bhagalpur-813210

¹Deptt. of Plant Breeding and Genetics, Bihar Agricultural College, Sabour, Bhagalpur

*Email: versatilerash@rediffmail.com

Abstract

Aonla (*Emblia officinalis* Gaertn), commonly called Indian gooseberry, belonging to family Euphorbiaceae, is one of the oldest known indigenous fruit tree species with wide distribution, reflecting its adaptation to wide range of edaphoclimatic conditions. It has significant contribution to improvement of economic status of farming communities through commercial orcharding, nursery production and processing of herbal respect of fruit size, maturity period and yield per plant. Due to predominance of seedling propagation India holds rich genetic diversity in cultivated and their wild relatives of aonla. It is an important fruit owing to its nutritional, therapeutical, and postharvest and industrial value. Various pharmaceutical attributes of aonla have been described in ancient treatise either in combined formulation or alone. In a bid to better utilize and improve the present genetic resource, there is a need to apprehend and appreciate the studies related to use, centre of origin and diversity, as well as the characterization, evaluation and conservation, taxonomy and systematics, phenology, floral biology and pollination. In addition to basic biology of plant, agro-techniques, propagation, canopy architecture, physiological disorders, insect-pests and diseases and their management practices, etc. have been used to conserve aonla germplasm as well as improve its production. Varieties viz. Banarsi, Francis, Chakaiya, Banarsi Red, Kanchan (NA 4), Krishna (NA 5), NA 6, NA 7, NA 10, Anand -I and Anand-2 are commercially cultivated varieties. Incorporation of desirable genes is possible only with the application of biotechnological approach for aonla improvement.

DEATH OF PIGEONS DUE TO CESTODES *RAILLIETINA ECHINOBOTHRIDIA*

Sanjiv Kumar*, Kaushal Kumar, Imran Ali and Deepak Kumar

Department of Veterinary Pathology, Bihar Veterinary College, BASU, Patna

*Email: mrsanvet@rediffmail.com

Abstract

In the present case, few pigeon carcasses from nearby Patna district of Bihar was brought by a pigeon owner in the department of Veterinary Pathology, Bihar Veterinary College, Patna for post mortem examination to ascertain the cause of death. According to the owner, he was owning about 100 pigeons and was affectionate for them. About thirteen of his pigeons have died in a 3 days' span time. Before death the birds were signs of watery faeces, incoordination and paralysis. Some ailing pigeons were also carried by him to the department. He was seeking advice from local veterinarians but treatment was not successful. Carcass was cut opened for detail necropsy examination. On opening the carcass, multiple small nodular growth of about 1-2 mm diameter was evident on the serosal surface of small intestine. The intestinal wall was thick. Intestine was cut opened to expose the mucosal surface. Several ribbon shaped segmented helminthic parasite were found firmly attached to the



mucosal surface. Most of them were still alive. These parasites were removed from the intestine and carefully examined under microscope. These were further diagnosed as *Raillietina echinobothridia* cestodes. Intestine was collected for histopathological examination which showed degeneration and necrosis of intestinal villi, on microscopic examination. Granuloma formation and nervous manifestation are features of *R. echinobothridia* in heavy infestation. These parasites require ants to complete its life cycle. In general, in small infestation they are not so dreaded but in heavy infestation they cause mortality. Body parasite is dorsoventrally flattened and about 25 cm and 1.5 cm in dimension. The body is divided into scolex, neck and strobili. They attach with the host intestine wall with help of scolex and gets their nutrition from

AGRO-MORPHOLOGICAL, PHYSIOLOGICAL AND ANATOMICAL CHANGES IN RICE GENOTYPES UNDER STAGE SPECIFIC AND CUMULATIVE DROUGHT CONDITIONS IN EASTERN REGION OF INDIA

Santosh Kumar^{1*}, A.K.Choudhary¹, Sahana Basu², Gautam Kumar³, Arvind Kumar^{4&5}

¹ICAR –Research Complex for Eastern Region, Patna-800014, India

²Assam University, Silcher, Assam, India

³Central University of South Bihar, Gaya, Bihar, India

⁴International Rice Research Institute, (IRRI), Philippines

⁵International Crops Research Institute for the Semi-Arid Tropics, Patancheru, Telangana, India

Email: santosh9239@gmail.com

Abstract

In the current changing climate situation, drought stress becomes the most important limiting factor for sustainable rice production in the drought prone rainfed as well as limited irrigated ecosystems of the Eastern India. Drought has devastating effects on morphology, physiological, & anatomical functions of rice. Most of the current high-yielding rice varieties growing in the drought-prone areas of eastern region of India are highly susceptible to drought, and have shown significant yield reduction even under mild to moderate drought. Development of multi-stage drought tolerant rice genotype is required to improve rice productivity in drought prone rainfed and poorly irrigated areas. Thus, the present study was conducted to explore the stage-specific as well multi-stages and effects of drought on rice genotypes sown under field conditions. Under present study, rice genotypes comprises of advanced breeding lines and check varieties IR 64 (susceptible) and Sahbhagi Dhan (tolerant) were evaluated under multi-stages drought (MSD), reproductive stage drought (RSD), vegetative stage drought (VSD), seedling stage drought (SSD) stress and irrigated conditions. Results of the study revealed that irrespective of the genotypes, there was a significant reduction in mean grain yield under MSD (61.1%), RSD (49.30%), SSD (24.45%) and VSD (14.9%) stresses as compare non-stress condition. Further studies revealed that physiological and biochemical traits like RWC, MSI, total chlorophyll, protein and starch content significantly ($P < 0.05$) declined under MSD, SSD, RSD and VSD conditions. The level of lipid peroxidation & peroxidase activity increased under different stage drought conditions. Among the rice genotypes, RCPR 22, RCPR 19, RCPR 58, RCPR 8, RCPR 16, and RCPR 20 were identified promising for multi-stages drought tolerance compare to Sahbhagi Dhan. Identified promising rice genotypes could be good substitutes for the existing drought tolerant varieties in drought prone rainfed as well as water limited irrigated areas in eastern region of India.

CONTRIBUTION OF ADVANCED AGROFORESTRY RESEARCH IN SUSTAINING SOIL QUALITY FOR INCREASING FOOD PRODUCTION AND FOOD SECURITY

Sarah Sharma, Savita Dewangan and Bipin Kumar Singh

Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, UP

*Email: sarusarah.sharma@gmail.com

Abstract

Agroforestry is a land use system that combines agriculture and forestry. From the beginning, the major tenets of agroforestry have been its soil conservation value and sustainability of agricultural production system. The horizontal and vertical growth of agroforestry has made significant stride towards wellbeing of the people. The surging interest in agroforestry to search solution for food security is based on the scientific revelations that the tree components of agroforestry not only supplement



and compliment growth of agri-components by improving soil health but also contribute towards mitigation of climate changes and food security. To achieve global food security, we need to approximately double food production over the coming decades. Agroforestry also increases resilience of crops and farm livelihoods, especially among the most vulnerable food producers. In addition to advancing food security, agroforestry provides a pathway out of poverty because the combination of increased yield, low cost, and additional tree-based farm products can significantly increase net farm income.

ENHANCEMENT OF RESISTANCE TO WHEAT STRIPE RUSTS BY INCORPORATION OF GENES USING MOLECULAR MARKERS

Satish Kumar*, C.N. Mishra, Amit Kumar Sharma, Gyanendra Singh and G.P. Singh

ICAR-Indian Institute of Wheat and Barley Research, Karnal, India-132001

*Email: kumarsatish227@gmail.com

Abstract

Among major constraints to wheat production in India, stripe rust is one of the main factors in wheat production in about 13.0 mha area in Northern Hills and North Western Plains. During 1990's, *Yr9* virulence of *Puccinia striiformis* spread over large areas and later occurrence of *Yr27* virulence since 2001 and its extensive spread rendered mega wheat variety, PBW 343 susceptible. Very few stripe rust resistant genes (*YrA*, *Yr2*, *Yr9*, *Yr18*, *Yr27*) were floating in the Indian wheat breeding programs during this period. Of these genes many were ineffective against the virulent races of the pathogen. New sources of resistance to stripe rust (*Yr5*, *Yr10*, *Yr15*, *Yr24*) became available under the umbrella of Indo-Australian collaboration. Hybridizations of these donors were carried out with Indian recipient varieties. A set of 16 advanced lines developed from these crosses out yielded the checks in preliminary evaluation and were promoted to the station trials. Out of these, five lines have been promoted for further testing in national coordinated trials with the purpose of variety release. Recently, five new stripe rust pathotypes were detected which are virulent on recently released cultivars. However a new set of stripe rust resistant genes (*Yr47*, *Yr51*, *Yr57*) have been made available and are being used in the breeding programs. At the same time a diverse set of resistant genes *Yr17*, *Yr18*, *Yr31*, *Yr36*, *Yr40*, *Yr53*, *YrC591*, *Yr70* has been developed and is being used. Breeding materials developed by using the stocks are at different stages of development. The recent progress has led to development of high yielding and stripe rust resistant lines and preparedness for any future threats arising as far as stripe rust is concerned.

SESAME (*SESAMUM INDICUM* L.) BREEDING FOR OIL SECURITY IN BIHAR

¹Sima Sinha, ²Vivek Kumar, ¹Kumari Rashmi, ¹S.S. Mandal,

¹Department of Plant Breeding & Genetics, Bihar Agricultural University, Sabour, 813210

²Department of Plant Breeding & Genetics, Punjab Agricultural University, Ludhiana, 141004

*Email: simasinhall@gmail.com

Abstract

Oilseed crops are grown in different agro-climatic conditions of India. Oilseeds are the primary source of vegetable oils (DMRR, 2015) in the country among them seven are edible, i.e. soybean, groundnut, rapeseed-mustard, sunflower, niger, sesame, safflower and two are non-edible, i.e. castor and linseed. Among edible oilseeds, sesame is having high Polyunsaturated Fatty acids (PUFA) and having property to reduce the bad cholesterol. Due to high medicinal value and good quality of oil, sesame is known as Queen of oilseeds. This leads, sesame breeding programme is essential to meet out the challenge of vegetable oil security. Sesame (*Til*) improvement programme is possible through conventional breeding and non-conventional breeding approach. Conventional plant breeding is the development or of cultivars using conservative tools for manipulating plant genome within the natural genetic boundaries of the species. Conventional plant breeding includes hybridization, selection, pedigree method, bulk method, single seed descent method, back cross, mutation breeding etc. Non-conventional plant breeding is the development of cultivars using advance tools such as molecular approach, tissue culture, mutation for manipulating plant genome. Conventional breeding requires a long term program which is a continuous and laborious task requiring compatibility and patience whereas, non conventional saves time in the breeding process. Cultivated sesame has some wild characters including seed shattering, indeterminate growth habit and asynchronous capsule ripening leading to low seed yield (700–800 Kg/ha). Sesame crop has a big challenge against indeterminate type plant which affects the synchronous maturity. Identification and introgression of determinate (*dt*) gene in selected lines through



conventional/ non-conventional approach which would be a great success in sesame improvement programme. Reduction in Seed shattering has directly increased the sesame production significantly.

DETECTION OF BIOFILM FORMING ABILITY BY *ESCHERICHIA COLI* ISOLATES FROM BOVINE

Sanjana¹, Savita Kumari^{*1}, Anjay², Pankaj Kumar¹, P. Kaushik² and Sudha Kumari¹

¹Department of Veterinary Microbiology, Bihar Veterinary College, BASU, Patna, Bihar

²Department of Veterinary Public Health and Epidemiology, Bihar Veterinary College, BASU, Patna, Bihar

Email: drsavitakumari@gmail.com

Abstract

A study was conducted for the detection of biofilm production in 21 isolates of *Escherichia coli* characterized from bovine urine samples. All isolates of *E. coli* were confirmed by cultural and biochemical characteristics along with PCR confirmation by amplification of 16S rRNA gene. Biofilm formation can be used as a mechanism for bacterial resistance and also for bacterial virulence. Among one of the several bacteria, *E. coli* is eligible to form biofilm structures and can switch between planktonic form and biofilm form. Congo red agar morphotyping was used to detect biofilm production in *E. coli* isolates. Congo red agar plates were prepared, then streaked with test organisms and kept at 37°C for 24-48 h incubation. Brown, dry and rough (BDAR) morphotype was produced by 10 isolates, indicating only curli production, whereas 04 isolates produced red, dry and rough (RDAR) morphotype, representing curli and cellulose production, and 07 isolates showed the smooth and white (SAW) morphotype. In this present study, approx. 66.6 % (14/21) of *E. coli* BDAR and RDAR morphotypes producing isolates were found associated to form biofilm. The study emphasized the need for further study to assess the possession of virulence factors in *E. coli* colonising urinary tract of bovine and their possible role in urinary tract infections.

STUDY ON SUSTAINABILITY INDEX IN ADVANCED RICE GENOTYPES (*ORYZA SATIVA* L.)

Sreelakshmi, Ch. Paramasiva I., Vineetha U. and Madhusudhan, P.

Agricultural Research Station, Nellore, ANGRAU, Andhra Pradesh

Email: sreelakshmi.angrau@gmail.com

Abstract

Any crop variety developed by either scientist or farmer should have adaptability over the regions and years for giving stabilized yields. Yield is polygenic in nature and it is a complex quantitative trait which is influenced by environment. The information on genotype x environment interaction plays a major role in success of the variety in the varied agro climatic conditions especially in decreased farm holdings and resource poor farmer conditions. In subsistence agricultural system, yield *per se* may be less important than reaching a certain yield level (Fox *et al.*, 1997). Therefore, development of varieties and hybrids with stable performance is gaining importance to help achieve sustainability in agricultural production. Sustainability index in terms of varietal stability gives an indication about the stability of a variety across the location and over the years. Hence the present investigation was undertaken to determine the sustainability index of seventeen rice genotypes evaluated for three consecutive years at Agricultural Research Station, Nellore, ANGRAU, Andhra Pradesh in a completely randomized block design with three replications. The grain yield was recorded on plot basis and was estimated in tonnes/ha. The three year data on each variety were used for estimation of sustainability index. The sustainability index was estimated according to following formula used by other workers (Singh and Agarawal, 2003; Gangwar *et al.*, 2004 and Tuteja, 2006).

$$\text{Sustainability index} = \frac{\text{Average performance} - \text{Standard Deviation}}{\text{Best performance}} \times 100$$

The value of sustainability index were arbitrarily divided in to five group viz. very low (up to 45%), low (46– 60 %), moderate (61- 75%), high (76-90) and very high (above 90%). In the present study, the yield differences were found to be significant over the years, indicating genetic difference among the varieties studied. NLR 3433 recorded highest grain yield and has highest sustainability index (5.15 t/ha and 70.33% respectively), indicating the best performance of this variety which could be taken as the indication of close proximity between the best performance and the average performance over the years. This



explains the good stable performance of NLR 3433 over the years. The second best genotype was NLR 3374 which recorded best performance of 5.711 t/ha and sustainability index of 71.12 percent followed by NLR 33892 (5.31t/ha SI: 69%). The genotypes NLR 3475 (6.13 t/ha; SI: 60%), NLR 3477(5.87 t/ha; SI: 58.28%), NLR 3474 (5.74 t/ha; SI: 45.40%) and NLR 3466 (5.87 t/ha; SI: 45.5%) although recorded high yield, however its sustainability index was moderate indicating its inconsistent performance over the years. Hence, these genotypes were considered that they were adaptable to specific situation only. The yield performance and sustainability index of remaining genotypes were poor to average indicating their unstable performance over the years. From the present investigation, it's concluded that the genotypes NLR 3433 and NLR 3374 were the most suitable genotypes with respect to yield and sustainability and these genotypes can be used as a parents in future breeding programme for evolving genotypes with high sustainability of grain yield.

EFFECT OF PRE-SOWING TREATMENTS ON THE SEED GERMINATION OF MEDICINAL PLANTS W.S.R.T. METHODS MENTIONED IN *VRIKSHAYURVEDA*

Sonal Singh Kushwaha^{1*} and Cheetu singh²

¹Department of Dravyagunā Vigyana, Shri Dhanwantry Ayurvedic College, Chandigarh

²Medical Officer, Health Department, Haryana

*Email: sonal27091999@gmail.com

Abstract

The Indian Government has identified the study of medicinal plants as one of the sectors that can put India as the global leader of 21st century because of an available treasure of 8000 medicinal plants. But somehow, owing to their tremendous global demand, they are indiscriminately collected from their natural habitats, resulting in scarcity and pushing them to verge of “endangered” category to the worst “extinct” level. *Vrikshayurveda*, a 10th century treatise, written by *Surpala*, works for the survival of plants. In modern era, texts like *Vrikshayurveda* are of immense significance because tons of chemicals are used injudiciously in agricultural lands just to increase the productivity and meet the huge market demands. Apart from being expensive, these chemicals are extremely hazardous to both the environment and human health. *Vrikshayurveda* is the way forward for organic production of seedlings as well as large scale cultivation of medicinal plants, horticultural crops. To Evaluate the effect of pre-sowing treatments on seed germination of medicinal plants w.s.r.t. *Vrikshayurveda*. An in-depth literary analysis was done to compare the effect of various pre-sowing treatments mentioned in *Vrikshayurveda* on seed germination. As the world is inclining towards organic and chemical free farming, conservation and sustainable utilization of bio-resources becomes essential. *Vrikshayurveda* is one of the treatises in *Āyurveda* which is comparatively less researched upon and there is hardly any research conducted on seed germination techniques mentioned in the text. This can serve as potential leads for the development of cost-effective medicines and also help to validate the existing *classical* literature.

IMPACT OF CLIMATE CHANGE ON FOOD SECURITY

Sreethu S., Gurleen Kaur and Vandna Chhabra*

Department of Agronomy, School of Agriculture, Lovely Professional University, Phagwara-144411 (Punjab) India

*Email: vandna.21027@lpu.co.in, itsmesreethu96@gmail.com

Abstract

Under the threat of rising global carbon dioxide concentrations, expanding population, and declining agricultural production, food insecurity around the world is getting worse. Food security is also threatened by climate change which gets accelerated due to the incidence of disease and pest attack. Changing precipitation patterns, rising atmospheric CO₂ levels, and elevated temperatures, all have a substantial impact on agricultural production. Rise in population increases the food demand of population and this get affected by the increased incidence of crop by insect pest which ultimately aggravates global food insecurity. It has frequently been hypothesised that climate change will have a significant impact on food production systems and that rising climate change might endanger food security. There is a dual relationship between food security and climate change, namely how food security is impacted by climate change and how climate change is impacted by food production. The effects of climate change on food production will have an impact on both the global and local food supplies. The negative impact of climate change on food security creates need to adopt proactive and systematic measures to the reduce and mitigate the consequences of climate change.



EFFECTS OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, YIELD, QUALITY OF SPROUTING BROCCOLI (BRASSICA OLERACEA VAR. ITALICA) CV. BESTY UNDER TRIPURA CONDITION

Subhra Shil and Manoj Shingh Sachan

Krishi Vigyan Kendra khowai (Tripura-799207)

Email: subhrasmily@gmail.com

Abstract

A field experiment was conducted at the instructional farm of Krishi Vigyan Kendra Khowai, Tripura during 2020-21 to study the effect of integrated nutrient management in Sprouting Broccoli cv. Besty for growth, yield, quality and economics in a randomised block design with four treatments. Treatments applied were Control (T1), 100% NPK (T2), 50% NPK + FYM 10 tonnes (T3), 50% NPK fertilizer + Vermicompost @2.5t/ha(T4). The soil test based recommended fertiliser dose applied was NPK @ @ 150:100:125 kg/ha. The Treatment, 4 i.e., 50% NPK + Vermicompost@2.5t/ha recorded maximum values for plant height (45.16cm), number of leaves per plant (19.27), leaf length (20.15cm), leaf width(16.18cm), days to 50% head initiation (53.67days) and days to first harvest (54.00). The treatment, T7 also recorded highest head girth (38.76cm), head diameter (13.06cm), terminal head weight 287.57g), gross yield (195.56q/ha), marketable yield (123.63q/ha), vitamin C(80.24mg/g), dry matter (11.77%), gross returns (Rs.700680.00/ha), net returns (Rs. 525510.00/ha) and benefit cost ratio (4.0). This was followed by treatment T3 (50% NPK +FYM 10 t/ ha). Among all the treatments, the Treatment T7 i.e., application of 50% recommended dose of NPK/ha with 2.5 t of vermicompost in sprouting broccoli was found to be the best for obtaining better growth, optimum yield, better quality produce, highest net returns as well as cost benefit ratio and is recommended for Tripura condition.

STANDARDIZATION OF PROPAGATION METHOD IN CUSTARD APPLE (*ANNONA SQUAMOSA* L.) CV. BALANAGAR UNDER DHULE CONDITION

Sunil D. Patil*, Rutuja B. Newase, Ravindra V. Patil and Rushikesh Bhusari

College of Agriculture, Dhule, Maharashtra

*Email: drsunilpatil18@gmail.com

Abstract

An experiment was conducted to Vegetative propagation studies in Custard apple (*Annona squamosa* L.) cv. Balanagar was conducted at Nursery and Research farm, Horticulture Section, College of Agriculture, Dhule during the period of January, 2020 to October, 2020 in a factorial randomized block design (FRBD) with Twenty-one treatments and three replications. It comprises of three methods of propagation i.e. Softwood grafting, patch budding and shield budding and seven different times commencing from 4th week of Jan to 4th week of April. The result of the study indicated that, out of the propagation methods and time tried Softwood grafting was found to be superior over patch and shield budding performed during 4th week of February. Softwood grafting performed during 4th week of February proved to be the best in terms of minimum number of days for sprouting (12.00), highest number of branches (3.80), maximum diameter of graft union (18.00), highest length of internodes (1.90), highest survival percentage (82.66 %), minimum number of days (59.00) for attaining saleable stage, highest B:C ratio (2.38). Softwood grafting was found to be superior over patch and shield budding performed during 4th week of February.

FARMING OF RAINBOW TROUT IN HIGHLANDS OF NEPAL

Tek Bahadur Gurung, Thaneswar Bhandari, Nelson Pokharel, Agni Nepal, Akbal Husen and Subodh Sharma

Agriculture and Forestry, Chitwan, Nepal

Email: tek_fisheries@hotmail.com

Abstract

Farming practices of cold-water fish rainbow trout is being adopted among the farmers of highlands communities in Nepal. Rainbow trout farming in high land above 600 m where water could be received from glacial rivers; and up from 1300 to 2300



meters above sea level with cold spring waters has been a successful practice involving hundreds of farmers securing their livelihood by increasing income. This paper aims to elucidate about rainbow trout farming status in different regions of Nepal. The information for the paper was collected from the published articles and report available from various and survey. The farming packages that were refined, innovated from Fisheries Research Station, Lalitpur has been scaled up to 30 highland districts of Nepal except few. At present, the technology is giving benefits to about 1000 farmer's families, youths, and women for their livelihood ensuring the food and nutritional security in mountains directly and indirectly. The trout aquaculture has the potentiality to be expand in areas having cold, clean and pristine water resources with access to transportation in urban areas. The farmers involving are more successful operating the restaurant, homestay, resort business along with the trout production. This technology seems to have immense potentiality in mountains linked with accessible roads having adequate fresh, clean and cold water in raceways for trout production.

IDEOTYPE BREEDING IN HORSEGRAM (*MACROTYLOMA UNIFLORUM*) FOR YIELD AND IMPROVEMENT OF PLANT ARCHITECTURES

Sudhir Kumar*

ICAR-Indian Institute of Agricultural Biotechnology, Ranchi-834003

*Email: sudhiraaidu2006@gmail.com

Abstract

Horsegram [*Macrotyloma uniflorum* (Lam.) Verdc.] is commonly known as kulthi or Madras gram. It is highly nutritious, lesser known, minor legume crop belongs having drought tolerance and responsive to low input agriculture. Along with good nutritional profile, it has antimicrobial, antibacterial, antioxidant, therapeutic and traditional medicinal value. Despite its potential, production and productivity of this crop is very much limited due to its poor plant architecture. Horsegram is grown mainly in marginal and sub marginal land as sole crop or under mixed cropping. Plants of horsegram are mostly climbing type, thin, twining habit, indeterminate growth, photosensitivity, asynchronous maturity and late flowering which ultimately led to unfit for modern agriculture. In Indian germplasm, all the desired traits are not available, therefore, identification or creation of novel sources of variation for these traits are primary concern to convert it from under-utilized crops to main legume crop. Ideotype breeding is an impressive approach that manipulates various agro-morphological and physiological traits to enhance the economic yield under given set of environments. Identification of key important traits from different sources and their synergistic convergence in elite background could lead to development of suitable ideotypes that perform well in targeted environment. The key component traits that could be targeted for development of ideotypes are earliness, medium plant height, photo-insensitivity, indeterminacy, erect plant growth habit and synchronous maturity. Mutation breeding is a straightforward alternative for, creation of genetic variability for improved plant architecture traits along with improved agronomic traits likes, early flowering, seed size, seed shape, seed yield and other nutritional traits. Induced mutation either through physical mutagen or chemical mutagens can create wide range of novel variation in respect of various economic important traits. The vital mutant may be selected and used as a raw material for ideotypes development. Presently the developments of crop ideotypes for horsegram are in progress and in near future perfect ideotypes for a given range of environments will be developed.

EFFECT OF DIETARY SUPPLEMENTATION OF NANO-SELENIUM AND NANO-CURCUMIN ON LIVER AND KIDNEY HISTOLOGY IN BROILER CHICKENS

Shwetha H.S.¹, Narayana Swamy M.¹, Srinivas R.B.¹, Kalmath G.P.¹, Byregowda T.R.¹, Veena M.P.¹ and Rajendran D.²

¹Veterinary College, Bengaluru, Karnataka, India

²National Institute of Animal Nutrition and Physiology, Audugodi, Karnataka, India

Email: drshwetha.h.s@gmail.com

Abstract

The present study was designed to evaluate the dietary influence of nano-selenium (Nano-Se) and nano-curcumin on histology of liver and kidney in Ven-Cobb broiler chickens. Nano-Se was prepared by simple precipitation method using ascorbic acid as a reducing agent and nano-curcumin was prepared by solvent-antisolvent precipitation method. A total of 360-day-old



broiler chicks were randomly divided into four groups with each group comprising 90 chicks. Group I chicks stood as control with standard broiler diet. While chickens kept in groups II, III and IV were supplemented with nano-Se (0.3 mg/kg diet), nano-curcumin (200 mg/kg diet) and combination of both nano-Se (0.15 mg/kg diet) and nano-curcumin (100 mg/kg diet) along with basal diet, respectively. At day, 42 the experimental birds were scarified to collect liver and kidney for histological examination. The histo-pathological photomicrographs of the liver and kidney sections in Group II and IV revealed very well-maintained cellular architecture, whereas, degenerative changes in the hepatocytes and kidney tubular epithelial cells were noted in samples from Group I. Thus, Nano-Se and nano-curcumin were found to be more effective in ameliorating oxidative stress with maintenance of cellular architecture that imparts physiological well-being of broiler chickens. This study will give clarity and evidence for ancient wisdom with modern medical science.

MODULATION OF SUPEROXIDE DISMUTASE AND ASCORBATE PEROXIDASE WITH EXOGENOUS SPERMINE UNDER SALINITY INDUCED OXIDATIVE STRESS IN WHEAT (*TRITICUM AESTIVUM EM THELL.*)

Midathala Raghavendra¹, Dommalapati Sudhakara Rao^{1*}, Naresh Kumar¹, Shashi Madan¹, Renu Munjal² and Gadelli Ramesh³

¹Department of Chemistry and Biochemistry, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana

²Department of Genetics and Plant Breeding, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana

³Department of Statistics, Mathematics and Computer Applications, ANGRAU-Agricultural College, Rajamahendravaram,

*Email: d.sudhakararao@angrau.ac.in

Abstract

Soil salinity is a serious concern in arid and semi-arid regions that impairs yield potential of cereal crops. The present research experiment was conducted in pot culture with four wheat varieties viz. DBW 88, HD 3086, Kharchia 65 and KRL 210 with two different salinity conditions such as 8 dSm⁻¹ and 12 dSm⁻¹. Spermine (spm) treatments at concentrations of 0.5 and 1.0 mm were given at 21 and 90 days after sowing (DAS). Antioxidant enzymes such as superoxide dismutase and ascorbate peroxidase were measured in wheat flag leaves at 0, 5, 10 and 15 days after treatment (DAT) with spermine. At 21 DAS superoxide dismutase (SOD) activity of 9.20 units g⁻¹ FW was observed at 12 dSm⁻¹ and highest SOD activity was observed with spm of 0.5 mm than spm 1.0 mm at 10 DAT. At 90 DAS, the highest SOD activity of 14.50 units g⁻¹ FW observed with 1.0 mm of spm at 12 dSm⁻¹ salinity. The SOD activity was highest in Kharchia 65 and lowest in DBW 88. At 21 DAS, low ascorbate peroxidase (APX) activity was noticed in DBW 88 and HD 3086 at 8 dSm⁻¹ and higher activity was recorded in Kharchia 65 and KRL 210 at 12 dSm⁻¹. Spm treatment increased APX activity, and it was higher at 10 DAT in Kharchia 65. At 90 DAS, APX activity decreased at 12 dSm⁻¹ in DBW 88 and was increased in Kharchia 65 and KRL 210. Spm treatment on salt stressed plants was found to be effective at 5 and 10 DAT.

ACCUMULATION AND REGULATION OF SEED RFOs IN PEANUT (*ARACHIS HYPOGAEA L.*): A BIOCHEMICAL AND MOLECULAR PERSPECTIVE

Sanyal R.^{1,2,3}, Bishi S.K.^{1*}, Kishore U. Tribhuwan¹, Madan Kumar¹ and Anil Dahuja²

¹ICAR-Indian Institute of Agricultural Biotechnology, Ranchi-834003, Jharkhand, India

²ICAR-Indian Agricultural Research Institute, Pusa-110012, New Delhi, India

³National Institute of Plant Genome Research, Aruna Asaf Ali Marg-110067, New Delhi

*Email: sujitbishi@gmail.com

Abstract

Plants use carbohydrates or their derivatives like Raffinose family oligosaccharides (RFOs) as stress signaling molecules. Despite their important physiological role, antinutritional property compromises their overall nutritional value. Identification of RFOs biosynthetic genes and their spatio-temporal expression is a prerequisite for their sustainable reduction, without compromising normal plant development and functioning. To identify those genes in peanuts, RNA-seq was performed in maturing seed stage (S1) and matured seed stage (S2) of three contrast varieties: TG37A (high RFOs) and GG7 (low RFOs) from Spanish group and Girnar 2 (high RFOs) from Virginia group. The transcriptomic data conformed the temporal and tissue-specific expression of different families of RFOs biosynthetic genes. Although stachyose was identified to be the major



component of RFOs, Raffinose Synthase (*RS*) played a differential role in RFOs accumulation in this study. Significant differential and seed-specific expression of *AhRS14* and *AhRS6* indicated them to be regulatory genes. As *AhRSV* expression was restricted to Girnar-2, it can be used as a biomarker for peanut group identification. Higher transcript density of *AhGols6* and *AhSS7* at all seed stages suggested their constitutive expression in seeds. Selective expression of homeologous genes also highlights their evolutionary significance during allopolyploidization. The identified genes can further be validated in a larger population and other legumes to serve as potential targets for developing low RFOs varieties. This will help improve the overall nutritional quality and solve the discomforts associated with the consumption of peanuts and other legumes.

BIOACTIVE, NUTRACEUTICAL PROPERTIES OF EDIBLE MUSHROOMS FOR THE DEVELOPMENT OF FUNCTIONAL FOODS

Suhani Sajad*¹ and Jagmohan Singh¹

¹Deptt. of Food Science & Technology, Sher-e-Kashmir University of Agricultural Sciences & Technology of Jammu, India

Email: suhanisajad94@gmail.com

Abstract

Nowadays, the food sector is highly concerned with environmental issues and foreseen to develop technologies to reduce waste and losses resulting from activities developed in the food system. Mushroom by-products represent a disposal problem, but they are also promising sources of important compounds, which may be used due to their functional and nutritional properties. Functional foods are conventional or everyday foods consumed as part of daily diet. They exert positive effects on target functions beyond their nutritive value, enhancing the well-being and quality of life, and/or reducing disease risks. The nutritional value of edible mushrooms is due to their high protein, fiber, vitamin and mineral contents, and low-fat levels. Mushroom fruit bodies are widely used as protein supplement and flavouring agent due to its unique and subtle umami flavour. Edible mushrooms can be processed to obtain a wide variety of food products enriched with high quality protein, which may have as well improved functional properties, giving them an added value. The presence of some bioactive substances, majorly polysaccharide-protein complex confers some bioactive properties like immunomodulating, anti-tumour, anti-hypercholesterolemia, anti-bacterial, anti-fungal, anti-inflammatory, anti-viral, anti-diabetic, and cardiovascular health promoting effects, have been obtained and applied in the development of nutraceutical and pharmaceutical formulations. The edible items fortified with mushrooms owing to their high nutritive value serves as a nutrient reservoir for malnourished populations. The current review is intended to envisage the nutraceutical potential of mushrooms, therapeutic properties, bioactive compounds, health benefits, and processing aspects of edible mushrooms for development of functional food ingredients.

GROUNDNUT FUNCTIONAL GENOMICS: IS MOLECULAR MODEL CROP RICE CAN BECOME A BOON

Sukrutha B.¹ and Srividhya Akkareddy^{2*}

¹S.V. Agricultural College, Acharya N.G. Ranga Agricultural University (ANGRAU), Tirupati, Andhra Pradesh, India

²Institute of Frontier Technology, Regional Agricultural Research Station (RARS), ANGRAU, Tirupati, Andhra Pradesh, India

*Email: a.srividhya@angrau.ac.in

Abstract

Using 17 different groundnut genotypes, the study “Groundnut Functional Genomics: Is Molecular Model Crop Rice Can Become a Boon” was conducted. Six yield-related variables and seven seed quality-related traits that were evaluated using ANOVA indicated substantial differences, indicating that there is a lot of genotype-to-genotype variation. Using 45 GTMs that target 24 known functional genes, molecular analysis was done to examine the transferability of known rice yield, grain size, and micronutrient content (Fe and Zn) regulating GTMs to peanut. The fact that 31 (76%) of the 45 markers could be transferred to peanuts indicates very strong conservation at functional regions. At the individual groundnut genotype level, the extent of rice GTM amplification ranged from 79.17% for the cultivated varieties (2n = 4x) Nithya Haritha, Greeshma, Prasuna, Kalahasti, and Narayani to 91.67% for the Dheeraj variety. The investigation of the transferrable effectiveness of each unique rice GTM revealed that all 17 genotypes of groundnut (100%) showed amplification of 17 markers belonging to 14 rice genes. Therefore, by concentrating research on the vast list of annotated orthologous genes present in “Omics”



databases and the functionally characterised genes of molecular model crops, it expands the possibility to tag the genes at the molecular level and thereby to improve crops like groundnut that have made only modest progress in gene tagging.

STANDARDIZATION OF MEDIAN LETHAL (LD50) AND GROWTH REDUCTION (GR50) DOSE OF GAMMA IRRADIATION FOR INDUCED MUTATION IN WHEAT

Sunita Mahapatra^{1*}, Sunanda Chakraborty², Anubhab Hooi³, Md. Nasim Ali⁴ and Ramesh Satdive⁵

^{1,2,3}BCKV, Department of Plant Pathology, Mohanpur, Nadia, W.B., India

⁴BCKV, Department of Ag.Biotechnology, Mohanpur, Nadia, W.B., India

⁵RNARC, GOI, Trombay, India

*Email: sunitamahapatra@yahoo.co.in

Abstract

The determination of the optimum dose of radiation through its impacts on the growth attributes of the crop is the prerequisite for successful induced mutation breeding. To evaluate the impact of different doses of gamma radiation on wheat, two varieties DBW 187 and K 1006 were irradiated at six different doses (200, 250, 300, 350, 400 and 450 Gy) using a Cobalt-60 source at Bidhan Chandra Krishi Viswavidyalaya, West Bengal, India. Seed germination, survivability and seedling length of the irradiated seeds were measured at 7 days after sowing in laboratory, while plant height, panicle length, grains per panicle and 1000 seed weight was recorded in field. It was observed that seed germination, survivability and plant height declined with the increase in gamma radiation dose. The germination percentage showed significant differences among treatments (100 to 75%), while the survival percentage exhibited significant differences from 200 to 300 Gy irrespective of varieties. Median Lethal Dose (LD50) and Median Growth Reduction (GR50) values varied in two varieties both in laboratory and field conditions. LD50 for DBW 187 and K 1006 were found to be 272.71 and 278.61 respectively, while the GR50 values were 316.22 and 346.73 for DBW 187 and K 1006 respectively. GR50 for field observations were found to be 341.19 Gy and 339.70 Gy for DBW 187 and K 1006 respectively. Hence, the gamma radiation dose between 250 Gy - 300 Gy was found optimum to obtain highest mutation mediated changes with less lethal effects in the subsequent generations of wheat.

GRAIN NITROGEN CONTENT AND PRODUCTIVITY OF RICE AND MAIZE UNDER VARIABLE DOSES OF FERTILIZER NITROGEN

Surajit Mondal, Kumar Varun Vijay, Manisha Kumari and Sana Raza Khan

Division of Crop Research, ICAR Research Complex for Eastern Region, Patna – 800 014, Bihar, India

*Email: surajit.icar@gmail.com; surajit.mondal@icar.gov.in

Abstract

The indiscriminate use of fertilizer is degrading the soil health and polluting the environment while lower use of fertilizer is causing lower productivity. Hence, fertilizer application must be optimized for sustainable higher yield, lower cost of cultivation and a cleaner and environment-friendly production system. Rice and maize are the major consumers of nitrogen fertilizer and need optimization in terms of input use efficiency. Grain quality should also be emphasized for achieving nutritional security. Under that context, a field experiment was conducted with different doses of fertilizer N for rice and maize. Fertilizer N was applied at the rate of 0, 40, 80, 120, 160, 200 and 240 kg ha⁻¹ (N0–N240). An increase in grain yield in rice and maize was observed for rice and maize up to 160 kg ha⁻¹ and beyond that, no gain in grain yield was noted. The N content of grain increased with N rates and the highest rice grain N content of 1.49% was noted for N240 treatment which was at par with N200 (1.42%) but significantly higher than others by 13-32%. With an increase of each kilogram of N, the grain N content increased by 14 and 20 µg (microgram) for rice and maize, respectively. The leaf N content registered a decreasing trend with the progress of the crop growth for both rice and maize. The decrease in leaf N content between the first and last measurements was 33 and 20% for rice and maize, respectively. The agronomic efficiency (AE) of N initially increased with an increase in the rate of fertilizer N followed by a decrease with higher doses of N. Unlike the AE, the partial factor productivity (PFP) of N decreased gradually with an increase in the rate of fertilizer N. Maize noted a higher PFP than rice up to N80 and beyond that rice yielded higher than maize. The chlorophyll content of flag leaves also registered an increasing trend with an increasing rate of fertilizer N. The N240 resulted in 1.7-, 1.7- and 1.9-times higher chlorophyll content than N0 at 39, 49 and 59 days after transplanting, respectively in rice whereas the same was 1.2-, 1.3- and 2.8-times at 63, 73, and 82



days after sowing for maize. On the surface soil (0-15 cm), the treatments which received lower (N0, N40) and higher (N240) fertilizer N recorded a comparatively higher total soil N than other treatments.

EFFECT OF HEAT STRESS AMELIORATION ON METABOLITE AND HORMONAL PROFILE OF MAGRA SHEEP IN HOT ARID ZONE ENVIRONMENT

Susavi Kumari¹, A.K. Patel², N. Saini³, H. K. Narula⁴, S. K. Ravi⁵, Pawan Singh⁶ and Shailendra Kr. Rajak¹

¹Ranchi Veterinary College, BAU, Ranchi

²ICAR-Central Arid Zone Research Institute, Jodhpur, Rajasthan

³ICAR-Central Sheep and Wool Research Institute, ARC, Bikaner, Rajasthan

⁴ICAR-National Bureau of Animal Genetic Resources, Karnal, Haryana

⁵Faculty of Veterinary and Animal Sciences, Institute of Agricultural Sciences, RGSC-Banaras Hindu University, Mirzapur

⁶ICAR-National Dairy Research Institute, Karnal, Haryana

*Email: skravilpm@gmail.com

Abstract

Provision of improved shelter and multinutrient pellet feeding either alone or in combination on metabolites and hormonal profile of Magra sheep during summer (April-June) under arid zone environment was investigated. Forty ewes with their lambs were randomly allotted to either of four groups (ten ewes per group) viz. G1 as control (Traditional shelter and grazing only); G2(Improved shelter and grazing only); G3 (Traditional shelter and fed multinutrient pellet (@ 2 % of BW) besides 8 hr. grazing) and G4(Improved shelter and fed multinutrient pellet (@ 2 % of BW) besides 8 hr. grazing). Multinutrient pellet was prepared at feed mill using locally available various feeds and fodders added with molasses, mineral mixture and salt whereas shelter was improvised by placing thatch over asbestos sheet in a closed housing with sufficient ventilation. Fortnightly blood collection was done for metabolic and hormonal parameters which were subjected to bio assay using kits. Levels of serum glucose and cholesterol ($P<0.01$) increased in T2 and T4. Serum NEFA level was higher ($P<0.01$) in T1 and T2. HSP-70 concentration was higher T1 and T3. Triiodothyronine and Thyroxine levels decreased in T2 and T4. Cortisol and IL-6 concentration was ($P<0.05$) higher T1 and T2. Serum glucose, cholesterol level increased by improved nutrition during summer season. It can be concluded that Triiodothyronine, thyroxine cortisol, HSP-70 and IL-6 can be used as biomarkers for heat stress.

BIO-EFFICACY OF NATIVE STRAINS OF *PSEUDOMONAS* AND *BACILLUS* IN MANAGING BLAST DISEASE IN FINGER MILLET

T.M. Hemalatha*, L. Madhavalatha, B. Vajantha, M. Shantipriya, M. Hemanth kumar, N.V. Sarala, K.R. Tagore

¹Agricultural Research Station, ANGRAU, Perumallapalle-517 505

*Email: hema.agri@gmail.com

Abstract

Finger millet is an important nutritive cereal crop of the semi-arid zones of the world and is the staple food crop the people in Africa and Asia. Blast disease in finger millet caused by *Pyricularia grisea* is one of the important and serious diseases resulting in 50-100% yield loss. Management of the disease is achieved by chemical fungicides, but due to increased concern over environmental pollution, strategies of use of plant growth promoting rhizobacteria are being used for maintaining the plant and soil health and to reduce the disease incidence. In the present study, 37 strains of *Pseudomonas* and *Bacillus* were isolated from the phylloplane of finger millet leaves and evaluated for their efficacy to manage the blast disease. Among the thirty-seven strains, two strains i.e., *Pseudomonas* isolate (P.I-7) and *Bacillus* isolate (B.I-10) showed maximum inhibition of 90.04% and 85.54% against the blast pathogen under *in-vitro*. Alternatively, these two bio-agents were evaluated for PGPR activity. The organisms showed positive reaction to siderophore production, protease production, phosphate solubilisation, Cellulase activity, HCN production and IAA production. These two organisms were identified as *Pseudomonas fluorescens* and *Bacillus subtilis* using molecular analysis of 16SrDNA region. Field studies with talc formulations of these two bioagents during 2019 and 2020 revealed that seed treatment @10g/kg + seedling dip @ 10g/Lit+ foliar spray at flowering stage @ 1% recorded least leaf blast score of 2.6 and neck blast incidence of 15.34% and finger blast incidence of 18.05% incidence and recorded highest grain yield of 32.64Q/ha. The control treatment showed maximum leaf blast score of 7.4, neck blast



incidence (53.9%) and finger blast incidence (49.34%) and grain yield of 21.12Q/ha respectively. Highest C:B ratio was obtained in the treatment (T5) viz., seed treatment @10g/kg + seedling dip @ 10g/L+ foliar spray (1%) at flowering stage with 1: 1.53.

ECOLOGICALLY SAFE METHODS OF SEED TREATMENT ON STORABILITY OF BLACKGRAM SEEDS.

T. Shunmuga Vadivel¹ and K. Sundaralingam²

¹Department of Seed Science and Technology, Athiparasakthi Agricultural College, Ranipett

²Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore, T.N.

Email: velseed1987@gmail.com

Abstract

Pulses are the major sources of dietary protein in the vegetarian diet of our country. Besides being a rich source of protein, they maintain soil fertility through biological nitrogen fixation in soil and thus, play a vital role in furthering sustainable agriculture. Presently the uses of chemicals are being restricted globally due to persistence of toxic residues in food grains and development of insect resistance for a particular chemical. Therefore, a need was felt to investigate the ecologically safe methods to control insect pests of pulses. A safe and feasible seed treatment has to be identified for maintaining seed vigour and viability during storage. The development of eco-friendly, easy to-do treatment of dry treatment with botanicals, oil, sea weeds and nano particles would be of great advantage to reduce the problems of insect infestation and the maintenance of seed quality during storage. Therefore, application of various seed treatment methods viz; seed treatment with botanicals, sea weed powder, use of nano particles to store seeds would be useful and optional technologies to replace the chemical control of bruchids in storage respectively. Constituted the base materials for this study, Control, Fenugreek seed powder @ 3g kg⁻¹, Castor oil @ 5ml kg⁻¹, Neem oil @ 5ml kg⁻¹, Seaweed Sargassum myricocystum powder @ 3g kg⁻¹, Seaweed Gracilaria edulis powder @ 3g kg⁻¹, Nanoparticles of ZnO @ 1250 mg kg⁻¹. After the seed treatments, fifty gram of seeds in each treatment were drawn and packed in cloth bag and Super grain bag and were stored under ambient conditions upto 10 months. Present investigation, seeds undergo deterioration with advancement in storage period. Seed quality attributes of blackgram CO 6 seeds were significantly influenced by seed treatments and packing materials during storage. Seed treatment with nano particles of ZnO @ 1250 mg kg⁻¹ maintained higher seed viability, vigour and biochemical attributes. Among the treatments, higher germination (86%), higher seedling attributes viz, speed of germination (22.3), root length (16.9 cm), shoot length (14.4 cm), drymatter production (0.229 g / seedlings) and vigour index (3228) followed by fenugreek seed powder @ 3 g / kg⁻¹ and neem (*Azadirachta indica*) oil @ 5ml/kg which were on par with each other.

GEOSTATISTICAL MAPPING OF SOIL MICROBIAL BIOMASS CARBON AND DEHYDROGENASE ENZYME ACTIVITY AT ICAR-IARI FARM, NEW DELHI

Tapan Gorai^{1*} and Nayan Ahmed²

¹Bhola Paswan Shastri Agricultural College, Purnea (BAU, Bhagalpur), Bihar, India

²Division of Soil Science and Agricultural Chemistry, ICAR-IARI, New Delhi, India

*Email: tapanbankura@rediffmail.com

Abstract

Soil microbial biomass carbon (MBC) and dehydrogenase activity (DHA) are two sensitive biological indicators of soil health for agricultural productivity and sustainability. The spatial variability mapping of soil biological properties viz. soil MBC and dehydrogenase activity were prepared for ICAR-IARI farm, New Delhi, India. Soil MBC and dehydrogenase enzyme activity of surface (0-0.15 m) soils were determined through standard procedures following 100 m grid sampling technique in assistance with Google earth image, global positioning system (GPS) device & geographic information system (GIS). Soil microbial biomass carbon (MBC) ranged from 19.7 to 519.7 µg g⁻¹ and mean & standard deviation of MBC was 197.7 and 84.1 µg g⁻¹ respectively. The analysed data of soil dehydrogenase activity (DHA) displayed a high variability ranging from 1.2 to 17.2 µg TPF g⁻¹ hr⁻¹ with SD and coefficient of variation (CV) of 3.3 and 53%, respectively. Spatial modeling and prediction map of soil MBC and DHA in the semiarid agricultural farm were generated using geo-statistical techniques through exploratory data analysis, semivariogram analysis & ordinary kriging in GIS software. Spatial variability of soil MBC & DHA



are influenced by soil internal and external factors including soil physico-chemical properties, fertility parameters etc. The prediction map at farm scale showed spatial variability of soil microbial biomass carbon, one key elemental composition of microbial biomass responsible for the decomposition of organic matter, nutrient transformation & cycling and spatial variability of dehydrogenase enzyme activity, indicative of the microbial oxidative activity of soil.

EVALUATION OF POST EMERGENCE HERBICIDES FOR WEED MANAGEMENT IN SESAMUM FOR NORTH COASTAL ZONE OF A.P.

Tulasi Lakshmi Thentu and A.B.M. Sirisha

Agriculture Research Station - Yellamanchili, Acharya N. G. Ranga Agricultural University, AP

*Email: tulasiagrico318@gmail.com

Abstract

Sesame is one of the important edible oilseed crops cultivated in India. the actual potential of the crop is much higher than the productivity levels currently realized at the field level. lack of proper weed management is one of the main constraints for poor yields of sesame. yield losses due to crop weed competition in sesame have been estimated to be 50-75 per cent. the period from 15 to 30 DAS (days after sowing) is the most critical period of crop weed competition in sesame. though manual weeding is an efficient method, it is costly, laborious and time consuming. hence, the experiment was formulated to screen various post emergence herbicides for controlling weeds in sesamum for north coastal zone of A.P. this experiment was carried out during two year 2020-21 and 2021-22 in both the season at agricultural research station-Yellamanchili, Visakhapatnam (Dist), A.P. the results of the experiment revealed that although metribuzin @ 0.350 kg/ha PoE at 25 DAS and fomesafen 11.1% + fluazifop-p-butyl 11.1% @ 0.111 kg/ha PoE at 25 DAS treatments has high weed control efficiency but they had expressed severe phytotoxicity on sesame crop. Hand weeding at 20 and 30 DAS resulted in highest weed control efficiency at 30 DAS and 60 DAS and also recorded lowest weed index. Highest B:C ratio was recorded in treatment two hand weeding at 20 and 40 das followed by quizalofop ethyl 5% @ 50 g/ha at 20 DAS with 1.06 this is due to high yields in manual weeding treatment.

PERFORMANCE OF RICE AT DIFFERENT CULTIVATION PRACTICES

U. Vineetha¹, I. Paramasiva², Ch. Sreelakshmi³, P. Madusudan⁴ and P.N. Harathi²

¹Deptt. of Agronomy, Agricultural Research Station, Nellore, Acharya N.G. Ranga Agricultural University, Andhra Pradesh

²Deptt. of Entomology, Agricultural Research Station, Nellore, Acharya N.G. Ranga Agricultural University, Andhra Pradesh

³Deptt. of Plant Breeding, Agricultural Research Station, Nellore, Acharya N.G. Ranga Agricultural University, Andhra Pradesh

⁴Deptt. of Plant pathology, Agricultural Research Station, Nellore, Acharya N.G. Ranga Agricultural University, Andhra Pradesh

*Email: u.vineetha@angrau.ac.in

Abstract

Rice is the staple food of India and is being cultivated in 46.78 M.ha of area with a production of 127.93 M.T and productivity of 2735 Kg/ha. Rice is cultivated in A.P in an area of 21.05 L. ha with a production of 120.0 L.tonnes and with a productivity of 5702 kg/ha. In recent times rice cultivation in India is not profitable to the farmers due to increased cost of cultivation due to higher labour wages and prices of fertilizers and pesticides. In view of getting higher net returns, farmers are using excess chemical fertilizers and pesticides which lead to increased risk of health. Hence, to reduce the usage of chemicals in agriculture and sustainability of soil health, present experiment was taken up at Agricultural research station, Nellore during *rabi*, 2021. The treatments consists of T₁: ANGRAU – ICM, (Integrated cultural management practices recommended by ANGRAU), T₂: Sahaja sendriya vyavasaya vidhanalu (SSVV), (Management practices under organic farming recommended by Dept. of Agriculture, A.P) T₃: Palekar's concept of Natural farming (PCNF). The results indicated that highest plant height (71.66 cm) was recorded in ANGRAU – ICM practice when compared with PCNF (65.39) and SSVV (60.72 cm). The highest number of tillers/hill (12.7), panicles/hill (12.0), No. of panicles/m² (498), Panicle length (21.74 cm) and No. of filled grains/panicle (199) were recorded in ANGRAU-ICM practice when compared with SSVV and PCNF. The highest grain yield was obtained with ANGRAU- ICM practice (7550 kg/ha) followed by Sahaja mariyu sendriya vyavasaya vidhanalu (SSVV) (3600 Kg/ha) and ZBNF (Palekar's concept) (3125 kg/ha) which were in turn on par with each other. There was a yield reduction of 58.60 % in PCNF and 52.32% yield reduction in SSVV when compared with ANGRAU – ICM and highest B: C ratio (1.58) was recorded in ANGRAU – ICM practice followed by PCNF (1.35) and SSVV (1.33). There was negligible incidence of pests during *rabi* in all the three methods of rice cultivation.



CONSTRAINTS IN USAGE OF INDIGENOUS TECHNICAL KNOWLEDGE IN FARMING PRACTICES

¹Thejane Nagi, ²Mary N. Odyuo and ³J. Longkumer

¹Department of Agricultural Extension, SASRD: Nagaland University

²Department of RDP, SASRD: NU. 797106.

³Department of Agricultural Extension, SASRD: Nagaland University

Email: maryodyuo@nagalanduniversity.ac.in

Abstract

Agriculture is the main occupation of the Angami tribe and rice is the staple food. From rest of the other tribes, the practice of settled cultivation in the form of terrace is among one of the most noticeable, unique feature of the Angami Naga tribe. This research was conducted in Kohima district, the home of the Angami tribe under Nagaland state, India. The indigenous technical practices of agriculture in today's generation seems to be dying because of many reasons and constraints in its usage is attributed to be one therefore, this study was made with an attempt to understand the extent of usage of ITK and to identify constraints in the usage of ITK in farming practices. It was concluded that more than 90 per cent of the respondents were medium to high users of ITK. Five major constraints in the usage of ITK in agricultural practices were identified and presented in the rank order as follows : (i) unpredictable weather (ii) consuming nature (iii) labour intensive nature (iv) difficulty in weed management (v) Pest management.

STATUS, CHALLENGES AND STRATEGIES OF FARM MECHANIZATION IN JHARKHAND STATE

Uttam Kumar

Deptt. of Agricultural Engineering, Birsa Agricultural University, Ranchi-834 006 (Jharkhand)

Email: uttam.bauranchi@gmail.com

Abstract

Farm machinery facilitate in increasing the productivity of land by ensuring timeliness of operation, increasing labour work out put per unit time by reducing effort and drudgery, besides, it improves quality of farm operations. The farm machines also enable efficient utilization of biological and chemical inputs in increasing productivity at reduced cost of production. Human and animal drawn farm equipment are used in traditional agriculture. These are slow but effective for small farms if draught animal power is available and labour wages are low. The farmers in Jharkhand have equally adopted mechanization inputs, especially irrigation pumps as it helped in adoption of high yielding varieties and other essential agricultural inputs to increase crop yields. The farmers are provided improved machinery, tractor and power tiller under the government's Implement Subsidy Scheme. Infrastructure has been created in the State for training of farmers and popularization of farm machinery. There is general awareness among farmers in the State for appreciating the role of mechanization in increasing productivity. The annual sale of tractor in the State has increased. Farmers have adopted line sowing and power threshing. They have also accepted modern machinery such as sprinkler and drip irrigation system. Cleaners, graders and improved storage bins have also been adopted at farm levels to reduce post-harvest losses and conserve food. The level of adoption of farm machinery in the State, compared to other progressive states like Punjab, Haryana, Rajasthan, Uttar Pradesh, Gujarat etc. however, are low, and as result farmers are not able to establish and harvest the crops in time. The farmers however, have shown positive response to improved machinery as evident from the increase in custom hiring of tractors and threshers in the State by the entrepreneurs from other States.

HETEROSIS AND INBREEDING DEPRESSION STUDIES IN MUNGBEAN [*VIGNA RADIATA* (L.) WILCZEK]

V.B. Rathod* and H.G. Kanara

Main Dry Farming Research Station, Junagadh Agricultural University, Targadia-360023 (Gujarat)

*Email: rathodviraj21@jau.in

Abstract

Twenty-eight mungbean hybrids derived from 8 x 8 diallel excluding reciprocal crosses were studied to know the magnitude



of heterobeltiosis, standard heterosis and inbreeding depression for yield and its component characters in mungbean. The magnitude of heterobeltiosis and standard heterosis was high for seed yield per plant, number of pods per plant, number of clusters per plant and number of primary branches per plant. The crosses Vaibhav x Asha for heterobeltiosis and K 851 x OUM 11-5 for standard heterosis showed significant and the highest value for seed yield per plant and its important component traits. Only one heterotic cross i.e. K 851 x Pant-M 4 for seed yield did not show inbreeding depression for same trait. Further this cross did not show inbreeding depression for most of the characters.

HETEROSIS, GENETIC PARAMETERS AND CHARACTER ASSOCIATION STUDIES IN CASTOR (*RICINUS COMMUNIS* L.)

K. Sadaiah*, G. Neelima, G. Madhuri, V. Divya Rani, N. Nalini, M. Sujatha and M. Goverdhan

Regional Agricultural Research Station, PJTSAU, Palem, Nagarkurnool district, Telangana – 509215.

*Email: sadaiah.kurapati@gmail.com

Abstract

Castor is an important non-edible oilseed crop having huge industrial and export potential. Castor oil is highly stable and variation in fatty acid is very minimal making it the best raw industrial oil. It is used as an efficient lubricant for high-speed engines and as an ingredient in several commodities. Because of its multifarious industrial applications, castor oil enjoys tremendous demand world-wide. To meet the growing demand, it is essential to produce high yielding cultivars. Study on heterosis and genetic parameters will be helpful to identify the crosses showing hybrid vigour for yield and earliness and also to understand the inheritance of the traits. In the present study 48 entries viz., three pistillate lines and eleven inbred lines and their 33 hybrid combinations along with standard check ICH-66 were evaluated in RBD with three replications during kharif, 2020 at the experimental plots of RARS, PJTSAU, Palem. Analysis of variance studies showed that significant variation exists in the material under study. Estimates of standard heterosis over ICH-66 revealed that crosses viz., SKP-84 x ICS-142, SKP-84 x DCS-89 and SKP-84 x JI-244 has shown significant heterosis for yield (26.6%, 17.9% and 16.9% respectively) and earliness (-10.4%, -9.1% and -7.0% respectively). Heritability, genetic advance as per cent of mean and degree of dominance studies indicated preponderance effect of non-additive gene action in governing the traits. Thus exploiting hybrid vigour through heterosis breeding will be an effective method of crop improvement in castor. Correlation studies showed that grain yield has recorded significant positive association with primary spike length, effective primary spike length and number capsules per primary spike. Hence selection for these component traits will be effective in obtaining high yielding cultivars in castor.

INTEGRATED DISEASE MANAGEMENT OF *FUSARIUM* WILT IN EGGPLANT

V. Govardhan Rao¹, H.S. Viswanath², K.T. Apet³, C.V. Ambadkar³ and K.D. Navgire³

¹Department of Plant Pathology, Dr.YSRHU-HRS, Ambajipet, East Godavari District, A.P., India

²College of Agriculture Sciences, Teerthankar Mahaveer University, Moradabad (Uttar Pradesh), India

³Department of Plant Pathology, VNMKV, Parbhani (MS), India-431 402

*Email: vgrao2007@gmail.com

Abstract

Wilt of Eggplant (*Solanum melongena* L.) due to *Fusarium oxysporum* f.sp. *melongena* causes much damage to the crop. To manage wilt through integrated approaches an experiment was conducted with twelve treatments considering Seedling root dip of Carbendazim, *Trichoderma harzianum* soil application, soil application of Neem Seed Cake alone, *Trichoderma* fortified Neem Seed Cake, *Brassica* tissue soil incorporation and integration of treatments. The reduction in per cent disease incidence was ranged from 29.70 to 88.49 per cent. However, highest reductions in per cent disease incidence was recorded with the treatment T11 (Seedling root dip of Carbendazim + soil application of *Trichoderma* fortified Neem Seed Cake + *Brassica* tissue soil incorporation) (88.49 %) followed by T10 (Seedling root dip of Carbendazim + Seedling root dip with *T.harzianum* + *Brassica* tissue soil incorporation) (79.49 %), T9 (soil application of *Trichoderma* fortified Neem Seed Cake + *Brassica* tissue soil incorporation) (69.78 %), T6 (Seedling root dip of Carbendazim + soil application of *Trichoderma* fortified Neem Seed Cake) (66.71 %), T7 (Seedling root dip of Carbendazim + *Brassica* tissue soil incorporation) (62.65 %), T5 (soil application of *Trichoderma* fortified Neem Seed Cake + *Trichoderma harzianum* soil application) (55.64 %), T3 (soil



application of *Trichoderma* fortified Neem Seed Cake) (52.88 %), T4(*Brassica* tissue soil incorporation) (49.79 %), T1(Seedling root dip of Carbendazim) (40.52 %), T8 (soil application of neem seed cake alone) (38.38 %) and T2 (*Trichoderma harzianum* soil application) (29.70%). However, the per cent increase in yield over the control was ranged from 38.41 to 115.39 per cent among the treatments, and the highest yield increase was noticed with the treatment T11 (115.39 %) followed by T10 (104.74%), T9(98.27%), T6 (88.65%), T3 (87.77 %), T8 (77.85%), T5 (67.44%), T7 (66.11%), T1 (57.32%), T4 (44.58%) and T2 (38.41%).

STUDY OF JAMUN GENOTYPES FOR QUALITY PARAMETERS

¹*Vani N.U, ²P.C. Tripathi, ³V. Keshav Rao and ⁴A. Prabhakar Singh

¹Department of Horticulture with Specialization in Fruit Science, IGKV, Raipur

²Division of Fruit crops, ICAR-IIHR, Bengaluru

³Division of Basic sciences, ICAR-IIHR, Bengaluru,

⁴Department of Fruit Science, College of Agriculture, IGKV, Raipur

*Email: nuvani26@gmail.com

Abstract

An experiment was carried out to determine the quality parameters of selected 32 genotypes in the division of Basic Sciences, at ICAR-IIHR, Bengaluru, Karnataka during the year 2020-21. Jamun is a wholesome fruit with several uses. The fruit has sub- acid spicy flavor and are either eaten fresh or processed into a variety of products, such as juice, squash, jellies, jam, wine, vinegar and pickles. Small jamun fruits are suitable for beverage industry as they contained a high amount of acidity, tannins and anthocyanins. The average mean bio-chemical parameters like TSS (17.92 ? Brix), titrable acidity (1.87%), Brix: Acid ratio (11.58), total sugars (13.99%), reducing sugars (9.22%), non- reducing sugars (4.77%), ascorbic acid (50.93mg/100g), anthocyanin (177.78mg/100g), phenol content (481.39mg/100g GAE) and antioxidant activity (921.62mg/100g) were recorded from 32 genotypes evaluated. Kaveripatnam -2 recorded highest acidity (3.76%), non- reducing sugars (9.93%) and antioxidant activity (1829.3 mg/100g). Collection -11, Collection-5, Collection -9 and Collection -2 recorded maximum TSS (24.87), total sugars (17.82%), anthocyanin (381.15mg/100g) and phenol content (855 mg/100g GAE) respectively. This study offered the chance to investigate the quality as well as superior genotypes that have excellent health benefits. Collection-11, Collection-10, Collection-8, Kaveripatnam -2 and Hirehally were significantly superior when compared with other genotypes for attributing better quality.

IMPACT OF ORGANIC FARMING AND GENETIC DIVERSITY STUDY IN *LATHYRUS*

Vandana S. Madke¹, Bhavna R. Wankhade¹, Sapna B. Baviskar¹ and Gajanan D. Chandankar²

¹College of Agriculture, Nagpur (Dr. P.D.K.V., Akola)

²Reginal Research Centre, Amravati (Dr. P.D.K.V., Akola)

Email: vandanarg2004@yahoo.co.in

Abstract

Organic agriculture is an alternative farming system that involves crop production without chemicals and with differential land use. The growing popularity of organic agriculture means that an understanding of the relationships between phytochemical content and farming system is particularly relevant. Contrary to conventional farming, the organic farming system of fertilization is supplied by crop rotation, animal manure, cover crops and/or biological preparations. While the use of pesticides and their environmental impact is avoided (Winter, C.K.; Davis, S.F., 2006), organic farming also promotes biodiversity among species both in the soil biological activity and in the environment. All of these factors are indicated as ways in which environmental stress on plants can be increased, which in turn might induce changes in the nutrient composition of the fruit and vegetables, especially in terms of the phytochemical content and profile (Worthington, W, 2001, Del Amor, M.F.; Serrano-Martinez, A., 2008, Brandt, K.; Mølgaard, J.P., 2001) Consequently, organic agriculture might be an interesting strategy to increase the phytochemical content of crops. Moreover, statistics indicate that the attractiveness of both organic farming practices and organic products has increased in recent years in EU countries (e.g., to 10.64 million hectares in 2011; FiBL-ILFOAM survey, 2013; (Available online). Fifty-seven genotypes were evaluated for genetic divergence to identify the likely desirable and potential parents for lathyrus breeding programme aimed at yield and earliness improvement.



These genotypes were grown in randomized completed block design replicated thrice and observation were recorded for eight characters. Mahalanobis generalized distance for eight characters was used in this study for computing genetic divergence. The analysis of dispersion for eight corrected for eight corrected variables using Wilk's criterion, revealed highly significant difference between genotypes for aggregate of the eight characters. The 57 genotypes were grouped into eight clusters by Tocher's method. The maximum inter cluster distance was recorded between cluster IV and cluster VIII (110.67). The canonical analysis indicated that the plant height at maturity, pods plant⁻¹, Yield plant⁻¹, days to 50 % flowering, seeds pod⁻¹, number of primary branches and days to maturity were significant and important sources of variation in the vector I, in vector II variation. In vector III days to 50 % flowering, days to maturity, number of seeds pod⁻¹ and 100 seed weight were important source of variation. The genotypes belonging to distant cluster and exhibiting high performance in the desirable direction for plant height, yield plant⁻¹, days to 50 % flowering and pods plant⁻¹ were identified as the potential parents for hybridization programme. The 20 genotypes were identified as potential and diverse parents for their use in crossing programme. Thus, the present study demonstrates that under an organic farming system, the choice of the varieties that are richest in antioxidant compounds and the use of alternative cultivation techniques can be very useful for the production of high-phenolic crops for human health purposes.

QUALITY ASSESSMENT OF BUFFALO MILK *CHAKKA* PREPARED FROM DIFFERENT STARTER CULTURES

Varsha Vihan *, V.P. Singh, Akhilesh K. Verma, Pramila Umaraw and Chirag Singh

Department of Livestock Products Technology, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut-250110, (Uttar Pradesh) India

*Email: varshavihan16495@gmail.com

Abstract

Chakka is a sour dairy product obtained by draining the whey from fermented milk (dahi, known as Indian yogurt). In fermented dairy products, the starter culture is of great importance to determine the overall elemental quality of the final product. The present study was carried to find out the suitability of three different cultures for development of *chakka* viz. T₁ (1.5% Mixed microbial culture), T₂ (1.5% bacterial culture (STI-13 freeze-dried Lactic culture)), and T₃ (1.5% yeast cultures). Among the different culture various quality characteristics, physico-chemical parameters and sensory characteristics were assessed for their ability to form *chakka*. Curd prepared from the lactobacillus culture (T₂) was found most suitable for preparation of *chakka* as T₂ delivered highest yield of curd mass, protein, least pH value and moisture content compared to microbial culture and yeast culture. Sensory attributes of *chakka* also varied significantly (P<0.05) among cultures. All sensory attributes rated higher for T₂ (lactobacillus cultures). Therefore, result of the study concluded that T₂ (1.5% lactobacillus) culture was most appropriate for formulation of *chakka*.

WHEAT: NEW HOST RECORD FOR POTATO APHID *MACROSIPHUM EUPHORBIAE* THOMAS (HEMIPTERA: APHIDIDAE) AND ITS LIFE TABLES

Venkatesh Y.N.¹, Rajna S.¹, Vinod Kumar Padala¹ and Subhash Chander²

¹Division of Entomology, ICAR-Indian Agricultural Research Institute, New Delhi, India

²ICAR-National Centre for Integrated Pest Management, New Delhi, India

Email: venkateshyn27@gmail.com

Abstract

Wheat (*Triticum aestivum* L.) is the major global staple food to meet the food security demand of various nations of all most all the continents. The recent reduction in wheat production is attributed to several biotic and abiotic factors especially, significant shifts in temperature and rainfall patterns and pest occurrence due to climate change. Among insect pests, aphid species are emerging as new pests of economic importance in India and elsewhere. The present investigation identified a new aphid species *Macrosiphum euphorbiae* that can infect the wheat crop. The morpho-molecular characterization of two different aphid morphotypes revealed the infestation of *Macrosiphum euphorbiae* and *Rhopalosiphum padi* on wheat during 2022. The complete biological parameters and life table parameters were studied for both the aphid species fed on wheat foliage. The total nymphal duration and life cycle duration of *R. padi* (4.76±0.54 and 9.71±1.38 days) and *M. euphorbiae*



(5.84±0.69 and 9.96±1.31 days) was significantly different for each aphid species. The fecundity of both aphid species was 23.95±8.67 and 11.6±4.10 (progeny/female) and no Pre-oviposition period was observed. Age-stage survival rate (S_{xj}) duration was more in *M. euphorbiae* as compared to *R. padi* in all the stages of the life cycle. Age-specific survival rate (l_x), age-specific fecundity (f_x) and population age-specific fecundity (m_x) studies showed high population fecundity and female age-specific fecundity in *R. Padi* compared to *M. euphorbiae*. Reproductive value (V_{xj}) was high in *R. padi* but the duration of reproduction was less, while in *M. euphorbiae* reproductive value was low but the duration was more. The gross reproduction rate (GRR) found highest in *R. Padi* (29.17 offspring/adult lifetime) compared to *M. euphorbiae* (19.58 offspring/adult lifetime). This study highlighted the *M. euphorbiae* shift to new host i.e wheat which caused several significant changes in its growth and development with long life expectancy and slightly reduced reproduction rates. This adoption strategy to survive long periods on crop may pose threat to the wheat crop in near future.

DESIGN AND DEVELOPMENT OF ROBOTIC ARM FOR HANDLING PAPER POT SEEDLINGS

Vikas Paradkar¹ and Gourav Sahu²

¹Mahatma Gandhi Integrated Farming Institute, Motihari Bihar

²Birsa Agricultural University, Ranchi, Jharkhand

Email: vikasparadkar@gmail.com

Abstract

Most of the vegetable transplanters available in India are mostly semi-automatic using bare root seedlings or pot seedlings. Though these semi-automatic machines were reported to be successful for transplanting various vegetables, but they require significant amount of labour and time to feed the seedlings resulting in lower field capacity and field efficiency. The automatic transplanters available are having very complicated metering mechanisms. Hence, to mechanize transplanting of vegetable seedlings, possibility of using robots may play an important role. For this, a suitable robotic arm to handle pot seedlings was developed. The developed robotic arm has 3 degrees of freedom (DOF) and it included arm, shoulder, wrist and gripper. Servo motors were used as actuator and Arduino UNO microcontroller was used for controlling the movement of the robotic arm. Forward and inverse kinematics equations were derived using Denavit-Hartenberg notation. The power consumption of the robotic arm was measured to handle the pot seedling. From the results the minimum power required to operate the robotic arm was found to be 10.64 W. The feeding conveyor was designed for conveying the paper pot seedling to be handled by the robotic arm. It included belt, platform, pulley, motor, LDR and LED circuit. The power consumption of the motor for conveying the seedling was varying from 2.1 W to 6.4 W with no load and with load, respectively. The developed robotic arm could pick and drop the pot seedlings each weighing 68 g in only 6 seconds.

SCOPE OF MILLET AS A FUNCTIONAL INGREDIENT IN MANUFACTURING OF FOOD PRODUCTS

Vini K. Swarup¹ and Anamika Das²

¹Warner College of Dairy Technology, SHUATS, Prayagraj, U.P.-211007

²Warner College of Dairy Technology, SHUATS, Prayagraj, U.P.-21107

Email: viniswarup885@gmail.com

Abstract

Millets plays a significant role in the traditional diets of population of many regions throughout the country. Millets are a good source of complex carbohydrates, proteins, fat, crude fibre, vitamins and minerals. They are a good source of vitamin B complex, magnesium, antioxidants, manganese, phosphorus and also iron. Millets are also a good source of essential fatty acids like linoleic, oleic and palmitic acids which are found in their free form. Millets are usually subdivided into large millets (Sorghum and Pearl millet) and small millets (Finger, Barnyard, Little, Kodo, Foxtail and Proso millet). There are many foods which are prepared by different millets that can be used by the consumers on daily bases, like, Ragi upma Pakoda, little millet fried rice, bajra roti, barnyard millet kalajamun etc. Millets based foods have low Glycemic Index and reduces the postprandial blood glucose level. As millets are gluten free, they have considerable potential in foods and beverages and can meet the growing demand for gluten free foods and is suitable for individuals suffering from celiac disease. Millet foods are characterized to be potential prebiotic and can enhance the viability or functionality of probiotics with significant health benefits. It is very important to introduce millets as a nutritious food, as it is fulfilling the nutritional need of global population



and to find ways to consume the millets nutritionally, effectively and to reduce the problems of malnutrition and other health problems.

DISTRIBUTION PATTERN OF WATER LILY APHID *RHOPALOSIPHUM NYMPHAEAE* IN MAKHANA *EURYALE FEROX*

Vinod K. Padala^{1,2*}, Ramya N.², Venkatesh Y.N.³ and Rajna S.²

¹ICAR-RCER, Research Centre for Makhana, Darbhanga, Bihar 846005, India

²ICAR-Indian Agricultural Research Institute, New Delhi

³ICAR-Central Agroforestry Research Institute, Jhansi, India

*Email: vinodkumarpadala66@gmail.com

Abstract

Water lily aphid *Rhopalosiphum nymphaeae* L. (Hemiptera: Aphididae) is the major pest of Makhana/Gorgon nut. The basic information such as distribution pattern and optimum sample size for estimating population density in the field is unknown. Therefore, we studied spatial distribution patterns for two stages, i.e. nymph and adults of *R. nymphaeae*, using five different distribution indices and two regression methods viz., Taylor's power law and Iwao's mean crowding index methods for two years. All the indices showed aggregated distribution by nymphs and adults of *R. nymphaeae* in both years individually and with the pooled data of two years. The values of aggregation parameter (b) of Taylor's power law and density contagiousness co-efficient () of Iwao's mean crowding index were found to be more than one for both nymphs and adults for each of the years, and pooled data of two years indicated an aggregated distribution of the *R. nymphaeae*. The optimal sample size (n) was estimated at three fixed precision levels of 0.05, 0.10, and 0.25 with Iwao's regression coefficients. The results showed that the optimum sample size decreased with increased levels of precision and mean aphid density. The optimum sample size (n) for estimating the lowest (3.3/leaf) and highest density (217.6/leaf) of both nymph and adults ranged from 305.2 to 26.3, 76.3 to 6.6, and 12.2 to 1.0 with 5, 10 and 25% level of precision. This basic information on spatial distribution pattern and optimum sample size helps monitor and formulate effective management strategies against *R. nymphaeae*.

CARBON FOOTPRINT OF MILK PRODUCTION AT THE FARM LEVEL-A CRADLE TO FARM GATE LIFECYCLE ASSESSMENT

Vipin*, Ashok Santra, Sachin Tripura and Prabhakar

*Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur,

ICAR-National Dairy Research Institute, Eastern Regional Station, Kalyani, West Bengal, India

*Email: vipinsingh729@gmail.com

Abstract

The concept of life cycle assessment (LCA) has proven to be useful in recent years due to its ability to assess the total environmental impact of dairy products. Therefore, the current study was performed to investigate the carbon footprint of milk production through a cradle-to-farm gate LCA conducted from the year 2016 to 2020. This study was conducted on the cattle farm of the Eastern Regional Station, National Dairy Research Institute, Nadia district of West Bengal state, Eastern India. The average numbers of total Jersey crossbred cows present at the farm were 158.92±1.94, 192.67±4.40, 201.17±4.73, 205.83±1.59, and 218.00±4.77 for the years 2016, 2017, 2018, 2019, and 2020, respectively. The average body weight of all the cows was 304.00±57.15, 297.49±52.77, 276.80±53.57, 279.62±53.44, and 273.72±53.61 kg for the years 2016, 2017, 2018, 2019, and 2020, respectively. The fat protein corrected milk (FPCM) production was 189392.60, 246149.50, 243715.20, 252040.90 and 246118.70 kg for the years 2016, 2017, 2018, 2019, and 2020, respectively. The average carbon footprint (CF) of Jersey crossbred cow's milk was 2.13, 1.85, 1.86, 1.93, and 1.92 kg CO₂eq. per kg FPCM for the years 2016, 2017, 2018, 2019, and 2020, respectively. The average CO₂eq./kg FPCM yield for five years was 1.94±0.05 kg CO₂eq. per kg FPCM. Emission (%) of CH₄ and N₂O was 73.11 and 0.03 % of the total greenhouse gas (GHG) emissions in the farm for milk production. However, based on mass (kg), emissions of CH₄ and N₂O were 99.99 and 0.004% of the total GHG emissions on the farm for cow's milk production. The contribution of enteric emission (CH₄), emission from manure (CH₄ and N₂O), emission from fertilizers consumed, emission from diesel consumed and emission from electricity used was 68.70, 4.42, 13.53, 3.05, and 10.27%, respectively. It may be concluded from the study that enteric emission was the biggest source of GHG emissions at the farm level.



COMPATIBILITY AND PATHOGENICITY OF NATIVE EPN *HETERORHABDITIS* SP. (ANAND H-I) WITH INSECTICIDES REGISTERED FOR MANAGEMENT OF FALL ARMYWORM, *SPODOPTERA FRUGIPERDA*

S.V. Dobariya and Ajay Kumar Maru

Department of Nematology, B.A. College of Agriculture, Anand Agricultural University, Anand-383001

Email: marujay@gmail.com

Abstract

The compatibility of native isolated EPN, *Heterorhabditis* sp. (Anand H-I) with insecticides registered for management of *S. frugiperda* tested at its recommended and half of the recommended doses. Among all insecticides and dose combinations tested, *Heterorhabditis* sp. (Anand H-I) was found compatible with spinetoram 11.7 SC, chlorantraniliprole 18.5 SC, emamectin benzoate 5 SG at both the recommended and half of the recommended dose based on the per cent mortality of IJs recorded after 12, 24, 36 and 48 hrs after inoculation. Chlorantraniliprole @ 0.004 per cent and spinetoram @ 0.003 per cent showed lower mortality or higher compatibility while thiodicarb @ 0.150 per cent caused higher mortality or lower compatibility of *Heterorhabditis* sp. (Anand H-I). The pathogenicity of treated *Heterorhabditis* sp. (Anand H-I) with chlorantraniliprole @ 0.004 per cent was found comparatively more virulent against *S. frugiperda* over all other treatment combinations.

USE OF CHLORPROMAZINE IN THE TREATMENT OF BOVINE *STAPHYLOCOCCAL* MASTITIS

Abhishek Kumar, Vikash Kumar, Shubham Kumar and Puja Mukherjee

Department of Veterinary Medicine, Ranchi Veterinary College, Ranchi, Jharkhand

Abstract

The study was conducted on the cases presented or reported at clinical complex, RVC or in and around Ranchi with the history of change in either taste of milk or reduction in milk yield by individual quarter or any other clinical abnormality in milk. The test samples were confirmed through different tests and the organisms were cultured, isolated and identified.

The treatment was initiated dividing the entire screened animal in to three (3) equal group i.e. A, B and C consisting of 20 animals in each groups. The Group-A was given Chlorpromazine (CPZ) @ 2ml I/MM, Group-B was given Ciprofloxacin (CIP) @250 mg I/MM and Group-C was given combination of both Chlorpromazine (CPZ) + Ciprofloxacin (CIP) at prescribed dose through intramammary route. These treatments were continued up to 7 days along with supportive treatment consisting of flunixin meglumine @ 1.5mg/kg body weight as I/M route. The treatment was assessed on daily basis by early and complete cure of mastitis detected through SCC and through clinical improvement and to evaluate the relapse of mastitis the milk samples were assessed on 7th & 14th day of cessation of treatment.

The finding showed over all prevalence of mastitis as 35.43% and 10.70% with respect to *number of cows and quarters affected* respectively. Prevalence of *Staphylococcus aureus* was 56.60%, coagulase negative *Staphylococcus spp.* 13.21% & other un-identified organisms were 30.19%. The quarter wise prevalence of *staphylococcus aureus* were 9.274%, 6.40%, 5.645% and 2.857% with respect to LF, RF, RH and LH respectively. Minimum inhibitory concentration (MIC) of Chlorpromazine against *Staphylococcus aureus* was found 50 g/ml. Antibacterial sensitivity of chlorpromazine, ciprofloxacin and combination of both were found 21.42mm, 24.57mm and 40.38mm respectively against *Staphylococcus aureus*. Moreover, antibacterial sensitivity was same for tablet as well as for injectable form of chlorpromazine against *Staphylococcus aureus*. The Somatic Cell Count (SCC) was found more reliable test to detect mastitis as compared to CMT and WST. The combined treatment (CPZ+CIP) showed time dependent faster decrease in number of neutrophil count as compared to that of CIP & CPZ treated groups. This indicated comparatively faster clearance of organisms in combined treated group as compared to other group. The absolute macrophage count showed a time dependent highest decrease in combined treated group followed by alone CIP and CPZ treated group. It suggested faster clearance of the organism in combined treated group. Lymphocyte cell count showed time dependent highest increase in combined treated (CIP+CPZ) group as compared to CPZ and CIP treated group. Epithelial cell count showed time dependent highest increase in CIP treated group as compare to CPZ and combined treated group. The absolute epithelial cell count showed a time dependent highest decrease in combined group as compared to CPZ and CIP treated group. This decrease in absolute epithelial cell count showed faster repairing process in combined treated group.



On the basis of SCC, the recovery % were found 80%, 80% and 90% recovery after 7th days of treatment with chlorpromazine, ciprofloxacin and combined treatment with chlorpromazine & ciprofloxacin respectively. The chance of reoccurrence of mastitis in cows treated with chlorpromazine, ciprofloxacin and combination of chlorpromazine & ciprofloxacin were found 18.75%, 12.5% and 0% respectively after 14th days and 25%, 18.75% and 5.56% respectively after 21 days of treatment. Hence, the present findings had been concluded as Chlorpromazine can be used more efficiently in combination with antibiotic (ciprofloxacin) specially in chronic case of mastitis, while with efficacy of 80% it can be used alone as intra-mammary infusion either in the form of aqueous solution of tablet or as injection with the total treatment cost of rupees between 12 to 56.

FERTIGATION SCHEDULING FOR GUAVA CV. LUCKNOW 49 UNDER HDP IN SALT AFFECTED SOILS

A. Nithya Devi, J. Auxilia and K. Kumanan

Horticultural College and Research Institute for Women, Tamil Nadu Agricultural University
Tiruchirappalli, Tamil Nadu, India-620 027

*Corresponding author Email : nithyadevi.a@tnau.ac.in

Abstract

Salt affected soils (SAS) is a holistic term used to designate the soils having either excess soluble salts and/or exchangeable sodium. Based on the values of electrical conductivity (EC), pH and exchangeable sodium percentage (ESP), soils are classified into normal, saline, sodic and saline-sodic. In India, approximately 120 M ha land suffers from one or another form of degradation viz., soil erosion (94.9 M ha), salinity and sodicity (6.74 M ha), soil acidity (17.94 M ha) and other stresses (1.07 M ha) (Sharma *et al.*, 2015). High ESP (>15) deteriorates the structure, impedes the water and air flows, reduces water intake capacity and hampers the root penetration in sodic soils. To find out the effect of fertigation on growth and yield of guava under sodic soil conditions at HC & RI (W), Trichy the study was attempted. The guava layers of cv. Lucknow-49 were planted at a spacing of 3 x 1.5 accommodating 2222 plants/ha under HDP system. Four year old trees were imposed with four treatment schedule viz., T1 (100 % of RDF through fertigation), T2 (75 % of RDF through fertigation), T3 (50 % of RDF through fertigation) and T4 (100 % RDF as soil application). The fertilizer dose as recommended by CISH, Lucknow was applied @ 480:240:240g/ plant/year (4th year dose) i.e., 240:120:120g of N, P₂O₅ and K₂O per season was applied after pruning. The trial was conducted in RCBD with five replications. Among the treatments, T3 with 50% RDF through fertigation was found to be the best, which recorded the highest fruit yield (12.60 kg/tree) and average fruit weight (186.74g) followed by T2(75% RDF). The average fruit weight was not differed among fertigation treatments, while significantly different from soil application of fertilizers (control). Analysis of soil physico-chemical characters indicated that the highest pH of 8.20 was noticed in control. Soil available N and P level was found to be the highest in the best treatment T3 (279.10 kg/ha and 25.77 kg/ha), while the same treatment recorded the lowest available K (127.46 kg/ha). However, the study indicated that to obtain higher yields as registered in the normal soil, the fertigation doses has to be fixed based on the soil nutrient properties.

THE POTENTIAL OF BLACK RICE-FROM STAPLE FOOD TO NUTRACEUTICAL

A.Qureshi¹, C.R. Netam², O.P. Parganiha¹ and Amit Dahate¹

¹College of Agriculture and Research Station, Marra (Patan)

²College of Agriculture and Research Station, Gariyaband

Corresponding E mail: qureshi.ameen76@gmail.com

Abstract

The lesser known chakhao black rice, locally called 'Chakhao', meaning delicious rice in Manipuri language, has drawn attention of the scientific community in most recent times owing to its higher nutraceutical properties such as antioxidant, anticarcinogenic, fiber, vitamin and mineral contents. The high anthocyanin content in the pericarp gives the rice dark purple colour which has antioxidant property. Historically, black rice was considered to be a royal delicacy and forbidden for common people in Asian countries such as China and Indonesia. As the legend has it, in China during imperial period, common people were not allowed to store/cultivate black rice without the approval from authorities and hence it was called



‘forbidden rice’ or ‘imperial rice’. Pregnant women are traditionally served with black rice a few days before delivery. Black rice is also consumed in small quantities by persons afflicted with diabetes. The antioxidant and anti-carcinogenic properties of black rice have recently been recognized. China cultivates the most black rice followed by Sri Lanka, Indonesia, India and Philippines etc. Based on historical record, black rice was only for the kings of China and Indonesia (forbidden rice). This is because black rice has a double function, namely as a source of staple food with good taste, fluffier and fragrance, as well as an efficacious medicine to cure various illnesses.

EVALUATION OF DIFFERENT HYBRIDS OF BRINJAL FOR THE WESTERN PLATEAU REGION OF JHARKHAND

Abdul Majid Ansari^{1*}, Ekhlaque Ahmad¹, Nazrussalam¹ and D.N. Singh²

¹Zonal Research Station (Birsa Agricultural University), Chianki, Palamau-822102

²Associate Director, ZRS (Birsa Agricultural University), Chianki, Jharkhand, India.

*At present Department of Horticulture, BAU, Ranchi

e-mail: majid.gbp@gmail.com

Abstract

Brinjal or eggplant ($2n=2x=24$) botanically *Solanum melongena* L. is an important Solanaceae vegetable crop commercially cultivated around the year in most parts of the country. The shape, size and colour of marketable fruits are important traits for their cultivation. This crop is highly prone to different insect-pest and diseases. The development of a brinjal hybrid with the prime objective of resistance against abiotic and biotic stresses is an essential breeding objective of this crop. A breeding programme was initiated at Zonal Research Station, Chianki using Griffing's Diallel Method-II for the crossing among seven diverse parental genotypes. After an initial evaluation of all 21 F₁ and seven parents, three promising hybrids were identified as promising with respect to yield and other parameters. Subsequently, an evaluation trial was carried out during 2018-19, 2019-20 and 2020-21 using seven entries including three hybrids of ZRS, Chianki (CBH-5, CBH-6 and CBH-34). The field trial was laid out in a randomized block design with three replications over the years. Observations were recorded for nine important characters and mean data was subjected to suitable statistical analysis. Analyzed data revealed that seven entries of brinjal hybrids gave significant effect for all traits understudied over the year of experimentations. The hybrid CBH-6 gave significantly highest yield during 2018-19, 2019-20 and 2020-21 with the value of 523.76 q/ha, 579.22 q/ha and 611.93 q/ha, respectively, followed by CBH-5 which gave 501.64 q/ha and 522.10 q/ha yields during 2018-19 and 2020-21, respectively. On the basis of the results, it is concluded that the hybrid CBH-6 is the most suitable brinjal hybrid for *rabi* cultivations in the western plateau region of Jharkhand and for the similar agro-climatic conditions of the adjoining areas of the region.

ASSESSMENT OF GROWTH AND PRODUCTIVITY OF GARLIC (*ALLIUM SATIVUM* L.) VARIETIES IN AGRI-HORTICULTURE SYSTEMS UNDER MID-HILL SITUATION OF GARHWAL HIMALAYA, INDIA

Abhishek Pratap Singh

College of Forestry, Veer Chandra Singh Garhwali Uttarakhand University of Horticulture and Forestry, Ranichauri, India

Email : abhishekpratap435@gmail.com

Abstract

The present experiment was carried out at Horticulture Research Block, College of Forestry, VCSG Uttarakhand University of Horticulture and Forestry, Uttarakhand, India under agri-horticulture systems and open farming system to evaluate the soil properties and tree crop interaction effect of three fruit trees i.e. peach (*Prunus persica* L.), plum (*Prunus domestica* L.) and apricot (*Prunus armeniaca* L.) on growth, yield and economic parameters of two garlic (*Allium sativum* L.) varieties i.e. “UUHF G 12-1” & “Agrifound Parvati”. Growth and yield parameters viz. plant height (86.33 cm), leaf length (42.53 cm), leaf width (1.2 cm), number of leaves per plant (7.91), bulb neck diameter (1.03 cm), bulb diameter (4.09 cm), bulb length (4.46 cm), bulb weight (64.83 g), number of cloves per bulb (8.91), clove weight (6.26 g), clove length (3.40 cm), clove width (2.48 cm) and bulb yield (14.62 t) were recorded maximum for V1 (UUHF G 12-1). Among studied farming systems better performance of crop was found under peach based agri-horticulture system followed by apricot and plum based



agri-horticulture system, while deficient performance was found under the open farming system. Soil pH (6.06) and soil organic carbon (2.77 %) was observed maximum under the peach tree and available nitrogen (263.35 kg) was recorded maximum under control conditions. Available phosphorus (45.95 kg) and available potassium (145.89 kg) was observed maximum under the apricot tree and available sulphur (32.39 mg) was recorded maximum under the plum-based agri-horticulture system. Economic parameters of crop such as gross return (1338666.67 ?), net return (1000166.67 ?) and B:C (3.95) were found maximum for UHF G 12-1 grown under the peach. The finding of the present study suggested that garlic can be grown more profitably under the agri-horticulture system as an intercropping.

MOLECULAR TAXONOMY AND PHYLOGENETICS OF SPECIES UNDER THE GENUS *OSTEOBRAMA* HECKEL, 1842 IN INDIA

Anjali Pushp^{1,2}, K.V. Radhakrishnan¹ and Himanshu Priyadarshi¹

¹College of Fisheries, Central Agricultural University, Imphal, Lembucherra, Tripura (W)-799210

²College of Fisheries, BASU, Bihar-855107

Abstract

Genus *Osteobrama* Heckel (family: Cyprinidae) include small to medium sized fishes distributed in India, Pakistan, Bangladesh, Myanmar and China. In India, it is found in North-eastern and Peninsular region only. The present study involves taxonomic validation and elucidation of phylogenetic relationships of 7 *Osteobrama* species distributed within India. The results of meristic analyses showed significant level variation between *O. cunma*, *O. cotio*, *O. belangeri*, *O. cotio peninsularis*, *O. neilli*, *O. bakeri* and *O. vigorsii*, mainly for counts of anal fin rays, lateral line scales and in the presence/absence of barbells. The Principal Component Analysis (PCA) conducted on twenty- six morphometric ratios showed a varied pattern of clustering between the species. The results of molecular studies showed that out of 647 positions analyzed in the COI dataset for various species, 181 positions were variable (27.9%). The genetic distance between different *Osteobrama* species studied ranged from 0.5% (between *O. cotio* and *O. cotio peninsularis*) to 16.8% (between *O. bakeri* and *O. belangeri*) for COI sequences. The highest genetic distance between *O. bakeri* and *O. belangeri* could be explained by their highest geographical separation. The results of morphological and molecular taxonomy showed that while *O. cotio* and *O. cotio peninsularis* could be differentiated based on morphology, genetically they are closely similar. *Osteobrama belangeri* showed high interspecies K2P distance from all other *Osteobrama* species, indicating that it is diverged quite early from other *Osteobrama* species. The maximum- likelihood (ML) phylogenetic tree constructed using COI sequences showed that *O. belangeri* is genetically distinct from other *Osteobrama* species corroborating with the pattern of evolution and dispersion of other Cyprinid fish species in India.

IDENTIFICATION OF VARIATIONS AMONG MUSTARD VARIETIES FOR PHOSPHORUS ACQUISITION EFFICIENCY

Artika Singh* and S.K. Chaturvedi

Rani Lakshmi Bai Central Agricultural University, Jhansi-284003, India

*Corresponding Author Email: artika14singh@gmail.com

Abstract

The phosphorus (P) plays a critical role in plant metabolism, particularly in energy transfer, respiration and photosynthesis. Phosphoric fertilizers have been considered as a major input in mustard production. When mustard is grown on 'P' deficient soils, poor growth and low yields are commonly observed and at the same time application of phosphorus improves seed size, seed filling and oil content. India is importing huge quantity of phosphoric fertilizers. Any effort for identification of better phosphorus acquisition efficient (PAE) variety/genotypes will lead in development of high yielding varieties with better PAE. These varieties will also provide much needed stability in production when sub-optimal doses of phosphoric fertilizer are used under rainfed agriculture. To reduce import of phosphoric fertilizers, RLBCAU conducted an experiment with 40 mustard varieties collected from different centres were grown in winter season of 2021-22 in randomized block design with three two levels of P (deficient and soil with optimum quantity of nutrients). Large variations among 40 mustard varieties were observed for combined acquisition efficiency of phosphorus (P). Out of 40 varieties, only three varieties viz., Pusa Tarak 8 (2%), Pusa Mahak 9 (3%) and Pusa Bold 6 (13%) exhibited less than 15% reduction in grain yield when compared with optimum and low



P conditions under open field at the Research Farm of the RLBCAU. The results suggest further assessment for the presence of variations with respect to seed yield and oil content in mustard varieties in promising varieties/genotypes. The identification of most PAE efficient variety/genotype will open doors for identification of gene(s) responsible for higher PAE and their mapping and tagging for the development of mustard varieties with better PAE. Such varieties will require less amount of P from external sources ensuring lesser cost of cultivation for mustard crop.

IMPORTANCE OF GOAT FARMING IN INDIA

Arjun Kumar Rao and G.C. Negi

College of Veterinary and Animal Sciences, Chaudhary Sarvan Kumar H.P. Krishi Vishvavidyalaya Palampur-176062

Email : radhekrishna3198@gmail.com

Abstract

A versatile animal the goat produces milk, meat, hide, and fleece for human consumption in addition to manure for use in enhancing soil fertility. With low overhead cost, basic housing, easy upkeep and favourable all atmospheric conditions, goat farming is feasible. For the sale of its products there are markets everywhere. On poor quality grazing areas, goat farming can be quite effective in production alongside other animals (such as sheep & cattle). Goats are efficient in producing high quality lean meat from inferior grazing material that is undesirable to other livestock. Resourceful person can guide the farmers regarding modifications of the existing goat rearing system by different integrated farming methodologies.

INFLUENCE OF REFRIGERATED STORAGE ON QUALITY ATTRIBUTES OF *CHHANA PODO* PACKED UNDER LOW DENSITY POLYETHYLENE PACKAGING CONDITIONS

Ashritha B.*, Siva Kumar S., Rekha Chawla, Shubham Kumar and Viji P.C.

College of Dairy Science and Technology, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab

Corresponding Author: ashrithanash@gmail.com

Abstract

Chhana podo, baked sweet cottage cheese, an Indian delicacy is famous in the eastern parts of India. This product is prepared from chhana, sugar, semolina and is often decorated with nuts, cloves and cardamom. The present study was designed to conduct storage study of *chhana podo* packed in LDPE pouches stored under refrigerated condition. During the storage, samples were analysed for changes in physico chemical characteristics such as moisture, fat, protein, pH, ash, free fatty acid, tyrosine value, HMF content, water activity, peroxide value and microbiological parameters such as Standard Plate Count, Coliform, Yeast and mold at a regular interval of 3 days. Both physico chemical and microbiological attributes showed a significant changes ($p < 0.05$) in the samples during the storage study. All the parameters were within the limit of FSSAI standards. The product packed in LDPE packaging showed an acceptability of 21 days under refrigerated storage.

CRYPTOSPORIDIUM DYNAMICS AND MRNA BASED DUPLEX TAQMAN® PROBE REAL TIME PCR ASSAY IN NEONATAL GOAT KIDS

Atul Kumar Sharma¹, Gururaj Kumaresan¹, Dinesh Kumar Sharma¹, Souvik Paul¹, Anjana Goel² and Rama Sharma²

¹*Division of Animal Health, ICAR-CIRG, Makhdoom, Mathura 281122, U.P.* ²*G.L.A. University, Mathura*

Cryptosporidium spp. is the most important foodborne and waterborne pathogens and leading the cause of mortality from foodborne and waterborne gastrointestinal disease. *Cryptosporidium parvum* and *Cryptosporidium xiaoi* are the major cause of diarrhoeic health problem among the neonatal goat kids. Detection of *Cryptosporidium* spp. in water, food and other contamination sources can be very difficult due to their low number of oocytes with the reproductive stage and complexity of the host matrix, however, 10 oocytes can cause the infection in humans and animals. *Cryptosporidiosis* leads to decline in productivity, retarded growth, decreased feed efficiency, delayed maturity, loss of fertility and financial loss in the form of treatment of ailing animals. There are several reports of *cryptosporidiosis* from India, however, the information like duration of infection, active and passive transmission, live and dead oocyst, oocyst shedding patterns in naturally occurring infection and flock dynamics of the disease are still scientifically undocumented. The current study was attempted to investigate oocyst



shedding pattern, differentiation of live and dead oocyst and duration of naturally acquired cryptosporidiosis in neonatal goats. Moreover, the diagnostic tests available currently cannot predict the stage of infection in the host taking into account the immune status. By delving into the accurate stage of life cycle leveraged by any robust diagnostic technique that can differentiate live/active oocysts from that of inactive or dead oocyst can help achieve these aforementioned lacunae. To overcome this challenge mRNA based TaqMan® probe PCR used to target the *Cryptosporidium* oocyst wall protein (COWP) gene and 18SSU rRNA gene in a single tube. 644 samples were collected from pre-weaned 1-90 days of age goat kids. Based on the microscopic findings of mZN staining of faecal samples (n=644), 227 samples were positive based on the visualisation of *Cryptosporidium* oocysts as acid fast round bodies against a blue-green background. The highest prevalence of *Cryptosporidium* infection was recorded when goat kids were 1-30 days, with 63.81%, from 31 to 60 days of age, the *Cryptosporidium* infection reduced slowly to 43.37% and reached finally to 29.52% at 61-90 days of age. The results also suggested that majority of kids pick up the infection during the first week of their life. Diminished shedding percentage and decreasing scours during 61-90 days probably suggested that the immune system is being slowly activated with the formation of protective antibodies which limit the infection. This current diagnostic assay will be a quantitative marker that will help assess the active stages of cryptosporidium infection in neonatal animals. The disease dynamics will help better understand to formulate the control, strategies and spread of infection among the healthy animals. The information generated is, however, useful for researchers, veterinarians and farmers to study the disease and take appropriate control and hygienic measure limiting the infection among neonatal kids. It may help to devise a suitable age-group directed control strategy for the disease.

USE OF ROOT DIPPING IN SSP-MC SLURRY METHOD IS ENHANCING PADDY PRODUCTIVITY IN KHOWAI DISTRICT OF TRIPURA, NORTH EAST INDIA

D. Dey, M.S. Sachan, S.C. Biswas

Krishi Vigyan Kendra, Khowai, Chebri-799207

*Corresponding author's email: ddey611@gmail.com

Abstract

Rock Phosphate and integrated nutrient management is often recommended to increase crop productivity on acidic soils. To ascertain the effects of application of Rock Phosphate @125 kg/ha, 50% of RDF of N and K application along with Root dipping of Paddy seedlings in SSP-microbial Culture on Paddy productivity, a three year long field experiment was conducted by KVK, Khowai on Phosphorus deficit acidic soil at Khowai district of Tripura for evaluation of effect on status of post harvest available Phosphorus, soil organic carbon, crop yield of Paddy. Addition of rock phosphate along with root dipping of Paddy Seedlings in SSP-microbial culture Solution along with addition of 50% RDF of Nitrogen and Potassium increased post harvest available phosphorus status along with soil organic carbon content. However crop yield drastically increased under application of Rock Phosphate along with Root dipping of Paddy seedlings with SSP-mc slurry and addition of 50% dose of RDF of Nitrogen and Potassium as compare to the direct transplanting of Paddy Seedlings along with RDF of Nitrogen, Phosphorus and Potassium. Results of this study suggested application of Rock Phosphate@125 kg/ha instead of SSP along with application of 50% of RDF of Nitrogen and Potassium along with Root dipping of Paddy seedlings in SSP-microbial Culture if applied properly can lead to significant increase in crop productivity of Paddy along with increase in availability of available phosphorus on acidic soils of Khowai district of Tripura and other districts of Tripura with similar soils.

KNOWLEDGE OF ETHNO-VETERINARY PRACTICES FOLLOWED BY LIVESTOCK KEEPERS IN KANDI REGION OF PUNJAB

Balbir Singh Khadda, Shashipal, Harmeet Kaur and Parul Gupta

GADVASU-Krishi Vigyan Kendra, SAS Nagar (Mohali)

Email : khadda74@gmail.com

Abstract

An extensive survey was conducted to collect the information on livestock production systems and the common diseases inflicting losses to the livestock along with the use of local plants, plants parts and other traditional healthcare practices followed by the livestock keeper of the SAS Nagar district of Punjab. According to the livestock keepers, diarrhoea, pneumonia, anestrus problem, bloat/ tympanites, gastrointestinal helminthiasis, external parasites, retention of placenta,



constipation, wounds, indigestion problem, and plant poisonings are very common problems/ ailments of livestock for which traditional ethno-veterinary practices are usually being used in the area. The plants and other ingredients which are commonly used for healing of the livestock by the farmers in the study are *Pipal* (*Ficus religiosa* L.), *Mango* (*Mangifera indica* L.) and *Neem* (*Azadirachta indica* A. Juss.), *Bakain* (*Melia azedarach* L.), *Marigold* (*Tagetes erecta* L.), *Jamun* (*Syzygium cumini* L.), *Tulsi* (*Ocimum sanctum* L.), *Banana* (*Musa paradisiaca* L.), *Kasni* (*Cichorium intybus* L.), *sugarcane* (*Saccharum officinarum* L.), *Loung* (*Syzygium aromaticum* L.), *Methi* (*Trigonella foenum-graecum* L.), *Ajwain* (*Trachyspermum ammi*), *Kutki* (*Picrorhiza kurroa*), *ginger* (*Zingiber officinalis* Rosc.), *Heeng* (*Ferula asafetida* L.), *Jaggery* and *black salt*. Plant roots, leaves, twigs, bark powder, fruits, seeds, oils, heeng, black salt and jaggery are also used for treatment. Moreover, some ethno-veterinary practices like bolus made from pigeon droppings and sprouted *Triticum* for induction of heat in anestrus dairy animals, feeding cotton seeds to enhance body growth for goat and increment of fat percentage in milk of dairy animals, oral administration of a mixture of *Asafetida*, *Chirayata swertia*, *Trachyspermum ammi* and black salt for tympanites, feeding a paste of *Curcuma longa*, *Trachyspermum ammi* and black salt for fever and pneumonia, feeding castor (*Ricinus communis*) seeds for constipation, applying a paste of leaves of *Azadirachta indica* on wounds, feeding a paste prepared from powder of *Trigonella foenum-graecum* seeds, *Allium sativum*, leaves of *Azadirachta indica*, black salt and jaggery; and mixture of *Asafetida*, *Trachyspermum ammi* and black salt for indigestion, boiled water with leaves of *Azadirachta indica* and Potassium permanganate mixed in water for douching oral cavity and infected hooves, etc. Based on the present study it may be concluded that the traditional knowledge of ethno-veterinary practices have played a significant role in the conservation of unique biodiversity and are considered to be better in economic terms with the added advantages of healing the ailments without any side effects. Therefore, indigenous knowledge of ethno-veterinary practices may be beneficial for the entire animal kingdom if validated scientifically.

EVALUATION OF DIFFERENT *RHIZOBIUM* ISOLATES ON NODULATION AND GRAIN YIELD OF MUNGBEAN

Geetanjali A. Kamble¹, G.K. Giri², S.S. Lande¹ and E.R. Vaidya¹

¹Pulses Research Unit Dr. PDKV, Akola, 444 104

²Department of Plant Pathology, Dr. PDKV, Akola, 444 104

Email-gitakola09@gmail.com

Abstract

A field experiment was conducted during *kharif* 2021-22 at Pulses Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.) to evaluate the effect of various *Rhizobium* isolates of Mungbean on nodulation and grain yield of variety Green Gold. The experiment comprising of nine treatments including control and a treatment of recommended dose of chemical fertilizer with seven treatments of *Rhizobium* isolates which procured from different agro climatic regions of India. Experiment was laid out in randomized block design with three replications. The carrier based culture of *Rhizobium* isolates were inoculated @ 25 g/kg of seed. The results of present study revealed that the seed inoculation of *Rhizobium* isolate (AKMR-19) recorded higher grain yield (854 kg/ha) and maximum number of nodulation (25.87 nodules /plant) among the isolates.

CHARACTERIZATION AND UTILIZATION OF SEWAGE SLUDGE AS A GROWTH MEDIUM FOR ORNAMENTALS

Biju Joseph^{*1} and Gladis R.¹

Department of Soil Science and Agricultural Chemistry, College of Agriculture, Vellayani-695522, Thiruvananthapuram, Kerala Agricultural University

*Corresponding author Email : biju.joseph@kau.in

Abstract

A study was carried out in College of Agriculture, Vellayani during 2017 to characterize the sewage sludge generated from sewage treatment plant, Muttathara, Thiruvananthapuram and growing media was prepared using potting mixture and sewage sludge at different proportions of 1:9, 2:8, 3:7, 4:6, 1:1, 6:4, 7:3, 8:2, 9:1 and suitability of these growing media for ornamentals was evaluated in a pot culture experiment using marigold as test crop. The results revealed that the sewage sludge



generated from Muttathara treatment plant was strongly acidic (pH 2.91). The organic carbon content was high (12.2%). It was rich in plant nutrients N (2.05%), P (2.65%), K (1.80%), Ca (1.02%), Mg (0.63%), S (460 mg kg⁻¹), Fe (3.2%), Mn (0.15%), Zn (224.7 mg kg⁻¹), Cu (225.5 mg kg⁻¹) and B (13.5 mg kg⁻¹). Physical properties namely water holding capacity (26.1%) and porosity (65.7%) were high. Bulk density was very low (0.65 g cc⁻¹). The sludge contained the heavy metals Pb (11.5 mg kg⁻¹), Cr (31.5 mg kg⁻¹), Ni (33.5 mg kg⁻¹) and Cd (27 mg kg⁻¹). Presence of *E.coli* was also detected (> 2400 MPN/ 100g). Analysis of physical, chemical and biological properties of growing media revealed that pH decreased and the organic carbon content increased with increasing levels of sewage sludge in the growing media. The water holding capacity, porosity, content of major nutrients, secondary nutrients and micronutrients were also found to increase due to the addition of sewage sludge. The content of heavy metals Cd, Cr, Ni and Pb also increased. The treatment having potting mixture and sewage sludge in the ratio of 9:1 recorded the maximum number of flowers (79.60 plant⁻¹) and flower yield (706.36 g plant⁻¹). It was also superior with respect to vegetative and floral parameters. The heavy metal content in plant (shoot and root) was the highest in treatment applied with sewage sludge alone.

GENETIC GAIN IN PRODUCTION TRAITS OF MAGRA SHEEP IN ORGANIZED FLOCK OF ARID REGION

Ashish Chopra, H.K. Narula, Ashok Kumar and Nirmala Saini

Arid Region Campus, ICAR-Central Sheep & Wool Research Institute, Bikaner-334006, INDIA

Email: ashishchopra1234@gmail.com

Abstract

In India, sheep is an important livestock species and it contribute immensely to the agrarian economy by providing gainful employment and income to large number of rural poor especially socially backward, marginal and landless labourer. Magra is an important carpet wool breed of Rajasthan and is found in its purest form in Bikaner and adjoining areas of Nagaur, Churu and Jhunjhunu districts. The wool produced by Magra is most suitable for carpet production and is in great demand due to its lustre. To fill up the gap between demand and supply of lustrous wool, there is need of higher production of indigenous lustrous carpet wool. Keeping in view the above things, the project for genetic improvement of Magra breed for carpet wool production is formulated with the objectives to achieve 25.0 Kg., 30.0 kg body weight at 6, 12 month and 2.2 Kg adult annual greasy fleece yield respectively. Growth data for 21 years were analyzed by SPSS 25.0. The overall least squares means of birth, 3, 6, 9 and 12 month's weight of lambs were 3.13±0.00 (4752), 16.16±0.05 (4477), 22.97±0.07 (4037), 27.22±0.08 (3266) and 30.04±0.09 (2840) kg, respectively. The six-month body weights varied between 19.45 and 24.72 Kg whereas 12-month body weight varied between 23.01 to 34.02 Kg. All the body weights at different stages were significantly affected by Period and Sex. The body weight at six-month improved by 27.09 percent i.e. from 19.45 kg to 24.72 kg over the period after start of Network Project. Additionally, the data on 3993 individuals spanning over 21 years (1998-2019) was used for genetic analysis. Individuals predicted breeding values were calculated for body weight at six months and first six monthly greasy fleece yields. These two traits were under selection over the years. The genetic trends were calculated by regression of average predicted breeding values for the traits (body weight at six months and first six monthly GFY) versus the animal's birth year and generation wise. For six-month body weight the year wise and generation wise genetic gain were 82.6 gm/year and 191.7 gm/generation, respectively. For first six monthly clip the year wise and generation wise genetic gain were 1.86 gm/year and 3.68 gm/generation, respectively. Positive genetic trends and period wise significant improvement in growth performance shows further scope of selection in the promising carpet producing Magra sheep.

GENDER PERSPECTIVES OF CLIMATE CHANGE AND COMMUNITY ADAPTATION IN BIHAR

Bineeta Satpathy* and Rubina Rai

Department of Extension Education, Dr.Rajendra Prasad Central Agricultural University, Pusa, Bihar-848125

*Email : bineeta.satpathy@rpcau.ac.in

Abstract

The successful application of a gender approach in development requires a thorough understanding and appreciation of the involvement of both men and women in the development process. An integrated gender approach in community-based adaptation facilitates the equitable participation of men and women alike and adequately addresses the sometimes differing



strategic needs of both genders. Climate change has serious ramifications in four dimensions of food security i.e food availability, food accessibility, food utilization and food systems stability. Women farmers currently account for 45-80 per cent of all food production in developing countries depending on the region. Women face loss of income as well as harvests—often their sole sources of food and income. Furthermore, women are often excluded from decision-making on access to and the use of land and resources critical to their livelihoods. For these reasons, it is important that the rights of rural women are ensured in regards to food security, non-discriminatory access to resources, and equitable participation in decision-making processes. Gender analysis is considered one of the best approaches to reach this objective, promoting a shift from a special focus on women to the adoption of a broader gender approach, based on the relations between men and women. In particular, the “confusion between a gender-aware approach and women-only support can lead to a range of problems. Creating gender knowledge systems, Mapping of gender-specific profiles, mitigative and adaptative capacity, assessment of impacts based parameters can be considered for influencing policy. This paper will throw light on climate change effects, potential risks and potential effect on women and enabling factors.

STCR- BASED MANURE AND FERTILIZERS APPLICATION EFFECT ON PERFORMANCE OF WHEAT (*TRITICUM AESTIVUM* L.) AND PHYSICAL PROPERTIES IN A INCEPTISOL

Brijesh Kumar* and Tarence Thomas

Department of Soil Science and Agricultural Chemistry, SHUATS, Prayagraj-211007, U.P., India

*Email : dr.brijeshkr@gmail.com

Abstract

A field experiment was carried out during Rabi season of 2020-2021 and 2021-2022 at the Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj research field out the STCR- Based Manure and Fertilizers Application Effect on Performance of Wheat (*Triticum aestivum* L.) and Physical properties in a Inceptisol. The treatment details were T₁; Farmers practice 60 N:40 P₂O₅:40 K₂O kg/ha, T₂; GRD 120 N:60 P₂O₅:40K₂O, T₃ GRD 120 N:60 P₂O₅:40K₂O + FYM 0 t/ha, T₄ GRD 120 N:60 P₂O₅:40 K₂O + FYM 5 t/ha, T₅ GRD 120 N:60 P₂O₅:40K₂O + FYM 10 t/ha, T₆ STB 150 N:50 P₂O₅:70 K₂O, T₇ STB 150 N:50 P₂O₅:70K₂O + FYM 0 t/ha, T₈ STB 150 N:50 P₂O₅:70 K₂O + FYM 5 t/ha, T₉ STB 150 N:50 P₂O₅:70K₂O + FYM 10t/ha and carried out in Randomized Block Design (RBD) with three replication. Sandy loam in texture belongs to order Inceptisol and neutral to alkaline in reaction. The result revealed that wheat number of leaves and grain yield was significantly affected due to fertilizers and manure application and recorded highest yield in treatment T₉ (6.5 t/ha) which was significantly superior to farmers practices (5.65 t/ha). The results indicated that the STCR based treatment with target yield 6.5 t/ha along with application of 10 t/ha recorded bulk density (1.11, 1.12 and 1.20 Mg m⁻³) and particle density (2.65 and 2.66 Mg m⁻³) at 0-15 and 15-30 cm soil depth. Overall, we concluded that the integrated use of NPK fertilizers with FYM based on STCR approach not only gave higher wheat yield but also improved soil properties and soil fertility.

NATURAL FARMING FOR SOIL HEALTH MANAGEMENT AND HEALTHY FOOD PRODUCTION

Chandrashekara, C.P., Manjunatha S.B., Patil, B.O., Sankalpa, C.P., Girish V.P. and Nargis Fatima

Natural farming Operational Research Project Zone -8 (Agriculture) University of Agricultural Sciences, Dharwad-580005

Corresponding author email: chandrashekharcp@uasd.in

Abstract

The farmers are under stress due to practices in modern agriculture loaded with chemicals whose productivity declined over years and have several negative consequences. The present organic carbon content is very low (0.3 to 0.5 %), against the requirement of more than 1.0 for sustainable production. Our farmers are exposed to harmful chemicals leads to incurable diseases. Finally consumers end up with foods laced with harmful chemicals. So we have to transform agricultural practices to be more ecologically sustainable. Natural Farming (NF) is a set of farming methods involving Bheejamrit, Jeevamrit, Mulching with dust, live or crop residues and Whaphasa (Soil Aeration). The plant protection is done through eco-friendly herbal formulations. Natural Farming (NF): it releases nutrients locked in the soil by triggering microbial activities and bring the earthworms activities back and encourage plants to fix the atmospheric moisture. These microbes release all the nutrients locked in the soil and converts unavailable to available forms. NF is regenerative; it increases the carbon content in the soil and reverses ongoing desertification. Increasing carbon content allows us to retain more water in soil creating life in the soil with humus which increases the fertility of the soil.



Field experiments were conducted in green gram, black gram, soybean, maize and wheat at northern transitional zone of Karnataka (Zone-8), UAS, Dharwad from 2019-20 to 2021-22. Natural Farming practice showed reduction in the yield compared to conventional farming practices (CNF). The yield reduction were less in green gram to the extent of 27%, black gram (-26%), and soybean (-22%), as compared to high input demanding crops like maize (-62%), wheat (-35%). The cost of production saved was about 10 to 36% and material/input costs saved were 20 to 55% under NF over CNF. Natural Farming is being adopted by several farmers, Chemicals can be reduced in plant protection can bring down the chemical residues in food and their ill effects. These alternative initiatives emphasize on sustainable farming systems are not just a matter of replacing inputs like chemical fertilizers/ pesticides rather than instituting farming methods that emphasize on bio intensive farming systems and soil building practices. Natural farming has several benefits like higher income, better health, improved soil fertility and lower costs.

VARIATION IN BIOMASS ALONG AN ALTITUDINAL GRADIENT OF SUBTROPICAL CHIR PINE FOREST AND GRASSLAND IN GIRI CATCHMENT OF HIMACHAL PRADESH, INDIA

¹Debasis Mahato, B. Gupta² and N. Salam³

¹Biswa agricultural University, Kanke, Ranchi-834006 (Jharkhand)

²Dr.Y.S. Parmar University of Horticulture and Forestry, Nauni-173230 (HP)

Email: debasis_mahato@rediffmail.com

Abstract

Giri catchment is distributed in Shimla, Sirmour and Solan districts of Himachal Pradesh known as Giri-ganga (Gopal and Chauhan, 2007) and it is comprised of 135 sub-watersheds. Variation in biomass of subtropical chir pine forest and grassland along altitudinal gradient in north western Himalaya was carried out in Giri catchment of Himachal Pradesh, located between 30° 33' 48" and 31° 16' 08" N latitude and 77° 02' 32" to 77° 38' 22" E longitude and an area of 2389 km² (Rao *et al.*, 1989). The climatic condition of experimental sites ranges from tropical/sub-tropical through sub-humid to sub-temperate climate and soil is clay to sandy soils. In each experimental site three sample plots of size 0.10 ha for trees, two plots of 10m x 10m were marked to study shrubs and in each sample plot, six quadrates of size 50cm x 50cm were harvested to study herbs characteristics. Biomass (q/ha) of different vegetation layers of grassland and chir pine forests for herb and shrub were analyzed in 42 experimental sites in 14 representatives of sub-watersheds and stratified in three elevation viz., (E₁:900-1300m, E₂:1300 -1700m and E₃:1700m and above). Average herbage biomass 59.03, 54.47 and 50.23 q/ha in grassland and 50.88, 44.95, 40.86 q/ha in chir pine forests were recorded for E₁, E₂ and E₃, respectively. The biomass for shrub 8.29, 6.70 and 7.57 q/ha in grassland and 15.30, 10.01 and 10.93 q/ha in Chir pine forest were recorded for E₁, E₂ and E₃, respectively. Average total biomass of trees was highest at E₂ (1399.04) as compared to E₁ (1244.92) and E₃ (1000.43). Total biomass (q/ha) in grassland decreased in the order: E₁>E₂> E₃ and in chir pine forest, it was higher at elevation E₂ and was followed by E₁ and E₃.

IMPROVEMENT OF SOIL SUSTAINABILITY BY ECO-FRIENDLY PEST MANAGEMENT APPROACHES FOR BLACK PEPPER ROOT MEALYBUG (*DYSMICOCUS BREVIPES* COCKERELL)

Divya K.K.¹, Yamini Varma C.K.² and Airina C.K.³

Pepper Research Station, Panniyur, Kerala Agricultural University, Vellanikkara, Kerala, India

Abstract

Black pepper is the world's most important spice crop, and it is an integral part of Kerala's homesteads and mixed cropping systems. Because of its pest and disease prone root system, post-planting cultural operations are generally kept to a minimum. The major problem in the black pepper belts is root mealybug and associated secondary infections, which can result in crop loss. Although recommendations like soil drenching of chemical insecticides are available in the state, frequent applications of chemical insecticides may have an impact on the existence of soil microflora and fauna, as well as pesticide resistance, residue, and resurgence issues. In this context, eco-friendly alternatives were evaluated in the pot trial. Two-year old black pepper plants with artificially inoculated root mealybugs were used for the study. Fifteen root mealybugs were inoculated in



each of the twelve treatments. Applications were given as basal drenches, except in the case of neem cake. It was applied as basal, followed by the required irrigation, which was also done. The study revealed that Chlorpyrifos 0.075 % (chemical check-KAU-Package of practice) was significantly superior over all other treatments with a mortality of 86.67%, followed by KAU Neem Garlic Soap RTU, HMO3, and 5% with a mortality of 66.67, 64.44, and 64.44, respectively. The treatments like chitosan AFM, chitin oligosaccharide, neemcake, and azadirachtin resulted in a mortality rate in the range of 37.78–46.67% and were found to be statistically on par. Hence, basal application of these treatments in the initial stage of pest establishment can reduce their population buildup, and their application at short intervals will be more effective. Environmentally friendly pest management methods for below-ground pests will increase soil sustainability and reduce pesticide load in soil and plants.

STUDIES ON THE EFFECT OF FLORAL PRESERVATIVES IN EXTENDING VASELIFE OF GYPSOPHILA CUT FLOWERS

G. Jyothi*, A. Girwani, P. Prasanth, P. Saida Naik and Srinivasa Chary

SLTSHU, College of Horticulture, Rajendranagar, Hyderabad

*Email : dr.jyothi.gadde@gmail.com

Abstract

An experiment was carried out at Floricultural research station on studies on the effect of postharvest treatments in extending vase life of Gypsophila cut flowers during 2019- 2020. Freshly harvested gypsophila flowers are treated with floral preservatives viz., Aluminium sulphate, Cobalt chloride and Sodium benzoate each @100 ppm, 200 ppm and 300 ppm respectively and data was recorded for every alternate days to study vase life period. The flowers were continuously held in the treatment solutions till the end of vase life period. Vase life was determined by recording the number of days the flowers remained in good condition without spoilage. The solutions were prepared with distilled water and freshly prepared solutions were used in the experiment. The experiment among the different floral preservatives studied, revealed that the treatment cobalt chloride at 100 ppm was very effective in increasing the vase life of gypsophila flowers (13.33 days). It has led to increased water uptake (15.23 g/f), maximum fresh weight change (106.92%), water balance (4.840 g/f), minimum physiological loss in weight (4.71%) and low microbial count (6.040×10^{-5} cfu/ml.) and control (distilled water) recorded minimum vase life (5.10 days), water uptake (7.44 g/f), fresh weight change (85.15%), water balance (2.640 g/f), maximum physiological loss in weight (8.78%) and high microbial count (7.580×10^{-5} cfu/ml). It is concluded that the vase life of gypsophila cut flowers which are treated with different floral preservatives at different concentrations in holding solutions, cobalt chloride at 100 ppm was very effective in extending vase life of gypsophila cut flowers due to its antimicrobial action and is considered as the best floral preservative as it enhanced vase life of gypsophila cut flowers.

IMPACT OF NON-TIMBER FOREST PRODUCTS (NTFPs) ON FOOD AND LIVELIHOOD SECURITY: AN ECONOMIC STUDY OF TRIBAL ECONOMY IN TITIBHERU VILLAGE, MALKANGIRI FOREST DIVISION, ODISHA

H. Nayak*, N. Majhi, S. Das, M.C. Behera, S. Behera and T.L. Mohanty

College of Forestry, Odisha University of Agriculture and Technology, Bhubaneswar, India

Email : hiranmayee.nayak@gmail.com

Abstract

Forest productions a vital role in the socio-economic life of tribal people in fact their life can't be imagined without forests. Collection and sale of different minor forest products for commercial purposes are considered crucial means of their livelihood. The tribal people seasonally collect various NTFPs to satisfy their needs for food, fodder, and medicine. This paper is entitled "Impact of Non-timber forest products (NTFPs) on food and livelihood security: an economic study of tribal economy in Titibheru village, Malkangiri Forest division, Odisha". All the households had been randomly selected from the village. A total of 21 families from that village were selected for the study. The data were collected through a structured survey questionnaire, analyzed, and interpreted in accordance with the objectives of the study. It was found from the study that the age groups i.e. from 18-40 and 41-60 years were mostly collecting NTFPs from the forest. There were more no. of males going to the forest to collect forest produce than females. Married people were mostly dependent on the forest, it is due to the family burden on them. It was derived from the study area that 71.4% of respondents were illiterate. It might be due to the less



developed in that village area. Most of the respondents were having a family size of 4 members. The maximum number of respondents were dependent upon agriculture for their livelihood in the study. It is concluded the majority of the respondents were dependent upon agriculture and NTFPs collection for their livelihood. It is due to the fact that most people have owned agricultural land and depend on the forest for NTFPs collection as it produces a variety of NTFPs. It was concluded that the majority of the households had an annual income of INR 10000 - 25000 per annum. Out of all the NTFPs collected by the respondents in the studied area, many NTFPs like Sal leaves, Mahua fruit, siali leaves, and kendu leaves were collected abundantly in their seasons. Agriculture generated the highest average annual income per household (Rs11,750) followed by NTFP (Rs 10,050). Forest produce is an important source of employment and income for the village Forest produce was collected for both subsistence and for sale of cash income NTFP was found to be the secondary employment source after daily wages and a secondary income generator after agriculture. Due to a lack of marketing facilities, it was seen that the dependency on forests is decreasing fast and leading to migration, malnutrition, poverty, etc. and people do not take an interest for safeguard the forest, which impacts the environment and climate significantly. The NTFPs can also be referred to as all the resources or products that may be extracted from forest ecosystem and are utilized within the household or are marketed or have social, cultural, or religious significance (Shackleton *et. al.*, 2004; Marshall *et.al.*, 2003). The majority of rural households in developing countries and a large proportion of urban households depend on the products to meet some part of their nutritional, health, house construction, or other needs. The NTFPs create high economic value and large-scale employment. The NTFPs have attracted global interest due to the increasing recognition of the fact that they can provide important community needs for improved rural livelihood (FAO., 1995; World Bank, 2006).

EVOLUTION OF INSTITUTIONAL CREDIT FLOW TO AGRICULTURAL SECTOR IN INDIA

Jaspreet Kaur and Mohit Gupta

School of Business Studies, Punjab Agricultural University, Ludhiana, Punjab, India

Abstract

Agriculture is the largest sector of the Indian economy. The success of the Indian economy is reliant on the growth of the agricultural sector. One of the essential components for the development of the agricultural sector is credit. Credit is crucial for developing a successful and sustainable farming system. Agricultural production in India depends upon millions of small and marginal farmers. Thus, for agriculture to reach its full potential as a lucrative sector, more and more farmers must have access to adequate, timely, and affordable loans from institutional sources. In this paper, the need and institutional arrangements for agriculture credit have been discussed. In India, agricultural credit is disbursed through a multi-agency network. Further, this paper describes the evolution of the institutional structure through various Government policy interventions that changed the scenario from non-institutional to institutional credit flow to agriculture. This paper observes that there has not been a constant rise of agricultural credit over all these years. It has undergone quite dramatic variations. This helps to understand the impact of the policy measures on agricultural credit with respect to agricultural GDP. The changing share of different formal institutions, namely Scheduled Commercial Banks (SCBs), Co-operative Institutions, Regional Rural Banks (RRBs), and Micro-Finance Institutions (MFIs) in the overall institutional credit to agriculture has been taken into consideration. In last, the study presents the recent measures such as digitization of land records, land leasing framework, digital innovations in agriculture, various government schemes, etc. taken to improve the reach of institutional credit in the agriculture sector.

EFFECT OF ELECTRON BEAM IRRADIATION ON THE QUALITY OF DRIED FISH AND SHELL FISH

Jeyakumari A.¹, Narasimha Murthy L.¹, Sarma K.S.S.², Rawat, K.P. ² and Shaikh Abdul Khader²

¹ICAR-Central Institute of Fisheries Technology, Cochin – 682 029

²Electron beam processing section, IRAD, BARC, BRIT/BARC complex, Navi Mumbai-400 703

Abstract

In the present study, quality of electron beam irradiated dried Bombay duck (*Harpadon nehereus*) and dried Jawala shrimp (*Acetys* sp.) were studied. The irradiation doses used were 0, 2.0 kGy, 4.0 kGy and 6kGy. After the exposure of irradiation doses, all the samples were kept at room temperature. Biochemical and microbiological qualities were analyzed. Moisture content ranged between 16.71-17.78%. There is no significant difference in the proximate composition of irradiated and non



–irradiated samples. Biochemical analysis indicated that control had higher TVB-N in both dried Bombay duck and dried acetos sp. than irradiated ones. Moreover, Peroxide value was higher in irradiated sample than control in dried Bombay duck. Microbial analysis of dried Bombay duck indicated that total bacterial count (3.8-3.3 log cfu/g) was lower in the irradiated samples compared to control (4.35 log cfu/g). Results suggested that electron beam irradiation could reduce the biochemical and microbial activity thereby extend the shelf life of fishery products.

BRASSINOLIDE AND ZINC INFLUENCING PHYSIO-BIOCHEMICAL TRAITS OF GARDEN PEA (*PISUM SATIVUM* L.) UNDER WATER DEFICIT CONDITION

Jyotsnarani Pradhan^{1*}, Kartik Pramanik² and Hemlata Singh¹

¹Department of Botany, Plant Physiology and Biochemistry, College of Basic Science & Humanities, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar-848125

²Department of Vegetable Sciences, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar

*Corresponding author's email : jyotsna.pradhan@rpcau.ac.in

Abstract

The study was aimed to evaluate the role of exogenously applied 24-epi-brassinolide (e-BL) and Zinc (Zn) concentrations on physio-biochemical processes in garden pea (*Pisum sativum* L.) under water-deficit stress. A poly-house experiment was framed with a Completely Randomized Design with three replications by e-BL pretreated seeds of garden pea genotype HUP-2 with 0.01 and 0.05 mM and/or Zn under induced water deficit stress in different stages of crop growth i.e. before and after anthesis. Garden pea seeds pre-treated with e-BL in addition to Zn micronutrient supply resulted positive response against water deficit in terms of membrane stability and various enzymatic activity. The effect post anthesis water deficit, which is more potent to yield loss, found to be lessened by e-BL and Zn. Seed pre-treatment with e-BL and basal application of Zn are having potency against water deficit in HUP-2 genotype of garden pea.

IMPACT OF INTERVENTION ON AWARENESS OF WOMEN REGARDING LEGAL PROVISION TOWARD DOMESTIC VIOLENCE

Madhulika Gautam

Department of Home Science, Dayalbagh Educational Institute (Deemed University), Dayalbagh, Agra, U.P.

Abstract

The study was done to assess the Impact of intervention on awareness of women regarding legal provision toward domestic violence. Agra district was selected as the locale of the study. Hundred twenty women were selected by multistage random sampling technique. A self prepared schedule was used for collecting the base line and post intervention awareness of women regarding right to free medical care, law regarding shared homes and alternate accommodation, medical examination in domestic violence, provision of psychological advice and punishment for domestic violence. Comparison of baseline and post intervention score was done using 't' test. The results reveal that there was a significant increase in awareness of women from base line (18.07) to post intervention stage (24.75), this is evident from the significant t value which was 14.89.

ASSESSMENT GENETIC DIVERSITY IN CARDAMOM ACCESSIONS USING ISSR MARKERS

Kaliyaperumal Ashokkumar^{1*}, M.K. Dhanya² and Muthusamy Murugan³

¹School of Agriculture and Animal Sciences, Gandhigram Rural Institute-Deemed University, Gandhigram, Dindigul, Tamil Nadu, India

²Regional Agricultural Research Station, Kerala Agricultural University, Kumarakom, Kottayam, Kerala, India

³Cardamom Research Station, Kerala Agricultural University, Pampadumpara, Idukki, Kerala, India

*Corresponding author: biotech.ashok@gmail.com

Abstract

Small cardamom [*Elettaria cardamomum* (L.) Matton.] is a perennial crop and hence significantly delays conventional genetic characterization. Many problems are being experienced due to misidentification and inadvertent duplication of varieties in



many cardamom collections. Therefore, the present study conducted for molecular characterization of cardamom accessions by ISSR markers. Results showed that our modified CTAB DNA extraction protocols yielded pure DNA as documented from Bio-spectrophotometer readings, where the A260/280 ratio was 1.6-1.9, indicating the absence of contaminants. DNA forms a thick, intact single band of high molecular weight in agarose gels, confirming good quality. PCR with 20 ISSR primers yielded high-intensity amplification from the DNA. ISSR primer found polymorphisms in all 15 cardamom accessions. ISSR analysis revealed an average 64.18 % polymorphism in 15 cardamom genotypes. ISSR primers S851 and S817 yielded 6 and 8 polymorphic bands, respectively. ISSR scored 90 reproducible 100–1110 bp bands. UPGMA analysis and Jaccard's similarity coefficient grouped the 15 cardamom genotypes into three groups, ranging from 0.33 to 0.72 at 52% variation. Cluster I had 8 accessions: PV 1, PV2, PV 3, PV 34, HY12–HY15. Cluster II included PV5, PV8, HY9, GREEN GOLD, PINK BASE, and PS1 x GG Type 1. Cluster III also featured PV4, an accession.

EVALUATION OF THE ADAPTABILITY OF IMPROVED TAPIOCA (*MANIHOT ESCULENTA* CRANTZ) VARIETIES IN THIRUVARUR REGION OF TAMIL NADU

Kumanan K.¹ and A. Nithya Devi²

Agricultural College and Research Institute, Tamil Nadu Agricultural University, Pudukottai, Tamil Nadu

*Corresponding author e-mail: kumanan@tnau.ac.in

Abstract

Tapioca (*Manihot esculenta*) belongs to family Euphorbiaceae is one of the significant tropical tuber crops and cultivated for its tuberous roots which contain starch. Despite the importance of this crop, the production and productivity is constrained by different biophysical and socioeconomic constraints, such as lack of adapted and improved technologies and varieties, lack of knowledge and proper utilization of the crop are a few to mention. Therefore, this study was designed to test the adaptability and acceptability of improved cassava varieties with farmers for further scaling up; create awareness to farmers and evaluate the yield potential of the varieties in Thiruvavarur district. The farmers are predominantly cultivating the traditional local type of tapioca which gives less yield and more prone to pest and diseases. To replace the existing traditional variety, the field experiment was conducted in Thiruvavarur region of Tamil Nadu with different varieties of tapioca under irrigated condition. Observations on growth parameters and yield traits were recorded. Among the different varieties evaluated three varieties including a local type. Co (TP) 4 recorded higher values for plant height (224.3 cm), number of primary branches per plant (3.8), number of secondary branches per plant (5.7), stem girth (8.8cm), number of leaves (99.6), number of tubers per plant (14.2), length of tuber (32.5 cm), girth of tuber (15.6cm), single tuber weight (274.6 gm), tuber yield per plant (8.1 kg), tuber yield per hectare (48.6 t/ha) and starch content (28.6%) followed by the variety H-226. The least values for the characters studied were recorded in local adopted check variety. The highest gross returns, net return and B:C Ratio of Rs. 194400/ha, Rs. 129400/ha and 3.0, respectively were realized with Co (TP) 4 as compared to other two varieties evaluated at Thiruvavarur region of Tamil Nadu.

STUDIES ON PHYSIOLOGICAL AND BIOCHEMICAL CHANGES DURING SEED DEVELOPMENT, ONSET OF DESICCATION TOLERANCE AND STORAGE OF BARNYARD MILLET [*ECHINOCHLOA FRUMENTACEA* (ROBX.) LINK] VARIETIES

Mahantesh B. Mudennavar¹, Jagadish Hosamani^{1*}, Jolli R.B.¹, Motagi B.N.² and Amasiddha Bellundagi³ and Nandagavi R.A.⁴

¹Department of Seed Science and Technology, College of Agriculture, Vijayapur–586101, Karnataka, India

²AICRP on Groundnut, Main Agricultural Research Station, Dharwad–580005, Karnataka, India

³ICAR-Indian Institute of Millets Research, Rajendranagar, Hyderabad–500030, Telangana, India

⁴Department of Agronomy, College of Agriculture, Vijayapur–586101, Karnataka, India

*Corresponding author: hosamanijy@uasd.in

Abstract

Studies on interrelationship between the lipid peroxidation and antioxidants during seed development and onset of desiccation tolerance was conducted in seeds of DHBM-93-3, CO-2, PRJ-1, VL-172 and VL-207 barnyard millet varieties which were harvested at 7, 14, 21, 28, 35 and 42 days after anthesis (DAA). Maximum catalase and superoxide dismutase antioxidant



activities were noticed around 35 DAA in DHBM-93-3, VL-207, VL-172 and CO-2 varieties except in PRJ-1 (28 DAA) and it was marked by drastic reduction in the production of volatile aldehydes and malondialdehyde, when physiological maturity and the maximum seedling dry weight were attained. It was concomitant to the stage at which desiccation tolerance occurred. The interrelationship between the lipid peroxidation and antioxidant activity was noticed with the advancement of seed development. Higher seed viability has been reported to be associated with a reduction in the highly reactive free radicals which were protected by the activities of antioxidant enzymes *viz.*, superoxide dismutase and catalase.

The plant phenological, yield and yield attributing parameter studies of *rabi* sown barnyard millet varieties revealed that PRJ-1 was early maturing (84 days) compared to mean of other varieties (109 days). Highest yield was recorded in the variety DHBM-93-3 (1109.73 kg/ha) and lowest in the variety PRJ-1 (838.63 kg/ha). Physiological changes in fresh and old seeds of barnyard millet varieties DHBM-93-3, VL-207, VL-172 and CO-2 showed very less decrease in the viability after storage, whereas in the variety PRJ-1 there was significant decrease in viability. Lipid peroxidation was mediated by volatile aldehydes and malondialdehyde production which was counteracted by superoxide dismutase and catalase enzyme activities. It was evident that seed quality of early maturing variety PRJ-1 deteriorated in a long-term storage (15 months) compared to DHBM-93-3, VL-207, VL-172 and CO-2 barnyard millet varieties.

STUDY ON PRODUCTION, REPRODUCTION PERFORMANCE AND MOLECULAR CHARACTERIZATION OF BLACK BENGAL GOAT OF JHARKHAND

Mukesh Kumar

Department of ILFC Ranchi Veterinary College, BAU, Ranchi, Jharkhand

Corresponding author Email : mukesh2509.mk@gmail.com

Abstract

India ranks second on goat population with 148.88 million goats (census 2019). Around eighty percent of global goat population is in developing countries. Out of the thirty-four goat breeds registered with NBAGR, Black Bengal goat is an important breed marked for high prolificacy, better reproductive performance, good quality meat and hides. In this study Base line data was recorded and collected from AICRP Project on Black Bengal goat improvement Annual report 2012 to 2013 RVC, BAU. Each unit consisting of 20 farmers were selected from each village randomly. A total no of 80 households were selected for study in three agro-climatic zones in Jharkhand. Four types of coat colour viz Black, Brown, Grey, and White were observed. The coat colour which was observed highest in animals under study was Black (75.63%). Three agro climatic zones had significant influence on body weight of Black Bangle goat from birth weight to 12 months of age. Significantly higher ($P<0.05$) body weight in kids was observed in goats in agro- climatic zone IV (central and north eastern plateau) followed by V (western plateau) and VI (southern plateau) respectively. Year wise (2014-2020) progressive improvement in body weight of goats was observed in different villages under studied. Better reproductive performance was observed in goats reared in agro- climatic zone IV followed by V and VI respectively. A set of 10 RAPD markers were found to be polymorphic in goat population under studied. The average no of polymorphic bands were found to be high. The sub- population of Barabanki and Palajori displayed higher polymorphic loci. The pair wise genetic identity was high between sub- populations, and phylogenetically they showed relationship themselves.

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NUTRIGENETIC HYBRIDS EVALUATION FOR ECONOMIC PARAMETERS DURING SPRING SEASON UNDER SUBTROPICAL CONDITION OF JAMMU (J&K)

Murali S.¹, Sardar Singh² and Chhattar Pal³

¹P2 Basic Seed Farm, Horsley Hills, Andhra Pradesh-517525

²Central Sericultural Research and Training Institute, Pampore-192121

³Regional Sericultural Research Station, Sahaspur-248197

Correspondence : dr.mmrl@rediffmail.com

Abstract

Fifteen bivoltine nutrigenetic hybrid combinations viz., RSJ14×BHR2, RSJ14×BHR3, RSJ14×B.con1, RSJ14×B.con4, RSJ14×NB₄D₂, ATR16×BHR2, ATR16×BHR3, ATR16×B.con1, ATR16×B.con4, ATR16×NB₄D₂, CSR50×BHR2, CSR50×BHR3, CSR50×B.con1, CSR50×B.con4, CSR50×NB₄D₂ along with two controls CSR₂×CSR₄ and FC₁×FC₂ were evaluated during spring season (2021 & 2022) respectively at RSRS, Jammu (J&K). The rearing and reeling performance was documented for analysis and multiple trait evaluation index & Sub ordinate function values were utilized to determine the best performing hybrid. Based on evaluation index and subordinate function values, the hybrids shortlisted viz., CSR50×B.con1, RSJ14×B.con4, CSR50×BHR3, CSR50×B.con4, CSR50×BHR2 (Spring, 2021) and CSR50×BHR3, CSR50×B.con4, CSR50×BHR2, CSR50×B.con1, RSJ14×BHR3 (Spring, 2022) respectively. The average of spring season for both the years (2021 and 2022) hybrids were shortlisted viz., CSR50×B.con4, CSR50×BHR3, CSR50×B.con1, CSR50×BHR2 and RSJ14×BHR3 and the result of the present study indicated that hybrids has scored average EI values >50 for the maximum of 10 individual traits viz., Fecundity, Single cocoon weight, Single shell weight, Shell ratio, Cocoon yield by weight, Pupation rate, Average filament length, Reelability, Raw silk and Neatness. The shortlisted hybrids were on par with the performance of double hybrid, FC₁×FC₂ and better than the single hybrid, CSR₂×CSR₄ used as controls. From one way ANOVA shows that all the parameters significantly different from each other except for yield by No.

EVALUATION OF CHEMICAL STIMULANTS IN IMPARTING SYSTEMIC RESISTANCE FOR THE MANAGEMENT OF SHEATH BLIGHT DISEASE OF RICE

N.K. Toorray

CARS, Marra (Patan), Durg, C.G.

Abstract

Sheath blight is one of India's widespread and harmful rice diseases. Rice sheath blight disease is causing significant loss, particularly in areas where high yielding varieties are cultivated. *Rhizoctonia solani* (Perfect stage-*Thanatephorus cucumeris*) which causes rice sheath blight in both soil and water borne. Chemical modification of rice plant resistance to *R. solani* appears to be an effective tool for treating sheath blight. The application of systemic resistance inducing chemicals would be suitable alternative strategy to improve the sheath blight disease management in paddy (Usharani *et al*, 2013 and Toal and Jones, 1999). Defense signaling hormones such as salicylic acid, jasmonic acid, rose bengal and oxallic acid play important roles in activation of plant defense responses (Taheri & Monica, 2007). Chemical stimulants were evaluated in imparting systemic resistance for the management of sheath blight disease of rice. The solutions of the Salicylic acid, Jasmonic acid, Rose Bengal and Oxallic acid were prepared in sterile distilled water by adding requisite quantities of chemicals



viz. 25, 50, 100 and 250 g/ml. This experiment was performed *in vitro* in complete randomized design in year 2016 and under pot condition in CRD design during kharif 2016 and 2017 with four replications. To investigate the effect of the chemicals on growth of *Rhizoctonia solani* *in vitro*, poisoned food technique (Grover and Moore, 1962) was followed with four replications and the development of sheath blight lesion *in vivo*, the standard method given by Bhattacharya and Roy (1998) was followed on a susceptible rice cultivar swarna. Inoculation by insertion of sclerotia in the sheath after 48 hrs of chemical sprays was done (Usharani *et al.*, 2013). It is studied that pretreatment with salicylic acid, which is used in agriculture, can unexpectedly lead to resistance to sheath blight in plants. Salicylic acid treatment inhibits the advancement of *Rhizoctonia solani* to the point in the infection process where fungal biomass shows remarkable expansion and developed the specific infection machinery. Therefore the study was undertaken for the use of salicylic acid, rose bengal, jasmonic acid and oxallic acid under *in vitro* and pot condition for the management of *Rhizoctonia solani*. Taken observations for mycelial growth and sclerotial formation seven days after inoculation and incubation (*in vitro*) and per cent disease severity (*in vivo*) was recorded 21 days after spraying of chemicals. Resistance-inducing chemicals such as salicylic acid, rose bengal, jasmonic acid, and oxallic acid showed good response when tested in both *in vitro* and pot conditions to minimize the severity of the disease caused by *R. solani*. The minimum mycelial growth (0.0mm) with 100% reduction over control of *R. solani* was observed in oxallic acid, followed by salicylic acid, jasmonic acid and rose bengal at a concentration of 250µg/ml as compared to the control (90.0 mm) when tested *in vitro*, while a concentration of 25 µg/ml was found to be less effective. The mycelium growth of *R. solani* was strongly influenced by oxallic acid in all concentrations. Under pot conditions, oxallic acid, salicylic acid, rose bengal and jasmonic acid showed the highest reduction in the percent disease index in 250 g/ml, while the concentration of 25 g/ml was found to be the least effective. All concentrations in oxallic acid significantly reduced the severity of the disease with 33.34% PDI and 57.13% disease reduction over control (77.78%) treatment. This result clearly indicates that the induction of resistance by the chemicals was mediated by the host, whereby the formation of antifungals can be triggered by resistance-inducing chemicals in the plant system in response to fungal attack. The resistant inducing chemicals *i.e.* salicylic acid, jasmonic acid, rose bengal and oxallic acid adversely reduced the mycelial growth of *R. solani* under *in vitro* whereas in pot study, the oxallic acid at 250µg/ml concentration strongly reduced the sheath blight PDI (33.34%) with 57.13 percent decrease over control treatment. The use of chemicals that induce systemic resistance would therefore be the appropriate alternative strategy to improve the management of sheath blight diseases in rice.

KNOWLEDGE LEVEL OF THE FARMERS ON IMPROVED LIVESTOCK REARING PRACTICES

Kumari Nandita Bera¹, Alok Kumar Pandey² and Jagannath Oraon²

¹Department of Veterinary and Animal Husbandry Extension Education, Ranchi Veterinary College, BAU, Ranchi, Jharkhand

²Deptt. of VAHEE Ranchi Veterinary College, Birsa Agricultural University, Ranchi, Jharkhand

Abstract

India is number one country in the world in livestock population, yet animal husbandry is still not being perceived as the “primary occupation” by the farmers of India. And, this may be the reason behind their low/poor level of awareness about recent advances in the field of animal husbandry. The present study was conducted in Ranchi district of Jharkhand state. Four blocks of Ranchi district and total of 8 villages were selected for the study. A total of 160 respondents were selected randomly. The result of study revealed that majority of farmers were having medium level of knowledge in improved breeding practices, management practices, feeding practices as well as in health care and disease control of the animals.

SHELLAC MODIFICATION TO PREPARE NON-DRYING ADHESIVE FOR STICKY INSECT TRAPS

Nandkishore Thombare and A. Mohanasundaram

ICAR-National Institute of Secondary Agriculture, Namkum, Ranchi-834010, Jharkhand

*Presenting Author Email : nandkishore.icar@gmail.com

Abstract

Sticky traps are effective means of small sized- flying pest control, especially, in vegetable crops where frequent use of pesticides is not advisable. Mostly, the synthetic adhesives used in commercially available insect traps have some problems like pungent odour, drying out, difficulty in spreading, melting/thinning with tropical temperature, not resistant to water, etc. Hence natural resin based non-drying glue formulation as an alternative to the existing synthetic glues used in sticky insect



traps is need of the hour. To meet this research gap, effort was made to develop natural resin, lac- based non-drying glue for trapping small insects. Several experiments for hydrolysis of shellac were carried out to obtain best quality non-drying adhesive with decent yield. To achieve quality as well as quantity of the adhesive, different parameters like quantity of alkali for hydrolysis, amount of acid for neutralization, heating time, number of washings, etc. were varied. Characterization of the samples with tensile strength was done by UTM. Bleached hydrolyzed lac was obtained by the action of suitable bleaching agents like hydrogen peroxide to avoid darkening of colour. Addition of raw lac to the formulation showed improved adhesion as compared to other formulations. To increase spreading ability on polythene sheet, some vegetable oil based fillers were added to the lac based non-drying adhesive. The formulations were compared with commercially used formulation (Chipku®) and it was observed that the tensile strength of developed formulation (0.3 Kg/cm^2) was higher than the commercial formulation (0.25 Kg/cm^2). The formulations so made have great potential in sustainable agricultural applications.

INVESTIGATION OF WATER ABSORPTION AND MORPHOLOGICAL BEHAVIOUR OF RICE STRAW REINFORCED BIO-COMPOSITE

Neenu Poonia¹, Vinod Kadam², Neelam M. Rose¹, Saroj Yadav¹ and Shalini Rukhiya¹

¹Department of Textile and Apparel Designing, CCSHAU, Hisar (Haryana)

²Department of Textile manufacturing and Textile Chemistry, ICAR-CSWRI, Avikanagar (Rajasthan)

Abstract

The objective of this study was to examine water absorption properties and structural morphology of rice straw reinforced biocomposite. The rice straw were given different treatment such as alkali treatment, enzyme treatment and alkali-enzyme treatment. After giving treatment, rice straw as filler and epoxy resin as matrix material was used to prepare biocomposite via hand layup techniques. The results revealed that maximum increase in percent water absorption was noticed in enzyme treated rice straw fibre reinforced composite (20.60-21.98%) followed by alkali-enzyme treated (5.08-5.45%) and alkali treated (0.60-0.94%) rice straw fibre reinforced composites. The composites fabricated using alkali, enzyme and alkali-enzyme treated rice straw fibres for surface modification exhibited that the resultant composite samples attained improved properties in terms of water absorption as compared to composite fabricated with untreated rice straw. The FE-SEM images revealed that rice straw and the matrix merged with the fibre at the interface and the gap (crack) between matrix and surface treated rice straw interface became quite small as compared to the gap between matrix and untreated rice straw. Thus the alkali, enzyme and alkali-enzyme treated rice straw reinforced bio-composites depicted improved fibre matrix interfacial adhesion and further supported higher water absorption properties of all surface rice straw reinforced bio-composites.

KAIPAD – A UNIQUE INDIGENOUS RICE ECOSYSTEM OF KERALA

Ninitha Nath C.^{1*}, Adheena Ram A.² and Vanaja T.³

¹Department of Plant Breeding and Genetics, KAU

²College of Agriculture, Vellayani, Thiruvananthapuram, Kerala

³Regional Agricultural Research Station (NZ), Pilicode, Kasaragod, Kerala

Email : ninithanath.c@kau.in

Abstract

Kaipad is a complex and ecologically unique rice-fish farming tract of North Kerala, India. The lush green of paddy fields fringed by mangroves is the most captivating feature of Kaipad tracts. This tract is spread in the north Malabar districts of Kerala, India, in Kozhikode, Kannur, and Kasaragod near the Arabian sea. The present study is an investigation into Kaipad, an indigenous rice farming system followed in the coastal wetland, which is a saline-prone and naturally organic production tract of North Kerala. Rice farming is carried out in a peculiar way in Kaipad, purely naturally relying on the monsoons and the sea tides. In this tract, rice is cultivated in the first crop season in saline wetlands that are subjected to regular tidal action, taking advantage of the heavy South West monsoon, which results in flushing out the salt content from the farmland followed by traditional fish farming. Native people follow their indigenous knowledge of raising a single rice crop on mounds, in a low to a medium-saline phase of the production cycle from June to October. Neither chemical fertilizers nor plant protection chemicals are used and there is no need for any cultural operations until harvest. After the harvest of paddy, the Kaipad field is left for aquaculture, especially shrimp culture. The rice produced from this system is purely organic. Apart from the integrated



organic farming system, the Kaipad ecosystem has a rich biodiversity of flora and fauna, organically rich soil, mangroves, and migratory birds. In the present era of organic agriculture gaining societal, political, and scientific recognition for its contribution to sustainable agriculture, the development of naturally organic production system like the Kaipad rice tract has excellent relevance with respect to food security, nutritional security, water security and enhancement of the standard of living of small and marginal farmers.

STUDY ON GROWTH PERFORMANCE OF JAPANESE QUAIL UNDER DEEP-LITTER SYSTEM OF MANAGEMENT BY FEEDING *MORINGA OLEIFERA* LEAF POWDER

Nirmala Minj, Manmohan Kumar, Nishant Patel, Sweta Kumari, Sunita Kumari Murmu, Vishakha Singh, Pawan Kumar Verma and Md. Taufique Ahmad

Department of Livestock Production and Management, Ranchi Veterinary College, Kanke, Ranchi

Abstract

The present research work was designed to evaluate the productive performance of quails chicks by substituting the four different concentration of *Moringa oleifera* leaf powder (0%, 1.5%, 3% and 4.5%) by weight basis in feed. A total of 108 day old chicks were procured and after two weeks of brooding they were randomly divided into four experimental groups. Each group was further subdivided into 3 replicates containing 9 chicks in each. Different combinations of feed were offered to them for a period upto 12 weeks. The investigation of above research work showed that birds fed on diets containing *Moringa oleifera* leaf powder (MOLP) gains significantly higher body weight gain and having more body weight gain than that of birds feeding on control diet (0% MOLP). It could be concluded that inclusion of MOLP at 1.5%, 3% and 4.5% in quails diets improves the growth performance than control diet however, the best result on growth performance was shown by the birds fed on 1.5-3% MOLP.

CARCASS CHARACTERISTICS OF VANARAJA BIRDS UNDER DIFFERENT SYSTEM OF MANAGEMENT

Nishant Patel¹, Nirmala Minj², Manmohan Kumar³ and Pawan Kumar Verma⁴

Department of Livestock Production and Management, Ranchi Veterinary College, Kanke Ranchi

Abstract

The Vanaraja variety does not need any special diet supplement once left free in the backyard. It will feed on worms and other food materials available to it unlike the poultry bird when special care is needed to be taken. In backyard system of management, the dressing percentage was observed to be maximum (76.07+_{8.32}) followed by semi intensive (75.70+_{5.68}) and in deep litter (71.22+_{0.97}) system of management in case of male birds. The corresponding values in case of female birds were (52.01+_{2.21}), (50.36+_{2.41}) and (54.55+_{4.54}) respectively under backyard, semi-intensive and deep litter system of management. The effect associated with systems of management was observed to be non-significant in all parameters except blood loss (%) in female and defeathered weight (%) in male.

PRATAP MUNGPALI-5 (DGUG 244) A NEW HIGH YIELDING GENOTYPE

P.B Singh¹, Narendra Kumar², A.L. Rathnakumar², Chunilal², M.C. Dagla², Ajay B.C.², S.K. Bera², R.S. Choudhary¹, R.N. Bunkar¹, S. Ramesh Babu¹, Surendra Singh Rathore¹, Arvind Verma¹ and S.K. Sharma¹

¹RCA, MPUAT, Udaipur, Rajasthan

²ICAR-DGR, Junagadh

Abstract

UG 244 a new generation high yielding and foliar disease resistant genotype derived from the cross SG 99 x TAG 24 is a Spanish bunch type and medium maturing genotype of groundnut recommended for entire Spanish bunch groundnut growing belt of Rajasthan, where groundnut is grown under both irrigated as well as rainfed condition. Yield trials conducted in different agro-climatic zones of Rajasthan over 12 locations DGUG 244 (PBS 12196) showed 24 to 90% superiority for dry pod yield over checks viz., TG 37 A, SG 99, JL 501, GG 7, GJG 9 and local check Pratap Raj Mungphali. It has average dry



pod yield and kernel yield of 26-38 q/ha and 18-30 q/ha, respectively. It has 50 % oil content, medium 100-kernal weight (42 g) and 71 % shelling out turn. It possesses moderately resistance to early leaf spot (ELS), collar rot, stem rot and late leaf spot (LLS). The variety shows moderately resistance to *Spodoptera litura*, leaf miner, defoliators, jassids, thrips and leafhopper. Overall, this genotype will be a boon for the farmers of entire Spanish bunch groundnut growing belt of Rajasthan in enhancing yield. I acknowledged ICAR-DGR, Junagadh for sharing this genotype.

FARMER'S PRODUCER ORGANIZATIONS—A WAY FORWARD FOR SMALL AND MARGINAL FARMERS OF PUNJAB

Parul Gupta*, Balbir Singh Khadda and Vaishali

Krishi Vigyan Kendra, S.A.S. Nagar (Mohali) Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana

*Corresponding author's email: parulgupta145@gmail.com

Abstract

Punjab as a state comprises of largely fertile lands with a cultivable area of approximately 4.20 million hectares out of which around 97 percent that is 4.03 million hectares is the net sown area. The state's farm land holdings comprise of 18.7 percent as marginal farmers with 2.04 lakh land holdings and 1.83 lakh farmers i.e. around 16.7 percent are part of small farmers. The total comes out to be 35.4 percent which is more than one third of the total land holdings in Punjab (*Punjab Farmer's Guide*, Department of Agriculture & Cooperation Mechanisation and Technology Division, Ministry of Agriculture, Government of India). As per the study conducted by Punjab Agricultural University in Punjab which tracked the rise in farm incomes for farmers in Punjab found a direct link with increase in income of small, marginal and semi-medium farmers after they joined a Farmers Producer Organization. As per the study, there was only a marginal increase in labour employment permanently, whereas the income of farmers had increased by 15.71 percent considerable after joining the FPO's. This was mainly led by factors like shift in cropping patterns and improved and effective use of farm inputs (Vasudeva, 2021). As per the data by Ministry of Agriculture and Farmers Welfare, there are 122 registered FPO's in Punjab by agencies like NABARD, Small Farmers Agri Business Consortium and other Implementing Agencies as on 09th of March, 2022 (Farmer Producer Organizations, 2021). The membership of FPO's led to increased awareness among farmers which leads to decreased input costs and efficient utilisation of resources, thereby leading to agripreneurship among farmers. FPOs link farmers with strong managerial capabilities to national /global markets in sustainable manner. The As per the Punjab Government's policy, FPO's has to be supported and encouraged by the government with the support of funds from both central and state government schemes (*Farmer Producers Organizations (FPOs) Policy for State of Punjab*). The support that these FPOs provide to the farmers is very important and it can help in building uniform production system and post-harvest management of agriculture and allied sectors. The current study will be an attempt to study the impact that FPOs can have on the small and marginal farmers so that they can improve their incomes especially through the marketing support initiatives taken by the FPOs as marketing is the biggest challenge that the FPOs confront when they start facing the actual competitive forces in the market.

TREND ANALYSIS OF STANDARDIZED PRECIPITATION EVAPOTRANSPIRATION INDEX IN BARNALA DISTRICT OF PUNJAB, INDIA

Priya Rai and Pravendra Kumar

Department of Soil & Water Conservation Engineering, College of Technology, G.B. Pant University of Agriculture and Technology, Pantnagar-263145, Uttarakhand, India

Abstract

The knowledge of trends is essential for hydrologists, agriculturists, and environmentalists. So, this study investigates the temporal trend in multi-scalar SPEI (Standardized Precipitation Evapotranspiration Index) using the Mann-Kendall (MK), and Innovative Trend Analysis (ITA) approaches in the Barnala district of Punjab, India. The magnitude of the trend was examined by using the α -en-Slope Estimator (α SE) method. The SPEI was computed on 1, 3, 6, 9, 12, and 24 months using 36-year (1985-2020) rainfall, maximum, and minimum temperatures data. Based on the MK method results it was noted that there is no significant trend in multi-scalar SPEI from January to December, while the ITA method indicates a significant negative (positive) trend in January to December on SPEI-1, SPEI-3, SPEI-6, SPEI-9, SPEI-12, and SPEI-24 at 5% significance level. The magnitude of the trend also varies from positive to negative in January to December on multi-scalar SPEI. In addition, the



positive and negative trends in multi-scalar SPEI indicate more attention towards drought and wet conditions (i.e., extreme, severe, moderate). Overall, the ITA method demonstrates supremacy over the MK in identifying the hidden trend that could not be inspected by the MK in multi-scalar SPEI at the study site. Also, these outcomes will help to formulate better plans for sustainable management of the available water resources in the study region.

EFFICACY OF CONSERVATIVE THERAPY IN CHRONIC RENAL FAILURE (CRF) IN DOGS

Abhishek Kumar, Puja Mukherjee, Vikash Kumar and Shubham Kumar

Department of Veterinary Medicine, Ranchi Veterinary College, Ranchi, Jharkhand

Abstract

The present study was conducted on 18 dogs diagnosed with CRF at Deptt. of Vet. Medicine, RVC during 2018-19. The Data pertaining to Age, breed, Sex, onset of symptoms, history pertaining to vomiting, urination and previous medication were collected. The cases were thoroughly examined for physical parameters (temp., pulse, heart and respiration rate) and clinical signs (anorexia, polyuria, polydipsia and vomiting). Oral cavity for ulceration and visible mucous membrane were also examined. Blood samples were collected for hematological (Hb%, TEC, TLC & DLC) as well as serum biochemical tests (BUN, Creatinine, phosphorus, & Glucose) through standard technique twice weekly. Urine samples were examined for specific gravity and presence of protein. All the dogs were treated with Ringer's lactate soln. (RL) and 5% DNS through I/V, Torsemide @ 0.2mg/kg b.wt. i/v, Renitidine @ 0.5mg/kg b.wt I/m, Ceftiofur sod. @.5mg/kg b. wt. s/c, supported with Imferon @1ml, B- Complex with liver extract @ 2 ml I/m and Sucralfate suspension @ 5ml bid orally/day. Therapy was given until serum creatinine level becomes normal and continued 3 days thereafter. The Data were analyzed by t-test (Snedecor and Cochran, 1994).

Out of 18 Dogs treated, 10 completely recovered and 8 died during therapy. There was no significant variation in Hb%, TEC, TLC & DLC of Surviving dogs before and after treatment. However, these dogs revealed normocytic normochromic anemia. BUN levels decreases faster as compared to serum creatinine levels following therapy in surviving dogs as BUN levels reached to normal in 3 to 7 days whereas serum creatinine in 7 – 10 days. The level of BUN, Creatinine and phosphorus were significantly reduced in surviving dogs after treatment. The means serum glucose level in surviving dogs was 86.32±2.13 mg/dl after treatment as compared to 66.92±3.24 mg/dl in dogs that died. The means specific gravity of urine was 1.0143±0.0012 and 1.0298±0.0014 before and after treatment respectively and dog that died following therapy was specific gravity of 1.0064±0.0016. Clinical improvement in appetite & cessation of vomiting was observed between 3 – 7 days in surviving dogs.

Incidence of CRF was higher in middle to old aged dogs as compared to young dogs. Anorexia, polydipsia, polyuria and vomiting are typical finding of CRF disease. Oral ulceration also occurs due to breakdown of urea in saliva to ammonia by oral bacteria. High level of Azotemia and hyper-phosphatemia combined with history and physical examination were helpful in diagnosis of CRF. Conservative medical management formulated to maintain fluid, electrolyte, acid- base, nutrient & vitamins balance, control of hyper-phosphatemia and uremic gastropathy can be used successfully to minimize the clinical and patho-physiological consequences of reduced renal function due to CRF.

ROLE OF MOBILE APPS IN DISSEMINATING INNOVATIVE AGRICULTURE TECHNOLOGIES TO FARMING COMMUNITY

Pushpa P. *, Jayalaxmi B. Pawar, Annapurna F. Neeralagi and Ramesh A.P.

University of Horticultural Sciences, Bagalkot, Karnataka

Abstract

In the modern age, there is need to inform millions of people quickly and accurately about scientific technical and recent developments. The farmers are information hungry and present public extension system is not able to meet the demand of the farmers for information. The farmer and extension worker ratio is widening. On the other side, communication tools development is enormous. Private extension is also coming into picture. Today Farmers need timely information in response to their specific needs. There are mobile applications that provide latest agricultural information about trends, equipment, technologies and methods being used, help identify pests and diseases, provide real-time data about weather, early warnings



about storms, local markets offering best prices, seeds, fertilizers etc. Government of India has launched a number of web and mobile based applications for dissemination of information on agriculture related activities, free of cost, for the benefit of farmers and other stakeholders. Kisan Suvidha is an omnibus mobile app developed to help farmers by providing relevant information. Pusa krishi Provides information related to new varieties of crops developed by the Indian Council of Agricultural Research (ICAR), resource conserving cultivation practices, farm machinery and its implementation and production technologies, to the farmers. Soil Health card scheme gives soil nutrient status to each farmer for his/her land holding and also gives advice on fertilizer dosage and soil amendments needed to maintain soil health in the long run. crop insurance, Bhuvan Hailstorm App, eNAM Mobile App, Pashu Poshan, mKrishi Fisheries App are the different types of mobile apps available farmers. In addition, farmers can also interact and get guidance from agriculture experts across the country via the apps. These apps help in providing market information, facilitating market links, providing access to extension services, farm related information etc. There by farmers can apply these innovative ideas in their fields and improve their livelihood security.

MULTI NUTRIENT TABLETS ENHANCES NUTRIENT USE EFFICIENCY AND YIELD IN BRINJAL

R. Gladis^{1*} and Biju Joseph¹

¹Department of Soil Science and Agricultural Chemistry, College of Agriculture, Vellayani, Thiruvananthapuram-695522, Kerala Agricultural University

*Corresponding Author Email: gladis.r@kau.in

Abstract

Multi nutrient tablet contains all the major, secondary and micronutrients which were prepared using compatible fertilizer materials, binding agents and filler materials. Multi nutrient tablets containing fertilizer materials like neem coated urea, factamphos, muriate of potash, magnesium oxide, phosphogypsum, zinc sulphate, borax and binding agent methyl cellulose and clay (filler) were applied to brinjal grown in grow bags @ 100 per cent of recommended dose of fertilizers i.e. 8 tablets/plant in 2 splits basal & 1 MAP which increased the nutrient availability in soil, nutrient use efficiency and yield of brinjal. The available nitrogen (321.96 kg ha⁻¹), phosphorus (88.18 kg ha⁻¹), potassium (216.53 kg ha⁻¹), calcium (342.56 mg kg⁻¹), boron (0.34 mg kg⁻¹) and zinc (4.21 mg kg⁻¹) was also found to be the highest in treatment receiving 100 % recommended dose of multi nutrient tablet. The highest fruit yield of brinjal observed was 1.49 kg/ plant. The highest uptake of nitrogen (4.06 g plant⁻¹), phosphorus (0.29 g plant⁻¹), potassium (1.98 g plant⁻¹), calcium (1.51 g plant⁻¹), magnesium (1.16 g plant⁻¹), sulphur (0.53 g plant⁻¹), boron (3.85 mg plant⁻¹) and zinc (9.54 mg plant⁻¹) was also obtained. The highest NUE of nitrogen (58.77 g g⁻¹), phosphorus (55.10 g g⁻¹) and potassium (79.35 g g⁻¹) was also observed. The apparent recovery percentage of nitrogen 96.87 %, phosphorus 90.53 % and potassium 94.95 % and partial factor productivity of 27.71 g g⁻¹ were recorded due to the application of multi nutrient tablets.

EVALUATION OF MALE DATE PALM FOR HIGHER YIELD AND QUALITY TRAITS UNDER HOT ARID ECOSYSTEM

R.K. Meena, M.K. Choudhary, Chet Ram and K.L. Kumawat

ICAR-Central Institute for Arid Horticulture, Beechwal, Bikaner (Rajasthan)

Abstract

The cultivation of male date palm plays an important role in pollination, fruit set, fruit maturity, fruit yield and quality. It is a dioecious plant and hand pollination is essential but due to lack of sufficient numbers and superior type of male plants, the availability of pollen grains is limited. ICAR-CIAH, Bikaner is one of DUS centre for date palm in India and maintaining 64 variable germplasm along with eight elite male date palm seedling plants in field repository. The present study was conducted to identification of promising male date plant under hot arid condition for higher pollen production, compatibility, stability and suitability under hot arid region of western Rajasthan.

Eight date palm promising seedling were evaluated for morphometric parameters, pollen grain yield & chemical parameters under hot arid condition. morphological parameters were ranges viz., flower emergence ranges from January to March, time of spathe opening (20.4- 39.8 days), length of spathe (32.8-122.4 cm), width of spathe (12.4- 19.4 cm), number of spadix (15-26.8), weight of spadix (0.516-1.86 kg), weight of spathe (0.259-0.875 kg), weight of inflorescence (0.257-0.990 kg), number of



strands spath⁻¹ (105-156.8), length of strands (13-33.6 cm), length of central axis (16.8-50.6 cm), length of peduncle (11.8-54.6 cm), number of flowers strands⁻¹ (44-104.6), weight of pollen spath⁻¹ (7.8-24.8 g) and pollen yield (129-744.86 g). Further, among the male seedlings, considerable variability also recorded in respect to chemical composition of pollen grains like phenolics (7.95-11.90 mg GAE/g), Flavonoids (0.322-0.496 mg E.Cat./g DW), TAA (11.34-17.55 mg AAE/g DW), total soluble sugar (60.99-134 mg/g) and reducing sugar (3.46-11.63 mg/g) etc. On the basis of evaluation CIAH/DP/M1 & CIAH/DP/M6 were found superior in respect to pollen grain yield per plant (744.86 gm & 529 g) and other observed parameters under hot arid ecosystem of western Rajasthan. Among the seedlings, considerable variability with among the parameters was recorded due to climatic abbreviations and different genetic make of the male date palm plants.

HETEROSIS OF TWO LINE HYBRIDS FOR YIELD AND YIELD COMPONENTS IN RICE *ORYZA SATIVA* L.

R. Latha^{1*}, P. Shanthi² and S. Kanchanarani³

¹Agricultural Research Station (TNAU), Thirupathisaram

²Department of Agricultural Botany, Centre for Plant Breeding and Genetics, TNAU, Coimbatore

³Oilseed Research Station (TNAU), Tindivanam

*Email : latharamaiah@yahoo.co.in

Abstract

Hybrid vigour in rice was reported as early as 1926 by Jones and subsequently by Ramiah in 1933. Until the discovery of CMS system in rice, heterosis has not been exploited commercially. China was the first country to release F₁ hybrids for cultivation in 1976. These hybrids recorded 30 per cent yield advantage over the pure line varieties (Yuan, 1996). To break the yield ceiling in three line hybrids, two line hybrids have been developed which had an yield advantage of 5-10 per cent over the three line hybrids (Wang and Li, 1992). Six TGMS lines and 22 non TGMS lines were crossed in line tester fashion and the 132 hybrids obtained were evaluated for their heterotic potential for yield and yield components. The hybrid CORH 2 and the variety ADT 39 were used as checks. The highest standard heterosis in the negative direction over the checks CORH 2 and ADT 39 was recorded by TS 29 N 22 (-22.68 and -21.05 %) followed by TS 29 IR 62030-54 and TS 46 N 22 (-17.53 and -15.79 %) and TS 29 IR 62030-83 (-17.01 and -15.26 %) for days to 50% flowering. Among the hybrids, TS 29 BPI 76 recorded the maximum spikelet fertility of 98.99 per cent followed by TS 29 IR 62030-54 (98.93 %), TS 46 CB 97033 (98.84 %) and TS 29 IR 62030-83 (98.57 %).

The highest grain yield was recorded by TS 18 CB 96026 (52.75 g) followed by TS 46 BPI 76 (50.91 g), TS 18 MRST 9 (48.70 g), TS 18 BPI 76 (47.00) and TS 16 CB 96073 (46.55 g). Three hybrids viz., TS 18 CB 96026, TS 46 BPI 76 and TS 18 MRST 9 recorded significant positive heterosis of 26.11, 21.71 and 16.41 per cent over CORH 2.

MORPHOLOGICAL CHARACTERIZATION OF *ACACIA MANGIUM*, *ACACIA AURICULIFORMIS* AND ITS NATURAL HYBRIDS IN COASTAL AGROCLIMATIC ZONES OF ODISHA

R. Premila, T.L. Mohanty, S.G. Nair and S.K. Rout

College of Forestry, OUAT, Bhubaneswar-751003

Abstract

The current experiment was conducted in College of Forestry, OUAT in 2022. The experiment was laid by CRD with 5 treatments and 4 replications. The maximum height (273 cm) was observed in T5. The minimum height (191.2 cm) was found in T1. The maximum collar diameter (2.9 cm) was observed in T5. The minimum collar diameter (1 cm) was observed in T1. The maximum no. of branches (27) was observed in T4 which was significantly at par with T5 (24). The minimum no. of branches (3) was found in T2. The maximum no. of leaves in a branch (18) was observed in T1, T3, T4. The minimum no. of leaves in a branch (13) was found in T5. But the average of total no. of leaves in the whole plant of T2 is 28. The maximum leaf length (24.4 cm) was observed in T5. The minimum leaf length (16.48 cm) was observed in T4. The maximum leaf width (7.218 cm) was observed in T1. The minimum leaf width (2.439 cm) was observed in T2. The maximum leaf area (27.99 cm²) was observed in T1. The minimum leaf area (8.30 cm²) was observed in T2. The ratio of leaf length and leaf width is maximum in case of T2. The ratio between leaf length and leaf width is minimum in T1. The maximum leaf dry biomass, stem biomass



and root biomass, all were observed in T4. The minimum leaf dry biomass, stem biomass and root biomass, all were found in T1. T5 had the highest seedling quality index followed by T4 depicting its quality and superiority than their parents. Leaf morphological characters, venation, phyllotaxy, leaf angle, petiole, shape of stem etc were studied for qualitative analysis. Out of all treatments, T5 which was similar to *Acacia mangium* in morphological characters was found to be the best one with highest SQI value.

FINDING PLAUSIBLE OPTIONS FOR CROP RESIDUE MANAGEMENT

Ram Datt¹ and Shashikant Divakar²

¹School of Agribusiness & Rural Management, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar

²Department of Extension Education Bihar Agricultural University, Sabour, Bhagalpur

Abstract

Crop residue burning is a serious agricultural problem in some parts of our country, including Punjab, Haryana, Western Uttar Pradesh, South Bihar, and others. Every year, an estimated 700 million tonnes of crop residues are produced in India, with Bihar producing 30 million tonnes. The cereal crops contribute maximum 54 per cent crop residue followed by sugarcane 11 per cent. Among cereal crops, rice crop contributes maximum residue (*Hiloidhari et al., 2014*). Across the country 100 million tonnes of crop residues are burnt and around 4 million tonnes in Bihar. Crop residue burning causes serious air & soil pollution and further it badly impacts human health. Government is striving hard to stop crop residue burning through various awareness programmes, incentives & punishment. At the same time research based institutions are trying to explore various alternatives of crop residue management. Shyamsundar et al. (2019) evaluated comparative profitability of burning and non-burning of crop residue in northwestern India and found Mulch SMS+ Happy Seeder most profitable followed by Mulch Manual+Happy Seeder, bale+zero till seeder, Burn+zero till seeder, bale+rotaseeder, burn+rotaseeder, bale+disc harrow, Burn + disc harrow, Incorporation + disc harrow and Incorporation + rotavator. A study was conducted in eastern gangetic plains to understand farmers' perspectives towards the cause of stubble burning and adoption of crop residue management practices. Majority of farmers during the focus group discussion reported the extensive use of combine harvester, short window between kharif and rabi crops, shortage of labour, lack of economical use of crop residues as the reasons for stubble burning. Farmers also reported that most of the alternatives of crop residue management are not doable and scalable.

PADDY RESIDUES MANAGEMENT FOR AGRICULTURAL SUSTAINABILITY IN UTTER PRADESH

Ram Naresh, U.S. Gautam, Sadhana Panday, Shantanu Kumar Dubey, Raghwendra Singh, Rajeev Singh, Mohil Kumar, Nikhil Vikram Singh and Rohit Kumar Sengar

ICAR-ATARI Zone III, Kanpur, U.P.

Email : rngurjar9@gmail.com

Abstract

Paddy residue management through mechanical means for left over material after the crop has been harvest under Rice Wheat system. Crop residue are most valuable recourse that can be improve soil structure increase organic carbon content in the soil, reduce & evaporation and help in fixing CO₂ in the soil. Crop residue management is a well-known and widely accepted practice, and is a key component of conservation agriculture. The rapid shift from conventional agriculture to modern mechanized agricultural practices often leads to manage the Paddy crop residues. Growing more food for an ever-increasing population brings the chance of fast residue generation. Ecosystem services from crop residues improve soil health status and supplement necessary elements in plants. However, this is just one side of the shield. Indecorous crop residue management, including in-situ residue burning, often causes serious environmental hazards. This happens to be one of the most serious environmental hazard issues witnessed by the agricultural sector. Moreover, improper management of these residues often restrains them from imparting their beneficial effects. The different aspects of Paddy residue management, like the impact of the residues on crop and soil health, natural resource recycling, and strategies related to residue retention in farming systems, which are linked to the environment and ecology. This is may be helpful for different stakeholders to formulate suitable residue management techniques that will fit well under existing farming system practices without compromising the systems' productivity and Environmental sustainability.



DEVELOPMENT AND EVALUATION OF LOCATION SPECIFIC CHICKEN VARIETY FOR IMPROVING RURAL POULTRY FARMING IN DIFFERENT AGRO CLIMATIC ZONES OF JHARKHAND, INDIA

Ravindra Kumar and Sushil Prasad

Department of Livestock Production and Management, College of Veterinary Science and A.H., Birsa Agricultural University, Kanke, Ranchi

Abstract

Rural poultry farming is being practiced in many countries. The land of forests, Jharkhand is situated in the eastern part of India. It is endowed with rich flora and fauna. The vast boundary of towering mountains, dense forests, and gushing waterfalls. Most of the state lies on the Chota Nagpur Plateau. Jharkhand has 26.3 % tribal population. They practice goat, pig, cattle rearing and keep chicken as a source of supplementary income. The availability of improved stock for backyard poultry farming is limited and together with the constraints like lack of technical knowhow and poor managerial skill of ordinary rural poultry farmer, growth of poultry is sluggish compared to national average. The present study was planned with the objective of development of suitable location specific poultry variety infusing improved germplasm for enhanced egg production and utilizing native poultry germplasm to maintain adaptability to improve rural poultry farming in state. After conducting baseline survey to know the preference of local people for the type of variety to be developed, “Jharsuk” a location specific chicken variety was developed by three way crossing using Dahlem Red, Panjab Broiler and indigenous/native chicken. These birds demonstrated comparatively better growth than native (Male 1.6-1.8 kg and Female 1.3-1.5 kg at 20 weeks; Male 2.0-2.3 kg and Female 1.6-1.7 kg at 40 weeks) at farmer’s door. Jharsim birds mature early (170 days), lay larger eggs (50-55gm) with annual egg production potential of 135-145 eggs/bird under farmer’s flock and 150-160 eggs/ bird under farm rearing conditions. The developed variety is well adapted to local agro climatic condition and is readily accepted by farmers as stock of choice for backyard/rural poultry farming.

MAJOR CONSTRAINTS PERCEIVED AGAINST ATTAINING HIGH YIELD IN WHEAT IN MALWA PLATEAU OF MADHYA PRADESH

S.K. Kaushik and R.P. Sharma

RVSKVV-Krishi Vigyan Kendra-Ujjain (M.P.)

*Corresponding Author’s Email : Kaushik.surendra@rediffmail.com

Abstract

Wheat crop cultivated in our nation with many species of genus *Triticum*. It is a widely adaptable crop that can be grown in climates ranging from temperate to tropical and cold northern parts. It is a very important crop among the world’s cereal crops. India ranked second largest producer of wheat in the globe. The contribution of wheat in the world’s gross food production is 34%. In addition, it can be cultivated anywhere from land on sea level to an altitude of up to 3300 meters. Places with a cool, moist weather for most part of the year followed by a short, dry and warm spell is most suited for wheat cultivation. This type of weather condition permits appropriate maturing and ripening of grains. However, areas with heavy rainfall, moist and warm climate are not suited for commercial wheat farming. Similarly, drought-like conditions, extremely low or high temperatures during the flowering stage would affect the wheat crop. During high temperature, a lot of energy is lost owing to transpiration. Hence, there is very little residual energy left within the crop resulting in low yields. High humidity and low temperature are likely to induce rust attack on the crops. Wheat is mainly used for making bread (Roti) in India. Due to high gluten content in wheat flour, the flour is used to prepare bread, biscuits etc. Wheat is also used to make semolina or rava, maida and bran (for cattle) and fine wine. Due to the large number of animals in India, wheat straw is used to feed the animals. Whereas in developed countries like America, England, after cutting the wheat ear from the crop, the remaining vegetative part is used to give biomass to the land. When wheat productivity is compared with other wheat producing countries then it seems that India has low yield in wheat. In order to find out the constraints in attaining the high yield potentiality in wheat cultivation the present study was conducted in 6 villages of Ujjain district of Malwa plateau during rabi 2019-20. A total of 24 wheat growing farmers were selected for the study. The constraints were categorized in nine classes for ease of the points to be understood. In this study, it is observed that inception of loose smut and Yellow rust in diseases, termite and aphid attack in insect-pest, emergence of *Phalaris minor* and *Avena ludoviciana* (Jangali Jai) in weed infestation, declining water table and high



temperature at maturity under abiotic stresses, non-availability of labour and small land holding under Socio-economic structures, lack of irrigation facilities and high cost of inputs, low organic matter and imbalanced use of fertilizers under technological category, Poor information delivery by state extension machinery and Poor participation in exposure visits arranged by various departments under extension, low price of produce and attack of rodents were major constraints that hinders the yield potentiality of wheat. Wheat production not only faces the above challenges, but the intensity gets magnified in the context of climate change owing to its vulnerability. The study suggested that with all the present technical know-how, we can enhance the wheat production and productivity if we can focus on improving the constraints discussed in this study.

INFLUENCE OF NUTRIENT AND IRRIGATION MANAGEMENT PRACTICES ON MANGO + PINEAPPLE AGROFORESTRY SYSTEM

Pujashree Mishra¹, Sasmita Behera¹, Subash Chandra Mohapatra¹ and Hiranmayee Nayak²

¹AICRP on Agro Forestry, College of Forestry, Odisha University of Agriculture & Technology, Bhubaneswar, Odisha

²Dept. of Forest Policy and Law, College of Forestry, Odisha University of Agriculture & Technology, Bhubaneswar, Odisha,

Abstract

Fruit based agroforestry system is a highly sustainable, self-reliant and most adoptive practice in Coastal Odisha. A field experiment was conducted at the experimental site of AICRP on Agroforestry Research Farm, OUAT, Bhubaneswar, Odisha during May 2020 to June 2021. The experiment comprised of three main plots including three irrigation systems i.e., sprinkler, drip & ridge furrow and four subplots including nutrient management such as organic [FYM + Dry leaf mulch + biofertilizer (Azotobacter: Azospirillum: PSB in 1:1:1){4 kg each/ha}], recommended dose of fertilization (RDF) (75%) + FYM, RDF (100%) + FYM, RDF (125%) + FYM. The treatments were replicated thrice and the experiment was carried out in split plot design. The mango trees planted at a distance of 6 x 6 m² and spacing between the intercrop pineapple 75 x 60 cm². During the investigation period The biometric observation of Pineapple such as D-leaf length (67.3 cm), plant height (93.9 cm), crown spread (151.7 cm) and number of leaves (49.3) were observed highest with RDF (125%) + FYM and similar trend also followed in pineapple with drip irrigation system. The application of RDF (125%) + FYM was found the best with the highest yield of mango and pineapple (72.39 q ha⁻¹ and 93.82 q ha⁻¹) and gave highest net return of Rs 4.02 lakhs per year per ha and BCR 3.46.

MANAGEMENT OF COLLAR ROT DISEASES IN GROUNDNUT THROUGH INORGANIC AND ORGANIC FUNGICIDES

Rekha Kumawat^{1*} and Rakesh Kumar²

¹Agricultural Research Station (Agriculture University, Jodhpur), Mandor-342304

²College of Agriculture (Agriculture University, Jodhpur), Nagaur

*Corresponding author Email : rekha.kumawat25@gmail.com

Abstract

Groundnut (*Arachis hypogaea* L.) is an important edible oilseed crop of the family *Leguminosae*. Brazil (South America) is considered to be the native place of groundnut. India is a world leader in groundnut production. In India, it is mostly grown in Gujarat, Rajasthan, Tamil Nadu, Andhra Pradesh, Karnataka, Madhya Pradesh, Maharashtra, West Bengal, Uttar Pradesh and Orissa. During its production it suffers from various soil borne diseases like collar rot/crown rot/seedling blight, root rot, stem rot, wilt etc. Collar rot (*Aspergillus niger* van Tieghem) is an important seed and soil borne disease of groundnut which vitiate quality and quantity of kernels. Collar rot damaged regularly because the pathogen is seed and soil borne in nature. This disease covers almost all groundnut growing states. An experimental trial was laid out to test the efficacy of different organic and inorganic fungicides against collar rot of groundnut at Agricultural Research Station (Agriculture University, Jodhpur), Mandor during *Kharif* 2021. Total ten treatments including one check were taken and replicate thrice. The organic fungicides were applied as soil and seed and inorganic were applied as seed treatment. The percent collar rot incidence was calculated by remarking the infected plants from total number of plants from sowing to harvest. The results of various organic and inorganic fungicides against collar rot of groundnut were found considerably superior in reducing per cent collar rot incidence of groundnut over control. Minimum 0.59% per cent disease incidence of collar rot was recorded in organic seed treatment of *Trichoderma viride* @ 10g/kg seed and soil application of *T. viride* @ 2.5 kg/ha enriched in 100 kg of FYM and neem cake @



250 kg/ha at the time of sowing with maximum (2222 kg/ha) seed yield. In inorganic, seed treatment with Azoxystrobin 23% SC recorded minimum 1.01% per cent disease incidence with 2139kg/h seed yield.

STUDIES ON INSECTICIDAL SEED TREATMENT ON SEED VIABILITY OF SORGHUM SEED

Rashmi S. Bhoge*, V.R. Shelar, Dhanshree H. Sarnobat, A.P. Karjule

Seed Technology Research Unit, Seed Cell, Mahatma Phule Krishi Vidyapeeth, Rahuri

*Corresponding Author Email : bhoge.rashmi@gmail.com

Abstract

Sorghum, *Sorghum bicolor* (L.) Moench is an important cereal crop grown worldwide for food and feed purposes. Sorghum ranks second among cereals and the fifth among all crops in terms of production in India. Most of the sorghum produced in India are stored at farm or village level by rural farmers to ensure domestic consumption and seed for planting in the next season. Storage is particularly important because agricultural production is seasonal while the demands for agricultural commodities are more evenly spread throughout the year. In this circumstance, there is a need to meet average demand by storing excess supply during the harvest season for gradual release to the market during off-season periods to stabilize seasonal prices. Safe storage of grains against insect damage is a serious concern. *Sitophilus oryzae* is serious pest of storage sorghum, 3.5 to 4.0 mm long beetle with large round punctures on the thorax. The head is protruded into rostrum, with a biting-chewing mouthparts. With this view laboratory experiment was conducted at Seed Technology Research Unit, MPKV., Rahuri during 2020-21 to ascertain new insecticides against *Sitophilus oryzae* on stored sorghum seed. Insecticides viz; Spinetorum 11.7%SC, Flupyradifurone 200 SL, Emamectin benzoate 5 % SG and Deltamethrin 2.8 % EC at different concentrations were evaluated against *Sitophilus oryzae*. The seeds without any seed treatment were included as control. Among the insecticides, Deltamethrin 2.8 EC @0.04 ml/kg of seed and Spinetorum 11.7%SC @25.6 ml /kg seed found better by recording significantly higher germination percentage i.e.88.00 % and 87.00 % respectively with no insect infestation upto 12 month of storage. While in control there was 60.00 % seed germination with 25.00 % *Sitophilus oryzae* damage upto 12 month of storage. Study suggested that seed treatment with Deltamethrin 2.8 EC @0.04 ml/kg of seed and Spinetorum 11.7%SC @25.6 ml /kg seed could be useful to prolong the storage life of sorghum seeds.

REVEALING THE GENETIC STRUCTURE OF CLUBROOT DISEASE IN *BRASSICA SPECIES* BY ASSOCIATIVE TRANSCRIPTOMICS

Rushikesh Mane^{1*}, Bishun Deo Prasad¹ and Sangita Sahni²

¹Department of Agricultural Biotechnology and Molecular Biology, College Of Basic Sciences & Humanities, Dr. Rajendra Prasad Central Agriculture University, Pusa, Bihar-848125

²Department of Plant Pathology, TCA, Dholi, Dr. Rajendra Prasad Central Agriculture University, Pusa, Bihar-848125

*Email: maners7777@gmail.com

Abstract

Clubroot, caused by Soil-borne pathogen *Plasmodiophora brassicae* Woronin is an important disease of Brassica crops worldwide. Brassica spp., Known as rapeseed-mustard, important crop in the Indian economy by providing edible oils, vegetables, condiments and used for animal feed. Worldwide, India holds second and third position in rapeseed-mustard area under cultivation and production, respectively. Reductions in yield of cruciferous crops are major loss governed by *P.Brassicaceae*. Although there is some kind of resistance in oilseed crops but the genetic basis of that resistance is still poorly understood. Different approaches in rapeseed-mustard like molecular breeding, omics and biotechnological interventions have been used to develop varieties for improved yield and oil quality, climate resilient and tolerance to abiotic and biotic stresses. To dissect genome of rapeseed-mustard, by using associative transcriptomics approach we can elucidate the genetic basis of resistance to clubroot disease. We would perform a single nucleotide polymorphism (SNP) association analysis distributed across genome of Brassica Species and combine with transcript abundance data of available coding DNA sequence (CDS). On the basis of SNP association and gene expression marker analysis we will identify major and minor genes (loci) controlling resistance. Other genes will be implicated as potentially involved in resistance using gene expression marker (GEM) analysis. Through gene ontology (GO) analysis and InterPro functional analysis of identified genes, we would find candidate genes as having roles in clubroot resistance. These results will provide useful information for marker-assisted breeding which would lead to accelerating of pyramiding of multiple cluberoot resistance genes in novel elite cultivars.



ISOLATION AND SCREENING OF LIGNOCELLULOSES DEGRADING MICROBES FROM SOIL

Reshma Shinde^{1*}, D.K. Shahi², S.K. Naik¹ and A.K. Singh¹

¹ICAR- Research Complex for Eastern Region, Farming system Research Centre for Hill and Plateau Region, Ranchi- 834010, Jharkhand, India

²Birsa Agriculture University, Kanke, Ranchi-834006, Jharkhand, India

*Corresponding Author's Email : reshma.icar@gmail.com

Abstract

Crop residues (CRs) is the most abundant biorenewable biomass on earth, and rich source of nutrient. However, it is structurally complex lignocellulosic material which is resistant to degradation due to various biologically stable linkages present in it. There are several microbes occurring in soil which are capable of degrading the complex lignocellulosic material which needs to be isolated. Enhancing the process of its biological degradation using microbial strains capable of decomposing lignocellulose would not only solve the problem of CR disposal but also recycle the organic carbon and plant nutrients back into the soil. This study was aimed at isolating and screening of the lignocellulose decomposing microbes from various soils such as crop residue incorporated soil, forest soil, soil near decaying wood, compost pit and dump yard. Total of 15 fungi and 6 bacteria were isolated in the form of pure colonies and screened for cellulose and lignin decomposing ability using carboxymethylcellulose (CMC) and tannic acid (TA) agar media on the basis of appearance of clear zone. Five fungal and two bacterial cultures identified as lignocellulose decomposers were further screened quantitatively for CMCase and filter paperase enzyme assay by standard protocols. Two fungal strains, identified as *Trichoderma* species and *Aspergillus* species showed significant enzymatic activity and can be utilized as a potential lignocellulose decomposer.

EFFECT OF DIETARY OIL CAKE REPLACEMENT WITH *MORINGA OLEIFERA* LEAVES ON GROWTH PERFORMANCE AND NUTRIENT UTILIZATION IN GROWING CROSSBRED CALVES

Sachin Tripura^{1*}, Ashok Santra¹, Ravindra Kumar², Vipin¹, Prabhakar¹, Rakesh Kumar¹

¹Division of Animal Nutrition, Eastern Regional Station of ICAR-National Dairy Research Institute, Kalyani-741235 (W.B.)

²Department of Livestock Production and Management, Ranchi Veterinary College, Birsa Agricultural University, Ranchi-834006 (Jharkhand)

Abstract

The present study was conducted to assess the effect of dietary oil cake replacement with *Moringa oleifera* leaves on the plane of nutrition, body weight gain, feed conversion efficiency, and nutrient digestibility of growing crossbred calves. The experiment was conducted for 167 days. A total of 15 growing male crossbred calves were selected from the cattle herd maintained at ERS of NDRI, Kalyani, West Bengal. Selected calves were randomly assigned into three groups (n=5) on body weight (59.9±1.5 kg). Calves in the T₁ group were fed with a control diet with 40:60 roughage (paddy straw) to concentrate ratio supplementation as basal ration. The T₂ and T₃ group of animals were also fed with 40% paddy straw and 60% concentrate mixture. However, the mustard oil cake (protein content basis) of the concentrate mixture in T₂ and T₃ was replaced with *Moringa oleifera* leaves by 25% and 50% respectively. The diet of all groups was isonitrogenous. The experimental calves were fed as per NRC (2001) for 600g average daily gain (ADG). A digestibility trial was conducted on all the experimental animals after 75 days of experimental feeding with 7 days collection period to assess the nutrient digestibility. Total feed intake (kg/day) was 4.4, 4.9, and 4.5 in T₁, T₂, and T₃, respectively and it did not vary significantly between treatment groups. Digestibility of nutrients viz. CP and EE did not vary significantly between treatment groups. However, the digestibility of DM, OM, total carbohydrates (T-CHO), NDF, ADF, and cellulose of the T₂ and T₃ groups was significantly higher (P<0.01) than the control (T₁). Intake of TDN was 2.5, 2.9, and 2.7 kg/day, and intake of DCP was 453.7, 517.1, and 466.5 g/day in T₁, T₂, and T₃ respectively and it did not vary significantly between treatment groups. Average body weight gain was 527.5, 555.1, and 536.5 g/day in T₁, T₂, and T₃ respectively and the differences between the groups were non-significant. Feed efficiency in terms of percentage was 15.8%, 15.7%, and 15.9 % in the T₁, T₂, and T₃ groups respectively. FCR of the experimental calves belonging to the T₁, T₂, and T₃ groups was 6.4, 6.3, and 6.3 respectively. It can be concluded that *Moringa oleifera* leaves can replace the conventional oil cake such as mustard oil cake partially upto the level of 25% and 50% in 40:60 roughage to concentrate ratio in the rations of growing crossbred calves without any adverse effect on animal performance.



CONSTRAINTS EXPERIENCED BY FARMERS ON INTEGRATED FARMING SYSTEM IN TELANGANA STATE

S. Kavitha¹, G. Samuel², I. Sreenivasa Rao³, M. Goverdhan⁴ and D. Srinivasa Chary⁵

¹Department of Agricultural Extension, College of Agriculture, Rajendranagar, PJTSAU, Telangana

²PJTSAU, Rajendranagar, Hyderabad-500030

³EEL, Rajendranagar, Hyderabad-500030

⁴ARS, Kampasagar, Nalgonda-508 207

⁵Department of Statistics and Mathematics, College of Agriculture, Rajendranagar, Hyderabad-500 030

Abstract

Agriculture plays a vital role in many rural farm families. Crop alone enterprises may not sufficient to lead meaningful life. Hence, it is suggested to keep related enterprises of backyard poultry, goat, milching cow, mushroom and other activities as subsidiary which deliver regular income. Considering the multiple activities suitable various eco systems, the present study was conducted to identify the constraints expressed by farmers in Integrated Farming System An exploratory research design was employed for the investigation. The total sample size was 180 respondents. Data was collected by using well-structured interview schedule. Data were analysed by using percentage analysis and rank order method. The results of the study revealed that constraints faced by Integrated Farming System (IFS) farmers were categorized into three viz., technological, operational and marketing constraints. Poor knowledge on suitable cropping systems in Integrated Farming System and their interaction (86.67%), lack of knowledge on usage of ICT tools in farming (80.00%) were major technological constraints, irrigation and labour problem (90.00% and 86.67%) were major operational constraints, lack of skills and knowledge on online marketing (90.00%), price fluctuations (76.67%) were important marketing constraints experienced by IFS farmers. Adequate training and necessary marketing intervention needs to be facilitated to enhance farmers interest and sustaining the farm enterprises.

MODERN TECHNOLOGY USED FOR FINGER MILLET PROCESSING AND VALUE ADDITION

Manisha Sahu

DKS College of Agriculture and Research Station, Bhatapara, IGKV, Raipur

Abstract

Finger millet (*Eleusine Coracana* L.) commonly called as “ragi” in India. Of all the cereals and millets, finger millet has the highest amount of calcium (344 mg%) and potassium (408 mg%). It has higher dietary fiber, minerals, and sulfur containing amino acids compared to white rice, the current major staple in India. Finger millet is crop reasonably sustainable for poor segment of the world’s population. However, existence of anti-nutrients (Tannins, phytat & polyphenols) could reduce the accessibility of nutrients which restrict the application of finger millet in food preparations. Antinutritional factors can be reduced to permissible limits with the application of certain pre-treatments like roasting, soaking, boiling, parboiling, fermentation, milling, germination, decortications, and extrusion cooking. Various value added products can be prepared by pretreatments of finger millets such as pasta, vermicelli, noodles, papads, soups, Indian sweets (Halwa) and bakery items. Therefore, in this review the value addition through processing technologies and its impact on properties of finger millet with health benefit has been studied.

BREEDING FOR LOW GLYCEMIC INDEX RICE HAPLOTYPES

Sk. Sameera*, M. Reddissekhar, P. Shanthi, V. Lakshminarayana Reddy, Ch. Sree Lakshmi, P. Maheswar Reddy, Sk. Nafeez Umar and P. Sri valli

S.V. Agricultural College, Tirupati, Chittoor (ANGR Agricultural University, Guntur, Andhra Pradesh)

*Email : s.sameera@angrau.ac.in

Abstract

Rice (*Oryza sativa* L.) as a staple food contains 80% of starch and increased consumption leads to the risk of type II diabetes and is predicted to affect almost 330 million people by 2030 (Misra *et al.*, 2010). Rice varieties having slowly digestible starch (high amylose) are likely to have low glycemic index and can be useful for management of type II diabetes. Glycemic index of rice which is a highly complex trait and understanding genetic mechanisms underlying starch biosynthesis and metabolism of



cooked rice can pave the way for developing efficient breeding and selection strategy for combining high grain yield with low glycemic index. In this context, the use of available rice genome sequence information encoding key enzymes involved in biosynthesis of amylose component of starch can unravel novel alleles involving single nucleotide polymorphisms (SNPs). A multi-allelic *waxy gene (Wx)* encoding *Granule-Bound Starch Synthase I (GBSS I)* enzyme is known to determine amylose content in rice endosperm. Potential molecular markers are now available to detect *GBSS I* alleles (SNPs) associated with five classes of amylose (waxy: 0–5%, very low: 5–12%, low: 12–20%, intermediate: 20–25%, and high: 25–33%). The superior donors for the target traits identified through haplopheno analysis having superior haplotype combinations will be utilized in Haplotype-Based breeding for developing next generation tailor-made high-quality healthier rice varieties suitable to consumer preference and market demand. Mainly the global shift in food consumption patterns accompanied by a sedentary lifestyle has been driving the upsurge of non-communicable diseases, projected to remain as a global health challenge for the coming decades. A multidisciplinary approach of introducing low to moderate GI rice varieties through profitable and high throughput phenotyping techniques to enable the selection of molecular markers and breeding lines of low GI with better palatability through genomic-assisted breeding and diet-based diversification solutions offers a sustainable way to address the growing nutritional challenges.

AN ASSESSMENT OF FACTORS INFLUENCING THE LIVELIHOOD DIVERSITY OF FARMERS FROM NORTH 24 PARGANAS DISTRICT, WEST BENGAL

Shamna A. and S.K. Jha

Agricultural Extension Section, ICAR-CRIJAF

Abstract

Livelihood diversification is beneficial to mitigate economic and environmental risks and to improve livelihood sustainability and regional sustainable development. Due to decrease in size of land and vagaries in weather the farmers are not able to meet the requirement of households from their farm alone. An analysis of livelihood diversification by the farm families is required in order to understand the existing situation and plan for their betterment of future. In this background, a study to find out the livelihood security index of farmers and its determinants is conducted in Barrackpore-1 and Amdanga blocks in North 24 Parganas district of West Bengal. Simpson livelihood diversity index equation is used to calculate the index values and categorise the farmers. Based on the values obtained, it was observed that 42 percent of farmers were having medium livelihood index level (0.26 to 0.5), 22 percent were having High livelihood index level (0.51 to 0.75) and none of the farmers were in Very high Livelihood index category. The determinants of livelihood security index were further analysed using multinomial logistic regression. It was observed that the independent variables like Income had an influence on farmers under LDI category with an odd ratio of 1 in comparison to the farmers with no diversification. Similarly the variable Economic motivation was significant ($p < 0.01$) for farmers under medium LDI category with an odd ratio of 22.43 when compared to farmers with no livelihood diversification and the independent variables like education ($p < 0.05$) and economic motivation ($p < 0.01$) had greater influence on farmers with high LDI when compared to farmers with no livelihood diversification. The study indicates that education, income level and economic motivation play an active role in increasing the livelihood diversification strategies. The study suggests policy measures in reducing various constraints, targeting the improvement in education level, enhancing economic motivation, capacity building etc so that the farmers can confidently opt for diversified activities for improving the livelihood and livelihood diversification as a risk management strategy can come to farmers rescue.

HYDROPONICS : AN EMERGING TECHNOLOGY FOR CLIMATE RESILIENT HORTICULTURE

Kumari Shashi Bala*, Seema, Manish Kumar, Shashikant and Sanjay Kumar Singh

Nalanda College of Horticulture, Noorsarai, Nalanda, Bihar Agricultural University, Sabour, Bhagalpur

*Corresponding author's email: shashib808@gmail.com

Abstract

The environmental changes predicted as a result of climate change are likely to intensify the pressures on Indian agriculture, along with on-going stresses of yield stagnation, land-usage, competition for land, water, and other resources, and globalization. Under such circumstances, hydroponics is emerging as a technology to produce seeds and plants free from the



diseases. Hydroponics is a cultivation method that uses water supplemented with nutrients rather than soil to grow plants. Either root is supported by growing media like pebbles, clay, or rocks or they are suspended in water. Adoption of Hydroponics is promoted as a strategy to combat climate change, to lessen the environmental damage and species extinction due to over exploitation and intensive farming. By using shades and LED lighting, fans to circulate air, and the ability to precisely control the water temperatures, hydroponics can deal with a hotter and wetter world, taking climate change head on. Hydroponic systems promote the growth of crops, along with environmental benefits such as dramatic reductions in water and fertilizer use. Reusing and capturing water and fertiliser also stops fertiliser runoff into rivers, which prevent water pollution that can harm ecosystems and obliterate aquatic life. Additionally, this method is effective in quality production of high value fruits and vegetables. The technology has its application in vertical gardening as well. It provide continuous crop production, eliminate herbicide and pesticide use, defend from weather-associated variations in crop production, conserve and recycle water, and are people and climate friendly. In metropolitan locations with a shortage of fertile land, hydroponics is a significant alternative planting technique for growing fruit and vegetables. Therefore, there is a need for promoting hydroponics to provide higher income per unit area of land and water, which can help farmers to achieve the enhanced income in climate change scenario.

THE DIVERSITY OF BIOMOLECULES ASSOCIATED WITH DWARF VARIETIES OF TENDER COCONUT WATER

Shyama V.U., Kumanan K.* and Nakkeeran S.

Agricultural College and Research Institute, Tamil Nadu Agricultural University, Pudukottai, Tamil Nadu

*Corresponding author e mail: kumanan@tnau.ac.in

Abstract

Coconut contains auxin which plays a vital role in plant growth and development (Abdul *et al.*, 2011). Considering the importance of tender coconut water pertaining to its nutrient content the present investigation was carried out at Agricultural College and Research Institute, Kudumiyamalai to analyze the physicochemical characters and diversity of volatile and non-volatile compounds in tender coconut water dwarf varieties. The analysis was carried out in six varieties of dwarf tender coconut pertaining to Malayan Yellow Dwarf (MYD), Malayan Orange Dwarf (MOD), Andaman Orange Dwarf (AOD), Chowghat Orange Dwarf (COD), Kenthali Dwarf (KTD) and Malayan Green Dwarf (MGD). The tender nut of Andaman Ordinary Dwarf (AOD) had higher weight of 1.6 kg with the highest volume of water (260 ml) followed by Chowghat Orange Dwarf. Total Soluble Solids and pH were similar in all the varieties. However, Potassium was higher in Malayan Green Dwarf (2908 ppm). Hitherto, sodium content was higher in Chowghat Orange Dwarf (106 ppm). The present investigation also confirmed the presence of diverse volatile compounds and non volatile compounds. Further the critical analysis of tender coconut water in Malayan Green Dwarf revealed the presence of elimicin, which was not present in any other variety. Further, analysis of tender coconut observed in Malayan Yellow Dwarf refreshed the presence of unique compounds including Alpha-Elementene, Bicyclicolelementene, -bourbonene, -amyrin, Linalool, 1-Octen-3-ol, Sabinene and Zonarene. Similarly the unique compounds like -caryophyllene, Coumaric acid, α -Farnesene, Nandrolone and Neophytadiene were observed in Andaman Ordinary Dwarf. Thus the validation in volatile compounds and non volatile compounds need further investigation for value addition.

THE DIVERSITY OF BIOMOLECULES ASSOCIATED WITH DWARF VARIETIES OF TENDER COCONUT WATER

V.U. Shyama, K. Kumanan* and S. Nakkeeran

Agricultural College and Research Institute, Tamil Nadu Agricultural University, Pudukottai, Tamil Nadu

*Corresponding author e mail : kumanan@tnau.ac.in

Abstract

Coconut water as a growth promoting component in tissue culture medium formulation can be traced back to more than half a century ago, when Overbeek *et al.* first introduced coconut water as a new component of a nutrient medium for callus cultures in 1941. It contains indole-3-acetic acid (IAA), the primary auxin in plants. Auxin is implicated in many regulatory processes in plants especially those relating to plant growth and development (Abdul *et al.*, 2011). Considering the importance of tender



coconut water in the aspects of its nutrient content the study was carried out at Agricultural College and Research Institute, Kudumiyamalai to analyze the physicochemical characters and diversity of volatile and non-volatile compounds in dwarf varieties of tender coconut water. Six varieties of dwarf tender coconut water such as Malayan Yellow Dwarf (MYD), Malayan Orange Dwarf (MOD), Andaman Orange Dwarf (AOD), Chowghat Orange Dwarf (COD), Kenthali Dwarf (KTD), Malayan Green Dwarf (MGD) were the treatments with four replications in Completely Randomized Design (CRD). The physical parameters, chemical composition, diversity of volatile and non-volatile organic compounds and confirmation of antifungal activity of tender coconut against *Fusarium oxysporum* f. sp. *cubense* were analyzed under in vitro condition. The tender nut of Andaman Ordinary Dwarf (AOD) had higher weight of 1.6758 kg and highest volume of water (260 ml) was recorded in Chowghat Orange Dwarf. TSS and pH were similar in all the varieties. Potassium was the major element in tender coconut water and was found to be higher in Malayan Green Dwarf (2908.13 ppm) and sodium content was found higher in Chowghat Orange Dwarf (106.83 ppm). As per the GC-MS analysis, the tender coconut water has a wide diversity of volatile and non-volatile organic compound chiefly 2- nonanol, α - pinene, α -caryophyllene, resorcinol, oxalic acid and malic acid. The MYD and AOD have nonanol content which has antifungal property. Andaman Ordinary Dwarf (AOD) had superior characteristic like organoleptic taste, volume of water, weight and had high antifungal activity.

CHARACTERIZATION OF PEARL MILLET HYBRIDS [*Pennisetum glaucum* (L.) R. BR.] USING SSR BASED DNA FINGERPRINTING

Supriya Ambawat*, C. Tara Satyavathi, R.C. Meena, Rajbala Meena and Vikas Khandelwal

ICAR-AICRP on Pearl Millet, Mandor, Agriculture University, Jodhpur-342 304, Rajasthan, India

*Corresponding author email: biotechsupriya@gmail.com

Abstract

Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is a major cereal crop grown mainly in the arid and semi-arid regions of Asia and Africa. DNA fingerprinting is mandatory for registration of newly developed hybrids and varieties with National Bureau of Plant Genetic Resources (NBPGR), New Delhi and Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA). In the present study, two advanced hybrid entries of pearl millet of third year testing viz. MH 2423 (NBH5929) and MH 2439 (86M80) were analyzed for DNA fingerprinting along with two checks (KBH108 and 86M86) using 36 SSR markers. Out of the 36 primers used, 26 SSR primers (72.2%) were found polymorphic with MH 2423 (NBH5929) and 28 SSR primers (77.8%) were found polymorphic with MH 2439 (86M80). The SSR profiles were analyzed based on pattern of bands and a unique profile was obtained for both the hybrids with amplicon size ranging between 100 to 500 bp. Thus, the SSRs very well differentiated the two hybrids generating a unique DNA fingerprinting profile for both the hybrids. The identified makers can prove useful further for genetic purity testing, utilization for identification of the diverse germplasm and future DNA fingerprinting studies.

EFFECT OF CONCENTRATE FEEDS ON BODY WEIGHT OF BLACK BENGAL GOAT IN GARHWA DISTRICT OF JHARKHAND

Sushma Lalita Baxla^{1*}, Ashok Kumar¹, Pankaj Seth¹, Sudhir Kumar Jha² and Jagannath Oraon³

¹Krishi Vigyan Kendra, Garhwa, Birsa Agricultural University, Ranchi-834006 (Jharkhand), India

²Krishi Vigyan Kendra, Saraikela Kharsawan, Birsa Agricultural University, Ranchi-834006 (Jharkhand) India

³Directorate of Extension Education, Birsa Agricultural University, Ranchi- 834006 (Jharkhand) India

Abstract

Goat farming is an age old practice and one of the first animal to be domesticated in rural India. The purpose of the goat rearing is mainly for meat (chevon), milk, hide and manure. It provides livelihood security as well as a good source of protein with less input cost and considered as 'poor man's cow'. An On Farm Trial was conducted in farmers' field to evaluate the effect of concentrate feeds on body weight of Black Bengal goat by Krishi Vigyan Kendra (KVK), Garhwa Jharkhand. There were three groups, T1: Farmers' Practice (Gazing), T2: Grazing + feeding concentrate feed ingredients (crushed maize - 23% + gram- 20% + linseed cake- 30%+ rice bran- 24% + Vitamin with mineral mixture – 2% + salts - 0.5% and molasses- 2%). Dose: 50 g / goat from 2 -3 month after weaning, 100 g/goat from 3-4 months and 200 g/goat after 4 month till maturity and T3: Grazing + locally available succulent green fodders (jackfruit, gulmohar, ber, mango, pipal, moringa leaves etc.) +



vitamin and mineral mixture – 2%, salt – 0.5%+ molasses – 2%. Each treatment has 7 replications with 3 goats of 2:1 ratio. The results depicted that grazing with concentrate feeds along with vit. min. mix and molasses was given better body weight gain i.e. 8.34 kg with low mortality (1.6%) as compared to farmers practice i.e. 6.20 kg and 4.25 % respectively on 6 month of age. The study concluded that balanced feed ingredients increases the body weight and make the animal resistant against various diseases. Therefore, more training and demonstrations should be conducted in farmers field to increase the farmers' income.

STUDY ON ANTIBIOTIC SENSITIVITY TEST OF METHICILLIN RESISTANT AND NON-METHICILLIN RESISTANT *STAPHYLOCOCCUS AUREUS* FROM CLINICAL MASTITIC MILK

Sweta Kumari, Arun Prasad, Swati Sahay, Nirmala Minj, Md Taufique Ahmad, Sunita Kumari Murmu, Rajesh Kumar and Sanjit Kumar

Department of Veterinary Microbiology, Ranchi Veterinary College, Kanke, Ranchi-06

Abstract

The current investigation was planned to evaluate the incidence of “Methicillin resistant *Staphylococcus aureus*” (MRSA) and “Non-Methicillin resistant *Staphylococcus aureus*” (Non- MRSA) from clinical mastitis milk samples and their antibiotic resistance profile. From acute clinical mastitic samples isolation and identification of MRSA and Non- MRSA were executed. The isolates were tested using agar disc diffusion method for their antimicrobial susceptibility for eight (8) different antimicrobial drugs. A total of 167 clinical samples of mastitic milk from milching cows were cultured for incidence of *S. aureus*. MRSA and non MRSA were isolated in 11 (22%) and 39 (78%) from the total of fifty (50) *S. aureus* positive samples respectively. Based on the antimicrobial sensitivity test results, MRSA isolates were found 100%, 36.36% and 27.27% sensitive to vancomycin, cefazolin and cefotaxime respectively & found 100%, 100%, 100%, 90.90% resistant to, cloxacillin, penicillin, methicillin and oxacillin respectively. Similarly, non MRSA isolates were found 100%, 97.43%, 94.87%, 89.74%, 84.61%, sensitive to vancomycin, methicillin, cefoxitin, oxacillin, cefotaxime respectively & found 20.5%, 15.3%, 10.25% resistant to penicillin, cloxacillin and cefazolin respectively.

MONITORING OF MINERAL PROFILE IN DAIRY COWS AT DIFFERENT LACTATION STAGE IN RVC DAIRY FARM AND ADJOINING AREA

Abhishek Kumar, Vikash Kumar, Shubham Kumar and Puja Mukherjee

Department of Veterinary Medicine, Ranchi Veterinary College, Kanke, Ranchi

Abstract

A study on mineral profile at different lactation stage in RVC Dairy farm and adjoining areas was conducted. A total of 150 cows were randomly divided into 3 equal groups as per lactational stage i.e. early, mid and late lactation. 10 ml of blood was collected in a sterilized vial for separation of serum. The serum samples were subjected to estimation of calcium, magnesium, manganese, sodium, potassium, cobalt, copper, zinc and iron levels through standard methods. The results were analyzed by ANOVA test as per Snedecor and Cochran, 1994.

The level of blood calcium concentration was found to be maximum (129.42 ± 2.09 ppm) in late lactation and minimum (105.24 ± 1.36 ppm) in early lactation. The levels differed significantly from the values in mid and late lactation. The magnesium concentration was recorded highest (46.25 ± 0.68 ppm) in early lactation as compared to late lactation (42.02 ± 2.46 ppm). Early lactation revealed lowest concentration of serum manganese (0.26 ± 0.04 ppm) as its concentration has positive correlation with glucose utilization for the synthesis of lactose. The serum sodium level was lowest (159.02 ± 1.06 ppm) during early lactation and increased non-significantly with the advancement of stage of lactation, similarly, a non-significant variation could also be recorded in serum potassium level in different lactational stages. A negative correlation was observed between serum cobalt concentration and stage of lactation. In late stage of lactation, cow was found to have significantly lower copper level (0.58 ± 0.20 ppm) which might be due to decreased absorption or increased excretion of copper. Cow in early lactation had significantly lower level of zinc (1.88 ± 0.42 ppm) as compared to mid and late stage of lactation. A non-significant variation was found in serum iron level at different stages of lactation. It was concluded that the cow in early



lactation revealed lower levels of serum calcium, manganese and zinc while, cow in mid lactation had low level of magnesium whereas cow in late lactation revealed lower serum copper level.

LAND SUITABILITY EVALUATION FOR TURMERIC CULTIVATION IN KERALA USING GIS TECHNIQUE FOR FUTURE CLIMATE SCENARIO

Banu M.¹, K.S. Krishnamurthy² and Surendran U.¹

¹KSCSTE–Centre for Water Resources Development and Management, Kozhikode-673571 India

²ICAR–Indian Institute of Spices Research, Kozhikode. Kerala, India

Abstract

It is anticipated that climate change and climate variability will change the geographic suitability of lands for crop cultivation. As turmeric is a spice crop that needs to be adapted to vulnerable areas and cultivated sustainably, an early understanding of the future climate of growing areas is essential. The total area of Kerala is 38,863 km², 70% of which is used for agriculture. The aim of this study was to assess the climate suitability for turmeric cultivation in Kerala. Turmeric (*Curcuma longa*) can be grown in a variety of tropical climates, altitudes up to 1500m MSL, temperatures ranging from 20-30°C, and annual rainfall above 1500mm and grown on sandy loam or clay soil, well drained, pH from 4.5 to 7.5. This study seeks to predict the suitable area for turmeric cultivation in Kerala for future climate scenario for the year 2050, in the category of Representative Concentration Pathways 4.5 (RCP 4.5). Downscaled climate data for the year 2050 was collected from the Regional Climate Model - HadGEM 2-ES. Site and soil suitability criteria was considered based on the criteria from NBSSLUP. The future scenario showed that annual rainfall of Kerala varied between 1305-3840 mm, maximum and the minimum temperature is in the range of 20.7 - 33.6°C & 13.5 - 25.8° in 2050 respectively. A GIS environment was used to model the suitability of turmeric and analyse changes in climate in relation to soil and crop characteristics. Suitability analysis was performed by overlaying physical parameters (elevation, slope), climate (precipitation, temperature) and soil (depth, texture, drainage, pH) using weighted overlay analysis. The results of this study showed that 33% of the land area in Kerala will be highly suitable for growing turmeric by 2050, while 42%, 28% and 7% of the land area is moderate, marginally or completely unsuitable. In this study, it was found that the northern districts of Kerala have highly suitable areas for turmeric cultivation.

CONSTRUCTION OF MICROSATELLITE MARKER FROM GENOME SEQUENCE OF ORYZA SATIVA BY USING MISA TOOLS

Dilip Kumar^{1*}, Vikas Kumar¹, Asit Kumar Pradhan², Sudir Kumar Rawat³, Ritika⁴, Himanshushekhar Chaurasiya⁴, Rajiv Kumar⁶, Kapil Kumar Singh⁷

¹ICAR-National Institute of Agricultural Economics and Policy Research, Pusa, New Delhi

²ICAR-National Rice Research Institute, Cuttack

³KVK, Hathras, UP

⁴ICAR-Indian Agricultural Research Institute, Pusa, New Delhi

⁵ICAR-Central Institute for Research on Cotton Technology, Mumbai

⁶ICAR-Indian Agricultural Statistics Research Institute, Pusa, New Delhi

⁷Gautam Budh University, Greater Noida, GB Nagar UP

*Corresponding author email: dilip.kumar5@icar.gov.in

Abstract

Agriculture plays a significant role in our Indian economy. Agriculture is the main source of livelihood of many people in India and world. Increasing human population requires more land for living as well as for growing food, but one major problem is that land is fixed. Hence there is a requirement of more food from less land, which is the basic need. To fulfill this need, we have to apply modern methods on crop production. In modern agricultural practices, genetics and plant breeding plays a significant role in increasing the agricultural products. Microsatellite help in indicating the change in DNA sequences as well as marks the points where change occurs. Retrieving microsatellite markers for any species requires running of various tools, which is a cumbersome task. The output generated from these tools can be stored into database, so that retrieval of microsatellite and its related information becomes easy for the user. By studying and visualizing information of microsatellite on rice, breeders and researchers can develop new varieties which are disease resistant and high in food grain production.



NON-LINEAR REGRESSION ANALYSIS FOR REACTIVE BLUE-19 DYE ADSORPTION ON MAIZE COB HUSK

Manindra Barman, Thungashan Kikon, Chakrapani Saikrishna Kishore, V.K. Sharma and Indu Chopra*

Division of Soil Science and Agricultural Chemistry, ICAR-Indian Agricultural Research Institute (IARI), New Delhi, India

*Corresponding author e-mail: tinaindu@gmail.com

Abstract

The presence of toxic dyes in water bodies are attributed to textile, pulp, tannery, paper, and paint industries, of which, textile industries contribute an estimated 70-90% of dye (majorly reactive dyes) effluents discharged into the environment. The unaltered dye-contaminated water affects the aquatic environment through change in colour, nature, temperature, and pH of the water bodies. In addition, it affects the crop produce adversely as the untreated effluents are used to irrigate crops due to diminishing source of fresh water. India generates approximately 71 Mt of maize crop residue on-farm and off-farm annually (Devi *et al.*, 2017). As a strategy for alternative residue management to remediate dye pollution, this study was undertaken to explore the potential of maize cob husk as an adsorbent for the removal of Reactive Blue-19 (RB-19) from simulated aqueous solutions.

Morphology and functional groups present in the adsorbent were characterized using Scanning Electron Microscopy (SEM) and Fourier Transform Infrared (FTIR) Microscopy. Batch adsorption experiments were carried out to optimize various parameters *viz.*, pH, initial dye concentration, adsorbent dosage, and contact time for maximum removal of the dye from simulated dye effluent. Maximum adsorption was achieved at pH 3 with an equilibrium time of 60 minutes. A decrease in initial dye concentration resulted in increased dye removal. The adsorption equilibrium data were fitted on two-parameter non-linear isotherm models *viz.* Langmuir, Freundlich and Temkin models and values of their constants were also obtained. Adsorption equilibrium data were best described by the Freundlich model. The maximum dye uptake of the Reactive Blue-19 on maize cob husk was 3.91 mg/g. Adsorption kinetic modelling was also done using pseudo-first-order, pseudo- second-order, and intraparticle diffusion models. The adsorption kinetic data showed excellent correlation with the pseudo- second-order model with R^2 value of 0.99. In order to enhance the adsorption capacity of agricultural waste and commercialize the technology, further studies need to be carried out.

TLR 6 GENE POLYMORPHISM ANALYSIS AND IT'S SIGNIFICANCE IN PIG

Nandani Kumari^{1*}, Sushil Prasad², Ujjawal Kumar¹ and Ravindra Kumar³

¹Department of Animal Genetics and Breeding, R.V.C., B.A.U., Jharkhand, India.

²Dean, RVC

³Deptt. of LPM, RVC

*Author, Email : drnandanikumari@gmail.com

Abstract

Different genes involved in immune response of different livestock particularly pig, TLR (TOLL-LIKE RECEPTOR) gene is of prime importance in innate immunity response. Polymorphisms and/or differences in the production of immune molecules, such as TLRs, have a profound influence on responses to a wide range of pathogens and are associated with resistance and susceptibility to diseases (Lazarus *et al.* 2002). So far, 13 members of the TLR family were identified in mammals (Beutler, 2005). Studies with dominant negative receptors have shown that TLR6 cooperates with TLR2 to recognize peptidoglycan and the yeast cell wall particle. Furthermore, TLR6 deficient mice were reported to be hyporesponsive to mycoplasma macrophage-activating lipopeptide-2 kD (MALP-2), a diacylated lipoprotein, suggesting that and TLR6 coordinate the response to this ligand. Hence TLR6 have the potential to become candidate gene for marker assisted selection for disease resistance that could be exploited by breeding strategies.

A total of nine primers were used to amplify the DNA extracted from Blood taken from swine by standard protocol by PCR technique. Out of nine primers except for fourth, all the eight others gave amplified products which were used for further processing by SSCP technique. Polymorphic patterns of TLR6-1 gene indicated that SNP genotypes were significantly associated body weight at birth. Polymorphic patterns of TLR6-2 gene indicated SNP genotypes Haplotypes had non-significant effect on traits under study. Polymorphic patterns of TLR6-3 indicated that haplotypes had non-significant effect on other traits except for body weight at 42-day. Polymorphic patterns of TLR6-5 indicated that haplotypes for primer



-5 (TLR6-5) had non-significant effect on all the traits. Polymorphic patterns of TLR6-6 indicated that haplotypes had non-significant effect on all the traits under study. Polymorphic patterns of TLR6-7 indicated that out of all the traits under study, the haplotypes had significant effect on body weight at birth and body weight at 42-day and on body weight at 56-day. Polymorphic patterns of TLR6-8 indicated that haplotypes had non-significant effect on all the traits under study. Polymorphic patterns of TLR6-9 indicated that out of all the traits under study, the haplotypes had significant effect on litter weight at weaning.

Phylogenetic studies based on TLR6 gene fragment were studied figure showed the genetic distance among different species of animals with reference sequence ICI / 56329 of TLR 6 gene fragment. The sequence was found nearest to *sus scrofa* mRNA and TLR 6, TLR1 and TLR10. It was found to be most distant from *Bubali bubalis* and nearer to *Equus Caballus* than other domestic animals. The genetic distance among the different species of animals with reference sequence (ICI / 62869) gene fragment. The genetic distance among the different species of animals with reference sequence ICI / 40627 of TLR6-5 gene fragment from which TLR6 mRNA and TLR 6, TLR 1 and TLR10 seems to have evolved. Further based on this sequence *Sus scrofa* is equidistant from other domestic animals w.r.t phylogeny. The genetic distance among the different species of animals with reference sequence ICI / 36573 of TLR6-6 gene seems to have evolved from *Felis catus* along with other domestic animals. Further the TLR6 gene fragment shows that *Sus scrofa* is nearest to *Equus Caballus* and almost equidistant from other domestic animals like *Bubalas bubalis*, *ovis aris* and *Bos indicus*. As found according to the analysis, the genetic distance among the different species of animals with reference sequence ICI / 35303 of TLR 6-7 gene fragment. The fragment based phylogeny shows that swine is nearest to *Equus caballus* and most distant from *ovis aries* and *capra hircus*. The PCR-SSCP analysis of TLR -6 gene revealed the polymorphic pattern of genotypes in Swine. Presence of Different Haplotypes was evidence of allelic variants and hence polymorphism and mutations at different loci which could be studied and exploited for population and selection studies in swine.

Significant association of TLR-6 gene polymorphism with the Humoral Immune response against SRBCs was observed.

SOCIO-ECONOMIC ANALYSIS OF AGROFORESTRY PRACTICES IN DEOGHAR DISTRICT OF JHARKHAND

Prashant Kumar, P.R. Oraon* and Vidya Sagar

Department of Silviculture and Agroforestry, Birsa Agricultural University, Ranchi, Jharkhand

*Corresponding Author : prabhat.ranjan.oraon@gmail.com

Abstract

The perception of farmers' towards attitude and knowledge including motivational factors pertaining to adoption of agroforestry systems holds the key for addressing the current problems like widening the gap between demand and supply of tree products, deforestation and environmental degradation. However, the development of agroforestry as a viable option for farmers in diverse ecological and socio-economic conditions has become very challenging issue. Many researchers highlighted that farmers positive perception towards agro-forestry have significantly positive effects on adoption of agro-forestry. Present study was taken in three blocks of Deoghar district with the objectives to survey and identify the existing agroforestry practices and to assess the socio-economic impacts on the farmers. Three blocks (Palojori, Sarath & Mohanpur) and 240 households were selected for study. Questionnaire was prepared and data on different parameters were collected by adopting multi-stage random sampling. Socio-demographic status of respondents in the study area were most of the respondents engaged in farming and agro-forestry practices were male (87.09%) and maximum number of respondents belongs to 31-40 years (31.67%). 96.25% belongs to Hindu religion, out of which maximum concentration belongs to OBC category (45.83%). Nearly 53.6% of the respondents had illiterate to elementary educational status and nearly three-fourth of the respondents (76.25%) were engaged in farming activities. Economic, livestock status, cropping pattern and land use practices of respondent's as low monthly income (Rs.5001-9000) was observed for nearly 46.2% of the respondents. Both stall feeding and grazing (72.91%) was prevailed in the study area. Mainly sole cropping (76.67%) was dominated in the study area followed by mixed cropping (17.50%). Among different land-use practices, seven major practices were identified, out of which agriculture was the main practice, followed by horticulture, home-garden and agroforestry practices. Practice of home garden was found prevalent in the study area (22.50%) with maximum number of trees/ha followed by agrihorticulture and agrisilviculture practices. More percentage (95.41%) of respondents were interested in growing horticulture trees than timber trees (74.50%) around their farms.



ADVANCES IN BREEDING OF AONLA

Sanjay Sahay¹, Kumari Rashmi^{2*}, M. Feza Ahmad¹, H. Mir¹, S. Sengupta¹, Ravindra Kumar¹, M. Kundu¹, Pawan Kumar¹, Ruby Rani¹ and Kumari Karuna¹

¹Deptt. of Horticulture, Bihar Agricultural College, Sabour, Bhagalpur-813210

²Deptt. of Plant Breeding and Genetics, Bihar Agricultural College, Sabour, Bhagalpur

*Corresponding Author E-mail: versatilerash@rediffmail.com

Abstract

Aonla (*Emblica officinalis* Gaertn), commonly called Indian gooseberry, belonging to family Euphorbiaceae, is one of the oldest known indigenous fruit tree species with wide distribution, reflecting its adaptation to wide range of edaphoclimatic conditions. It has significant contribution to improvement of economic status of farming communities through commercial orcharding, nursery production and processing of herbal respect of fruit size, maturity period and yield per plant. Due to predominance of seedling propagation India holds rich genetic diversity in cultivated and their wild relatives of aonla. It is an important fruit owing to its nutritional, therapeutical, and postharvest and industrial value. Various pharmaceutical attributes of aonla have been described in ancient treatise either in combined formulation or alone. In a bid to better utilize and improve the present genetic resource, there is a need to apprehend and appreciate the studies related to use, centre of origin and diversity, as well as the characterization, evaluation and conservation, taxonomy and systematics, phenology, floral biology and pollination. In addition to basic biology of plant, agro-techniques, propagation, canopy architecture, physiological disorders, insect-pests and diseases and their management practices, etc. have been used to conserve aonla germplasm as well as improve its production. Varieties viz. Banarsi, Francis, Chakaiya, Banarsi Red, Kanchan (NA 4), Krishna (NA 5), NA 6, NA 7, NA 10, Anand -1 and Anand-2 are commercially cultivated varieties. Incorporation of desirable genes is possible only with the application of biotechnological approach for aonla improvement.

CARBON CREDITS (CC) GAIN IN PADDY CULTIVATION USING DRIP IRRIGATION IN HYDERABAD KARNATAKA REGION

Ravindra Yaligar¹, P. Balakrishnan², P.S. Kanannavar³ and R.S. Chilur⁴

¹ICAR-Indian Institute of Soil and Water Conservation (IISWC), RC, Ooty-643004, Tamil Nadu

²College of Agricultural Engineering (CAE), UAS, Raichur

³Dept. of Soil and Water Engineering (SWE), UAS, Dharwad

⁴College of Sericulture, Chintamani, GKVK, UAS, Bengaluru

Abstract

With the progress of mankind there has been an increasing adverse effect on the global environment due to hazardous emissions including carbon. This has caused what we know of as global warming. To address this issue of global warming, the United Nations Framework Convention on Climate change (UNFCCC) was adopted in 1992, with the objective of limiting the concentration of green house gases in the atmosphere. The concept of carbon credit came into existence as a result of increasing awareness of the need for controlling emissions. Carbon credits are units that can offset a company's carbon footprint. Carbon credits are a tradable permit scheme. It is a simple, non-compulsory way to counteract the greenhouse gasses that contribute to climate change and global warming. Carbon credits create a market for reducing greenhouse emissions by giving a monetary value to the cost of polluting the air. The Carbon Credit is the new currency and each carbon credit represents one tonne of carbon dioxide either removed from the atmosphere or saved from being emitted. Carbon credits are also called emission permit. With this back ground the experiment was carried out in the farmer's field located at Govinadoddi village in Manvi taluka of Raichur district in the jurisdiction of the University of Agricultural Sciences (UAS) Raichur, Karnataka during kharif 2015 and kharif 2016. In the present investigation, the data regarding electricity consumption (kWh ha⁻¹), water energy consumption (MJ ha⁻¹) as influenced by different cultivation practices (DSR and TPR), land levelling (Laser and Conventional) and irrigation (Drip and Flood) methods for paddy production during the years 2015, 2016 and pooled mean observed that there was a gain of 5.183 carbon credit (equivalent to a saving of Rs. 13476) in case of dry DSR treatment of laser land levelling and subsurface drip irrigation at 60 cm lateral spacing compared to the control plot of transplanted rice with conventional land levelling using flood irrigation.



GENERATION MEAN ANALYSIS IN LINSEED (*LINUM USITATISSIMUM* L.)

Shanti Bhushan^{1*}, Sunil Kumar¹, Sanjay Kumar², Anuj Kumar Choudhary³, Subodh Kumar¹, Akhilesh Kumar Singh¹, Kamleshwar Kumar⁴, Ravi Kumar⁴, Yogendra Prasad⁴ and Sohan Ram⁴

¹Veer Kunwar Singh College of Agriculture, Dumraon-802136, Buxar, Bihar, India (BAU, Sabour)

²Mandan Bharti Agricultural College, Agwanpur, Saharsa, Bihar India (BAU, Sabour)

³Bhola Paswan Shastri Agricultural College, Purnea-854302, Bihar, India (BAU, Sabour)

⁴Ranchi Agricultural College, BAU, Kanke, Jharkhand, India

*Corresponding author- shantidixit@rediffmail.com

Abstract

Generation mean analyses using six parameter model was carried out to study genetic architecture of yield and yield attributing traits in linseed (*Linum usitatissimum* L.) using five crosses viz., Chambal x SLS-61 (Cross-I), Nagarkot x SLS-61 (Cross-II), Janki X SLS-61 (Cross-III), Rashmi x SLS-61 (Cross-IV), Mukta x SLS-61. The scaling tests were applied to the data to detect the presence or absence of non-allelic interactions. Significant values of A, B, C and D scales for almost all the traits in different crosses were found indicating presence of epistasis. Further, joint scaling test was applied to test the adequacy of additive-dominance model and the data from all the crosses where χ^2 values observed significant were further analyzed using six parameter model for their practical implications. In this study duplicate epistasis was more prevalent than complementary epistasis confirming the prevalence of dominance effects indicating that variability in segregating generations may be reduced hindering the selection process making more difficult to utilize them in breeding programme.

CLINICAL, HEMATOLOGIC AND BIOCHEMICAL FINDINGS IN CATTLE INFECTED WITH LUMPY SKIN DISEASE DURING AN OUTBREAK IN KODERMA, JHARKHAND

Sudhanshu Shekhar¹ and Shashi Bhushan Sudhakar²

¹Krishi Vigyan Kendra (ICAR-NRRI, Cuttack), Koderma, Jharkhand

²ICAR-National Institute of High Security Animal Diseases, Bhopal

Corresponding Author Email: sudhanshukoderma@gmail.com

Abstract

Lumpy skin disease (LSD) is a transboundary viral disease of cattle and sometimes buffalo caused by LSD virus (LSDV) of the family *Poxviridae*. In India, LSD was first reported in 2019 in Odisha state and later a severe LSD outbreak reported in Koderma district in Jharkhand state. This study was performed to determine the haematological and biochemical alterations in natural LSD infection in cattle. During an outbreak of LSD in Jainagar and Chandwara block in Koderma district, 20 clinically infected cows aging (2-4 years) were examined and blood and sera samples were collected to measure hematological and biochemical parameters. For the comparison, 10 apparent healthy cows of same age, sex and breed were considered. The affected cattle showed pyrexia (above 40°C), anorexia, ocular and nasal discharges and development of generalized skin nodules along with the enlargements of the prescapular and prefemoral lymph nodes and decreased milk production. In hematologic assessment, the average numbers of erythrocytes, leukocytes, lymphocytes and platelets as well as the average level of hemoglobin in the infected animals were significantly lower than in the healthy group. In biochemical assessment, the average level of total protein and cholesterol were significantly lower than in the healthy group however, the level of urea, AST and ALT were significantly increased.

The results of this study suggest that LSDV infection induces anemia, leucopenia and thrombocytopenia. These alterations could be related to the inflammatory disease processes and injuries in various organs, especially the liver and other complications. AST present in the hepatocytes, skeletal muscle and muscular cardiac cells and its elevation may be attributed to the muscular injuries. A significant increase in blood urea nitrogen is attributed to anorexia, the direct effect of LSDV on the kidneys, loss of muscle mass, increased protein catabolism and reduced renal blood flow during the viraemic stage of LSD. A decrease in serum total cholesterol level is due to viral infectious diseases and stressful conditions. This is the clinical examination that documents hematological and biochemical findings associated with natural LSD infection which may be helpful for choosing a good strategy for rapidly detecting and diagnosing LSDV infection. Understanding the complete blood and serum profile may give further insight to the pathogenesis of the disease and help in management and treatment of cattle.



AN ANALYSIS OF GLOBAL AND NATIONAL STATUS AND EFFORTS FOR PROMOTION OF ORGANIC FARMING IN INDIA

Vikas Kumar^{1*}, Dilip Kumar¹, Sudhir K. Rawat², Ritika³, Mohamad Awais⁴, S.K. Singh⁵ and Kapil K. Singh⁶

¹ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi,

²KVK, Hathras, UP.

³ICAR-Indian Agricultural Research Institute, Pusa, New Delhi

⁴Centre of Agricultural Education, FAS, AMU, Aligarh

⁵Institute of Agricultural Sciences, Bundelkhand University, Jhansi

⁶Gautam Budha University, Greater Noida, GB Nagar, UP

*Corresponding author email: vikas.kumar1@icar.gov.in

Abstract

Organic agriculture, a dynamic and continuously developing farming system based on the science of agro-ecology, is a forerunner of truly sustainable agriculture and offers practical solutions to address major global challenges. Organic agriculture and equally sustainable systems produce healthy, nutritious food and other natural products for a growing population. It is seen that organic farming is growing both at internationally and at national level. The area under organic farming at world level was 29211.2 thousand hectares in 2005 and reached to 72213.3 thousand hectares in 2019. While, its area is increasing fast in Oceania region (49.69 % of world area) and Europe (21.87% of world area). In India, the area under organic farming was 2299.2 thousand hectares (1.3% of total agricultural land) in 2019. The CAGR for area under organic farming is 9.77% at world level and India level is found as 26.14% from 2014 - 2019. In India, few states have taken the lead in improving organic farming coverage, as a major part of this area is concentrated only in a handful of states. The top three states — Madhya Pradesh, Rajasthan and Maharashtra — account for about half the area under organic cultivation. There are many challenges, that are faced by organic farming. A cooperative model may be very helpful to overcome the challenges faced by individual farmers in organic farming. In India, government has also made number initiatives to give a boost to organic farming to harness its potential.

BIO EFFICACY OF ANTIBIOTICS, ANTIBACTERIAL CHEMICALS AND BIO-AGENTS AGAINST TIP OVER DISEASE OF BANANA CAUSED BY *ERWINIA CAROTOVORA* SUB SP. *CAROTOVORA*

S.T. Yenjerappa¹, V. Thiyagarajan¹, Gururaj Sunkad¹ and D.S. Aswathanarayana¹

¹Department of Plant Pathology, College of Agriculture, University of Agricultural Sciences, Raichur, Karnataka

Abstract

Banana (*Musa* spp.) is an important ancient fruit crop of India, which is popularly known as 'Kalpatharu' owing to its enormous utility as food, medicine, culture, traditions and livelihood of the people. Banana is prone to attack by various diseases caused by large number of pathogens such as fungi, bacteria, viruses and nematodes which cause enormous economic losses in terms of production, productivity there by affecting export potential. Among the bacterial diseases, tip-over or bacterial rhizome rot caused by *Erwinia carotovora* sub sp. *carotovora* is of vital important in recent years in Karnataka. The disease manifest itself in the form of pale yellow, lusterless plants with marginal necrosis of leaves and infected rhizomes with massive soft, rotting and brown and black discoloration. Considering the ability of the pathogen invading host with the production of tissue degrading pectolytic enzymes and losses resulted, it is inevitable to manage the disease effectively involving suitable antibiotics, antibacterial chemicals and bio pesticides to save the crop to the largest extent. Hence, efforts were made to evaluate these pesticides both by *invitro* and *invivo* screening methods. Among all the antibiotics evaluated, streptomycin was found significantly effective with mean inhibition zone of 53.9 mm. Comparatively poor efficacy was observed in bacterinashak at all the three concentrations (42.3 mm). Similarly, among the antibacterial chemicals, copper hydroxide, was found to reduce the growth of pathogen to the maximum extent with mean inhibition zone of 39.4 mm. *Pseudomonas fluorescens* was found significantly superior in suppressing the pathogen with an inhibition zone of 21.0 mm among all the bioagents tested. Poor efficacy was exhibited by *Bacillus thuringiensis* (14.60 mm). Based on the performance obtained in *invitro* studies, field evaluation of effective chemicals and bio pesticides was taken up to assess their efficacy against the disease. Results obtained that, streptomycin (500 ppm) in combination with copper oxychloride (2000 ppm) was found significantly superior in controlling the disease exhibiting the highest efficacy of hundred per cent recovery of all the infected plants.



EFFECT OF TILLAGE AND CROP RESIDUE MANAGEMENT ON YIELD OF WHEAT (*TRITICUM AESTIVUM* L.) UNDER CONSERVATION AGRICULTURE

A.J. Rathod*, M.P. Jagtap and S.S. Kinge

Department of Agronomy, VNMKV Parbhani, India 431402

*Email: aishwaryarathod01@gmail.com

Abstract

A field experiment was conducted at Experiment farm of Agronomy Department, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during season *rabi* 2019 in deep black, clayey texture soil on “Tillage and crop residue management in wheat (*Triticum aestivum* L.) under conservation agriculture”. The experimental plot was laid out in split plot design of fifteen treatment combinations replicated thrice. Where in main plot consist of three tillage practices viz., T₁ (Zero tillage), T₂ (Reduced tillage) and T₃ (Conventional tillage) and sub plot to five crop residue management practices viz., R₁ (crop residue @ 2.5t/ha), R₂ (crop residue @ 5t/ha), R₃ (crop residue @ 2.5t/ha + consortia @ 5kg/ha), R₄ (crop residue @ 5t/ha + consortia @ 5kg/ha) and R₅ (without crop residue). The result showed that the reduced tillage was found significantly superior over the zero tillage and found at par with convectional tillage in respect of all yield attributes viz; length of panicle, grain weight plant⁻¹, and also grain yield, straw yield. Among the crop residue management practice application of crop residue @ 5t/ha + consortia @ 5kg/ha i.e., R₄ was found significantly superior over the rest of the treatment and at par with treatment R₂ in respect of all yield attributes viz; length of panicle, grain weight plant⁻¹, and also grain yield, straw yield.

A GOD GIFTED MEDICINAL AND AROMATIC PLANT - FENNEL OVERVIEW

Abhinav* and Hoshyar Singh

Department of Agriculture, Vivekananda Global University Jaipur, 303012 (Raj.)

Email: khedarabhinav@gmail.com

Abstract

Economy of India is based on agriculture and pastoral activities. Nearly seventy percent Indian population dependent on agriculture. India produces in large scale wheat, barley, pulses, oilseeds, spices and medicinal crops. Fennel is a flavorful herb and medicinal plant belongs to family Apiaceae formerly by Umbelliferae. Fennel plant is 1 meter tall and has green and feathery leaves with yellow flower. Crunchy bulbs and seeds of fennel plant have a licorice like flavor. The fennel seeds contain 3 to 4 % essential oil and principal components are anethole and fenchone. Fennel seed known for its antioxidant, antibacterial and anti-inflammatory effects. Fennel is good source of vitamin C, manganese, calcium and potassium which are important for enzyme activation, metabolism, bone development, cellular protection and regulate to blood circulation. Dried fennel seeds contain fiber 2 grams, Vitamin C 1% of the RDI (Recommended Dietary Intake), Calcium 5% of the RDI, Iron 6% of the RDI, Magnesium 5% of the RDI, Manganese 17% of the RDI. Seeds and oil are also used in perfume industry, liqueurs, medicines and sweet pickles.

INFLUENCE OF OZONE TREATMENT ON GLUTEN CONTENT OF WHEAT (*TRITICUM AESTIVUM*) DURING BULK STORAGE

¹Shingala Abhishaben M.*, ²M.N. Dabhi

^{1,2}Department of Processing and Food Engineering, College of Agricultural Engineering and Technology, Junagadh Agricultural University, Junagadh.

³ Department of Biochemistry, College of Agriculture, Junagadh Agricultural University, Junagadh.

Email: abhisha794@gmail.com

Abstract

The purpose of the current study was to determine the effect of gaseous ozone exposure time and ozone cycle on the gluten content of wheat variety-GW 496 during storage. Insects and pests are a serious challenge in the bulk storage of wheat grain in metal silos, which is managed via gaseous ozone treatment. Ozone gas is the preferred and most feasible approach for treating grains while they are stored in bulk since it leaves no residue and is



environmentally benign. The ozone gas treatment was administered to wheat grain during bulk storage in this study, and the influence on wheat gluten content was investigated. A pilot-scale ozone disinfestation system for wheat grains was developed. The two-factorial experimental design on the influence of the parameters of ozone treatment on the gluten content of stored wheat was carried out. Wheat grains were treated by gaseous ozone with various time durations (0 min, 30 min, 60 min, 90 min, and 120 min) and at various frequency cycles (7 days, 14 days, 21 days). The gluten content of wheat during storage was significantly different after every 30-day interval up to 120 days of storage. A decrease from (8.83% to 8.17%) in gluten content was observed for the control sample for the storage period up to 120 days, whereas 60 min of ozone exposure time and 21 days of ozone cycle increased the gluten content from (8.85 to 9.25%) in the ozone-treated sample for the storage period up to 120 days. On the other hand, excess ozone can also cause some negative effects on gluten content. This study provided new insights into how stored wheat grain responds to ozone treatment and highlighted the role of treatment time durations and frequency of cycle for the gluten content of stored wheat.

USE OF ARTIFICIAL INTELLIGENCE IN AGRICULTURE

Abhilasha Gehlot

Rajasthan College of Agriculture, Udaipur, Rajasthan

Email: abhigehlot1995@gmail.com

Abstract

Artificial intelligence (AI) is the branch of computer science that emphasizes the creation of intelligent machines that work and react like humans. It is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the task of using computers to understand human intelligence. John McCarthy came up with the name “artificial intelligence” in 1955. Artificial Intelligence (A.I.) plays a growing role in the eyes of scientists and governments, in an attempt to face this challenge. Despite the relatively short history of this field, complex platforms and devices for solving some specific problems have already been developed (National Research Council USA, 1997) and intensive research projects are on-going. There have been various sorts of efforts to implement artificial intelligence and check the innumerable effect it has on different aspects like production time, assistance, output etc. Researchers are constantly working on technologies like machine learning, neural network to aid artificial intelligence as a product for human use. Agriculture is seeing rapid adoption of Artificial Intelligence (AI) and Machine Learning (ML) both in terms of agricultural products and in-field farming techniques. Cognitive computing in particular, to become the most technology in agriculture services. It can understand, learn, and respond to different situations (based on learning) to increase efficiency. Currently, Microsoft is working with 175 farmers in AP, India to provide advisory services for sowing, land, fertilizer and so on. This initiative has already resulted in 30% higher yield per hectare on an average compared to last year.

CRISPR : AN INNOVATIVE TECHNOLOGY FOR CROP IMPROVEMENT

Abhishek Kumar¹, Bishun Dev Prasad², Satish Kumar¹, Satyendra³

¹Department of Genetics and plant breeding DRPCA U Pusa Samastipur, 848125

²Department of Agricultural Biotechnology & Molecular Biology, College of Basic Sciences & Humanities, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, 848125

³Department of Plant Breeding and Genetics BAU Sabour Bhagalpur, 813210

*Email: abhi155125@gmail.com

Abstract

Food security is important to feed our fast-growing population in near future due to biotic stress. Statistical survey reveals that yield loss in major staple crops like 30% in rice, 21.5% in wheat, 22.5% in maize, 17.2% in potato and 21% in soyabean respectively during the period of 2010 to 2014. The global population is expected to cross more than ten billion people by



2050. In addition to depletion of available agricultural land and water global food demand will increase by 25 to 70%. So, this situation shows a major concern to feed the raising population in light of climate change. Therefore, it requires important steps to full fill the food demand. One of the major management strategies like chemical pesticides are adopted but it leads to create disturbance in food chain as well as plant pest become resistant to many pesticides due to indiscriminate application of the pesticides. Therefore, an efficient and fast tool is immediately needed which can provide resistance without yield penalty. Vertical and horizontally resistant in plants towards pests and diseases can help in cutting of pesticide and yield losses by using conventional breeding, mutation breeding, transgenic or editing approaches. Another conventional plant breeding approach is generally adopted for disease resistance via backcrossing method but it shows limitations in introgression of resistance gene (R-gene) and resistance breakage after some time make this technology mostly undependable in present scenario of climate change and human population explosion. Transgenic method of crop improvement is robust, specific and less time consuming but it is incapable to fit in public domain due to strict biosafety rules and regulations. These never-ending challenges requires faster and newer methods using site specific nucleases (genome editing technology) to achieve disease resistance without hampering yield and any other important traits. Due to technological advancements more recently CRISPR-based gene editing technologies have increased. This technology was discovered as a unique genomic locus in *E. coli* in 1987 identified as a acquired immunity in most of the bacterial system. It enabled the targeted induction of double strands break at desired portion of genome and includes three important components: crRNAs, tracrRNA, and Cas protein. The crRNA and tracrRNA combined to form single guide RNA (gRNA). This system is an RNA-guided DNA binding complex in which CrRNA binds to a 20-nt sequence of complementary target DNA, then Cas9 makes a double strand break (DSB) which is located 3 bp upstream of PAM sequence. This CRISPR based technology leads to rapid crop improvement in variety of way as it generates diversity and crop domestication, increasing crop yield potential, improving crop product quality and enhancing crop resistance/tolerance to biotic/abiotic stress. In addition to that it also helps in Knock-out of multiple genes, engineering efficient plant metabolic pathways, transcriptional regulation, chromosomal segment restructuring and multiplex base alterations.

SEEDLING QUALITY AND QUALITY PARAMETERS IN MEDICINAL & AROMATIC PLANTS

Abhishek Sharma¹, Yashpal Sharma¹ and Pankaj Sharma²

¹Dr YS Parmar, University of Horticulture & Forestry, Nauni, Solan (H.P.).

²Himachal Pradesh State Biodiversity Board, Paryavaran Bhawan, Shimla. 171001

Email: email: abhi87manu@gmail.com

Abstract

Quality is a Latin word “QUALITAS” which refers to Attributes, Property or basic nature of an object. Quality is defined as “The totality of features and characteristics of a product or services that bears its ability to satisfy stated or implied needs” (ISO 8402-1986). It is not absolute and can only be judged or realized by comparison with some specified standard(s), once achieved- the quality of the product can be described as “better or worse” or “higher or lower”. **Quality seedlings** are those that meet defined levels of performance (survival and growth) on a particular planting site. Quality seedlings targeted for different sites may look different from each other but they all have one thing in common: a well-developed root system with many root tips from which new roots can quickly develop. The clients and the conditions at the site where the seedlings will be planted (site) determine what kind of seedling is needed. A researcher will require planting stock raised under uniform conditions to ensure that research results are not confounded by the status of the seedlings. Seedling quality evaluation can be used to establish benchmarks at specific points, such as time of lift or delivery, so that the nursery and the customer have a quantitative appraisal of a particular seedling lot. Seedling quality data can help users to better understand seasonal patterns among species, stock types, seed lots, and cultural treatments. Quality parameters in MAP's- Herbal drug preparations are supposed to be produced with high “Quality”. Quality encompasses all the properties of the final product which makes it optimal suitable for it's intended use. Indian herbal drug industries generally face the problem of adulteration and substitution which is the burning problem in herbal industry and has caused major effect in the commercial use of natural products.

To meet out the great demand of the botanicals for producing standardized and quality herbal market and to promote export it is essential to maintain the quality of herbs used for the preparation of these products. Therefore, identity of plant species, variety/chemotypes, time of harvest, drying, storage, packing are some of the important steps for producing quality herbal medicine and desirable therapeutic effects. Quality assurance can be achieved by using pharmacogenetic parameters, HPTLC,



HPLC, GC and other modern tools. These steps are important for keeping raw herbs devoid of foreign matter, pesticides and heavy metal as per WHO limits (AYUSH). Some essential steps to ensure quality of herbal product include compliance with GMP, preparation of standard formulations, preparation of SOP's, strict adherence to standard protocols and quality of raw materials, etc.

SCREENING OF INDIAN MUSTARD (*BRASSICA JUNCEA* L.) GENOTYPE (S) AGAINST FUNGAL DISEASES BASED ON DISEASE INDEXING AND MOLECULAR MARKERS

Aditi Shrivastava* and Manoj Kumar Tripathi

Department of Genetics & Plant Breeding, Rajmata Vijayaraje Scindia Krishi Vidyalaya, Gwalior (M.P.)

*Email: aditishrivastava007@gmail.com

Abstract

Indian mustard (*Brassica juncea* L. Czern. & Coss) is the dominant species of the Brassica group of oilseed crops, which is a naturally occurring amphidiploid ($2n = 36$, AABB genome). In India, fungi-related problems with Indian mustard are becoming a big issue. In terms of production, India ranks third in the world for mustard farming. Due to the low productivity of Indian Brassica genotypes, India is the world's largest importer of edible oil; therefore, the urgent need for high yielding better cultivars. During present research, a field experiment was carried out at Research Farm and laboratory work at Plant Molecular Biology Laboratory, Biotechnology Center, RVSKVV, Gwalior (M.P.). Experimental material consists of 75 genotypes with diverse reactions against different fungal diseases. On each genotype, the start of blooming coincided with the emergence of white rust pustules. *Albugo candida*, which causes white rust, and *Erysiphe cruciferarum*, which causes powdery mildew, were both studied in the field and rated on a scale of 0 to 9. Furthermore, using 77 SSR and SCAR genetic markers, molecular characterization of Indian mustard genotypes against several fungal infections was carried out. The results of 21 molecular markers were polymorphic. Also analyzed were biochemical parameters such protein, reducing and non-reducing sugar, chlorophyll, total sugar, amino acids, phenol, proline, and malondialdehyde (MDA) test. The biochemical parameters were estimated in two stages, from healthy as well as mustard plants infested with different fungal diseases. The fungal diseases resistant/tolerant genotype (s) can be employed for further crop improvement programme that can withstand fungal infestation and harsh climatic conditions.

THERAPEUTIC MANAGEMENT OF CAPRINE MASTITIS

Aditya Kumar¹, Harshit Saroha², Amit Kumar Verma^{3*}, Arbind Singh³ and Ayush Pal⁴

¹Department of Veterinary Medicine, College of Veterinary and Animal Sciences, G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India (Pin:263145)

²Department of Animal Reproduction, Gynecology and Obstetrics, ICAR-National Dairy Research Institute, Karnal, Haryana, India

³Department of Veterinary Medicine, College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh, India

⁴B.V.Sc and A.H. scholar, College of Veterinary and Animal Sciences,

Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh, India

*Email: drakverma79@gmail.com

Abstract

Mastitis is the one of the most common infectious diseases among goats specially in dairy breeds. This disease is mainly caused by bacteria (*Staphylococcus spp.*, *Streptococcus spp.*, *E. coli* and *Clostridium spp.*), virus (Caprine arthritis encephalitis virus), mycoplasma (*Mycoplasma capricolum* and *Mycoplasma mycoides*), fungus and by physical injuries to udder and teats. The mastitis may be of clinical or subclinical depending on sign and symptoms. In case of clinical mastitis fever, anorexia, clots and flakes in milk are observed, udder and teats become hypersensitive to physical stimulations and udder become fibrosed while in case of subclinical form there is no such symptoms. Kid mortality is common in case of caprine mastitis. Diagnosis is done by using Somatic Cell Count (SCC), California mastitis test (CMT), strip cup test and bacterial culture. Several strategies can be taken in consideration for the management of the disease: Dry off therapy, selection of antimicrobial drug according to culture sensitivity report, anti-inflammatory and supportive treatment. Serratiopeptidase



bolus and some homeopathy medicines such as *conium*, *Belladonna* are found to be effective in case of hot-fibrosed udder conditions. Mamiup bolus (nutritive elements and herbs) and mammidium powder (nutritive elements like selenium, vit. E etc.) are efficacious in regulating milk pH and enhancing the udder immunity. A proper management of the hygiene is still considered to be the most effective measure to control mastitis.

FOOT AND MOUTH DISEASE OUTBREAK INVESTIGATION IN MUZAFFARNAGAR DISTRICT OF UTTAR PRADEH

Afroz*, Amit Kumar Verma, Amit Kumar, Surendra Upadhayay, Arbind Singh and T.K. Sarkar

Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh-250110, India

*Email : afrozbeg7@gmail.com

Abstract

Foot and mouth disease (FMD) is highly contagious, devastating and economically important disease affecting the cloven-footed animals in India. In the present study, the Foot and mouth disease outbreak investigation was undertaken to identify the causative virus serotype in the affected village of Muzaffarnagar district of Uttar Pradesh. The affected animals in the village Chappar, district Muzaffarnagar were showing the clinical signs viz., pyrexia, vesicular lesions on tongue, gums, dental pads and teats, increased salivation, anorexia and reluctant to move. Specimen such as vesicular epithelium from tongue, dental pad and blood were collected for further laboratory confirmation. The FMD virus serotype involved in the outbreak was identified by antigen detection ELISA from clinical samples and further confirmed by reverse transcription polymerase chain reaction (RT-PCR). The blood samples (07) were processed for serum separation and further screened for the presence of antibodies against non-structural proteins of Foot-and-Mouth disease virus using NSP-ELISA. On laboratory examination, the outbreak was confirmed to be due to FMD virus serotype A. The purchase of contaminated cattle and buffaloes from the neighbourhood market and animal mingling with those from other villages were considered as potential common causes of the outbreak. The prevalence of FMD in Uttar Pradesh is a cause for serious worry as widespread vaccination campaigns against the disease are ongoing in cattle and buffaloes. This research makes a plea to the national and state authorities to enact stringent laws governing the movement of animals and to further enhance monitoring and surveillance programmes.

EFFECT OF NON-GENETIC FACTORS ON LINEAR TYPE TRAITS SCORE IN SAHIWAL CATTLE

Ajay Kumar, S.S. Lathwal, Rajneesh Sirohi, D.N. Singh, Yajuvendra Singh and Mamta

ICAR-National Dairy Research Institute Karnal- 132001(Haryana), India

Email: vet.vinodsingh@gmail.com

Abstract

The present study was to investigate the changes of linear type score in Sahiwal cows. For this purpose, 246 observations were obtained from 23 linear type traits on 150 Sahiwal cattle. All the data were analyzed by using univariate analysis of variance in the GLM of SPSS. The overall means and standard error of different linear type traits viz., stature (ST) 5.82 ± 0.10 , chest width (CW) 4.69 ± 0.11 , body depth (BD) 5.31 ± 0.11 , rump width (RW) 5.51 ± 0.11 , rump angle (RA) 4.42 ± 0.10 , rear legs set (RLS) 4.67 ± 0.13 , foot angle (FA) 4.91 ± 0.12 , fore udder attachment (FUA) 4.71 ± 0.13 , rear udder height (RUH) 5.55 ± 0.12 , udder depth (UD) 5.23 ± 0.08 , rear udder width (RUD) 4.27 ± 0.11 , central ligament (CL) 3.97 ± 0.09 , fore teat length (FTL) 3.82 ± 0.12 , rear teat length (RTL) 3.96 ± 0.11 , teat circumference (TC) 4.21 ± 0.13 , teat diameter (TD) 4.11 ± 0.13 , udder balance (UB) 5.24 ± 0.13 , angularity (ANG) 4.82 ± 0.11 , rear legs rear view (RLRV) 5.08 ± 0.07 , body condition score (BCS) 6.33 ± 0.10 , locomotion (LM) 4.84 ± 0.08 , fore teat placement (FTP) 4.40 ± 0.09 and rear teat placement (RTP) 6.36 ± 0.06 , respectively in Sahiwal cattle. Season was non-significant effect on linear type traits in present study. Parity had significant ($p < 0.05$) effect on chest width, body depth, rump width, fore udder attachment, udder depth, rear udder width, central ligament, fore teat length and rear teat length. Stage of lactation had significant ($p < 0.05$) effect on body depth, body condition score, rear udder height and rear udder width. The main issue of dairyman to reduced the adverse effect of environmental factors on conformation traits of dairy animals. The result of our study showed considerable effect on environmental factors on linear type traits of Sahiwal cattle, while parity and stage of lactation were main source of environmental factors affecting the linear type traits.



EFFECT OF MACHINE MILKING ON PHYSIOLOGICAL, BEHAVIOURAL AND PRODUCTION PERFORMANCE OF BUFFALOES

Ajay Kumar, Yajuvendra Singh, Mamta, Rajneesh Sirohi, D.N. Singh
ICAR-National Dairy Research Institute Karnal-132001(Haryana), India

Abstract

Buffalo is the principal dairy animal in the developing countries of Asia and the main stay of the Indian dairy industry, contributing over 49.50% of the total milk production. Much work has been done on the milking management of dairy cattle, sheep and goat, but comparatively little research data is available on the milking management of buffaloes. Mechanized milking is commonly used today in buffalo farms to reducing the labour cost, improving the productivity of farms and increasing the hygiene of milk are the key factors for machine milking of dairy buffaloes. The physiology of the buffalo udder differs slightly from other bovine. Buffaloes are said to be slow and hard milkers because of their slow milk ejection reflex and their hard teat sphincter muscle. Availability of the cisternal fraction, mode of milk ejection and teat dimensions and teat sphincter resistance are some of the established factors known to influence the efficiency of machine milking in dairy animals. Normally milk ejection occurs within 2-3 minutes after manual pre stimulation, but may be as long as 10 minutes with the concomitance of oxytocin and prolactin release. The vacuum level applied to buffalo varies in the range 40 to 52kPa. The use of high working vacuum in absence of cisternal milk can cause irritation in mammary tissue and stress to the animals. Good temperament is often equated with or used to describe calm behaviour of the animal while poor temperament describes an animal that appears more disturbed and agitated. The docile buffaloes have a higher rate of concentrate intake, shorter let-down time, slightly longer milking time, higher daily milk yield and higher milk flow rate. It may be concluded that buffaloes compared to cows with regard to milk flow traits is scant; more studies may be needed in this regard.

THE EFFECTS OF DIFFERENT AGRO-WASTES ON THE GROWTH AND YIELD OF OYSTER MUSHROOMS (*PLEUROTUS FLORIDA*) IN UTTARAKHAND

Abhishek Bahuguna¹ and Neelam Devrari²

¹KVK, GBPUAT, Pantnagar, Gairwa Pithoragarh, Uttarakhand

²Sai Institute of Paramedical and Allied Sciences, Dehradun,

Email: sanbhi11@gmail.com

Abstract

The study was conducted to compare the effects of different agro-wastes on the growth and yield of oyster mushrooms (*Pleurotus florida*). Thirteen substrate formulas including wheat straw, corncob, news paper, sugarcane waste alone and in combination of 80:20 (wheat straw and corncob), 80: 20 (wheat straw and news paper), 80: 20 (wheat straw and sugarcane waste), 100 (wheat straw), 100 (corncob), 100 (news paper), 100 (sugarcane waste), 25: 25: 25: 25 (wheat straw, corncob, news paper and sugarcane waste), 40: 20: 20: 20 (wheat straw, corncob, news paper and sugarcane waste), 50: 50 (wheat straw and corncob), 50: 50 (wheat straw and news paper), 50: 50 (wheat straw and sugarcane waste), 50: 50 (corncob and sugarcane waste) were investigated. The results indicated that different substrate formulas gave a significant difference in total colonization period, characteristics of fruiting bodies, yield per bag, and total yield of oyster mushroom. All the treatment significantly increased days taken to spawn running, Days taken to pinning, number of mushroom per bag, yield per bag (kg), total yield (kg) and total dry weight (kg). The best treatment was found to be T₄ treatment (100 wheat straw).

POPULATION DYNAMICS OF WHITEFLY (*BEMISIA TABACI*) ON BRINJAL WITH PREVAILING WEATHER CONDITION

Ajita Soren* and M.K. Chakravarty

Department of Entomology, Faculty of Agriculture, Birsa Agricultural University, Kanke, Ranchi-834001(Jharkhand)*Email: sorenajita@gmail.com

Abstract

Brinjal, (*Solanum melongena* L.) is an important vegetable crop and due to versatility in use in Indian food, brinjal is often described as “the king of vegetables”. In Jharkhand, the area under brinjal cultivation was 5,581 hectares with production of



67,864 tons in the year 2011-12. A field experiment was conducted at the Commercial Horticulture Unit of Birsa Agricultural University, Kanke, Ranchi during rabi season of 2016-2017 and 2017-2018 for observing the incidence and abundance of whitefly (*Bemisia tabaci*). Soon after the transplanting the activity of whitefly started. The severe attack of whitefly was observed from 34th August 2016 to 2nd January 2017. The highest whitefly number per leaf was found as (9.3/3 leaves) at maximum temperature and minimum temperature 24.6°C and 4.8°C, respectively. The correlation was found positive and highly significant ($r = -0.833^{**}$) with maximum temperature ($r = -0.833^{**}$) and ($r = -0.792^{**}$) minimum temperature. The Correlation coefficient was observed ($R^2 = 0.760$). The maximum relative humidity and minimum relative humidity was ($r = -0.522^*$) and ($r = -0.329$) respectively observed the negatively significant and negatively significant correlation with population of whitefly. In the consecutive year 2017-18, the peak (11.5/ 3 leaves) whitefly activities were recorded at 42nd SMW. The pest was active throughout the season with a fluctuation range of 3.8 to 11.5 whitefly per three leaves. The correlation was found and highly significant ($r = -0.715^{**}$) with maximum temperature ($r = -0.715^{**}$) and ($r = -0.703^{**}$) minimum temperature. The different weather conditions together were able to explain up to the extent of 76-84 per cent population dynamics fluctuation in whitefly numbers.

STUDY AND OPTIMIZATION OF ENERGY REQUIREMENT IN MAJOR CROPS OF UTTARAKHAND

Akanksha* and T.P. Singh

Department of Farm Machinery and Power Engineering, College of Technology, GBPUAT Pantnagar, Uttarakhand India

*Email: akanksha18792@gmail.com

Abstract

India is a predominantly agricultural country. About 70% of its population depends on agriculture. Food grain productivity in the country increased linearly from 0.71 t/ha to 2.39 t/ha as power availability climbed from 0.3 kW/ha in 1961-62 to 2.76 kW/ha in 2020-21. Food grain production covers the dominant part of the cropped area (65%) in Indian agriculture. India is the second-largest producer of wheat, rice, pulses and sugarcane. The highest food grain production of 316.06 million tonnes was recorded in 2021-22. Total geographical area of Uttarakhand is 3055sq km and the soil is alluvial in nature. Major crops are Paddy, Wheat, Sugarcane with the area of 98565ha, 95515ha, 41374ha respectively. Production of 310108 MT, 365049MT, 234200MT respectively with the productivity of 31.46Qtl/ha, 38.22Qtl/ha, 566.0Qtl/ha respectively. The scope for bringing new areas under these crops is very limited, so the yield should be raised by adapting mechanized and optimal practices. Nowadays cropping pattern, farm activities and level of technology define the energy requirements. Energy requirements in agriculture are divided into two groups, direct and indirect. Direct energy is required to perform various tasks related to crop production processes such as land preparation, irrigation, intercultural, threshing, and harvesting and transportation of agricultural inputs and produce. Direct energy is directly used at farms and on fields. Indirect energy, on the other hand, consists of the energy used in the manufacture of machineries, agri-chemicals, energy possessed by seed and fertilizers. All inputs were converted to energy units using the energy coefficients. Therefore, the energy consumed was calculated using conversion factors and expressed in MJ/ha. Irrigation is the most energy consuming operation with about 43% of total energy inputs. Electricity, fertilizers, fuel and machinery are the main energy inputs. The yield and total energy input will be fitted with mathematical relationships. Optimizing energy consumption can conserve energy while maintaining a constant level of yield, maximize productivity, and reduce production costs. Therefore, by ensuring optimal energy inputs in different crops in different regions of the Country production could be increased.

SOYBEAN ENHANCEMENT THROUGH BREEDING AND BIOTECHNOLOGICAL APPROACHES

Akash Barela*, Shivangi Rahangdale and Praveen Singh

Department of Genetics and Plant Breeding, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) India

*Email: akashbarelagpb@gmail.com

Abstract

Earlier stages of plant breeding programs focus on high-quality phenotypes and are still a constraint to improve genetic gain. Biotechnology can be defined broadly group tools that allows scientists to genetically improve living organisms. Several upcoming technologies, such as molecular characterization and genetic manipulation, are already being used extensively for



the purpose of plant development. Other emerging technologies, includes genomics and proteomics, are also starting to impact plant improvement. Tools provided by biotechnology will not replace classical breeding methods, but rather will help provide new discoveries and contribute to improved nutritional value and yield improvement through greater resistance to biotic and abiotic factors. In soybeans, biotechnology has and will continue to play a important role in soybean breeding programs. Availability and combination of conventional and molecular technologies, a substantial increase in the rate of genetic gain for economically important soybean traits can be predicted in the next decade. In this paper, a short review of technologies for molecular markers analysis and CRISPR genome editing tools in soybean in the area of genetic transformation in soybean.

VARIATION IN TREE GROWTH CHARACTERS IN CLONAL POPULATION OF SAND PEARS

Akriti Chauhan¹, Dinesh Singh², Vishal S. Rana³ and R.K. Dogra⁴

¹Regional Horticultural Research and Training Station, Mashobra (Shimla) H.P.

²Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan H.P.

Email: chauhanakriti7@gmail.com

Abstract

The study was conducted on existing sand pear plantations in Solan, Sirmour and Shimla districts of Himachal Pradesh during 2018-2020. On the basis of pre selection survey, a total of 125 healthy sand pear genotypes were marked and further subjected to morphological characterization to study the nature and magnitude of variability among them. Marked trees were observed to be fastigate to upright to semi-spreading to spreading to weeping to drooping in growth habit, trunk girth in Solan, Sirmour and Shimla varied between 25.60- 90.40 cm, 22.63-104.83 cm and 38.43-95.23 cm respectively. Yield and yield efficiency ranged from 38.00-83.00 kg/tree, 36.00-94.00 kg/tree and 48.00-98.00 kg/tree, and 0.13-1.35 kg/cm², 0.09- 1.55 kg/cm² and 0.11-0.83 kg/cm². The substantial variability present among these sand pear genotypes will not only help in exploitation of lesser-known fruits like sand pears but will also help in diversification in present day horticulture to meet the demands of growing population.

ISOLATION AND IDENTIFICATION OF DYE TOLERANT FUNGAL SPECIES FROM MALACHITE GREEN DYE TREATED SOIL FOR THE DEVELOPMENT OF FUNGAL BIOMASS TO ENHANCED DYE BIOSORPTION FROM POLLUTED WATER

Amit Kumar^{1*}, Sanjay Kumar¹, Ashu Tyagi² and Raj Singh³

¹Department of Botany, Maharaj Singh College Saharanpur (UP) India

²Department of Botany C.C.S. University, Meerut, UP, India.

³Deptt. of Biotechnology, Maharishi Markandeshwar (Deemed to be University), Mullana-Ambala, 133207, Haryana, India.

*Email: amitsaini.saini421@gmail.com

Abstract

The present study was aimed to find out the fungal strains from malachite green dye treated soil in search of efficient biosorbent for dye biosorption. The collected soil was sampled treating with different concentrations (100, 250 and 500 ppm) of MG dye over a period of 45 days. Simultaneously, a sample of soil was prepared treating with distilled water which served as control soil. From the control soil and MG dye-treated soil, dye tolerant fungi were isolated and identified on the basis of morphological characters. The key characteristics for identification were studied with microscopic examination. A total of 41 fungal species could be isolated from control and MG dye treated soil. After 15 days the maximum number of isolates (327 isolates of 28 species) could be isolated from control soil, which further showed gradual reduction upto the 45th day. After 30th day total 105 isolates of 14 species could be isolated from control soil while from the control soil after 45th day 130 isolates of 12 species could be isolated. From MG dye treated soil the maximum number (236 isolates of 12 species) of isolates were isolated from 100 ppm MG dye treated soil after 15 days which decreased to 71 isolates in 250 ppm MG dye treated soil and 119 isolates (of 17 species) in 500 ppm MG dye treated soil. After 30 days the number of isolates was declined in MG dye treated soils as 131 isolates from 100 ppm MG dye treated soil, 94 isolates from 250 ppm MG dye treated soil and 119 isolates (of 9 species) from 500 ppm MG dye treated soil. After 45 days the number of isolates was again reduced in comparison of 15- and 30-days treatments. 95 isolates in 100 ppm MG dye treated soil, 120 isolates from 250 ppm MG dye treated soil and 64 isolates from 500 ppm MG dye treated soil could be isolated after 45 days. Out of total forty-one isolated species, *Aspergillus*



flavus, *Aspergillus niger*, *Penicillium glabrum* and *Aspergillus fumigatus* were found to have high tolerance to malachite green dye, even upto 500 ppm concentration of dye. The capacity of these fungi to resist different concentrations of MG dye is in full agreement with the opinion that these species can be used as biosorbents for biosorption of malachite green dye from polluted waste water.

EFFECT OF *SESBANIA ACULEATA* AS BROWN MANURE ON ECONOMICS OF DRY DIRECT SEEDED RICE-WHEAT SYSTEM

Akhilesh Sah*, Md. N. Ali, Abhishek and D.N. Singh

Birsa Agricultural University, Kanke, Ranchi

*Email: akhilesh.chiyanki@gmail.com

Abstract

Present study was undertaken to assess the scope of *Sesbania aculeata* as brown manure on economics as well as to cut down the nutritional requirement of direct seeded rice and transplanted rice-wheat system cropping system. Results revealed that Puddle transplanted treatment having 100% NPK with *Sesbania aculeata* recorded highest rice grain yield (42.8 q/ha) which was statistically at par to dry direct seeded rice treatment having 100%, 75% and 50% NPK with *Sesbania aculeata*. The yield of wheat after puddled transplanted rice was recorded lower than the wheat grown after direct-seeded rice. System productivity, net returns and B: C ratio of DSR-wheat was higher (74.9 q/ha, 25 kg grain/kg nutrient applied, 3.3%, Rs. 64349.1/ha, 1.18) compared to puddle transplanted rice-wheat (73.8 q/ha, 24.5 kg grain/kg nutrient applied, 0.6 %, Rs. 58138.2 /ha, 0.96, respectively). The highest B: C ratio (2.37) was recorded in treatment having 50% NPK of recommended dose, which was statistically at par with the treatment having 75% NPK of recommended dose. Interaction effect of nutrient application coupled with crop establishment method revealed that the highest B: C ratio (1.77) was registered also in DSR-wheat system having 50% NPK of recommended dose.

DIFFERENT BIOFERTILIZER FORMULATIONS AND THEIR EFFECT ON GROWTH PARAMETERS IN CHILLI

¹Alka Kataria, ¹Stuti Bhatnagar and ²R.G. Dudwal

¹IIS (Deemed to be University), Jaipur, Rajasthan

²Rajasthan Agriculture Research Institute, Jaipur, Rajasthan

Email: alka.kataria@iisuniv.ac.in

Abstract

The purpose of the present study was to compare the effect of liquid and carrier based biofertilizers on Chilli using pot culture with treatments; T1: Absolute control, T2: Control + Vermicompost, T3: Liquid bio-fertilizer + Vermicompost, T4: Carrier based bio-fertilizer + Vermicompost and T5: Liquid bio-fertilizer + Carrier based bio-fertilizer + Vermicompost. The study highlighted that combined inoculation of liquid bio-fertilizer and carrier-based bio-fertilizer (*Azotobacter*) could enhance the growth parameters such as height of the plant, shoot length, root length and biochemical constituents such as chlorophyll compared to individual inoculation and control. The physico-chemical parameters also highlighted the increase in available nitrogen and phosphorus in the tested soil.

SENSORS DETECTING CONTROLLED FERTILIZER RELEASE

Amit Kumar Pandey* and Ashutosh Singh

Mandan Bharti Agriculture College, Agwanpur, Saharsa

*Email: amitpandeybau@gmail.com

Abstract

One of the serious issues that the world is facing now days is the adverse effects of fertilizers on the environment. The improper application of fertilizers on farmlands had led to pollution of water, air, and soil. Currently, the world is facing the problem of an exponential increase in population. The population of this planet was around three billion in 1960, which is



expected to reach nine billion in 2040. The world does not have too much time to ensure that there is enough land, food, water, and energy for the fast-growing population. At the same time, the rising food demand brings a positive surge in the fertilizers' demand and consequently the agriculture-based economy. As revealed by the International Fertilizer Association, the world uses 170 million tons of fertilizer every year for food, fuel, fiber, and feed. Among this, the nitrogenous fertilizers are being used to meet 48% of the total food demand of the world. High fertilizer inputs augment the reactive nitrogen level in soil, air, and water. Unused reactive nitrogen acts as a pollutant and harms natural resources. Therefore, researchers are investigating different methods and mechanisms to minimize losses during fertilization for high crop yield. The use of controlled release fertilizers for slowing down the nutrients' leaching has recently been practiced by farmers worldwide. The added advantage of such fertilizers is the availability of a controlled amount of nutrients in the soil for longer periods of time. However, to date, monitoring of the complete discharge time and discharge rate of controlled released fertilizers is not completely understood by the researchers. Different types of sensors are being developed to monitor the discharge parameters of controlled release fertilizers. The proposed chapter will review different types of sensors for monitoring the controlled release fertilizers, reported in the past literature. Special emphasis will be placed on Nano sensors, optical sensors, electrochemical sensors, proximal sensors, and airborne sensors.

DUAL PURPOSE CEREALS TO MEET FORAGE NEEDS

Amit Sharma*, A.K. Dhaka and Kamal

Department of Agronomy, CCS Haryana Agricultural University, Hisar-125004, Haryana (India)

*Email: amitsharma110297@gmail.com

Abstract

Agriculture is the backbone of Indian economy due to diverse agro-climatic conditions, the successful production of various types of crops could be possible. Indian soils are famous for production of cereals, oilseeds, pulses, beverages, spices *etc.* However, both quantitatively and qualitatively, we are still far behind in fodder production. Forages are the primary source of animal wealth and their production is the backbone of livestock industry. Due to continuous decline in the size of agricultural land holdings and growing food security concern, there is no scope to increase the area under fodder production. Cultivation of dual-purpose cereals could be a better option to meet out the problem of land shortage and fodder scarcity. Therefore, growing dual purpose cereal varieties can serve both the concerns of growing food demand and forage shortage. Cereals like wheat (*Triticum aestivum*), oats (*Avena sativa*) and barley (*Hordeum vulgare*) can be used as dual purpose *i.e.* these can be used as a source of grain as well as fodder. These crops have production potential to meet the requirements of human as well as livestock population. Both barley and oat are an important crop in India which is used for feed and fodder purpose. These are highly nutritious and energy rich crop having good regeneration ability along with high dry matter content. Taking one cut for green fodder at 50-55 days after sowing and grain production from regrowth, improves the economics of multi-cut fodder cultivation. Growth of plant is directly related to the nutrient supply and if it is in the integrated form, it adds more to growth. Being a fast growing and high yielding crop, oats require a large quantity of fertilizer nitrogen for enhancing production of quality herbage. Balanced fertilizer use along with organic manure like farm yard manure (FYM) is considered as promising agro- technique to sustain yield, increase fertilizer-use efficiency and restore soil fertility. So, to obtain higher yield (fodder & grain) both quantitatively and qualitatively balanced dose of fertilizers should be used to meet fodder needs.

IMPROVEMENT OF CATTLE GERMLASM THROUGH PROGENY TESTING PROGRAMME

Anamika¹ and Vinesh Yadav

¹Student, Ph.D. Scholar, Lala Lajpat Rai University of Veterinary Sciences, Hisar, India

Email: anamikagothwal1995@gmail.com

Abstract

Selection is the process a breeder uses to achieve long-term changes in an animal breeding population. Prior to independence, sires were chosen in India based on breed features and pedigree information when it was available. The most effective strategy for dairy breed improvement entails thorough testing of the progeny of a large number of bulls and rigorous selection of the tested bulls. Recent studies have shown that the extensive usage of bulls and the examination of their progeny have been a major source of genetic improvement in dairy animals. The use of crossbred bulls with established genetic levels and foreign



blood may help improve unremarkable animals and advance genetic development in crossbred herds. Progeny testing may also be used to identify individuals who are heterozygous for a problematic recessive trait. In India, there are not enough bulls that have been progeny tested, and even when there are small numbers of bulls that have been tested, the results are rarely repeatable because the progeny tests are based on a small number of daughters who were often raised at institutional farms. The progeny testing programmes must be expanded to farmers' herds, where many daughters per bull can be generated and recorded, due to the limited facilities offered by institutional farms. In the middle of the 1980s, the Project Directorate on Cattle (PDC), now known as the Central Institute for Research on Cattle (CIRC), in Meerut, Uttar Pradesh, began a massive field progeny testing (FPT) programme in cooperation with agricultural universities and non-governmental organizations at various agro-climatic regions of the nation.

IMPACT OF HEAT STRESS ON PERFORMANCE OF POULTRY

Anamika and Vinesh Yadav

Lala Lajpat Rai University of Veterinary Sciences, Hisar, India

Email: anamikagothwal1995@gmail.com

Abstract

The management and production of poultry is facing a significant challenge as a result of global and Indian climate change. Environmental temperatures, precipitation patterns, and atmospheric carbon dioxide have all changed as a result of climate change. Heat stress in chicken production results in substantial financial losses, particularly in tropical and desert regions of the world. Recent researches have looked into the impact of heat stress on the welfare and productivity of chicken. Oxidative stress, an acid-base imbalance, and immunocompetence suppression are just a few of the physiological changes brought on by heat stress. These changes increase mortality and reduce feed efficiency, body weight gain, feed intake, egg production, and egg quality, as well as the production and quality of meat. The detrimental effects of heat stress on avian behaviour, wellbeing, and reproduction have been the subject of recent studies. Feed supplementation and management have been the main methods used to reduce heat stress in poultry farms, but the results haven't always been reliable. Nutritional techniques that have been extensively researched and found to lessen the harmful effects of heat stress includes reducing the feed, dual feeding, adding fat to the food, and supplementing vitamins, minerals, osmolytes, and phytochemicals. Environmental changes (early heat conditioning, open sheds, and cooling systems) are effective in management measures to lessen heat stress in chickens. Only a few of these methods, however, seen widespread application in the poultry business. Therefore, the impact of heat stress on the health and productivity of poultry requires feasible preventative measures for broiler chickens and laying hens.

SOIL HEALTH MANAGEMENT AND PRACTICES: KEY FACTOR FOR CROP PRODUCTIVITY

Anchal Singh^{1*}, Shweta Gupta¹ and Ashutosh Kumar²

¹Department of Agronomy, Banda University of Agriculture and technology, Banda, Uttar Pradesh, 210001.

²Deptt. of Soil Science and Agricultural Chemistry, Banda University of Agriculture and Technology, Banda, U.P., 210001

*Email: *anchalsinghbuat123@gmail.com

Abstract

Healthy soils are the foundation of good agricultural ecosystems that are directly related to food and nutritional security, human health, biodiversity, water quality and climate change mitigation. Healthy soil is that which allows plants to grow their maximum productivity without diseases or pests and without a need for off-farm supplements. By understanding how the soil processes that supports plant growth and regulate environmental quality are affected by management practices, it is possible to design a crop and soil management system that maintains and improves soil health for longer period. Soil fertility and health management practices plays a vital role in crop production and increases the productivity of crops. Due to continuous cultivation of crops, nutrients in soil get degraded. In order to fulfil the crop nutrient requirement, an integrated approach to nutrient management is necessary and it's also helps in maintains the soil fertility status of the soil. Nutrients are supplied to the crop through chemical fertilizers, organic manure, biofertilizers, nano fertilizers and green manuring. Effective utilization of all these components fulfils the nutrients requirements of the crop without affecting soil health and practices. Soil health management systems are agricultural system that prioritize the health of soils, by less soil disturbance and keeping living roots in the ground. Armoring the soil, maintaining continual live plant, increasing plant diversity are the methods of healthy soil management. Proper soil management practices protect and enhance soil performance for crop productivity.



ECONOMICS OF MILK PRODUCTION IN PUNJAB

Aniketa Horo*

Department of Economics and Sociology, Punjab Agricultural University, Ludhiana-141004

*Corresponding author: Vandana.horo@gmail.com

Abstract

Milk forms an essential part of daily diet in India owing to several health benefits associated with it. Punjab is the leader in milk production and per capita milk availability in the country, hence, the present study was undertaken to study the economics of milk production in the state. Primary data was collected from 100 farmers belonging to the districts of Amritsar, Ludhiana, Bhatinda, and Patiala during 2019-20. The average herd size was found to be 12.51 with crossbred cow having the maximum share in it. The average milk productivity/animal/day was reported to be higher for crossbred cow but buffalo rearing proved to be more profitable as its high fat content delivers higher milk price. Indigenous cow was found to be loss making, suggesting that the herd size should majorly be comprised of profitable milch animals than the ones incurring economic losses to the farmer in the state.

EFFECT OF DIFFERENT NUTRIENT MANAGEMENT STRATEGIES ON MICRONUTRIENTS'S CONTENT IN SOIL AND THEIR UPTAKE UNDER DIRECT SEEDED RICE

Anil Kumar*, R.S. Garhwal and Dinesh

Department of Soil Science, Chaudhary Charan Singh Haryana Agricultural University-125004, Hisar, India

*Email: anilchauhan999111@gmail.com

Abstract

Presumably use of chemical fertilizer led to a huge increase in production but for many years continuous use of chemical fertilizers has led to a decline the soil productivity and soil fertility. The combined use of organic manures and inorganic fertilizers have shown promising results not only in sustaining productivity but also in maintaining soil health and enhancing nutrient use efficiency. Thus a field experiment was carried out at CCS HAU, College of Agriculture, Kaul farm during 2019, to study the effects of different organic, inorganic and integrated sources on micronutrients and its uptake in direct seeded basmati rice. The experiment was planned in a randomized block design with ten treatments including N, P, K, biogas slurry and vermicompost alone and in combination i.e. T₁ - Control, T₂ - N₇₅ P₃₀ K₃₀, T₃ - N_{37.5} P₁₅ K₁₅, T₄ - Biogas slurry @ 4 t ha⁻¹, T₅ - N_{37.5} P₁₅ K₁₅ + Biogas slurry @ 2 t ha⁻¹, T₆ - N_{37.5} P₁₅ K₁₅ + Biogas slurry @ 4 t ha⁻¹, T₇ - Vermicompost @ 4 t ha⁻¹, T₈ - N_{37.5} P₁₅ K₁₅ + Vermicompost @ 2 t ha⁻¹, T₉ - N_{37.5} P₁₅ K₁₅ + Vermicompost @ 4 t ha⁻¹ and T₁₀ - Vermicompost @ 2 t ha⁻¹ + Biogas slurry 2 t ha⁻¹. DTPA extractable micronutrients' content i.e. Fe, Mn and Zn was significantly higher in treatment N_{37.5} P₁₅ K₁₅ + Vermicompost @ 4 t ha⁻¹ as compared to control (16.58, 3.18 and 2.39 mg kg⁻¹ respectively), while the Cu content (1.38 mg kg⁻¹) was lower in treatment where organic fertilizer was applied alone. Micronutrients' content and uptake in direct seeded rice was increased with application of vermicompost or biogas slurry alone or with integrated use of inorganic fertilizers. Higher response was observed in treatments where vermicompost or biogas slurry along with inorganic fertilizer was applied for the nutrient supply of DSR crop which resulted in improvement in micronutrients and its uptake.

CHARACTER ASSOCIATION STUDIES IN FENNEL (*FOENICULUM VULGARE* MILL.)

Anil Kulheri* and S.S. Rajput

Department of Plant Breeding & Genetics, Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan

*Email: kulherianil@gmail.com

Abstract

78 genotypes of fennel (*Foeniculum vulgare* Mill.) were evaluated in a randomized block design with three replications at the research farm, S.K.N. College of Agriculture, Jobner (Rajasthan) for seed yield and quality parameters. The analysis of variance revealed significant differences between the entries for all the characters studied indicating the existence of variability among genotypes. Phenotypic and genotypic correlation coefficient indicated that seed yield per plant showed significant and positive genotypic association with total plant height, branches per plant, umbels per plant, 1000-seed weight,



biological yield per plant and harvest index. Hence, the selection based on phenotypic performance for these characters would be beneficial for achieving the desired gain.

EFFECT OF NITROGEN FERTILIZER ON DOWNY MILDEW IN PEARL MILLET

Anil Kumar Sharma

Department of Plant Pathology, College of Agriculture, RVSKVV, Gwalior (M.P.)

Email: anilbohreabvp@gmail.com

Abstract

The study conducted in Bhind, Morena and Gwalior, reported that the application of nitrogen increased the incidence of downy mildew in the downy mildew susceptible pearl millet cultivar. At 60 days after sowing the downy mildew incidence under 0, 20, 40, 60, 80 and 100 kg N/ha was 13.50, 16.24, 24.13, 30.78, 33.06 and 34.73 per cent, respectively. This indicate a gradual increase in downy mildew incidence with the increase in nitrogen application, but it was non-significant with the increase in application from 0 to 20, 60 to 80 and 80 to 100 kg N/ha, however a significant increase in downy mildew incidence was recorded with the increase in nitrogen level from 20 to 40 and 40 to 60 kg/ha. The grain yield under 0, 20, 40, 60, 80 and 100 kg nitrogen application was 987.50, 1193.75, 1275.00, 1384.37, 1475.0 and 1556.25 kg/ha respectively.

EFFECT OF NITROGEN FERTILIZER ON DOWNY MILDEW IN PEARL MILLET

Anil Kumar Sharma

Department of Plant Pathology, College of Agriculture, RVSKVV, Gwalior (M.P.)

Email: anilbohreabvp@gmail.com

Abstract

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EVALUATION OF MACRO AND MICRONUTRIENTS IN SOILS OF MEDKICHCK VILLAGE OF DEWAS DISTRICT OF WESTERN M.P

Anjali Bhargava*, Anamika Tomar and S.K. Sharma

Department of Soil Science and Agricultural Chemistry, RVSKVV, Gwalior, M.P.

*Email: anjali bhargava003@gmail.com

Abstract

The present “Evaluation of Macro and Micronutrients in Soils of Medkichck Village of Dewas District of Western M.P “was carried out during the year 2016 in the Department of Soil Science & Agricultural Chemistry, College of Agriculture, Indore. Looking at the crop production and soil related constraints in Mendakichak village of Dewas District of Madhya Pradesh we found it important to characterize the soils of the village. For this purpose, surface soil samples were collected from 130 locations in Mendakichak village. The GPS points were also collected for preparing the spatial distribution maps of various analysed soil parameters (textural class, pH, EC, OC, Available-N, P, K, S, Zn, Mn, Fe, Cu etc). For soil analysis standard methods were adopted. DTPA- extractable Zn, Fe, Cu and Mn were determined to know the micronutrient status of Mendakichak village. Soil fertility maps in GIS environment using software Arc GIS version 10.4 were prepared for EC, pH, OC, N, P, K, S, Zn, Cu, Mn, Fe, Sand, Silt and Clay. The pH of Mendakichak village varied from 6.6 to 8.5 with the mean value of 7.5. The Electrical conductivity of soil water suspension ranged from 0.11 to 0.97 dS m⁻¹ with a mean value of 0.33 dSm⁻¹ emphasizing that these soils are in safe limit of EC. The variation in organic carbon content in this soil was from 0.13%



to 0.88% with a mean value of 0.49%. In general, the organic carbon status of Mendakichak village soils was low to medium. The soils of the study area are clayey in nature. Available N content in soils of Mendakichak village ranged from 100 to 361 kg ha⁻¹ with an average of 203.27 kg ha⁻¹. The status of available phosphorous varied from 5.4 to 38.25 kg ha⁻¹ with a mean value of 17.07 kg ha⁻¹. The 8% soil samples of the study area were classified as low fertility class and 64.6 % in medium fertility class. The nutrient index value for P was in medium fertility class. The status of available potassium varied from 216 to 877 kg ha⁻¹ with a mean value of 446.66 kg ha⁻¹. The status of available sulphur varied from 4 to 30 kg ha⁻¹ with a mean value of 13.71 kg ha⁻¹. The 23.8% soil samples under the study were classified as low fertility class, 60% as medium fertility class. The status of available iron varied from 3.13 to 13.25 mg kg⁻¹ with a mean value of 6.71 mg kg⁻¹. The status of available manganese and copper varied from 1.10 to 8.80 mg kg⁻¹ and 0.21 to 0.97 mg kg⁻¹ with a mean value of 5.36 and 0.46 mg kg⁻¹, respectively. Similarly, the status of available zinc varied from 0.2 to 1.93 mg kg⁻¹ with a mean value of 0.70 mg kg⁻¹.

GROWTH IN AREA, PRODUCTION AND YIELD OF MAJOR VEGETABLES IN UTTARAKHAND: AN ECONOMIC ANALYSIS

Anjali Tiwari* and Anil Kumar

Department of Agricultural Economics, GBPUAT, Pantnagar, Uttarakhand

*Email: anjalit1105@gmail.com

Abstract

Vegetables play an important role in the food basket of Indian population and are imperative in ensuring nutritional security. India stands second in vegetable production after China. Vegetables have the highest share in total production among horticultural crops. Their cultivation generally yields higher returns and is much better suited for the marginal and fragmented land holdings of Uttarakhand as compared to conventional crops. The state provides an array of agro-climatic zones suitable for vegetable production throughout the year. With the ever-increasing human population and continuously shrinking land under cultivation, it is an uphill task to meet the rising demand for food. It is important to strike a balance between demand and supply to ensure price stability and food security. Being a highly input intensive cash crop, vegetable cultivation is fraught with risks. So, a study was conducted to examine the growth and variability in area, production and productivity of major vegetables in Uttarakhand. Top five vegetables with maximum acreage in Uttarakhand were selected for this purpose. The study is entirely based on secondary sources of data. For the purpose of the study, the data regarding area, production and yield of major vegetables of Uttarakhand were collected. Using the data, Compound Annual Growth Rate (CAGR) and Instability index were calculated. The instability index reveals the risk associated with growing a crop in future. An insight into the growth in area, production and productivity help in formulating policies influencing farm decisions.

AVAILABLE MICRONUTRIENTS IN SOILS EXPERIENCED DIFFERENT CROPPING SYSTEMS IN DISTRICT HISAR, HARYANA

Ankit*, Dhram Prakash, Sunita Sheoran and Manju Kumari

Department of Soil Science, CCS HAU, Hisar, Haryana, India

*Email: ankityadamal@hau.ac.in

Abstract

Knowledge of micronutrients availability in soil is important as these play key roles in growth and development of crop plants, animals and humans. In this regards, effect of different cropping systems (rice-wheat, cotton-wheat, pearl millet-wheat and pearl millet-mustard) on DTPA-extractable soil micronutrients *i.e.* zinc (Zn), iron (Fe) manganese (Mn) and copper (Cu) was studied. The DTPA-extractable Zn concentration in soils under rice-wheat, cotton-wheat, pearl millet-wheat and pearl millet-mustard cropping system ranged from 0.60-3.14, 0.50-2.40, 0.14-2.37 and 0.49-1.76 mg kg⁻¹, respectively. The DTPA-extractable Zn concentration followed the order as: rice-wheat (1.93 mg kg⁻¹) > cotton-wheat (1.48 mg kg⁻¹) > pearl millet-wheat (1.19 mg kg⁻¹) > pearl millet-mustard (1.16 mg kg⁻¹) cropping system. The DTPA-extractable Fe concentration in soils under rice-wheat, cotton-wheat, pearl millet-wheat and pearl millet-mustard cropping system varied between 14.68-40.05, 6.23-30.57, 1.34-18.21 and 4.14-21.64 mg kg⁻¹, respectively. Among the different cropping systems, the DTPA-extractable Fe concentration followed the order as: rice-wheat (24.32 mg kg⁻¹) > cotton-wheat (18.90 mg kg⁻¹) > pearl millet-mustard (11.08 mg kg⁻¹) > pearl millet-wheat (7.18 mg kg⁻¹) cropping system. The DTPA-extractable Mn concentration in



soils under rice-wheat, cotton-wheat, pearl millet-wheat and pearl millet-mustard cropping system ranged from 6.45-22.40, 1.82-17.34, 4.09-12.67 and 4.13-12.50 mg kg⁻¹ with the mean value of 12.85, 10.31, 8.64 and 8.70 mg kg⁻¹, respectively. The DTPA-extractable Cu concentration in soils under rice-wheat, cotton-wheat, pearl millet-wheat and pearl millet-mustard cropping system ranged from 0.74-3.30, 0.86-2.93, 0.47-1.91 and 0.67-1.60 mg kg⁻¹ with the mean value of 2.00, 1.97, 1.07 and 1.08 mg kg⁻¹, respectively. The DTPA-extractable micronutrients (Zn, Fe, Mn and Cu) in soils were significantly ($p < 0.05$) affected by the different cropping systems. The soils under rice-wheat cropping system had significantly higher DTPA-extractable micronutrients (Zn, Fe, Mn and Cu) concentration as compared to cotton-wheat, pearl millet-wheat and pearl millet-mustard cropping system.

STUDY ON SOIL MOISTURE DEPLETION PATTERN OF WHEAT UNDER DIFFERENT IRRIGATION SCHEDULING AND HYDROGEL LEVELS

Ankur Tripathi¹, Shivam Tripathi¹, A.K. Singh¹, Shubhendu Singh², V.K. Singh³ and M.K. Tripathi^{3*}

¹ANDUAT, Kumarganj, Ayodhya, U.P.

²BHU, Varanasi, U.P.

³ICAR-IISR, Lucknow, U.P.

Email: mktripathi72@gmail.com

Abstract

The present investigation was carried out to study the soil moisture depletion pattern of wheat under different irrigation schedules and hydrogel levels. The experiment was conducted at Agronomy Research Farm of Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, Uttar Pradesh during *Rabi* season of 2018-19. The experiment consisted of 12 treatment combinations, comprised of four irrigation schedules and three hydrogel levels, were tested in split plot design with three replications. Wheat was sown in rows 20 cm apart and 4-5 cm deep in furrows opened by Kudali. The field was fertilized with N: P₂O₅: K₂O @ 120:60:40 Kg ha⁻¹ in the form of urea, di-ammonium phosphate and muriate of potash, respectively. Crop was irrigated as per irrigation schedule. Hydrogel was applied as per treatment in the field by mixing with dry soil in a ratio of 1: 10 for uniform distribution in the field. After application it was mixed in the upper soil layer (0–15 cm). Data related to soil moisture depletion was recorded from 0-15, 15-30, 30-45 and 45-60 cm soil depth. The results revealed that different irrigation schedules and hydrogel levels markedly influenced the soil moisture depletion pattern. Successive increment in number of irrigation and hydrogel levels resulted into more soil moisture depletion from upper layers and vice-versa. I₃ (four irrigation at CRI, jointing, milking and dough stage) depleted more moisture (69.17 %) from upper (0-30 cm) soil layers as compared to I₁ (one irrigation at CRI) which extracted 55.16 % only. The similar trend in moisture depletion pattern was observed in hydrogel application also.

VIRUS-INDUCED GENE SILENCING (VIGS)-MEDIATED FUNCTIONAL CHARACTERIZATION OF TWO GENES INVOLVED IN ABIOTIC STRESS RESISTANCE IN POTATO.

Anshul Sharma Manjul^{1*}, Charu Lata², Som Dutt³, Amarjit K. Nath¹ and Brajesh Singh³

¹Department of Biotechnology, Dr YS Parmar, UHF, Nauni, Solan (HP)-173230

²ICAR-Indian Institute of Wheat and Barley Research, Regional Station-Flowerdale, Shimla (HP)-171002

³ICAR-Central Potato Research Institute, Shimla (HP)-171001

*Email: anshulsharma.uhf@gmail.com

Abstract

Potato (*Solanum tuberosum* L.), an important nutritional food crop along with its great commercial potential, is greatly affected by many environmental factors like high temperature and drought stress etc. The increase in temperature and later changes in rainfall distributions will have a far-reaching impact on potato's productivity. A wide gene response network and an array of mechanisms for the plant to adapt against changing environments at various levels viz., physiological, biochemical, and molecular, increases the tolerance towards stress. Heat shock transcription factors (HSFs) of plants are the terminal components of signal transduction chain which play a role in the expression of various abiotic stress genes. In the present study, virus-induced gene silencing (VIGS) was utilized to carry out functional characterization of two *HSF* genes in potato under high temperature and drought stress. The vector pCambia3301+TRV2 was used in the present studies for the



preparation of VIGS construct. The developed constructs, pTRV2:HP1 and pTRV2:HP2 mobilized in *Agrobacterium* were used for the VIGS experiment along with pTRV1 mobilized in *Agrobacterium* in potato cultivar Kufri Surya. It could be concluded from the results of the VIGS experiments that the down regulation of HP1 and HP2 resulted in no or very less tuber formation as well as the growth of the potato plants were stunted. Present work has identified HP1 and HP2 genes as important candidates associated with tuberization process in potato under elevated temperature and drought conditions and hence, may be utilized in future studies for heat and/or drought tolerant potato cultivar/s.

EFFECT OF DRAINAGE SYSTEM ON WATERLOGGED AND SALT AFFECTED SOILS

Ashish Kumar¹ and Sanjay Kumar²

¹Department of Soil and Water Engineering, College of Agricultural Engineering & Technology, CCS Haryana Agricultural University, Hisar, Haryana, India

²Department of Soil and Water Engineering, College of Agricultural Engineering & Technology, CCS Haryana Agricultural University, Hisar, Haryana, India

Email: kamboashish@gmail.com

Abstract

Waterlogged and salt affected soils (SAS) are the main restrictions for agricultural production in India pose serious threat to national economy. It affects millions of hectares of productive land in many countries. Besides economic losses, rapid salinization of land and water resources is inflicting environmental damage, particularly in irrigated areas where salinity increase has charted a parallel path with irrigation development. However, irrigated land use as such is not responsible for salinization, but it is the faulty irrigation practices, inadequate provision of drainage and lopsided economic incentives that play a major role. After decades of experiments, recommendation emerged as technologies for reclamation and management of SAS as, gypsum technology for reclamation of alkali soils, developing salt tolerant crop varieties, guidelines for use of poor-quality waters, rehabilitation of salty lands using forestry species, etc. Different measures including surface, subsurface and bio-drainage systems have been adopted to prevent/mitigate and reclaim the affected areas. Large scale adoption of mechanized subsurface drainage (SSD) systems is at its inception stage. Experiences from large scale SSD installations in the northern states of Haryana, Rajasthan and Maharashtra have evidenced that the technology can be successfully adopted in reclaiming salt affected and waterlogged lands, thus enhancing and sustaining agricultural productivity and national economic development.

EFFECT OF NITROGEN DOSES ON QUANTITY AND QUALITY OF DIFFERENT VARIETIES OF FODDER OAT (*AVENA SATIVA* L.)

Ashish Kumar Verma

Department of Agronomy, College of Agriculture, ANDUAT, Kumarganj, Ayodhya,

Email: ashishverma9787@gmail.com

Abstract

The field experiment was conducted on “Effect of nitrogen doses on quantity and quality of different varieties of fodder oat (*Avena sativa* L.)” at G.P.B. Farm of Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.), India during *rabi* season of 2019-20. The experiment was laid out in split plot design with three replications. The treatment were consisted of twelve treatment combinations as main plot with the three varieties of oat, viz., RO- 19 (V₁), JHO-851 (V₂), UPO- 212 (V₃) and sub plot comprised of four cutting & splitting of nitrogen management viz., Two cut + 60% Basal + 40% at 1st cut (N₁), Two cut + 50% Basal + 50% at 1st cut (N₂), Three cut + 50% Basal + 25% at 1st cut + 25% at 2nd cut (N₃), Three cut + 40% Basal + 30% at 1st cut + 30% at 2nd cut (N₄). The oat crop was sown date on 18 November 2019. Seed was used @ 100 kg ha⁻¹ in the plot. Soil of the experiment field was classified as silt loam in texture with alkaline reaction (pH 8.8) Low in organic carbon (0.25%) and available nitrogen (190 kg ha⁻¹), medium in phosphorus (16.5kg ha⁻¹) and potash (238.1 kg ha⁻¹). Result revealed that the variety JHO-851 recorded significantly higher growth as well as green fodder and dry fodder yield (q ha⁻¹) followed by varieties R-19 and UPO-212. The variety JHO-851 showed maximum crude protein, total ash and nitrogen content in plant than rest of the varieties and cutting and splitting of nitrogen at various cutting stages of growth parameters significantly higher at first and second cut at two cuttings (55 DAS & 50% flowering) + 60% N as basal + 40% N



at Ist cut and quality parameters crude protein, crude fibre, total ash, nitrogen content in plant uptake significantly higher at two cuttings (55 DAS & 50% flowering) + 60% N as basal + 40% N at Ist cut and water soluble carbohydrates, digestible crude protein and total digestible nutrient significantly higher at three cuttings (55 DAS, 35 days after 1st cut & 50% flowering) + 40% N as basal + 30% N at Ist cut + 30% N at IInd cut. The highest net return Rs. 73434.71 ha⁻¹ treatment (V₂N₂) and benefit cost ratio 2.20 (V₂N₂).

EVALUATION OF SOME NEWER MOLECULES OF FUNGICIDES AGAINST LOOSE SMUT OF WHEAT

Vinay Kumar Verma

Department of Plant Pathology, College of Agriculture, ANDUAT, Kumarganj, Ayodhya, U.P.

Email: vk717866@gmail.com

Abstract

The field experiment was conducted on “Evaluation of some newer molecules of fungicides against loose smut of wheat” at Experimental Farm of Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.), India during *rabi* season of 2017-18. Wheat (*Triticum aestivum* L.) is one of the most important cereal crops. It is the second staple food in India after the rice and has played vital role in stabilizing the food grain production depends on wheat for intake of about 20% of food calories. Different types of biotic (fungi, bacteria, viruses and nematodes etc.) and abiotic (temperature, humidity etc.) stress, that decrease the production and productivity. Loose smut of wheat is one of the most important designated seed borne disease caused by a fungus *Ustilago tritici* (Pers.). Seed treatment with Raxil- 2ds @ 2gm/kg seed or Folicur (Tebuconazole 29.5%) @ 1gm/kg seed were found equally without any ear head infection of loose smut. The seed lot used for experimentation was having 1.13% embryo infection of loose smut. Minimum ear head infection (0.00%) in the seed lot which was treated with Tebuconazole @ 1gm/kg seed and Raxil- 2DS @ 2gm/kg seed, with maximum germination (91.00%), seedling length (27.00cm), vigour index (2456.00), field emergence (88.62%), plant height (77.8cm), and number of productive tiller per plant (5.67) was recorded thoroughly seed treatment of Vitavax powder @ 2.5gm/kg seed. For the inoculation of epiphytotic and produce of infected seed for experimentation methods spikelet cutting and spore dusting, spikelet cutting and syringing spore suspension, and gogo method were compared. Spikelet cutting and spore dusting was found most suitable for the development the epiphytotic under field condition and maximize of seed infection. A direct correlation between different morphological characters and disease severity was recorded which may be exploit during the selection of loose smut resistant varieties.

ORGANIC FERTILIZERS AND NANOTECHNOLOGY AS A ROUTE TO CONTROLLED RELEASE OF NUTRIENTS

Ashutosh Singh* and Amit Kumar Pandey

Mandan Bharti Agriculture College, Agwanpur, Saharsa

*Email: dr.ashusingh1984@gmail.com

Abstract

Organic fertilizers are naturally available mineral sources that contain moderate amount of plant essential nutrients. They are capable of mitigating problems associated with synthetic fertilizers. They reduce the necessity of repeated application of synthetic fertilizers to maintain soil fertility. They gradually release nutrients into the soil solution and maintain nutrient balance for healthy growth of crop plants. They also act as an effective energy source of soil microbes which in turn improve soil structure and crop growth. Organic fertilizers are generally thought to be slow releasing fertilizers and they contain many trace elements. They are safer alternatives to chemical fertilizers. However, the improper use of organic fertilizers leads to over fertilization or nutrient deficiency in the soil. Hence, controlled release of organic fertilizers is an effective and advanced way to overcome these impacts and maintain sustainable agriculture yield. Traditional or conventional release of fertilizers leads to the wastage of about 50% of the used fertilizers to the soil, water bodies, and to the environment. Only very small portion of the applied fertilizers will benefit the plants. This leads to the repeated use of fertilizers and in turn increases the labor and cost. To minimize the loss of fertilizers by enhancing the availability of fertilizers to the plants, scientists have adopted many modern techniques. Among these techniques, the most important and powerful technique is the development of



nanotechnology for the controlled release of fertilizers and pesticides in the agriculture fields. Development of Nano carriers, Nano fertilizers, and Nano sensors has improved fertilizer efficiency with minimum wastage.

MORPHO-PHYSIOLOGICAL CHANGES IN RESPONSE TO SUBMERGENCE IN RAINFED LOWLAND RICE

Anuradha Singh

Botany Department Meerut College, Meerut

Email: sinanuradha@gmail.com

Abstract

Morpho-physiological changes in response to submergence were studied in tolerant and susceptible rainfed lowland rice varieties. Increase in submergence duration, induced shoot elongation, root elongation, root volume and decrease the plant survival, tiller number per plant and root and shoot dry weight. The survival was higher in tolerant varieties FR13A (87%) and Vaidehi (80%) than susceptible varieties Mahsuri (27%) and IR42 (13%). Tolerant varieties invariably had higher vigor (Plant height and dry matter) before submergence though underwater shoot elongation, root elongation was more in intolerant varieties. It is evident that shoot elongation and root elongation has a significant impact on the survival behavior of rice plants after submergence.

INVESTIGATIONS ON EFFECT OF TEMPERATURE, RELATIVE HUMIDITY AND SUGAR CONCENTRATIONS ON SPORE GERMINATION OF *ERYSIPHE CICHORACEARUM*- INCITANT OF BHENDI POWDERY MILDEW

Ashwini R., Amaresh Y.S., Yenjerappa, S.T., Sunil Kulkarni, Shekhargouda Patil and S.G. Hanchinal

Department of Plant Pathology, University of Agricultural Sciences, College of Agriculture, Raichur

Email: ashupatil158915@gmail.com

Abstract

Powdery mildew of Bhendi caused by *Erysiphe cichoracearum* D.C. is important foliar disease affecting all the stages of the plant growth by causing premature defoliation and resulting 17.0 to 86.6 per cent yield loss in bhendi. To establish relationship between environment factors and disease development present study has been conducted under *in vitro* conditions. Results revealed that after 24 hours of incubation, maximum conidial germination (84.64%) was observed in 1.5 per cent glucose solution, which differed significantly with remaining treatments followed by glucose (79.15%) at 2 per cent concentration. Least conidial germination was noticed in distilled water (64.28%). The poor germination of conidia in the distilled water could be due to the lack of essential nutrients. Maximum conidial germination of 58.12 per cent was observed at 25 °C, which varied significantly from other temperature levels tested. Whereas, least conidial germination (7.22, 13.19 %) was observed at 5 °C and 40 °C respectively. Maximum conidial germination 56.32 per cent was observed at 85 per cent relative humidity, which was significantly superior over other treatments. However, least conidial germination of 8.45 per cent was observed at 50 per cent relative humidity. The conidia of *E. cichoracearum* germinated even at 55 per cent and 100 per cent relative humidity, indicating the fungus ability to infect both under dry and humid conditions in the presence of higher water content.

ORGANOLEPTIC AND NUTRITIONAL EVALUATION OF VALUE ADDED PRODUCT-TOFFEE PREPARED FROM AONLA VARIETIES

Ashwini Uikey*, P.K.S. Gurjar and Shubham Rathour

Rajmata Vijayaraje Scindia Agricultural University, Gwalior, Madhya Pradesh, India

*Email : ashwiniuikey@gmail.com

Abstract

A research experiment was conducted during the year 2019-20 and 2020- 21 in the Fruit and Vegetable Processing Unit Laboratory, Department of Horticulture, College of Agriculture, Gwalior with seven different varieties of aonla viz., NA-4, NA-5, NA-6, NA-7, NA-10, Laxmi and Chakaiya. It was studied about the preparation of various value added product- aonla



toffee. Observations were recorded up to storage period of six months at ambient conditions. This study is analyzed in a completely randomised design with three replications. Laxmi and Chakaiya varieties was found superior with respect to colour and appearance, taste, aroma as well as flavour. It has been noticed that the overall acceptability of processed products have been found significant with the respect to 30, 60, 90 and 120 days of storage. As far as organoleptic and nutritional evaluation of different aonla toffee was concerned, the Laxmi and Chakaiya varieties are found to be superior for the purpose of processing industry. The postharvest losses in aonla vary from 30-40% due to its perishable nature and glut during harvesting time, which reduces the market value of fruit. Hence, value addition through processing would be the only effective tool for economic utilization of increased production of aonla in future.

EVALUATION OF CHILLI GENOTYPES FOR GROWTH, YIELD AND QUALITY CHARACTERS UNDER SUBTROPICAL CONDITIONS OF JAMMU

Atal Hameedi, Satesh Kumar, Ravinder Kumar Samnotra, S.K. Rai, Iqbal Jeelani Bhat and Vikas Abrol

Sher-e-Kashmir Agricultural University of Agricultural Sciences and Technology of Jammu, Chatha, India

Email: hameedi.atal@gmail.com

Abstract

The present experiment was conducted to evaluate chilli genotypes for growth yield and quality characters during 2021-2022 at Vegetable Experimental Farm, Division of vegetable Science and Floriculture, SKUAST, Jammu, Chatha under Randomized Complete Block Design, having 20 genotypes (SJC-01, SJC-02, Pusa Sadabahar, Pusa Jwala, DKC-8, Suraj Mukhi, Hot Queen, Hy-509, TNAU-1, TNAU-2, TNAU-3, TNAU-4, TNAU-5, TNAU-6, TNAU-7, TNAU-8, TNAU-9, Bareilly Local, Mahabaleshwar Local, Chandigarh Local.) collected from different locations of the country. Analysis of variance revealed that there were significant differences between the genotypes under study for all the characters. Maximum number of primary branches per plant were recorded in Pusa Sadabahar, plant height in Chandigarh local, Fruit length in TNAU-6, fruit width and fruit weight in Hot Queen, red fruit dry matter content in TNAU-3, ascorbic acid in TNAU-9, Yield per plant (g), Yield per hectare (q) and less days to 50% flowering and days to first fruit picking was recorded in Hy-509. Minimum of all these characters were recorded from TNAU-7 and Suraj Mukhi. Among all the genotypes under study Hy-509, SJC-01, SJC-02, Hot Queen, Pusa Sadabahar, Chandigarh local, TNAU-4, TNAU-3, TNAU-6, TNAU-9 were observed to be promising for growth, yield and quality characters, therefore they can be further used in breeding programs for releasing as pureline varieties or development inbred lines for hybrid breeding program.

EFFECT OF PRESERVATION TECHNIQUES ON PHYSICO-CHEMICAL, TEXTURAL AND MICROBIOLOGICAL PROPERTIES OF REDUCED FAT WHEY CHEESE SPREAD DURING STORAGE

Avinash Chandra Gautam*, Nitika Goel, P.K. Singh, Veena N. and Namita Rokana

College of Dairy Science and Technology, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab

*Email: avinash.gautam52@gmail.com

Abstract

Whey Cheese Spread (WCS) is a novel product prepared from heat co-precipitation of proteins from mixture of mozzarella cheese whey and reduced fat milk (1.5% fat) followed by homogenization along with addition of salt and hydrocolloids to gain soft creamy consistency with improved spreadability. WCS has very low shelf-life due to its high moisture content adjusted to 75%. Hence, to improve the keeping quality of WCS, effect of various preservation techniques viz. chemical preservative (potassium sorbate), bio-preservative (nisin) and heat treatment (85°C/10 min) on properties of product were studied individually and in combination during storage. During storage period, pH values increased whereas whey syneresis values decreased in WCS samples treated with different preservation techniques, singly or in combination. L* value of all the samples decreased significantly as storage period proceeds whereas a* value of all the samples increased toward green hue during the storage. No significant change was observed in b* value of the samples except heat treated samples showed increase in b* value during storage. Firmness (g), work of shear (g.s), stickiness (g) and work of adhesion (g.s) of all the samples were found to be increased during storage. Heat treated samples were reported to have highest firmness (g), work of shear (g.s), stickiness (g) and work of adhesion (g.s) throughout the storage due to loss of moisture during heat treatment. A



significant decrease in standard plate count and coliforms was observed in all the samples treated with different preservation techniques singly or in combination till 28th day. Least microbial count was observed in WCS containing both PS and N in combination. The yeast and mold count were found to be nil in all the samples throughout the storage. Heat treated samples lost the texture due to heating due to which this treatment was not suitable for the product. The product was highly acceptable till 28th day of the storage.

STABILIZING FARMERS INCOME VIA PM-KISAN SCHEME

Avinash Kumar^{1*} and Deepak Kumar Patel²

¹Department of Extension Education, Dr. Rajendra Prasad Central Agricultural University, PUSA, Samastipur, Bihar

²Department of Extension Education, Bihar Agricultural University, Bhagalpur, Sabour, Bihar

*Email: avinashjhapintu@gmail.com

Abstract

The central government with a view to augment the income of the farm families initiated a Central Sector Scheme, namely, “Pradhan Mantri Kisan Samman Nidhi (PM-KISAN)”. With a view to provide income support to all land holding eligible farmer families. The Scheme is in effect from 01.12.2018 and was officially launched on 24th February, 2019. The scheme aims to supplement the financial needs of the farmers in procuring various inputs to ensure proper crop health and appropriate yields, commensurate with the anticipated farm income. All land holding eligible farmer families (subject to the prevalent exclusion criteria) are to avail of the benefits under this scheme, as per the cabinet decision taken during May 2019. The Scheme is expected to cover around 14.5 crore beneficiaries. Earlier, under the scheme, financial benefit has been provided to all Small and Marginal landholder farmer families with total cultivable holding upto 2 hectares with a benefit of Rs. 6000 per annum per family payable in three equal installments, every four months. A sum of Rs. 75,000 crores has been granted for this scheme. State Government and UT administration is authorized to identify the farmer families which are eligible for support as per scheme guidelines. Definition of family for the scheme is husband, wife and minor children. The fund will be directly transferred to the bank accounts of the beneficiaries. Under PM-KISAN scheme over Rs. 2 Lakh crore in twelve installments each of Rs. 2000 has been transferred to beneficiaries account. There are various Exclusion Categories for the scheme. Categories of beneficiaries of higher economic status shall not be eligible for benefit under the scheme. All Institutional land holders viz. holdings such as government farms, farms of sugarcane factories, cooperative farms, lands managed by trusts are excluded from this scheme. Former and present holders of constitutional posts like Former and present Ministers/ State Ministers and former/present Members of Lok Sabha/ Rajya Sabha/ State Legislative Assemblies/ State Legislative Councils, former and present Mayors of Municipal Corporations, former and present Chairpersons of District Panchayats. All serving or retired officers and employees of Central/ State Government Ministries /Offices/Departments and its field units Central or State PSEs and Attached offices /Autonomous Institutions under Government as well as regular employees of the Local Bodies (*Excluding Multi Tasking Staff /Class IV/Group D employees*). All superannuated/retired pensioners whose monthly pension is Rs.10,000/-or more (*Excluding Multi Tasking Staff/ Class IV/Group D employees*) of above category. Income Tax payee and professionals like Doctors, Engineers, Lawyers, Chartered Accountants, and Architects registered with Professional bodies and carrying out profession by undertaking practices. Any complaints and queries related to disbursement of payment can be inquired on PM-KISAN helpline number 155261.

BIOLOGICAL CONTROL OF MANGO ANTHRACNOSE AND STEM-END ROT PATHOGENS

B. Anusha*, G. Thiribhuvanamala, K. Prabakar

Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore- 641003.

*Email: anu_agri@rediffmail.com

Abstract

The diseases of mango are generally controlled through several rounds of fungicide application, thereby generating disadvantages such as environmental contamination, development of resistance in pathogens and residual contamination in fruits. To meet the demand for residue-free foods, use of biocontrol agents could be a promising alternative. Biocontrol involves naturally occurring non-pathogenic microorganisms that compete with the pathogen for space, nutrients and produce an array of antibiotics that are inhibitory to pathogen growth. In the present study, *Pseudomonas* and *Bacillus* strains were



tested for their effectivity against mango anthracnose and stem-end rot pathogens, *Colletotrichum gloeosporioides* and *Lasidiplodia theobromae*. Among the twenty strains of *P. fluorescens* screened, Pf-1 was the most effective, recording 44.44 per cent and 53.00 per cent inhibition of mycelial growth of *C. gloeosporioides* and *L. theobromae* respectively. In case of *B. subtilis*, among the twenty isolates screened, EPCO-16 was the most effective, inhibiting the mycelial growth by 37.44 per cent and 51.56 per cent respectively over control. Upon observation under microscope, the hyphal tips of *C. gloeosporioides* taken from Pf-1-streaked plates showed abnormal branching compared to that of control. In the presence of EPCO-16, the mycelial strands of *C. gloeosporioides* were thicker than that of control strands. Presence of excess vacuoles was observed in the hyphal strands of both the pathogens when compared to that of the vacuoles in the hypha taken from control plates. Hence, *P. fluorescens* and *B. subtilis* strains could be promising agents towards controlling anthracnose and stem-end rot diseases of mango.

FARMER PRODUCER GROUPS IN TRIBAL AREAS AND THEIR IMPACT ON LIVELIHOOD - A WAY TO SUSTAINABLE AGRICULTURAL DEVELOPMENT

B. Srishailam^{*}, V. Sailaja and S.V. Prasad

Department of Agricultural Extension Education, S.V. Agricultural College, Tirupati, ANGRAU.

*Email: sribathini15@gmail.com

Abstract

In the words of First Prime Minister of India- The biggest development in the history of humanity was the discovery of Agriculture. Agriculture is the back bone of our nation more than 80 per cent people in the country depends on agriculture directly. India is a diverse country with different geographical areas and various pockets of the country producing wide variety of products. The tribal areas in the country had great amount of contribution in the agricultural production with unique products in their indigenous aspect. The tribal population of the country as per 2011 census, is 10.43 crore, constituting 8.6% of the total population who resides mostly in hilly areas i.e., major forest areas of our country which is favorable for crop cultivation and yield of most valuable products, these regions perform poorly in terms of infrastructure, return from agriculture and almost all human development indicators. To conquer all these problems Farmer Producer Groups (FPGs) are one of the interventions to provide sustainable livelihood security to the tribal farmers. Farmer Producer Group (FPG) is a group of 15-20 farmers with a special interest and concerned with developed structure, formal membership, status and functions for its members and with a set of bylaws and rules. The main aim of organizing tribal farmers into small interest groups is to provide backward linkages such as inputs, credit facilities and technologies and forward linkage like production services, market and value addition services etc., Tribal FPGs will play a unique role in improving economic status of tribal people through which they can access credit, value addition of forest produce and marketing facilities. In view of this in-depth analysis of these FPGs can give further improvements in the functioning of these groups by creating sustainable livelihood to tribal farmers.

EFFECT OF MICROWAVE POWER LEVELS ON QUALITY OF *STEVIA REBAUDIANA* LEAVES DURING MICROWAVE DRYING

Baldev Singh Kalsi^{*}, Sandhya and Mohammed Shafiq Alam

Department of Processing and Food Engineering, Punjab Agricultural University, Ludhiana, Punjab

*Email: baldev.kalsi94@gmail.com

Abstract

Stevia rebaudiana is in considerable demand in food industry owing to its health benefits, especially in diabetes and metabolic-related disorders. *Stevia* leaves can be consumed fresh or dry, and crushed to extract sweet components. Drying *stevia* leaves, like other therapeutic plants, is required for preservation and use. In this study, the *stevia* leaves were dehydrated in microwave dryer in order to compare the effect of different microwave powers (900, 720, 540, 360 and 180 Watt) on *stevia* leaves. The results showed that with increase of power, the time of drying reduced. A significant difference was observed in the color parameters between the fresh and dried samples, but the changes in their values were not dependent on the power output of the microwave drier. The highest value of ascorbic acid values was obtained in the drying period with 720 W microwave power. *Stevia* leaves dried at 180 W showed the highest rehydration capacity and lowest at 900 W. The current



study's findings appeared potentially significant for the application of microwave drying on Stevia leaves to increase the availability of leaves throughout the year with less drying time and better retention of color and ascorbic acid.

LAND SUITABILITY EVALUATION FOR TURMERIC CULTIVATION IN KERALA USING GIS TECHNIQUE FOR FUTURE CLIMATE SCENARIO.

Banu M.¹, K.S. Krishnamurthy² and Surendran U.^{1*}

¹KSCSTE-Centre for Water Resources Development and Management, Kozhikode-673571, India

²ICAR-Indian Institute of Spices Research, Kozhikode, Kerala, India

*Email: suren@cwrwm.org

Abstract

It is anticipated that climate change and climate variability will change the geographic suitability of lands for crop cultivation. As turmeric is a spice crop that needs to be adapted to vulnerable areas and cultivated sustainably, an early understanding of the future climate of growing areas is essential. The total area of Kerala is 38,863 km², 70% of which is used for agriculture. The aim of this study was to assess the climate suitability for turmeric cultivation in Kerala. Turmeric (*Curcuma longa*) can be grown in a variety of tropical climates, altitudes up to 1500m MSL, temperatures ranging from 20-30°C, and annual rainfall above 1500mm and grown on sandy loam or clay soil, well drained, pH from 4.5 to 7.5. This study seeks to predict the suitable area for turmeric cultivation in Kerala for future climate scenario for the year 2050, in the category of Representative Concentration Pathways 4.5 (RCP 4.5). Downscaled climate data for the year 2050 was collected from the regional climate model – Had GEM 2-ES. Site and soil suitability criteria was considered based on the criteria from NBSSLUP. The future scenario showed that annual rainfall of Kerala varied between 1305-3840 mm, maximum and the minimum temperature is in the range of 20.7 - 33.6°C & 13.5 - 25.8° in 2050 respectively. A GIS environment was used to model the suitability of turmeric and analyze changes in climate in relation to soil and crop characteristics. Suitability analysis was performed by overlaying physical parameters (elevation, slope), climate (precipitation, temperature) and soil (depth, texture, drainage, pH) using weighted overlay analysis. The results of this study showed that 33% of the land area in Kerala will be highly suitable for growing turmeric by 2050, while 42%, 28% and 7% of the land area is moderate, marginally or completely unsuitable. In this study, it was found that the northern districts of Kerala have highly suitable areas for turmeric cultivation.

CHARACTERIZATION OF WHEAT GENOTYPES FOR MULTIPLE FUNGAL RESISTANCE USING FUNCTIONAL MARKERS

Bharat Garg^{1*}, Shikha Yashveer¹, Jyoti Taunk², Jayanti Tokas³ and Anita¹

¹Department of Molecular Biology, Biotechnology & Bioinformatics, College of Basic Sciences & Humanities, CCS Haryana Agricultural University, Hisar-125004, Haryana, India

²Department of Biotechnology, University Centre for Research and Development, Chandigarh University, Mohali-140413, Punjab, India

³Department of Biochemistry, College of Basic Sciences & Humanities, CCS Haryana Agricultural University, Hisar-125004, Haryana, India

*Email: gargb3916@gmail.com

Abstract

Wheat that is one of the most important staple food crops in the world is adversely affected by fungal pathogens. For plant breeding to be successful, techniques for evaluating plant materials quickly and cheaply to gather information before the next round of selection are essential. The present investigation was planned to analyze the allelic variations of fungal disease resistant functional genes in wheat genotypes, which can further help in gene pyramiding for producing multiple disease resistant wheat genotypes. Fifty-eight wheat varieties consisting of both susceptible and resistant genotypes were used in this study. A total of 29 SSR primer pairs were selected for screening genotypes for multiple fungal resistant alleles. Genomic DNA was isolated from the young leaves of 58 wheat genotypes using Cetyltrimethyl ammonium bromide (CTAB) extraction method. PCR reactions were performed. The dendrogram was constructed using the distance matrix in SAHN sub-programme of NTSYS-pc by the Unweighted Pair-Group Method with Arithmetic Average (UPGMA) algorithm. Principal Component Analysis (PCA) was done to construct 2 and 3-dimensional diagrams. Out of 29 SSRs screened on 58 wheat genotypes, only



24 showed amplifications (82.7%) and 23 showed polymorphism (95.83%) with a total of 46 alleles. The number of alleles per locus ranged from 1-3 with an average of 1.96 alleles per locus. PBW 725 and WH 1268 were found to be most diverse at a similarity coefficient of 77%. Further, SSR marker polymorphism rates were determined using polymorphism information content (PIC), expected heterozygosity, marker index, discriminating power and resolving power values. Out of 29 markers analysed, 8 proficient markers viz. Barc232, Xbarc124, Xbarc32, Swm271, Xwmc44, Xgwm26, Gpw5029, and Xwmc557 are suggested for Indian wheat disease resistance profiling.

IMPACT OF CROP RESIDUE RETENTION AND NUTRIENT LEVELS ON WHEAT (*TRITICUM AESTIVUM* L.) PRODUCTIVITY UNDER CONSERVATION AGRICULTURE

Bharti Parmar¹, A.K. Vishwakarma^{2*}, Varsha Gupta¹, Pramod Jha², A.K. Biswas², K.M. Hati², Ganesh Malgaya¹, A.K. Patra²

¹Rajmata Vijayaraja Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh (474002) India

²ICAR-Indian Institute of Soil Science, Berasia Road, Nabi Bagh Bhopal, Madhya Pradesh (462038) India

*Email: parmarbharti1223@gmail.com

Abstract

A field experiment was conducted during *Rabi* season of 2020-21 and 2021-22 to evaluate the effect of different levels of crop residue retention and nutrient levels on performance of wheat crop under conservation agriculture (CA). The experiment was laid out in Factorial Randomized Block Design (FRBD) comprised of 16 combinations of 4 residue level (0%, 30%, 60% and 90%) and 4 nutrient doses (N₁-RDF (120:60:40 kg N,P₂O₅ and K₂O ha⁻¹), N₂-75% N+100% P₂O₅ and K₂O ha⁻¹, N₃-75% P₂O₅+100% N and K₂O ha⁻¹, N₄-75% K₂O+100% N and P₂O₅ ha⁻¹) with 3 replication under ongoing CRP-CA (Consortium Research Platform on Conservation Agriculture) experiment at ICAR-Indian Institute of Soil Science, Bhopal (M.P.). The data on yield parameters indicated significant influence of crop residue retention on yield parameters viz., number of ear head m⁻¹ row length (158.69), length of ear head (17.75 cm), number of grains ear head⁻¹ (78.5), weight of grains ear head⁻¹ (4.41 g) and test weight (39.88 g) were recorded under higher level of crop residue retention (90%). Significantly higher grain yield (6474 kg ha⁻¹) and straw yield (9650 kg ha⁻¹) was also recorded under higher residue level retention treatment. The influence of nutrient levels on straw and biological yield was found to be significant, while the interaction between residue and nutrient levels was found to be non-significant for most of the yield parameters except stover yield. All levels of residue retention treatments improved soil physical and chemical qualities significantly as compared to no residue retention treatment. The current study demonstrated that increased levels of crop residue retention resulted in a considerable increase in crop output and a 25% reduction in nutrient use.

BIORATIONAL INSECTICIDES AND THEIR USE FOR INSECT PEST MANAGEMENT IN INDIAN AGRICULTURE SCENARIO

Bhawani Singh Meena* and Pooja Sharma

Department of Entomology, SKN Agriculture University, Jobner (Raj.)

*Email: 125bhawanisingh@gmail.com

Abstract

Most of the commercially available conventional and synthetic insecticides have broad range toxicity as they target those insect's systems which have physiology exactly like the higher mammals including man. That why they are imposing serious health hazard threats (mutagenic, carcinogenic and teratogenic effects) on human being due to possessing very high mammalian toxicity, long-term residual persistency and high magnification potential. They are also creating many other serious problems like ecological backlashes in pest species, environmental pollution and degradation, threat to biodiversity conservation and loss of beneficial fauna (predators, parasites pollinators etc.). There is a need to explore and develop biorational molecules/products which would tackle most of the issues associated with conventional insecticides. Need is to develop analogues of such biorational and highly target specific biomolecules through modern biotechnological molecular approaches. Biorational products/approaches are based on the growth and development as well as communication system of insects which is quite different from higher animals and human being. These products have great potential for replacing the persistent conventional insecticides, confirming effective cost-benefit ratio, tackling ecological back lashes and ensuring food



security with safe environment and enhanced exports. In the new era of biotechnology, most of the issues associated with these biorational products have been solved and these products are not only winning the reliability of the market and end user; but also demonstrating their worth and potential in sustainable IPM program.

AGROFORESTRY : THE CLIMATE RESILIENT AGRICULTURE

Bhupender*, Ajay and Ishu Redhu

Department of Forestry, CCS HAU, Hisar Haryana

*Email: bhupygill97@hau.ac.in

Abstract

Regional changes in climate have been observed in many parts of the world posing significant threats to all kinds of ecosystem and livelihood especially in agriculture (climate sensitive sector). Atmospheric CO₂ concentration has crossed 400 ppm. Methane concentration increased from 800 to 1800 ppb. Nitrous oxide concentration increased from 270 to 320 ppb (IPCC 5th Assessment Report 2014). It is adversely affecting the agricultural productivity by increasing crop respiration losses, decrease in grain filling duration, reducing rainfall/ irrigation supply, reducing in soil organic matter and also by increasing crop evapotranspirational demand. Since forest is large carbon sink but there is no scope to increase the forest area in the country. But there is lot of scope to increase carbon storage through reforestation and agroforestry. The carbon storage capacity in agroforestry varies across the species and geography. The amount of carbon in any agroforestry system (AFS) depends upon the structure and function of different components within system put in to practice. But there are several constraints in adoption of agroforestry systems e.g., lack of information about cultivation of region-specific trees suitable for agroforestry, tree-crop competition, lack of package and practices about cultivation of trees and ag. crops together in agroforestry where the both have interaction effect on each other and IPM and INM in agroforestry etc. If suitable economically and environmentally sound agroforestry models will be developed for different agro-climatic zones (that can easily be adoptable for all type of farmers i.e., Marginal, Small and large farmers) only then our agriculture system can become climate resilient.

EFFECT OF SURFACE STERILIZING AGENTS ON *IN VITRO* CULTURE ESTABLISHMENT OF GUAVA (*PSIDIUM GUAJAVA* L.) CV. ARKA KIRAN

Bhyravi, B.M.^{1*}, Athani, S.I.², D.P. Prakasha³ and Anil Ishwar Sabarad⁴

¹KRCCH, Arabhavi-591218, Gokak (Tq), Belgam (Dist), Karnataka, India.

²UHS, Bagalkot-587104, Karnataka, India.

³Department of Fruit Science, College of Horticulture, Sirsi-581401, Karnataka, India.

⁴Dept. of Fruit Science, KRCCH, Arabhavi, -591218, Gokak (Tq), Belgam (Dist), Karnataka, India.

*Email: bhyraviyadav@gmail.com

Abstract

Improvement in the productivity of guava in recent days is mainly achieved by adopting some of the improved cultivation techniques like HDP and Meadow orcharding. So, there is an increase in cultivation of guava due to its wide range of adoptability to soil and climatic condition, high nutritional value, popularity of processed products and its production potential. Arka Kiran is gaining popularity in now a days is mainly because of pink pulp with average fruit weight of 200-220g with medium soft seeds. In this regard, the production of large scale, disease free and high yielding quality planting material of this variety is needed, which is achievable with tissue culture. Surface sterilization is an obligatory step prior to *in vitro* culture of any plant tissue. An experiment was designed to test the efficacy of various surface sterilizing agents, their safest concentration and duration of treatment for maximum aseptic culture establishment. Nodal explants were collected from the plants grown under polyhouse, washed and treated with Bavistin (2g/lit), Citrimide (0.5g/lit) and Tween 20 for four hrs. Then the explants were washed with sterile distilled water for three times. The sterilizing agents viz., NaOCl (4%), HgCl₂ (0.1% and 0.05%) at 3, 5, 8 and 10 min, respectively were tested for clean culture establishment. After each treatment the explants were subjected to wash for five times with sterile distilled water to remove the residual toxicity of the disinfecting agents. Observations on contamination, health and survival were recorded till 30 days after inoculation. Among the different treatments the 0.1% HgCl₂ (5, 8 min) and 0.05% HgCl₂ (10 min) were shown no contamination and all the explants on 0.1% HgCl₂ at 5 min were healthy compared to all other treatments. Further, 100 per cent explants survived in 0.1% HgCl₂ (5 and 8 min) and 0.05% HgCl₂ at (10 min). In this presentation, methodology of experiments conducted, results obtained will discuss.



AGRICULTURE AND ENVIRONMENT WITH SPECIAL REFERENCE TO ARISED PROBLEMS AND MITIGATING FACTORS

Bharat Lal Meena* and Ghazala Banyala

Department of Agronomy, SKN Agriculture University, Jobner (Raj.)

**Email: bharatmeena447@gmail.com*

Abstract

The major environmental issues that Indian agriculture is currently confronting stem from global climate change because of emission of GHGs, water, soil, air pollution emanating from industry, transport, fertilizer application and persistent organic pollutants and loss of biodiversity. Impaired environment can be restored by some tools: Carbon sequestration, Conservation agriculture, Crop diversification, Amelioration of polluted environment, Renewable source of energy, Bio-diesel crops, Agricultural waste management. To identify existing and emerging constraints limiting productivity and opportunity for sustainable increase in the future, It is important to understand agriculture-environment interactions in totality. This would include identification of the key environmental problems from an agricultural perspective, impact of these on agriculture, impact agricultural activities on the environment, and restoration of environment by agriculture. In India, Resource conservation technologies (RCTs) are more resource efficient: reduced nutrient loss, increased soil organic C content, use less inputs, improved production and income and reduced GHG emission compared to the conventional practices. Sustainable agriculture holds promise for humankind and the planet Earth, and it can be successful if all developed and developing nations stand together to seek “our common future” to produce more food while generating less environmental pressure.

PRODUCTION PERFORMANCE OF DUAL PURPOSE CROSSES OF INDIGENOUS CHICKEN WITH IMPROVED VARIETY OF BIHAR

Birendra Kumar, S.R.K. Gunjan, Alok Bharti* and Ramesh Kumar

Bihar Veterinary College, Patna

**Email: alokbharti18@gmail.com*

Abstract

The present experiment was conducted on Vanaraja (VR) and its crosses with Desi fowl native to Bihar at Institutional Livestock Farm Complex, BVC, Patna, Bihar. Vanaraja was received from PDP, Hyderabad and Desi males were collected from Muzaffarpur (MUZ) and Gaya (GAYA) districts of Bihar. Males were crossed with the females of Vanaraja in the sex ratio of 1:5. Body weight of the chicks at 0 day, 5, 10, 15, 20 week was taken. Effect of Genetic Groups on Body weight at various ages was studied. The least squares means; standard error and coefficient of correlation were calculated through least squares models (Harvey, 1990). The phenotypic correlation coefficients of between the traits have been estimated. It was recorded that the genetic group had significant ($P < 0.05$) effect on body weight at all the ages. VR?? x VR ?? (Vanaraja) excelled over all the genetic groups whereas GAYA?? x VR ?? had the lowest body weights at all the age groups. Sex also had significant ($P < 0.05$) influence on the body weight at all the age groups and males were heavier than the females. Positive and significant correlation coefficients of high magnitude among body weights suggested that selection for improvement in any one of the traits would also lead to the simultaneous improvement of other correlated traits.

WEED MANAGEMENT BY PRE AND POST EMERGENCE HERBICIDES IN BT COTTON UNDER IRRIGATED CONDITION

Bishan Singh*, V.S. Hooda, Todarmal, Satpal

Department of Agronomy, CCS Haryana Agricultural University, Hisar-125004 (Haryana), India

**Email: bishanhau@gmail.com*

Abstract

Cotton is the major kharif cash crop of Haryana and India known as “White Gold”. Cotton is highly vulnerable to weed competition especially in the early stage of growth. As the cotton is slow growing crop while the growth of many weeds is very fast therefore, they produce competition and also suppress the growth of cotton. Cotton being a long duration crop, the critical period of weed competition prevails up to 60 to 90 DAS and during this period the crop needs weed free condition for



better seed cotton yield. Losses caused by weeds in cotton ranges from 50 to 85 percent depending upon the types of nature and intensity of weeds in field. The most common practice adopting by the farmers physically weeding and inter culture operation hoeing in the cotton. But scarcity of labour and high soil moisture conditions due to more no. of irrigation or frequent rainfall during kharif season, farmers are unable to doing on time proper inter-cultural practices. But several times these operations are more time consuming, costlier and challengeable. Hence, it has become imperative to control weeds by using pre and post emergence herbicides in critical period and to get higher productivity. Successful cotton production depends on weed management strategy that adapts to the unique characteristics of the crop variety.

PROCESSING AND VALUE ADDITION OF VEGETABLE CROPS

Braj Kishor^{1*}, Rajiv¹, Jitendra Kumar² and Nirankar¹

¹Department of Vegetable Science, CSAUAT, Kanpur

²Rama University Kanpur

*Email: brajkishor718@gmail.com

Abstract

The development of the vegetable product is always important as it is helpful in mentioning long life of the vegetables and it also improves the quality of vegetable by the addition of value in it. This paper consists of the processing and value addition of different vegetables. In India there are various types of under-utilized vegetables are available because they are not utilized properly although they have very high nutritive value. These crops have high potential in maintaining sustainability in terms of the economy of the country. Many of the vegetables are underestimated in terms of processing although they have a high processing capacity. This review gives information about processing of some of the major vegetable crops and it also covers processed products of these vegetables.

EVALUATION OF CONO WEEDER AT VARIABLE BLADE ANGLE

N.A. Shirsat, S.V. Pathak*, V.M. Puri, P.U. Shahare and C.S. Bagde

Department of FMPE, CAET, DBSKKV, Dapoli, Maharashtra

*Email: sachinpathak76@gmail.com

Abstract

Rice (*Oryza Sativa L.*) is one of the most leading food crops in the world within the world-wide cultivated cereals. Good yield realizations are expected for the season due to excellent monsoon rains with no major weather issues, pests or diseases. Weeds are the major problem of rice crop they lower the yield and quality of crop. Cono weeder is one of best tools for weeding in SRI Rice cultivation which compare with hand weeding causes a considerable reduction in labor costs and time consumption. The mechanization in the Konkan region is very limited. Weeding in paddy crop is traditionally done by labors or using different types of weeders i.e., cono weeder, Japanese weeder etc. Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli has designed and developed the cono weeder which has been supplied throughout Maharashtra state. The performance evaluation of DBSKKV cono weeder were evaluated in terms of actual field capacity (ha/h), field efficiency (%) and weeding efficiency (%) at different blade angles (20°, 30°, 40°). It was found that the travelling speed of the DBSKKV make cono weeder was 1.05 km/h. The theoretical and actual field capacity were found ideal at 30° which is to be 0.013 ha/h and 0.0099 ha/h respectively for DBSKKV make cono weeder. The field efficiency was found to be 72.99%. The weeding efficiency was found to be 81.58%.

PERFORMANCE TESTING OF BATTERY-OPERATED KNAPSACK SPRAYER

N.A. Shirsat, S.V. Pathak*, S.S. Ware, P.U. Shahare and C.S. Bagde

Department of FMPE, CAET, DBSKKV, Dapoli, Maharashtra

*Email: sachinpathak76@gmail.com

Abstract

The battery-operated knapsack sprayer is a spray equipment used for crop protection in many developing countries. Spraying is one of the important and widely accepted operations in crop production to increase the yield of the crop. The proper



selection of pesticides and application of correct dose at proper time are not only the attributes of a good performance in pest control, but in order to obtain maximum returns from their use, it is necessary to select the most efficient equipment for securing uniform deposit of pesticide on the target without any wastage of materials in least time and with minimum labour. For achieving this purpose, the modernization of spraying equipment has gone hand in hand with the development of new agrochemical and improved techniques. The project was under taken to study performance testing of battery-operated knapsack sprayer. The project work was carried out in Department of Farm Machinery and Power with respect to relevant IS code. All dimensions of all measurable parts of knapsack sprayer such as length of strap, width of strap, thickness of tank, length of tank, etc were checked and noted. Performance test like discharge test, tilt and inversion test, spray distribution test, strap test, tank drop test and battery test were carried out. The battery-operated knapsack sprayer consists of pump, boom, hose pipe, nozzle which mounted on frame. The sprayer has 12-V battery with 9 MAh capacity. The weight of the sprayer without water was found 5.3 kg. The capacity of sprayer tank was 16l. The maximum duration of working of battery-operated knapsack sprayer was 4.41 hours.

PERFORMANCE EVALUATION OF DIFFERENT TYPES OF CHAFF CUTTER

C.S. Bagde¹, S.V. Pathak^{1*}, V.S. Are², P.U. Shahare¹

¹Department of FMPE, CAET, DBSKKV, Dapoli, Maharashtra

²Department of FMPE, CAET, SHUATS, Prayagraj, U.P.

*Email : sachinpathak76@gmail.com

Abstract

Animal feeding is a very important aspect of livestock husbandry. It is very necessary to have effective utilization of available feed sources. Chaff is hay cut into small pieces for feeding livestock. Cutting fodder can be done by a manually operated, diesel-operated, or electric-operated machine. Traditionally, the farmers used hand sickles or an axe to cut the forage stalk into pieces. One adult bullock consumes 10-15 kg of fodder per day, while cows and buffaloes consume 8-10 kg per day. The study was done to evaluate the performance of different types of power operated chaff cutters, i.e., 2 HP, 5 HP, and 10 HP, and to conduct trials of these chaff cutters for sorghum and maize. The 2 HP power operated chaff cutter is used for both chaffing and grinding purposes, whereas the 5 HP and 10 HP are used only for chaffing purposes. The 10 HP power-operated chaff cutter gives more output than the other two types of chaff cutters. The overall performance of the 10 HP power operated chaff cutter was found satisfactory with effective output capacity and chaffing efficiency. The chaffing efficiency of 2 HP, 5 HP, and 10 HP machines for wet fodder was 82.72, 90, 93.03% for sorghum, 80.80, 82, 88.55% for maize, and 81, 88, 91.76% for sorghum and 77.47, 81, 86, 14% for maize. And for the grinding efficiency, it should be 95% and 96% for sorghum grain and maize grain, respectively. The average length of cut pieces for 2 HP, 5 HP, and 10 HP machine wet fodder was observed to be 90, 60.07, and 33.51 mm for sorghum; 26.6, 26.76, and 35.37 mm for maize; and for dry fodder it was found to be 24.6, 16.43, and 35.09 mm for sorghum; and 25, 25.59, and 38.64 mm for maize; and for the grinding material it should be 2 mm and 4mm, respectively for sorghum and maize.

COMPATIBILITY AND EFFICACY OF *STEINERNEMA BICORNATUM* AGAINST *SPODOPTERA LITURA* (FAB.) IN LABORATORY CONDITION

D.B. Ingole*, Supriya Koosari, Soumya S. Dash, D.P. Kashyap, N.V. Lavhe

Entomology Section, College of Agriculture, Nagpur, Maharashtra.

Email: dnyaneshwaringole81@gmail.com

Abstract

The present investigation was studied with the title “ Compatibility and Efficacy of *Steinernema bicornatum* against *Spodoptera litura* (Fab.) in laboratory condition” and the work was carried out in the Post Graduate laboratory of Entomology Section, College of Agriculture Nagpur during 2020-21 with aim to test the compatibility of CIB registered insecticides with entomopathogenic nematode *Steinernema bicornatum* use against *Spodoptera litura*. The compatibility of *S. bicornatum* with combination of Thiamethoxam 25% WG, Diafenthiuron 50% WP, Imidacloprid 17.8% SL, Chlorantraniliprole 18.5% SC, Indoxacarb 14.5% SC, Cypermethrin 10% EC, Chlorpyrifos 20% EC with double the recommended dose was found compatible with all treated insecticides except Cypermethrin 10% EC and Chlorpyrifos 20% EC which were found



incompatible with *S. bicornatum*. The pathogenicity of treated EPNs were tested against *S. litura* and *G. mellonella* @ 50 IJs/larva after 48 hrs and 72 hrs exposure with insecticides. The results showed that all treatments reduced their pathogenicity as compared to untreated control except Imidacloprid 17.8% SL which was found more superior than other treatments. Moreover *G. mellonella* was found more susceptible as compared to *S. litura*.

STUDIES ON THE EFFECT OF DIFFERENT LEVELS OF DRIP IRRIGATION AND PLASTIC MULCH ON GROWTH, YIELD AND WATER USE EFFICIENCY OF CAULIFLOWER (*BRASSICA OLERACEA* VAR. *BOTRYTIS*)

Daleshwar Rajak^{1*}, Gondra Mardi², Prasad Pradeep³ and Nazurssalam⁴

¹Agricultural Engineering, Zonal Research Station, Darisai (BAU), Barakhurshi, East Singhbhum, Jharkhand

²Plant Protection, K.V.K., East Singhbhum, Jharkhand

³Agronomy, Zonal Research Station, Darisai (BAU), East Singhbhum, Jharkhand

⁴Entomology, Zonal Research Station, Darisai (BAU), East Singhbhum, Jharkhand

*Email: drajak76@rediffmail.com

Abstract

A field experiment was conducted on sandy loam during rabi season of 2019-20 to 2020-21 at Zonal Research Station, Darisai, East Singhbhum, Jharkhand to study effect of different levels of drip irrigation and plastic mulch on growth, yield and water use efficiency of cauliflower (*Brassica oleracea* var. *botrytis*). The experiments were laid out in randomized block design with eight treatments viz: T₁- drip irrigation with 100% ET (Evapo-transpiration), T₂- T₁ + silver black polyethylene mulch, T₃- drip irrigation with 80% ET, T₄- T₃ + silver black polyethylene mulch, T₅- drip irrigation with 60% ET, T₆- T₅+ silver black polyethylene mulch, T₇- surface irrigation, T₈- T₇ + silver black polyethylene mulch and were replicated thrice. The experiment revealed that higher yield (255.83 q/ha) was recorded in treatment T₄- Drip irrigation at 80% ET + Silver black polyethylene mulch with maximum plant height, plant spread and diameter of curd and was significantly superior over rest treatment. The water use efficiency of 142.01 kg/ha/mm was recorded in drip irrigation at 80% ET+ Silver black polyethylene mulch. The maximum net income (193764.68 Rs/ha) and benefit-cost ratio (3.12) was also noted in T₄- Drip irrigation at 80% ET + Silver black polyethylene mulch and minimum net income (Rs 75818.50/ha) and benefit cost ratio (1.77) was recorded in T₇- Surface irrigation.

ROLE OF INTEGRATED FARMING SYSTEMS FOR AUGMENTING FARMER'S INCOME

Deepa Amgoth^{1*} and B. Jamuna Rani²

¹Department of Extension Education and Communication Management, College of Community Science, Professor Jayashankar Telangana State Agricultural University, Hyderabad, 500030, Telangana. India.

²Director, International Programmes, Admin Block, Professor Jayashankar Telangana State Agricultural University, Hyderabad, 500004, Telangana. India.

*Email: deepanaikamgoth@gmail.com

Abstract

Farmers work incredibly hard all across the world but do not make any money, especially small farmers who have very little left over after paying for all inputs. The definition of farming is the process of allocating farm resources to meet the needs and goals of the farmer in his particular local environment.

It is a framework for an alternative development model to increase the viability of small-scale farming operations in comparison to bigger ones thanks to the creation of Integrated Farming Systems (IFS).

Cropping systems, horticulture, livestock, fisheries, forestry, and poultry are some of the farm enterprises that make up a farming system, together with the resources available to farmers to raise these commodities profitably. It effectively interacts with the environment without upsetting the ecological and socio-economic balance while still attempting to achieve the national objective. The farming system in its truest form will contribute in a variety of ways to raising the country's overall farmers' standard of living and agricultural economy. The farming system takes into account the needs of the family as a whole, as well as economic factors like the relative profitability of technically feasible business ventures, the availability of farm



resources, infrastructure and institutions like irrigation, marketing facilities including storage and transportation, and credit, in addition to the agro biological consideration of any interdependence between different technically feasible business ventures.

USE OF NANOTECHNOLOGY IN DISEASE MANAGEMENT OF CITRUS SPP.

Deepa N. Muske^{1*} and Snehal S. Deshmukh¹

¹College of Horticulture, Bidar;

² Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola

*Email: muskedeepa@gmail.com

Abstract

Citrus fruits are one of the most popular fruits in the world. They represent an important part of our daily diet not only because of the good taste, but also because of their high nutrition values and health benefits. Effective diagnostic tools for timely determination of plant diseases become essential to the assurance of agricultural sustainability and global food security. Molecular and Immunology based assays are gold-standard methodologies for the diagnosis of plant diseases till date, but the analyzing procedures are complex and laborious and required specific set of reagents to confirm the diseases. The prominent physical or chemical properties of nonmaterial's have enabled their use as innovative and high-performance diagnostic tools for numerous plant pathogens. Green synthesis of Cu and Zn nanoparticles by utilizing different plant extract is an emerging class of nanotechnology. It revolutionizes all the field of biological sciences by synthesizing chemical free nanoparticles and their applications in disease management. Two structurally different nanoparticles like copper and zinc were used for efficacy against citrus fungal diseases on highly susceptible cultivar. The study shows that the control of citrus fungal diseases was observed. In conclusion, the application of nanoparticles shows better performance than other chemicals used for control management. There are advantages of using nanoparticles over other management practices low toxicity, high surface area and antimicrobial activity, ability to move translaminal. Like this way for future its betterment to use nanoparticles in disease management as well as in agriculture and horticulture industry for multiple purposes.

EMERGENCE AND APPLICATIONS OF RNA INTERFERENCE IN AGRICULTURE

Deepa N. Muske^{1*} and Snehal S. Deshmukh¹

¹College of Horticulture, Bidar

²Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola

*Email: muskedeepa@gmail.com

Abstract

The discovery of RNA interference (RNAi) in mid-ninety's added a new dimension in the regulation of gene expression by different types of RNA. First discovered in plants the nematode *Caenorhabditis elegans*, the production of small interfering RNAs (siRNAs) that bind to and induce the degradation of specific endogenous mRNAs is now recognized as a mechanism that is widely employed by eukaryotic cells to inhibit protein production at a post-transcriptional level. The endogenous si RNAs are typically 19- to 23-base double-stranded RNA oligonucleotides, produced from much larger RNAs that upon binding to target mRNAs recruit RNases to a protein complex that degrades the targeted mRNA. Methods for expressing siRNAs in cells in culture and in vivo using viral vectors, and for transfecting cells with synthetic siRNAs, have been developed and are being used to establish the functions of specific proteins in various cell types and organisms. The historical background of RNAi, describes the role of different classes of RNA molecules, particularly of ds (double stranded) RNAs, hp (hairpin) RNAs, siRNAs and mi (micro) RNAs and two important polymerase III enzymes, namely, Dicer and RISC (RNA induced Silencing Complex) that help RNAi's carry out its function through a unique process. RNA interference methods provide several major advantages over prior methods (antisense DNA or antibody-based techniques) for suppressing gene expression. There are wide application of this technology in medicine, therapeutics, neurosciences and agriculture. In agriculture for crop improvement and development of resistance in plant against pathogen RNAi technology is widely using now a days. The technology became a powerful tool to understand the functions of individual genes and also proved useful for molecular breeders to produce improved crop varieties. Use of this powerful tool to understand the functions of plant genes and improve crop production. The application of this technology to enhance livestock production through increased



production efficiency and prevention of disease. An increased demand for sustainable food production is at the forefront of scientific challenges and RNAi technology will undoubtedly play a key role.

IDENTIFICATION OF PHYTOPHTHORA FUNGUS IN CITRUS ORCHARD USING MOLECULAR APPROACH.

Deepa N. Muske^{1*}, S.J. Gahukar² and Amrapali A. Akhare³

¹College of Horticulture, Bidar

^{2,3}Dr.Panjabrao Deshmukh Krishi Vidyapeeth, Akola - 444104. MH India

*Email: muskedeepa@gmail.com

Abstract

Citrus is one of the major economic horticultural crops of India. In recent years, the production of citrus is greatly affected because of diseases, caused by *Phytophthora* and Citrus Tristeza Virus (CTV), etc. Among them *Phytophthora* causes 80 to 90 % economic losses to grower. It has an extensive host range infecting different crops and weeds. It's very difficult for control management because of its pseudo fungus nature. For control management there is need of sensitive and accurate diagnosis of disease. In this study ITS (Internal transcribed spacer) regions are used to discriminate *phytophthora* from other fungus because ITS region sequences are much more variable, even among quite closely related organisms. More than 25 restriction enzymes are used for digestion of PCR product. By using restriction digestion of amplified PCR product of ITS4-ITS6 it was found that there is clear cut discrimination where it's possible to identify presence of *phytophthora* from a bulk of fungi samples. And specific amplicon sequence analysis was made for designing specific primer for *phytophthora*. This primer will be used for detection of *phytophthora* in bulk of fungi isolates. Applying this accurate diagnosis method grower can follow appropriate control management practices. And there will not be mismanagement in disease control. This method is applied to soil as well as nursery plant to detect infection of *phytophthora*. It's easy for a pathologist to diagnosis disease and develops accurate control management practices.

TOXICOLOGICAL CONSEQUENCES OF BUTACHLOR IN PADDY SOIL

Deepika*, Duhan, A., Priyanka and Monika

Department of Chemistry, CCS Haryana Agricultural University, Hisar-125004, India

Email: deepikabamal001@gmail.com

Abstract

Butachlor, a chloroacetanilide herbicide, is widely used as a pre-emergence weed management all over the world. As a result, there is a lot of concern about its potential adverse environmental effects and toxicity. The effects of herbicide on microbial populations, activities of dehydrogenase and hydrogen peroxidase enzymes in paddy soil, were investigated. The results concluded that when various concentrations of butachlor were applied, the population of actinomycetes decreased dramatically, while that of fungi & bacteria increased significantly. But at higher concentrations growth of fungi is also inhibited. It had a greater impact on fungi than it did on bacteria. Also, the growth of hydrogen-producing acetogenic bacteria was declined with the application of butachlor. At increasing doses, butachlor increased the activities of both the enzymes dehydrogenase and hydrogen peroxidase. It is clear that its application effects on population of different organisms and enzymes activities vary in rice soil. The concentration of butachlor used has a significant impact on the communities of several microorganisms and enzyme activity in paddy soil.

ADVANCEMENT OF AGRICULTURE IN INDIA VIA ICT

Deepak Kumar Patel¹, Shashikant Divakar¹ and Avinash Kumar²

¹Department of Extension Education, Bihar Agricultural University, Bhagalpur, Sabour, Bihar

²Department of Extension Education, Dr.Rajendra Prasad Central Agricultural University, PUSA, Samastipur, Bihar

Email: dkpbhu9915@gmail.com

Abstract

Use of ICT in agriculture is mainly to disseminate agriculture related information to the farmers. Agriculture is different from



industry and plays a significant role in the economic development of a nation. ICT has become an integral part of Information & Technology and has played a great role in the development of society, education and civilization. Information Communication Technology (ICT) has great potential in knowledge transmission system. ICT help expand educational opportunities, enhance the quality of teaching and learning, sustain life-long learning, and improve efficiency and effectiveness in learning methodology Agriculture just like other sector has improved a lot due to ICT revolution and has made advancement in ICT in various ways. Millions of house hold own TV and mobile phone and acting as a tool of communication among rural and urban farmers or cultivators. These tools of ICT ranges to advanced modern technologies, such as GPS navigation, satellite communication, and wireless connectivity, to older technologies such as radio and television. More than 70% rural populations are dependent on agriculture. However, the rural people still lack basic communication infrastructure in accessing crucial information in order to make timely decisions. The application of ICT in agriculture has potential to meet out scientific information gap related to agricultural practice to rural people and also to promote the agricultural production by providing same information to them directly. Moreover, Farmers now need information about trend and technology needed in farming so as to produce more and participate effectively in setting price of their product. To make all this tools materialized farmer particularly rural, need to awaken and make them more familiar with the advance tools and technique of ICT.

SOURCE OF INFORMATION INFLUENCING THE ADOPTION OF STRATEGIES TO MITIGATE CLIMATE CHANGE

Deepali Suryawanshi

Department of Agricultural Extension and Communication, RVSKVV, Gwalior (M.P.)

Email: deepasuryaa@gmail.com

Abstract

According to the term “climate change,” significant long-term changes in the world’s climatic systems are taking place. The GHGs (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, etc.) are causing the earth’s surface to warm as a result of trapping them there. Among the GHGs, carbon dioxide levels peaked and reached 410 ppm at the time of writing. This gas is the main contributor to global warming. By trapping more of this heat, the atmospheric concentration of this gas causes the earth to warm. Since the beginning of the industrial revolution, human activities like burning fossil fuels have increased the content of CO₂ in the atmosphere by 40 per cent, methane by more than 150 per cent, and nitrous oxide by about 20 per cent. In developing countries like India, the agricultural sector employs the majority of the rural population. However, the climatic conditions have an effect on their capacity to raise families and produce food. Climate change is India’s farmers’ biggest barrier to creating sustainable agricultural production, particularly in the state of Madhya Pradesh. To further understand the implications of different sources of climate information, adaptation strategies are evaluated at the farm household level and climate information is selected at the farmer level. the study’s participants, who took part in the study, which was carried out in the state of M.P.’s Chhindwara district.

CHARACTER ASSOCIATION AND PATH ANALYSIS IN ELITE GENOTYPES IN CHICKPEA [*CICER ARIETINUM* L.]

Dattesh Tamatam* and Sanjeev kumar

Department of Genetics and Plant Breeding, Lovely Professional University, Phagwara (Punjab), India.

**Email: samson.dattesh.7@gmail.com*

Abstract

The genetic variability studies carried out on 30 genotypes of chickpea indicated that the estimate of phenotypic coefficient of variation were greater than those of the genotypic coefficient of variation for all the traits studied. The close proximity between PCV & GCV values for most of the characters indicated less influence of environment on the expression of the characters under study. Considering heritability, all the characters studied recorded high heritability values. High heritability coupled with high genetic advance as per cent of mean was recorded for PH, NSP, 100 SW, TCC, RLWC, ELI, LP, Proline and SYP-1 indicating the scope of improvement through direct selection. Correlation analysis revealed that all the characters under study were positively and significantly associated with grain yield per plant. Path analysis revealed that DFF had the highest positive direct effect followed by NPB, NSP-1, H.I, PH, RLWC, LP and TCC dependent character i.e., grain yield per



plant. Hence, these characters could be considered as criteria for selection for higher yield as these were mutually and directly associated with grain yield.

EFFECT OF SOWING DATES AND SPACING ON (*TRIGONELLA CORNICULATA*) FENUGREEK CV. KASURI UNDER SUB-TROPICAL REGIONS

Deepanshi Deora^{1*}, Akansha Deora² and Abhitej Singh Shekhawat³

¹Department of Vegetable Science, College of Agriculture (RVSKVV) Gwalior, Madhya Pradesh

²Division of Plant Pathology, Rajasthan Agricultural Research Institute (SKNAU) Durgapura, Jaipur, Rajasthan

³Department of Soil Science & Agricultural Chemistry, College of Agriculture, Baytu (AU, Jodhpur), Rajasthan

*Email: deepanshideora29@gmail.com

Abstract

The present field experiment entitled “Effect of sowing dates and spacing on (*Trigonella corniculata*) fenugreek cv. Kasuri under sub-tropical regions” was conducted at Research Farm, Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture Mandsaur, RVSKVV, Gwalior (M.P.) during the year 2021-2022 with three dates of sowing viz. D₁ - 15th October, D₂ - 30th October and D₃ - 15th November and four different plant spacings S₁ (15 × 10 cm), S₂ (20 × 10 cm), S₃ (25 × 10 cm) and S₄ (30 × 10 cm). The result obtained during present investigation to measure the morphology, growth, herbage yield, seed yield and yield attributing parameters were studied. The plant height, number of branches, number of leaves, fresh weight of plant, dry weight of plant, herbage yield, seed yield and yield attributing parameters were found maximum when crop sown on 30th October. The plant height decreased gradually while other mentioned parameters increased with wider spacing from 15 cm to 30 cm. Interaction effect of date of sowing and spacing showed that kasuri methi sown on 30th October with spacing 15 × 10 cm significantly gave maximum fresh (155.32 q ha⁻¹) and dry (21.35 q ha⁻¹) herbage yield while crop sown on 30th October with spacing 25 × 10 cm produced maximum seed yield (6.67 q ha⁻¹) and yield attributing parameters.

CROP IMPROVEMENT THROUGH MICROBES WITH SPECIAL EMPHASIS ON INCORPORATION AND DECOMPOSITION OF PADDY STRAW

Deepika Dhanda¹, Baljeet Singh Saharan^{2*} and Vishal Ahlawat³

¹Dept. of Botany & Plant Physiology (Environmental Sciences), College of Agriculture, CCSHAU, Hisar

²Department of Microbiology, College of Basic Sciences & Humanities, CCSHAU, Hisar

³Department of Soil Science, College of Agriculture, CCSHAU, Hisar

*Email: baljeetsaharan@hau.ac.in

Abstract

Microorganisms are the most important candidates for improving yield by enhancing soil conditions and fertility. Moreover, plant growth-promoting microbes are commonly used to enhance plant growth and crop yields. The rhizosphere creates the microclimate where triple (plant-bacteria-fungus) interactions take place. Microorganisms help in enhancing the quality of soil by decomposition of agro-waste/residue. North India produces large quantities of paddy straw which is not properly utilized and ultimately leads to degradation of soil quality and environmental problems. Paddy straw is not a preferred material as animal feed due to its high lignin and silica content. Alternatively, the paddy straw is burnt in the open to remove it from the field. Stubble burning is not only environmentally unacceptable (as it causes air pollution) but also leads to loss of soil organic matter and essential nutrients, reduces microbial activity and makes the land more vulnerable to soil erosion. Direct burning of paddy straw in the field causes significant changes in soil temperature, especially in the top layer of soil, in addition to reducing C sources, soil P and soil ammonium levels for microbes. Straw burning also reduces microbial biomass, microbial quotient and CO₂-C respiration. The rising cost of fertilizers and the need to restore plant nutrients to improve the crop yield has led to the practice of incorporation and decomposition of paddy straw by potent microbes. Microbes use their enzymes for the degradation of recalcitrant compounds (such as lignin etc.) in rice straw. Direct mixing of paddy straw into the soil and its biodegradation is a practice that can help in the use/consumption of large amounts of this problematic agro-waste for the slow release of nutrients into the soil for the respective crops. In addition, it acts as a source of nutrients to improve soil structure, soil health, increase its organic matter and ultimately help in plant growth and development during natural farming conditions.



ROLE OF MICROBES IN SOIL HEALTH MANAGEMENT AND PRACTICES: A GATEWAY TO SUSTAINABLE AGRICULTURE

Swati Meel and Baljeet Singh Saharan*

Department of Microbiology; CCS Haryana Agricultural University, Hisar 125 004, INDIA

*Email: Baljeetsaharan@hau.ac.in

Abstract

In the modern era, our soils are facing the problem of nutrient deficiency. Therefore, we should look into alternative approaches and plant growth promoting rhizobacteria (PGPR) is very important among them. PGPR are the bacteria of rhizosphere that help in enhancing the plant growth by various processes like production of 1-Aminocyclopropane-1-carboxylate deaminase (ACC), volatile organic compounds (VOCs) and phytohormones. In addition to production, they also help in phosphate solubilization, siderophore production and by exhibiting antifungal activity. In near future, the use of pesticides and chemical fertilizers may be reduced due to the increased potentiality of PGPR. A variety of microbial communities are supported in soil due to moist environment and availability of reduced carbon. The microbial colonization is also favoured due to diverse form of root exudates and presence of plant cell debris. To enhance the plant growth and production, different indigenous PGPR are enriched in respective soils using natural farming practices. PGPR show direct and indirect ways to enhance growth of plant. The direct method is being used for growth enhancement using mineral acquisition and growth augmentation. The indirect method uses a variety of ways to protect plant from pathogen attack by favouring competition and antibiosis. The main problem for farmers is the abiotic stress which adversely affects the plant growth. PGPR having enzyme ACC deaminase helps in conversion of ACC into α -ketobutyrate and ammonia. PGPR produce different VOCs like terpenes, nitrogen-containing compounds and fatty acid derivatives. These mainly helps in the chemical communication between bacteria and plants. These are the most important growth regulators having a great impact on metabolism of plant and stimulation of plant defense response mechanisms in case of stress conditions. PSB strains solubilizes mineral phosphate into soluble form by releasing low molecular weight organic acids by which their carboxyl and hydroxyl groups chelate the cations bounded to phosphate. Siderophores having low molecular weight compounds which are mainly produced under iron-limiting conditions and transport of Fe into microbial cell takes place by chelating the ferric ion (3+) with high specific activity. Indirect mechanism of PGPR, includes production of phenazine, 2,4-Diacetylphloroglucinol (DAPG), pyrrolnitrin and pyoluteorin helps in suppression of different pathogenic fungi and bacteria. Emphasis should be given to explore the potential of isolated PGPR from natural farming conditions and to demonstrate their biocontrol capabilities.

EVALUATING APPLICATION METHODS OF SUPERABSORBENTS ON SOIL WATER AVAILABILITY AND CROP PRODUCTIVITY IN CLUSTER BEAN (*CYAMOPSIS TETRAGONOLOBA*) UNDER RAINFED CONDITION

R.S., Dadarwal¹, Vishal Ahlawat², Vinay Rawal¹, M.K. Jat³ and Kavita¹

¹Department of Agronomy, College of Agriculture, CCS HAU, Hisar, Haryana-125004, India.

²Department of Soil Science, College of Agriculture, CCS HAU, Hisar, Haryana-125004, India.

³Regional Research Station, Bawal, CCS HAU Haryana-123501, India.

*Email: vahlawat@hau.ac.in

Abstract

Cluster bean (*Cyamopsis tetragonoloba* L. Taub) alias guar is one of the important multifaceted, African originated, legume crops in India. It is utilized as vegetable, fodder and gum producing leguminous crop. The present investigation was carried out to Evaluating Application Methods of Superabsorbents on Soil Water Availability and Crop Productivity in Cluster bean (*Cyamopsis tetragonoloba*) under Rainfed Condition. A field experiment was laid out in split-plot design comprising four level of super absorbents (3 kg/ha Pusa hydrogel, 3 kg/ha Gond katira, 3 kg/ha Gum *sterculia* and control) in sub-plots and four levels of super absorbents application methods (Mixing at plough depth, furrow application, seed coating and mixing at plough depth and seed coating and furrow application) in main-plots, replicated thrice. Improvement in water productivity, water use efficiency and yield were witnessed with Pusa hydrogel application under seed coating and furrow application method. Furthermore, application of super absorbents through seed coating and furrow application method was evinced economically and ecologically sustainable in the rainfed condition of Haryana, India. Super absorbents are to be leveraged for



utilizing existing water potential vis-à-vis to advance crop productivity, which ensure minimum inputs imply maximum output in a sustainable genre.

AGROECOLOGICAL FARMING PRACTICES: CONTRIBUTION ON ECOSYSTEM SERVICES AND CLIMATE RESILIENCE

Devendra Kumar Kurrey*, Hulas Pathak and G.N. Narnaware¹

Department of Agricultural Economics, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Krishak Nagar, Raipur, Chhattisgarh

¹College of Dairy Technology, MAFSU, Nagpur, Maharashtra

Email: devendrakurrey95@gmail.com

Abstract

Climate of a country, region, and state determines what are the crops can be grown it can be said that climate of the region decides cropping system and crop rotation of that particular region and it has direct relationship. Cropping systems and crop rotation have developed over time immemorial by farmers for food security and marketable surplus depending on weather, soil, food needs (quantity and quality) and many other factors. Since Indian agriculture is predominantly dependent on Monsoon and weather, soil type India has been divided into heterogeneous agroecological and agroclimatic zones to facilitate planning for crop production. the objective this study is to assess what type of action will be needed to best produce a profit for the farmer while supporting the environment. Agroecological farming practices enhance resilience is to reduce vulnerability to climate change, climatic extremes and other shocks; and also tries to improve capacity to adapt. It has been practiced and evolving in almost all the states in India. Various practices have been developed in all over the world to tackle climatic variations and ecological calamities. we analyzed some of potential activities to cope up these issues, e.g., selecting crops and local varieties which are climate resilience, Direct seeding and SRI techniques, water harvesting and conservation structures, Crop diversification for livelihood security and resilience to climate variability. Integrated farming systems, tillage practices, composting and botanical sprays. we discussed the theoretical and methodological implications in this research to foster sustainability and climate resilience. This research on the subject also has been quite wide and guided farmers for profitable cropping systems which gives maximum yield from a piece of land at the same time protect natural resources. This study will help stakeholders to foster agroecological-policy linkage.

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH AND YIELD OF MAIZE (*ZEAMAYS L.*)

Dheeraj Kushawaha

Department of Agronomy, National P.G. College, Barhalganj, Gorakhpur, India

Email: dkushawaha481@gmail.com

Abstract

A field study entitled “Effect of integrated nutrient management on growth and yield of maize (*Zea mays L.*)” was conducted during rabi season of year 2021 at research farm of the National P.G. College Barhalganj, Gorakhpur, India. The study was assessed the effect of application of plant nutrients through organic and inorganic sources and their combination on yield and nutrient partitioning and accumulation in plant parts productivity, along with economics of maize production. The experiment consisted of 7 treatments comprising chemical fertilizers, organic manure, and their combinations, viz., T₁ (100% RDF), T₂ (50% Nitrogen + 50% FYM), T₃ (50% Nitrogen + 50% Vermicompost), T₄ (50% Nitrogen + 50% Vermicompost + PSB), T₅ (75% Nitrogen + 25% FYM), T₆ (75% Nitrogen + 25% Vermicompost), T₇ (75% Nitrogen + 25% Vermicompost + PSB). These treatments were evaluated under randomized block design (RBD) with three replications. Maize cultivar (VNR-4226) was taken as test crop. The results revealed that the grain, biological and stover yield of maize respond significantly with the different treatment combination. The results showed highest grain yield (47.29 q ha⁻¹), biological yield (134.97 q ha⁻¹), stover yield (87.68 q ha⁻¹) and harvest index (35.03%) with the application of T₄ (50% Nitrogen + 50% Vermicompost + PSB) though the results were at par with those obtained by applying T₇ (75% Nitrogen + 25% Vermicompost + PSB). Nitrogen, phosphorus, potassium, zinc, iron, manganese and copper content and uptake in grain and stover highest with the application of (50% Nitrogen + 50% Vermicompost + PSB) with statistically equivalent result with application of (75% Nitrogen + 25% Vermicompost + PSB). The application of (50% Nitrogen + 50% Vermicompost + PSB) contributed significantly to the soil



properties under investigation vis., aggregates, porosity and hydraulic conductivity and balanced as well as higher level of plant nutrition significantly enhanced the fertility status of soil. The study revealed that soil enrichment with 50% Nitrogen + 50% Vermicompost + PSB) resulted in highest monetary returns of Rs.100057.7 ha⁻¹ and maximum C:B ratio (1.70).

INVESTIGATION OF SOYBEAN INSECT PESTS

Devesh Parmar

Department of Entomology, Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan

Email: 0909deveshparmar@gmail.com

Abstract

The Department of Entomology at the Rajasthan College of Agriculture, MPUAT, Udaipur, conducted research on “Screening and effects of intercropping on soybean [*Glycine max* (L.) Merrill] insect pests and Molecular characterization and Population dynamics of major insect pests of soybean” starting in the Kharif season of 2021. During the investigation, the predatory pentatomid insect (*Eucanthecona furcellata*), spiders, and stem fly parasitoids were the related natural enemies. To study the effects of intercropping in soybean against insect pests, Soybean were intercropped with Urd bean, Maize, Cowpea, Sesame, Groundnut in 2:2, 2:2, 2:1, 2:1, 2:1 row proportion respectively and Soybean was cultivated with and without farmscaping. *Spodoptera litura*, *Hedylepta indicata*, and *Diachrysia orchalcea*, were the three species of defoliators, and *Spodoptera litura* was by far the worst. Maize and pigeonpea proved the most effective intercrops because of their phenology, repellent chemicals, and physical barriers and also because they were not the natural hosts of the defoliators and did not compete with soybean. In these two crops, the incidence of the defoliators and the extent of damage to soybean leaves were the lowest and the yields were the highest (3.56 t/ha in soybean–maize and 3.25 t/ha in soybean–pigeonpea).

LUMPY SKIN DISEASE IN INDIA

Dheeraj Kumar

Department of Animal Production, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, (Rajasthan), 313001.

Email: dheerumaal@gmail.com

Abstract

The lumpy skin disease has created havoc in India. The disease, which mostly affects cattle, has now spread to over ten states in India. Reportedly, it has already killed 75,000 cattle in the country. The virus mostly affects cows, buffaloes and deer. Lumpy skin disease is a viral disease and is transmitted by blood-feeding insects, such as certain species of flies and mosquitoes, or ticks. It causes fever and nodules on the skin and can lead to the death of the cattle. Lumpy skin disease is a contagious viral disease that spreads among cattle through mosquitoes, flies, lice and wasps by direct contact, as also through contaminated food and water. It does not transmit from cattle to humans. According to the Centre, the disease has spread in Gujarat, Rajasthan, Punjab, Haryana, Uttar Pradesh and Andhra Pradesh. The disease was first reported in India in 2019.

POST- HARVEST HANDLING OF CHRYSANTHEMUM: A STEP TOWARDS INCREASING MARKET POTENTIAL OF FLORICULTURE

Divesh Thakur^{*1}, Puja Sharma¹, Reva Jaryal² and Sunandini³

¹Department of Floriculture and Landscape Architecture, Dr Y S P University of Horticulture & Forestry, (Nauni) Solan, Himachal Pradesh

²Deptt. of Seed Science and Technology, Dr.Y.S.P. University of Horticulture & Forestry, (Nauni) Solan, Himachal Pradesh

³Department of Forest Products, Dr.Y.S.P. University of Horticulture & Forestry, (Nauni) Solan, Himachal Pradesh

*Email: thakurdivesh125@gmail.com

Abstract

The flowers are highly perishable and are prone to post harvest losses. Nearly 30 % flowers perish during handling. In India as well in international market, the demand of cut blooms is increasing year after year. Chrysanthemum is an important cut flower has high economic value, including flowers that are in great demand at domestic or abroad. It ranks second after rose (spray



type) and seventh (standard type) in cut flower production. As cut flowers, chrysanthemums are used for decoration and flower arrangements at weddings, and for opening new offices. The quality of cut flowers depends on the appearance and durability of freshness. Flowers with prime quality have higher sales value than low-quality cut flowers. The handling of post-harvest chrysanthemums is an important factor that is inseparable from the stages of cultivation and greatly influences the selling value and added value that will be obtained by farmers and traders. Various factors-affecting postharvest keeping quality of chrysanthemum consist of inherent factors, pre-harvest growing conditions, harvesting of chrysanthemum and post-harvest handling of chrysanthemum. Before reaching the consumer, chrysanthemum pass through many handling steps such as pre-cooling, grading, storage, packing and transit. To enhance the vase life of chrysanthemum floral preservatives likes pulsing solution, bud opening solution and holding solution or vase solutions are used. Storage of chrysanthemum is highly useful to regulate supply of flower in the markets to prevent glut especially, during the period of high production and low demand when the prices crash down. Chrysanthemum cut stems are held tightly in the boxes so that they are not damaged by the jerk movements during transit. Efforts to maintain the quality of chrysanthemum cut flowers that meet the quality standards can provide added value for farmers and flower traders. By implementing post-harvest chrysanthemums in accordance with handling procedures, chrysanthemums will be obtained that can meet quality standards.

INTEGRATED APPROACHES FOR MANAGEMENT OF PIGEONPEA WILT CAUSED BY *FUSARIUM UDUM*

Durga Prasad

Department of Plant Pathology, College of Agriculture, Baytu-344034, Agriculture University, Jodhpur, Rajasthan, India

Email: dp.coabaytu@gmail.com

Abstract

Pigeon pea [*Cajanus cajan* (L.) Millsp.] is the second most important pulse crop after chickpea in India. Among the pulses, it is extensively used as an important source of protein in the human diet. It finds an important place in the farming systems adopted by small and marginal farmers in a large number of developing countries as it restores the soil fertility by fixing atmospheric nitrogen. The main constraints in boosting the yield of the crop are its susceptibility to diseases, insects and other physiological stresses. This crop is affected by more than a hundred pathogens. Among the diseases, wilt caused by *Fusarium udum* is a serious problem in the production of pigeonpea in Bundelkhand region of Uttar Pradesh. Soil amendment with SMS, farm yard manure and bio-agents promote the population of antagonistic microorganisms which interfere with the activities of pathogenic fungi. They stimulate the natural disease defence system in plants and minimize the affect of different soil borne fungal pathogen. Keeping in the view of above facts, a pot experiment was conducted during *Kharif* seasons of 2021 under polyhouse conditions at BUAT, Banda (U.P.) to assess the efficacy of single & integrated application of spent mushroom substrate of oyster, farm yard manure, bio-agent [*Trichoderma harzianum* (Th)&*Pseudomonas fluorescens* (Pf)] and chemical (Carbendazim 50% WP) against *Fusarium udum* and to evolve a measure which can control the wilt disease effectively. Out of 11 treatments evaluated against *Fusarium udum*, the highest seed germination (100%) was recorded in the pots in which the pigeon pea seeds were treated with Carbendazim 50% WP prior to sowing. The second highest seed germination (95.83%) recorded in pots where the soil was amended with combination of spent mushroom substrate (SMS) + Th followed by 91.67% seed germination obtained due to amendment of soil with combination of SMS + (Th + Pf) or Farm Yard Manure + (Th + Pf). In view of percentage of wilted plants, minimum wilting i.e. 5% was observed in treatment where soil was amended with combination of SMS + (Th + Pf) followed by 8.33 and 8.34% wilt incidence due to seed treatment with Carbendazim 50% WP and soil amendment with combination of FYM + (Th + Pf), respectively.

INTEGRATED APPROACHES FOR MANAGEMENT OF PHYTOPHTHORA BLIGHT OF SESAME CAUSED BY *PHYTOPHTHORA NICOTIANAE* VAR. *SESAME*

Durga Prasad

Department of Plant Pathology, College of Agriculture, Baytu-344034, Agriculture University, Jodhpur, Rajasthan, India

Email: dp.coabaytu@gmail.com

Abstract

Sesame (*Sesamum indicum* L.) is one of the oldest oilseed crops widely grown in the India. It contains high quality unsaturated



fatty acid and natural anti-oxidants. The yield potential of sesame is much higher than the actual yield the farmers are still realizing because much damage occurs by pests and diseases. Among the different diseases, Phytophthora Blight of Sesame caused by *Phytophthora nicotianae* var. *sesame* is a most destructive disease and one of the major constraints for low productivity of this crop. Soil amendment with spent mushroom substrate (SMS), farm yard manure and bio-agents promote the population of antagonistic microorganisms which interfere with the activities of pathogenic fungi. They stimulate the natural disease defence system in plants and minimize the affect of different soil borne fungal pathogen. Therefore, an experiment was conducted during *Kharif* seasons of 2021 at BUAT, Banda (U.P.) to assess the effect of integrated modules with chemicals, organics and bio-control agents [*Trichoderma harzianum* (Th)&*Pseudomonas fluorescens* (Pf)] on Phytophthora blight and yield of sesame under natural epiphytotic field conditions. Out of 11 treatments evaluated against *Phytophthora nicotianae* var. *sesame*, the least disease incidence (73.97%) was observed in the treatment in which the soil was amended with combination of SMS + (Th + Pf) which was at par with 75.42 and 76% incidence recorded in the treatments where soil was amended with combination of SMS + Th and combination of FYM + (Th + Pf), respectively. Minimum disease severity (44.70%) was obtained due to amendment of soil with combination of SMS + Th and it was also at par with 45.33 and 46.29% severity observed in treatments where soil was amended with combination of SMS + (Th + Pf) and seed treated with Th prior to sowing, respectively. Soil amendment with combination of SMS + Th resulted in the highest yield (31.7 q/ha) which was statistically equal to yields obtained due to amendment of soil with combination of SMS + (Th + Pf) i.e. 30.80 q/ha and combination of FYM + (Th + Pf) i.e. 29.10 q/ha. The disease incidence, severity and yield obtained in unprotected crop were 92.51%, 93.36% and 17.60 q/ha, respectively.

EFFECT OF THE HEALTHY LIFE STYLE, GOOD DIETARY HABITS AND INCLUSION OF FIBER AND ANTIOXIDANT RICH FOOD IN DIABETIC PATIENTS OF UDHAMPUR DISTRICT (J&K)

Ekta Sharma

Department of Home Science, NIMS University Jaipur, Rajasthan (303121)

Email: ekta.sharma4482@gmail.com

Abstract

Udhampur is the southwestern district of J&K state of northern India which experience sudden rise in noncommunicable disease (NCD's) i.e. diabetes. According to the World Health Organization (WHO), noncommunicable disease (NCDs) accounted for 74% of death globally in 2019, of which, diabetes resulted in 1.6 million deaths, thus becoming the 9th leading cause of death globally. The National Family Health Survey has revealed that 8.35 percent of the population of Jammu and Kashmir is affected with the diabetes which is relatively much higher in than several states in India. The number of diabetic patients (both men and women) in term of "very high" blood sugar level was found to be higher in urban areas (3.15%) than rural areas (2.85%) (NFHS-5, July 1, 2019- January 30, 2020). People with sedentary lifestyle, bad and poor dietary habits are more susceptible to diabetes. That is why there is an urgent need to understand the importance of healthy life style, awareness regarding to fiber rich food and antioxidant food for diabetic patients. (Type of research: quantitative research), For convenience of getting patients I have selected Military Hospital (CHNC) Udhampur J&K. CHNC Hospital opd caters exclusively to patients of diabetes new and follow up. The data was collected by interview method on the same day visit for diet prescription. 104 males and 104 females were selected. data was collected through anthropometric scale i.e. height, weight and BMI, questionnaire method, biochemical tests and diet history was collected by 24 hours food recall. The result showed that the both the quality and type of carbohydrates influence post prandial blood sugar level. Carbohydrates restriction and increase intake of fiber rich food has shown to be effective in improving blood glucose level on selected subjects and reducing the dose of medication. Fruits and vegetables are rich in antioxidants. By adding antioxidant rich food, it is observed that there is reduction of oxidative stress in patients and they feel healthier. Daily walking of 30 to 45 minutes was done by the subjects which helps them to reduce their blood sugar level. It emerged from the result that the selected subjects had very low knowledge about diets and also had lack of awareness about their disease. Lower consumption of antioxidants i.e. lower consumption of fruits and vegetables leads to the oxidative stress in the diabetic patients. Adopting healthy lifestyle, healthy eating pattern, inclusion of fiber rich food, balancing quality and quantity of carbohydrates and adding fruits and vegetables in diets are the key factors in controlling blood sugar level. Subjects were not aware of antioxidant rich food, balancing meal, portion control and quality and quantity of carbohydrates. Subjects mostly have sedentary lifestyle. Therefore, it is important of add fiber rich food as preventive measure as well as it is important to increase the intake of antioxidant rich food as a therapeutic measure for the management of Diabetes.



OPTIMIZATION FOR PHENOLIC COMPOUNDS FROM LEAF EXTRACT OF MEDICINAL PLANTS (*POTENTILLA FRUTICOSA* AND *REINWARDTIA INDICA*)

Farzana Kouser*, Gurdev chand, Monika Kumari and Sapalika Dogra

Division of Plant Physiology SKUAST- Jammu

*Email: farzanaalyas57@gmail.com

Abstract

Potentilla fruticosa have been shown to possess relatively high concentrations of phenolic acids and flavonoid and powerful radical scavenging capacity. It is a natural source of bioactive compounds with the potential of antitumor. And *Reinwardtia indica* has high ethnos medicinal and ornamental value, stem paste is applied on wounds, cuts, boils, and pimples. The presence of photochemical compounds in the plants indicates its medicinal potential. An optimization method was developed for total phenolic content (TPC), in leaf extract of *Potentilla fruticosa* and *Reinwardtia indica* with Organic solvents (methanol (99.8%), ethanol (99%), and acetone (99.5%)), and chloroform (99.8 %) were used for extraction. The estimation of TPC, in plant materials was carried out using UV-spectrophotometer with the standard Gallic acid. This result revealed that methanol is the best solvent for recovery of the TPC value from leaf extract in comparison to other solvents. Solvents have shown a significant effect in the extraction of phenolic compounds. In conclusion, the optimal solvent for extraction depends on the part of the plant material and the compounds that are to be isolated.

EFFECT OF FOLIAR APPLICATION OF SALICYLIC ACID AND NUTRIENTS ON GROWTH, YIELD AND FRUIT QUALITY OF NAGPUR MANDARIN (*CITRUS RETICULATA* BLANCO.)

G. Girwal¹, R.N. Kanpure¹, B.K. Kachouli², J. Bhandari^{3*} and P. K. Ausari⁴

¹Department of Fruit Science RVSKVV College of Horticulture, Mandsaur (M.P.)

²Plant Breeding & Genetics RVSKVV College of Horticulture, Mandsaur (M.P.)

³Krishi Vigyan Kendra, Jaora, Ratlam (M.P.)

⁴Department of Horticulture RVSKVV College of Agriculture, Gwalior (M.P.)

*Email: bhandarijitendra01@gmail.com

Abstract

An investigation was carried out at Instructional cum Research Fruit Orchard, Department of Fruit Science College of Horticulture, Mandsaur (M.P.) during 2019-20, to study the effect of foliar application of salicylic acid and nutrients on growth, yield and fruit quality of Nagpur mandarin (*Citrus reticulata* Blanco.). Results revealed that the maximum plant height (2.92 m), plant spread East-West direction (1.81 m), plant spread North-South direction (1.73 m), canopy volume (15.9 m³), number of flowers plant⁻¹ (563.67), fruit setting (54.05 %), minimum fruit drop (28.33 %), fruit retention (71.67 %), fruit length (6.61 cm), fruit diameter (6.79 cm), fruit volume (145.33 ml), fruit juice (36.20 %), minimum number of seeds fruit⁻¹ (10.34), TSS (12.37 °Brix), minimum acidity (0.74 %), TSS: acid ratio (16.74), ascorbic acid content (26.65 mg/100 ml juice), SPAD value (68.72), total sugars (8.32 %), number of fruits per plant (201.33), fruit weight (138.33 g), fruit yield plant⁻¹ (27.85 kg) and fruit yield hectare⁻¹ (7.71 tonnes) were observed with foliar spray of SA @ 5mg/l + K₂SO₄ @ 0.4% + ZnSO₄ @ 0.4% + Ca (NO₃)₂ @ 0.4% (T₁₀) followed by treatment T₉ (SA @ 5mg/l + ZnSO₄ @ 0.4% + Ca (NO₃)₂ @ 0.4%). The minimum data were recorded with respect to all the parameters under control (T₁₁).

KNOWLEDGE OF INFORMATION COMMUNICATION TECHNOLOGY AMONG STUDENTS

Garima^{1*} and Sangeeta Gupta²

¹RCA Girls PG College Mathura, U.P.

²C.S. Azad University of Agriculture and Technology Kanpur

*Email: garimahome18@gmail.com

Abstract

Information and Communication Technologies (ICT) are defined as all devices, tools, content, resources, forums, and services that can be converted into or delivered through digital forms, which can be deployed for realizing the goals of teaching learning, enhancing access to and reach of resources, building of capacities, as well as management of the educational system.



These will not only include hardware devices connected to computers, and software applications, but also interactive digital content, internet and other satellite communication devices, radio and television services, web-based content, interactive forums, learning management systems, and management information systems. These will also include processes for digitalization, deployment and management of content, development and deployment of platforms and processes for capacity development, and creation of forums for interaction and exchange. The 21st century has seen ICT use becoming an inevitable part of life. Moreover, the ICT has the impact on students which enable them to any place learning. Use of the new technology of ICT, the off-campus delivery was an option for the students who were unable to attend the classes. Now a days, more students are accepted with this technology- facilitated learning settings. There is one of the examples that show the impact of ICT for the student. Traditional classroom learning has provided to learning in work-based settings which enable them to the access of courses and programs from their study places. This strategy not only have the impact of convenience for students but help to save the costs associated with the travel and time away from school and also situation and application of the learning activities within meaningful and useful contexts.

SKIN THICKNESS AND ITS RELATION TO MILK YIELD IN DAIRY ANIMALS

Durgesh Nandan and P.S. Pramanik

C.V.Sc. & A.H., A.N.D.U.A.T. Kumarganj Ayodhya (UP)

Email: dr.durgesh152@gmail.com

Abstract

The aim of the present investigation was to examine the relationship between skin thickness and milk yield. The experiment was conducted at Livestock Farm Complex, C.V.Sc. & A.H., ANDUAT Ayodhya, Ram Newaj Singh Dairy Farm, Kumarganj, Ayodhya (UP) and Gorakhnath Singh Dairy, Baijnathpur Gorakhpur (UP) as per availability of lactating animals (Murrah buffalo, Gir and Sahiwal cows) which was 32 animals of each breed. A total of 96 dairy animals were studied in this experiment in which 32 Murrah buffaloes, 32 Sahiwal cows and 32 Gir cows ranging from first to fourth lactation periods. The dairy animals were selected on daily milk yield and total milk yield were recorded from the records over an average period of 120 days of lactation length. The skin thickness was measured from seven sites or regions namely neck, chest, abdomen, rump, hind quarter, udder and flank of each animal. The result shows that, in Murrah buffaloes the highest average DMY was 8.16 ± 0.52 , 8.62 ± 0.55 , 8.29 ± 0.78 , 8.15 ± 0.55 , 8.69 ± 0.77 and 7.86 ± 0.39 litres by animals under thin skin thickness of neck, chest, abdomen, hind quarter, udder and flank regions respectively. In Sahiwal cows, it was observed that the highest average DMY was 7.26 ± 0.31 , 7.47 ± 0.65 , 7.63 ± 0.48 , and 7.69 ± 0.76 litres by animals under low skin thickness of neck, chest, abdomen and udder regions respectively. Whereas in Gir cows it was observed that the highest average DMY was 6.23 ± 0.46 , 6.06 ± 0.41 , 5.96 ± 0.51 , 5.06 ± 0.36 and 6.03 ± 0.65 litres by animals under low skin thickness of neck, abdomen, hind quarter, udder and flank regions respectively. However, it was also observed that all the Murrah buffaloes, Sahiwal and Gir cows having thick skin of different regions were found to produce lowest milk yield per day. Least square analysis showed that the relation between DMY and skin thickness of thin, moderate and thick in different regions was found to be statistically non-significant except in flank regions where different types of skin thickness found significant ($p < 0.01$). It may be concluded that, the udder skin thickness was minimum followed by that in ascending order in the neck, chest, abdomen, hindquarter, flank and rump regions of the animals. Further it was evident that Murrah buffalo, Sahiwal and Gir cows under their skin thickness were found to produce more milk, while moderate skin thickness produced more milk and then thick skin thickness produced milk.

INFLUENCE OF DIFFERENT AGROFORESTRY SYSTEMS ON YIELD AND NUTRIENT UPTAKE IN SEMI-ARID REGION OF HARYANA

Garima Dahiya*, K.K. Bhardwaj, Sonia Devi and Isha Ahlawat¹

Department of Soil Science, CCS Haryana Agricultural University, Hisar-125004, Haryana

¹*Department of Agronomy, CCS Haryana Agricultural University, Hisar-125004, Haryana*

Email: garimadahiya79@gmail.com

Abstract

Agroforestry system is one of the most promising land use systems which not only influences the soil properties, dynamic soil



biodiversity but also maintains the agricultural sustainability. The present study was conducted at the research farm, department of forestry, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana-125004, India to ascertain the effect of different agroforestry systems (Poplar + wheat, *Eucalyptus* + barley, *Melia* + wheat, Shisham + mustard, wheat, barley and mustard) on nutrient content, uptake and yield in semi-arid region of Haryana. Nutrient content *i.e.* N and P in grain, N in straw and micronutrient (Zn, Fe, Mn and Cu) in both grain and straw was non-significant among different agroforestry system. Maximum nutrient uptake *i.e.* N, P, K and micronutrient (Zn, Fe, Mn and Cu) in both grain and straw was obtained under sole wheat crop. Yield declined under all the agroforestry systems as compared to sole cropping. Under Poplar + wheat and *Melia* + wheat, both grain and straw yield reduced by 10.6; 13.2 and 17.8; 16.3%, respectively as compared to sole wheat crop. Similarly, grain as well as straw yield reduced by 5.0 and 6.8% under *Eucalyptus* + barley system, respectively. Shisham + mustard agroforestry system also recorded decline in both grain and straw yield by 22.2 and 20.0%, respectively.

BODY CONDITION SCORING AND BODY WEIGHT CHANGES DURING EARLY LACTATION IN GOATS

Gautami Sarma* and Sumit Gangwar

Department of Livestock Production Management, College of Veterinary and Animal Sciences, GBPUAT, Pantnagar- 263145, Uttarakhand

Email: s.gangwar026@gmail.com

Abstract

The Body Condition Score (BCS) method allows for a subjective evaluation of the live animal's condition or degree of fatness. Goats can be ranked according to their bodily reserves by touch and sight, which is an easy, non-intrusive, efficient management technique. According to their nutritional state, physiological requirements, and access to adipose tissue, goats mobilize their body fat reserves. After parturition when the animal is in negative energy balance state, there is fat mobilization which causes metabolic alterations that may have a significant impact on the health, welfare, and productivity of the animal. The present study was undertaken with 16 postpartum Surti goats divided into two groups: singlet and twin kids bearing. The body condition score and body weight of the dams were observed up to 60 days of parturition. Udder shape and biometry was also observed on the day of parturition. The mean value of BCS and body weight of twin bearing group was higher as compared to singlet bearing group in 1st month, while singlet group had higher BCS than twin group in 2nd month though the difference was not significant. The mean value of udder length, width, depth, circumference and teat diameter was significantly ($P < 0.01$) higher in twin kids bearing dams as compared to single kid bearing dams. The mean value of teat length was higher in singlet group than twin group though it was not significantly different.

ROLE OF MELATONIN IN ALLEVIATING SALT STRESS IN SORGHUM

Gayatri Kumari^{1*}, Sarita Devi¹, Bhupnesh Sharma¹ and ²Satpal

¹Department of Botany and Plant Physiology, CCS Haryana Agricultural University, Hisar (India)

²Department of Agronomy, CCS Haryana Agricultural University, Hisar (India)

*Email: ydvgayatri714@gmail.com

Abstract

Climate change has adversely affected our agriculture sectors by intensifying the frequency of various biotic and abiotic stresses. Salinity is one of the foremost abiotic stresses that has affected the crop phenology, growth and production via reduction in germination, decreased photosynthetic rate, yield attributes, decreased or delayed flowering, and pollen sterility thereby affecting food security. Salt affected areas continue to increase due to improper agricultural practices and different anthropogenic activities. Around 50% of the world's arable area is salt affected, in India alone, it is 6.7 mha. With the increasing human population and decreased arable lands it is hard to meet the demands for food supply. *Sorghum bicolor* is an annual C4 crop belonging to family *Poaceae*. It is primarily grown for feed and fodder requirements in drier parts of the world. However, sorghum is considered as tolerant crop for most of the abiotic stresses such as drought, heat etc. but salinity is the major constrain that reduces sorghum production. Biostimulants (salicylic and ortho-salicylic acid, jasmonic acid, GAs, glycine betaine, etc) are natural or synthetic chemicals that are involved in regulating the growth and development of plants and help to alleviate different abiotic stresses. Melatonin is one of the biostimulants that help to alleviate salt stress by



increasing plant height, leaf length, width, and stem diameter, increasing gas exchange parameters, relative water content and reducing abscisic acid content and eventually helping the plant to cope up with the salt stress in sorghum crop. Therefore, foliar application of melatonin can be successfully used for the improvement of sorghum growth under salinity stress and can further be useful in crop improvement programmes.

NANOTECHNOLOGY IN AGRICULTURE

Gayatri Kumari* and Sarita Devi

Department of Botany and Plant Physiology, CCS Haryana Agricultural University, Hisar (India)

*Email: ydvgayatri714@gmail.com

Abstract

World food production and distribution are facing huge stress with increasing population, climate change and various biotic and abiotic stresses that negatively affected the agriculture sector. Increasing agriculture under such scenario uses a staggering number of resources and energy such as increased use of pesticides, fertilizers, technology and man power. Nanotechnology is an emerging technology in the field of precision agriculture and food industry that could address many issues in agriculture. Nanomaterials plays a vital role in place of fertilizer and pesticide use. Application of nanomaterials can improve plant adaptation to the stressed environments such as drought and salinity by nutrition enhancement, improved soil condition, disease prevention, control and value-added product from animal by products and wastes. Different types of nanomaterial are being used such as carbon-based nanocarriers, polymeric and silver nanoparticles and liposomes. Nanofertilizers improves the metabolism of the plants by intake of nutrients through nanocuticles and release the nutrients only when they are required by the plants thereby, limiting the unwanted volatilization of fertilizers. Nanofertilizers will improve production of crop only at optimum levels. At the same time, improper nanofertilizer usage can also have a negative effect of crop production and yield. Therefore, nanotechnology is a promising technology that can be used to improve crop production for future demands, knowing the optimum amount of nanofertilizers that has to be applied for improved production.

EFFECT OF SIMULATED SOIL SALINITY CONDITIONS AND VARIETIES OF PIGEON PEA (*CAJANUS CAJAN* L.) ON BIOCHEMICAL PARAMETERS

Gaytri Soni¹ and S.G. Savalia²

¹Department of Agricultural Chemistry and Soil Science, College of Agriculture, JAU, Junagadh

²Department of Agricultural Chemistry and Soil Science, College of Agriculture, JAU, Junagadh

Email: gayatrisoni13@gmail.com

Abstract

The experiment constitutes five salinity levels (Control, 40, 60, 80 and 100 meq l⁻¹) and four pigeon pea varieties (V₁: GJP-1, V₂: Vaishali, V₃: BDN-2, V₄: AGT-2) in Completely Randomized Design (Factorial) replicated three times. Biochemical parameters viz., the highest proline accumulation (0.980 µmole/gf.wt) was found with variety V₄ (AGT-2) and it increased with increasing salinity levels. Among the different tested varieties, variety V₄ (AGT-2) produced significantly higher RWC, chlorophyll a, chlorophyll b and total chlorophyll content in leaves of pigeon pea at 45 DAS and these parameters decreased with an increase in salinity level. So, it can be concluded that variety V₄ (AGT-2) is salt-tolerant due to the highest concentration of proline, RWC, chlorophyll a, chlorophyll b and total chlorophyll content were obtained in it.

IMPACTS OF CLIMATE CHANGE ON CROP PLANTS AND FOREST TREES: REVIEW

Girish Chandra Tiwari

Department of Genetics & Plant Breeding, Baba Raghav Das Post Graduate College Deoria 274001, Affiliated to Deen Dayal Upadhyay Gorakhpur University Gorakhpur (U.P), India

Email: girishtiwari2012@gmail.com

Abstract

Present and expected pattern of global climate change are major concern in many areas of socio-economic activities, such as



agriculture and forestry. Climate means the average weather condition in an area over a long period of time usually 30 years or longer. Climate change is the abnormal change in climate patterns or environmental shift. Environmental shift affects the extent of plant diseases and insect pests both the presently occurrence and infestation, introduce of the new species. Following these changes, a number of diseases, pests and weeds, preventing actions needed to reduce the effects on human health and ecosystems. Climate change is a result from emission of greenhouse gases which increased due to increasing world population and industrial development. Emission of greenhouse gases in the past century that will cause atmospheric warming. Warming directly affects rate of plant respiration, photosynthesis and other biochemical processes. Use of fossil fuels, deforestation, burning and decay of biomass etc. leads to higher atmospheric concentration. Enhanced concentration can increase photosynthetic rate especially for plants growing under warm and dry condition such as plants. Naturally plants have their own mechanism to tolerate a certain level of increased temperature. As soil temperature increase, the decomposition rate of organic matter will increase and then nutrient mineralization and availability for plants uptake become increased at presence of sufficient water if other condition are unchanged. Thus, the interaction and different combination effect of rise concentration and temperature are determined by soil properties, water, mineral and nutrient availability etc., as a result the expected response of plants in different environments and climate variability can be either positively or negatively affected. Therefore, climate change is one of the main drivers of terrestrial biotic change and has different effects, such as disturbances and loss of habitat, fragmentation and increasing the incidence of photogenes. Due to impacts of climate change agricultural productivity affected in developed and developing world and climate change impacts on crops affect human health largely through potential for mal-nutrition and as a result, few studies have estimated millions of peoples are at risk or hunger. Furthermore, the effect will be higher on different sectors such as agriculture, forestry and health etc. and natural diseases expected to increase. Therefore, challenge of climate change requires coordinated action and united supports of the international community as a whole.

DEVELOPMENT AND CHARACTERIZATION OF NATIVE AND STARCH NANO PARTICLE BASED COMPOSITE FILMS FROM MANGO (*MANGIFERA INDICA*) KERNEL STARCH

Gurvendra Pal Singh^{1*}, Tianxi Yang², Prafull Chavan¹, Krishna Aayush¹ and Dinesh Kumar¹

¹School of Bioengineering and Food Technology, Shoolini University of Biotechnology and Management Sciences, Bajhol, PO Sultanpur, Distt., Solan 173229, HP, India.

²Food, Nutrition and Health Program, Faculty of Land and Food System, The University of British Columbia, Vancouver, BC V6T 1Z4, Canada.

*Email: gurvendranohwar@gmail.com

Abstract

Our population utilizes a large amount of disposable plastic. Thus, we need packaging materials that degrade efficiently also without damaging the environment. One of the primary sources for the development of biodegradable packaging is agricultural goods. In the present study, starch was isolated from mango kernels and used for the synthesis of nano starch. Nano starch-based composite films with varying concentrations (1, 2, 5, and 10%) of nano starch were prepared by the solution casting method. The native starch film properties such as thickness (0.053 mm), moisture content (10.03 %), water vapor transmission rate ($6.182 \times 10^{-3} \text{ g} \cdot \text{s}^{-1}$), water solubility (39.49 %) and burst strength (943.49 g) were observed. With the incorporation of nano starch at concentration of 1 to 10 %, film properties such as thickness (0.053 to 0.071 mm), burst strength (943.56 to 1265 g), moisture content (7.19 to 5.43 %), water vapor transmission rate (5.558×10^{-3} to $3.364 \times 10^{-3} \text{ g} \cdot \text{s}^{-1}$) and solubility (37.65 to 34.19 %) were improved. So, it would be a better replacement of plastic-based packaging.

BOTTLENECKS COMES DURING PRODUCTION AND MARKETING OF MUSTARD CROP IN JAMMU DISTRICT OF J&K UT

Goldy Bhagat, S.P. Singh & Anil Bhat

Division of Agricultural Economics and Agri-Business Management SKUAST- Jammu, JK- UT, India.

Email: goldybhagat18@gmail.com

Abstract

The word ‘mustard’ is derived from latin word ‘mustum’ or “must”, which denotes ‘expressed juice of grapes’ and “ardens”



means “hot & burning”. In Jammu and Kashmir, total area under mustard crop is 47.61 thousand hectares with total production of 250.22 thousand quintals and productivity of 525.76 kg/ha (Directorate of agriculture, Jammu, 2017-18). A study was conducted in Jammu district of JK- UT where out of 20 development blocks falling in Jammu district, we have selected two blocks named “R. S. Pura” and “Bishnah” randomly. The primary data on Mustard were collected by surveying through interview method with the help of pre-tested questionnaire and thereafter analyzed the constraints faced by them at various levels. We have used the Henry Garrett Ranking Technique to calculate the values for different type of constraints so that we could identify the problems faced by mustard growers. The study revealed that under production constraints, farmers faced maximum problem of high labour cost having average score 68.12 with Rank I followed by unavailability of labour during peak period with average score 65.47 having Rank II, uneducated farmers (Rank III), lack of technical know-how (Rank IV), no seed treatment (V Rank) etc., with the lowest Rank IX for uncertain rainfall. In case of marketing constraints, we have revealed that the highest rank (I) was given to high transportation charges (Average score 64.74) and lowest rank (VI) for lack of storage facilities at farm house (avg score 14.30). So, we have found that for encouraging the mustard cultivation on wide scale in Jammu district, the labour should be in surplus during peak period as it is labour intensive crop and the transportation charges should relatively be less whenever they transport their produce from production site to mandis or processing units.

FEED ADDITIVES : A STRATEGIC INTERVENTION TO REDUCE METHANE EMISSIONS

Gautami Sarma^{1*}, Olypica Sarma² and Sumit Gangwar¹

¹Department of Livestock Production Management, College of Veterinary and Animal Sciences, GBPUAT, Pantnagar, Uttarakhand

²Department of Animal Genetics and Breeding, College of Veterinary and Animal Sciences, GBPUAT, Pantnagar, Uttarakhand

*Email: gautami.sarma@gmail.com

Abstract

Methane is a byproduct of anaerobic fermentation produced in the rumen by methanogens. Ruminant methane emissions are viewed as a waste of feed energy that could have been put to better use in productivity. Methane is a potent greenhouse gas with high global warming potential by absorbing heat from the sun. These harmful greenhouse gases damage human health in addition to being environmental pollutants. Livestock contribute significantly to climate change by releasing these biogases into the environment. Agriculture byproducts with high lignin content can also increase methane production. For the purpose of reducing enteric methane emissions from ruminant animals, nutritional interventions like use of feed additives and methanogenesis inhibitors have been carried out. In order to increase feed consumption and lower the release of harmful biogases, research in recent years has concentrated on altering the rumen microbiota and the kinetics of fermentation in livestock. Substances such as probiotics, exogenous enzymes, plant metabolites and fodder trees, organic acids, and dietary fiber have also been explored for reducing methane emission. Feed additives like red seaweed, 3-nitrooxypropanol, tannins, nitrates, essential oils etc. have been known to reduce enteric methane emissions. Tannins with their defaunation ability control methane production. Virgin coconut oil containing medium chain fatty acid inhibit the growth of ciliate protozoa and methanogenic bacteria thereby reducing methane production in the rumen. Direct fed microbials like *Saccharomyces cerevisiae*, *Bacillus amyloliquefaciens* and *Aspergillus oryzae* also reduce methane production. Feed additives have proven to be helpful in maintaining sustainable production with simultaneous decrease in environmental impact

EFFECT OF POLLINATION METHODS ON FRUITING CHARACTERISTICS OF DIFFERENT STRAWBERRY CULTIVARS

Gurwinder Singh* and Parshant Bakshi

Division of Fruit Science, Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu

*Email: gurisdhu1009@gmail.com

Abstract

The present investigation was carried out at experimental research farm of Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu at Chatha during 2019-20 and 2020-21. Eight genetically diverse cultivars of strawberry were selected based on their genetic value and crossed through hand self-pollination and caging methods of pollination to



produce inbred lines of cultivars. After crossing of genetically superior parent by two different pollination methods viz., hand self-pollination and pollination by caging, Nabila showed best results among different cultivars. In hand self-pollination, fruit set after 21 days was found to be maximum in Nabila cultivar along with fruit retention, fruit weight, fruit length, fruit breadth, number of achenes per fruit and achene density. However, cv. Jutog Special showed lowest performance among all these parameters. In self-pollination by caging, fruit set after 21 days was found in cv. Rania, fruit retention in cv. Nabila, fruit weight in cv. Nabila, fruit length in cv. Rania and cv. Nabila, fruit breadth in cv. Nabila, number of achenes per fruit and achenes density in Sweet Charlie. However, maximum fruit set after 21 days were recorded by hand self pollination methods which resulted into maximum fruit retention, fruit weight, fruit length, fruit breadth etc. as compared to self pollination through caging. Hand self-pollination methods is best methods to develop fruit under controlled condition and ensure the pollination in strawberry cultivars to develop inbred lines.

STUDIES ON GENETIC VARIABILITY IN F₃ GENERATION OF THE CROSS GKVK13 × KCG2 IN GROUNDNUT (*ARACHIS HYPOGAEA* L.) FOR YIELD AND WATER USE EFFICIENCY RELATED TRAITS

H.C. Sowmya

Department of Genetics and Plant Breeding, UAS, Raichur, Karnataka

Email: hc.sowmya@gmail.com

Abstract

In order to identify drought tolerant genotypes, estimation of Water Use Efficiency through its related traits like SCMR and SLA is simple method. For effective selection of high yielding genotypes, knowledge on genetic parameters such as genetic variability, heritability and genetic advance is essential. Genetic variability studies for yield and WUE related traits are very important for selecting climate resilient genotypes in the present context of climate change. The present study has enabled to know the variability existing for different traits in the segregation generation and for further selection and to develop high yielding and water use efficient genotypes. The F₃ generation of the cross GKVK13 × KCG2 and their parents were evaluated. Observations were recorded on F₃ generation plants for days to first flowering, plant height, primary branches per plant, SCMR, SLA, pods per plant, pod yield per plant, kernel yield per plant, Shelling *per cent* and SMK *per cent*. Variability analysis was carried out in F₃ generation using the recorded data. High GCV and PCV values were recorded for pods/plant, moderate values for Plant height, pod yield/plant, kernel yield/plant, SMK and low values for days to first flowering, primary branches per plant, SCMR, SLA and Shelling percentage. There is low heritability for almost all the traits except Days to first flowering and plant height. Sufficient amount of variability exists for yield related traits but not for WUE related traits in the F₃ generation of the cross GKVK13 × KCG2 and further selection will be effective based on yield related traits but not on WUE related traits.

GENETIC VARIABILITY STUDIES IN F₃ GENERATION OF THE CROSS GKVK16 × KCG2 IN GROUNDNUT (*ARACHIS HYPOGAEA* L.) FOR YIELD AND WATER USE EFFICIENCY RELATED TRAITS

H.C. Sowmya

Department of Genetics and Plant Breeding, UAS, Raichur, Karnataka

Email: hc.sowmya@gmail.com

Abstract

Groundnut (*Arachis hypogaea* L.) is one of the important edible oilseed crops of the world which is native to Brazil in South America and presently cultivated throughout tropical, subtropical and warm temperate regions of the world. Kernels are rich source of edible oil (44-55%), dietary protein (25-33%), carbohydrate (20%), B-complex vitamins, especially thiamine and nicotinic acid but deficient in fat soluble vitamins A and D and almost lacking vitamin C. It also contains a higher proportion of unsaturated fatty acids including essential fatty acids like linolenic acid and linoleic acids. Thus, the crop has great future as oilseed as well as food crop. Haulm is an excellent fodder and oilcake is used for animal feed. Variability study is required to know the variability existing for different traits in the segregation generation and for further selection of high yielding and water use efficient genotypes. The F₃ generation of the cross GKVK16 × KCG2 and their parents were evaluated.



Observations were recorded on F₃ generation plants for days to first flowering, plant height, primary branches per plant, SCMR, SLA, pods per plant, pod yield per plant, kernel yield per plant, Shelling *per cent* and SMK *per cent*. Variability analysis was carried out in F₃ generation using the recorded data. High GCV and PCV values were recorded for pods/plant, pod yield per plant, kernel yield per plant, moderate values for Plant height, primary branches per plant, SLA, SMK and low values for days to first flowering, SCMR and Shelling percentage. There is low heritability for almost all the traits except Days to first flowering. Sufficient amount of variability exists for yield related traits but not for WUE related traits in the F₃ generation of the cross GKVK16 × KCG2 and further selection will be effective based on yield related traits but not on WUE related traits to develop high yielding genotypes.

MANAGEMENT OF THE BRINJAL SHOOT AND FRUIT BORER *LEUCINODES ORBONALIS* (GUEN.) THROUGH NEWER INSECTICIDES IN BRINJAL

Hansa Kumari Jat*

Rajasthan Agricultural Research Institute, Durgapura, Jaipur

Email: bbhansika@gmail.com

Abstract

The study on management of brinjal shoot and fruit borer *Leucinodes orbonalis* (Guen.) through newer insecticides were carried out. The treatment spinosad 45 SC and indoxacarb 14.5 SC were significantly reducing the shoot infestation with 3.42 percent and 3.58 percent, respectively. Whereas chlorantraniliprole 18.5 SC and flubendiamide 20 WG found least effective with 4.69 percent, 4.78 percent shoot infestation, respectively. The treatment spinosad 45 SC and indoxacarb 14.5 SC were significantly reducing the fruits infestation with 3.11 percent and 3.28 percent, respectively. Whereas the treatment flubendiamide 20 WG and chlorantraniliprole 18.5 SC found least effective with 4.99 percent, 4.69 percent fruits infestation, respectively.

FLORAL BIOLOGY OF BER (*ZIZIPHUS MAURITIANA LAMK.*) CULTIVARS UNDER SEMI-ARID CONDITIONS OF HARYANA

Hardeep

Department of Horticulture, Maharana Pratap Horticultural University, Karnal, Haryana, India

Email: hardeepsangwan13@gmail.com

Abstract

A field experiment was carried out at experimental orchard, CCS Haryana Agricultural University, RRS, Bawal (Rewari), Haryana to study the floral biology of ber. Nine cultivars of ber planted during 2007 (13 years old plants) at 7 m × 7 m in randomized block design were selected for evaluation. The plants were tagged in the month of April. These cultivars were observed to study the variability in floral biological parameters. The floral parameter such as flowering habit in the selected cultivars was recorded on the leaf axis of secondary branches. The ovary was observed superior to half-inferior among the cultivars. Anthesis occurred in forenoon in some cultivars whereas, in afternoon in others. Dehiscence time was observed from 1 to 3 hours in different cultivars. Date of initiation of flowering to end of flowering, flowering duration, time taken from flowering to fruit setting, time taken from fruit setting to fruit maturity varied as 16 August to 31 October, 49-62 days, 16-21 days and 128-151 days, respectively.

EFFECT OF PHYSICAL AND CHEMICAL MUTAGENS ON FLOWERING CHARACTERS OF GLADIOLUS (*GLADIOLUS GRANDIFLORUS L.*)

Harendra Tiwari and Ashok Kumar Pandey

Department of Horticulture, Janta College, Bakewar, Etawah, C.S.J.M. University, Kanpur, U.P, India

Email: harendratiwari545@gmail.com

Abstract

A field experiment was conducted to evaluate the flowering characters of two commercial varieties of Gladiolus, i.e., cv.



American Beauty and Nova Lux, at Janta College, research farm, Bakewar, Etawah, of CSJM University, Kanpur during the winter seasons of two successive years, 2020–21 & 2021–22, respectively. The experiment was laid out in Factorial R.B.D. with three replications, nine treatments, and 18 treatment combinations separately. Studies showed that the minimum days to emergence of spike, maximum number of spikes per plant, maximum duration of flowering, maximum length of spike (cm), minimum days to first floret opening, maximum number of florets per spike, maximum diameter of florets (cm), maximum length of florets (cm) and maximum vase life of cut spike (days), were recorded in treatment with @ (2kR Gamma irradiation), followed by @ (3kR Gamma irradiation) treatment, while the maximum days to emergence of spike, minimum number of spikes per plant, minimum duration of flowering, minimum length of spike (cm), maximum days to first floret opening, minimum number of florets per spike, minimum diameter of florets (cm), minimum length of florets (cm), minimum vase life of cut spike (days), and maximum vegetative abnormalities were recorded in treatment with @ (5kR Gamma irradiation) followed by @ (0.8% EMS), under the south-western agro-climatic conditions of Uttar Pradesh.

PERCEPTION AND BUYING BEHAVIOUR OF CONSUMERS TOWARDS FUNCTIONAL DAIRY PRODUCTS

Harmilan Kaur, Ritish Raheja, Gagandeep Banga and Babita Kumar

School of Business Studies, Punjab Agricultural University, Ludhiana, Punjab, India

Email: harmilankaur1997@gmail.com

Abstract

The present study was conducted to study the perception and buying behaviour of consumers towards functional dairy products in Ludhiana. The study was undertaken by selecting 225 respondents from the Ludhiana District. A list of residential areas of Ludhiana was prepared and from the list 5 localities each from high-, middle- and low-income group were selected on judgement basis and 15 households from each locality was selected on the basis of convenience sampling. The family member who makes the purchase decision from each household was selected, thus a total of 225 consumers was selected for the study. A systematic, open-ended questionnaire was used to gather the data. The survey found that there is a growing awareness of functional dairy products. With the increase in the awareness of the functional dairy products, perception of the consumers is also changing in the positive way. According to the responses, functional dairy products enhance intestinal health; all yoghurts contain probiotics; they boost immunity; and they can speed up the healing process after an illness. Poor packaging, health concerns, and trust issues are the main barriers to the adoption of functional dairy products.

SPEED BREEDING : A PROMISING TOOL TO ACCELERATE CROP PRODUCTION

Harsiddhi Limbani* and D.R. Mehta

Department of Genetics and Plant Breeding, College of Agriculture, JAU, Junagadh

*Email: limbani.hari111@gmail.com

Abstract

Global human population growth amounts to around 83 million annually and it is estimated this will grow till 9.8 billion by mid-2050. Providing global food security to this growing human population makes the pressure high on researcher and the changing climatic scenario makes the crop improvement much back breaking. The conventional breeding methods have given lot of high yielding varieties but these methods are taking longer time to accelerate the crop improvement so the faster crop improvement rate can be achieved by the method called 'speed breeding' for improving crops genotypically as well as phenotypically. Speed Breeding greatly shortens generation time and accelerates breeding and research program. Speed breeding can be used to achieve up to 6 generations per year for spring wheat (*Triticum aestivum*), durum wheat (*T. durum*), barley (*Hordeum vulgare*), chickpea (*Cicer arietinum*) and pea (*Pisum sativum*), and 4 generations for canola (*Brassica napus*), instead of 2-3 under normal glasshouse conditions. This accelerated research can be achieved by providing crops 24 hours of artificial lights and optimum relative humidity and temperature in controlled environment like glasshouse. The use of supplemental lighting in a glasshouse environment allows rapid generation cycling through single seed descent (SSD). Crops are harvested to earliest germination of seed condition from the date of sowing to increase generations per year. Speed breeding as a platform can be combined with several other technologies such as marker assisted selection, genomic selection, CRISPR gene editing, etc. to get to the end result faster.



SCREENING AND CHARACTERIZATION OF ENDOPHYTES HAVING PLANT GROWTH PROMOTION TRAITS FROM BACOPA MONNIERI

Himani, Vivek Kumar and Sanjay Gupta

Himalayan School of Bio Sciences: Swami Rama Himalayan University Jollygrant, Dehradun Uttarakhand

Email: himanibartwal28@gmail.com

Abstract

Bacopa monnieri leaf harbours numerous biochemical compounds such as flavonoids, alkaloids, cultivated commercially using chemical inputs, which results in higher plant growth, more biomass, and a higher amount of active ingredients. Endophytes are regarded with immense potential in terms of plant growth-promoting (PGP) elicitors. To minimize the usage of chemical inputs and to get higher plant biomass and active ingredients, endophytic bacteria, and fungi from *Bacopa monnieri* plants were isolated, characterized, and screened for plant growth-promoting attributes. In our study, the majority of the endophytic microbes produced phytohormone indole acetic acid (IAA), excreted ammonia, and solubilized phosphate. Siderophore and HCN production was also shown by some isolates. Under *in vitro* conditions, out of 30 isolates, 14 endophytes produced Indole acetic acid (IAA), excreted ammonia, and also solubilized phosphate, while five endophytes produced HCN and siderophore.

STUDY ON THE UTERINE MICROBIOTA OF CATTLES SUFFERING FROM CLINICAL AND SUB-CLINICAL ENDOMETRITIS

Himani Ravi^{1*}, Prasenjit Dhar², Subhash Verma² and Rajesh Chahota²

Department of Veterinary Microbiology, DCGN, COVAS, CSKHPKV, Palampur, H.P (167062)

*Email: himani111296@gmail.com

Abstract

Bovine endometritis is one of the most important causes of infertility in cattle resulting in high economic losses in the dairy industry. Endometritis is a superficial inflammation of the endometrial layer of the uterus. Endometritis could be Clinical or Sub-clinical on the basis of clinical symptoms like type and consistency of discharge. A large variety of bacteria including potential pathogens are found that are common to cause endometritis in cattle. The objective of this study is to identify and isolate the potential bacterial genera that are related to cause endometritis in cattle and further culture sensitivity test was done to treat the condition with specific antibiotics. Uterine discharge samples of cattle with endometritis were collected at 30 days postpartum. The results of bacterial culture and biochemical tests demonstrated the presence of *Staphylococcus* spp., *Streptococcus* spp., *Pseudomonas* spp., *E. coli*, *Klebsiella* spp, *Bacillus* spp and *Micrococcus* spp. and on Culture Sensitivity tests, Enrofloxacin, Levofloxacin and Gentamycin were found to be sensitive. This study reveals that endometritis is caused by variety of pathogens and as this condition is treated with broad spectrum antibiotics thus it is necessary to identify the bacteria that are responsible for endometritis.

BROWN PLANT HOPPER MANAGEMENT STRATEGIES IN KYMORE PLEATU AND SATPURA HILLS AGROCLIMATIC ZONE OF MADHYA PRADESH

Jai Singh* and A.K. Chaubey

JNKVV, Kishi Vigyan Kendra, Singrauli, M.P. -486886

*Email: sidhi_jai01@rediffmail.com

Abstract

Rice is world's most important staple food crop the world. The Asian continent is produced more than 90 percent rice of the world. Globally, India possesses rank second in rice production after China. Brown Plant Hopper (BPH) is a serious sucking pest of rice in all rice growing areas of the country. During severe infestation it can cause complete wilting of Rice plants, a stage known as hopper burn. The BPH also act as vectors of grassy stunt and ragged stunt virus of Rice crop. A study was undertaken to assess the efficacy of integrated management modules for management of BPH in Rice. The comparative efficacy of integrated management strategies were incredibly convincing for the farmers. It was realized that all three treatments tested



were significantly superior over prevailing farmer's practice (T_1). Treatment-4(T_4) having Sensible use of fertilizer by splitting nitrogen application + Proper drainage in rice field + Provision of alleyways of 30 cm width after every 2-3 meter in field + foliar spray of Thiomethaxom -25WG @125g/ha of water at ETL (10 insect/hill at vegetative stage while , 20 insect/ hill at post flowering stage) found most effective in reducing BPH infestation (76.45%) which is a average of three crop season. The yield increase (27.37 %), net return (Rs. 10580.80) and benefit- cost ratio for the T_4 were very favorable and encouraging. Treatment-3 was found to be the next best. The Treatments were improving production that to without imposing any drastic input burden to farmers, as evidenced by cost and benefit estimates of our study. Hence it can be concluded that T_4 may be considered for improved sustainable package of practice for Brown Plant Hopper management of Rice.

EVALUATION OF SOIL EROSION MODELLING USING DIFFERENT DATASETS IN BHARTHAPUZHA RIVER BASIN OF HUMID TROPICAL KERALA

Jasin S.*, Rajeev P.C. and Surendran U.

Land and Water Management Research Group, KSCSTE–Centre for Water Resources Development and Management,
Kozhikode – 673 571

*Email: jasin197@gmail.com

Abstract

Soil erosion causes soil degradation by deteriorating soil structure, loss in soil organic matter and poor drainage that possess serious implication on social, economic and environmental conditions. To give soils and soil degradation, social and political visibility, small- and large-scale modelling and mapping of soil erosion is inevitable. Palakkad district in Kerala falls under Bharatapuzha basin and is known as the 'rice bowl' of the state and its economy is primarily sustained by agriculture. RUSLE model was selected and applied in study area as it can be easily integrated with GIS for better analysis. The obtained result was compared with datasets from other models viz., Global soil erosion dataset (ESDAC), Indian Rainfall Erosivity dataset, coarse resolution soil texture map of Kerala. After calculating the annual soil loss, the area was classified into 7 classes namely- Very Slight, Slight, Moderate, Moderately Severe, Severe, Very Severe and Extremely Severe. Soil Erosion map of Bharatapuzha extracted from soil texture map of Kerala showed majority of study area had low to moderate erosion risk. Global Soil Displacement data-based modelling showed that 31.5% of the study area comes under extremely severe erosion ($>80 \text{ t h}^{-1} \text{ y}^{-1}$). Map obtained from IRED (Indian Rainfall Erosivity dataset) showed that 0.079% of the study area comes under extremely severe erosion ($>80 \text{ t h}^{-1} \text{ y}^{-1}$). The results showed using RUSLE model about 98% of the study area is classified as very slight potential erosion risk ($<5 \text{ t h}^{-1} \text{ y}^{-1}$), while rest of the area is under slight to extremely severe erosion risk. 0.16% of the study area has extremely high soil erosion risk ($>80 \text{ t h}^{-1} \text{ y}^{-1}$), and 1% of the area has severe to very severe risk of soil erosion ($20\text{--}80 \text{ t h}^{-1} \text{ y}^{-1}$), which closely matches with the field observed data on monthly basis. Suitable management strategies were also discussed in the paper for soil and water conservation.

PERFORMANCE OF ESTABLISHMENT METHODS AND NUTRIENT MANAGEMENT PRACTICES ON YIELD AND ECONOMICS OF RICE

Jaya Bharti¹, Raghav Thakur¹, Ashok Kumar Singh¹, R.P. Manjhi¹ and Ranveer Kumar²

¹Department of Agronomy, Birsa Agricultural University, Ranchi, Jharkhand-834006, India.

²Department of Plant pathology, G.B. Pant University of Agriculture & Technology, Pantnagar, Udham Singh Nagar, Uttarakhand -263145, India.

*Email: [bharti636@gmail.com](mailto:bhartij636@gmail.com)

Abstract

Rice (*Oryza sativa* L.) is the world's most important crop and primary source of food for more than half of the world's population and the possibility of expanding the area under rice is limited in near future. Therefore, there is a need of productivity gain with good management practices. Rice is grown mostly through transplanting in India which requires more labour. In such circumstances, wet direct seeding through drum seeder may be an alternative to transplanting in boosting the rice production along with better nutrient management practices which is also a major component of soil and crop management system. Knowing the required nutrients for all growth stages is critical for profitable crop production. The present investigation was carried out during Kharif -2018 with the objective to find out the effect of rice establishment



methods and nutrient management practices on yield and economics of rice. The experiment was laid out in Split Plot Design replicated thrice with variety Naveen. The treatments comprised of three different rice establishment methods viz., normal transplanting, wet direct seeding using drum seeder and aerobic rice and five nutrient management practices. Results revealed that wet direct seeding of rice using drum seeder recorded maximum grain yield (42.19 q/ha) and straw yield (65.22 q/ha) which were comparable with transplanting method. Among the nutrient management practices, RDF + 25% N through FYM produced maximum grain yield (46.33 q/ha) and straw yield (71.53 q/ha) which was significantly better than rest of the treatments except LCC based N application. Wet direct seeded rice using drum seeder also recorded maximum net return (58337 `/ha) and B:C ratio (2.00) which is significantly at par with aerobic rice. Among the various nutrient management practices, the higher net return (64030 `/ha) and B:C ratio (2.28) was recorded with LCC based N application.

SOIL HEALTH MANAGEMENT AND PRACTICES: KEY FACTOR FOR CROP PRODUCTIVITY CONSERVATION AGRICULTURE: A SUSTAINABLE FARMING SYSTEM THAT MITIGATES AND ADAPTS TO CLIMATE CHANGE

Jayesh Shesh

College Of Agriculture, IGKV, Raipur Chhattisgarh

Email: jayeshshesh@gmail.com

Abstract

Conservation agriculture (CA) is a resource-saving strategy encompassing three broad principles viz., minimum soil disturbance, diversified crop rotation and adequate soil cover through residue retention. Conservation agriculture is an important component of the overall strategy for enhancing productivity, improve environmental quality and preserve natural resources for food security and poverty alleviation. Soil tillage is one of the fundamental agrotechnical operations in agriculture because of its influence on soil properties, environment and crop growth. Since continuous soil tillage strongly influence the soil properties, it is important to apply appropriate tillage practices that avoid the degradation of soil structure, maintain crop yield as well as ecosystem stability. Sustaining production and productivity of any system is of paramount importance by improving the soil's physical, chemical and biological properties. Conventional tillage operations will alter these properties in every cropping cycle thereby affecting the soil system. To combat soil loss and preserve soil moisture soil conservation techniques were developed in USA known as conservation tillage (CT), this involves soil management practices that minimize the disruption of the soil's structure, composition and natural biodiversity, thereby minimizing erosion and degradation, control annual weed and seed bank but also water contamination.

ROLE OF ICT IN TRANSFER OF AGRICULTURAL TECHNOLOGIES AS PERCEIVED BY THE TRIBAL FRAMERS

Jeewan Ram Jat¹ and N.K. Punjabi²

¹*Department of Animal Production, Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan*

²*Department of Extension Education, Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan*

Email: jbagariya@gmail.com

Abstract

Role of ICTs in the field of agriculture is highly significant, it can help extension workers and researchers to acquaint themselves with improved agricultural practices and disseminate them to farmers. ICTs provide agricultural information that is relevant to farmers such as agricultural techniques, commodity prices, weather forecasts etc. The present study was conducted in Dungarpur and Banswara districts of Southern Rajasthan. The districts were selected based on the availability of maximum number of facility centers for promoting use of ICT. For the selection of tehsils, based on the availability of maximum number of facility centres for promoting use of ICTs, two tehsils from each selected district for the purpose of investigation. Finally, ten respondents were selected from each village by random sampling technique thereby, making a sample of 160 respondents for the study purpose. The findings indicated that the role of ICTs in latest technological information on agriculture and allied field, live shows to get first hand agricultural information, agricultural news, quick solution of farmers problem, Scientific package of practices of crops, timely decision making on matters related to agriculture and Plant protection measures were



major roles perceived by the respondents of Banswara and Dungarpur district application of ICT tools in transfer of agricultural technology. It can be concluded that there was no significant difference in direct role of ICT tools in transfer of agricultural technology between the respondents of Banswara and Dungarpur district.

KNOWLEDGE AND ADOPTION OF RECOMMENDED CULTIVATION PRACTICES OF TARAMIRA BY THE FARMERS IN DISTRICT JAIPUR OF RAJASTHAN

Jitendra Kuri^{1*}, Sita Ram Bijarnia¹, Kamlesh¹, Choudhary Jitendra Kumar², Ramlal Degra²

¹Department of Agricultural Extension and Communication. Collage of Agriculture, SKRAU, Bikaner Rajasthan

²Department of Extension Education. Rajasthan Collage of Agriculture, MPUAT, Udaipur Rajasthan

*Email: Kurijitendracoa@gmail.com

Abstract

Taramira is cultivated mainly in Jaipur, Tonk, Sawai Madhopur, Sri Ganganagar, Bhilwara and Dausa districts of Rajasthan. In Rajasthan, Jaipur district ranked first in area (15670 hectares) and production (10032 metric tonnes). The study reveals that, majority of respondents i.e. 63.33 per cent (76) of the total respondents were in medium constraints group, whereas 20.83 per cent (25) in high and remaining 15.83 per cent (19) respondents were observed in the group of low constraints in the study area. The study indicated that “high cost of insecticides and pesticides”, “high cost of seed” (economic constraints), “lack of knowledge about recommended seed rate and spacing”, “lack of knowledge about major insect-pest diseases and their control” (technical constraints), “irregular supply of electricity for irrigation” “timely availability of fertilizers” (seed and supplies constraints), “non availability of market at village” and “lack of knowledge about scientific storage of Taramira seed” (post-harvest constraints) were perceived as most important constraints by the Taramira growers.

KNOWLEDGE AND ADOPTION OF RECOMMENDED CULTIVATION PRACTICES OF TARAMIRA BY THE FARMERS IN DISTRICT JAIPUR OF RAJASTHAN

Jitendra Kuri^{1*}, Sita Ram Bijarnia¹, Kamlesh¹, Choudhary Jitendra Kumar² and Ramlal Degra²

¹Department of Agricultural Extension and Communication. Collage of Agriculture, SKRAU, Bikaner Rajasthan

²Department of Extension Education. Rajasthan Collage of Agriculture, MPUAT, Udaipur Rajasthan

*Email: Kurijitendracoa@gmail.com

Abstract

Taramira is cultivated mainly in Jaipur, Tonk, Sawai Madhopur, Sri Ganganagar, Bhilwara and Dausa districts of Rajasthan. In Rajasthan, Jaipur district ranked first in area (15670 hectares) and production (10032 metric tonnes). The study reveals that, majority of respondents i.e. 63.33 per cent (76) of the total respondents were in medium constraints group, whereas 20.83 per cent (25) in high and remaining 15.83 per cent (19) respondents were observed in the group of low constraints in the study area. The study indicated that “high cost of insecticides and pesticides”, “high cost of seed” (economic constraints), “lack of knowledge about recommended seed rate and spacing”, “lack of knowledge about major insect-pest diseases and their control” (technical constraints), “irregular supply of electricity for irrigation” “timely availability of fertilizers” (seed and supplies constraints), “non availability of market at village” and “lack of knowledge about scientific storage of Taramira seed” (post-harvest constraints) were perceived as most important constraints by the Taramira growers.

EFFECT OF PHOSPHORUS IN OILSEED CROPS FOR OPTIMIZING YIELD AND QUALITY

Kamal*, A.K. Dhaka, Amit Sharma and Ravi

Department of Agronomy, Chaudhary Charan Singh Haryana Agricultural University, Hisar-125004, Haryana (India)

*Email: kamal827@hau.ac.in

Abstract

Oilseeds play an important role in agricultural economy of India. Oil derived from oilseed crops is considered as essential raw material for many industries. Phosphorus plays an important role in the growth, development and maturity of all crops. An adequate supply of phosphorus in the early stages of crop helps in initiating its reproductive parts. Proper supply of



phosphorus lengthens the phenology i.e. maturity period, moreover it also influences the physiological parameters i.e. harvest index, leaf area index, net assimilation rate and crop growth rate. The phosphorus requirement of oilseeds and pulses is relatively high as it plays an important role in plant metabolism. Phosphorus is one of the principal nutrients, which boost root growth, thus facilitating water and nutrient uptake from deeper layers of the soil thus accelerates growth of plants. Phosphorous has been found to improve the crop's effective use of soil nutrients, plant nodulation, increase biological nitrogen fixation by increasing nitrogenase activity and improves the quality of seeds. Due to phosphorus deficiency, plants growth will be slow and stunted, and the older leaves will have a purple coloration, particularly on the underside. Phosphorus excess will not have a direct effect on the plant but may show visual deficiencies of Zn, Fe and Mn. Application of phosphorus in optimum amount has been observed to have a positive influence on the yield attributes and yield of oilseed crops.

SEASONAL OCCURRENCE OF EARLY BLIGHT OF TOMATO UNDER FIELD CONDITIONS

K.N. Koshale^{1*} and C.P. Khare²

¹Kumari Devi Choubey College of Agriculture and Research Station, Mohgaon, Saja, IGKV, Distt.- Bemetara (C.G.)-491993,

²Department of Plant Pathology, CoA, IGKV, Raipur (C.G.)-492012

*Email: koshalekamalnarayan@gmail.com

Abstract

Tomato, *Solanum lycopersicum* L. a member of the family Solanaceae is one of the most popular and extensively grown vegetables of both tropics and subtropics of the world. The tomato plant is infected with number of diseases in its life span. Among them early blight of tomato caused by *Alternaria solani* is one of the important diseases of tomato. Therefore a study was undertaken in *Kharif* season of three consecutive years (2015, 2016 and 2017) at Horticulture Instruction cum Research Farm, College of Agriculture, IGKV, Raipur (Chhattisgarh) to know the occurrence pattern and extent of infection of tomato early blight disease. The first appearance of early blight was observed in first fortnight of October in 2015 whereas in 2016 and 2017 first symptom of the disease was recorded in second fortnight of September and appeared up to first fortnight of November. Initially the occurrence of the disease started with very low percent disease incidence of 4.03, 2.91 and 0.95 percent and percent disease index of 0.32, 0.11 and 0.03 percent in *Kharif* 2015, 2016 and 2017 respectively. The percent disease incidence and percent disease index increased with increase in age of the plant and reached maximum in first fortnight of November with percent disease incidence of 52.79, 54.57, and 56.89, percent and percent disease index of 19.91, 26.45 and 29.11 percent in *Kharif* 2015, 2016 and 2017 respectively.

INFLUENCE OF ABIOTIC FACTORS ON THE SHOOTFLY (*ATHERIGONA PULLA* WIEDE) INFESTATION IN LITTLE MILLET

Kamal Kartik Kenny Kundra^{1*}, M.K. Chakravarty¹, Navin Kumar Ranjan², Pramod Kumar³, and Ankit Kumar Singh¹

¹Department of Agricultural Entomology, Birsa Agricultural University, Kanke, Ranchi, Jharkhand, India

²Department of Horticulture, Birsa Agricultural University, Kanke, Ranchi, Jharkhand, India

³Department of Agrometeorology and Environmental Science, Birsa Agricultural University, Kanke, Ranchi, Jharkhand, India

*Email: kamalkenny@gmail.com

Abstract

The Little millet (*Panicum sumatrense*) belongs to the family *gramineae* and is an indigenous crop of the Indian sub - continent. It is a short duration crop, takes about 65 to 75 days, depending on the variety cultivated. In India, it is grown in the state of Tamil Nadu, Karnataka, Andhra Pradesh, Maharashtra, Madhya Pradesh, Jharkhand, Chhattisgarh, Odisha and Gujarat. In Jharkhand, mostly short duration variety of Gundli is preferred by the farmers as they get ample time to grow another crop after the harvest of little millet. Nearly 32 per cent of the crop is lost due to the attack of insect pests in India (Borad and Mittal, 1983). Shoot flies (*Atherigona pulla* Wiede) rank first among the insect pests that attacks little millet, often resulting in heavy loss in the crop yield (Anonymous, 1991). As the shootfly is now being considered as a key pest of little millet in Jharkhand. Keeping in view the importance of shootfly on little millet crop, the present investigation entitled "Ecofriendly management of shootfly (*Atherigona pulla*) infesting little millet " was undertaken at small millets research plots



of Ranchi Agriculture College under Birsa Agricultural University, Kanke, Ranchi during *kharif*, 2017-2018. The outcome of the research could be summarized as – the effect of different abiotic factors on the occurrence of shootfly indicated that maximum infestation of *Atherigona pulla* was observed in the 3rd week after germination (i.e. 3rd week of July). Field experiment on varietal screening revealed that out of the 19 genotypes tested, IIMR LM7012, BG 1, DLM95, and OLM217 recorded the lowest damage and were considered to be least susceptible to shootfly. Higher grain yield was also recorded in above cultivars. The cultivar OLM 203, with 27.31 per cent deadhearts, was considered to be the most susceptible one against shootfly. The mean deadheart percentage was significantly lowered in spraying of 1500ppm at 7 DAS against shootfly infesting little millet followed by the seed treatment with chlorpyrifos 20 EC @ 2.5ml/kg of seed. The highest seed yield (688 kg/ha) was obtained in application of spraying of 1500ppm neem/azadirachtin at 7 DAS followed by seed treatment with chlorpyrifos 20 EC (635 kg/ha).

AN ECONOMIC ANALYSIS OF TOMATO CULTIVATION IN SIDDIPET DISTRICT OF TELANGANA STATE, INDIA

K. Sruthi Sai*, Md. Ali Baba and R. Vijayakumari

Agricultural College, Palem, Nagarkurnool

*Email: sruthisaikaranam63508@gmail.com

Abstract

India being the second largest producer of vegetables in the world is still confronted with quite a few challenges in the vegetable sector. According to a report of the Committee for Doubling Farmer's Income, projected demand of vegetables in India by 2050 is 342 million tonnes. It means that there is a need for about 75 percent increase in the production of vegetables. As a result, there is a felt need to study the production practices of vegetables so as to improve profitability of vegetable cultivation. The primary data required for the study was collected from 102 tomato growers randomly selected from 6 villages which were purposively selected from Siddipet district. The findings of the study revealed that variable costs occupied a lion's share of 91.95 percent in the total cost of cultivation (Rs. 2, 16,266.43 per hectare) and among which labour charges was the major item. In addition, the yield and net income were found to be 30.46 tonnes and Rs. 91, 012.98 per hectare respectively. Tomato cultivation was found to be profitable as indicated by the returns per rupee investment of 1.29. Further, the study recommended few suggestions such as contract farming of tomato growers with processors, organic cultivation, zero budget natural farming and use of low cost fertilizers such as nano urea to improve the profitability of tomato cultivation.

OCCURRENCE AND MANAGEMENT OF FUSARIUM WILT ON *DENDROBIUM SP* IN WEST BENGAL

Joseph Soren¹ and Amitava Basu¹

¹Department of Plant Pathology, Bidhan Chandra Krishi Vishwavidyalaya, Mohanpur, Nadia, West Bengal-741252, India

Email: Josephsoren04@gmail.com

Abstract

The dendrobium is a tropical and commercial orchid plant under Orchideaceae family known for beautiful delicate and exotic ornamental flowers. An investigation in orchid growing areas were conducted in Hooghly district of west Bengal during 2019 which established that *Fusarium proliferatum* was responsible for both quantitative and qualitative yield losses by causing wilting in orchid plants. The symptoms were black discoloration of buds along with drooping of leaves. Pathogen was isolated and grown on 5 different growth media namely Potato Dextrose Agar (PDA), Carrot Agar, Czapek Dox agar, Oat meal agar, and Potato Carrot agar. Pathogen showed best growth of 75 mm diameter on PDA media having prominent pink cottony growth with irregular margin after 7th day of incubation. The dry mycelial weight of 1.48g was observed on Potato Dextrose broth in comparison to 0.32g in Carrot broth. The Poison food technique was adopted for *in vitro* sensitivity study with 5 different fungicides i.e. acrobat, (Metalaxyl+Mancozeb), Metiram, Origin and Silvox. The Origin (Flubendiamide 3.5% + Hexaconazole 5% WDG) exhibited appreciable response through inhibiting 100% mycelial growth at 500ppm with lowest EC50 value of 50.1ppm.



GENETIC DIVERGENCE FOR YIELD COMPONENTS IN BLACK GRAM (*VIGNA MUNGO* (L.) HEPPEL)

K. Lakshmi Prasanna¹, D. Ratna Babu^{1*}, J. Sateesh Babu² and D. Ramesh³

¹Department of Genetics and Plant Breeding, Agricultural College, Bapatla

²Department of Genetics and Plant Breeding, RARS, Lam, Guntur

³Department of Statistics and Computer Applications, Agricultural College, Bapatla

*Email: d.ratnababu@angrau.ac.in

Abstract

Fifty black gram genotypes were evaluated to assess the genetic diversity. Based on Mahalanobis D² statistics, the fifty black gram genotypes were grouped into twelve clusters. Pods per plant contributed maximum towards total diversity followed by seeds per pod and plant height. The fifty genotypes were grouped into twelve discrete clusters, among which cluster II was the largest with twenty genotypes followed by cluster I with fifteen genotypes and cluster III with six genotypes and remaining clusters viz., IV, V, VI, VII, VIII, IX, X, XI and XII were monogenotypic. The maximum *per se* performance for grain yield was recorded in cluster III followed by clusters IX, XI and XII and the Mahalanobis D² distances between clusters III and clusters XI, XII & IX are 87.04, 72.94 and 43.24, respectively, indicating that these three monogenotypic clusters (XI, XII & IX) with high *per se* were having considerable divergence with cluster III.

EFFECT OF DIETARY AJWAIN (*TRACHYSPERMUM AMMI*) ON SERUM BIOCHEMICAL PARAMETERS IN NILE TILAPIA (*OREOCHROMIS NILOTICUS*) CULTURE

Jayashri Mahadev Swamy*, Ganapathi Naik M. and Monica K.S.

Department of Aquaculture, College of Fisheries, Mangalore -575002, India

*Email: jayashriswamy22@gmail.com

Abstract

The study was carried out to investigate the supplemental effects of dietary ajwain (*Trachyspermum ammi*) on serum biochemical indices in Nile tilapia (*Oreochromis niloticus*) culture. A total of 225 numbers of Nile tilapia fingerlings were randomly divided into five groups each in triplicates. The control group T₀ was fed with a basal diet, while the T₁, T₂, T₃ and T₄ were fed with basal diets supplemented with ajwain at the doses of 10, 15, 20 and 25 g/kg respectively. The Alkaline phosphate (ALP) level was higher in the fish fed with 10g ajwain /kg diet and serum alanine aminotransferase (ALP) and aspartate aminotransferase (ASP) levels were significantly (p <0.05) decreased in the same diet fed group. In fish fed with ajwain at 10g ajwain /kg diet had significantly lower serum glucose, cholesterol and triglyceride levels (p <0.05). The highest values of sodium, potassium, magnesium and calcium were observed in same diet fed group. The findings suggested that the dietary inclusion of ajwain at dose rate of 10g/kg diet improved the serum biochemical parameters in Nile tilapia culture.

ZERO BUDGET NATURAL FARMING A KEY TO SUSTAINABLE AGRICULTURE

Karukumalli Sindhura*, Polasa Bhuvana Sri¹ and Palapati Ashwini²

*Division of Agricultural Extension Education, SKUAST-Jammu

¹Division of Agricultural Extension Education, S.R University, Warangal

²Department of Agricultural Economics, PJTSAU, Hyderabad

*Email: Karukumallisindhura95@gmail.com

Abstract

Zero Budget Natural Farming (ZBNF) is an emerging set of agricultural practice designed dramatically to reduce farmers direct costs while boosting yields and farm health through the use of non-synthetic inputs sourced locally. First time in the world, Japanese agriculturist M Fukuoka developed natural farming and the same trend was made in India by Mr. Subhash Palekar, he started the ZBNF concept and made it successful in south India. ZBNF mainly works on four concepts they are jeevamrutham, beejamrutham, mulching, and soil aeration. These four concepts help better soil health, increased microbial population, and enhance crop yield. Andhra Pradesh has set out the aim of unfurling ZBNF to all 6 million farmers in the state



through a state-led programme of training and extension. The present data shows statistically significant differences between ZBNF and non-ZBNF yields and farmer incomes at multiple locations and with a variety of crops, as well as preliminary results on farmers experiences with crop health and household transitions after the adoption of ZBNF. We like to conclude it with reflections on the lessons derived from Andhra Pradesh state support for ZBNF.

SOIL HEALTH MANAGEMENT PRACTICES AND KEY FACTOR FOR CROP PRODUCTIVITY

Kobagapu Mani Ratnam

Department of agronomy, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, U.P., India.

Email: kobagapumaniratnam43774@gmail.com

Abstract

Globally, food systems face multiple challenges, including minimizing environmental impacts, adapting to a changing climate, increasing yields, and maintaining and/or increasing crop nutritional quality. Management techniques that focus on soil health (SH) are promising solutions to mitigate some environmental impacts and may increase economic returns. However, claims that SH increases will concurrently increase crop quality and productivity merit careful examination. Factors beyond SH metrics determine crop nutritional quality. While SH frameworks are comparatively recent initiatives, there are thousands of published conservation agriculture studies that examine yield outcomes with cover crops, no-till, and rotation. This literature indicates that SH practices can also have neutral or negative yield impacts only in select systems have consistent yield increases been realized, highlighting the need for language clarification and improvements in mechanistic understanding of regional-scale yield impact. Suitable crop management practices can increase the productivity of the crop, out of which soil fertility and health management play a vital role in crop production. Due to the extensive cultivation of crops, nutrients in the soil get degraded. In order to fulfil the crop nutrient requirement, an integrated approach to nutrient management is necessary. Nutrients to the crop are supplied through organic manures, biofertilizers, green manuring, chemical fertilizers, and Nano fertilizers. Effective utilization of all these components surely fulfils the crop requirement without affecting soil health and fertility. So that better crop yield can be expected from healthy soil in a sustainable way.

AGRICULTURAL VALUE CHAINS IN INDIA: AN OVERVIEW

Karukumalli Sindhura*, Polasa Bhuvana Sri¹ and Pallepati Ashwini²

**Division of Agricultural Extension Education, SKUAST-Jammu*

¹Division of Agricultural Extension Education, S.R University, Warangal

²Department of Agricultural Economics, PJTSAU, Hyderabad

Email: Karukumallisindhura95@gmail.com

Abstract

Agriculture has been and continues to be a critical component of Indian economy contributing about 18% to Indian GDP. The fast-developing high value agricultural markets provide immense opportunity to India's smallholders who constitute 86.1% of total farm holdings. The agriculture system in India has undergone rapid transformations over the past few decades particularly after the economic reforms of 1990s. Food Processing Industry in India has been growing at an average annual growth rate of around 11.8%. The emergence of integrated agriculture and food supply and value chains is one of the most visible market phenomena in India. Agriculture value chain can be a vertical linking or a network between various independent business organisations and can involve processing, packaging, storage, transport and distribution. There are few business models of agricultural value chains in India namely Producer-driven model, Buyer-driven model, Facilitator-driven model and Vertically Integrated model. There are empirical evidences establishing that successful coordination in the value chain has a significant impact on cost reduction and farm-income enhancement as well as resulting in positive externalities. But the overarching question is whether the agricultural sector has the necessary and sufficient conditions for the development of successful value chains. Developing a favourable policy environment coupled with encouraging market conditions can lift farmers status. This can become a significant step not only in the development of agriculture or welfare of farmers but also reducing the problem of region-wide unemployment through motivating youth in entrepreneurship in agriculture and allied sector.



RECENT PROGRESS IN REGENERATION AND GENETIC TRANSFORMATION SYSTEM OF CUCUMBER (*CUCUMIS SATIVUS* L.)

Khedkar Prasad Dhanraj* and Harmeet Singh Janeja

¹Department of Genetics and Plant Breeding, Lovely Professional University, Phagwara, Punjab, India

²Department of Genetics and Plant Breeding, Lovely Professional University, Phagwara, Punjab, India

*Email: rajepirasadkhedkar@gmail.com

Abstract

Cucumber (*Cucumis sativus* L.), belonging to the family Cucurbitaceae, is one of the major vegetable crops in India. Conventional genetic breeding techniques are ineffective in the short term for improving cucumber tolerance to various environmental challenges, diseases, and pests, however bio-engineering technologies can be applied to cucumber breeding to generate new cultivars with high yield and quality. Regeneration and genetic transformation systems are important tools in cucumber breeding presently. Genetic transformation methods are not yet entirely successful when compared to regeneration systems, and the low efficiency of genetic transformation represents a bottleneck in cucumber cultivation. Here, we systematically review the key factors influencing the regeneration and genetic transformation of cucumber plants, including the selection of genotype, source of explants and forms of exogenous hormones added to the medium, the methods of transgenic introduction and co-cultivation, and selection methods. In addition, we also focus on recent advances in the study of molecular mechanisms underlying important agronomic traits using genetic transformation technology, such as fruit length, fruit warts, and floral development. Hence, this review provides reference information for future research on improvements in cucumber varieties.

VALUE ADDITION OF FRUITS AND VEGETABLES FOR IMPROVING ECONOMIC CONDITION OF RURAL PEOPLE

Kanchan Devi^{1*} and Kirti Devi²

¹Department of Extension Education and Communication Management, Chandra Shekhar Azad University of Agriculture and Technology Kanpur UP

²Department of Extension Education and Communication Management, College of Home Science, Sam Higginbottom University of Agriculture, Technology and Science, Allahabad UP

*Email: kanchankirtisingh@gmail.com

Abstract

India is among the topmost vegetable and fruit producer in the world. India's food processing sector covers fruits and vegetables. After harvest, fruits and vegetables are liable to accelerated physiological, chemical, and microbial processes that invariably lead to deterioration and loss of wholesomeness. Therefore, it is necessary to institute some measure of processing such as reduction in moisture content, denaturation of endogenous enzymes and microorganisms, or packaging in order to curtail perishability. The challenge of feeding the population of the world has always been a sustainable key issue for human societies. The development of agriculture /horticultural produce has greatly enabled expanded food production in order to meet the rapidly growing human population. The long success of agriculture has confined human population, now also in large "metro cities", to focus on increasing food production. Groups should be set up and adequate training should be given by qualified persons for the development of skills. Emphasis should be laid on self-employment rather than on wage employment.

COMBINED EFFECT OF BIO-PESTICIDES FOR THE MANAGEMENT OF GRAM POD BORER ON CHICKPEA AT PRAYAGRAJ

Kommoji Phani Sai

Department of Entomology, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj-211007.

Email: phanisai444@gmail.com

Abstract

An experiment was conducted during Rabi season 2019 at central research field; SHUATS, Prayagraj, U.P. Biopesticides and



combination were used with seven treatments and three replications. Experiment was laid in Randomized Block Design. The results obtained based on pest population, grain yield and B: C ratio are as follows, Emamectin benzoate (220gm/ha) + Indoxacarb (30gm/ha) (2.19) and (1932.67kg/ha) was most effective treatment followed by Indoxacarb (60gm/ha) (3.3) (1880.33kg/ha), NSKE (25kg/ha) + Indoxacarb (30gm/ha) (3.6) (1584.33kg/ha), Neem oil (5ml) + Indoxacarb (30gm/ha) (3.9) (1435.00kg/ha), *Beauveria bassiana* (400gm/ha) + Indoxacarb (30gm/ha) (4.4) (1332.00kg/ha) and *Bacillus thuringiensis* (750-1000gm/ha) + Indoxacarb (30gm/ha) (5.2) (1224.33kg/ha). The highest cost benefit ratio was obtained from Emamectin benzoate + Indoxacarb (1:2.70) ? Indoxacarb (1:2.65) ? NSKE + Indoxacarb (1:2.23) ? Neem oil + Indoxacarb (1:2.03) ? *Beauveria bassiana* + Indoxacarb (1:1.84) ? *Bacillus thuringiensis* + Indoxacarb (1:1.64) ? control (1:1.21). From the analysis of present findings, it can be concluded that among all the treatments Emamectin benzoate (220gm/ha) + Indoxacarb (30gm/ha) was proved to be the best treatment in managing *Helicoverpa armigera* population. This avoids issues like ecosystem contamination, including soil contamination, water pollution, pesticide residue in food, pest resurgence, impact on non-target pests, etc. Therefore, using a combination of bio-pesticides may help develop an effective integrated pest management strategy to combat infestation of *Helicoverpa armigera*.

HETEROSIS, GENETIC PARAMETERS AND CHARACTER ASSOCIATION STUDIES IN CASTOR (*RICINUS COMMUNIS* L.)

K. Sadaiah*, G. Neelima, G. Madhuri, V. Divya Rani, N. Nalini, M. Sujatha and M. Goverdhan

Regional Agricultural Research Station, PJTSAU, Palem, Nagarkurnool district, Telangana – 509215.

*Email: sadaiah.kurapati@gmail.com

Abstract

Castor is an important non-edible oilseed crop having huge industrial and export potential. Castor oil is highly stable and variation in fatty acid is very minimal making it the best raw industrial oil. It is used as an efficient lubricant for high-speed engines and as an ingredient in several commodities. Because of its multifarious industrial applications, castor oil enjoys tremendous demand world-wide. To meet the growing demand, it is essential to produce high yielding cultivars. Study on heterosis and genetic parameters will be helpful to identify the crosses showing hybrid vigour for yield and earliness and also to understand the inheritance of the traits. In the present study 48 entries viz., three pistillate lines and eleven inbred lines and their 33 hybrid combinations along with standard check ICH-66 were evaluated in RBD with three replications during kharif, 2020 at the experimental plots of RARS, PJTSAU, Palem. Analysis of variance studies showed that significant variation exists in the material under study. Estimates of standard heterosis over ICH-66 revealed that crosses viz., SKP-84 x ICS-142, SKP-84 x DCS-89 and SKP-84 x JI-244 has shown significant heterosis for yield (26.6%, 17.9% and 16.9% respectively) and earliness (-10.4%, -9.1% and -7.0% respectively). Heritability, genetic advance as per cent of mean and degree of dominance studies indicated preponderance effect of non-additive gene action in governing the traits. Thus exploiting hybrid vigour through heterosis breeding will be an effective method of crop improvement in castor. Correlation studies showed that grain yield has recorded significant positive association with primary spike length, effective primary spike length and number capsules per primary spike. Hence selection for these component traits will be effective in obtaining high yielding cultivars in castor.

IMPACT OF CLIMATE VARIATIONS ON AGRICULTURE AND ADAPTIVE STRATEGIES

Karukumalli Sindhura*, Polasa Bhuvana Sri¹, Palapati Ashwini²

*Division of Agricultural Extension Education, SKUAST-Jammu

¹Division of Agricultural Extension Education, S.R University, Warangal

²Department of Agricultural Economics, PJTSAU, Hyderabad

*Email: Karukumallisindhura95@gmail.com

Abstract

Climatological variations are due to anthropogenic emissions of greenhouse gases which occurs in the earth's atmosphere. In developing countries like India, climate variations could represent an additional stress on ecological and socio-economic systems that are already facing tremendous pressures due to rapid urbanization, industrialization and economic development. Climate variations effects the monsoons too. India is heavily dependent on the monsoon to meet its agricultural and water



needs, and also for protecting and propagating its rich biodiversity. There is considerable world wide support at present in advocating organic agriculture for mitigating climate variation. The potential of organic agriculture in mitigating climate variation depends on its ability to reduce emissions of GHGs, nitrous oxide and methane, increase soil carbon sequestration, and enhance effects of organic farming practices which favour the above two processes. Soil organic carbon is of fundamental importance to soil health as it affects all these aspects of soil fertility, namely chemical, physical and biological fertility. The activity of living organisms in soil is dependent on regular inputs of organic matters. In addition, organic agriculture is highly adaptable to climate variation and is also provides a high degree of diversity in the ecosystem.

ATTITUDE OF RURAL AND TRIBAL WOMEN TOWARDS GIRL CHILD IN TELANGANA STATE

K. Spandana Deepika^{1*} and R. Geetha Reddy²

¹Department of Extension Education and Communication Management, College of Community Science, Hyderabad, Professor Jayashankar Telangana State Agricultural University, Telangana, India. Mail Id. ²Department of Extension Education and Communication Management, College of Community Science, Hyderabad, Professor Jayashankar Telangana State Agricultural University, Telangana, India.

*Email: spandanadeepika05@gmail.com

Abstract

A girl child should be treated equally to a boy in all aspects of her life. Girl child deserves the same respect and affection as everyone else and shares equally in the nation's growth and development. The attitude of rural and tribal women towards girl child in terms of their equal nutritional, health, and emotional care was assessed in this study. The nutritional care was measured in terms of equal duration of breast feeding, equal quantity of food items served and nutritious food to female child; equal health care to female child was indicated in terms of taking her to hospital during sickness and paying attention at home; their extent of emotional support given to female child was analysed in terms of encouraging words and good support system in need. The study examined the attitude of rural and tribal women towards girl child in Telangana state. An exploratory research design was used, and respondents were chosen via purposeful random sampling. A total of 120 samples were taken for the study, 60 from rural area of Gadwal district and 60 from tribal area of Nagar Kurnool district. The results of the study indicated that majority (66.67%) of the rural, followed by 61.67% tribal respondents expressed favourable attitude towards Nutritional care to girl child. Regarding health care to girl child, majority of the respondents had positive attitude in rural (70.00%) and in tribal (63.33%) areas. A higher percentage (66.67%) in rural followed by 60.00% in tribal population emotionally supported the girl child. The extent of nutritional, health and emotional support given to the girl child during in need by majority of the parents without any discrimination is a positive sign to accept and support.

CONSTRAINTS FACED BY THE CASTOR GROWERS IN ADOPTION OF CASTOR PRODUCTION TECHNOLOGY

K.V. Chaudhry^{1*}, S.P. Pandya² and K.N. Raval³

¹Department of Agril. Extension and Communication, CPCA, SDAU, Gujarat

²Directorate of Research, SDAU, Gujarat

³Department of Agril. Extension and Communication, CPCA, SDAU, Gujarat

*Email: kalachaudhry1811@gmail.com

Abstract

Production of a new technology is generally not the major problem now-a-day in our country. The agricultural scientists are capable of producing appropriate technology. The main problem as it exists today is that of diffusion and adoption of new farm technologies among the farmers. Diffusion of knowledge is relatively an easy task. Getting people to understand, accept and apply is the difficult one. The present study was purposively undertaken in the three talukas viz., Patan, Saraswati and Harij talukas of Patan district of Gujarat state. The ex-post facto research design and multistage sampling technique were followed for present study. Five villages were randomly selected from each taluka having castor cultivation. Thus, total fifteen villages were selected. From each selected village, ten farmers were selected randomly by making a sample of 150 respondents. The study revealed that majority constraints faced by the castor growers in the adoption of castor production technology were; unavailability of certified seed at local level, shortage and high wages of labor, high cost of fertilizers, inadequate finance,



high cost of seed, attack of pests and diseases, lacking of technical guidance and non remunerative price of production. The most important suggestions expressed by castor growers to overcome the constraints faced by them in maximum adoption of recommended castor production technology were; reasonable price should be given to agricultural produce, certified seed should be made locally, price of agricultural inputs should be minimized, timely technical guidance should be provided and crop loan should be provided to the farmers.

CORRELATION STUDIES ON YIELD AND FIBRE TRAITS IN UPLAND COTTON (*GOSSYPIMUM HIRSUTUM* L.)

K.V. Siva Reddy, Rani Chapara*, M. Sudha Rani, and B. Sree Lakshmi

Regional Agricultural Research Station, Acharya N.G. Ranga Agricultural University, Lam, Guntur

*Email: ranichapara@angrau.ac.in

Abstract

In the world Cotton is one of the most important cash crops (in the world. fibre crops). Worldwide totally 35% of the fibre is contributed by cotton itself. Cotton breeders are interested in using diverse genotypes to enhance both fibre quality as well as seed cotton yield. In this regard, the present study aimed to explore the relationship among different yield and quality traits and conducted during *Kharif* 2021-22 using nine varieties along with two checks in RBD design. Data was collected on the on biometrical observations viz., number of bolls per plants, boll weight (g), Ginning out turn (%), lint yield (kg/ha), upper half mean length, uniformity index, micronaire, fibre strength, fibre elongation and seed cotton yield (kg/ha). For seed cotton yield, a significant genotypic positive correlation was noticed for the traits, number of bolls per plant ($r = 0.913^{**}$), boll weight ($r = 0.944^{**}$), ginning out turn per cent ($r = 0.851^{**}$), lint yield ($r = 0.985^{**}$), upper half mean length (0.847^{**}), uniformity index (0.787^{**}), fibre strength (0.668^{**}) and elongation (0.767^{**}) while significant negative association was observed with micronaire (-0.809^{**}). Hence, while selecting and breeding for high yield cotton genotypes with superior quality more focus should be given on number of bolls per plant, high boll weight, number of bolls per plant, ginning out turn, lint yield, upper half mean length, uniformity index and fibre strength.

EFFECT OF SALINITY STRESS ON INITIAL STAGES OF PEARL MILLET IN POT AND HYDROPONIC EXPERIMENTS

Chandrika Ghoshal, Nirupma Singh and Kajal Nagre

Division of Genetics, ICAR-IARI, New Delhi-110012

Email: nirupmasingh@rediffmail.com

Abstract

In dry and semi-arid environments, temperature and salinity are key factors of plant productivity. Salt stress can diminish leaf water potential, resulting in decreased turgor and other responses, and ultimately lower crop output. Salt stress impairs plants' ability to absorb water, resulting in rapid growth rate reductions. Salt impacts are most likely to be responsible for the initial decline in shoot growth. When too much salt enters the plant, it will eventually reach toxic levels, reducing the photosynthetic leaf area of the plant, preventing it from growing. Pearl millet (*Pennisetum glaucum*) is the 6th leading cereal crop in Africa and India's arid and semi-arid land. To strengthen the candidature of pearl millet for salinity tolerance, three experiments were conducted to study the salinity stress effects of sodium chloride on pearl millet. The first experiment was a pot experiment conducted with two varieties of pearl millet, ICMR-01222 and a local landrace in a greenhouse. In the pot experiment, the stress treatment of distilled water (control), 25, 50, 75, 100, 150, 200, 250, 300, and 400 mM NaCl was applied to 10-day old seedlings. The results showed a progressive decrease in leaf length, shoot length, shoot fresh weight, and root fresh weight with increasing salinity. The second experiment was conducted in 9cm diameter Petri dishes in artificial conditions to determine the optimal or threshold salt stress concentration at seed germination. Both the factors (plant variety and stress levels) were the same as in the pot experiment, and Petri dishes were kept in an incubator. Seeds were considered to be germinated when the radicle length reached half of the seed length. It was found that 200mM NaCl was the threshold salt concentration for screening genotypes at the germination stage. The standardization of protocol for salinity stress in pearl millet in soil conditions at seed and seedling stages were successfully attempted. In hydroponics experiment, 250 genotypes were screened in 200mM conc. saline solutions. Each set of studies was carried out for a total of 21 days. The experiments



identified the tolerant genotypes, IP1060, IP449431, IP13444, IP11333, IP1222, IP13444 and IP 11333 which can now be studied further to identify genes and proteins involved in salt stress tolerance.

IMPROVING GLOBAL FOOD SECURITY THROUGH ACCELERATED PLANT BREEDING.

Kamala Devi Datla, Mounika Reddy Macha, Nukala Himaja, Shivani D., Sushmita Dey, Sasi Priya

School of Agricultural Sciences, Malla Reddy University, Hyderabad, Telangana

*Email: amruthaammulu1103@gmail.com

Abstract

The most pressing challenges to food availability now and in the future are population growth and climate change. Future food security faces a four-fold challenge: upward pressure on demand, downward pressure on supply and the need for production that is both resilient and sustainable. Recent studies indicated that the current food production practices do not suffice to meet future food demand. In the present scenario, among all the breeding approaches Rapid generation advance (RGA) is found to be one of the best solutions to future food security challenge. RGA compared to other breeding methods was efficient in speed, technical simplicity, requirement of less resources and low costs. This method shortens the variety development time and breeding cycle about 2 years. Plant breeding, which has played an important role in alleviating hunger in the past, is typically characterized by long production processes facing rapidly changing market, environmental and climate conditions. Foresight information on markets, environment and climate, pre-breeding research are needed to improve the food security. RGA as the most appropriate breeding method that could be implemented by public sector breeding programs to overcome the future food security challenge.

DESIGN AND DEVELOPMENT OF POWER OPERATED PADDY STRAW SIZE CUTTER FOR MUSHROOM PRODUCTION

Kanhaiya Lal* and R.K. Naik

Indira Gandhi Krishi Vishwavidyalaya, Raipur, C.G.

Department of Farm Machinery and Power Engineering, FAE, SVCAET&RS IGKV, Raipur, Chhattisgarh.

*Email: thakurkhanhaiyalal@gmail.com

Abstract

A power operated paddy straw size cutter was developed for the benefit of small and marginal farmers to prepare the paddy straw size in mushroom cultivation. The physical properties of paddy straw relevant to the design of size cutter were determined. The length ranges was found to be 540 mm to 870 mm with the average length of 769.09 mm. Similarly, width varies from 6 mm to 13 mm with average of 9.81 mm. The thickness varies 1 mm to 4 mm with average thickness of 2.45 mm. The straw size cutter was developed with conveying mechanism. The labour requirement for cutting by local cutting equipment (*katti*) was higher than power operated straw cutter, and was found as 48 man-h/ton and 1 man-h/ton. This paddy straw cutting might be the solution to the problems faced by a small scale farmer regarding labour implementation and cost. After testing this machine in farm, it is found that the cost of cutting using this paddy straw size cutter is considerably much less as compare to manual cutting.

EFFECT OF HUMIC ACID APPLICATION ON PRODUCTIVITY OF SUMMER BLACK GRAM

Kanik Kumar Bansal^{1*}, Ashwani Kumar Sharma² and Vijay Bharti³

¹*Division of Agronomy, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu*

^{2,3}*Water Management Research Centre, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu*

*Email: kanikbansal09@gmail.com

Abstract

The present study entitled “Effect of humic acid application on productivity of summer black gram and its residual effect on rice” was conducted at the Research Farm, Water Management Research Centre, SKUAST-JAMMU Summer seasons of 2022. The soil of the experimental site was sandy loam in texture, slightly alkaline in reaction, low in organic carbon. The



experiment was laid out in Factorial Randomized Block Design with three factors and replicated thrice. twenty treatment combinations comprising of humic acid source and dose, viz Soil Application of Humic acid @ 2.5kg/ha (Market ready), Soil Application of Humic acid @ 5kg/ha (Market ready), Soil Application of Humic acid @ 2.5kg/ha (FYM), Soil Application of Humic acid @ 5kg/ha (FYM) and control, Phosphorus Solubilizing Bacteria (*PSB*) viz With *PSB* and Without *PSB* and Phosphorus nutrition viz 100% Recommended N:100% Recommended P (15:40 kg/ha) and 100% Recommended N:75% Recommended P (15: 30 kg/ha). Blackgram crop was sown at spacing of 30 cm with seed rate of 20 kg/ha. Soil application of humic acid will be done at sowing time and 10 DAS of black gram. Among the humic acid source and dose, Soil Application of Humic acid @ 5kg/ha (Market ready) observed significantly superior yield attributing characters viz. Number of pods/plant, Number of grains/pod, 100-seed weight (g), Number of grains/pod, Seed yield (kg/ha) and Stover yield (kg/ha) as compared to other treatments but was at par with Soil Application of Humic acid @ 5kg/ha (FYM). Whereas, among Phosphorus Solubilising Bacteria (*PSB*) and Phosphorus nutrition, With *PSB* and 100% Recommended N:75% Recommended P (15: 30kg/ha) was significantly superior respectively.

PERFORMANCE EVALUATION OF LIFETIME PRODUCTION AND REPRODUCTION TRAITS OF HARIANA CATTLE

Kartik Tomar^{1*}, Raj Kumar¹, Kuldeep Kumar Tyagi², Atul Gupta², D.S. Sahu¹, S.P. Yadav¹ and Deepak Singh¹

¹Deptt. of Animal Husbandry, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, Uttar Pradesh, India

²Department of Animal Genetics and Breeding, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, Uttar Pradesh, India

*Email: kktomar996@gmail.com

Abstract

For the least squares analysis, data from 655 Haryana cattle with lifetime records of productivity and reproduction that were raised from 1965 to 2020 at the State Livestock and Agriculture Farm in Babugarh, Hapur, India, were used. The overall least square estimates for lifetime traits viz. Breeding Efficiency by Tomar method, Breeding Efficiency by Wilcox method, Herd Life, Productive Days, Productive Life, Unproductive Days, Total Lactation Milk Yield in Pail, Total Standard Lactation Milk Yield in Pail, Total Lactation Milk Yield in Pail / Herd Life, Total Lactation Milk Yield in Pail / Productive Days and Total Lactation Milk Yield / Productive Life in Pail were $79.54 \pm 0.47\%$, $76.98 \pm 0.73\%$, 4241.91 ± 33.19 days, 1633.53 ± 23.95 days, 2392.06 ± 30.34 days, 758.53 ± 17.87 days, 5365.85 ± 113.60 kg, 5179.09 ± 97.08 kg, 1.17 ± 0.02 kg/day, 3.10 ± 0.04 kg/day, 2.16 ± 0.03 kg/day respectively. Except for a minor, the lifetime traits were shown to be highly influenced by a number of fixed factors utilised in the model. For animal breeders, a frame of reference will be the predicted lifespan least square means. The fixed factors that have been found as having a significant effect on lifetime traits in Haryana cattle will be helpful for standardizing information related to genetic study.

STUDY OF THE CHANGES IN PHYSICO-CHEMICAL PARAMETERS OF FISH POND OF PALKOT BLOCK LOCATED IN GUMLA DISTRICT, JHARKHAND

Kashish Bhardwaz^{1*} and T.K. Ghosh¹

¹ Department of Aquaculture, Faculty of Fisheries Sciences, Kolkata, West Bengal- 700 094, India

*Email: kashishbhardwaz1996@gmail.com

Abstract

Water from agricultural fields gets accumulated in the pond which is utilized for aquaculture purposes. The physicochemical parameters of the fish pond have been studied in the present study. The changes in physicochemical parameters due to fisheries activities have been recorded. Two ponds namely Umra (P1) and Tilaidih (P2) of Palkot Block located in Gumla District, Jharkhand. It has been observed that the water temperature variation of the fish pond in the upper and bottom layers of the fish pond ranges between 21.6 to 26.4 °C. The pH of pond P1 and P2 increased from 6.9 to 7.3 and 7.9 to 8.2 respectively. The conductivity of pond P1 changed from 1446 to 1561 and pond P2 from 538 to 553 μ mhos. Total dissolved solids of pond P1 ranged between 1258 to 1312.8 ppm and pond P2 from 468 to 453.2 ppm, the dissolved oxygen concentration of pond P1 ranged between 5.4 to 6.75 mg/l and pond P2 from 4.8 to 7.2 mg/l. The free carbon dioxide of pond P1 decreased from 13.2 to 11 mg/l and pond 2 from 8.80 to 6.16 mg/l, the total alkalinity of pond P1 from 66 to 109 mg/l and pond 2 from 216 to 151



mg/l, total hardness of pond P1 from 796 to 860 mg/l and pond P2 from 260 to 256 mg/l, the chemical oxygen demand of pond P1 from 128 to 42.5 mg/l and pond 2 from 24.0 to 30.4 mg/l, the biological oxygen demand of pond P1 3.4 to 2 mg/l and pond P2 from 2.40 to 1.48 mg/l, the ammonia of pond P1 from 0.25 to 0.29 mg/l and pond P2 from 0.24 to 0.18 mg/l, the nitrate of pond P1 from 2.0 to 1.1 mg/l and pond P2 2.40 to 1.98 mg/l, the ortho-phosphate of pond P1 from 0.40 to 2.00 mg/l and pond P2 from 0.50 to 0.70 mg/l, the organic carbon of pond P1 from 2.40 to 5.20 (%) and pond P2 5.40 to 2.80 (%). In the present study, drastic changes in dissolved oxygen concentration were observed after the 1.5 m of water depth. The fish ponds P1 and P2 behave differently in different physicochemical parameters. The physicochemical parameters of pond water directly affect fish production. The fish ponds may be developed by simple modification i.e., flood water with surface water which will improve the water quality for aquaculture.

PRODUCTION OF HONEY IN INDIA-PRESENT STATUS AND FUTURE APPROACHES

Kaushik Pramanik^{1*} and Pranabesh Nandi²

^{1,2}Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal- 741252

*Email: kpramanik.kaushik@gmail.com

Abstract

Since ancient times, people have utilized honey as a medicinal and sweetener. India was foremost in the worldwide honey trade till the colonial rule took over the honey into its hands. Since that time, tribes and rural people have turned to beekeeping as an additional source of income. The minerals present in honey include copper, calcium, iron, manganese, silicates, magnesium, sodium, chlorides, potassium, phosphates, and sulphates. The antimicrobial (e.g., against *Streptococcus pyogenes*, *Helicobacter pylori* etc.), anti-inflammatory, antioxidant, antidiabetic, and wound-healing effects of this substance are well documented. Honey is also used to treat respiratory, gastrointestinal, cardiovascular and nervous system diseases. It is in high demand in both the food and pharmaceutical industries because of its sweet flavour and medicinal qualities. In the past 10 years, a continual increase in honey production has been reflected as a result of constant efforts through numerous programmes. Roughly 200% growth in honey production has been recorded in the last decade. In order to make a “Sweet Revolution,” the government of India created the NBHM (National Beekeeping & Honey Mission) in 2020. Yet more efforts are necessary to enhance honey production in India. According to National Bee Board (NBB), India has the capability to harbour 200 million bee colonies. Expansion and more successful enactment of scientific beekeeping will be beneficial to utilise the highest potential of India in honey production. Certain listed approaches can result in improved honey production in India for instance modern pest management tactics, developing genetic resistance in honeybees, modified cultural practices, use of biocontrol agents (such as *Metarhizium anisopliae*, *Chelifer cancroides*, *Stratiolaelaps scimitus* etc.), insect sterilization techniques etc.

EFFECT OF DIFFERENT BUD OPENING PRESERVATIVE SOLUTIONS ON POST-HARVEST LIFE OF CUT CHRYSANTHEMUM (*DENDRANTHEMA GRANDIFLORA* TZVELVE) CULTIVARS ‘SOLAN SHRINGAR’ AND ‘YELLOW STAR’

Kavita Negi, Puja Sharma, Sita Ram Dhiman and Shabnam Pangtu*

Department of Floriculture and Landscape Architecture, Dr.Y.S. Parmar University of Horticulture and Forestry Nauni, Solan

*Email: shabnam.pangtu34@gmail.com

Abstract

The present investigations entitled, “Effect of different bud opening preservative solutions on post-harvest life of cut chrysanthemum (*Dendranthema grandiflora* Tzvelve) cultivars ‘Solan Shringar’ and ‘Yellow Star’ were carried out at Department of Floriculture and Landscape Architecture, Dr Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan (H.P). The experiment on bud opening solution was conducted in a Completely Randomized Design (factorial). The details of experiment: Two Cultivars i.e. ‘Solan Shringar’ and ‘Yellow Star’, Two bud opening stages of flower bud i.e. at 40 mm, 60 mm diameter of flower bud and seven different preservative solutions i.e. T₁ - Control (distilled water), T₂ - Sucrose (4%)+8-HQC (50 ppm), T₃ - Sucrose (4%)+8-HQC (100 ppm), T₄ - Sucrose (4%)+8-HQC (150 ppm), T₅ - Sucrose (8%)+8-HQC (50 ppm), T₆ - Sucrose (8%)+8-HQC (100 ppm) and T₇ - Sucrose (8%)+8-HQC (150 ppm). Studies revealed that bud- cut flowers of cultivar ‘Yellow Star’ opened earliest when placed in preservative solution containing sucrose (8%)+



8-HQC (150 ppm) whereas, 'Solan Shringar' in sucrose (4%) + 8-HQC (150 ppm). However, maximum flower diameter, flower height and increase in weight of cut stems and amount of solution consumed by cut stems of both the cultivars was obtained when flowers were opened in sucrose (4%) + 8-HQC (150 ppm). Vase life, amount of distilled water consumed and appearance was maximum when harvested at fully opened stage.

EFFECT OF INTEGRATED FOLIAR NUTRITION ON NUTRIENT UPTAKE OF SUMMER COWPEA

Kavyashree C¹., S.A. Biradar² and V.S. Devaranavadi³

¹Department of Agronomy, University of Agricultural Sciences, Raichur

²ICAR- Krishi Vigyan Kendra, Dharwad, Karnataka

³Agricultural Engineering, ICAR-Krishi Vigyan Kendra, Vijayapur, Karnataka

*Email: kavya1341997@gmail.com

Abstract

The experiment was conducted at KVK farm, Vijayapur, University of Agricultural Sciences (UAS), Dharwad. To evaluate the effect of integrated foliar nutrition on nutrient uptake of summer cowpea in Northern Dry Zone of Karnataka under changing climate. Experiment consists of application of five foliar nutrients, (Vermiwash, Cow urine, Pulse magic, 19:19:19 and DAP), their concentrations and integrated application of nutrients at flower initiation and peak flowering stage along with RPP (5 t FYM + 25 kg N + 50 kg P₂O₅ + 25 kg K₂O + 20 kg S + 25 kg ZnSO₄ ha⁻¹). The experiment consists of nine treatments replicated thrice in RCBD (Randomized Complete Block Design). The nutrient uptake of nitrogen, phosphorus and potassium was significantly varied with foliar application of RPP + 19:19:19 @ 1% + Vermiwash @ 10%. Highest nitrogen uptake (211.47 kg ha⁻¹), phosphorus uptake (60.09 kg ha⁻¹) and potassium uptake (107.25 kg ha⁻¹) was recorded at harvest with application of RPP + 19:19:19 @ 1% + Vermiwash @ 10% at flower initiation and peak flowering stage, which was on par with treatments RPP + 19:19:19 @ 1% + Cow urine @ 10% and RPP + 19:19:19 @ 1% + Pulse magic @ 1%, whereas the lowest nitrogen uptake (110.94 kg ha⁻¹), phosphorus uptake (34.14 kg ha⁻¹) and potassium uptake (66.26 kg ha⁻¹) was recorded with application of recommended Package of Practice.

STUDIES ON GENETIC VARIABILITY, CHARACTER ASSOCIATION AND DIVERGENCE IN CHICKPEA (*CICER ARIETINUM* L.)

Keshav Babu*, Sarvendra Kumar, Mahak Singh and Ravi Dixit

Department of Genetics and Plant Breeding, C.S.A. University of Agriculture and Technology, Kanpur

*Email: kgangwar423@gmail.com

Abstract

An field experiment of 50 diverse genotypes of chickpea was conducted during rabi season 2020-21 at oil seed research station C.S. Azad University of Agriculture and Technology Kanpur 208002 (U.P). These genotypes were evaluated for various traits viz; days of 50 % flowering, days to maturity, plant height (cm), number of primary branches /plant, number of pods /plant, number of seeds / pod, biological yield /plant, 100 seed weight (g), harvest index and seed yield /plant (g). Analysis of variance revealed the presence of sufficient variability among the genotypes for all the traits under the study. Genotypic and phenotypic coefficient of variation were found to be higher for the number of seeds per pod, number of pods /plant, number of primary branches, plant height, 100 seed weight (g) and biological yield /plant. Moderate GCV and PCV was observed for harvest index and seed yield /plant. High heritability coupled with high genetic advance was found for number of pods /plants, biological yield /plant, plant height(cm), days of 50% flowering, whereas high heritability with moderate genetic advance was found for harvest index (%), 100- seed weight (g), days to maturity. High heritability with low genetic advance was observed for seed yield /plant, seeds per pod, number of primary branches /plant. Correlation studies revealed seed yield /plant had positive and significant association with 100- seed weight (g), number of pod /plants, biological yield /plant (g), number of seeds / pods, and harvest index (%). Path analysis revealed direct positive effect of biological yield /plant(g), harvest index(%), plant height(cm), number of pods /plant, days of 50 % flowering, 100- seed weight(g) days to maturity, and negative effect of number of primary branches. Selection yield traits for increasing seed yield /plant(g) are 100- seed weight(g), harvest index, plant height(cm), number of pods /plants, days of 50% flowering, 100- seed weight(g). Six clusters with 19 genotypes were included in cluster (I) followed by cluster II (14), cluster III (9), cluster IV (4), cluster V and cluster VI



include 2 genotype each. The maximum inter cluster distance $D = 2469.73$ was observed between cluster II and cluster IV followed by cluster IV and cluster V ($D = 2344.23$), cluster I and cluster V ($D = 1940.15$), cluster I and cluster II ($D = 1661.36$) indicating that the genotypes falling in these clusters were highly divergent from each other indicating large amount of diversity within and between groups, which could be exploited in breeding programmes.

GENETIC AMELIORATION FOR SHELF-LIFE IMPROVEMENT IN FRUITS AND VEGETABLES THROUGH BIOTECHNOLOGICAL INTERVENTIONS

Kinjal Mondal^{1*}, Shivam Sharama², Ayush G. Jain³ and Shaik Munnysha⁴

¹Department of Molecular Biology and Biotechnology, Maharana Pratap University of Agriculture and Technology, Udaipur-313001, (Raj.), India

²Department of Vegetable Science, CSK Himachal Pradesh Agriculture University, Palampur-176062, (H.P.), India

³Department of Research & Development, Prathista Industries, Hyderabad-508252, (Tel.), India

⁴Department of Plant Pathology, Maharana Pratap University of Agriculture and Technology, Udaipur-313001, (Raj.), India

*Email: kinjal.mondal1234@gmail.com

Abstract

Fruits and vegetables are excellent providers of vitamins (A, B1, B6, B9, C, and E), minerals, carbohydrates, antioxidants, and dietary fibre, all of which are crucial for a healthy body and clear vision. The shelf-life of many of them is quite short after harvest, necessitating special precautions. The process of fruit ripening affects its attractiveness by disturbing the levels of sugars, acids, and aromatic compounds as well as the pigments (carotenoids and flavonoids). It also speeds up tissue softening, which causes post-harvest deterioration. Reducing the rate of senescence in these crops is not so facile by conventional breeding programs with limited knowledge about biochemical and cellular processes associated with fruit aging. Recent advances in molecular biology (*in vitro* mutagenesis, genetic engineering, DNA sequencing, cloning, molecular marker systems, etc.) have already begun to be applied as one of the major weaponries in the field of crop improvement to enhance fruit and vegetable quality and shelf life. Development of “Flavr Savr” tomato by antisense technology has already opened the path of discovery in fruit science since May 21, 1994 when it was commercialised for the first time in U.S. market. This transgenic tomato was put on hold for a longer period of time and has remained so ever since it can no longer manufacture polygalacturonase (PG), an enzyme crucial in softening fruit. In the realm of fruit-ripening biology, the use of gene editing utilising the CRISPR/Cas9 technique is unquestionably thought to give more practical options. Additionally, marker-assisted selection (MAS), which appears to be economically appealing and appropriate for markets in both rich and developing nations, can greatly increase the efficiency of QTL selection in specific crop species regardless of ethylene perception.

USE OF MOBILE-BASED INFORMATION COMMUNICATION TECHNOLOGY TOOLS BY DAIRY FARMERS IN WESTERN MAHARASHTRA

Kiran Jadhav, Smita Kolhe*, Milind Nande A.V. Khanvilkar and Akash Doiphode

Department of Veterinary & Animal Husbandry Extension Education,

KNP College of Veterinary Science Shirwal, MAFSU, DistSatara Maharashtra, 412801

*Email: drsmi@rediffmail.com

Abstract

This study was conducted in the Pune and Satara districts of Western Maharashtra to know the socio-economic profile, knowledge level, extent of use, and constraints faced by dairy farmers while using mobile-based ICT tools. Almost all the variables studied viz. age group (68.32%), family size (39.17), land holding (48.33%), herd size (45.00%), experience (69.17%), social participation (75.84%), extension contacts (70.00%) and knowledge level (72.50%) could be grouped under medium level. Overall, the extent of use of 24 mobile-based ICT tools and their utilization for dairy farming was analyzed. Results showed that dairy farmers were mostly aware of voice calls (90.83%), Whatsapp (82.50%) and financial apps for e-transaction (65%). All the respondents were completely unaware of Twitter, Skype, Instagram, Bluetooth and GIS applications. Over 95 percent of the respondents didn't use e-literature, multimedia, video recorder facilities, mobile applications, Facebook, e-mail, etc. to acquire information regarding dairy-related activities. Likewise, most of the respondents never used video calls (73.34%), SMS facility (70.84%), and mobile for taking photographs (64.16%) related to



dairy farming. Most of the farmers were daily using Whatsapp followed by voice calls and financial apps. On a weekly and monthly basis, a lower number of respondents were using mobile-based ICT tools. Most of the dairy farmers use mobile-based ICT tools primarily for social purposes with less involvement in its use in order to improve dairy farming activities. Major constraints faced by dairy farmers while using mobile-based ICT tools were the unavailability of relevant information in the local language, lack of reliable, useful, and location-specific content, lack of repairing services and centers in the village, etc. There is a need to popularize the use of mobile-based ICT tools and impart competence and skills in using mobile-based ICT tools among dairy farmers.

ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICES OF DAIRY FARMERS ON USE OF ANTIBIOTICS AND ANTIMICROBIAL RESISTANCE

Mahesh Dhangar, Smita Kolhe, Vikas Waskar, A.V. Khanvillkar and Gokul Sonowane

Department of Veterinary & Animal Husbandry Extension Education,

KNP College of Veterinary Science Shirwal, MAFSU, Dist Satara Maharashtra, 412801

Abstract

The study was undertaken with the objective of assessing the knowledge attitude and practices followed by dairy farmers towards antibiotic use and antimicrobial resistance. A total of 120 respondents were purposively selected from Pune and Satara district of Maharashtra and data was collected through a structured interview schedule. Collected data were exposed to statistical analysis, KAP index and results were interpreted. Almost all the variables studied *viz.* age group (67.50%), education level (61.66%), annual income (74.17%), landholding (48.33%), herd size (75.00%), experience (71.66%), milk production (79.16%), social participation (80%), extension contacts (53.33%), knowledge level (80.33), attitude (68.33%) and practices (78.33%) could be grouped under medium level. Dairy farmer's understudy had a low to medium level of knowledge towards antibiotics and their use while little knowledge regarding antimicrobial resistance. The majority of the respondents used antibiotics for the treatment of animals, however, knowledge on the specific use of antibiotics, dose regime, storage, expiry, residual effect, risk of spread to humans was low to moderate. Thus, there is enough scope for improvement of the dairy farmer's knowledge regarding appropriate antibiotic use and antimicrobial resistance. The majority of dairy farmers had an unfavorable attitude and followed low to medium levels of good practices towards the use of antibiotics and antimicrobial resistance. A significant association between education, social and extension contact of the respondents with knowledge, social and extension contact with attitude and practices score was observed. Also, among all socioeconomic variables only education, extension contact and social participation are highly significant with KAP of the dairy farmers towards antibiotics, its use and antimicrobial resistance. Thus, applicable informative interventions should be intended to reach and educate the farmers about the rational use of antibiotics and the development of antimicrobial resistance taking into account the social and extension context. Periodic training programs, awareness campaigns, workshops, demonstrations, etc. are desirable to generate a paradigm shift in the perceptions of the dairy farmers and to raise awareness about antibiotics, rational drug use, and resistance with specific consideration to public health.

TRADITIONAL BEEKEEPING AND ITS IMPORTANCE IN POLLINATION IN WESTERN HIMALAYAN REGION BY *APIS CERANA*.

Raj Kumar Thakur, Kritika Sood* and Priyanka Rani

Department of Entomology, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan (Himachal Pradesh), India – 173230

**Email: kritika.22sood@gmail.com*

Abstract

Apis cerana, the indigenous honeybee, has played a major role in increasing agricultural output as a natural pollinator for a variety of fruits and crops. This species can be found in a variety of habitats and temperatures, including colder areas at higher latitudes and elevations, dry, semi-arid environments, and tropical climes. Traditional knowledge is wisdom passed down from one generation to another, and it includes the environmentally sustainable use of natural resources. Man has been able to retain bee space, which is a sequence of regular-spaced parallel combs, in a variety of indigenously manufactured hives, including clay pots, boxes, logs, and historic house wall recesses, due to the preference of bee for nesting in the dark. The



indigenous expertise of beekeeping and the art of honey collection is passed down from generation to generation. Traditional hives are more suitable in hilly areas than contemporary hives, although they have a disadvantage in colony management. Even in the absence of written documents or formal training, they have continued to follow the ancient tradition. Honey bees were plagued by wasps, wax moths, palm-civets, ants, and bears. For management of these hives, no chemicals and artificial feeding is used. *Apis cerana* is more active than *Apis mellifera* during flowering and shedding of some fruits like apricot. Keeping in view the importance of traditional knowledge, the detailed indigenous practises of beekeeping with *Apis cerana* were studied.

ROLE OF GREEN SYNTHESISED SILICA NANOPARTICLES IN DROUGHT TOLERANCE IN WHEAT (*TRITICUM AESTIVUM* L.) BY FOLIAR APPLICATION

Komal Bisht* and Pushpa Lohani

Department of Molecular Biology & Genetic Engineering, College of Basic Science & Humanities, G. B. Pant University of Agriculture & Technology, Pantnagar, Udham Singh Nagar, Uttarakhand 263145.

*Email: komalplantbiotechnology@gmail.com

Abstract

In the present scenario of changing climatic conditions, it is speculated that in future drought like conditions shall prevail. There is a challenge to feed growing population with shrinking agricultural land. Drought can be one of the major abiotic stresses that impairs the growth and productivity of wheat, a crop of high nutritional value and socio-economic importance. Therefore, there is an urgent need to develop strategies to improve drought tolerance in crops. Silica Nanoparticles are thought to play an important role in providing tolerance to abiotic stress. In this study, green synthesised silica nanoparticles with average size 80 nm were used. A pot-based experiment was conducted to study the effect of silica nanoparticles at different concentrations (0 ppm i.e. control, 25 ppm, 50 ppm and 100 ppm) on drought tolerance and growth of HUW-843, a drought sensitive variety of wheat. Nanoparticles were applied on drought stressed wheat via foliar spray. Drought was imposed by withholding irrigation for 10 days at vegetative stage. Morpho-physiological and biochemical responses of wheat were recorded at vegetative stage after treatment with silica nanoparticles with defined concentrations and time interval. It was observed that with treatment of 25 ppm, 50 ppm and 100 ppm of silica nanoparticles morpho-physiological features like plant height, root length, number of leaves per plant, leaf area, relative water content, total chlorophyll and carotenoid content and biochemical components like free proline, ascorbate, total soluble sugars, total free amino acids, total phenolics and flavonoid content significantly improved as compared to drought stressed control plants. A decrease in malondialdehyde content was observed. Specific activity of ROS scavenging enzymes like superoxide dismutase, ascorbate peroxidase, guaiacol peroxidase and glutathione reductase also improved on application of silica nanoparticles. Thus, it can be concluded that silica nanoparticles provide drought tolerance in drought sensitive variety of wheat. 50 ppm to 100 ppm concentration dose of silica nanoparticles can be recommended for providing drought tolerance.

GRAFT HYBRIDIZATION IN VEGETABLES

Kowsalya K.B.^{1*} and Sulochana K.H.¹

¹Division of Vegetable Crops, ICAR-Indian Institute of Horticulture Research, Bengaluru, Karnataka

*Email: kowsalyakb@gmail.com

Abstract

Climate change is impacting the agricultural production considerably in company with other issues like land fragmentation, non-availability of labors leading to emergence of new races of pests, diseases, creating more of abiotic stresses on plants and vegetables are not an excuse to this. To breed varieties resilient for climate change, breeders have various ways and the most significant and the oldest with its full potential is none other than 'grafting technique'. While grafting is done between two genetically dissimilar plant parts (scion and rootstock), a hybrid plant is produced exhibiting characters of both the stock and the scion and these new characters are heritable in nature when the grafted scion is selfed and advanced to next generation. The concept was first proposed by Darwin in 1868, also supported by Winkler's, Michurin's findings. mRNA molecules derived from the stock cells could possibly be reverse transcribed into cDNA capable of being integrated into genome of the scion cells, resulting in heritable changes in the scion. Mobility of sRNA via Phloem and plasmodesmata from rootstock or



scion occurs. Graft hybridization is now explained by horizontal gene transfer and DNA transformation. In addition, the long-distance transport of mRNA and small RNAs is also considered to be involved in the formation of graft hybrids. Graft induced changes created phenotypic variation in pepper fruits. Investigation of the graft transmission of high-temperature tolerance into tomato scions (non-transgenic) from transgenic rootstocks (tomato), where the fatty acid desaturase gene (LeFAD7) was RNA-silenced (Nakamura *et al.*, 2016). Transgenic rootstocks have been created and tested as potential means to enhance scion performance or to understand signaling mechanisms in its best way so that, it helps in understanding the process if graft hybridization in the plant system. Graft hybridization is considered to be a simple and efficient means of plant breeding for the crop improvement.

STUDIES ON THE APPLICATION OF BETEL LEAF EXTRACT EDIBLE COATING AS A PACKAGING FOR EXTENDING THE SHELF LIFE OF TOMATOES

Krishna Aayush^{1*}, Somesh Sharma¹, Tianxi Yang², Kanika Sharma¹, Gurvendra Pal Singh¹

¹School of Bioengineering and Food Technology, Shoolini University, Bajhol, Distt Solan H.P, India.

²Food, Nutrition and Health Program, Faculty of Land and Food System, The University of British Columbia, Vancouver, BC V6T 1Z4, Canada. *Email: krishnaaayush@shooliniuniversity.com

Abstract

This work aims to improve the shelf life of the tomato fruit by applying an edible coating formulated by the xanthan gum (0.4%) which was incorporated by betel leaf extract (BLE). The edible coating was obtained in the nano range with acceptable PDI. Coated tomatoes were stored in the room and refrigerator temperature and various physiochemical characteristics were analyzed at an interval of 3 days. Tomatoes with edible coating possess minimal weight loss and firmness. It maintains TSS and pH. Further, the total phenolic content and antioxidant activity show that edible coated tomatoes incorporated with BLE were increased slightly which helps in maintaining the quality of tomatoes during storage than control. The edible coating containing BLE was most effective at inhibiting the growth of pathogenic fungi and total bacterial count. The sensory evaluation scores by semi-trained panel members revealed that the tomatoes were still acceptable to even after 21 days at room temperature and 27 days under refrigerated conditions. The results of the studies finally revealed that the application of edible coatings has certainly increased the shelf life of tomatoes.

EFFECT OF DIGITAL MEDIA ON AGRICULTURE SECTOR

Krishna Kumari Purbia

Department of Extension Education, Rajasthan College of Agriculture, MPUAT, Udaipur (313001) (Rajasthan)

Email: Krishnapurbia228@gmail.com

Abstract

Digital media are tools meant for digital communication that aids in the interaction among a group of people and acts as information exchange media across the globe. Since ages newspapers, television, and magazines have been the most used source of information in the agriculture sector. But now the power of the 21st century is literally in our hands. Social media user numbers have continued to grow over the past 12 months too, with 227 million new users joining social media since this time last year. There are 4.70 billion social media users around the world in July 2022. Platforms like Facebook, YouTube, WhatsApp, twitter, telegram, instagram, goggle and other apps to help farmers to improve their skills and knowledge. Facebook is one of the prominent social media applications for pages and profile creation. YouTube videos are an excellent source of dissemination of knowledge using audio-visual aids. WhatsApp is the handy use of social media and mostly preferred for related groups. In many social media platforms are being used in agricultural extension service delivery worldwide with Facebook having the highest popularity (64.7%). Social media is continuously growing and getting the attention of users with the emergence of several smartphones. However, it has not grown widely for agriculture in India because of various challenges prevalent in rural India that are the shortage of infrastructure, limitation in participation, illiteracy in rural zones, non-institutionalization, lack of quality control, etc. Nowadays, social media is gradually being appreciated in agricultural extension service delivery but continuously facing several challenges. Thus, the need of the hour is to put structures in place and efforts to be made by training and other methods by all stakeholders to ensure good use of its benefits in agricultural extension and rural development.



FEASIBILITY OF USE OF POOR QUALITY WATER IN AGRICULTURE

Kuldeep Kumar^{1*} and Pramod Kumar²

¹Department of Agronomy, Birsa Agricultural University, Kanke, Ranchi, Jharkhand, India-834006

²Deptt. of Agrometeorology and Environmental Science, Birsa Agricultural University, Kanke, Ranchi, Jharkhand, India

*Email: kdbauranchi@gmail.com

Abstract

The global population is rising continuously and is expected to touch the 9.5 billion mark in 2050 from the current 7.2 billion (United Nations, 2017). This increase in population needs about 60% additional foods to feed them (FAO, 2016). Against the backdrop, the sustainability of water resources is a critical issue for fulfilling the rising water demands of various competitive sectors including agriculture, which is the largest water user and consumes over 70% of the abstracted freshwater globally (Singh, 2015). The issue has become more challenging in the light of dwindling resource base due to urbanization, contamination, and climate change impacts. The continuous increase in global population and simultaneous decrease in good quality water resources emphasize the need of using poor quality irrigation water for agricultural production (Singh, 2015). However, the injudicious use of poor quality irrigation water for crop production can be detrimental to the environment. Irrigation water quality has been considered as a serious environmental factor for the assessment of sustainable development during the last few decades. About 97.5% of water on Earth is salty, thus, only about 2.5 per cent of water on Earth is freshwater. Out of them only about 1.2 percent water is considered for surface water, (<https://www.statista.com/statistics/564724/distribution-of-earths-water-resources>). The world's water resources accounts only 4 per cent, out of them India accounts about 2.45 per cent of world's surface area, and while, there is about 16 per cent of world's population. The total water available from precipitation in the country in a year is about 4,000 cubic km (<https://ncert.nic.in/ncerts/l/legy206.pdf>). However, without proper planning and management, the intensification of irrigated agriculture can result in declining biodiversity and other environmental problems in agro-ecosystems (Singh, 2010). For instance, more than one-third of the world's irrigated land is affected by salinization / waterlogging and this condition poses a threat for food security and environmental conservation. There are several scientists and researchers are reported that the application of distillery effluents increased the sugarcane yield and sugar yield but also increased the Quality parameter of sugarcane juice due to presence of N,P,K,Ca, Mg and Fe content effluence. Sharma and Minhas (2005) revealed that with the increased in amount of gypsum, yield of rice and wheat generally increased and they also reported that the alternative use fresh water and alkali water causes dilution effect and effectively used irrigation propose in both crops.

NUTRIENT AND WATER MANAGEMENT & TRANSFER OF TECHNOLOGY THROUGH AI AND ICT FOR ENHANCING CROP PRODUCTIVITY AND SOIL HEALTH

Kunal Narwal, G.D. Sharma and Tarun Sharma

Department of Agronomy, College of Agriculture, CSK HPKV, Palampur, HP-176 062, India

*Email: kunalnarwal0055@gmail.com

Abstract

With the ever-growing population and the challenges that the human-kind is facing currently such as climate change, poverty and hunger there is a need of tech-based agriculture that is highly efficient, productive and sustainable. Artificial intelligence and ICTs in the present times holds the key for a tech-based revolution in agriculture. Artificial intelligence is basically a branch of computer science that imitates through processes, learning abilities and knowledge management. Water and Nutrients are one of the major inputs supplied to crop fields. Optimization of their application is the major aim for most of the agronomic practices, but due to the spatial, temporal variability within crop fields and lack of site-specific information in real time there is a great hindrance to such optimized applications. AI and ICT based nutrient and water management helps in assessing farm fields at their micro-climate levels and make efficient decisions keeping in mind the crop needs and thus resulting in enhanced productivity levels and resource use efficiency, maximized returns and Improved soil health. These technologies integrate historical, real time and forecasted data from various resources to make decisions on their own. Data can be obtained from different sensors located in the crop fields or through unmanned aerial vehicle mounted spectral camera or through remote sensing. Data obtained as such is transferred to GIS based software to create digital maps which are fed to decision support systems (coded programs or AI algorithms) to make efficient decisions or provide optimized input



application recommendations. These recommendations are in last forwarded to variable rate applicators for site specific application. With such optimized recommendations digital technologies are able to sustain enhanced productivity levels along with resource conservation.

A STUDY ON THE KNOWLEDGE INTERVENTION OF COMPLEMENTARY FEEDING PRACTICES OF RURAL WOMEN IN TELANGANA STATE

Lopamudra Mohapatra^{1*} and R. Neela Rani²

¹Department of Extension Education and Communication Management, College of Community Science, PJTSAU, Hyderabad, Telangana-500030

²Dept. of Extension Education and Communication Management, AICRP-WIA, PG&RC, PJTSAU, Rajendranagar, Hyderabad, Telangana-500030

*Email: lpmohapatra123@gmail.com

Abstract

The initial two years of life provide an opportunity for making sure that the child gets the right kind of nutrition to promote healthy growth and development. To ensure the growth of children, keep them healthy and develop to their full potential, adequate nutrition during infancy and in the early years of childhood is crucial. Complementary feeding is one of the most crucial aspects of infant and young child feeding practices. Inappropriate complementary feeding is a major cause of child malnutrition and death. The present study was conducted by using an Action research study design in the Medak district of Telangana purposively to know about the existing knowledge and practices on complementary feeding followed by rural women. A total of 120 samples were selected for the study. The data was collected using the personal interview method with the aid of a structured interview schedule. After 15 days, intervention on complementary feeding and locally available standardized recipes were provided. The responses were collected regarding the change in knowledge and practices of complementary feeding. Results of the study revealed that the majority (87.5%) of the respondents had poor knowledge regarding complementary feeding and there was a lack of knowledge regarding age-wise ideal frequency, consistency and quantity of complementary foods. After providing intervention on complementary feeding, a significant difference in change in knowledge and practice was found among the respondents. The majority (66.67%) of the respondents got good knowledge regarding breastfeeding likewise complementary feeding (75.83%) and meal frequency and preparation of complementary foods (77.50%). According to the results of the current study, most rural women were not well informed on complementary feeding, for which they were following low-recommended practices.

BIO-DECOMPOSER AND NITROGEN MANAGEMENT ON INITIAL GROWTH, NITROGEN CONTENT AND PRODUCTIVITY OF SUPER SEEDER SOWN WHEAT UNDER RICE RESIDUE INCORPORATION

L. Peace Raising*, V. Pratap Singh¹ and Subhas Chandra²

Department of Agronomy, GBPUAT, Pantnagar

*Email: peaceraising@gmail.com

Abstract

Field experiments entitled “Bio-decomposer and nitrogen management on initial growth, nitrogen content and productivity of super seeder sown wheat under rice residue incorporation” were conducted at Pantnagar during 2020-21 and 2021-22, to study the effect of bio-decomposer, nitrogen dose and its scheduling on initial growth and productivity of wheat. Field experiment was laid in split plot design with two factors in the main plot viz. without and with application of bio-decomposer and Nitrogen level @150 and @80 kg/ha and three nitrogen split viz. 50%:25%:25%, 40%:30%:30% and 30%:35%:35% and replicated thrice. Bio-decomposer was prepared and sprayed prior 5 days before sowing of the wheat crop. The growth parameters i.e., plant height, no. of shoots/m² dry matter accumulation, green seeker reading and nitrogen content in wheat crop were recorded significantly higher in treatment receiving nitrogen @180 kg/ha and split as 50%:25%:25% which was at par with 40%:30%:30% over 150 kg N/ha and split as 30%+35%+35% during both the years of study. Yield attributes such as spike length and 1000-grains weight were not influence by different factors whereas effective tillers/m², no. of grains/spike and grain weight/spike were recorded significantly higher in in treatment receiving additional nitrogen i.e., 180 kg/ha and split as 50% as basal which was at par with 40%:30%:30% over recommended dose @150 kg N/ha and split as 30%:35%:35%



during both the years of study. Harvest index was not influenced by different factors while grain yield, straw yield and biological yield were recorded significantly higher in nitrogen @180 kg/ha and split as 50%:25%:25% which was at par with 40%:30%:30% over 150 kg N/ha and split as 30%:35%:35% during both the years of study. Non-significant effect was observed in bio-decomposer application in all the above parameters although higher values were recorded with bio-decomposer application than without its application.

DEVELOPMENT AND CHARACTERIZATION OF CELL LINES FROM ZEBRAFISH *DANIO RERIO* (HAMILTON 1822)

Lakan Lal Meena^{1*}, Mukunda Goswami¹ and Naresh Raj Keer²

¹ICAR-Central Institute of Fisheries Education, Versova, Andheri (W), Mumbai-400 061, India

²College of Fisheries, Bihar Animal Sciences University, Kishanganj, Bihar-855107

*Email: lakhanbiotechmfsc@gmail.com

Abstract

The present study was aimed to develop cell lines from selected tissues of *Danio rerio* and to characterize those using molecular and cytogenetic markers. Primary cultures were developed from the explants prepared from caudal fin, heart, eye, ovary, testis, kidney, gill, muscles, skin, spleen, and brain. Many short-term cultures were developed from heart, eye, ovary, testis, muscles, and skin. These were subcultured up to 6, 7, 6, 5, 4 & 3 passages, respectively. A cell line designated as DRCF was developed from caudal fin of *D. rerio*. The cell line was maintained in Leibovitz's L-15 medium supplemented with 20% fetal bovine serum (FBS). The DRCF cell line consisted predominantly of fibroblast-like cells. The cells were able to grow at temperatures between 25 °C and 30 °C with an optimum temperature of 28 °C. The growth rate of DRCF cells increased as the FBS proportion increased from 10% to 20% at 28 °C with optimum growth at the concentration of 20% FBS. DRCF cell line was subcultured up to 31 passages. The PCR amplification of mitochondrial gene 16S rRNA and COI authenticated the identity of the cell line. The DRCF was checked for GFP expression and the expression was observed 48 h post transfection. A finite cell line designed DRES was also developed from *D. rerio* eye and subcultured up to 7 passages. DRES cell line was transfected for GFP expression and this line expressed GFP after 48 hrs. These cell lines are being maintained and subcultured routinely in the cell culture lab.

GENETIC ANALYSIS FOR GRAIN IRON AND ZINC CONTENTS IN PEARL MILLET [*Pennisetum glaucum* (L.) R. BR.]

M. Bala Barathi^{1*} and P. Sanjana Reddy²

¹Department of Genetics and Plant Breeding, Agricultural College, Bapatla-522101 Andhra Pradesh, India

²Indian Institute of Millets Research, Rajendranagar-500030, Hyderabad, Telangana, India

*Email: balu3modugula@gmail.com

Abstract

Pearl millet is an important dual purpose crop in arid and semi-arid regions of Africa and Asia. Pearl millet grains are of good nutritive value with 73% carbohydrates, 11% proteins, 8.4% fat and rich source of minerals such as iron (6-7mg/100g) and zinc (3-4 mg/100g). Most of the global population is affected from the micronutrient deficiency especially iron and zinc. So, there is a need to develop cultivars with high nutrient contents. Development of hybrids in pearl millet could be successfully possible because of its protogynous, highly cross pollinated nature and availability of male sterility sources. Selection of parents based on their per se alone may not provide better results when used directly in hybridization programme. Hence, studies on combining ability gives information regarding gene action and helps in identification of desired parents and cross combinations. The present investigation was carried out at IIMR, Hyderabad to study heterosis and combining ability for grain iron and zinc contents in pearl millet. Plant material consists of 60 hybrids developed by crossing 30 landraces and two male sterile lines in L × T mating design. All the F₁'s and their parents were evaluated in alpha lattice design. Out of the 32 parents 16 parents recorded significant GCA effects and among the 60 cross combinations, 30 crosses recorded significant SCA effects in desirable direction for both the traits. The ratio of GCA variance to SCA variance were less than unity for both the traits indicating the predominance of non-additive gene action in the inheritance of these traits. Hence improvement of these traits can be possible by utilizing heterosis breeding and by production of synthetics and composites.



EUCALYPTUS LEAF OIL AS ECO-FRIENDLY FUNGICIDES FOR PLANT DISEASE MANAGEMENT

Mamta Khaiper*, Pawan Kumar Poonia, Sunil Kumar Dhanda and Preety Verma

Department of Forestry, Chaudhary Charan Singh Haryana Agricultural University, Hisar 125004, India

*Email: mamtakhaiper247@gmail.com

Abstract

Eucalyptus is one of the most important genus which belongs to family Myrtaceae. *Eucalyptus spp.* is being extensively planted in order to fulfil the increasing demand of pulpwood. The essential oils of eucalyptus leaf have potency as an antifungal agent especially against Root rot and wilt causing pathogens in plants. *Fusarium spp.* cause a wide range of plant diseases such as wilts and cankers in many horticultural, field and ornamental plants. Wilt caused by *Fusarium spp.* is one of the most important diseases that affect production resulting in decrease in grain yield and quality due to contamination with various mycotoxins such as fumonisins, deoxynivalenol, nivalenol and zearalenone. The study therefore confirms the fungicidal nature of eucalyptus essential oil and the potential uses of this oil as an alternative to chemical fungicides. Eucalyptus leaves oil was extracted by hydro- distillation method of four clones (i.e., C-7, C-83, C-288 and C-413) and assessment of the antifungal activity of the essential oil was carried out using the food poisoned technique. Out of these clones, two clones (C- 288 and C- 83) showed more than 50% mycelial growth inhibition percentage followed by the C-7 and C-413 at 2% concentration whereas, 100% inhibition of *Fusarium* mycelia were observed at higher concentration (i.e., 4%) in all the tested clones.

ALLELOPATHIC EFFECTS OF LEAF EXTRACTS OF KALMEGH ON SEED GERMINATION AND SEEDLING GROWTH OF WHEAT

M.P. Mandal^{1*} and Preeti Kumari²

Department of Plant Physiology and Biochemistry, Bihar Agricultural College, BAU, Sabour, Bhagalpur, Bihar, (India)

*Email: mpmbotany64@gmail.com

Abstract

Andrographis paniculata Nees. is a traditionally known as Kalmegh. Laboratory experiments was conducted to evaluate the allelopathic effects of the aqueous extract of Kalmegh on the seed germination, shoot length, root length, fresh and dry weight in wheat. The allelopathic potentialities of leaf extract of Kalmegh decreased the seed germination with the rise of leaf extract concentration. The extract also inhibited in shoot and root length, germination relative index and vigour index of different leaf extract and was maximum in susceptible genotypes/varieties namely, K-1317 and GW-322 followed by tolerant genotypes/varieties namely HD-2967 and HD-2733. It also showed inhibitory effects in terms of reducing sugar, non-reducing sugar, total sugar, amylase activity and starch contents. The inhibitory effects might be detrimental due to presence of the allelochemicals such as andrographolide, neoandrographolide, 14-Deoxy-11, 12-dehydroandrographolide and andrograpanin in the aqueous leaf extract of Kalmegh used in the present study. Hence it can be concluded that leaf extract contains water soluble allelochemicals which inhibits the seed germination, shoot length, root length, fresh and dry weight of root and shoot. The result indicated that the allelopathic effect of leaf extract was maximum in terms of every physiological and biochemical parameters studied.

STUDIES ON GENETIC VARIATION FOR YIELD AND YIELD CONTRIBUTING TRAITS IN LITTLE MILLET (*PANICUM SUMATRENSE*)

M. Muni Khyathi¹, D. Ratna Babu¹, N. Anuradha², G. Rama Rao³ and D. Ramesh⁴

¹Department of Genetics and Plant Breeding, Agricultural College, Bapatla

²Agricultural Research Station, Vizianagaram

³ANGRAU, Lam, Guntur

⁴Department of Statistics and Computer Applications, Agricultural College, Bapatla

*Email: d.ratnababu@angrau.ac.in

Abstract

The present investigation was carried out with 35 little millet genotypes, during *Kharif*, 2020 at ARS, Vizianagaram, to



estimate different genetic parameters. Analysis of variance revealed that majority of the traits viz. days to 50% flowering, plant height, flag leaf length, leaves per plant, panicle length, tillers per plant, productive tillers per plant, days to maturity, seed iron content, seed protein content and grain yield per plant showed significant differences. The phenotypic coefficient of variation for all the characters was greater than the genotypic coefficients of variation indicating the influence of environment on expression of these traits. Productive tillers per plant and seed iron content recorded high PCV and high GCV. Whereas, days to 50% flowering, tillers per plant, seed zinc content, seed manganese content and grain yield per plant showed high PCV and moderate GCV. Moderate PCV and GCV were observed for plant height, flag leaf length, leaves per main tiller, panicle length, days to maturity, test weight and protein content. This shows that there is considerable amount of variability for most of the characters studied. Days to 50% flowering, flag leaf length, leaves per main tiller, panicle length, tillers per plant, productive tillers per plant, days to maturity, test weight, seed iron content and seed manganese content recorded high heritability and high expected genetic advance as per cent of mean indicating the predominance of additive gene action in controlling the inheritance of these traits. Hence, direct phenotypic selection will be rewarding to improve these traits. High heritability and moderate expected genetic advance as per cent of mean was observed for plant height and grain yield per plant.

BIOCHAR-A VITAL SOURCE FOR SUSTAINABLE AGRICULTURE

M.R. Apoorva

Department of Soil Science and Agricultural Chemistry, College of Agriculture, PJTSAU, Rajendranagar, Hyderabad

**Email: apoorva.muthya123@gmail.com*

Abstract

Food security and environmental safety are the emerging concern due to non-sustainable agricultural and soil management practices. Thus, giving rise to the limiting influence of biotic and abiotic stress factors on the plant and soil health. Biochar is a solid waste material obtained from thermochemical conversion of plant or animal biomass or both in an oxygen limited environment. The thermal process is carried out on sources of biomass including agricultural wastes, green waste and animal manures (biomass feedstock) at temperatures ranging from 200 to 900°C. Its surface area and complex pore structure are hospitable to bacteria and fungi that plants need to absorb nutrients from the soil. Biochar production and utilization systems differ from most biomass energy systems because the technology is carbon negative and it removes net carbon dioxide from the atmosphere and stores it as stable soil carbon sinks in the terrestrial ecosystem. Biochar may persist in soil for millennia because it is very resistant to microbial decomposition and mineralization and leads to a net sequestration of CO₂. The overall benefit of biochar to environment and production systems is based on three sustainability factors: use of sustainable biomass, sustainable production processes and sustainable end use. Therefore, biochar amended soil causes alterations in soil health and this encompasses physical, chemical and biological features while it as well maintains the functions of both natural and managed ecosystems essential for sustainable agricultural fertility and productivity.

ADVANCES IN BREEDING STRATEGIES FOR CLIMATE RESILIENT CROPS

Lakshmi Shyamala Sreeramakavacham, Shiva Kumar Reddy Mudedla*, Nagaraju Berla, Shivani D., Susmita Dey, Sasi Priya S.

School of Agricultural Sciences, Malla Reddy University, Hyderabad, Telangana

**Email: shivakm1998@gmail.com*

Abstract

In spite of rising demand of food for the growing population, food security has become a threat globally due to rapid climate change. As a result of climate change, the crop production and productivity were reduced by various biotic and abiotic factors. Plant breeding has always played a crucial role in revolutionizing agriculture to feed the ever-growing population. It can rescue mankind from various threats to agriculture posed by changing climatic conditions globally. With modern breeding techniques, innovations, and recent advancements, it can explore and exploit variation in underutilized crops and pave the way forward to fulfill the food requirements of the present and future. Using recent innovations and advancements such as next-generation breeding (NGB) tools, genome-assisted breeding (GAB), high throughput phenotyping, genomic sequencing, and breeding methodologies along with genome editing tools like clustered regularly interspaced short palindromic



repeat/CRISPR-associated (CRISPR/Cas) systems, in integration with artificial intelligence (AI) and machine learning (ML), it can open new doors to accelerate the development of climate-ready crops to ensure global food security.

NON-LINEAR REGRESSION ANALYSIS FOR REACTIVE BLUE-19 DYE ADSORPTION ON MAIZE COB HUSK

Manindra Barman, Thungashan Kikon, Chakrapani Saikrishna Kishore, V.K. Sharma and Indu Chopra*

Division of Soil Science and Agricultural Chemistry, ICAR-Indian Agricultural Research Institute

New Delhi -110012, India

**Email: tinaindu@gmail.com*

Abstract

The presence of toxic dyes in water bodies are attributed to textile, pulp, tannery, paper, and paint industries, of which, textile industries contribute an estimated 70-90% of dye (majorly reactive dyes) effluents discharged into the environment. The unaltered dye-contaminated water affects the aquatic environment through change in colour, nature, temperature, and pH of the water bodies. In addition, it affects the crop produce adversely as the untreated effluents are used to irrigate crops due to diminishing source of fresh water. India generates approximately 71 Mt of maize crop residue on-farm and off-farm annually. As a strategy for alternative residue management to remediate dye pollution, this study was undertaken to explore the potential of maize cob husk as an adsorbent for the removal of Reactive Blue-19 (RB-19) from simulated aqueous solutions. Morphology and functional groups present in the adsorbent were characterized using Scanning Electron Microscopy (SEM) and Fourier Transform Infrared (FTIR) Microscopy. Batch adsorption experiments were carried out to optimize various parameters *viz.*, pH, initial dye concentration, adsorbent dosage, and contact time for maximum removal of the dye from simulated dye effluent. Maximum adsorption was achieved at pH 3 with an equilibrium time of 60 minutes. A decrease in initial dye concentration resulted in increased dye removal. The adsorption equilibrium data were fitted on two-parameter non-linear isotherm models *viz.* Langmuir, Freundlich and Temkin models and values of their constants were also obtained. Adsorption equilibrium data were best described by the Freundlich model. The maximum dye uptake of the Reactive Blue-19 on maize cob husk was 3.91 mg/g. Adsorption kinetic modelling was also done using pseudo-first-order, pseudo-second-order, and intraparticle diffusion models. The adsorption kinetic data showed excellent correlation with the pseudo-second-order model with R^2 value of 0.99. In order to enhance the adsorption capacity of agricultural waste and commercialize the technology, further studies need to be carried out.

DIVERSITY AND USE OF SOME IMPORTANT WILD EDIBLE PLANTS OF TIRTHAN WILDLIFE SANCTUARY IN HIMACHAL PRADESH, INDIA

Mamta Thakur*, Prem Kumar Khosla and Radha

School of Biological and Environmental Sciences, Shoolini University of Biotechnology and Management Sciences, Solan

**Email: mamtaparmar369@gmail.com*

Abstract

Wild edible plants are being consumed by rural inhabitants as a source of food where they still rely on locally available natural resource to meet their daily requirements. The present study was conducted in Tirthan wildlife sanctuary of Kullu district of Himachal Pradesh, India. In the present study, ethnobotanical data was collected through a pre-tested questionnaire, direct interviews, group discussions and participatory observations. A total of 23 wild edible plant species were collected from the study site. Of these reported plants, 13 were found to be herbs 5 shrubs and 5 were trees. The highest number of wild edible plants belonged to Rosacea family i.e. 6 in number followed by Polygonaceae family having 3 plants. Fruits were the most commonly used wild edible plant parts followed by leaves, shoots, flowers and twigs. Extensive field visits were carried out to the study area from September 2018 to May 2020. The wild edible plants are an important source of food and at the same time are rich in nutraceuticals. They have health enhancing effects and can be consumed to overcome mineral deficiencies. In the present survey, most of the informants were old people including both men and women, who possessed a rich and vast traditional knowledge about the diversity and use of locally available wild edible plants. Younger generations neither have much knowledge nor they are interested in such traditional natural resources of food. Therefore, the traditional indigenous knowledge about the diversity and use of wild edible plants is degrading day by day and is on the verge of extinction. There is



a need for protection and conservation of traditional knowledge for future reference too. This will help in the protection and conservation of knowledge as well as protection of endangered plant species.

EFFECT OF INOCULATION OF FORMULATIONS OF MICROBIAL CONSORTIA ON GROWTH OF PADDY UNDER POT CULTURE

Manasa S.G.* , Mahadevaswamy, Nagaraj M. Naik, Ramesh Y. Narayana Rao K. and Gundappagol R.C.

Department of Agricultural Microbiology, College of Agriculture, Raichur, Karnataka

*Email: manasasg44@gmail.com

Abstract

A greenhouse pot experiment was conducted to test the effect of bacterial microbial consortia containing nitrogen fixer, phosphate solubilizer, potassium solubilizer, zinc solubilizer and silicate solubilizer on growth attributes of paddy. The effect of developed formulations was compared with reference strains which has triple inoculation of nitrogen fixing bacteria, phosphate solubilizing bacteria and potassium solubilizing bacteria and with the uninoculated control. The effect of three microbial consortia on plant height, number of leaves per hill, number of tillers per hill, leaf area index and dry matter production over control of paddy was recorded at 30, 60, 90 DAT and at the harvest. Among all the four formulations (lignite, peat, sodium alginate and liquid) used, the treatment receiving liquid formulation recorded significantly highest. Treatments with liquid and sodium alginate formulations were found significantly higher compared to the other treatments. Uninoculated control recorded the lowest plant growth. Plant growth was found to increase significantly at different growth stages when inoculated with PMC 2 compared to PMC 1 and PMC 3. In all the growth stages, interaction of PMC2 receiving Liquid formulation of PMC 2 recorded significantly the highest plant height followed by PMC2 receiving alginate formulation of PMC 2. These two were found to be significantly superior compared to other interactions. Whereas, growth was the lowest in the PMC3 receiving peat formulation.

BIOCHEMICAL CHARACTERIZATION OF EFFICIENT BACTERIAL ISOLATES FOR THE DEVELOPMENT OF PADDY MICROBIAL CONSORTIA

Manasa S.G.* , Mahadevaswamy, Nagaraj M. Naik., Ramesh Y. Narayana Rao K. And Gundappagol R.C.

Department of Agricultural Microbiology, College of Agriculture, Raichur, Karnataka

*Email: manasasg44@gmail.com

Abstract

Biochemical test was conducted for the tentative identification of bacteria responsible for phosphate solubilization (MPSB 4), potassium solubilization (MKSB 12), zinc solubilization (MZSB 6) and silicate solubilization (MSSB 2). All the isolates were subjected to different biochemical tests. In sporulation test MKSB 12 and MSSB 2 reported positive while MPSB 4 and MZSB 6 were negative. MPSB 4, MKSB 12 and MZSB 6 showed positive results for hydrogen sulfide production while MSSB 2 was negative. In Voges-Proskauer test MPSB 4, MKSB 12, MZSB 6 tested positive and MSSB 2 isolate showed negative results. All the isolates showed positive results for starch hydrolysis test, catalase test, Citrate utilization test, methyl red test. All the isolates showed negative results for casein hydrolysis test, urease activity and indole test. For Acid and gas production MPSB 4 and MZSB 6 isolates produced acid and gas in the glucose broth while, remaining isolates tested negative. Isolates MPSB 4 and MZSB 6 showed positive results for gelatin liquefaction test. Based on biochemical tests tentatively MPSB 4, MKSB 12, MZSB 6 and MSSB 2 was considered as *Pseudomonas*, *Bacillus*, *Pseudomonas*, *Bacillus* sp., respectively.

ISOLATION AND SCREENING OF SILICATE SOLUBILIZING BACTERIA FROM THE RHIZOSPHERE SOIL OF PADDY GROWN IN KALYANA KARNATAKA REGION

Manasa S.G.* , Mahadevaswamy, Nagaraj M. Naik., Ramesh Y. Narayana Rao K. and Gundappagol R.C.

Department of Agricultural Microbiology, College of Agriculture, Raichur, Karnataka

*Email: manasasg44@gmail.com

Abstract

Silicate solubilizing bacteria were isolated from rhizosphere soil of paddy by serial dilution plate count method using silicate



medium which is a selective medium for isolation of silicate solubilizers. Agar medium containing magnesium trisilicate was used as silicate source. The plates were incubated at room temperature ($30 \pm 1^\circ\text{C}$) for 3 days and the colonies exhibiting clear zones were selected, purified by four-way streak plate method and stored for further studies. To determine solubilizing activity, 24-48 hrs old test organism was spot inoculated at the center of the silicate solubilizing media plate and incubated at room temperature for 4 days. The mineral solubilizing activity was indicated by a clear zone around the colony and width of the clear zone was measured to find out the solubilization efficiency (%). Out of 29 isolates the isolate MSSB 2 produced solubilization zone of 15.2 mm, culture diameter of 4.10 mm and solubilization efficiency of 370.73 %. IAA production by MSSB 2 was 39.45 μg / 50 ml of broth and siderophore production of 55.86 %.

DROUGHT STRESS ON WHEAT PLANTS

Mandeep Kour*, Gurdev Chand and Bhav Kumar Sinha

Division of Plant Physiology, Faculty of Basic Sciences, SKUAST-J, Chatha-180009, India

*Email-kourmandeep1996@gmail.com

Abstract

Wheat (*Triticum aestivum* L.) is an edible starchy cereal grain crop belonging to family *Poaceae*. It is the most extensively grown staple cereal crop in the world, covering about 225 million hectares with a production of 772.64 million tonnes (Anonymous, 2021). Drought is one of the environmental stresses that limits and affects the growth and yield of crops. Drought stress tend to cause changes in protein content, chlorophyll pigments, anti-oxidant production, opening and closing of stomata, hormone composition, cuticle thickness (Zhu, 2002). Shi *et al.* (2010) expressed that drought can affect vegetative and reproductive stages. Lonbani and Arzani (2011) claimed that the length and area of flag leaf in wheat increased while the width of the flag leaf did not significantly change under drought stress. Moreover, the number of leaves per plant, leaf size, and leaf longevity can be shrunk by water stress (Shao *et al.*, 2008). Root is an important organ as it has the capability to move in order to find water (Hawes *et al.*, 2000). It is the first organ to be induced by drought stress (Shimazaki *et al.*, 2005). In drought stress condition, roots continue to grow to find water, but the airy organs are limited to develop. To facilitate water absorption, root-to-shoot ratio rises under drought conditions, which are linked to the ABA content of roots and shoots (Rane *et al.*, 2001). Entz & Fowler (1990) declared that environmental stresses between stages 21 (tillering) and 65 (flowering) had maximum effects on grain quantity, shoots dry matter production, harvest index, grain protein yield, number of spikes per square meter, number of grains per spike, and number of grains per square meter.

WEED MANAGEMENT BY SOIL SOLARIZATION

Mandeep Kumar¹, Y.K. Singh¹ and Ravindra Sachan²

¹Department of Agronomy, C.S.A. University of Agriculture and Technology, Kanpur

²Department of Soil Science and Agricultural Chemistry, C.S.A. University of Agriculture and Technology, Kanpur

*Email: mandeepmaurya9198@gmail.com

Abstract

Soil solarization is a non-chemical soil treatment that utilizes solar radiation and a thin film of transparent mulch, usually of Polythene Sheets, to heat the soil to a range of 38–50°C to a depth of about 10 to 20 cm. It offers weed management based on trapping solar radiation by tightly covering the soil usually with transparent polyethylene sheets. This result in a significant increase of 10-15°C above normal temperature of soil, temperature up to the point where most weeds are vulnerable to heat effects. Generally, soil solarization is conducted for a minimum of four to six weeks during the warmer time of year, when there is high solar irradiation and minimal cloud and precipitation, thus its effect is climate dependent. In addition, depending on soil texture, solarization heat penetrates to different soil depths. Unlike other method of weed management soil Solarization brings about control of wide variety of pests, soil borne fungi, bacteria, nematodes and enhance availability of mineral nutrient to crop plants apart from weed control. In addition, many parts of tropical India experience extreme summer, thus this area have a great potential to utilize soil Solarization for weed management. Soil Solarization is simple, safe, cost-effective and eco-friendly technology for weed control. Unfortunately, in our country most of the farmers are not aware about the application of soil Solarization technology for weed management and safe crop production. Hence there is an urgent need for the popularization of the soil Solarization process among the farmers through the workshops and mass awareness programmes



because weed plants, is not controlled effectively can reduce crop yield to the extent of 20-50 per cent or even more and the loss due to weeds in India is around Rs. 2000 crores every year.

EVALUATION OF EFFICIENT MARKETING CHANNEL FOR THE MARKETING OF FISH IN JAMMU DISTRICT OF J&K UT

Maninder Singh*, S.P. Singh and Goldy Bhagat

Division of Agril. Economics & ABM

*Email: maninder19931@gmail.com

Abstract

Fishery is a state subject under the Constitution of India but only a few states have a policy specifically aimed at fish marketing. All state fisheries departments, state fish development corporations and apex fishermen cooperative societies have schemes to help fishermen to market their catch efficiently. The schemes include provision of vehicles for transporting fish from landing centres to markets, fish kiosks and marketing implements like insulated boxes, utensils, dressing knives, etc. The present study was conducted in Jammu district by taking both primary and secondary data. The primary data was taken through well prepared schedule by interviewing the respondents. The sampling technique used for study was convenience sampling technique. The sample size consisted of 50 respondents comprising (10) traders of fishes, (15) retailers and (25) consumers. We have used the Acharya's marketing efficiency formula to find out the results. The results revealed that three marketing channels were observed in the study area viz., Channel-1 (Fishermen-Auctioneer-Retailers-Consumers), Channel-2 (Fishermen-Fish collector/Local Dealer-Auctioneer-Wholesaler-Retailers-Consumers) and Channel-3 (Fishermen-Wholesaler-Retailers-Consumers). Marketing efficiency of channel-1 was 1.22 percent followed by channel-2 (2.16%) and channel-3 (2.60%). So, from the study we have found that channel-3 is the most efficient marketing channel for fish marketing.

COMPARATIVE ANALYSIS OF CROSS BREED AND LOCAL INDIGENOUS MANIPURI COW MILK IN IMPHAL WEST DISTRICT OF MANIPUR

Menalsh Laishram, Blessa Sailo*, Chongtham Sonia and B.K Sharma

Animal Science Section, ICAR Research Complex for NEH Region, Imphal, Manipur-795004, India

*Email: drblessavet@gmail.com

Abstract

Milk is a very important ideal food having high nutritive value and there is no comparative report of the milk of local indigenous and cross-bred cows in Manipur. The present study was conducted to evaluate the comparative physical qualities of Cross breed and local Indigenous Manipuri cows in and around Imphal West district of Manipur collected during the month of August and September 2022. A total of 48 milk samples cross-bred (n=24) as well as local Indigenous Manipuri cows (n=24) were examined for macro nutrients such as fat, solid-not-fats, protein, lactose, salt, and physical properties like- density and freezing point. A remarkable ($P<0.05$) significance of fat, density, freezing point, protein and lactose was observed in Cross bred cows. However, there was no significance difference ($P<0.05$) in the composition of solid not-fats and salt percentages.

EFFECT OF LONG-TERM APPLICATION OF ORGANIC MANURES AND FERTILIZERS ON SOIL ORGANIC CARBON (SOC) ON POST-HARVEST OF WHEAT CROP UNDER PEARL MILLET-WHEAT CROPPING SYSTEM

Manju Kumari¹, Sunita Sheoran², Dharam Prakash², Apurva² and Ankit Yadav²

¹Division of Soil Science and Agricultural Chemistry, IARI, New Delhi, 110012

²Department of Soil science, CCS HAU, Hisar, 125004

*Email: manju100d@gmail.com

Abstract

A long-term experiment was started since 1995 (Rabi) under pearl millet-wheat cropping system at Research Farm of



Department of Soil Science, CCS HAU, Hisar, Haryana. The initial SOC content in soil was 0.39%. After 25 years of experiment, the soil organic carbon (SOC) content of soil ranged from 0.37 to 1.18 in plough layer among different treatments. The highest SOC content *i.e.* 1.18 % was observed in plot receiving FYM along with recommended dose of N and half of recommended dose of P (FYM₁₅N₁₅₀P₃₀) fertilizer. The lowest SOC content *i.e.* 0.37 % was acquired from half of recommended dose of NP (N₇₅P₃₀) fertilizers applied in wheat. The plots treated with organic manures showed the significantly higher SOC content as compared to chemical fertilizers treatments. Among the organic manures applied alone, the SOC content followed the order as: FYM > pressmud > poultry manure. The plots receiving combined application of organic manures along with recommended dose of N and half of recommended dose of P fertilizer recorded the significantly higher SOC content over chemical fertilizers and where organic manures applied alone. The application FYM₁₅N₁₅₀P₃₀, poultry manure₅N₁₅₀P₃₀ and pressmud_{7.5}N₁₅₀P₃₀ treatment recorded the 156.5, 76.0 and 106.5%, respectively, higher SOC content over recommended dose of NP fertilizers. Application of FYM₁₅, poultry manure₅ and pressmud_{7.5} increased the SOC content by 130.4, 63.0 and 93.5%, respectively, over recommended dose of NP fertilizers. Application of recommended dose of NP fertilizers showed the non-significantly higher SOC content over half of recommended dose of NP fertilizers.

IMPORTANCE OF PRE-BREEDING IN THE ERA OF GENOMICS

Matcha Hima Varshini^{1*} and Kasanaboina Krishna²

¹Centurion University of Technology and Management, Alluri Nagar, R. Sitapur, Odisha-761211

²ICRISAT, PJTSAU

*Email: matchahimavarshini@gmail.com

Abstract

The genetic diversity of modern cultivars has decreased in contrast to their parent species as a result of domestication, which has led to the loss of numerous allelic variations of genes governing features that are unsuitable for cultivation. Pre-breeding is essential for extending the genetic base of the crop by identifying useful traits in poorly adapted materials and transferring them to better adapted ones for subsequent breeding. Genetic resources and breeding are integrated via pre-breeding. Exotic and indigenous germplasm (primitive landraces, wild species, and their relatives) both contain high amounts of genetic variation for desirable traits. Meanwhile only a limited amount of this natural genetic diversity, though, has been applied to crop improvement. Increased efforts are therefore required to utilize this potential germplasm that is currently available, identify beneficial genes, especially those controlling traits like higher yield, resistance to biotic and abiotic stresses, and high nutritional qualities, and for their introgression in mainstream cultivars. (Haussmann *et al.*, 2004). Advances in genomics have provided us with high-quality reference genomes, sequencing and re-sequencing platforms with reduced cost, marker and QTL assisted selection, genomic selection and population level genotyping platforms. Furthermore, genome editing techniques like CRISPR/Cas9 and its most recent base editing technology can be used to create mutants that specifically affect a target gene. These methods are crucial for determining how genes work in relation to their phenotypes by creating knockout mutations. With the help of these new genomic techniques, cultivars with the intended traits can be created by generating, analysing, and altering genetic variability. Genomics era has provided various technologies which includes, cost-effective genotyping platforms and genome editing which can result in effective management of PGR with enhanced utilization along with efficient pre-breeding. The genomic tools will help conventional pre-breeding in broadening the genetic base of modern cultivars using landraces or wild relatives for various traits.

INFLUENCE OF NACL ON SEED GERMINATION AND MORPHOLOGY OF *SOLANUM TRILOBATUM* L.

Immaculate Mary T. and Sujatha G.*

PG and Research Department of Botany, Thanthai Periyar Government Arts and Science College (Autonomous),
Tiruchirappalli-20 023 Tamil Nadu

*Email: sujathagovindaraj@gmail.com

Abstract

The response of a biological system to extreme environmental factors that cause functional changes in plant life such as growth inhibition, decrease in bioproduction, and adaptation or a combination of these changes is referred to as stress. Salt



stress is one of the most important abiotic factors in agriculture, influencing plant growth and secondary metabolite production in plants. The present study focuses on the impact of salt stress on seed germination and morphological responses of *Solanum trilobatum* L. The plant seeds were allowed to germinate in earthen pots filled with the potting mixture (sand, red soil, and farmyard manure) in the ratio of 1:2:1. The experiments were conducted in a completely randomised block design with five replicates at different salt concentrations of NaCl, such as 25 mM, 50 mM, 75 mM, and 100 mM respectively while untreated plants were maintained as control. All the pots were irrigated with equal amount of water every day. Up to seven weeks the plants were irrigated with normal water followed by watering with different concentration of NaCl (25, 50, 75 and 100 mM) in the successive weeks. Seed germination percentage, plant height, number of leaves, leaf length, leaf diameter, number of branches, branch length, shoot diameter, number of roots, root length and root diameter were observed and recorded until 18 weeks. Seed germination frequency was found to be 100% at different NaCl concentration. The various morphological parameters were found escalating with increase in salt concentrations till 16th week beyond which it declined.

DIVERSITY ON PREDATORS OF MEALYBUGS (HEMIPTERA: PESUDOCOCCIDAE) IN KERALA

Mithra Mohan* and N. Anitha

Department of Agricultural Entomology, College of Agriculture, Vellayani, Thiruvananthapuram-695 522, Kerala, India

*Email: mithramohan56@gmail.com

Abstract

Mealybugs are of great importance in economic entomology, due to their tremendous damaging potential, wide distribution pattern, broad host range, invasiveness and rapid establishment ability together with the vectoring of plant pathogens. The repetitive application of broad-spectrum chemicals led to the elimination of natural control agents, development of resistance and residue problems. However, mealy bugs are confronted by a diverse array of natural enemies that play a vital role in the regulation of the pest population. In this scenario, an investigation was carried out at different districts of Kerala to identify the predatory fauna associated with the mealy bugs during 2017-2020. The study recorded a total of twenty species of predators belongs to five families under four orders viz. Coleoptera, Lepidoptera, Diptera and Neuroptera from mealybugs infesting vegetables in Kerala. The predominant family was Coccinellidae with 16 species under six genera and the majority belongs to the genus *Scymnus*. Among the various predators documented, *Cacoxenus* sp. was recorded for the first time as a predator of *Pseudococcus jackbeardsleyi* Gimpel and Milller. Among the different mealybug species recorded from Kerala, the highest number of predators were observed in *Coccidohystrix insolita* Green (13 species) followed by *Ferrisia virgata* (Cockrell) (5 species). The major predators on *C. insolita* belongs to the family Coccinellidae with 12 species. The relatively high preference exhibited by coccinellids on *C. insolita* may be due to the predator-prey size relationship as most of the coccinellids were very small in size especially the genus *Scymnus* which was a dominant predator on mealybug *C. insolita*. The morphological peculiarities of the mealybug viz., small size and less mobility favored the easy predation on *C. insolita*. Furthermore, most of the coccinellid grubs were observed to be feeding on the eggs in the long ovisac of *C. insolita* that provided protection from harsh external factors.

SEED PRIMING : AN EFFECTIVE STRATEGY TO IMPROVE THE ABIOTIC STRESS TOLERANCE

Monika Kumari^{1*}, Chandan thappa², Gurdev Chand¹, Sapalika dogra¹ and Farzana Kouser¹

¹Division of Plant Physiology, Faculty of Basic Sciences, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu

²Division of Biochemistry, Faculty of Basic Sciences, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu

*Email: monikathakkar781@gmail.com

Abstract

Abiotic stress such as salinity, drought, heat, chill etc., are critical abiotic stresses that are caused by changing climate that challenges crop production and quality. Abiotic stress, particularly drought and salinity, are the most challenging to the entire agricultural system, leading to limit agricultural productivity. Various strategies are now used to create plants that can withstand these stresses. In recent years, Seed priming is a simple and low-cost pre-germination strategy, which can effectively



help to get better germination, quick establishment and uniform seedling growth by minimizing the negative effects of abiotic stress on the process. Seed priming strategy is used to reduce the limiting conditions faced during seed germination and emergence even under environmental stressful situations. Currently, many seed priming methods have been used like hydro-priming, osmo-priming, halo-priming, thermo-priming, bio-priming and solid matrix priming. Seed priming methods ameliorate better nutrient management system and help uniform and fast seed germination processes even under limiting environmental conditions by mitigating the effect of abiotic stress. This is the compilation of several pieces of research that adopted the seed priming methods using a variety of priming agents and observed their impact on seed germination, growth and resistance to abiotic stress in various crops. This strategy will be helpful for its wide application in agriculture to deal with reducing seed germination barriers, and declining crop productivity due to adverse conditions.

EFFECTS OF PLANT GROWTH REGULATORS ON CALLUS INDUCTION AND ORGANOGENESIS IN TISSUE CULTURE OF BROCCOLI (*BRASSICA OLERACEA* VAR. ITALICA)

Muzamil Yousuf* and Gurdev Singh

Sher-e-Kashmir University of Agricultural Sciences & Technology, Jammu

*Email: mwani676@gmail.com

Abstract

An in vitro efficient complete protocol has been developed for plant regeneration through callus induction in the medicinal plant Broccoli (*Brassica oleracea* var. italica) using leaves as explants. Modified gamborg medium (B5) supplemented with different concentration and combinations of auxins and cytokinens were studied. Results showed that B5 medium plus IBA and Kinetin was the best medium for shoot induction. Rooting of microshoots was achieved in the basal medium supplemented with NAA. Furthermore, the callus induction was achieved after the treatment of auxin which stimulate both cell division and cell elongation also. The successful in vitro plants were acclimatized on nutrient film technique. After acclimatization the survival plantlets were transferred to the field conditions. This optimized protocol is suitable for vegetative propagation and secondary metabolism studies

SURVEY FOR THE EXTENT OF LOSSES IN BRINJAL CAUSED BY BRINJAL SHOOT AND FRUIT BORER ON FARMER'S FIELDS IN DEORIA AND GORAKHPUR DISTRICT IN UTTAR PRADESH

Naveen Kumar¹, Rajnish Kumar² and Kishan Lal³

¹Department of Entomology, National P.G. College, Barhalganj, Gorakhpur-273402

²Department of Entomology, B.R.D.P.G. College Deoria-271201

³Department of Plant Pathology, National P.G. College, Barhalganj, Gorakhpur-273402.

*Email: saxenanveen2912@gmail.com

Abstract

A field survey conducted during Kharif 2020-21 and 2021-22 in several villages of different blocks in Uttar Pradesh's Deoria and Gorakhpur districts revealed that damage caused by brinjal shoot and fruit borer in the brinjal ecosystem. During Kharif 2020-21, the extent of damage caused by brinjal shoot and fruit borer was recorded to be the maximum percent of shoot damage observed in the field of Ramprasad Mishra (block- Rampur Karkhana, village- Kamdhenvan) with 45.13% shoot infestation. The highest fruit infestation (58.56%) was found in the field of Hari Shankar (block- Patardeva, village- Kanthipatti) in the Deoria district. The field of Krishna Murari (block- Gogha, village- Rawat Par) had the highest percent of shoot damage in Gorakhpur district, with 45.12% shoot damage, while the field of Prabhu Nath (block- Gola, village- Bhawanipur) had the highest percent of fruit damage, with 56.46% fruit damage. Similarly, during Kharif 2021-22, the maximum percent of shoot damage (40.83% shoot damage) was recorded in the field of Ramprasad Mishra (block- Rampur Karkhana, village- Kamdhenvan). However, the maximum percent of fruit damage (54.19% fruit damage) was observed in the field of Prannath Yadav (block- Barhaj, village- Ruchapar) in the Deoria district. In Gorakhpur district, the maximum percent of shoot damage was observed in the field of Krishna Murari (block- Gogha, village- Rawat Par) with 42.43% shoot damage. While, the highest percent of fruit damage was recorded in the field of Durga Charan (block- Belghat, village- Ganeshpur) with 54.67% fruit damage. Extensive cultivation of brinjal as an intercrop or sole crop inflicted a higher incidence of the above insect and thereby greater damage while the lower incidence observed was mainly because of the crop grown marginally in isolated areas or around the high-valued crops.



EFFECT OF GROWTH REGULATORS ON VASE LIFE OF TUBEROSE CUT FLOWERS

Nasima* and Sonu Sheoran

Department of Horticulture, CCS Haryana Agricultural University Hisar-125004

*Email: nizzukhan1298@gmail.com

Abstract

The study entitled “Effect of growth regulators on vase life of tuberose cut flowers” was carried out at laboratory of Department of Horticulture, CCS Haryana Agricultural University, Hisar during the year of 2022. Different combinations of treatments were taken viz, sucrose (2% and 4%), gibberellic acid (100 mg/l and 150 mg/l), benzyl adenine (100 mg/l and 150 mg/l) and salicylic acid (100 mg/l and 150 mg/l) along with control (distilled water) in Completely Randomized Design with three replications. The vase solution of 4% sucrose + 150 mg/l salicylic acid (SA) was found best in terms of number of opened florets per spike, percentage of opened florets per spike, days to opening of 3rd floret, number of florets open at a time freshness index, spike weight at wilting of 3rd floret, floret diameter, vase life and water uptake. However, a significant reduction in number of unopened florets per spike, water loss/water uptake ratio, physiological loss in weight and proximal end browning was observed with same treatment. The above stated parameters were found not promising with control.

FOOD PROCESSING, VALUE ADDITION AND POST HARVEST TECHNOLOGY

Naveen Kumar Meena

Department of Genetics and Plant Breeding, Rajasthan College of Agriculture, (MPUAT) Udaipur

Email: naveenmeena5762@gmail.com

Abstract

The actualization of food security globally can only be initiated when deliberate actions are taken to protect, process and/or preserve harvested food produce; to increase food availability to the growing world population, while maintaining the quality and safety of fresh produce. The inclusion of vegetables and „fruit vegetables?, which are very important for human nutrition and health in daily diets, along with exercise and weight control, have been found to have a remarkable ability in the prevention of most diseases. India harvested 223.089 million tonnes of horticultural produce from 20.876 million hectares of land in the 11th five year plan. The major crops contributing to it are fruits and vegetables (approx 204 million tonnes from 14.314 million hectares area). Horticulture sector contributing 30 percent to the India’s agricultural GDP from 8.5 percent of cropped area. As the waste utilization technology are adopting in developed countries and the scales of economies of these technologies does follow in Indian conditions due to various factors. Therefore, there is a need for development of cost-effective technologies for the production of value-added products. Post harvest management of fruits and vegetables provides ample opportunities for value addition besides providing wealth from waste. Its effective utilization helps in reducing the cost of production of crops besides optimum utilization of biomass. Causes of postharvest losses in vegetable production arise from metabolic, developmental and mechanical factors; environmental factors like temperature, relative humidity and atmospheric composition; biotic factors like diseases, insects and social-economic factors like transportation and marketing. Strategies aimed at achieving value addition in fruits and vegetables include fermentation, drying, blanching, storage in containers (buckets and clay pots) and storage in a fruit shed.

EFFECT OF HYDROGEL AND SALICYLIC ACID ON PHYSIOLOGICAL EFFICIENCY AND YIELD ATTRIBUTES OF INDIAN MUSTARD UNDER MOISTURE STRESS CONDITION

Neelam Rani* and Neeraj Kumar

Department Of Botany and Plant Physiology, CCS HAU Hisar-125004, Haryana, India

*Email: neelamkaswan009@gmail.com

Abstract

After the United States, China, and Brazil, India is the world’s fourth largest grower and producer of oilseeds, accounting for around 19 percent of worldwide area and 2.7 percent of global production. India is on the threshold of another Yellow Revolution in agriculture, this time in the production of oilseeds. Mustard will be at the forefront of the revolution, as the country’s most widely produced oilseed. The Solvent Extractors Association of India (SEA) established the “Mustard Mission



2025" in 2021, to boost mustard production to 20 million tones by 2025. Abiotic stress factors such as drought, salt, low and high temperatures, and heavy metals have a significant impact on plant productivity. Drought stress occurs when a plant's water loss exceeds its roots' ability to absorb water, and the plant's water level drops to the point where normal plant functions are disrupted. With these considerations in mind, the present investigation was conducted at the research farm of the Oilseeds Section, CCS Haryana Agricultural University, Hisar, India. The crop was grown in the Research Farm of Oilseeds Section during two successive Rabi seasons of 2019-20 and 2020-21. The experiment consisted of 16 treatment combinations in randomized block design with three replications. Among these treatments, application of hydrogel @ 5 kg/ha + SA (200ppm/ha) at flowering and siliqua formation stage significantly improves the physiological efficiency, yield attributes and soil moisture content of Indian mustard. Whereas a significantly higher B: C ratio was recorded in irrigation treatment over all the opposite treatments.

EFFECT OF DIFFERENT BUDDING METHODS AND BUDDING TIME FOR PROPAGATION OF SWEET CHERRY

Neena Chauhan* and Pooja Kumari

Regional Horticultural Research and Training Station, Mashobra, Shimla

Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan

*Email: neenach97@rediffmail.com

Abstract

The present studies entitled "Standardization of budding techniques for propagation of sweet cherry was conducting at Regional Horticultural Research and Training Station, Mashobra, Shimla, Dr YS Parmar University of Horticulture and Forestry, Nauni-Solan, Himachal Pradesh. The study consisted of four budding methods viz, chip budding, shield budding, annular budding and patch budding as main plot treatments and nine budding dates viz, 15th May, 30th May, 14th June, 29th June, 14th July, 29th July, 13th August, 28th August and 12th September as sub plot treatment. The experiment was laid out in Split Plot Design and was replicated four times. The results revealed that among four methods of budding, chip budding recorded maximum bud take success (52.21%), linear growth of scion (67.97cm), numbers of feathers (2.42), length of feathers ((8.17cm), number of internodes (12.40), internodal length (4.00cm) and percentage of saleable plants (59.80%). Plants budded on 30th May recorded highest per cent sprouting (83.00 %) and maximum bud take success (68.99%) and values recorded for growth parameters like linear growth of plant (66.18cm), radial growth of scion (7.52mm), number of feathers (1.84), number of leaves (53.16), leaf area (23.37cm²) and length of internodes (3.94cm) during 15th May and 30th May were also appreciable. Thus, taking the grafting success and proportion of commercial grade plants into consideration, chipbudding performed during 15th May - 30th May can be recommended for cherry propagation.

BEEVECTORIZING : A NOVEL TOOL FOR CROP PROTECTION

Neethu Roy D.^{1*}, Raghavender B.² and Veena K.¹

¹Department of Agricultural Entomology, College of Agriculture, UAS, Raichur-584104, Karnataka

²Department of Entomology, College of Agriculture, PJTSAU, Hyderabad-500030, Telangana

*Email: neethu.roy96@outlook.com

Abstract

Bees are recognized worldwide for their crucial role in crop pollination. But in agricultural systems especially, honey bees coming in contact with pesticides which are used to control economically harmful insect, pathogen and weed pests. Producers are facing difficulty in controlling multitude of damaging pests while balancing safety for the bees which are needed for pollination services. Wouldn't it be nice if an integrated pest management (IPM) approach existed that could address pest control while promoting pollination services simultaneously? Well, there could be! Beevectoring, also called entomovectoring or apivectoring, is the use of pollinating insects as vectors for the precision delivery of microbial control agents (MCA) that kill target pests. However, its success is based on mutual and suited interactions between the appropriate components of vector, biocontrol agent, formulation and dispenser and it needs to be safe for the environment and the human health. It may seem like science fiction, but this technology has been successfully used to control various crop insect pests and plant pathogens in Canada and Europe, in both greenhouse and open field conditions. Dissemination of *Trichoderma harzianum*



spores to control straw berry grey mould (*Botrytis cinerea*) using honey bee as a vector resulted in deposition of spores @ 1.31×10^6 CFU/flower, which was effective in controlling the grey mould in the straw berry field. At present the beevectoring technology is already recommended for practice and is used with success such as BeeTreat, flying doctors in Finland, but the system should benefit from further improvements. However, it should be remarked that whatever technology will be developed and recommended, its practical uptake will be directly dependent on its simplicity and its ease of use, while still providing good control at a low cost.

SOIL CONSERVATION PRACTICES TO MITIGATE THE ADVERSE EFFECTS OF CLIMATE CHANGE : A STUDY IN UDHAM SINGH NAGAR DISTRICT OF UTTARAKHAND

Neha

Department of Agricultural Extension, College of Agriculture Sciences, Teerthanker Mahaveer University, Moradabad

Email: neha72133s@gmail.com

Abstract

At a large scale, food system faces multiple challenges including soil degradation, adapting to climate change and food security, and maintaining or improving crop nutritional quality, crop yield and soil health. Management or conservation techniques that improve soil health are the best solutions to mitigate some environmental impacts on crop quality and productivity. Testing these problems regarding soil management practices the study was conducted in Udhm Singh Nagar district of Uttarakhand. The study comprised of 180 farmers, and stratified random sampling was used for the sample selection. The findings showed that majority of the farmers (87.78%) have adopted bunding as a soil conservation practice, followed by 81.11 percent adopting afforestation measure to conserve soil. Additionally, less than half of the farmers (40%) reported to have implemented crop rotation in their fields, followed by only few farmers who had adopted ploughing (15%), mulching (11.11%) and strip cropping (7.22%). Hence, Sustainable intensification of agriculture, based on the above soil management practices will have a substantial contribution to increasing food production on existing land, low input cost and ecological friendly farming methods to small and marginal farmers, also reverse the process of soil degradation and avoid the encroachment of natural ecosystems in general.

WHEAT GROWTH INDICES AS AFFECTED BY TILLAGE AND RESIDUE MANAGEMENT PRACTICES

Nesar Ahmad Nesar^{1*}, R. Puniya¹, B.R. Bazaya¹, Vikas Sharma², B.K. Sinha³, Tuhina Dey⁴ and B.C. Sharma¹

¹Division of Agronomy, FoA, SKUAST – J, J&K, India 180009

²Division of Soil Science and Agricultural Chemistry, FoA, SKUAST–J, J&K, India 180009

³Division of Plant Physiology, FoA, SKUAST–J, J&K, India 180009

⁴Division of Genetics and Plant Breeding, FoA, SKUAST–J, J&K, India 180009

*Email: nesaragron@gmail.com

Abstract

During the Rabi season 2020–21, a field experiment was conducted at the Research Farm, Division of Agronomy, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu to examine the effects of tillage and residue management practices on wheat growth indices. The experiment was conducted in a factorial RBD design with two tillage systems viz., zero tillage and conventional tillage, and five residue management practices viz., control, 6 t/ha paddy residue, 6 t/ha paddy residue + 25% additional N over RDN, 6 t/ha paddy residue + PUSA decomposer, and 6 t/ha paddy residue + 25% additional N over RDN + PUSA decomposer. The soil in the experimental location was sandy clay loam in texture, which had low organic carbon and available nitrogen content but medium accessible potassium and phosphorus. The results showed that, at 60 and 90 DAS, and harvest zero tillage, documented significantly higher plant height, tillers m⁻², dry matter, CGR, and RGR than conventional tillage. Among residue management practices at 60 and 90 DA and harvest, all residue retention treatments documented significantly higher growth parameters viz., plant height, tillers m⁻², dry matter, CGR, and RGR compared to the control but were statistically at par with each other.



IMPACT OF APPLE CIDER VINEGAR IN CARDIO VASCULAR DISEASE

Neetu* and Rekha Yadav

Department of Foods & Nutrition, CCS HAU, Hisar

*Email: neetuhr75@gmail.com

Abstract

Apple cider vinegar has been traditionally used since many years ago to treat a certain number of diseases including hyperlipidemia. Early prevention and treatment of atherosclerosis can prevent complications of cardiovascular diseases. The influence of apple cider vinegar consumption influences on reducing blood lipid levels. Abnormal metabolism of lipids leads the elevated level of fatty substances largely cholesterol and triglycerides into blood stream results, hyperlipidemia. The lowering of lipid concentration in blood through dietary or drugs therapy seems to be associated with a decrease in the risk of cardio vascular disease. Apple cider vinegar is a home remedy which is widely taken by the people in Malaysia to reduce the body weight. The presence of acetic acid and other components in vinegar could be responsible for its therapeutic effect. Apple cider vinegars, regardless of the production method, decreased triglyceride and VLDL levels in all groups when compared to animals on high-cholesterol diets without vinegar supplementation. Apple cider vinegar increased total cholesterol and HDL and LDL cholesterol levels and decreased liver function tests when compared to animals on a high cholesterol diet without vinegar supplementation. A daily dose of apple cider vinegar would affect cardiovascular risk factor associated with obesity in high fat diet induced hyperlipidemic Wistar rats. Apple cider vinegar consumption significantly decreases serum total cholesterol, fasting plasma glucose, and HbA1C concentrations. Juice consumption may be a convenient way to take advantage of the health effects of the bioactive components present in apples.

PRECISION FLORICULTURE : TECHNIQUES TO UPTURN CROP PRODUCTIVITY AND FARMERS INCOME

Nidhi Sharma^{*1}, Harinder Singh Baweja², Balbir Singh Ditta¹ and Monica Negi¹

¹Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh

²Director Horticulture and Food Processing, Government of Uttarakhand, Uttarakhand-263651

*Email: nidhi13shrm@gmail.com

Abstract

Floriculture, a branch of horticulture which deals with the cultivation of flowers, is considered to be a labour-intensive farming system requiring persistent surveillance during whole cropping period. With the changing climatic patterns within a short period of time it has become difficult to estimate the growth pattern, yield as well as incidences of insect pests and diseases in flower crops. Hence precision farming provides a good scientific solution by analyzing intra-field variations and providing a management towards upcoming halts or opportunities. Various technological advances under precision farming includes Satellite imagery information technology, Geospatial tools and Satellite positioning system like GPS. All these precision floriculture tools holds the potential to increase the productivity of the crop thereby increasing the farmer's revenues by reducing the inputs. The sustainability of floriculture at global level can only be maintained by these information systems supplementing decision making capabilities of the farmers.

PHENOTYPING AND CHARACTERIZATION OF PEARL MILLET (*Pennisetum glaucum* (L.) R. BR.) AT SEEDLING STAGE FOR HEAT STRESS TOLERANCE

Nirupma Singh, Aarti Kumari, Chandrika Ghoshal, Kajal Nagre and S.P. Singh

Division of Genetics, ICAR-IARI, New Delhi-110012

Abstract

Pearl millet is a climate resilient cereal grown for grain, stover, and green fodder. It is the staple crop in the semiarid and arid regions of Asia and sub-Saharan Africa. In India, major pearl millet growing states are Rajasthan, Maharashtra, Gujarat, Uttar Pradesh and Haryana accounts for more than 90% of pearl millet acreage. Its grains are highly nutritious with high levels of energy and protein, iron and zinc, and more balanced amino acid profile than maize or sorghum. But drought and high temperature are the most yield limiting abiotic stress factors in hot arid region. The seedlings are most vulnerable to high



temperatures during the first 10 days of sowing. The maximum air temperatures around 43 °C being observed in the arid zone during the rainy season with soil surface temperatures reaching 60–62 °C during germination. The erratic rainfall and high soil temperature during the germination leads to low population stand and ultimately low yields. The high temperature and drought has therefore, been an important breeding and genomics research objective for many decades. Recently, farmers of Rajasthan state has suffered a great loss due to sowing of pearl millet after pre monsoon showers and then a huge gap of rainfall and high temperature leading to low seedling establishment and crop failure. Rapid screening procedures for seedling survival under high temperatures and genotypes with tolerance have been identified earlier. However, there are no reports of using the identified heat-tolerant sources in the targeted breeding programme. The heat stress influences the seed germination, plant growth and development resulting severe reduction in yield. Therefore, to develop or identify heat tolerant genotypes, knowledge of screening methods, heat tolerance mechanisms along with breeding techniques are important. Heat stress decreases the rate of germination and may also inhibit the germination depending on heat tolerance of the genotype. A lot of genetic variability is available for heat tolerance in pearl millet. In this study germplasm of pearl millet is utilized for searching of heat tolerant line. Different morphological, biochemical and physiological parameters are utilized for screening the germplasm for heat tolerance. To overcome the heat stress, plants may changes various mechanisms such as maintenance of membrane stability, scavenging of reactive oxygen species (ROS), production of anti-oxidants, osmo-regulation of solutes and synthesis of heat stroke proteins (HSPs). In this study, we are focusing to understand this mechanism specially on production of anti-oxidants, maintenance of membrane stability. In further study, both conventional as well as molecular breeding techniques will be utilized for genetic improvement for heat tolerance.

SPECTROPHOTOMETRIC METHOD FOR THE ASSESSMENT OF ENVIRONMENTAL TOXICITY OF MONOCROTOPHOS INSECTICIDE

Nisha Sharma* and Akhil Chaudhary

Department of Chemistry, Himachal Pradesh University, Shimla-171005

*Email: nishasharma581@gmail.com

Abstract

Monocrotophos is an organophosphorus insecticide widely used in agriculture for protection of crops from pests. The insecticide has also been reported to exhibit various toxic effects. In view of wide agricultural use and environmental pollution problems associated with its use, it is inevitable to assess its environmental toxicity. A new, rapid and sensitive spectrophotometric method has been developed for the purpose. The method is based on the transformation of amino group of the insecticide in aqueous acetonitrile in the presence of sodium bicarbonate to the corresponding dithiocarbamate derivative and the reaction of later with nickel (II) acetate to form corresponding yellow nickel(II) complex. The analysis is concluded by measuring the yellow colour at 370nm. The Beer's law is obeyed upto 15.6 µg mL⁻¹ of monocrotophos solution. The method is quite sensitive and as little as 1.12 µg of the insecticide can be determined by the proposed method. The method has been applied to study the fate of insecticide in soils and the extent of surface and ground water contamination. The soil adsorption of the insecticide has been studied on two Indian soils of different soils characteristics. By using batch equilibration method, ground ubiquity score (GUS) for the insecticide in terms of leaching behavior will be evaluated to find contamination to water resources. The procedural details, salient features of the proposed method and the results of the findings will be discussed.

MOLECULAR ANALYSIS OF *FUSARIUM OXYSPORUM* ISOLATES SURVEYED FROM DIFFERENT DISTRICTS OF RAJASTHAN

Nitisha Gahlot*, R.N. Bunker and Abhinav

Department of Plant Pathology R.C.A. Udaipur 313001, (Rajasthan)

Email: nitishagahlot1991@gmail.com

Abstract

Fusarium wilt or vascular wilt of tomato, caused by *Fusarium oxysporum* f.sp. *lycopersici* (Sacc.) W.C. Snyder and H.N. Hansen is one of the major constraints in tomato production. Five different districts of Rajasthan were selected in which ten different locations in each district were surveyed for fusarium wilt of tomato. Samples were brought to the laboratory. All the



samples were thoroughly washed and used for further studies. Ten different locations of Rajasthan were marked from where the most fusarium spp. were isolated and isolates cultures were further designated as UDPA Fo-1, UDPB Fo-2, PRTB Fo-3, PRTD Fo-4, JPRD Fo-5, JPRB Fo-6, CHTT Fo-7, CHTG Fo-8, BNSH Fo-9 and BNSB Fo-10. For molecular analysis of all the isolated cultures DNA was extracted from fungal mycelium by using CTAB method, described by Doyle and Doyle (1987) with slight modifications. Isolated DNA from various isolates was compared by using RAPD methodology. DNA was amplified with RAPD-PCR method by using random primers in thermal cycler. Similarity coefficient among the isolates ranged from 1.8 per cent (BNSH Fo-9 and PRTB Fo-3) to 68.9 per cent (CHTGFo-8 and JPRDFo-5). Genetic similarity coefficient was relatively low among all the isolates, which ranged from 0.018 to 0.68. The maximum similarity value (0.689) was obtained between isolates CHTGFo-8 and JPRDFo-5, both of which belong to Chittorgarh and Jaipur districts. Molecular analysis is necessary to predict the control measures of similar fungal species.

IMPACT OF THERMAL VARIATION ON LIVESTOCK

Olympica Sarma¹ and Gautami Sarma²

¹Department of Animal Genetics and Breeding, College of Veterinary and Animal Sciences, GBPUAT, Pantnagar, Uttarakhand

²Department of Livestock Production and Management, College of Veterinary and Animal Sciences, GBPUAT, Pantnagar, Uttarakhand

*Email: olyucky15@gmail.com

Abstract

Industrialization and advancement in technology has added great comfort in the life of humans but at the same time, other living species has struggled. Human nature of using resources more than need to fulfill its greed for comfort resulted into pumping oil, coal and other natural products from mother earth. Industrialization needs energy which is supplied by combustion of traditional energy sources in the form of coal, natural gas and oil. Such energy generation further adds up into global warming. Global warming results into melting glaciers, increase in sea water level. This harms growth and production of dairy products, meat products and other products which we get from animals. Increment in world population and reduction in animal-based food products creates huge demand supply gap. The Temperature Humidity Index, respiration rate, temperature and other parameters are measured to determine the level of heat stress in livestock. Lack of milk production and changes in content proportion in milk production was observed at places during peak heat in summers. Heat stress not only affects milk production but also results into lower breeding efficiency. Increasing temperature also caused internal damage to cellular and tissue level body structure. Animal experts are working on planning to reduce the affect of heat stress on animals and related products. Certain strategies include experiments in diet of cattle to reduce heat and temperature rise in metabolic actions. With upcoming modern technologies, genetics researchers are working on the detection of DNA segments which can withstand rising heat and temperature. At the end, in order to manage animal food production in the era of global warming, united efforts of government organizations, scientists and farmers and animal products related business persons is needed such that health of animals and efficiency of animal products can be protected.

KNOWLEDGE AND ADOPTION OF RECOMMENDED CULTIVATION PRACTICES OF CHICKPEA BY THE FARMERS OF BIKANER DISTRICT OF RAJASTHAN

Om Prakash Choudhary*, R.K. Verma, Sita Ram Bijarnia, Jitendra Kuri, Kamlesh Choudhary, Aravindh Kumar S. and Naresh Kumar Kumawat

Department of Agricultural Extension and Communication, Collage of Agriculture, Swami Keshwanand Rajasthan Agriculture University, Bikaner-334006

*Email: choudharyop678@gmail.com

Abstract

According to the study's findings, the majority of respondents (47.78%) had a medium level of knowledge, while more than half (62.22%) had adopted the recommended practices for controlling pod borer in chickpeas to a high level, followed by 36.67% and 25.56% of respondents with medium and low levels of adoption, respectively. As a result, it was discovered that although most respondents were aware of cultural, mechanical, and physical practices, their adoption was not particularly



noteworthy. These techniques, which some farmers only partially embraced, failed to effectively control the pod borer. 71.11% of respondents said that they had not adopted. According to relationship analysis, the knowledge and adoption of farmers were highly and significantly connected with education, annual income, interactions with extension personnel, and innovativeness.

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT PRACTICES ON CROP GROWTH, YIELD AND UPTAKE OF BLACK GRAM

Keerthan P.*and R. Ranjith

Department of Agronomy, TNAU-Coimbatore, Tamil Nadu

*Email: pkeerthanang@gmail.com

Abstract

The factors attributed for low yields of pulses in India as compared to the world productivity are non-availability of quality seeds of improved and short duration varieties, growing of pulses under marginal and less fertile soil with low inputs and without pest and disease management, growing of pulses under moisture stress, unscientific post-harvest practices and storage under unfavorable conditions. Based on the facts, the research on different organic and inorganic source of nutrients for cultivating the black gram was conducted to find out the effective nutrient input for black gram. Field experiment was conducted during March to May 2017 with a set of treatments comprising of organic and inorganic sources of nutrients. The organic manures treatments comprised vermicompost, farmyard manure, panchagavya, inorganic fertilizers alone and in combination with inorganic sources of nutrients was found to be superior for attaining soil nutrient content, crop growth, yield and uptake of the crop. Among the treatments, application recommended dose of fertilizer (RDF) 25:50:25 kg NPK ha⁻¹ + Vermicompost @ 5 t ha⁻¹ + Four spray of panchagavya @ 4% at 15, 25, 30 and 45 DAS was recorded the highest plant growth, yield and uptake of blackgram compared to recommended dose of fertilizer (RDF) 25:50:25 kg NPK ha⁻¹.

EVALUATION OF DIFFERENT ESSENTIAL OILS AGAINST RICE BLAST IN FIELD CONDITIONS

P. Madhusudhan*, I. Paramasiva, U. Vineetha and Ch. Sreelakshmi

Agricultural Research Station, Acharya N.G. Ranga Agricultural University, Nellore-524003

*Email: p.madhusudhan@angrau.ac.in

Abstract

Rice is known to be attacked by many insect's pest and diseases at different stages of its growth which cause huge losses annually. Among diseases, rice blast caused by *Magnaporthe oryzae* B.C. Couch is one of the most important fungal diseases causing heavy yield losses. In the present investigation different essential oils along with carbendazim 50% WP @1 g/l evaluated against the blast in Randomized Block Design under field conditions. Among the treatments carbendazim 50% WP @1 g/l recorded significantly least per cent disease index (33.66%). Among the essential oils clove oil @ 2ml/l recorded least per cent disease index (47.03%) which is at par with rest of the essential oils: (Neem oil @ 2ml/l(48.14%), Nigundi oil @ 2ml/l (50.73%), Citronella oil @ 2ml/l(51.47%), Cedar wood oil @ 2ml/l(51.85%), Eucalyptus oil @ 2ml/l (51.84%) and lemon grass oil @ 2ml/l(52.59%). In untreated control the per cent disease index was 66.29 %. Grain yield was non-significant among the treatments.

DEMONSTRATION OF FEEDING OF ORAL CALCIUM AND PHOSPHORUS FOR ITS EFFECT ON MILK PRODUCTION IN GRADED MURRAH BUFFALOES

P.P. Singh¹, Rupesh Jain², Reeta Mishra¹, B.P.S. Raghubanshi³ and R.P.S. Tomar¹

¹RVSKVV-Krishi Vigyan Kendra Morena, (M.P.)

²RVSKVV-Krishi Vigyan Kendra Datia, (M.P.)

³RVSKVV-Krishi Vigyan Kendra Lahar (M.P.)

*Email: prabalsingh1978@gmail.com

Abstract

The Front-Line Demonstration (FLD) was conducted to demonstrate the effect of oral Calcium and Phosphorus supplements



for its effect on milk production in graded murrah buffaloes under village conditions in adopted villages of KVK, Morena, M.P. The buffaloes in their 2nd or 3rd lactation were divided into two uniform groups of 10 each, on the basis of Farmers' practice (T1) and Demonstrated practice (T2) groups. T1 group animals were maintained with farmers practice without oral Calcium and Phosphorus supplements and T2 group animals were given oral Calcium and Phosphorus supplements @ 100ml/day/buffalo for a period of 50 days. The overall increase in milk production due to technological intervention in T2 group was to the tune of 21.46 per cent as compared to T1 group. The economic characteristics were recorded and analyzed to assess the economic efficiency of the FLD. The net return in T2 group was Rs.9910/animal/2 month as compared to T1 group (Rs.7621/animal/2 months). The B: C ratio in T2 and T1 was recorded at 2.42 and 2.21 respectively. Though there was handsome increase in milk yield but some of farmers express concern about cost of the supplements. Overall FLD showed the beneficial effect of oral Calcium and Phosphorus on milk production in graded Murrah buffaloes at farmer's field.

ESTIMATION OF GENETIC VARIATION FOR YIELD AND QUALITY TRAITS IN FINGER MILLET GENOTYPES

P. Tejasree¹, N. Anuradha^{*2}, D. Ratna Babu¹, G. Rama Rao³, D. Ramesh⁴

¹Department of Genetics and Plant Breeding, Agricultural College, Bapatla

²Agricultural Research Station, Vizianagaram

³ANGRAU Lam, Guntur

⁴Department of Statistics and Computer Applications, Agricultural College, Bapatla

*Email: n.anuradha@angrau.ac.in

Abstract

The present investigation was carried out to assess the nature and magnitude of genetic variability for yield and quality traits in 35 finger millet genotypes. The experiment was laid out in Alpha lattice design at Agricultural Research Station, Vizianagaram during *Kharif*, 2021. The analysis of variance revealed the presence of significant differences for all the traits indicating that the genotypes under study were genetically diverse for all the traits. Coefficient of variation studies indicated that the estimates of GCV were lesser than the corresponding PCV estimates for all the traits indicating the influence of environment on expression of these traits. High estimates of PCV and GCV were recorded for grain iron, zinc, manganese and copper contents. The traits plant height, grain iron, manganese and copper contents exhibited high expected genetic advance as per cent of mean coupled with high estimates of heritability indicating that, there is predominance of additive gene action in governing the inheritance of these traits and direct phenotypic selection would be effective for improvement of these traits.

EFFECT OF NATURAL FARMING ON INCIDENCE OF INSECT PEST IN RICE

Paramasiva* I.¹, Vineetha U.², Ch. Sreelakshmi³ and P. Madhusudan⁴

¹ Department of Entomology, Agricultural Research Station, Nellore

² Department of Agronomy, Agricultural Research Station, Nellore

³ Department of Pl. Breeding, Agricultural Research Station, Nellore

⁴ Department of Pl. Pathology, Agricultural Research Station, Nellore

Acharya N.G. Ranga Agricultural University, Guntur, Andhra Pradesh

*Email: paramasiva.reddy@gmail.com

Abstract

Awareness on organic farming and natural farming is increasing day by day in the society. Cow products are being used as important ingredients among all the extracts sprayed to protect the crop as well as a source of nutrients to plants. Organic farming can be practiced using easily available local natural resources with a view to protect our own natural resources and environment for a fertile soil, healthy crop and quality produce and let our future generations enjoy the benefits of non-chemical agriculture. Given the same profitability, organic farming is more advantageous than conventional farming considering its contribution to health, environment and sustainability. An experiment was conducted at Agricultural Research Station, Nellore (ANGRAU, Guntur) with three treatments i.e., T₁: University recommendation (ANGRAU – ICM), T₂: Sahaja mariyu sendriya vyavasaya vidhanalu (Dept. of Agriculture) and T₃: Palekar concept (as per the book “pettubadileni prakrithi vyavasam cheyadamela by Subhash palekar krishi”). In all the above three treatments maize was grown as exhaust



crop. The pest incidence and natural enemy data was collected at fifteen days intervals on randomly selected hill per plot. Results revealed that, at 30 days after transplantation 2.01 % stem borer incidence was recorded in T₃ (Palekar concept) followed by with T₂ (SSVV by DOA) with 1.05 % stem borer incidence. At 40 DAT highest stem borer incidence of 3.64 % was recorded with T₁ (ANGRAU –ICM), whereas with palekar concept 0.84 % stem borer incidence was noticed. In case of whorl maggot incidence also similar trend was observed, at 30 DAT highest whorl maggot (3.21 %) was recorded with palekar concept and lowest with ANGARU practice. At 40 DAT highest whorl maggot incidence was recorded with ANGARU practice (4.52 %) and lowest with Palekar concept (1.75 %). The highest grain yield was obtained with ANGRAU-ICM practice (7550 kg/ha) followed by sahamariyu sendriya vyavasaya vidhanalu (SSVV) (3600 kg/ha) and ZBNF (Palekar's concept) (3125/ha).

IMPACT OF PLANT GROWTH REGULATORS AND MICRO-NUTRIENT ON GROWTH AND YIELD OF CHICKPEA (*CICER ARIETINUM* L.)

Palvi Dogra

Lovely Professional University, Jalandhar, Phagwara, Punjab 144001, India

Email: palvidogra444@gmail.com

Abstract

A field experiment was conducted at the Agronomy Research field in Fatehgarh sahib, Punjab, India during *Rabi* season of 2019-20, to study the “Impact of plant growth regulators and micro-nutrient on growth and yield of chickpea (*Cicer arietinum* L.)”. The experiment was laid out according to randomized block design with three replications. The treatments consisting of ten treatment combinations viz., control (T₁), water spray (T₂), ZnSO₄ @ 0.5% (T₃), FeSO₄ @ 0.5% (T₄), CCC @ 200 ppm (T₅), NAA @ 50 ppm (T₆), ZnSO₄ @ 0.5% + NAA @ 50 ppm (T₇), ZnSO₄ @ 0.5% + CCC @ 200 ppm (T₈), FeSO₄ @ 0.5% + NAA @ 50 ppm (T₉) and FeSO₄ @ 0.5% + CCC @ 200 ppm (T₁₀) were applied to the chickpea *var.* PBG-7. Results showed that the maximum number of branches plant⁻¹, number of pods plant⁻¹, number of seeds pod⁻¹, seed yield (2167 kg ha⁻¹), haulm yield and biological yield, nutrient content and their uptake in seed and haulm, protein content, net returns (80598 ha⁻¹) and B: C ratio (3.69) of chickpea was obtained with combined application of FeSO₄ @ 0.5% + CCC @ 200 ppm (T₁₀) which was remained at par with the application of T₇, T₈ and T₉ and superior to all other treatments. However, the maximum mean plant height was recorded with the application of FeSO₄ @ 0.5% + NAA @ 50 ppm (T₉).

EVALUATION OF RICE ENTRIES AGAINST LEAFFOLDER, *CNAPHALOCROCIS MEDINALIS* (GUENEE)

Paramasiva I.^{1*}, Sreelakshmi Ch.², Madhusudhan P.³ and Vineetha U.⁴

¹Department of Entomology, Agricultural Research Station, Nellore

²Department of Plant breeding, Agricultural Research Station, Nellore

³Department of Plant breeding, Agricultural Research Station, Nellore

⁴Department of Agronomy, Agricultural Research Station, Nellore

Acharya N. G. Ranga Agricultural University, Guntur-522034 Andhra Pradesh, India

*Email: paramasiva.reddy@gmail.com

Abstract

In order to identify sources of resistance to rice leaf folder, *Cnaphalocrocis medinalis* (Guenee) some rice entries were screened under natural field conditions at Agricultural Research Station, Nellore, A.P. under All India Co-ordinated Rice Improvement Project during Kharif, 2021-22. Leaffolder incidence in terms of damaged leaves was recorded at 60 and 80 days after transplantation. 72 rice cultivars along with TN 1 (susceptible check) were sown in a single row of each line. Sowing was done on 25.08.2021 and one month old seedlings were transplanted in length of 330 cm for each line with row to row and plant to plant spacing of 20x15 cm. One seedling was transplanted per hill and susceptible TN 1 was planted as a skip row after every ten cultivars. All recommended package of practices were adapted, but without any insecticide application. Observations on total number of leaves and total number of leaffolder damaged leaves in twenty hills in each line were recorded and mean per cent damage was calculated. Out of 72 entries screened against leaf folder, two entries viz., BPT 2677 and BPT 2954 were found to be resistant/immune to leaf folder with below 10 % leaf damage by leaf folder where in



susceptible check TN 1 27.76 % leaf folder incidence was noticed at 60 days after transplantation. At 80 days after transplantation, BPT 3081, BPT 2677 were with below 10 % leaf damage by leaf folder where in susceptible check TN 1 90.28 % leaf folder incidence was noticed at 80 days after transplantation.

GENETIC VARIABILITY AND CORRELATION ANALYSIS IN OKRA [*ABELMOSCHUS ESCULENTUS* (L.) MOENCH]

P.V. Abhilash*, Nilesh Talekar, Suhel Mehandi and Harmeet Singh Janeja

Department of Genetics and Plant Breeding, Lovely Professional University, Punjab

*Email: pujalavenkataabhilash555@gmail.com

Abstract

The genetic diversity of 55 okra genotypes was estimated using a randomized complete block design (RCBD) with three replications and analyzed for 17 phenotypic parameters at the Agriculture Research Farm, Lovely Professional University, Phagwara (Punjab). The first flowering node has a high GCV and PCV. As genetic advance percent mean and high heritability recorded in fruit yield per plant. Because additive genes have a role in the inheritance of certain traits, these characteristics could be improved through simple phenotypic selection. Correlation studies demonstrated a substantial positive relationship between average fruit weight at both the genotypic and phenotypic levels.

EFFECT OF HERBICIDES ON DIFFERENT WEED FLORA IN TRANSPLANTED RICE (*ORYZA SATIVA* L.) IN EASTERN U.P.

***Peeyush Kumar Jaysawal, ¹S.K. Verma, ²S. Karmakar and ³Hem Chandra Lal**

¹Department of Agronomy, Banaras Hindu University, IAS, BHU, Varanasi-221 005, India.

²Department of Agronomy, Ranchi Agricultural Collage, BAU, Ranchi- 834006, Jharkhand

³Department of Mycology and Plant pathology, Ranchi Agricultural Collage, BAU, Ranchi, Jharkhand

*Email: peeyush.vishu@gmail.com

Abstract

The experiment consist of ten treatments namely viz. T₁: Bispyribac-Na 9.1 % (18.2 g/ha) + metsulfuron-methyl 1.2 % (2.4 g/ha) + chlorimuron ethyl 1.2 % (2.4 g/ha); T₂: Bispyribac-Na 9.1 % (22.75 g/ha) + metsulfuron-methyl 1.2 % (3 g/ha) + chlorimuron ethyl 1.2 % (3 g/ha); T₃: Bispyribac-Na 9.1 % (24.57 g/ha) + metsulfuron-methyl 1.2 % (3.24 g/ha) + chlorimuron ethyl 1.2 % (3.24 g/ha); T₄: Bispyribac-Na 10 % (25 g/ha); T₅: Metsulfuron-methyl 20 % (4 g/ha); T₆: Chlorimuron-ethyl 25 % (6 g/ha); T₇: Metsulfuron-methyl 10 % + chlorimuron-ethyl 10 % (4 g/ha); T₈: Penoxsulam 21.7 % (22.5 g/ha); T₉: Weedy check and T₁₀: Weed free, was conducted in *kharif*- 2017 and 2018. The results of mean data showed that minimum weed density, weed dry weight and maximum weed control efficiency after weed free plot at crop growth stage 30, 60 days after transplanting were recorded with application of T₃ Bispyribac-Na 9.1 % (24.57 g/ha) + metsulfuron-methyl 1.2 % (3.24 g/ha) + chlorimuron ethyl 1.2 % (3.24 g/ha) as post emergence followed by other after weed free plot during both the years of experiment. On the basis of present study, it is recommended that application of T₃-treatment was better in respect to weed control over other treatment.

IMPACT OF PROCESSING AND VALUE ADDITION ON FOOD QUALITY

Pooja¹* and Rekha Yadav²

¹Department of Food and Nutrition, PAU, Ludhiana

²Department of Foods and Nutrition, CCS HAU, Hisar

*Email: poojaluach025@gmail.com

Abstract

Food processing, as a vital part of the food system, makes a substantial contribution to the economic and social advancement of a nation. Food processing can be considered of as post-harvest processes that enhance the value of agricultural products before marketing. Traditional food processing techniques include milling, cooking, baking, fermentation, pickling, and other



forms of food preservation. New technologies are also utilized to make and package foods, including minimal food processing. Traditional food processing served two purposes: improving the food's digestibility and preserving it in times of scarcity. Ironically, processing is where we lack rather than production. Compared to more than 50% of global production, only 2% of Indian vegetable and fruit products are processed. Due to inappropriate handling, storage, packaging, and transportation, about 40% of fruits and vegetables are wasted each year. In order to reduce both qualitative and quantitative losses after harvesting, harvested fruits and vegetables require adequate and advance postharvest processing technology. Additionally, value addition in India is only 7%, compared to 23% in China and 88% in the UK. Despite dominating the production sector, Indians are only able to consume a small portion of this growing production due to a lack of storage, refrigeration, and processing facilities, all of which affect the food's quality, quantity, added nutritional value and shelf life. Better integration is therefore needed throughout the entire food supply chain, from the farm to the consumer, paying particular attention to quality, logistics, sustainability, food products and food processes.

REPRODUCTIVE CAPACITY OF INSECT IN ENVIRONMENT

***Pooja Sharma¹, Abhinav² and Sushila Choudhary³**

Department of Entomology, S.K.N.COA Jobner 303328 (Rajasthan)^{1&3}

Department of Plant Pathology, MPUAT, Udaipur, (Rajasthan)²

Email: Poojasharma0377@gmail.com

Abstract

Reproduction is a biological process in which new individuals are produced by their parents. The inherent high reproductive capacity (rate) of certain insect and mite pests ensures that some individuals within an insect or mite pest population will survive natural mortality or other disturbances such as pesticide (insecticide or miticide) applications due to the excessive numbers produced. Therefore, due to their high reproductive capacity, it is critical to suppress insect and mite pest populations before they reach levels that result in plant damage. A high reproductive capacity can impact the success of plant protection strategies, including the application of pesticides and release of biological control agents (e.g. parasitoids and predators). For instance, more frequent applications of pesticides may be required and additional individuals (biological control agents) may need to be released at more frequent intervals to "keep up" with the reproductive capacity of certain insect and mite pests. However, more frequent applications of pesticides can lead to higher levels of pesticide resistance. Nevertheless, preventative approaches associated with plant protection strategies are essential to alleviate problems or avoid outbreaks of insect and/or mite pests. The latest trend is to understand the nature of reproductive biology of these pests and their dependence on several environmental conditions. Environmental temperature and humidity affects the developmental phase and transpiration through insect body surface.

NANOPARTICLES : A POTENTIAL ADVANCEMENT IN PRODUCTION TECHNOLOGY OF FLOWER CROPS

Poonam Sharma^{1*}, Suman Bhatia¹, Sita Ram Dhiman¹, Shilpa Kamal¹ and Nepu Rana²

¹Deptt. of Floriculture and Landscape Architecture, Dr.Y.S. Parmar University of Horticulture and Forestry, Nauni Solan H.P.

²Department of Floriculture and Landscaping, Punjab Agricultural University, Ludhiana Punjab

**Email: poonamagnihotri96@gmail.com*

Abstract

Nutrients play a critical role in maintaining soil fertility and improving crop productivity and quality. Precise nutrient management of horticultural crops is a major challenge worldwide as it relies predominantly on chemical fertilizers. This has led to the search for environmentally friendly fertilizers, particularly those with high nutrient-use efficiency and nanotechnology is emerging as a promising alternative. Advances in nanotechnology have allowed for the production of specific nanoparticles with unique properties and a wide spectrum of practical applications. Nanoparticles can improve crop productivity by enhancing the rate of seed germination, seedling growth, photosynthetic activity, nitrogen metabolism, and carbohydrate and protein synthesis. Nano NPK increased the diameter of flower and spike stem and dry weight of gladiolus spikes. The role of nanoparticles in increasing the vase life has been demonstrated in different cut flowers like gerbera, gladiolus, and rose. Nanoparticles exhibit unique biological activities and may serve as novel plant growth stimulators. Silica



nanoparticles enhance physio-biochemical characters and increase the post-harvest life of flowers by lowering the transcript level of ethylene biosynthesis genes in rose (*Rosa hybrida* L.) cut flowers. A systematic and thorough quantitative analysis regarding the potential health impacts, environmental clearance, and safe disposal of nanomaterials can lead to improvements in designing further applications of nano-fertilizers.

ASSESSMENT OF SOIL NUTRIENTS CONTENT AT FARMER FIELD AFTER 30 DAYS OF TOMATO TRANSPLANTING

Prabhakar Prasad Barnwal^{1*}, Amitava Rakshit² and Kajal Singh²

¹Division of Soil Science and Agricultural Chemistry, IARI, New Delhi-110012

²Deptt. of Soil Science and Agricultural Chemistry, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi

*Email: prabhakarbarnwal632@gmail.com

Abstract

A survey was conducted among 30 farmers of Fatehpur village to know the details of inputs which were applied to grow pea crop. Eighteen farmers were selected to take part in the survey and were divided in three categories viz. CFP (farmers applying fertilizer inputs based on their perception) with N:P:K of 200:140:0; RDF (farmers applying fertilizers as per recommendation of authorized body) with N:P:K of 120:80:80 and CAI (farmers who adopted combination of FYM with chemical fertilizers) with N:P:K of 60:20:20. Soil samples were collected for analysis of N, P, K and B content. The analysis of soil sample was carried out in Department of Soil Science and Agricultural Chemistry of Institute of Agricultural Sciences, Banaras Hindu University. The N content recorded in CFP, RDF and CAI soils were ranged from 302.64 to 310.6, 240.09 to 256.77 and 200.9 to 205.16 kg/ha, respectively. The P content lied between 31.86 to 32.335 kg/ha in CFP soils, 20.42 to 24.156 kg/ha in RDF soils and 10.5 to 17.69 kg/ha in CAI soils. The K content was observed as: 101.92 to 115.36 kg/ha in CFP soils, 235.52 to 248.52 kg/ha in RDF soils and 180.08 to 190.92 kg/ha in CAI soils. Boron content ranged from 0.486 to 0.560 ppm in CFP soils, 0.655 to 0.704 ppm in RDF soils and 0.905 to 0.944 ppm in CAI soils. It can be concluded from the study that the minimum fertilizer requirement was fulfilled CAI package of practice for achieving the optimum nutrient content and hence farmers should regularly get their soil tested so that wastage of resources and time could be prevented.

STUDIES ON SKIN TEMPERATURE AND HEMATOLOGICAL PROFILES IN VANARAJA BIRDS DURING SUMMER SEASON

Prity Bharty and Pramod Kumar*

Department of Veterinary Physiology, BVC, Patna

*Email: pra_ghorasahan@rediffmail.com

Abstract

Vanaraja is multi-colored and dual-purpose birds having better survivability and grow faster than desi breeds. Vanaraja breed is well adapted to tropical climate. Chicken are more sensitive to high ambient temperatures due to lack of sweat glands and high body temperature. The experiment was performed on fifty bisexual birds having mean body weight approx. 500 gm. Hematological parameters were done regularly, but lack of reference value for these parameters make it complicated to interpret the results. Scanty information is available related to the reference value for hematology in Vanaraja birds. Skin temperature is associated with negative impacts of heat stress on production in poultry and gets severely affected and results in a tremendous economic loss for poultry sector in India. The value for Temperature Humidity Index (THI) max, min and avg. were recorded significantly ($p=0.05$) highest during summer followed by winter and lowest in autumn. The environmental condition had been significantly ($p=0.05$) influencing the skin temperature and observed higher during summer and lower in winter. The value for haemoglobin was observed significantly ($p=0.05$) higher during winter and lower during summer season. A significant ($p=0.05$) influence of season was observed on Mean corpuscular volume; Mean corpuscular haemoglobin; packed cell volume and total erythrocyte count recorded highest in winter and lowest in autumn than in summer. The value of total leucocytes count; heterophils and eosinophils was observed high in summer and low in winter. Whereas, the value of lymphocytes and monocytes was found higher in winter and lower in summer. Studies on haematological profiles concluded that they have direct effect on season and can be useful for genetic improvement of industrial and indigenous chicken. Summer stress has modulating effect on cellular immunity as indicated by decreased heterocyte/lymphocyte ratio in



Vanaraja birds. The results may be useful as diagnostic tool in clinical evaluation which could be contributed to physiological knowledge of Vanaraja birds.

IDENTIFICATION OF LINKED MARKERS TO BPH SCORES AND OTHER MORPHOLOGICAL CHARACTERS IN RICE (*ORYZA SATIVA* L.)

Prakriti Meshram

Department of Genetics and Plant Breeding, College of Agriculture, I.G.K.V., Raipur, Chhattisgarh

*Email: prakritimesh@gmail.com

Abstract

Developing cultivars resistant against different biotypes of brown planthopper (BPH) through plant breeding programme is an effective management strategy to control this pest. In this study, 28 polymorphic simple sequence repeat (SSR) markers were analyzed in 108 F₃ progenies derived from the cross of IR64 and CG Zn rice I cultivars to investigate the association with BPH resistance against different biotypes. For statistical analysis, parents and their offspring were grouped into 2 phenotypic classes based on their levels of BPH resistance. Chi-square analysis demonstrated a good fit to a ratio of 3:1 for the segregation of resistance and susceptibility. Association of SSR markers with phenotypic traits in F₃ progenies were identified. Six SSR markers (RM401, RM5953, RM217, RM210, RM242, and RM1103) were significantly associated with BPH resistance to biotypes 2 and 3 of BPH. Out of these 6 markers, RM401, RM5953, and RM217 accounted for about 17% of total phenotypic variation and RM210, RM242, and RM1103 accounted for 20% of total phenotypic variation against biotypes 2 and 3, respectively. Therefore, the above 6 markers were conformed for MAS in rice breeding programs to develop BPH-resistant rice cultivars.

PREPARATION AND CHARACTERISATION OF LITCHI SEED STARCH NANO PARTICLE BASED COMPOSITE FILMS

Prafull Chavan*, Gurvendra Pal Singh, Krishna Aayush and Somesh Sharma

School of Bioengineering and Food Technology, Shoolini University of Biotechnology and Management Sciences, Bajhol, PO Sultanpur, Dist., Solan 173229, HP, India.

*Email: prafullc16@gmail.com

Abstract

Increased constraints regarding food packaging, mainly due to environmental issues, consumer health concerns, and economic restrictions has led food scientists and technologists to focus more on developing biopolymer packages. Starch satisfies all the principal aspects making it a promising raw material for edible coatings/films. The present investigation aims to study films produced at different concentration of starch nanoparticles 1, 2, 5, and 10% and their effect on physicochemical, mechanical, structural, thermal, and morphological attributes of a novel edible film. The functional properties of edible films are influenced by starch nanoparticles properties, including chain conformation, molecular bonding, crystallinity, and water content. Fourier-transform infrared (FTIR) spectroscopy has been applied for the elucidation of the structure and conformation of polymer. This technique associated with chemometric data processing could indicate the relationship between the structural parameters and the functional properties of litchi seeds starch-based edible films. Marker-assisted selection for rice brown planthopper (*Nilaparvata lugens*) resistance using linked SSR markers.

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON NUTRIENT CONTENT AND UPTAKE BY CHICKPEA (*CICER ARIETINUM* L.)

Pramod Kumar*

Department of Soil Science and Agricultural Chemistry RCA, MPUAT, Udaipur, Rajasthan

*Email: yadavpramod33026@gmail.com

Abstract

A field experiment was conducted at Instructional farm, Rajasthan College of Agriculture, MPUAT, Udaipur (Rajasthan) during the rabi season 2021-22 to study the Effect of Integrated Nutrient Management On Nutrient Content And Uptake By



Chickpea (*Cicer arietinum* L.). Application of 75 % RDF +Poultry manure, 2.5t ha⁻¹ + PSB + Rhizobium. Improved inherent nutrient supplying and observed higher content and uptake of macronutrients (N, P and K) and micronutrients (Zn, Fe, Mn and Cu) were also recorded under 75% RDF + poultry manure 2.5t ha⁻¹ + PSB + Rhizobium (T9) which was higher over control.

IMPACT OF CLIMATE CHANGE ON BIODIVERSITY AND FOOD SECURITY: A REVIEW

Prakriti Shahdeo* and Anil Kumar

Department of Botany, Ranchi university, Ranchi, Jharkhand, India

*Email: shahdeoprakriti@gmail.com

Abstract

Climate change is one of the humanity's most serious threats, putting at risk the functioning of the natural systems that sustain human health. In the Anthropocene, human activities have significantly altered the Earth through global warming, habitat loss and changes to the atmosphere. Large changes in biodiversity are expected to occur if climate change continues at its current pace. Adverse effects include changes in species habitats and compositions, and consequently changes in ecosystem functioning. The UN Convention on Biological Diversity defines biodiversity as the diversity and variability among living organisms within the terrestrial, marine and other aquatic ecosystems they are part of. According to the World Wildlife Fund, there has been an average 68% fall in the monitored populations of mammals, birds, amphibians, reptiles and fish since 1970. Food security is a measure of people's access to safe and nutritional food. It depends on several factors, including the availability and affordability of food. The UN Committee on World Food Security defines the concept as : Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Climate change is happening due to natural factors and human activities. It expressively alters biodiversity, agricultural production, and food security. Mainly, narrowly adapted and endemic species are under extinction. Nevertheless, the impact of climate change on biodiversity and food security has been recognized, little is explored compared to the magnitude of the problem globally. Therefore, the objective of this review is to identify and synthesize the link between climate change, biodiversity, and food security.

ANALYTICAL EXPRESSION STUDY OF HEAT SHOCK PROTEINS GENE IN VANARAJA BIRDS DURING HEAT STRESS

Uma Shankar and Pramod Kumar*

Department of Veterinary Physiology, BVC, Patna

*Email: pra_ghorasahan@rediffmail.com

Abstract

Vanaraja breed is well adapted to tropical climate and are dual purpose colorful birds having better survivability. Exposure of high temperature during the growing phase of broilers has been related with poor meat characteristics of broiler chicken and loss their quality (Zhang et al., 2012). Chickens are homeothermic and the body temperature is maintained in the range of 41 to 42°C. Chicken are more sensitive to high ambient temperatures due to lack of sweat glands and high body temperature. The signs of heat stress in poultry are panting with open mouth, elevated their wings and squatting near to the ground, droopy acting, slowness and lethargic closed eyes, lying down, increased water intake, decreased appetite, drop in egg production, reduced egg size, poor egg shell quality, reduced body weight, and increased cannibalism (Dayyani and Bakhtiyari, 2013). All organisms respond to heat stress by inducing a set of proteins called as Heat Shock Proteins. HSPs are molecular chaperones that play key roles in the maintenance of cellular homeostasis under variable environmental conditions. HSPs are also implicated in other cellular functions such as stress tolerance, protein folding, cytoskeletal integrity and cell cycle (Bakthisaran et al., 2015). The mean value of THI avg. in hot humid was significantly (p=0.05) higher than hot dry season. The expression of heat shock protein 60, 70 and 90 were found to be significant (p=0.05) higher in both the extreme weather condition with higher expression during hot humid season as these acts as molecular chaperones essential for maintaining cellular functions. The findings of the present study reveal that expressions of HSPs were up-regulated during exposure of heat and HSP70 was found to be most induced. The observed data will fill the gap of knowledge on gene expression of heat shock proteins to the researchers doing work on Vanaraja birds.



ASSESSMENT OF HERBOLIV+ AGAINST WILDBOARS IN GROUNDNUT

Prasanna Lakshmi Ravuri*, Sahaja Deva, A.V. Nagavani and K. Raghavendra

District Agricultural Advisory and Technology Transfer Centre, Chittoor, Acharya N.G. Ranga Agricultural University, Guntur

*Email: pras.agrico@gmail.com

Abstract

Wild boar is the most problematic species causing significant crop damage across different agro climatic zones of the country. The basic reason for such unexpected abrupt raise in their populations can be attributed to degradation of natural habitats, non-availability of preferred dietary items in natural habitats. Deforestation resulted in the decline of the natural predators for wild boars like tigers, wolf, jackal etc there by indirectly contributing to the phenomenal raise in the wild boar populations. Damage by wild boars in crops grown near to forest areas is more severe. In Chittoor district of Andhra Pradesh, groundnut is the major crop and wild boars are major problem in groundnut production. Small and marginal farmers cannot afford permanent fencing methods hence low-cost methods were evaluated in farmers' fields. Herboliv+ is a wildboar repellents tested along with tying of GI wire around field in 4 rows against check. Wildboar damage was not observed in herboliv and GI wire methods whereas in check, 0.5-1% damage was observed. Mean yield of 1290kg was recorded in herboliv+ spray whereas it was 1200kg and 1170kg in GI wire treatment and check respectively. Herboliv spray found to be effective in reducing damage by wildboars in groundnut. But due to its high cost, it is not remunerative in rainfed groundnut and can be recommended in irrigated groundnut and other high value crops.

MANAGEMENT OF DAIRY ANIMAL AND IMPROVEMENT OF HEALTH: A REVIEW

¹Pramod Prabhakar, ²Rajan Singh, and Amratan Gautam

^{1,3}SHUATS, Prayagraj (Allahabad)

²Nagaland Central Agriculture University (SASRD) Campus Medziphema

Email: ppmbac@gmail.com

Abstract

Animal health management and product quality control have changed from a purely curative veterinary practise, where disease or quality issues were addressed after they had occurred, to the use of veterinary herd health and production management programmes, where herd performance was monitored in an operational setting to better prevent disorders. Early disease identification, herd monitoring, and risk assessment of health, reproductive, and productivity issues are much more the emphasis of herd health and production management programmes. Increased recently, the issue of product quality (such as the quality of milk and meat) and the production method have received more attention. The latter involves concerns for the welfare of animals, the state of their health, and the environment. From the farm level to the consumer level, there is a growing trend toward integrating animal production into food supply chains. Each link in such manufacturing chains must offer the next link protections for the given product, which is a crucial component. The various quality control ideas as they are used at the dairy farm level are covered in this article. Additionally, it covers the integration of farm-level quality management and herd health management. Materials meant for animals other than humans are known as animal health or veterinary medicine products. This includes medications used in animal feed. The aerosol transfer of diseases between animals and the impact of air pollution on pulmonary defence systems are crucial, especially to respiratory health, according to empirical findings and field tests. It is also thought that excessive moisture, gases, and other airborne pollutants are troublesome. However, it is unclear exactly how these elements interact.

SALICYLIC ACID (SA) : A DOUBLE-EDGED SWORD FOR THE PLANT DEFENSE SYSTEM

Pranabesh Nandi* and Kaushik Pramanik

Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal-741252

*Email: pranabeshnandi5@gmail.com

Abstract

Through morphological, physiological, and biochemical pathways, the plant hormone salicylic acid (SA) plays a significant part in the induction of plant defense against a variety of biotic and abiotic stressors. It functions as an endogenous signal



mediating local and systemic plant defense responses against pathogens and has been the subject of extensive investigation in recent years. Plants produce salicylic acid in response to a variety of phytopathogen challenges, and it is crucial for the development of both systemic and local acquired resistance (SAR). Pathogenesis-related (PR) protein increase is brought on by salicylic acid application. Pathogen susceptibility to both avirulent and virulent pathogens is increased by mutations that either result in decreased salicylic acid production or impaired perception of salicylic acid. Additionally, it has been discovered that salicylic acid contributes to how plants react to abiotic challenges such heat, osmotic stress, drought, and toxicity from heavy metals. In this regard, salicylic acid looks to be an “effective therapeutic drug” for plants, just as it is for mammals. However, we only have a basic understanding of the main signaling elements that activate salicylic acid production and relate to the accumulation of PR proteins. In addition to its involvement in regulating physiological and biochemical processes during biotic and abiotic stress, salicylic acid is essential for the regulation of these processes throughout the plant’s entire lifecycle.

DROUGHT AND ITS MITIGATION STRATEGIES IN AGRICULTURE SECTORS

Pramod Kumar^{1*}, Ramesh Kumar¹, Navin Kumar Ranjan², Kuldeep Kumar³ and Kamal Kartik Kundra Kenny⁴

¹Department of Agro-meteorology and Environmental Science, Birsa Agricultural University, Kanke, Ranchi, Jharkhand, India

²Department of Horticulture, Birsa Agricultural University, Kanke, Ranchi, Jharkhand, India

³Department of Agronomy, Birsa Agricultural University, Kanke, Ranchi, Jharkhand, India

⁴Department of Agril. Entomology, Birsa Agricultural University, Kanke, Ranchi, Jharkhand, India

*Email: pramod430.pk@gmail.com

Abstract

Drought is an occasion when the rainfall for a week is half of the normal or less, when the normal weekly rainfall is 5 mm or more. Agricultural drought is a period of four such consecutive weeks in the period from middle of October or six consecutive weeks during rest of the year. Drought is the result of an imbalance between the soil moisture and evapo-transpiration needs of an area over a fairly long period, so as to cause damage to the standing crop and reduction in crop yield (Irrigation commission, 1962). There are three major types of drought – Meteorological drought, Agricultural drought and Hydrological drought. Drought has mainly three types of impacts – Economic, Social and Environmental. According to Kamara et al. (2003) drought stress can reduce the yield of Maize upto 87%. In rice drought of reproductive stage can reduce it’s yield upto 92%. Agricultural drought can be mitigated by adopting – crop management and soil and moisture conservation measures. Early sowing provides longer period of maturation, early flowering and higher yield potential (Coventry et al. 2003). Hobbs and Gupta (2005) recorded yield increase upto 41% in zero tillage plots over conventional plot due to 24 days early planting. Ghuman and Sur (2000) submitted that minimum tillage with straw mulch can significantly increase yield and water retention capacity in maize and wheat. According to a report published by CAZRI, Jodhpur (2000) long – range forecast is a very effective strategy to mitigate drought in long – term. In India 60% of gross cropped depends on rain. That is why Indian agriculture is called a “Gamble of Monsoon”. Hence there is a great necessity to control and mitigate agriculture drought and its relevant problems.

DEMONSTRATION OF INTEGRATED PEST MANAGEMENT PRACTICES IN GROUNDNUT

Prasanna Lakshmi Ravuri*, Sahaja Deva, A.V. Nagavani and K. Raghavendra

District Agricultural Advisory and Technology Transfer Centre, Chittoor

Acharya N.G. Ranga Agricultural University, Guntur

*Email: pras.agrico@gmail.com

Abstract

Groundnut is the major crop during kharif in Chittoor district of Andhra Pradesh. It is grown in an area of 1,45,000 ha mainly under rainfed conditions. Gram pod borer, Thrips, dry root rot, collar rot and viral diseases like bud necrosis disease, stem necrosis disease are the major biotic factors causing yield losses to the farmers. Hence, front line demonstration was conducted to create awareness among farming community about different cost-effective pest management practices. Demonstration was conducted in 10 locations with integrated pest management practices like seed treatment with imidacloprid @ 2ml followed by tebuconazole @ 1g per kg of seed, border cropping with bajra, intercropping with redgram, removal of weeds, use of blue



sticky traps @5per acre and spraying of imidacloprid @0.3ml per lit of water at 25DAS. In demo plots, Rootrot and Helicoverpa damage was not observed whereas it was 7.63% and 10.33% in check respectively. Incidence of stem necrosis disease was 4.1% and 7.8% in demo and check respectively. An average yield of 1025kg and 950kg per ha was recorded in demo and check respectively. Net returns and B:C ratio were Rs.7625 per ha and 1.14 in demo plots whereas in check it was Rs.3000/- per ha and 1.05 respectively. IPM practices found to be effective in controlling pests and diseases and increasing yield in groundnut.

EVALUATION OF BIO-EFFICACY AND PHYTOTOXICITY OF OXYFLUORFEN 20% DF AGAINST WEED OF ONION CROP.

Prashun Sachan^{1*}, Mahak Singh², Anil Kumar Sachan² and R.A. Yadav¹

¹Department of Agronomy ²Directorate of Seed and Farms

Chandra Shekher Azad University of Agriculture and Technology, Kanpur-208002

*Email: prashun.sachan@gmail.com

Abstract

This experiment was conducted for evaluation of bio-efficacy and phytotoxicity of oxyfluorfen 20%DF against weeds of onion crop at Crop Research Farm Nawabganj, C.S. Azad University of Agriculture and Technology, Kanpur during both *Kharif* and *Rabi* seasons. The herbicide formulation oxyfluorfen 20% DF at different concentration viz. @ 500, 750, 1000, 2000 and 3000 g ha⁻¹ was evaluated for its bio-efficacy and phytotoxicity on weed flora in onion crop and were compared with control. The experiment was laid out in Randomized Block Design with three replications and onion variety Nasik N-53 (*Rabi* season) and NHRDF Red-2 (*Kharif* season) was used. The outcome of the above experiment was indicated by the data taken at 30, 45 and 60 days after application which is higher weed control efficiency against different weeds was recorded in weed free (100%) followed by oxyfluorfen 20%DF @ 3000 g ha⁻¹ (85.61, 81.20, 80.53 and 78.20%) followed by oxyfluorfen 20%DF @ 2000 g ha⁻¹ (84.39, 78.97, 77.69 and 74.16%) and oxyfluorfen 20%DF @ 1000 g ha⁻¹ (82.01, 77.09, 75.86 and 72.36%), respectively. The onion bulb yield recorded in experiment was ranged from (93.20-186.30 q ha⁻¹), significantly higher mean bulb yield was recorded in oxyfluorfen 20%DF @ 3000 g ha⁻¹ followed by oxyfluorfen 20%DF @ 2000 g ha⁻¹, oxyfluorfen 20%DF @ 1000 g ha⁻¹, oxyfluorfen 20%DF @ 750 g ha⁻¹ (184.80, 184.30, 180.80 and 175.90 q ha⁻¹), respectively and lower grain yield was recorded in weedy check (93.20 q ha⁻¹). Therefore, on the basis of two season studies it was observed that oxyfluorfen 20%DF did not produce any phyto-toxic symptoms and also it may be concluded that oxyfluorfen 20%DF @ 750-1000 g ha⁻¹ can be effectively used to control weeds in onion crop along with ultimate increase in bulb yield.

STRUCTURE DEVELOPMENT AND PROPERTIES OF PLA-PADDY STRAW COMPOSITES

Potdar Pratik Pandit ^{1*}, Preetinder Kaur¹, S. Radhakrishnan^{2*} and Manpreet Singh¹

¹Department of Processing and Food Engineering, Punjab Agricultural University, Ludhiana, Punjab

²Department of Polymer Engineering, MIT World Peace University, Paud Road Kothrud, Pune, Maharashtra

*Email: pratikpotdar13@gmail.com

Abstract

The natural fibre incorporated biopolymer composites, which are expected to replace single use plastics, are drawing much attention in recent years. On the other hand, the disposal of agriculture residue such as paddy straw has been in focus due to stubble burning and subsequent air pollution in the surrounding regions. An alternate route to utilization of such agricultural residue is to make value added product which would provide eco-friendly solution to this problem. Hence, the present study was focused on structure development and properties of paddy straw filled composite fabricated with polylactic acid (PLA) as a matrix both being bio-compostable. Chopped paddy straw obtained was washed thoroughly to eliminate impurities and dust followed by drying at 50°C for four hours and cooled to remove the moisture. After removing the moisture, the paddy straw was grind to obtain fine particles, the powdered paddy straw was dispersed in the plasticizer (PEG) with PLA and granules were extruded through extruder and then the granules were formed into sheets using compression mold. The structure was characterized using wide angle x-ray diffraction (XRD) and differential scanning calorimetry (DSC), thermal stability was checked by thermo gravimetric analysis (TGA) and morphology by scanning electron microscopy (SEM). The results indicate that the crystalline structure in the PLA matrix changes with the addition of paddy straw and crystallinity increases especially



at low concentration. Appearance of additional peaks suggested the phase change of starch type A type to type B. The DSC data show a shift in the crystallization peak to higher temperature suggesting nucleation effect with addition of paddy straw. The thermal stability is considerably improved as indicated by the shift in TGA curve to high temperature side by almost 20 °C after addition of paddy straw to the PLA blend. There is a sharp increase in load at break and decrease of elongation in the case of treated paddy straw composites. There is also less moisture transmission rate after the addition of treated paddy straw. These results have been explained on the basis of structure development in the PLA matrix in presence of paddy straw.

EFFECT OF SALICYLIC ACID ON PLANT WATER RELATION AND MEMBRANE INJURY IN CHICKPEA UNDER DROUGHT STRESS

Preeti*, Neeraj Kumar, Sarita Devi and Priyanka

Department of Botany and Plant physiology, CCS HAU, Hisar-125004, Haryana, India

*Email: preeti.kundu235@gmail.com

Abstract

Drought is one of the major factors limiting chickpea production in arid and semi-arid regions. So, the present investigation was carried out to find out the influence of salicylic acid (SA) on drought tolerance in two chickpea genotypes (H12-55 (HC-7) and ICCV-4958). A factorial experiment was conducted in a randomized block design with three replications in a Research area of Pulses Section, G&PB, CCSHAU, Hisar in 2020 and 2021 where chickpea genotypes was grown under two environments (Irrigated and Non-Irrigated). Drought stress creates imbalanced osmotic pressure and a notable reduction of relative and absolute water content and loss of turgidity. Physiological parameters like Relative water content (RWC %), osmotic potential, photosynthetic efficiency (F_v/F_m) and relative stress injury (RSI %) were measured. Decreasing trend in relative water content and photosynthetic efficiency, whereas increasing trend in RSI (%), osmotic potential was noticed under non- irrigated conditions. In order to compete with environmental stresses, the application of plant growth regulators, osmoprotectants has been found effective for alleviating the damaging effects of various abiotic stresses in plants including drought stress. Therefore, the plants were treated with varied concentrations of salicylic acid (SA) (0, 1 and 1.5 mM) under both environments. Sampling was done at 7 days after spray. Reduction in relative stress injury and osmotic potential was observed in plants treated with SA (0, 1 and 1.5 mM) as compared to control seedlings. Maximum reduction was observed at 1.5 mM SA. Photochemical efficiency (F_v/F_m) and RWC (%) was increased with foliar application of 1.5 mM SA. Thus, our study demonstrates that exogenous supply of salicylic acid (i.e. of 1.5 mM) is effective in mitigating drought stress in both chickpea genotypes as shown by various physiological parameters studied.

GRAIN AND STRAW YIELD OF PEARL MILLET AS INFLUENCED BY LEVELS AND SOURCES OF P APPLICATION

Preeti*, Sunita Sheoran and Dhram Prakash

Department of Soil Science, CCS HAU, Hisar, Haryana, India

*Email: dhramprakashteotia@gmail.com

Abstract

An experiment under pearl millet-mustard cropping system was carried out at Research Farm, Department of Soil Science, CCS HAU, Hisar in Rabi 2020-21 to evaluate the effect of different levels and sources of phosphorus on crop yield and nutrient uptake. First crop was mustard followed by pearl millet and this study represents the results of pearl millet. The experiment consisted of eleven treatments and laid out in randomized block design (RBD) with three replications. Irrespective of sources, application of P fertilizer either alone or in combination with farmyard manure (FYM) significantly enhanced the grain and straw yield of pearl millet and nutrient uptake (N, P and K). The highest (33.66 q ha⁻¹) and lowest (23.79 q ha⁻¹) grain yield of pearl millet was observed with the application of 7.5 t FYM ha⁻¹ along with SSP and control plots, respectively. Similar results were recorded for straw yield (80.70 and 50.81 q ha⁻¹) of pearl millet. Highest N uptake (163.26 kg ha⁻¹) and P uptake (65.09 kg ha⁻¹) by pearl millet was observed with the application of full recommended dose of P through SSP, whereas, K uptake was found highest (164.10 kg ha⁻¹) with the supply of 7.5 t FYM ha⁻¹ in conjunction with SSP, and the lowest N (75.72, kg ha⁻¹), P (23.96 kg ha⁻¹) and K (74.50 kg ha⁻¹) uptake was found in control plots. The results from present study indicated that instead of using P fertilizers alone, the integrated use of FYM and P fertilizers may be more effective to improve soil health and to sustain crop productivity.



RELATIVE ABUNDANCE OF PHOSPHORUS FRACTIONS IN SOIL UNDER LEVELS AND SOURCES OF P APPLICATION

Preeti*, Sunita sheoran and Dhram Prakash

Department of Soil Science, CCS HAU, Hisar, Haryana, India

**Email: dhramprakashteotia@gmail.com*

Abstract

The experiment entitled “Effect of different levels and sources of phosphorus application on soil P fractions under Pearl millet-Mustard cropping system” was started in *Rabi* 2020-21 at Research Farm, Department of Soil Science, CCS HAU, Hisar to evaluate the effect impact of different levels and sources of phosphorus (P) on soil P fractions. The experiment comprised total eleven treatment combinations and laid out in randomized block design (RBD) with three replications. Pearl millet crop was grown and soil samples were collected from 0-15 cm soil depth in 2021. Irrespective of sources, application of P fertilizers alone or in combination with FYM increased the soil P fractions. The relative abundance of inorganic P fractions in soil followed the order as: Ca-P (66.5%)>Fe-P (19.02%)>Al-P (11.87%)>Saloid-P (2.61%). Incorporation of 7.5 t FYM ha⁻¹ along with SSP showed significantly highest Sa-P (11.31 ppm), Al-P (48.12 ppm), Fe-P (58.21 ppm), Ca-P (185.42 ppm), TPi (264.90 ppm) and total-P (344.52 ppm) content of soil. It is concluded from the study that application of FYM along with P fertilizers played important role in improving soil P fractions under pearl millet-mustard cropping system.

ESTIMATION OF GENETIC COMPONENTS FOR GRAIN YIELD AND QUALITY TRAITS IN MAIZE

Preeti Sharma*, M.C Kamboj and Narender Singh

CCSHAU, Regional Research Station, Karnal

**Email: sharmapreeti.genetics@gmail.com*

Abstract

Maize has been preferred by the evolutionists, geneticist and plant breeders to develop concepts, quantitative genetic models and improved populations/hybrids for practical use over last many decades. It is an economically and nutritionally important cereal crop being cultivated in different agricultural zones under diverse situations of rainfall and altitude around the world. The dramatic increase in production and yield levels of maize during the last four decades is mostly due to genetic improvement of hybrids and better production technology. It is well known fact that greater is the variability among the parents, the tremendous are the chances of further improvement. Generation mean analysis is a useful technique that provides the estimation of main genetic effects (additive, dominance and their digenic interactions) involved in the expression of quantitative trait such as yield and its components traits. Therefore, current study has been designed to understand the nature and inheritance of grain yield and quality traits of maize and is necessary for proper choice of breeding procedures for developing QPM hybrids with increased grain yield. The present study was carried out with six crosses *viz.* HKI 209 x HKI 1128, HKI 209 x HKI 163, HKI 1332 x HKI 1128, HKI 1332 x HKI 163, HKI 325-17AN x HKI 1128 and HKI 325-17AN x HKI 163 with their six generations *viz.* P₁, P₂, F₁, F₂, BC₁ and BC₂. The results obtained for genetic components (genetic effects) are have been explained for grain yield and quality characters *viz.*, protein content, tryptophan content, oil content and starch content (expressed in percentage) according to the analysis procedure for three parameter and six parameter models. Both individual scaling test (A, B, C and D) and joint scaling tests were used in all the six crosses to determine whether at all, the additive-dominance model was adequate for different traits. Further, the three parameters m, (d) and (h) were estimated through joint scaling test to depict whether the additive-dominance model was adequate or not or to detect epistasis. In the presence of epistasis or inadequacy of three parameter model, the additive (d) and the dominance (h) effects and non-allelic interaction components (additive x additive (i), additive x dominance (j) and dominance x dominance (l)) of generation means were estimated according to Hayman (1958). The chi square (÷2) value was significant according to joint scaling test for all the characters in all the six crosses studied, except for oil content in cross HKI 325-17AN × HKI 1128 which were not significant, showing the adequacy of three parameter model where the additive dominance model was found to be fitted. Also, the significant values of scale A, B C, D in all the crosses for all the characters indicated the presence of epistasis (non-allelic interaction), which was also inferred from the generation means. As the three parameter models did not satisfactorily explain the genetic variability for all these traits, therefore, a six-parameter model was applied to accommodate epistatic interactions. Results revealed that duplicate type of interaction was apparent for protein, tryptophan, oil and starch content in cross HKI



325-17AN × HKI 163; oil, tryptophan and starch for cross HKI 1332 x HKI 1128; however, complementary type of interaction was reported for protein content in cross HKI 325-17AN x HKI 1128 and oil content in cross HKI 209 x HKI 163. For grain yield, dominance gene action is more pronounced as the magnitude of h (dominance) is higher than d (additive) in 5 crosses viz., HKI 209 x HKI 1128, HKI 209 x HKI 163, HKI 1332 x HKI 1128, HKI 1332 x HKI 163, HKI 325-17AN x HKI 1128. For protein content additive effects were significant for HKI 209 x HKI 1128, HKI 1332 x HKI 1128, HKI 1332 x HKI 163 as well as epistatic interactions played a significant role in inheritance of this trait and it was also revealed that significant magnitude of l and non-significant magnitude of h indicated the dispersal of alleles in the parents. The involvement of duplicate type of non-allelic gene interactions was prominent to explain the inheritance of tryptophan content. For oil content additive, dominance and interactions played a significant role in inheritance of this character in these crosses however the magnitude of dominance effect was more pronounced. For starch content the significant magnitudes of both d (additive) and h (dominance) and all non-allelic interaction (i, j and l) in HKI 1332 x HKI 163, HKI 325-17AN x HKI 1128 and HKI 325-17AN x HKI 163 revealed that additive, dominance and interactions played a significant role in inheritance of this character in these crosses. It was concluded that both additive[d] and dominance [h] gene effects were significant for most of the traits studied, indicated that both additive and dominance effects were important in the inheritance of these traits. Significant epistatic gene interaction (i, j and l) were also observed for all the characters under study suggesting the existence of epistasis gene action in the maize crosses.

INNOVATIVE TECHNOLOGY FOR CROP IMPROVEMENT, BIOTECHNOLOGY AND GENETIC ENGINEERING

Prem Kumar

Department of Genetics and Plant Breeding, Birsa Agricultural University, Ranchi-834006, Jharkhand

Email: premchand9693@gmail.com

Abstract

Crop development is a crucial component of today's society because, with the world's population expanding so quickly, survival is becoming increasingly challenging. Therefore, we require creative solutions and cutting-edge technology to help us boost crop yield, there quality etc. A branch of agricultural research called agricultural biotechnology uses numerous molecular methods to enhance the quality, productivity, and disease resistance of plants. In order to improve the effectiveness of plant genetics for plant productive technique and quality, some of the essential principles that can be used in conjunction with genetic modification and contemporary plant breeding methodologies are covered in this section. The procedures that are highlighted for gene isolation, validation, and gene transfer could be used to carry out genetic engineering. Through molecular marker-assisted selection, the sophisticated plant breeding method known as molecular breeding is a new technology that provides greater benefits. These are practical methods for choosing new desirable traits for stress resistance and nutritional improvement. The socioeconomic effects of molecular breeding are frequently considered, as well as risk assessment.

IN VITRO EVALUATION OF PEARL MILLET ENDOPHYTIC BACTERIA AGAINST MAGNAPORTHE GRISEA INCITING BLAST DISEASE OF PEARL MILLET

Preeti Verma*, Vinod Kumar Malik, Rakesh Kumar and Mamta Khaiper

Chaudhary Charan Singh Haryana Agricultural University, Hisar, India

**Email: vermapreeti5926@gmail.com*

Abstract

Pearl millet [*Pennisetum glaucum* (L.) R.Br. Syn. *Pennisetum americanum* (L.) Leeke] is the oldest cultivated millets that serve as a poor man's food. Pearl millet crop is prone to number of diseases out of which blast disease caused by *Magnaporthe grisea* emerged as a serious problem affecting both forage and grain production of pearl millet in India. Plant associated bacteria colonize inside plant tissues (endophytes). Bacterial endophytes are considered to have a beneficial effect on host plants, improving their growth by different mechanisms.

Plant samples were collected from experimental area of CCS HAU, Hisar of the *kharif* 2021 from which endophytic bacteria were isolated. The *in vitro* antagonistic effect of the endophytic bacterial isolates against the fungal pathogen was assessed



following dual culture technique. Both the organisms will allow growing on dual culture media, King's B + PDA (1:1) in the Petri dishes. Percent growth inhibition were calculated, following the method as below :

$$\text{Growth Inhibition (\%)} = \frac{C - T}{C} \times 100$$

Where, C = colony diameter of pathogen in control

T = colony diameter of pathogen in the inhibition plate.

A total of 38 pearl millet bacterial endophytes were retrieved from roots, stem and leaves of pearl millet. All isolates were assessed for biocontrol activities, out of which 9 were selected for invitro evaluation. Out of which 3 endophytic bacteria shows more than 50% growth inhibition and 4 shows 40-50% growth inhibition. Li *et al.* (2004) isolated two endophytic bacteria from the stems of pepper plants, which showed strong inhibition effects on *Ralstonia solanacearum*, which was the main pathogen to infect the stem of pepper and cause bacterial wilt.

LUMPY SKIN DISEASE : A RE-EMERGING VIRAL DISEASE OF CATTLE AND BUFFALO

Preetinder Singh^{1*} and Manisha Parmar²

¹Department of Veterinary Microbiology and Immunology, College of Veterinary and Animal Sciences, G.B.P.U.A.T, Pantnagar, Uttarakhand, India

²Department of Veterinary Microbiology, College of Veterinary Science, GADVASU, Ludhiana, Punjab, India

*Email: preet40c@gmail.com

Abstract

Lumpy Skin disease (LSD), also known as Neethling virus disease or knopvelsiekte is an infectious viral disease affecting cattle and buffalo. The causative agent of LSD is a brick shaped, enveloped, double stranded DNA virus *capripox* virus belonging to family *Poxviridae*. The main route of transmission is via arthropods however, non-vector borne transmission is also reported through bodily discharges and infected fomites. The first outbreak of LSD in India occurred in August 2019 at Odisha with the strain that was similar to South African strain. Since then the disease has spread throughout India affecting a large number of cattles and buffaloes. The incubation period of the disease is reported to be between 2-5 weeks with clinical signs including fever, emaciation, ocular discharge, development of painful nodular regions on the skin, muzzle, ear, eyes, neck, back, leg and scrotum. The lesions become hard and the healing process is slow which further leads to chances of secondary bacterial infections. Due to the severity and rapid spread of the LSDV, the disease has been declared notifiable by World organization for animal health (OIE). Being a transboundary disease, the early diagnosis of the disease is necessary. However, it is also important to differentiate this disease from other similar diseases and that can be done on the basis of nodular skin lesions. The confirmatory diagnosis is mainly based the isolation of virus in cell lines such as lamb testis cells, primary bovine fibroblast or the ovine testes cell line. The main focus is on prevention and control of the disease which is mainly based on the symptoms of LSD. Vaccination is available for the disease however, currently in India goat pox vaccine is being used as preventive measure from the disease.

SOIL HEALTH MANAGEMENT PRACTICES AND CROP PRODUCTIVITY

Prem Kumar^{1*} and Rahul Sahu²

¹Department of Genetics and Plant Breeding and ²Department of Entomology, Birsa Agricultural University, Ranchi-834006, Jharkhand

Email: premchand9693@gmail.com

Abstract

The global food systems must handle a wide range of issues, such as reducing environmental impact, responding to climate change, increasing yields, preserving and improving crop nutritional quality. Using management strategies that prioritise soil health can help reduce some environmental impacts and improve potential economic rewards. Claims that increased crop quality and yield will follow from improved soil health, however, need to be carefully examined. The nutritional quality of crops is influenced by more than only measures of the health of the soil. Concerns have been raised that future food demands won't be able to be met by yield improvements, making the yield results of controlling soil health critical. Although thousands



of studies on conservation agriculture have been published, the idea of soil health frameworks is very new. These studies examine the impact of intercrops, no-till farming, and rotation on yields. Only a few systems have consistently enhanced yields, underlining the need for deeper mechanistic knowledge of regional-scale yield consequences. This research suggests that soil health improvements may potentially have neutral or worse effects on yield. Healthy soil is the cornerstone of the food chain. Our soils serve as both the building blocks of agriculture and the habitat where nearly all plants that produce food are cultivated. Crops grown on fertile soils provide food for both humans and animals. In actuality, there is a direct relationship between soil quality and food quantity and quality. Soils give our food-producing plants the necessary nutrients, water, oxygen, and root support for them to develop and flourish. Therefore, many of the methods and maintenance are necessary for the healthy soil.

EFFECTS AND BENEFITS OF LATHYRUS (*LATHYRUS SATIVUS* L.)

Prema R. Manapure¹, P.V. Shende¹, Vandana S. Madke¹ and Gajanan D. Chandankar²

¹College of Agriculture, Nagpur (Dr. P.D.K.V., Akola),

²Reginal Research Centre, Amravati (Dr. P.D.K.V., Akola)

Email: prashant_srbe@rediffmail.com

Abstract

The *Lathyrus sativus* L. is part of the Fabaceae family. The people knew it under various names: dinner, dental peas, cicericula, dentisor. It is a precious annual plant, which has a long history of culture. The areas large occupy it crop. It is used in human nutrition and animal feeding. The berries are used up to mature, green and mature in the form of garner. It is use in animal feed as a green fodder, a fan, alone or mixed with cereals, and the grains are given as concentrated fodder. The *Lathyrus sativus* are also used to obtain high-quality glues used in aviation, textile, veneering, etc. The stem is in the muscle, branched, but non-resistant to fall. The leaves par pinnate with two narrow, lance late leaves, end with branched circle. The flowers are of violet color, rarely pink, blue, placed in racemic 2-3. Flour from the *Lathyrus sativus* is used (10%) for tasty bread. The fruit are a pod patty with two wings, containing 2-6 seeds, angular or flat, white, yellowish-yellow, variegated. Plant height is from 80-90 cm up to 150 cm. The plant has a pivotal, deep (120-125 cm) root with branches. The roots have porosities that represent colonies which are filled with nitrogen fixation bacteria. After the protein content exceeds peas, beans and other legumes for beans and from pod of *Lathyrus sativus*, can obtain casein, its quality being close to casein of animal origi. The green parts of the plant contain up to 800 mg of the vitamin C, carotene up to 22 mg percent. The plant also contains saponins, bitter substances, a small amount of alkaloids, flavonoids, trace elements: manganese, iron, copper, chromium, etc. The pod of chickling can only be used in the diet after boiling. It also serves as a good liver for bee. The bitter *Lathyrus sativus* contain on average 24.5% protein; 53.5% non-added extractive substances; 2.1% fat; 4.3% cellulose, etc. Straw and chaff have a 7 to 10% protein content, representing a fairly valuable feed. The *Lathyrus sativus* is recommended for use of the healing of chronic bronchitis and against pneumonia. Alcohol-ready with *Lathyrus sativus* can be used in homeopathy. The *Lathyrus sativus* has been studied in pharmacologically and clinically by the Tomsk Institute of Medicine, Russian Federation. At the same time, in popular medicine, the *Lathyrus sativus* is used to fight diarrhea. It is also used the infusion of roots from *Lathyrus sativus* in the case of insomnia and for heart pain. The secondary effects were not observed. As a herb are use the field *Lathyrus sativus*, the spring lathyrus.

STUDIES ON GENETIC ANALYSIS IN F₃ POPULATION OF LATHYRUS

Prema R. Manapure, Nitin Dadas Amey P. Jambulkar and Vandana S. Madke

College of Agriculture, Nagpur (Dr. P.D.K.V., Akola)

Email: ameyjam7@rediffmail.com

Abstract

The present study was conducted with the objectives to estimate between family and within family variances, to estimate genetic parameters and to identify superior progenies for forwarding to next generation on the basis of yield and yield



contributing characters at experimental farm of Agricultural Botany Section, College of Agriculture Nagpur during *rabi* 2018 in F₃ generation. 240 progenies along with checks and the parents involved in the crosses (Ratan, Prateek, NLK-06, NLK-12, NLK-40, NLK-48, NLK-73, LL-14-2 and LL-14-5) were evaluated in two replications in progeny rows and the observations on seven traits *i.e.* days to flowering, days to maturity, plant height, number of branches plant⁻¹, number of pod plant⁻¹, 100 seed weight and seed yield plant⁻¹ were recorded. Analysis of variance indicated that the mean square due to between family were highly significant for all traits, which revealed the presence of significance genetic variability between the families. Intra class correlation (t) lead to the conclusion that differences between individual within family is large and each family differentiated distinctly from the other one at lower level in F₃ generation hence, equal weightage to ²f and ²w were suggested to be considered for selection in M₃ generation. When all the genetic parameters for seven characters were considered, it was found that plant height, number of branches and 100 seed weight exhibited high genotypic coefficient of variation, high heritability along with high genetic advance as percentage of mean. Similarly other characters days to flowering, days to maturity, plant height and number of pod plant⁻¹ exhibited high GCV, moderate heritability and high genetic advance as percentage of mean. This indicated that all these seven characters were influenced by additive gene action operating in the expression of these traits in F₃ generation and hence helps as a criteria for making selection. 186 individual plants from 21 superior families out of 240 families studied were identified for raising in progeny rows for one more generation so that homozygosity will be attained and superior progenies can be then selected for forwarding to yield traits in the next generation.

FOLIAR APPLICATION OF GLYCINE BETAINE MITIGATES THE EFFECT OF HIGH TEMPERATURE STRESS IN CHICKPEA

Priyanka*, Sarita Devi and Preeti

Department of Botany and Plant Physiology, CCS HAU, Hisar-125004, Haryana, India

*Email: priyankabhardwaj1407@gmail.com

Abstract

High temperature stress is becoming the major concern for plant scientists worldwide due to the changing climate. Present investigation was carried out to study the effect of Glycine betaine on high temperature tolerance in two chickpea genotypes H12-55 (HC-7) and ICCV-92944. A factorial experiment was conducted in a randomized block design with three replications in a Research area of Pulses Section, Genetics & Plant Breeding, CCSHAU, Hisar in 2020 and 2021 where the chickpea genotypes was grown in different sowing environment (normal and late sowing). Physiological parameters such as relative water content (RWC %) and photosynthetic efficiency (Fv/Fm) decreased under high temperature stress whereas relative stress injury (RSI %) and MDA (Malondialdehyde) content increased. In order to compete with this stress the plants were treated with varied concentrations of Glycine betaine GB (0, 25 and 50 mM) under both environments. After foliar spray of GB, it was observed that reduction in RSI and MDA content while Fv/Fm and RWC (%) was increased. The concentration of 50mM GB caused the greatest decrease in RSI and MDA content along with the greatest increases in Fv/Fm and RWC (%). Thus, this study shows that foliar spray of Glycine betaine (*i.e.* of 50 mM) is effective in mitigating the effect of High temperature Stress in chickpea under field conditions in both chickpea genotypes as shown by various physiological parameters studied.

PYROLYSIS OIL PRODUCTION FROM PINE CONES

Priyanka Chand

Department of Farm Machinery and Power Engineering, College of Technology, G. B. Pant University of Agriculture and Technology

Email: chand.priyanka@gmail.com

Abstract

Pine cones are a non-grain lignocellulosic biomass resource which can be converted into an advanced hydrocarbon biofuel known as pyrolysis oil. Pyrolysis is the heating of biomass in the absence of oxygen to produce pyrolysis oil, producer gas and biochar. In this work, pine cones were pyrolyzed at temperatures ranging from 300 °C to 600 °C in a fixed bed batch type slow pyrolysis reactor. The maximum bio-oil yield of 35% (by wt.) was obtained at a temperature of 500 °C. The calorific value of



pine cone bio-oil was 20 MJ/kg. Pyrolysis oil is a complex oxygenated mixture of several compounds comprised of water, water-soluble compounds, such as acids, esters, etc., and some water-insoluble compounds. Pyrolysis oil is a substitute for fossil fuels in boilers and furnaces (including power stations) and can be upgraded to be used as a substitute for diesel in diesel engines. A wide range of chemicals can also be extracted or derived from pyrolysis oil. The calorific value of pine cone biochar was 29 MJ/kg and is suitable for use in biochar briquettes.

STUDY ON AGRO-MORPHOLOGICAL DIVERSITY ON TAMARIND GERMPLASM IN JHARKHAND

Priyadarshni Raj^{1*}, S.K. Sengupta¹, S.B. Choudhary², Rajeev Ranjan Tiwary¹ and Abhishek Yadav³

¹Department of Horticulture, Birsa Agricultural University Kanke, Ranchi, Jharkhand-834006

²ICAR-NBPGR Regional Station Ranchi, New Bhusur, Hatia, Ranchi-834003, Jharkhand

³RVC, BAU, Ranchi, Jharkhand-834006

*Email: abhipriya1423@gmail.com

Abstract

Tamarind (*Tamarindus indica* L.) is one of the common and most popular trees of Indian subcontinent belongs to the dicotyledonous family Leguminosae having chromosome number $2n = 24$. Tamarind is highly cross-pollinated crop, hence high degree of variation and wide range of heterozygosity with respect to size and quality of fruits are common in this species. The individual variation between the trees within population is of paramount importance and it may be worthwhile concentrating only to the best tree in relation to neighboring ones selected within ecological zones for increasing their frequencies. The magnitude of variability and its quantitative estimation for each character would indicate the potential of each tree and the scope for improving the desirable and economic characters through selection. A field experiment entitled "Study on Agro-morphological diversity on Tamarind (*Tamarindus indica* L.) germplasm in Jharkhand" was conducted during winter season of 2019-2020 at experimental farm of ICAR- NBPGR Regional station, New Bhusur, Tupudana, Ranchi. The experiment was laid out in augmented block design (ABD) and 36 germplasms of tamarind were selected from 51 tamarind trees. In the present study, the germplasm showed significant variation in terms of trunk height (IC 339919: 240 cm), trunk diameter (IC 594326: 161cm), pod length (IC 209890: 13.64 cm), pod width (IC 312361: 2.2 cm), pod weight (IC 209883: 25.88 g), pulp weight (IC 209912: 10.1 g), seed weight (IC 594345: 5.65 g) and Fibre weight (IC 594337: 0.83 g). Tamarind germplasm collected from district of Jharkhand representing different agro-ecological zone was used for studying the diversity analysis. Among 37 germplasm, accession no. IC 209912, IC 209883 and IC 339918 were found superior with respect to pulp weight, pod length, fruit weight, fibre weight and pod width. Therefore, this three germplasm is most promising and can used either for future evaluation or selection as a commercial cultivar or as gene source in tamarind improvement programme.

EFFECT OF THE FOOD PROCESSING AND USAGE ON THE ENVIRONMENT HEALTH

Priyanka Rohilla^{*1} and Khushbu Sharma²

¹Department of Food and Nutrition and ²Department of Zoology and Aquaculture, Chaudhary Charan Singh, Haryana Agricultural University, Hisar

*Email: Khushbu181997@gmail.com

Abstract

Food processing meaning is the transformation of the agricultural products into food and we can say that one form of food into the other forms. Each and every step in the food industry system food processing, production, storage, transformation, distribution, and marketing has some effect on the environment and there is much attention on environmental pollution. Due to the highly varied nature of the food industry, there are different types of food processing, handling, and packaging operations that create waste of different quality and quantity which if not treated lead to increasing disposal problems and leads to severe pollution problems. In addition, they represent a loss of most of the nutrients if not recovered by suitable methods and technology for upgrading, reutilization, and bioconversion. Research should be reinforced to improve the efficiency in waste treatment and to reduce the waste in food manufacturing and food processing operations through advanced manufacturing practices. Nowadays food manufacturing and technological approaches have offered a new markets and opportunities for



respond to changing environmental concerns. Maintenance of resources, reuse of materials, recycling, reutilization of by-products, and bio conservation of waste materials, altogether with reduced the environmental load and contribute to the sustainability of the environment. This realization has highlighted the need for effective research has to be minimizing the impact of processing and technological methods of the environment.

FIELD EFFICACY OF SOME INSECTICIDES AGAINST TOMATO FRUIT BORER, *HELICOVERPA ARMIGERA* (HUBNER)

Reguri Divya Reddy

Department of Entomology, SHUATS, Naini, Prayagraj, U.P.

Email: divyareddy4@gmail.com

Abstract

The field experiment on “Field efficacy of some insecticides against tomato fruit borer, *Helicoverpa armigera* (Hubner)” was conducted during Rabi 2019-2020, at Central Research Farm, Department of Entomology, SHUATS, Naini, Prayagraj, U.P. The relative efficacy of some insecticides viz., Chlorantraniliprole 18.5SC (0.5ml/lit), Spinosad 45%SC (0.5ml/lit), Flubendiamide 20%WG (0.3gm/lit), Novaluron 10EC (1.5ml/lit), Nisco sixer plus (2ml/lit), Novaluron 10EC + Nisco sixer plus (0.75+1ml/lit) and Indoxacarb 14.5SC (1ml/lit) were evaluated against fruit borer (*Helicoverpa armigera*). The data on incremental percent reduction of different treatments revealed that the treatment Indoxacarb 14.5SC (65.66%) followed by Spinosad 45%SC (63.85%), Novaluron 10EC + Nisco sixer plus (0.75+1ml/lit) (62.21%) Chlorantraniliprole 18.5SC (60.64%) ? Nisco sixer plus (58.19%) Flubendiamide 20%WG (56.74%) Novaluron 10EC (55.94%) found to be the most economical viable treatment. The highest cost benefit ratio was obtained from Indoxacarb (1:10.8).

IMPACT OF MICRONUTRIENTS (ZINC AND IRON) AND FARM YARD MANURE (FYM) ON ECONOMIC PARAMETERS UNDER DIRECT SEEDED BASMATI RICE

Priyanka Sanwal*, R.S. Gharwal

Department of Soil Science, CCSHAU, Hisar, 125003

*Email: sanwalpriyanka2015@gmail.com

Abstract

Paddling is an operation performed in a transplanting method but it is not feasible in rainfed areas. That's why the direct seeding method was developed. But there were some constraints associated with DSR, such as less nutrient availability and more weed infestation, which decrease the yield and economic returns. So, the current study aimed to study the impact of micronutrients and FYM on economic parameters under direct seeded basmati rice var., CSR-30. The experiment was performed on clay loam soil with bulk density 1.34 Mg m^{-3} , pH 8.66, electrical conductivity 0.11 dS m^{-1} , OC 0.54%, available nitrogen 105 kg ha^{-1} , available phosphorus 21.47 kg ha^{-1} , available potassium 360 kg ha^{-1} and DTPA extractable micronutrient Zn, Fe, Cu and Mn were 1.8, 14.75, 1.34 and 2.95 mg kg^{-1} respectively. Treatments of experiments were such as control (T_1), RDF (T_2), 75% RDF + FYM @ 15 t ha^{-1} (T_3), 50% RDF + FYM @ 15 t ha^{-1} (T_4), RDF + two sprays of 0.5% ZnSO_4 (T_5), RDF + two sprays of 0.5% FeSO_4 (T_6), RDF + two sprays of 0.5% FeSO_4 + two sprays of 0.5% ZnSO_4 (T_7) and replicated three times. Cost of cultivation, gross return and net return were observed highest in T_3 treatment (75% RDF + FYM @ 15 t ha^{-1}). Among all treatments, T_3 (75% RDF + FYM @ 15 t ha^{-1}) and T_4 (50% RDF + FYM @ 15 t ha^{-1}) treatments resulted in the highest B-C ratio.

NANOPARTICLES AS A PROSPECTIVE HALLMARKS OF ABIOTIC STRESS TOLERANCE IN CROP PLANTS

Pushpika Udawat* and Rajesh Singh Tomar

Amity Institute of Biotechnology, Amity University Madhya Pradesh

*Email: pudawat@gwa.amity.edu

Abstract

Nanoparticle plays a crucial role as one of the effective and environmentally friendly method for development of abiotic stress



tolerance in crops. Increasing the crop yield is the pressing priority owing to the increasing global population worldwide. Abiotic stresses singly and in combination with others are a great threat to the plant yield and productivity. Strategic crops are greatly affected particularly in reference to their normal growth and development. Abiotic stresses are multigenic in nature i.e. they come in combination and affect different aspect of plant growth and development. Abiotic stresses affect the morphology, physiology, biochemistry, basic cellular and molecular pathways in multiple ways. Nanoparticles of metallic or non-metallic origin are considerable due to their distinctive physical, chemical and biological properties. Previously, biological synthesis or greener ways of synthesis were not explored due to lack of knowledge about oxido-reductional potential of phytochemicals. Green synthesized nanoparticles are playing an important role in improving the antioxidant defense mechanisms, methylglyoxal detoxification and thus providing abiotic stress tolerance to crop plants. However, the molecular and physiological mechanism responsible for plant abiotic stress tolerance developed through nanoparticle is not thoroughly studied. Developing the deeper knowledge of crop abiotic stress resilience at different cellular levels will further help us in developing nanoparticles in different combination *viz.* unimetallic and bimetallic. The knowledge gaps are needed to be filled in by exploring the frontier areas and novel approaches of engineering plants with salt and drought stress tolerance.

ADOPTION OF AGROFORESTRY IN INDIA: ISSUES AND PROSPECTS

Qurat Ul Ain Binte Syed^{1*}, S.K Gupta¹, K.K. Sood¹, Asma Sultan², Amreena Akhter² Jauhar Rafeeq² Tanveer Ahmad Rather² and Manjot Singh Sidhu¹

¹Department of Agroforestry, Sher-e-Kashmir University of Agricultural Sciences & Technology of Jammu, 180009

²Faculty of Forestry, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir

*Email: Syedqurat04@gmail.com

Abstract

Agroforestry, the integration of woody perennials with farming systems, has been practiced in India since time immemorial as a tradition land use system because it offers both economically and ecologically viable option to farmers and rural people community for large-scale diversification in agriculture to get supplement fuel, fodder, fruits and fibers on one hand and environment amelioration on the other hand. In India, major Agroforestry systems are estimated to cover 25.32 million ha that is approximate 8.32% of total geographic area of country. The decision making process to adopt agroforestry depends on external factors such as the socioeconomic characteristics and internal factors like knowledge, attitudes and aspirations simultaneously. Despite Agroforestry's huge potential in India, the adoption rates are still low because there are several challenges that reap the benefits of agroforestry like shortage of superior planting material, insufficient research, lack of market infrastructure, cumbersome and frustrating legislation in respect of tree felling, wood transportation, processing. Due to increasing population and huge gap between demand and supply, forests were ruthlessly exploited to meet the increasing demand of fuel, fodder and timber. The adoption of National Agroforestry policy by the government of India in 2014 expected to remove these challenges as well as increases the farm productivity and the livelihood of the small and marginal farmers substantially in the future. Also emphasize the role of agroforestry for efficient nutrient cycling, organic matter addition for sustainable agriculture and for improving vegetation cover. However, agroforestry has not gained the desired importance as a resource development tool due to various factors.

POST HARVEST MANAGEMENT SIMPLIFIED THROUGH ICT

Ram Krishna Shekhawat

Department of Agronomy, SKNAU, Jobner-303329

Email: ramkrishnashekhawat@gmail.com

Abstract

The post-harvest value chain in Indian Agriculture remains long and the farmers often do not get a fair share of the value. This includes losses, owing both to post harvest operations (in food crops) during harvesting, threshing, drying etc. and once harvesting is over, losses that occur due to several other reasons: poor storage facilities, transportation problems, defective packaging, legacy marketing practices, flawed policies etc. Some of it may be due to lack of awareness and some due to unavailability of infrastructure to manage post harvest activities efficiently. Fair and remunerative prices of crop produce benefits all farmers, including tenants and sharecroppers, who constitute a large majority of Indian smallholder farmers, in a



big way. Use of better grading, storage, transportation and packing is the key to reducing these inefficiencies. It is thus imperative to facilitate the farmers for utilizing these improved facilities to enhance incomes and margins, from either the same crop or by diversifying to other crops which are more profitable. Modern solutions include ‘geo-tagging’ of agri-warehousing, cold storage, linking the ‘GPS coordinates’ and data are planned to be uploaded to a mobile app, which can be used by the farmers to locate the nearest warehouses and store their produce, reducing the risk of wastage, with a touch of ‘artificial intelligence’ to it will do miracles. Further we require an open access, data-science-based mobile application, using machine learning and physics-based food modeling, which will enable smallholders to access sustainable cooling facilities through the servitization business model, and to benefit from available data and market information to optimize decisions on produce and farm management. Key steps in making it successful are 1. Identify smallholder farmers that currently do not have access to cooling facilities and have the largest potential to adopt and implement our solution. 2. Predict the current quality of the stored food. 3. Forecast remaining postharvest life for the current cold storage conditions. 4. Use predictive market analytics to inform farmers about the optimal time to sell. 5. Provide cold chain control of the facility to maximize energy efficiency as post-harvest management of crops plays a crucial role in both value generation as well as value distribution along crop value chains, by mitigating post-harvest losses.

STUDIES ON COMBINING ABILITY ANALYSIS FOR SEED YIELD AND ITS CONTRIBUTING TRAITS IN INDIAN MUSTARD *BRASSICA JUNCEA* (L.) (CZERN AND COSS)

Ram Kumar Singh

Department of Genetics & Plant Breeding, R.S.M. (P.G.) College Dhampur, Bijnoor (U.P.)

Email: drksingh90@gmail.com

Abstract

A field experiment was conducted at Research farm R.S.M. (P.G.) College Dhampur, Bijnoor (U.P.) during Rabi 2020-21. 10 parents/ strains of Indian Mustard namely Viz; Kranti, Rohini, Pusa Bold, Vardan, Pusa Bahar, RH-30, RLM-198, Jawahar Mustard-, J.D-6 and NDRE-4 were crossed in dialled mating design (Excluding reciprocal crosses). 100 genotypes (45 F₁'s+ 45 F₂'s+10 parents) were evaluated for 10 characters viz; days to 50% flowering, days to maturity, plant height (cm), main raceme length (cm), no. of siliqua/plant, no. of primary branches/plant, no. of secondary branches/plant, oil content(%), 1000-seed weight (g) and seed yield/plant (g). Analysis of variance revealed that the genotypes were genetically differ to each for all the characters. Genetic components analysis exhibited that both additive and dominance components were highly significant for almost all the traits indicating the role of both additive as well as non-additive action in controlling the expression of concerned traits. In general dominance component values were higher than that of additive component for all the traits. The estimate of average degree of dominance indicated presence of over-dominance for all the traits.

The parents namely, Kranti, Rohini, Pusa Bold, RLM-198 and RH-30 were found best general combiners for 1000- seed weight, seed yield / plant and oil contents (%). Out of 45 crosses namely; Kranti x Rohini, Kranti x Pusa Bold, Rohini x RLM-198 and RH-30 x J.D-6 were found best specific combiners for 1000- seed weight, seed yield/plant and in oil content (%) in both F₁ and F₂ generations. These above specific crosses maybe utilized at commercial level by the Indian mustard cultivators for 2 or 3 early generations.

GENETIC STUDIES FOR SEED YIELD AND QUALITY PARAMETERS IN INDIAN MUSTARD [*BRASSICA JUNCEA* (L.) CZERN. & COSS.]

Ekta Saini^{1*}, Mahak Singh¹ and Ram Kumar Singh^{2*}

¹*Department of Genetics & Plant Breeding, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur (U.P.)*

²*R.S.M. (P.G.) College Dhampur, Bijnoor (U.P.)*

*Email: ektamanion03@gmail.com

Abstract

An field experiment was carried out at Oilseed Research Farm, Kanpur during *rabi* 2020-22 with 28 treatments [7 parents (PR-20, PR-21, Azad Mahak, KMR17-5, KMR17-4, NDR-8501 and KMR(L)17-6 and their possible combination excluding reciprocals)] following diallel cross analysis excluding reciprocals in 3 replications laid out in randomized block design.



Observations were made on 13 quantitative characters namely days to 50% flowering, days to maturity, plant height (cm), length of main raceme (cm), number of primary branches/plant, number of secondary branches / plant, number of siliquae/plant, 1000-seed weight (g), protein content (%), oil content (%), seed yield / plant (g), methionine content (%) and tryptophan content (%). The genetic component of variance showed significant values for both additive (D) except protein content%, methionine content % and seed yield / plant. The dominance (H1 & H2) were also significant for all the characters. The degree of dominance showed overdominance for all the characters except days to maturity and near to complete dominance for tryptophan content%. Analysis of Variance for combining ability revealed the significant values for both *gca* & *sca* various for all the characters. The estimated values of variance due to specific combining ability (*sca*) were higher than the variance of general combining ability (*gca*) for all the characters. It indicated these characters are under the control of non-additive gene action. Hybrids PR-20 × AZAD MAHAK, PR-20 × KMR17-5, PR-20 × KMR17-4 and PR-20 × PR-21 showed high heterosis over economic parent for seed yield / plant. While, KMR17-5 × NDR-8501, PR-21 × KMR17-4 and KMR17-5 × KMR(L)17-6 showed high economic heterosis for oil content (%). The parents AZAD MAHAK and PR-20 were good general combiners for a number of traits especially for oil content (%) and seed yield / plant (g). PR-20 × KMR17-5, AZAD MAHAK × KMR17-5 and AZAD MAHAK × KMR17-4 showed high *sca* effect for oil content (%) whereas PR-20 × AZAD MAHAK, PR- 20 × KMR17-5 and PR-20 × KMR17-4 showed high *sca* effect for seed yield / plant (g). Genotypic correlation coefficient was higher in magnitude than their corresponding phenotypic correlation coefficient for all the characters. Significant positive correlations were found in seed yield / plant with number siliquae / plant, number of secondary branches / plant, number of primary branches / plant and main raceme length (cm), 1000- seed weight (g), oil content(%), protein content(%), methionine content(%) and tryptophan content(%). Phenotypic path analysis values revealed that positive and direct effect on seed yield / plant was exerted by number of siliquae / plant followed by number of secondary branches / plant, , protein content, number of primary branches, 1000- seed weight days to maturity and methionine content. Whereas, tryptophan content, days to 50% flowering, main raceme length, plant height and oil content showed negative direct effects. Thus, the selection pressure on these traits may lead to overall increase in the yield. To harvest maximum yield potential, a certain degree of heterozygosity should be maintained in a population.

EFFECT OF IRRIGATION SCHEDULE AND SOIL AMENDMENTS ON YIELD AND WATER USE EFFICIENCY OF WHEAT IN SOYBEAN-WHEAT CROPPING SYSTEM UNDER VERTISOL

R.K. Yadav^{1*}, Baldev Ram¹, V.K. Yadav², Pratap Singh¹, S.L. Yadav¹, H.P. Meena¹, R.K. Yadav², J.P. Tatarwal¹, M.K. Sharma¹, C.K. Jadon¹, D.L. Yadav¹ and Udit Dhakad²

¹Agricultural Research Station, Ummedganj, Kota, Rajasthan, India

²College of Agriculture, Ummedganj, Kota, Rajasthan, India

*Email: raj91yadav@gmail.com

Abstract

A field experiment was carried out at Agricultural Research Station, Ummedganj-Kota, Rajasthan (Agriculture University, Kota) during *rabi* season of 2020-21 & 2021-22 to investigate the “Effect of irrigation schedule and soil amendments on yield and water use efficiency of wheat in soybean-wheat cropping system under Vertisol”. The experiment consisting of three levels of irrigation schedules (0.6, 0.8 and 1.0 IW/CPE ratios) kept in main plots and four soil amendments (No amendments, Mustard straw, wheat straw and Compost @ 5 t ha⁻¹) was kept in sub plots were laid out in strip plot design with three replications. The normal dose of fertilizer uniformly was applied to wheat variety Raj 4037. A field experiment was conducted at ARS, Kota during two consecutive *rabi* seasons during 2020-21 and 2021-22 to find out the suitable irrigation schedule and optimum dose of soil amendment for increasing yield, economics and water use efficiency of soybean-wheat cropping system. Results of two years (2020-21 & 2021-22) pooled data revealed that application of irrigation at IW/CPE 1.0 significantly recorded higher number of effective tillers per meter row length (125), number of grains/spike (51.2), seed yield (5225 kg/ha) as compared to irrigations applied at IW/CPE 0.6 and 0.8, respectively. The maximum water use efficiency (13.24 kg/ha-mm) was also recorded at IW/CPE 1.0 followed by IW/CPE 0.8 (12.91 kg/ha-mm) and least in IW/CPE 0.6 (14.73 kg/ha-mm), however it was found non-significant. Application of compost @ 5.0 t/ha was recorded significantly higher number of effective tillers per meter row length (124), number of grains/spike (49.7), seed yield (4697 kg/ha) being statistically on par with wheat straw @ 5.0 t/ha as compared to mustard straw @ 5.0 t/ha and no amendments. Similarly, maximum water use efficiency (14.07 kg/ha-mm) was also recorded in compost @ 5.0 t/ha followed by wheat straw @ 5.0 t/ha (13.36 kg/ha-mm) and least in no amendment (11.78 kg/ha-mm). On the basis of two years experimentations, it might be concluded that



irrigation schedule IW/CPE 1.0 and application compost @ 5.0 t ha⁻¹ as soil amendment was recorded significantly higher seed yield and higher maximum water use efficiency.

EVALUATION OF BLACK GRAM GENOTYPES FOR YIELD AND YIELD ATTRIBUTING TRAITS

Ram Lala Patel

Department of Genetics and Plant Breeding, Bundelkhand University, Jhansi, U.P.

Email: patelramlalapatel@gmail.com

Abstract

The present study was undertaken in order to find out the genetic variability and interrelationships among different characters towards yield and yield attributing traits. The experiment was laid-out for with thirty black gram genotypes in Randomized Block Design (RBD) with three replications at the Rain-fed Agriculture Research Farm, Narayanbagh of Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, Bundelkhand University, Jhansi, U.P., India during *kharif* season 2020-21. The estimates of mean sum of square due to genotypes revealed significant among all the sixteen characters indicating the presence of sufficient genetic variability among the genotypes and revealing the scope for selection of suitable parents for future hybridization and yield improvement in black gram. The present study revealed that the phenotypic coefficient of variation was higher than the corresponding genotypic coefficient of variation for all the characters which might be due to interaction of the genotypes with the environment to some degree or other explaining environmental factors influencing the expression of these characters. High phenotypic and genotypic coefficient of variation was observed for, seed yield per plant, harvest index and number of pods per cluster. The variation was highest for day to maturity, followed by number of leaves per plant, plant height, number of pods per plant, day to 50% flowering, harvest index, day to initial flowering, biological yield, number of clusters per plant, seed yield per plant, number of branches per plant, number of seed per pod, day to 50% germination, test weight and number of pods per cluster. An overall observation of the above results of yield and its components revealed that biological yield per plant, harvest index, plant height, day to initial flowering, number of branches per plant, number of seed per pod, pod length, number of leaves per plant, day to 50% flowering, test weight and number of pods per cluster, number of pods per plant, were the most important characters contributing towards seed yield per plant.

DIFFERENT TYPES OF ORGANIC AND INORGANIC SOURCE OF AMENDMENTS ON CROP GROWTH AND YIELD OF RICE UNDER WET LAND IFS ECO SYSTEM

Ranjith R¹*, A.Veeramani², A. Arun³ and A. Ammaiyappan¹

Department of Agronomy, TNAU- Coimbatore, Tamil Nadu ¹, AC & RI, TNAU-Chettinadu, Tamil Nadu ²

Department of Agronomy, MTCA, Pudukkottai, Tamil Nadu ³

*Email id: ranjithagrntnau@gmail.com

Abstract

In Periyar Vaigai Command (PVC) of wetland area of Madurai Dist., Tamil Nadu, rice is cultivated as major crop. However, due to major constraint of sandy clay loam type of soil of this area reduce the productivity of rice. This may be attributed to loss of applied nutrients caused by leaching of water in the above soil having more sand in proportion besides continuous use of synthetic fertilizers that deteriorate soil physico-chemical and biological properties of the soil. Apart from the above constraints, inadequate and delayed water supply are also lead to poor growth and development and yield reduction in rice in most of the years. Under that situation, developing strategy with necessary agronomic measures is a must. Taken into account of the same, a field experiment was conducted at AC&RI, Madurai during *rabi* season (2019-2020) in sandy clay loam soil to investigate the effect of IFS resources based nutrient management practices on rice under low land puddling condition. The experiment has eight treatments comprised of different organic amendments and inorganic fertilizers laid out in randomized block design with three replications. Different nutrient management practices were significant in influencing the Growth parameters, yield parameters & yield and NPK uptake of rice. It could be concluded that application of Tank silt @ 20 t ha⁻¹ + IFS Fish pond silt @ 5 t ha⁻¹ + NPK fertilizer on nutrient balance basis is the best practice to improve soil fertility status and soil moisture retention required to increase growth, yield and yield attributes besides increased productivity of rice in Periyar Vaigai Command area.



TO STUDY THE ACHIEVEMENTS AND CHALLENGES OF MID DAY MEAL SCHEMES OF SCHOOL GOING CHILDREN

Rahul Khajuria

Department of Home science, NIMS University Jaipur, Rajasthan-303121

Email: khajuriarahul8@gmail.com

Abstract

Mid Day Meal Scheme was first started in India from 15-08-1995 under the name of 'National Programme of Nutritional Support to Primary Education (NP-NSPE)'. In October 2007, National programme of nutritional support to primary education has renamed as 'National Programme of Mid-Day Meal in School, which is popularly known as Mid-Day Meal Scheme. Mid day meal is the most nutritional meal of the day for many children coming from challenging backgrounds. The supreme court of India has mandated that every child should get the require nutrients for their overall development. This was an observational cross-sectional study done in District Poonch in government and private schools to check the poor quality, hygiene and different variety of food with sickness after meal, irregular and delayed delivery of food grains and payments in some cases. The study showed that acquire a good quality cooking meal bearing AGMARK but the state Food and Drugs Administration need to collects the samples in some areas to ensure the meals quality and nutritional content. The scheme could be a platform for strengthening and boosting the school health programmes in order to produce a real effect. Since the supreme court says that the once to monitor the implementation of the scheme essentially lies with the central government, as it is the central government that is dispensing assistance, it is important that leakages from the MDMS should be stopped at all cost.

PERCEPTION OF TRIBAL FARMERS ABOUT OFT AND FLD CONDUCTED BY KRISHI VIGYAN KENDRA KANKER DISTRICT OF CHHATTISGARH

Rajesh Sarkar, Parvez Rajan, T.N.S.S. Srivani and Amrit Warshini

Department of Extension Education, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India.

Email: rajeshsarkar1107@gmail.com

Abstract

Krishi Vigyan Kendra (KVK) is one of the milestones of the Indian Council of Agriculture Research and is an integral part of the National Agricultural Research System (NARS). It is an innovative science-based institution that conducts OFT, FLD, and undertakes vocational training for farmers, farm women, and rural youths. KVK maintains a healthy relationship between scientists and farmers. The current study was conducted in Kanker district of Chhattisgarh state during 2021-22 to assess the perception of beneficiaries about OFT and FLD conducted by Krishi Vigyan Kendra. The study was conducted with 110 beneficiaries by using proportionate random sampling in 6 villages under 3 blocks. The findings of the study revealed that tribal farmers were comparatively of the middle age group, had completed education up to high school, medium annual income and landholdings, agriculture as a main occupation and medium farming experience. Perception of beneficiaries toward KVK services was assessed on the basis of two dimensions viz. On Farm Trials, front line demonstration conducted by KVK. The findings indicated that the majority (39.08%) of the beneficiaries had a more favourable perception towards On Farm Trials and Front-Line Demonstration of KVK. Based on the findings of the study, it can be concluded that KVK changed the perspective of the tribal farmers from traditional to modern technology, which helped in uplifting their economic status.

NEW TRENDS IN DISEASE AND INSECT-PEST MANAGEMENT : CHALLENGES AND OPPORTUNITIES

Rahul Kumar

Division of Crop Protection, ICAR-Indian Institute of Pulses Research, Kanpur

Email: kumarrahul018096@gmail.com

Abstract

Pulses crops are affected by several pests and diseases caused by arthropods, bacteria, fungi, oomycetes, viruses, virus-like organisms, and nematodes. The geographical range of most of these pests and pathogens is expanding because of growing



global trade and environmental change. Its crops are grown for several years; thus, long-term strategic decisions on pest and disease management are critical. Cultivar and selection as well as cropping system should be defined prior to crop establishment and short-term tactical decisions, such as spraying of plant protection products and cultural practices, should also be planned, and implemented for proper pest and disease management. Pulse crops are cultivated over large areas and management strategies should carefully consider the spatial dimensions and complex interactions with the surrounding landscape. Worldwide, the use of plant protection products must comply with stringent regulations, aimed at reducing the risks and impacts on public health and the environment, avoiding the development of pest and pathogen resistance, and preserving ecosystem services that benefit the biological control of diseases and insect-pests. The alternative and long duration effective methods, such as biocontrol agents and semi chemicals, are becoming increasingly important in pest and disease management. these approaches are particularly suited to integrated pest management and organic production, where they are preferred over the use of synthetic chemical pesticides. the abstract in this special issue include reviews and research articles covering damages caused by fungi, viruses, and insects in a diversity of pulse crops, such as pigeon pea, chickpea, lentil, and field pea etc. the efficacy of chemical fungicides has been evaluated in terms of seed dressing by *Trichoderma spp.*, foliar applications scheduled based on epidemiological information and assessing fungicide sensitivity. The efficacy of alternative products including biocontrol agent's semi chemicals and mycorrhizas has also been considered in this special issue. The disease management in pulses supported by new molecular and biotechnological approaches. The works included in this special issue cover a great diversity of regions, environments, and agronomic conditions, with substantial contributions by early career researchers.

RECENT ADVANCES IN INSECT PEST MANAGEMENT OF COLE CROP

Rahul Sahu^{1*}, Prem Kumar², Sneha Bharti³, Subhash Sahu⁴

¹Department of Entomology, BAU, Ranchi ²Department of Genetics and Plant Breeding, BAU, Ranchi

³Department of Entomology, BAU, Ranchi ⁴Department of Entomology, BAU, Ranchi

*Email: imrahulsahu10@gmail.com

Abstract

Cole crops are grown and have an important place among *Rabi* crops. The production and yield of cabbage is greatly hampered by many insect pests. In India, a total of 37 insect pests have been reported to cause loss in cabbage. Among them *P. xylostella* (17-99%) and *Pieris brassicae* (69%) are the most destructive pest causing severe yield loss to cabbage every year. For management of this notorious pest, many broad spectrum insecticides are being used intensively and indiscriminately by farmers. Integrated Pest Management (IPM) is an ecofriendly approach to manage this pest by utilizes all suitable techniques and methods in as compatible manner as possible and maintain pest population at level below those causing economic injury. IPM includes cultural, mechanical, biological and chemical method. Cultural practice such as deep summer ploughing, crop rotation, trap crop (mustard as trap crop at 22:2 ratio in cabbage field attract DBM). Synthetic sex pheromones are widely used for different purposes such as monitoring, mass trapping and mating disruption. The maximum numbers of DBM moths were trapped at the trap density being 24 traps/ ac. Using botanical pesticides (neem leaf extract, NSKE, neem oil) to protect crops and their products is now becoming popular. There are several advantages of botanicals over chemical pesticides such as rapid degradability, environment friendly and non harmful to beneficial pests. Concentrations of microbial pesticides (*Beauveria bassiana*, *Bacillus thuringiensis* and *Metarrhizium anisoplae* @ 2 g l⁻¹) are most effective against lepidopteran pests. In recent time biorational insecticides (Spinosad 2.5% SC, Emamectin benzoate 5% SG, Chlorantranilprole 18.5% SC, Fipronil 5% SC) are widely applied for insect pest management of cole crop.

NANO-MATERIAL MEDIATED NUTRIENT & WATER MANAGEMENT FOR IMPROVING CROP PRODUCTIVITY AND SOIL HEALTH MANAGEMENT

Rahul Sharma*, Sandeep Manuja and Kunal Narwal

Department of Agronomy, College of Agriculture CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur-176061, India

*Email: sharmarahul.alampur@gmail.com

Abstract

In present global scenario, effective resource management using modern techniques such as nanotechnology is essential for



improving agricultural production along with the management of soil health and environment. Nanomaterials are envisioned to have the potential for that exceptional possibility. World agricultural cropping systems intensively using large number of fertilizers and pesticides to achieve more production per unit area. The use of more doses than required (optimum) of these fertilizers and pesticides leads to several problems like environment pollution (soil, water, air pollution), low input-use efficiency, decreased quality of food material, development of resistance in different weeds, diseases, insects, less income from the production, soil degradation, deficiency of micronutrient in soil, toxicity to different beneficial living organism present above and below the soil surface etc. ultimately leading to decrease in the area of arable land for cultivation. Unfortunately, a rapid increase in population, expanding industrialization, urbanization, inadequate sewage treatment, industrial wastes, marine dumping issues, radioactive waste material and extensive agriculture practices are resulting in continuous deterioration of the quality of water resources, which is a matter of global concern. Recently, when the world is facing serious issues of drinking water, experts found that nanomaterial is better option to treat wastewater because it has some unique properties like nano size, large surface area, highly reactive, strong mechanical property, porosity characters, hydrophilicity, dispersibility and hydrophobicity. Some heavy metal like Pb, Mo, etc. organic and inorganic pollutants and various harmful microbes are reported to be successfully removed by using different nanomaterials. Hence, nanotechnology has a high potential for achieving sustainable agriculture, especially in developing countries like India.

SENSORY EVALUATION OF DEVELOPED *LADOOS* INCORPORATING CAULIFLOWER LEAVES POWDER IN PEARL MILLET

Rajni* and Asha Kawatra

Foods and Nutrition Department, I.C. College of Home Science, CCSHAU, Hisar, Haryana

*Email: rajni131199@gmail.com

Abstract

Pearl millet (*Pennisetum glaucum*) is a versatile cereal grown primarily in Africa and Asia for food, feed, and forage. It can survive drought and high temperatures, which increases its potential to be grown in areas where wheat, maize, and other cereal crops fail to thrive. Cauliflower leaves are also high in folate, vitamin C, vitamin E, and beta carotene, as well as other nutrients like indole-3-carbinol and the phytonutrient sulforaphane. These leaves have low carbohydrate content, high protein content, and fiber content. The protein in cauliflower leaves can lower blood glucose levels, which is beneficial to diabetic patients. These leaves are beneficial to cardiac patients due to their low fat content and high fibre content. The present investigation was carried out to develop value added product traditional product *ladoo* from pearl millet incorporating cauliflower leaves powder and to evaluate them for sensory characteristics. Four types of *lados* were prepared using pearl millet incorporating cauliflower leaves powder at 5, 10, 15 and 20% levels and all the *ladoo* were found to be organoleptically acceptable by judges on the basis of nine point hedonic scales. As the supplementation of cauliflower leaves powder at 15% level in developed *lados* with the overall acceptability fell in the category of 'liked moderately' but gradually addition of leaves powder in *lados* decreases the taste, aroma, texture and taste. The control counterpart had highest mean acceptability scores in developed *lados* and fell under "liked very much" category. The scores for color, appearance, aroma, texture, taste and overall acceptability of control *lados* was of 8.10, 8.10, 8.00, 8.10, 8.10 and 8.08, respectively. All the products had good sensory properties by judges. The overall conclusion of this study was to highlight that adding cauliflower leaves powder and pearl millet to value-added *lados* helps to prepare a low-cost recipe and that both combinations improved the overall sensory characteristics of the developed product.

EFFECT OF SUPPLEMENTATION OF *SHATAVARI* (*ASPARAGUS RACEMOSUS*) ROOT POWDER ON LACTATION MOTHERS

Rajni* and Varsha Rani

Foods and Nutrition Department, I.C. College of Home Science, CCS HAU, Hisar (Haryana)

*Email: rajni131199@gmail.com

Abstract

Asparagus racemosus is a perennial climbing shrub in the *Asparagaceae* subfamily *Liliaceae*. Its medicinal properties have been reported in traditional medical practices such as Ayurveda, Siddha, and Unani and have been utilized for people's



primary health care since time immemorial. It is popularly referred to as 'Shatavari or Shatavar.' This plant's roots (powder or extract) have predominantly been used for medicinal purposes. *Shatavari* literally means "having hundred spouses," and Ayurvedic texts claim that it strengthens a woman to the point where she can produce thousands of healthy eggs. This herb has a wide range of biological activities and is renowned as a Rasayan in Ayurvedic literature. *Shatavari* has traditionally the most important ingredient in female reproductive tonic with lactogenic properties, during pregnancy it helps to nurture the health of the foetus and reduce the chances of miscarriages and pre-eclampsia and can be effective in reducing adverse menopausal symptoms such as hot flushes, night sweats, insomnia and anxiety. *Shatavari* root powder is rich in ash, protein, crude fiber, iron and calcium. It also has high antioxidants activity which helps to scavenging the free radicals and protect from many degenerative diseases. Mother's milk is the best source of nutrition for babies during their first six months of life that contribute to the development of a strong and healthy human being. *Shatavari* helps lactating mothers to produce more milk because this herb contains steroidal saponins mainly *Shatavarins* I-V that helps to increase the production of milk. It can be consumed in various forms and the two main forms of *Shatavari* commonly used are capsule and powder, for breast milk doctors often recommend the powdered form of *Shatavari Kalpa*. The dosage that can be taken daily is 5-10 grams. It can be taken with honey, warm milk or water. The current investigation was conducted at *Vishnu Devi Janana Hospital* in Hisar, Haryana. The present study will examine the supplementation of consuming 10 gram of *Shatavari* root powder on boosting lactation performance in nursing mothers.

MELOIDOGYNE ENTEROLOBII – A MAJOR THREAT TO TOMATO PRODUCTION

¹Ramavath Abhi, ²Shaik Munnysha and ³Manisha

^{1&3}Department of Nematology, Maharana Pratap University of Agriculture & Technology, Udaipur

²Dept of Plant Pathology, Maharana Pratap University of Agriculture & Technology, Udaipur

Email: ramavathabhi1401@gmail.com

Abstract

Meloidogyne enterolobii (Syn. *M. mayaguensis*), a worm that causes guava root knots, is an emerging disease for numerous crops worldwide. This nematode can induce many root galls on host plants, which can lead to chlorosis, stunting, and decreased yields. Due to the aggressiveness of *M. enterolobii* and the lack of known resistance in commercially acceptable varieties, this virus has recently been viewed as a global danger to the production of tomatoes (*Solanum lycopersicum* L.). An essential first step in an integrated management is the identification of *M. enterolobii* using both traditional morphological and molecular methods. Integrated disease management techniques like crop rotation, field sanitation, biocontrol agents, fumigants, and resistance cultivars have been created and utilised before to successfully battle root-knot nematodes. *M. enterolobii* is not controlled by tomato varieties' resistance, which is mediated by known Mi-genes. The current state of control methods and suggested future plans to enhance *M. enterolobii* management in tomatoes.

COMPATIBILITY OF *PSEUDOMONAS FLUORESCENS* (PF-19) WITH SYSTEMIC, NON-SYSTEMIC AND COMBI-CHEMICAL FUNGICIDES

Ranjana Joshi*, Gururaj Sunkad, Amaresh, Y.S. and Mallikarjun Kenganal

¹University of Agricultural Sciences, Raichur, Karnataka-584104

*Email: ranjanajoshi18@gmail.com

Abstract

Pseudomonas fluorescens is a Gram negative bacterium belongs to the Phylum *Proteobacteria*, Class α -proteobacteria and family *Pseudomonadaceae*. It plays an active role in suppression of pathogenic microorganisms by several mechanisms which include production of antibiotics as secondary metabolites at low concentration, competition, HCN production, siderophore production and induced systemic resistance. To develop an effective disease management programme, the compatibility of the bio-agent with fungicides is essential. A study was conducted to know the compatibility of *P. fluorescens* (PF-19) with systemic fungicides at 0.05, 0.1 and 0.15 per cent concentration and non-systemic and combi fungicides at 0.1, 0.2 and 0.3 per cent concentrations by zone of inhibition technique. Among the six systemic fungicides evaluated, azoxystrobin, hexaconazole and tebuconazole were found compatible with *P. fluorescens* (PF-19) with least zone of inhibition (0.00 mm). Other systemic fungicides such as carbendazim, benomyl and thiophanate methyl were found compatible at lower



concentration, but were incompatible at higher concentration. Among the six non-systemic fungicides evaluated, propineb was highly compatible with *P. fluorescens* (PF-19) with no zone of inhibition. Whereas, *P. fluorescens* (PF-19) showed high incompatibility with copper oxychloride and copper hydroxide. Among the six combi fungicides evaluated, thiophanate methyl + pyraclostrobin and cymoxanil + mancozeb were compatible with *P. fluorescens* (PF-19). Whereas, copper oxychloride + copper hydroxide, carboxin + thiram and tebuconazole + trifloxystrobin were incompatible with *P. fluorescens* (PF-19).

CONSTRAINTS FACED BY CAPSICUM GROWERS IN CHATRA DISTRICT OF JHARKHAND

Ranjay Kumar Singh, Dharma Oraon, J.Oraon, V.K. Pandey, V.P. Rai, Upendra Kumar Singh, Zunaid Alam

Krishi Vigyan Kendra, Chatra, Birsa Agricultural University, Ranchi

Email: chatrakvk@gmail.com

Abstract

The study was carried out during the year 2020-21 in Chatra district of Jharkhand. The Bio-Physical and Socio-economic condition of Chatra district is very favourable for growing capsicum as a cash crop. Extension agencies of the district are doing rigorous extension activities to disseminate improved cultivation practices of capsicum for doubling farmers' income, but the results are not satisfactory. Keeping this fact under consideration KVK Chatra tried to understand the constraint faced by farmers for not adopting the improved capsicum technologies so, that the extension strategy may be redesign. Gidhour and Simariya blocks of Chatra district were selected for the study where the maximum area was covered under capsicum purposively. A total of 110 capsicum growers were selected as respondent in the study. The result of the study depicted that the majority of the respondents (60%) belonged to lower middle age group ranging between 30-45 years. A maximum of 80% of respondents belonged to OBC class and most of them are literate. 82% of the respondents belonged to joint families and they were interested to grow capsicum with improved practices. 90% of the respondents had 01-02ha of land with mixed houses. Unavailability of micronutrient, fluctuation of prices, lack of knowledge about improved practices, Lack of credit as loans and granting of subsidies in remote areas of the district are the major constraints faced by the capsicum growers. The majority of the capsicum growers suggested that the government should provide solar motor pump for irrigation to reduce the cost of cultivation and improved varieties with micro and major nutrients should be available at local markets in rural areas.

AGRI STARTUP ON MEDICINAL AND AROMATIC PLANTS IN PRESENT CLIMATE CHANGE

Ranvir Kumar*, Suman Kalyani and Shoji Lal Bairwa

Bihar Agricultural University, Sabour, Bhagalpur (Bihar)

*Email: talkranvir@gmail.com

Abstract

Agri Startup is a new dimension of agribusiness in the present era. Policymaker, administrators as well as researcher advocating for establishment of more number of Agri startup for economic prosperity of rural sector of India in general and Bihar state in particular. With the changing climate scenario the Medicinal and Aromatic Plants become more popular in this regards. Medicinal and Aromatic Plants oil has a worldwide demand. Medicinal and Aromatic Plants oil has a large range of uses mainly in cosmetics and medicinal uses. Medicinal and Aromatic Plants oil produced in north India fetches high price in international trade because of its premium quality oil. Bihar state still cannot occupies its position in its production and marketing. While analysing the establishment of Agri Startup of Medicinal and Aromatic Plants based on SWOT and focusing its strength; diseases and pests infestation are very low, availability of a number of training centre such as CIMAP, IIHR, Agricultural University, positive policy of state/union government, growing demand in market are some of positive points for it in the state. Whereas, inadequate information on international demand and supply, Lack of infrastructure mainly for processing and value addition are few weakness. However, the opportunities are: annual growth rate in international market is about 7%, a number of Indian companies are pre ready to buy extracted oil, there is no direct interaction with individual customer and fluctuating price in the market are only threat. If these compare with traditional crops then it has many merits like it can grow in all types of soil in the entire climate with less irrigation and least agrochemicals. Recurring income,



climate resilient, perennial crops, least damage by animals are its advantages. Lemon grass, Mentha, Khus, Tulsi, Pamarosa etc are some of the important Medicinal and Aromatic Plants that can be used under Agri startups. Rastrya Krishi Vikash Yojna (RKVY)-RAFTAR under M/o Agriculture & Farmer Welfare, Govt. of India is nourishing and financing it by Agri incubator established in almost all the state of the nation. Bihar state has also included in its policy for upliftment of farmers in the state.

IMPACT OF CLIMATE CHANGE ON FOOD SECURITY IN INDIA

Ranvir Kumar, Suman Kalyani and Shoji Lal Bairwa

Bihar Agricultural University, Sabour, Bhagalpur (Bihar)

**Email: talkranvir@gmail.com*

Abstract

Climate change refers to significant, long-term changes in the global climate. It mostly covered rainfall, changing temperatures. Climate change adversely affects food security in various ways: impacting growing conditions, soil health, crop yields, fish and livestock productivity, the nutritional value of food crops and access to markets. Rising temperature favour agricultural pests, diseases and disease vectors. While pushing up temperatures, also affects the availability of water through a decrease in seasonal rainfall and an increase in extreme rainfall events. It is fact that different crops grow best at quite specific temperatures and when those temperatures change, their productivity changes significantly. It is estimated that developing world will add 3 billion people by 2050 which requires double staple food crop production by then simply to maintain current levels of food consumption. Rising population combined with declining productivity, increasing incidence of drought and storms is increasingly leaving developing countries vulnerable of food shortfalls. Rising temperatures and erratic rainfall have been adversely affecting crop yields and with the blistering heat wave across large parts of India in March, April and May affecting the wheat crop which worried us about the future food security. Similarly crops like maize, too, which is sensitive to temperature and moisture its yields are declining. Many researches showed that the productivity of rice declines by high percentage (10%) with every 1°C rise in temperature. Similarly, the sudden increase in temperature in March led to the sugarcane withering and also decrease in sugar content. In recent, scientists are trying to produce chickpeas that are more nutritious and resistant to climate change. It is important for India to safeguard its food security while ensuring that the most vulnerable sections of the population have access to nutritious food. Challenges faced by agriculture in Bihar in relation to climate change, ensuring food security there is need of leveraging the agriculture science to the farmers field. Climate Adaptation implements and promotes a range of methods and approaches including climate-smart villages.

MAJOR ISSUES WITH FERTILIZER USE IN AGRICULTURE PRACTICES IN INDIA

Ranvir Kumar, Suman Kalyani and Shoji Lal Bairwa

Bihar Agricultural University, Sabour, Bhagalpur (Bihar)

**Email: talkranvir@gmail.com*

Abstract

The major issues with fertilizer use in agriculture practices in India are two folds i.e. under use of fertilizers and overuse and misuse of fertilizer. Food and nutritional security is serious concerned of policy maker, administrator and scientist as well. But, with the under use of fertilizers creates low yield of crops thus nutrition affected. Nutrient mining, multi-nutrient deficiency observed. Similarly, overuse & misuse of fertilizers creates soil and water pollution, greenhouse gas (GHG) emissions, soil acidity and biodiversity loss. A prompt step is needed to promote judicious use of fertilizers to prevent underuse, overuse/misuse and enhance nutrient use efficiency. There are two categories of states in India with respect to fertilizer consumption (NPK) in agriculture. The statistics states that the highest fertilizer consuming states are Telangana, Bihar, Punjab, Haryana and UP. Telangana state is the highest NPK fertilizer consuming (Kg/hac) state with tune of 275 kg/hac. State Bihar got second position with 229 kg/hac fertilizer use followed by Punjab (224 kg/hac), Haryana (223 kg/hac), AP (207 kg/hac). Under this category UP is the lowest consuming state with 180 kg/hac NPK during the year 2018-19. Similarly, under the low fertilizer consuming states are Goa, Rajasthan, HP, Kerla, Assam and MP. The state Goa consumes only 23 kg/hac NPK which is lowest in the nation. Rajasthan consumes 61 kg/hac, HP – 62 kg/hac, Kerala- 69 kg/hac, Assam, it is 71 kg/hac whereas MP state is the highest consuming state under this category with 96 kg/hac during the same year.



THERAPEUTIC EFFICACY OF CITRONELLA OIL AGAINST TICK INFESTATION IN CATTLE

Rashmi Goswami*, Niddhi Arora and Meena Mrigesh

Department of Veterinary Medicine, College of Veterinary and Animal Sciences, G.B. Pant University of Agriculture and Technology, Pantnagar, U.S. Nagar-263145 Uttarakhand, India

*Email: rashugoswami0911@gmail.com

Abstract

The study was carried out to determine the *in-vivo* effect of Citronella oil against tick infestation in cattle. Six tick infested cattle and six normal healthy cattle were selected for the present study. Cattle infested with ticks were topically treated with Citronella oil mixed with Sesame oil as a carrier oil applied once daily for 21 days. Therapeutic evaluation of Citronella oil was done on the basis of disappearance of clinical manifestations, reduction of tick count on the infested cattle and significant improvement in haemato-biochemical profiles. The clinical manifestations such as pruritus, erythema, scales, nodules and rough hair coat were significantly reduced at the end of the therapy. The haematological analysis revealed Hb, PCV, TEC, TLC, neutrophils and eosinophils showed significant differences ($P<0.05$) in all the treated cattle at the end of therapy in comparison to pre-treatment values and were similar to values in healthy control. No significant alteration ($P<0.05$) in lymphocytes, monocytes and basophils in comparison to pre-treatment values was observed. Biochemical profiles showed significant increase ($P<0.05$) in glucose, total protein, albumin, globulin, A: G ratio, calcium and phosphorus; significant decrease in AST, ALP and CK and there was no significant change in ALT, BUN and creatinine at the end of therapy as compared to their values before treatment. Reduction in tick count and improvement in clinical manifestations started on day 7 post therapy.

ROLE OF RENEWABLE FUELS IN WEEDING OPERATION

Rathinavel S.* and Mahendiran R.²

*Department of Farm Machinery and Power Engineering

²Associate Professor, Department of Renewable Energy Engineering, AEC & RI, TNAU, Coimbatore, Tamil Nadu

*Email: rathinavelesr@gmail.com

Abstract

Weeding is inevitable for sustainable crop production. Focusing complete mechanization in various crops, several weeding strategies have been emerged mechanically, chemically and electrically. These modern weeding strategies use various power sources including petrol, diesel, and electricity in addition with renewable fuels, which are interested in recent research and development. Adding to the deficit of conventional fuel expected, environmental friendly fuel applications were interested in the present era. The various energy sources including solar (thermal and photovoltaic), biofuels such as biodiesel, ethanol, bio-CNG etc can be directly/indirectly fuelled for weeding mechanization. Robotics and automation in weeding is under progress from various parts of the globe, several developments were unmanned ground vehicles which moves towards solar power. Applying such renewable sources will be eco friendly, long lasting, inexhaustible in nature and paves the way for several other benefits. Considering the future fuel crisis with respect to population explosion, rise in farm power availability and inevitable weeding operation, renewable fuels are the suitable energy options. Successful research outcomes catalyze the same. The chapter discusses the current involvement of renewable energy in weeding mechanization sector.

EFFECT OF TEMPERATURE ON QUALITY CHARACTERISTICS AND SHELF LIFE OF TOMATO UNDER MODIFIED ATMOSPHERE PACKAGING (MAP)

Raveena Kargwal*, M.K. Garg, V.K. Singh, Yadvika and Sunil Kumar

Department of Processing and Food Engineering, COAE&T, CCSHAU, Hisar, Haryana

*Email: raveenakargwal@gmail.com

Abstract

The purpose of the present study was to prolong the shelf life of tomato under modified atmosphere packaging (MAP). Hence, the effects of different temperatures, such as 10, 15, and 20 °C with relative humidity RH 85-90% and ambient



temperature (22–26 °C) with RH 62–66.5% on the quality parameters of tomato. Physiological loss in weight (PLW) was approximately 15.40% in the control sample. Packages at 10 °C and 15 °C had significantly lower PLW, followed by 20 °C. Yet no package sample exhibited more than 5.10 % PLW at any temperature. The shelf life and colour quality of tomatoes were maintained to be 21, 18 and 15 days at 10, 15 and 20 °C. The study found that under MAP conditions with LDPE film at 10±1°C and 85–90% RH, the best tomato quality could be maintained for up to 21 days.

VACUUM : A REVOLUTIONARY TECHNIQUE IN FOOD PROCESSING

Ravi Kumar^{*} V.K. Singh and Sunil Kumar

Department of Processing and Food Engineering, CCS Haryana Agricultural University, Hisar-125004, Haryana

**Email: ravisangwan11@gmail.com*

Abstract

Food preservation is an important part of our lives. The capability to prevent food from spoiling for longer has practical benefits *viz.* reducing food wastage, waste in landfills, and improve the environmental footprint. In the recent past, vacuum packing has emerged as one of the most popular packing methods in domestic and commercial spheres. Vacuum technology is essential for the processing of fruits and vegetables, right from the pre-cooling of freshly harvested produce to the finished goods. Traditional techniques for the processing of food products *viz.* blanching, frying, and drying expose the food products to high processing temperatures. Other difficulties include loss of nutrients, alterations inside the product's sensory characteristics, prolonged response time, as well as product contamination from exposure to environmental conditions. Now-a-days, the food sector has adapted revolutionary techniques like vacuum processing for processes like mixing, heating, frying, distillation, freezing, drying, evaporation, filtration, conveying, cooling, freeze drying, roasting, and packing in order to reduce the various restrictions. Vacuum processing uses a green strategy to safeguard the health and environment by eliminating the use of toxic components, hazardous solvents while lowering water and energy consumption use, reusing material, and assuring the safety as well as quality of food.

TRADITIONAL AGRICULTURE FOR ENVIRONMENTAL SUSTAINABILITY AND FOOD SECURITY

^{*1}Renu Gangwar, ¹Dhirendra Kumar Singh and ²Amita Yadav

College of Agriculture, Kotwa, Azamgarh (ANDUAT, Ayodhya)

College of Agriculture, GLA, Mathura, UP

**Email: renoogangwar@gmail.com*

Abstract

In present scenario, India and other developing nations with an affluent traditional agricultural system, the words smart agriculture means growing high yielding varieties of crops with increasing doses of chemical fertilisers and pesticides. The growing population pressurized modern agricultural practices to enhance food production. Catering the growing population and sustaining the calibre of the environment are the two major challenges of Indian agriculture system. Although, modern agriculture increased the food production several folds with compromising environmental degradation such as climate change, environmental pollution, degradation of soil health and biodiversity. Traditional agricultural practices have been an indispensable part of food production in India since human stay. It is characterized as low-input and natural farming system, basically depends on the natural resources and local tools for input. This technique maintains the soil health for future food production and food security. The soil nutrient and water are essential component of soil, because roots of the plant comprise the essential parts for nutrient and water uptake. This scenario will cover three aspects of traditional farming of India: cultivation, biological method of pest management and locally available sustainable practices of crop protection. Double cropping, mixed cropping, crop rotation, agroforestry and livestock integrated agriculture practices, use of local varieties and resources with host pathogen interaction is some of the prominent traditional agricultural practices in India which must be strengthened in view of the environment and food security. Such practices have a significant role in achieving the sustainability of agriculture by improving nutrition quality. There is a demand to practices such agricultural practices for the sustainability of environment and food production.



OSMOTIC DEHYDRATION PROCESSING TECHNIQUES OF FRUITS AND VEGETABLES COMBINED WITH DRYING METHODS FOR SUSTAINABLE FOOD PRODUCTION

Rekha Yadav*, Pooja and Neetu

Department of Foods & Nutrition, CCS HAU, Hisar

Department of Food & Nutrition, PAU, Ludhiana

**Email: rekhayadav 99@hau.ac.in*

Abstract

Processing of fruits and vegetables is very important to reduce the wastage of foods and make them available throughout the year. Fruits and vegetables are highly perishable because of their high water content. To increase the shelf life of these fruits and vegetables, many methods or combination of methods had been tried. The food industries are looking for different preservation methods for fruits and vegetables. Drying is one of the oldest methods for preservation processes available to the mankind. Osmotic dehydration is one of the best and suitable methods to increase the shelf life of fruits and vegetables. This process is preferred over others due to their vitamin and minerals, color, flavor and taste retention property. It has also proven that combination of osmosis and drying method to improve the food quality is efficient. Pre-treatments also lead to increase the osmotic process in fruits and vegetables. Osmotic dehydration is a mass transfer process in which water molecules from the food move to an osmo-active solution and the solutes from the solution migrate into the food. Some advanced osmotic dehydration techniques such as electric field pulse treatment, ultrasonic and microwave-assisted dehydration, pulsed vacuum, and osmo dehydrofreezing can improve the nutritional quality (bioactive) and sensory properties (color, texture, aroma, flavor) of fresh and cut-fruits without changing their reliability. Osmotic dehydration technologies also preserve the structure of fruit tissue by forming microscopic channels and increasing effective water diffusivity. However, it is very important to analyze the effect of advanced osmotic dehydration techniques on the quality of food products to understand the industrial scalability of these techniques.

CROPPING SYSTEM – A WAY FOR SUSTAINABLE AGRICULTURE

Rekha Kharra

Rajasthan College of Agriculture, Maharana Pratap University Agriculture and Technology, Udaipur

Email : nrkharra11@gmail.com

Abstract

India is a vast country with total geographical area of 329 Million hectare which is about 2 per cent of the world. Decline in per capita land availability (0.09 ha by 2050). The country has to provide food and fodder to huge human and livestock population. Increase in human population (1.61 Billion by 2050). It is required to boost the production of food grain for: Human consumption and Green and dry fodder for livestock. Cropping systems maintain and manage the soil fertility to the development of sustainable agriculture production system. Sustainable agriculture production system maintains an acceptable and increased level of productivity that satisfies prevailing needs and is continuously adapted to meet future demand. Cropping system is a land-use unit comprising soils, crop, weed, pathogen and insect subsystems that transform solar energy, water, nutrients, labour and other inputs into food, feed, fuel and fibre. The cropping system is a subsystem of the farming system. In other words, cropping system is pattern of crops taken up for a given piece of land over a fixed period and their interaction with farm resources and other farm enterprises.

CLUSTER ANALYSIS FOR WHITE RUST AND ECONOMICALLY IMPORTANT TRAITS IN INDIAN MUSTARD

Richa Sharma, Manmohan Sharma and R.K. Salgotra

School of Biotechnology, SKUAST-Jammu (J&K), India-180009

Email: richabiotech2@gmail.com

Abstract

Ninety genotypes of *Brassica juncea* belonging to European and Indian gene pool were evaluated for five economically important traits such as white rust resistance, grain yield/plant (g), oil content (%), erucic acid (%) and glucosinolates



(μ mole/g). Three genotypes (Donskaja IV, Domo and Cutlass) showed no infection and they were considered as immune against white rust. Maximum grain yield/plant was recorded in the genotypes DRMR-2017 (19.07 g) followed by J807/1/6 (18.36 g) and Vardan (17.72 g). Maximum oil content was found in PGR 12573 and EC 287711 (44.16%) followed by Stoke (44.01%) and Jubilejnaja (43.54%). Minimum erucic acid (12.18%) and glucosinolate content (28.92 μ mole/g) content was found in genotypes Donskaja IV and Heera, respectively. The genotypes were grouped into different clusters using R-Studio software. The population was divided mainly in two main clusters and five clusters indicating significant genetic variation in the germplasm. The maximum cluster distance (83.27) was observed between cluster 3 and cluster 5 followed by cluster 2 and cluster 5 (29.20) and between cluster 1 and cluster 3 (57.72). It indicated maximum genetic diversity between these pair of clusters; and possibility of developing high yielding, better quality and white rust resistant genotypes through hybridization between genotypes belonging to contrasting clusters.

EARLY GENERATION IDENTIFICATION AND SELECTION OF SUPERIOR TRANSGRESSIVE SEGREGANTS FROM INTER-VARIETAL CROSSES OF F₂ AND F₃ GENERATIONS OF BLACKGRAM (*VIGNA MUNGA* L. HEPPEL)

Rhitisha Sood^{1*}, Ajay Chauhan¹ and R.K. Mittal²

¹Department of Genetics and Plant Breeding, College of Agriculture, CSKHPKV, Palampur, India

²Department of Vegetable Sciences, CCS HAU, Hisar, Haryana, India

*Email: rhitishasood5529@gmail.com

Abstract

Blackgram, originating in India, is a widely grown self-pollinating short-duration leguminous crop. Central Asia is the secondary centre of origin with *V. mungo* var. *silverstris* as its progenitor, which belongs to the Fabaceae family. It contains a bunch of nutrients, including protein (25-28%), carbs (62-65%), fibre (3.5-4.5%), ash (4.5-5.5%), oil (0.5-1.5%), amino acids (methionine, lysine), vitamins (thiamine, niacin, riboflavin), and a few micronutrients (P and Fe). Even though the crop's production potential is stuck due to factors such as a low and limited genetic foundation, which in turn limits genetic variability, a lack of high yielding cultivars, a poor plant ideotype, planting in marginal and harsh areas, and susceptibility to biotic and abiotic stresses. To get around this, the study's primary objective was to identify transgressive segregants for desirable multiple traits in the early generations of black gram from 14 different cross combinations. Kharif 2018 and Kharif 2019 RBD evaluations were conducted over three replicates. Transgressive segregation fraction was found to be between 0-6.67% (F₂) and 33.33-100% (F₃) for seed yield per plant. Most segregants showed transgressions for seed yield together with one or more other variables, indicating that these traits are genetically linked and subject to linkage drag. In both generations, seven of the 14 crosses namely IC-398973×Him Mash-1 (plant no. 7,4), IC-281993×Him Mash-1(plant no. 2,1,5), IC-281980×HPBU-111 (plant no. 1,3), IC-281982×HPBU-111 (plant no. 4,8), IC-413306×HPBU-111 (plant no. 9,7), IC-413306× Him Mash-1 (plant no. 5,10) and IC-413304×HPBU-111 (plant no.5,8,6) scored the most promising transgressive segregants than the better parent and best check showing enhanced seed yield performance and other related qualities that help to exploit the maximum intensity of desired traits that is not present in the parents providing a wealth of opportunities for careful genotype selection and the introduction of advantageous alleles for blackgram breeding programmes in later generations to produce the desired plant genotype.

MELISSOPALYNOLOGICAL ANALYSIS OF HONEYS FROM MID HILL ZONE OF HIMACHAL PRADESH

Rohini Sharma^{1*}, Meena Thakur¹, Diksha Devi¹ and Sunita Devi²

¹Deptt. of Entomology, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, HP-173230

²Deptt. of Basic Sciences, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, HP-173230

*Email: rohiniyspu43@gmail.com

Abstract

Analysis of pollens in honey (melissopalynology) is an important parameter which provides relevant information about melliferous sources for honey bees in particular region. Thus, helps the beekeepers to frame proper management during dearth periods and also checks the fraud labelling of honey. Melissopalynological analysis of nine honey samples of *Apis mellifera*



collected from mid hills (Zone-II) of Himachal Pradesh was done during the year 2020-21. Three honey samples were collected each from Kangra, Mandi and Solan district of Zone-II (mid hills zone). Pollen analysis revealed the presence of 50 pollen morphotypes belonging to 32 families with maximum pollen grains from family fabaceae followed by asteraceae and myrtaceae. Pollen spectrum analysis revealed that out of these nine honey samples, four were found as unifloral with predominant pollen grains of *Eucalyptus* sp. (48.40%) from Baijnath, *Syzygium* sp. (48.89%) from Ranital both from Kangra, *Sapindus mukorosii* (50%) from Kotli (Mandi) and *Callistemon* sp. (48.38%) from Nauni (Solan). Other important floral sources visited regularly by honey bees in mid hills were of *Psidium* sp., *Litchi* sp., *Toona* sp., *Foeniculum* sp., *Mangifera* sp., *Albizia* sp., *Punica* sp., *Aegle* sp., *Citrus* sp., *Acacia* sp., *Murraya* sp., *Carissa* sp., *Bauhinia* sp., *Dalbergia* sp., *Jacaranda* sp., *Aptenia* sp., *Calendula* sp. and *Duranta* sp. Among all honeys one sample from Mandi (Sandhol) placed under Group-IV which was very rich in pollen content (5,45,000 pollen grains per 10g of honey). The high diversity and variability of pollen grains indicated that the honey samples were from various botanical and geographical origins, and the presence of a large number of pollen types indicated that the honey samples were pure and unadulterated.

THE IMPACT OF PLANT-PARASITIC NEMATODES ON AGRICULTURE AND ITS MANAGEMENT

Rohit Kumar*, Shweta, Ritu Yadav Vinod Kumar and S.S. Mann

Department of Nematology, CCS HAU, Hisar-125004

*Email: kantiwal.rohit11@gmail.com

Abstract

Plant-parasitic nematodes (PPNs) are costly burdens of crop production. Ubiquitous in nature, PPNs are associated with nearly every important agricultural crop and represent a significant constraint on global food security. According to an estimate PPNs are causing much more damage annually compared to insect pests. They caused projected yield loss of 12.3% (\$157 billion dollars) worldwide. Out of which \$40.3 million is reported from India. Farmers/growers identified insect pests, and other constraints as production problems but overlooked plant parasitic nematodes. Nematode diseases are difficult to control because of their hidden nature and hence, more often overlooked. PPNs not only cause damage individually but form disease-complexes with other micro-organism and increased the crop loss. Also the symptoms of nematode damage are not specific, resemble with the symptoms of other pathogens and abiotic stresses such as water and mineral deficiency. Declining use of chemical pesticides has brought great attention to research in alternative methods of nematode control. The most widely used and successful cultural practices for managing plant parasitic nematodes are resistant cultivars and some elements of cropping systems, such as rotation crops, cover crops, or nematode-antagonistic crops. Exclusion and sanitation practices, such as use of nematode-free planting material, site selection, and weed management, are useful in limiting infestations. Soil solarization, organic amendments, biological control, fallow, flooding, timing of planting dates, or tillage practices may be helpful in some areas, but additional research is needed to optimize their use. Integrated nematode management can be promoted through farmers-nematologists interactions, local production of bio-control agents and strict chemical pesticide regulations.

EFFECT OF DIFFERENT PACKAGING MATERIALS ON STORAGE QUALITIES OF KINNOW MANDARIN (*CITRUS* × *RETICULATA* BLANCO) AT AMBIENT TEMPERATURE

Rohit Kumar*, Priya Awasthi and Subhash Chandra Singh

Banda University of Agriculture and Technology, Banda, Uttar Pradesh

*Email: rohitgautam958@gmail.com

Abstract

Kinnow is perishable in nature and cannot be stored for long periods at ambient conditions. Keeping this in view, a study was planned at Banda university of Agriculture & Technology, Banda (U.P.). Uniform fruits in size, colour, firmness and maturity were selected for experiment purpose. Different packaging materials via; Brown paper, Perforated brown paper, LDPE (25 micron), Perforated LDPE (25 micron), News paper, Corrugated Fiber Board boxes, the perforated packaging materials was used for study. Thereafter, the packed fruits were stored under ambient conditions (18-20°C & 90-95% RH). Kinnow fruit were analyzed for various physico-chemical characteristics after 0, 15, 30 and 45 days of storage period. Results revealed that minimum volume loss (0.226 %) and maximum total soluble solids: titrable acidity ratio was found in corrugated fiber board



boxes. Maximum weight (141.358 gram) was found kinnow fruits packed in perforated LDPE (25 micron) and minimum acidity were registered in corrugated fiber board boxes during the entire storage period. TSS (10.833 °Brix) was found to be maximum in control or no packaging while minimum physiological loss in weight (0.099 %) was recorded in fruits packed in corrugated fiber board boxes. It can be concluded that the storage deterioration can be reduced by corrugated fiber board boxes and fruit quality can be maintained up to 45 days at ambient conditions without much deterioration.

EFFECT OF REFRACTANCE WINDOW DRYING AND CONVECTIVE DRYING ON PHYSICOCHEMICAL QUALITY OF CORIANDER POWDER

Ruchika Zalpouri^{1*}, Manpreet Singh² and Preetinder Kaur¹

¹Department of Processing and Food Engineering, Punjab Agricultural University, Ludhiana, Punjab

²Department of Renewable Energy Engineering, Punjab Agricultural University, Ludhiana, Punjab

*Email: zalpouri28@gmail.com

Abstract

Coriander (*Coriandrum sativum* L.) is a highly perishable crop with a shelf-life of a few days under refrigerated conditions. To increase its storage life, drying is most suitable postharvest treatments that can be applied. In this study, coriander roots and thick stems were removed manually and leaves along with fine stems were hot water blanched and pureed. The layer of 2 mm thick coriander puree was dried using two different drying methods viz. refractance window drying (water temperature: 70°C) and convective drying (50°C). The physicochemical quality attributes viz. colour (L* and b* value), total chlorophyll content, total flavonoid content, hygroscopicity of dried coriander powder were assessed. The results showed that drying method significantly ($p < 0.05$) affected the physicochemical quality of coriander powder. Drying of coriander puree with refractance window dryer witnessed higher colour indices (L* and b* value) due to retention of total chlorophyll content and total flavonoid content than that of convective dried samples. Also, the refractance window dried samples had lower drying time and hygroscopicity than convective dried samples. Therefore, it was concluded that refractance window drying (RWD) can be used as an effective and low-cost processing technology for drying of coriander puree within shorter drying time along with better-quality.

IMPACT OF FOLIAR NUTRITION ON GREENGRAM PRODUCTIVITY

S. Anandha Krishnaveni

Tamil Nadu Rice Research Institute, Aduthurai 612101, Thanjavur Dist., Tamil Nadu, India

Email: agroveni@gmail.com

Abstract

Green gram (*Vigna radiata* L.), is a third important pulse crop after chickpea and red gram. It contains 25 per cent protein which is two to three times more than cereals. In Tamil Nadu, the area under green gram is 1.01 L ha, the production of 0.608 L t and productivity of 605 kg ha⁻¹. It is one of the important short duration grain legumes which improve the soil and biodiversity. Proper nutrient management is also one of the important factors for sustained production on sodic soil due to their poor fertility status. Sodic soil contain sodium salts which decreases substrate water potential and thus restricts water and nutrient uptake by the roots, high salinity and pH may also cause ionic imbalance and toxicity in plants. Application of plant nutrients through foliar spray resulted in efficient absorption. Keeping this in view, the field experiment was conducted at Anbil Dharmalingam Agricultural College and Research Institute, Tiruchirapalli during summer season 2018-19 to study the effect of foliar application of nutrients on green gram variety (VBN 2) under sodic soil. The experiment was laid out in Randomized Block Design (RBD) with eight treatments and three replications. The entire dose of recommended dose of fertilizer of 20:40:20:20 kg ha⁻¹ N: P₂O₅:K₂O: S is applied as basal. Urea, Di-ammonium phosphate, Murate of potash and Phosphogypsum were used as sources of nitrogen, phosphorous, potassium and sulphur, respectively. The treatments consisted of control foliar application of water spray (T₁), DAP @ 2 % (T₂), KCl @ 2% (T₃), TNAU Pulse wonder @ 2 kg/ac (T₄), Panchagavya @ 5% (T₅), Cow urine @ 5% (T₆), Vermiwash @ 5 % (T₇), PPFM 2 % (T₈) was given. First spray was given at flower initiation and second spray at 15 days after the first spray. The results revealed that TNAU Pulse Wonder @ 2 kg ac⁻¹ at flowering enhances the productivity in green gram under sodic soil condition. Moreover, this study gives the option to the farmers i.e., if the farmer likes inorganic foliar nutrition (TNAU pulse wonder) and organic nutrition (Panchgavya @ 5 %) would be adopted.



STUDY OF GENETIC VARIABILITY AND CHARACTER ASSOCIATION FOR YIELD AND YIELD CONTRIBUTING CHARACTERS IN BLACK GRAM [*VIGNAMUNGO* (L.) *HEPPER*]"

Sapurma Anvesh*, Gabrial M. Lal and Bhoga Jyothi

Deptt. of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad

*Email: anveshstar006@gmail.com

Abstract

The research was investigated to evaluate the genetic variability characteristics, correlation, and path analysis that would aid in the selection of criteria for black gram seed yield among twenty black gram genotypes for 13 quantitative traits grown in kharif -2021. Genotype IPU-99 (9.72 g) showed the highest mean value for seed yield per plant and its associated characters. Low difference between genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) for most of traits studied indicated the little influence of environment and predominant role of additive gene actions, which is further evident by values of heritability coupled with high genetic advance as percent of mean for yield contributing traits such as number of pods per plant and number of clusters per plant. Correlation analysis revealed that, seed yield per plant exhibited a highly significant positive association with seed weight, plant height and days to maturity. Harvest index, number of pods per plant, biological yield per plant, seed weight and days to 50% flowering have exhibited positive direct effects on seed yield. Therefore, selection programme should be based on these traits to crop improvement with high yielding genotypes of black gram.

AGRICULTURAL EQUIPMENTS AND BRAND SELECTION: EVALUATION OF FARMERS' CHOICE PERTAINING TO SELECTION OF DIFFERENT BRANDS IN JAMMU DISTRICT OF J&K

S.P. Singh*, Kartikey Srivastava, Sudhakar Dwivedi, Anil Bhat, Ashish Verma and Goldy Bhagat, Yamini Raut, Tarunjeet Singh, Maninder Singh and Sugam Sharma

Division of Agril. Economics & ABM, SKUAST-Jammu-180009

*Email: singh_sp073@yahoo.com

Abstract

Agricultural equipment and machinery helps farmers to produce the goods that consumers want and need. Without proper machinery and equipment, farmers would not be working hard enough to provide food and other supplies. The paper discusses about three farming equipment that are mostly used by farmers for cultivation of crops i.e., Rotavator, Disc plough and Cultivator with relevance to the brands that were mostly chosen by the farmers. The results of the study reflected that brand named "Sonalka" for rotavator had the most preference with around 66 % market-cap. For the similar study in cultivator reflected that brand named "Agro King" had the most market-cap with around 62% of total share. Study was also conducted for Disc plough in the similar aspect which showed that brand name "Land force" had the major stake with approximately 26% of the market-cap.

CARBON DYNAMICS IN ESTUARINE MANGROVE DOMINATED ECOSYSTEMS OF INDIA: BHITARKANIKA, SUNDARBAN AND PICHAVARAM

Samayita Basu

Department of Soil Science, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal

Email: sbasu2509@gmail.com

Abstract

Soil carbon is considered to be one of the best parameters to assess soil fertility and soil health. Carbon can be stored or sequestered in different fractions like total soil carbon, soil inorganic carbon, soil organic carbon, recalcitrant carbon etc. As the mangroves are specialized to sequester soil carbon efficiently in terms of green carbon, 3 different tropical mangrove ecosystems of India namely Bhitarkanika (Orissa), Sundarban (West Bengal) and Pichavaram (Tamil Nadu) had been selected to understand the soil carbon dynamics. Soil samples were collected from 40 different places and prepared using standard methods. Different physical and chemical parameters like pH, BD, EC along with different fractions of carbon, MBC were analyzed. Soils were neutral to alkaline in reaction, coastal alluvial, frequently waterlogged and influenced with the sediments



and salty-water during tidal inundation. EC ranged from 4.24-5.36 dS.m⁻¹ in mangrove and 0.7-2.7 dS.m⁻¹ in MR. BD value of mangrove (1.25 Mg.m⁻³) was significantly higher than MR (1.2 Mg.m⁻³). OC value of mangrove (9.36 Mg.ha⁻¹) was also significantly higher than MR (7.54 Mg.ha⁻¹). The TC content of Mangrove was found to be 6.9% and 9.5% higher than rice and mangrove rice soil respectively. There was a slight increase in TOC stock under mangrove vegetation (16.9 Mg.ha⁻¹) over MR (16.35 Mg.ha⁻¹). RC of mangrove soil varied from 2.86 to 14.56 Mg.ha⁻¹, whereas that of MR system varied from 3.12 to 18.72 Mg.ha⁻¹. Soil CO₂ efflux values were highly correlated with soil temperature. The carbon dynamics of these estuaries were predominantly influenced by river discharge and seawater inundation. Among all, SIC of Sundarban was the highest but SOC was higher in Bhitarkanika than Sundarban and Pichavaram. Highest percent contribution of RC to TOC under mangrove ecosystem (38.9%) than rice ecosystem (27.3%) resulted in sound build-up of stable C which proves the mangroves to be efficient stabilizer of soil organic carbon.

INFLUENCE OF BIOFERTILIZER, LIQUID ORGANIC MANURES ALONG WITH RDF ON GROWTH OF OKRA

S.D. Jadhav^{1*}, S.J. Shinde¹, K.D. Deshmukh¹, P.D. Jadhav² and B.M. Kharat¹

¹Department of Horticulture, V.N.M.K.V, Parbhani, India. 431402

²Department of Agricultural Entomology, Dr. P.D.K.V., Akola, India.

Email: sonamjadhav0123@gmail.com

Abstract

An experiment was conducted at Department of Horticulture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, during *kharif* 2019 to study the influence of biofertilizer, liquid organic manures *Viz.*, Panchagavya, Vermiwash, Jeevamrit and Cow urine on growth of okra in the open field condition. The experiment was laid in Randomized Block Design with fifteen treatments replicated twice by using the variety Parbhani Kranti. Different concentration of liquid organic manures like Panchagavya (500 lit/ha), Vermiwash (100 lit/ha) and Cow urine (100 lit/ha) were given at 15, 45 and 75 DAS through foliar spray and Jeevamrit (500 lit/ha) and biofertilizer like *Azospirillum* (2.5 lit/ha) was applied through drenching at 15, 45 and 75 DAS along with Recommended dose of fertilizers (N:P:K::100:50:50). The result revealed that the significantly highest plant growth in terms of height of plant, number of branches, stem girth, number of leaves, number of nodes, inter nodal length was recorded with the application of T₁₄ [RDF + Jeevamrit + Vermiwash + Panchagavya] and it was found to be significantly superior over other treatments and gives best results as compared to Control (100:50:50 N:P:K kg/ha). Overall vegetative parameters were influenced due to application of nutrient through combination of organic liquid manures, biofertilizer and RDF were proved beneficially for increasing growth of okra crop. Maximum plant growth of okra with the application of T₁₄ [RDF + Jeevamrit + Vermiwash + Panchagavya], which might due to the increased availability of nutrient at initial stage through recommended dose of fertilizer (100:50:50 NPK/ha) in addition to nutritional & other benefits from liquid organic manures as compared to RDF alone.

VALIDATION OF OVYSYNCH AND HEATSYNCH PROTOCOLS IN POSTPARTUM ANOESTRUS COWS AT FARMER'S FIELD

Shailendra Kumar Rajak*, Arvind, Kr. Singh, Ravindra Kumar, Sushil Prasad, Susvi Kumari & Umesh Kumar

Deptt. of Livestock Production and Management, Ranchi Veterinary College, Birsa Agricultural University, Kanke, Ranchi

*Email : shailendra06rajak@gmail.com

Abstract

Anoestrus in dairy cattle mainly occurs due to poor nutrition, hormonal imbalance, infection and environmental stress. This hinders the productive and reproductive capacity of animals as well loss to the farmers in terms of money, labor and infrastructure. Synchronization of estrus manipulates cycle of animals and bring the batch of females into heat at predetermined time and scheduled calving in a favorable season. Hence, it is considered as one of the advanced management processes through which humane and management errors could be minimized. Therefore, present experiment was conducted for Validation of Ovysynch and Heatsynch protocols in postpartum anestrus cows at different village under Krishi Vigyan Kendra, Parsauni & Piprakothi, East Champaran district of Bihar. Total 30 postpartum anestrus crossbred female animals were selected having similar parity and divided randomly into 3 groups, containing 10 animals in each group, *Viz.*, Farmer Practice



(PF-Dewormer 3g +Phosphorous 80 mg i/m+multi mineral@1 bolus orally for 7 days), Treatment 1 (Ovy Synch -GnRH 10 ug, D7; PGF2 alpha 500 ug; D9; GnRH 10 ug and D10; Fixed time AI), Treatment 2 (Heat synch- GnRH 10 ug, D7; PGF2 alpha 500 ug; D8; Oestradiol 1 mg; D10; Fixed Time AI). Finding of the present study indicated that T1 animals exhibit higher concept rate (70%) followed by T2 (60%) and FP (50%), respectively. Similarly, the benefit cost ratio was found higher in T1 followed by T2 and FP, respectively. From the results of the present study, it may be concluded that ovsynch protocols give better results in terms of conception and B: C ratio at farmer's field.

UNDERSTANDING CONSUMER PREFERENCE FOR FRESH POTATOES BY USING CONJOINT ANALYSIS

Saptaparna Karmakar* and Debabrata Basu

Department of Agricultural Extension, BCKV, Mohanpur, Nadia, West Bengal-741252

*Email: saptaparna121997@gmail.com

Abstract

Market-led approach considered consumers as the most important stakeholders in the value chain. Therefore, an in depth understanding of consumer preferences is precursor for the development of agro-food industries across the globe. In India, potato is a primary vegetable in terms of domestic consumption and production. This study analyses consumer preference pattern for fresh potatoes in West Bengal by using conjoint analysis. Price, texture and size- three attributes were selected for the study. Three levels of price were selected i.e. above ₹ 20, ₹ 10-20 and below ₹ 10. Two levels of texture i.e. sandy and gummy were selected. Three levels of size i.e. large, medium and small were selected. These levels and attributes were selected based on pretesting. Data is collected by administering questionnaires to randomly selected hundred consumers in Tarakeswar municipality. Respondents were asked to rate 18 cards according to their preference. Rating scale is fixed at 1 to 18 [where 1= Best/most preferable combination; 18= Worst/least preferable combination]. This analysis determined utility of different levels of attributes. Findings after calculating utility of different levels showed that sandy texture was preferred by the consumer over gummy texture. Medium size of potato was preferred by the respondents followed by large and small size respectively. Below ₹.10' was the most preferred level of price attribute followed by '₹.10-₹20' and 'Above ₹.20'. After calculating relative importance of attribute, it was found that texture was more important to buyers followed by price and size respectively. This study provides feedback to the production sector who must consider the preference pattern of their downstream buyers to increase their profits.

PROCESS STANDARDIZATION OF NUTRI-RICH RAGI (*ELEUSINE COROCANA*) PRODUCTS

S. Patel¹* and Veenu Verma²

¹Indira Gandhi Krishi Vishwavidyalaya, Raipur-492 006, Chhattisgarh, India

²Government Polytechnic College, Mahasamund, Chhattisgarh, India

*Email address: patels47@rediffmail.com

Abstract

Finger millet is in food use since time immemorial and large number of traditional food preparations are in practice in the rural areas (predominantly tribal areas), particularly in the production catchments. Finger millet is also known as *ragi* in India and one of the important cereals occupies highest area under cultivation among the small millets. Finger millet is comparable to rice with regard to protein (6-8%) and fat (1-2%) and superior to major cereals like rice and wheat with respect to mineral and micronutrient contents. It is a major source of dietary carbohydrates for a large section of society. However, its utilization in the daily dietary at present is largely restricted to rural areas/tribal areas only. Unavailability of products to the taste of urban community is the main reason for its lesser consumption. Processing the finger millet using traditional as well as modern techniques for the development of value added and convenient food products would be the possible solution for its promotion and enhancement of consumption, nutritional status and thereby increasing profitability and better livelihood to the tribal community. In present investigation, number of food products were attempted by mixing other cereals in definite proportions and evaluated for their acceptability among the different age groups of consumers. All the products demonstrated a well acceptable score. The study indicated an encouraging scope for the formulation of newer foods to combat the nutritional deficiency of tribes in particular and rural segment of rural population in general.



FINANCIAL AND MARKETING PROBLEMS FACED BY FARM WOMEN

S. Prathibha* and R. Geetha Reddy

*Dept. of Extension Education & Communication Management, College of Community Science, Professor Jayashankar
Telangana State Agricultural University, Hyderabad, Telangana-500004*

**Email: prathibha.surkanti2526@gmail.com*

Abstract

Women make up 43% of the agricultural workforce in the developing countries, yet they typically have to make do with less access to resources like water, fertilizer, and market outlets than men. Rural women farmers experience discrimination on many different levels. In spite of the fact that women make up one-third of the workforce globally, they have much less access to, control over, and ownership of land than males do. According to the Food and Agriculture Organization (FAO) of the United Nations, women just represent 12.8% of the world's agricultural landholders. Financial and marketing issues are a concern for female farmers. They support farming in various ways rather than being engaged in financial matters like bank accounts, loans, etc. They face with inequity while simultaneously being obliged to care for cattle or perform other related tasks. Women's access to finance is impacted by differences in the ownership and control of physical assets between men and women as well as differences in human and social capital. The combination of decreased productivity, restricted access to superior inputs, and fewer opportunities to develop technical skills frequently results in lower yields. Farm women are facing problems in the marketing of agricultural produce due to lack of proper education, knowledge on market information (price and demand), lack of marketing channels for selling the farm produce, as they are more indulging in agricultural activities like sowing, weeding, transplanting etc. Women will be recognized as farmers and be able to access loans, inputs, and marketing channels if their land rights are protected and infrastructural assistance for women farmers will be improved. Governments and policymakers have the ability to implement and foster a framework that makes it easier for women working in agriculture to access financial services.

GENETIC VARIABILITY STUDIES IN RICE (*ORYZA SATIVA* L.) FOR YIELD AND ITS RELATED ATTRIBUTES

Sudhakar Reddy Basu

Department of Genetics and Plant Breeding, Agricultural College, Bapatla, Guntur District, Andhra Pradesh, India

Email: basusudhakarreddy@gmail.com

Abstract

The present investigation was undertaken with 49 rice genotypes to estimate genetic variability of the genotypes among yield and yield attributing characters. Observations were obtained for days to 50% flowering, plant height, ear bearing tillers, panicle length, filled grains per panicle, unfilled grains per panicle, spikelet fertility, test weight and grain yield per plant. Analysis of variance showed highly significant differences due to treatments for all the characters. A wide range of phenotypic and genotypic coefficient of variability was observed. The high magnitude (>20%) of PCV along with GCV was observed for filled grains per panicle, unfilled grains per panicle, test weight and grain yield per plant. Whereas, days to 50% flowering, plant height, filled grains per panicle and unfilled grains per panicle showed high estimates of heritability. Filled grains per panicle, plant height and unfilled grains per panicle showed high genetic advance in percent of mean. The present study revealed that there was highly genetic variability among the tested genotypes, indicating that it could be used for further improvement in rice breeding.

CHARACTERIZATION OF NATU TOBACCO GERMPLASM LINES IN SCARCE RAINFALL ZONE OF ANDHRA PRADESH

S. Rama Devi and P. Pulli Bai

Regional Agricultural Research Station, Nandyal, A.P. India

**Email: ramagpbr@gmail.com*

Abstract

A study for characterization of seventeen natu tobacco (*Nicotiana tabacum* L.) lines was taken up in scarce rainfall zone of Andhra Pradesh during 2021-22. A total of sixteen agro- morphological and yield attributing characters were recorded for the



studied germplasm lines. The range of traits observed was- days to 50% flowering: 112 days (NyNT 94) to 139 days (WAF); inter nodal length- range 2-4 cm; leaf length- 42 cm (NyNT 64) to 72 cm (Bhairavi); leaf width – 13.2 cm (NyNT 92) to 30 cm (NyNT 94); Suckering habit – low (10 entries), medium (6 entries) and high (1 entry); plant height- 89 cm (NyNT 65) to 132 cm (Bhairavi); leaf thickness (mg/cm²) –7.35 (NG 50) to 12.25 (II 1870); leaf colour- light green to dark green, leaf shape- lanceolate and oblong; Gummyiness- low (4 entries), medium (12 entries) and high (1 entry); days to maturity –142 days (NyNT 94) to 165 (Bhairavi) and cured leaf yield per plant (g/pl.)– 45.5 (NyNT 89) to 80 (WAF). The best lines identified for yield traits are NyNT 64, NyNT 70, WAF, NYNT 94, II1870 and Bhairavi can be utilized in tobacco breeding programmes to develop high yielding natu tobacco varieties specifically suited for scarce rainfall zone of Andhra Pradesh.

EFFECT OF LAND CONFIGURATION AND CROP RESIDUE MANAGEMENT ON YIELD OF SOYBEAN (*GLYCINE MAX* (L.) MERRILL)

S.S. Kinge^{1*}, A.J. Rathod², M. N. Wairagade³, G.A. Bhalerao⁴ and Y.S. Chavan⁵

^{1&2}Department of Agronomy, VNMKV Parbhani, India. 431402

³Department of Agronomy, College of Agriculture Nagpur, 440012.

⁴Department of Agronomy, VNMKV Parbhani, India. 431402

⁵Department of Agronomy, BSKKV Dapoli, Maharashtra India. 415712

*Email: sunilkinge40@gmail.com

Abstract

A field experiment was conducted at experimental farm of Agronomy Department, Vasant Rao Naik Marathwada Krishi Vidyapeeth, Parbhani during *kharif* 2009 with entitled “Studies on Effect of Land Configuration and Crop Residue Management on yield of Soybean (*Glycine max* (L.) Merrill)”. The experimental plot was laid out in split-plot design included fifteen treatment combinations replicated thrice. Among land configuration practices (L₂) broad bed furrow was found superior over the (L₁) flatbed and at par with (L₃) ridges & furrow in respect of yield attributes *viz.*, weight of pods plant⁻¹, seed yield plant⁻¹, number of seeds plant⁻¹ and seed index as well as grain, straw and biological yield including harvest index. Among the crop residue management practice application of (CR₄) crop residue @ 2.5 tones ha⁻¹ + 10 kg ha⁻¹ decomposing microorganism were recorded significantly superior in respect of yield attributes *viz.*, weight of pods plant⁻¹, seed yield plant⁻¹, number of seed plant⁻¹, seed index and also grain, straw and biological yield with harvest index respectively.

INTEGRATED WEED MANAGEMENT IN TRANSPLANTED AROMATIC RICE (*ORYZA SATIVA*) IN RAINFED CONDITION OF JHARKHAND

S.S. Kumar, K.K. Binjha, A.C. Panday and N. Salam

Zonal Research Station, Darisai, East Singhbhum, BAU, Ranchi, Jharkhand

Email: kumarshambhu.16@gmail.com

Abstract

The field experiment was conducted at Zonal Research Station, Darisai, East Singhbhum, Birsa Agricultural University, Ranchi, Jharkhand during *khari* fseason from 2020 and 2021 to study the integrated weed management in transplanted aromatic rice to find out the most suitable and effective weed management practices in medium land under rainfed condition of sub agro climatic zone-VI. The experiment comprises of seven treatments i.e., T₁- pretilachlor 1 kg/ha, PE, T₂- bispyribac sodium 25 g/ha, POE, T₃- pretilachlor 1 kg/ha + bispyribac sodium 25 g/ha, T₄- pretilachlor 1 kg/ha + one hand weeding (20 DAT), T₅ - bispyribac sodium 25 g/ha + one hand weeding (20 DAT), T₆- hand weeding at 20 and 40 DAT and T₇- weedy check in randomized block design which were replicated thrice resulted that Among different weed management practices application of pretilachlor 1 kg/ha + bispyribac sodium 25 g/ha recorded significantly higher seed yield (40.87 q/ha) and straw yield (66.20 q/ha) of transplanted aromatic rice and it was found at par with bispyribac sodium 25 g/ha + one hand weeding at 20 days after transplanting. The highest weed control efficiency (85%) was observed with the treated plot pretilachlor 1 kg/ha + bispyribac sodium 25 g/ha and which was followed by treatment bispyribac sodium 25 g/ha + one hand weeding at 20 days after transplanting (81.45 %). Whereas, the maximum net return (Rs. 60192/ha) and benefit: Cost ratio (2.23) was recorded with pretilachlor 1 kg/ha + bispyribac sodium 25 g/ha and which was followed by bispyribac sodium 25g/ha + one hand weeding at 20 days after transplanting. Hence, on the basis of above findings pretilachlor 1 kg/ha +



bispyribac sodium 25 g/ha might be established as best treatment due to proper weed management in the treatments reduced weed density and weed dry matter which was responsible for higher weed control efficiency there by recorded maximum seed yield, straw yield, net return and benefit : cost ratio.

PSYCHOLOGICAL IMPACT OF SOCIAL MEDIA ON STUDENTS

Soothram Sahithya* and Prakash Panwar

Dept. of Extension Education and Communication Management, Maharana Pratap University of Agriculture and Technology,
Udaipur 313001, Rajasthan

*Email: sahithi7777.sc@gmail.com

Abstract

The modern man's way of life is heavily dependent on technology. Technologies are important in many sectors. The term "Internet" was coined a few years ago. One of the most significant inventions of the twenty-first century is the smartphone. These phones provide people with instant Internet access (Swain and Pati, 2019). China, India, and the United States have the most Internet users combined. The twenty-first century is also known as the "Internet Era." People can use the internet to participate in social networking sites (SNSs) and online trading sites. It has significantly altered how people communicate with one another (Sahin 2018). University students frequently use social media platforms. They spend a significant amount of time on these sites as part of their daily lives (Azizi *et al.*, 2019). College students had a high prevalence of psychological symptoms. Health risk communication and usage social media were found to be important predictors (Li *et al.*, 2020). Studies published were thought to reveal positive social and psychological adjustments in terms of social media use and interaction, implying that social media has positive effects on social adaptation and psychological well-being for international students (Lin *et al.*, 2012). Sandel discovered that greater host interpersonal communication via Facebook was associated with higher levels of socio-cultural, academic adaptations and psychological well-being among foreign students (Sandel, 2014). Similarly, it has negative consequences, such as an increased risk of depression, loneliness, or social isolation. An online survey suggested that being in frequent communicate with home country nationals via social media could make them to suffer homesickness (Hendrickson, *et al.*, 2011). SNS use for recreational functions could increase students' sense of loneliness in Japan (Guo, *et al.*, 2014). Using SNS to interact with relations in home society is associated with psychological alienation (Hofhuis, *et al.*, 2019).

ROLE OF NANOTECHNOLOGY IN PEST MANAGEMENT

Sakshi Singh^{1*} and Sudha Singh²

Deptt. of Vegetable Science, Dr.Yashwant Singh Parmar University of Horticulture & Forestry, Nauni-Solan HP, India 173230

*Email : singhsakshi577@gmail.com

Abstract

Pest management in plants is a serious challenge faced by agriculturist in the present era. Horticultural and field crops are more vulnerable to the attack of insects-pests which have become more widespread geographically as a result of escalating global trade and environmental change, leading to significant reduction in yield to the tune of 40-50%. Larvae and adult insects have been most lethal and therefore, various management techniques from the very beginning to present such as cultural, mechanical, biological, chemical methods, etc have been in practice. More than 90% of pesticides are run off into the environment and remain in agricultural products during the application process due to the drawbacks of standard pesticide formulation, which also include the use of hazardous solvent, dust, drift, and inadequate dispersion. Loss of biodiversity leading to ecological imbalance, insect resistance, outbreaks, environmental degradation and risks to human health are the issues caused by the disorganised and excessive use of the chemicals. Therefore, nanotechnology provides green and efficient alternatives for the management of insect pests without harming nature. Small size, large surface area with less quantity requirement are the properties of the nanomaterial for effective pest management. Nano-formulation provides selective, targeted and long term controlled release of pesticides, which is ecologically more viable. Nano encapsulation, nano-emulsions and nanogels are the various nano-formulations which enhance solubility and dissolution properties of poorly water-soluble substances. Nanostructured alumina, nano-structured gold, nano-silver (Ag), nano-cadmium sulfide (CdS) are the metal and metal oxide nanoparticles having insecticidal efficacy. Nanostructured botanicals such as azadirachtin,



rotenone, carvacrol, thymol, curcumin etc prove very effective against insect pests. Overall, nano based insecticides becomes a better alternative of conventional insecticide and reduce the pesticide load on environment.

PRECISION HORTICULTURE FOR AUGMENTING FARMER'S INCOME

Sandeep Gautam¹, Supriya^{1*}, Neeraj Verma¹, Harshit Mishra¹ and Diksha Bohra²

¹Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya

²Maharana Pratap University of Agriculture and Technology, Udaipur

*Email: supriyaanand55@gmail.com

Abstract

Precision farming, one of the most sophisticated and cutting-edge techniques accessible, is becoming more and more popular in sustainable horticulture and agriculture as we approach the end of the 20th century. It is a concept- and information-based management system for monitoring and responding to intra-field changes, made possible by the current availability of various cutting-edge technologies in the agricultural industry. These modern technologies, which are used to evaluate and analyse changes in agricultural and horticultural productivity, include GPS, GIS, plant and pest sensors, yield monitoring tools, remote sensing, and variable rate technology. Farmers are now capable of recognizing, analyse, and manage the geographical and temporal variability of soil and plants for maximum profitability and productivity, sustainability, and conservation of the land resources. Precision in time and space is what makes GPS special. It has two benefits for agriculture. One is in connecting and combining simulation models with GIS data (soil, crop, and weather field history). Another is to assist the engineering department in building GPS-guided machines and implements (variable rate applicators) for precision agriculture. In order to determine the best time for harvesting water resources, calculate the amount of fertiliser needed, and more precisely predict crop performance, wireless sensor networks are used. The use of sensors and precision farming in horticulture attempts to increase productivity while lowering production costs and farming's negative environmental impact. The primary goals of precision farming adoption in India are to raise agricultural output, environmental quality, and farmer livelihoods. Despite being extensively done in wealthy nations, it is still in its infancy in the majority of developing nations and requires coordinated and long-term efforts.

IMPACT OF CLIMATE CHANGE ON BIODIVERSITY, AGRICULTURE, FOOD SECURITY AND HUMAN HEALTH

Sarla meena

Department of Agricultural Economics and Management, RCA, MPUAT, Udaipur-313001, Rajasthan.

Email: Sarlameena57@gmail.com

Abstract

Climate change is one of humanity's most serious threats putting at risk the functioning of the natural systems that sustain human health. Human activities have significantly altered the earth through global warming, habitat loss and changes to the atmosphere. According to United Nations Framework Convention- Climate change is the change that can be attributed "directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." Climate change (CC) is happening due to natural factors and human activities. It alters biodiversity, agricultural production and food security. CC affects species, ecosystem composition and function both directly (increases in temperature and changes in precipitation; water temperature and sea level) and indirectly (changes the intensity and frequency of wildfires). Likewise, human activities such as change in land-use patterns, degradation, modification, and fragmentation of ecosystems, exploitation of species and the introduction of invasive species have aggravated CC impacts. However, the relative impact of CC is likely to vary regionally due to land use variation, biotic invasions, pollution, human activities, fire, and ecosystem types. CC have severe impacts on agricultural production and food security, availability, accessibility, and utilization. The co-occurrence and synergistic interaction of climate change, loss of biodiversity and effects on food production have an exponential multiplier effect on human health compared to when these conditions are experienced separately. Climate change affects food production, diversity and increases food insecurity, leading to overnutrition, undernutrition and deficiencies in micronutrients, particularly among children and vulnerable groups. However, achieving food security requires strong policies, releasing high-yielding stress resistant varieties, developing



climate resilient irrigation structures and agriculture. Therefore, degraded land restoration, land use changes, use of bio-energy, sustainable forest management and community based biodiversity conservation are recommended to mitigate climate change impacts.

STUDIES ON COMBINING ABILITY PARAMETERS IN INDIAN MUSTARD [*BRASSICA JUNCEA* (L) CZERN AND COSS.]

Sanjay Kumar and Mahak Singh

Directorate of Seed and Farms, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur

*Email: sst8988@gmail.com

Abstract

A field experiment was carried out at Crop Research Farm Nawabganj, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur. Seven Varieties namely Varuna, Pusa Bold, PM-25, Kranti, Rohini, PM-27 and Vardan were crosses in dialled mating design (excluding reciprocals crosses). Twenty-eight treatments (7 Parents and 21 F₁s) were evaluated for nine traits viz.; days to flowering, plant height (cm.), number of primary branches, length of main raceme (cm.), number of siliqua on main raceme, number of seeds / siliqua, seed size, oil content and seed yield / plant. Result indicated that additive type of gene action was more prevalent than non-additive type of gene action for most of the traits. The estimated of average degree of dominance indicated presence of partial to over dominance for most of the traits. Combining ability analysis revealed that good general combiners were Varun, Kranti, Pusa Bold for high percent of oil content and Kranti, Varuna, Pusa Bold and PM-27 for high seed yield / plant. Out of 21 crossed for crosses namely; PM-25, Vardan, Varuna Kranti, Pusa Bold PM-27 and Varuna, PM-27 were good specific combiners for high seed yield / plant. Heterosis over economic parent was found in only one cross Varuna, Kranti for seed yield / plant. Seed yield / plant was significantly correlated with number of primary branches, length of main raceme, number of siliquae on main raceme, number of seeds / siliquae, seed size and oil content. High heritability coupled with high genetic advance was found for seed size, seed yield / plant, length of main raceme and number of siliquae on main raceme. These characters may be utilized in further breeding programme

ADOPTION LEVEL OF FARMERS ON PROTECTED CULTIVATION TECHNOLOGIES IN KALYANA KARNATAKA REGION OF KARNATAKA

Shashikala S. Ruli^{1*}, Goudappa S.B.², Ganeshagouda I. Patil¹ and Prabhakar Itagi¹

¹Department of Social and Allied Science, UHS, Bagalkot, Karnataka

²Department of Agricultural Extension Education, UAS, Raichur, Karnataka

*Email: shashikalaalagond80@gmail.com

Abstract

In present condition agriculture constraints like fragmentation of cultivable land, water scarcity, rapid urbanization, declining crop production and productivity, crashing market prices, declining biodiversity and ever increasing population, demand for food, especially vegetables has increased manifold. 'Protected cultivation' has offered a new dimension to get more income in a limited area in a district. The study was conducted in Koppal and Ballari districts of Kalyana Karnataka region in Karnataka during the year 2020-21. The districts were selected purposively due to maximum area under protected cultivation and also more scope for protected cultivation in these districts. From each district, 60 farmers who have adopted protected cultivation technology were selected for the study. Thus, the total sample of 120 farmers was selected by using simple random sampling procedure. The data were collected by personal interview and the focused group discussion method was used wherever it was found suitable. The results regarding the overall adoption of Protected Cultivation Technologies by respondents reported that majority (54.17%) of the respondents had medium level of adoption followed by high (26.67%) level of adoption and low (19.17%) level of the adoption. Since, majority of the respondents belonged to medium level of adoption with respect to adoption of protected cultivation practices. Hence, it is important to design more number of extension activities like demonstrations, study tours, exposure visits by the development departments to convince the farmers about protected cultivation practices for full adoption of the technologies. The extension agency should further intensify the awareness extension activities like demonstration, training, discussion, meetings etc., particularly on improved protected cultivation technologies and motivated them to adopt these technologies.



COVID-19 AND INCOME LEVELS OF MIGRANT AGRICULTURAL LABOURERS IN TELANGANA

Shaik Muneer*, D. Kumara Swamy and T. Lavanya

College of Agriculture, Raipur, Indira Gandhi Krishi Vishwavidyalaya, Chhattisgarh

*Email: shaikmuneer1911@gmail.com

Abstract

The COVID-19 pandemic has posed unprecedented challenges to the ruling governments across the world. This pandemic has affected almost all sections of the society and agricultural labourers is no exception. The present study was conducted with an objective to examine the income levels of migrant agricultural labourers before and during the COVID-19 pandemic. The study was based on both primary and secondary data. Multistage random sampling technique was used in selection of the sample district, mandals and villages in Telangana. In the first stage, Mahabubnagar district of Telangana state was purposively selected. In the second stage Devarakhadra and Jadcherla mandals of the district were selected based on the presence of maximum number of agricultural labourer population. In the third stage, two villages from each selected mandal with highest registered agricultural labourer population were selected. Thus, a total of four villages were selected for the study. From each selected village, 15 number of migrant agricultural labour households were selected randomly making a total sample of 60 households for the study. For the study various tools and techniques such as tabular analysis, averages *etc* were used. Average income levels of sample migrant agricultural labourers who have went for farm activities were increased compared to during the pandemic compared to the earlier non pandemic period. Whereas, average income levels of migrant agricultural labourers those who went to non-farm activities was decreased compared during the pandemic when compared to the earlier period. The policy measures recommended from the study include treating migrant workers as a unique labour group and providing them with the necessary institutional support like EPF facility and issuing of Ration Cards at their migrated locality *etc* along with strict implementation of minimum wages act during such abnormal times and constant attempts to do financial inclusion of migrants to prevent a drop in the standard of living.

EDIBLE MUSHROOM CULTIVATION: A MEANS OF NUTRITIONAL SECURITY & QUALITY LIFE

Seema*, Manish Kumar, Kumari Shashi Bala, Shashikant and Sanjay Kumar Singh

Nalanda College of Horticulture, Noorsarai, Nalanda, Bihar Agriculture University, Sabour, Bhagalpur

*Email: drseema3012@gmail.com

Abstract

It will be important to concentrate on secondary agriculture and innovative crops, like mushrooms, due to the world's rising population and declining per capita arable land, as well as fast urbanization and industrialization, climate change, and a desire for high-quality and functional foods. Production of mushrooms helps to increase sustainability through agricultural system diversification. Commercially growing edible mushrooms is a novel use of a microbial technique for the biotransformation of domestic, commercial, industrial, and forestry wastes into nutrient-dense food. There are over 14,000 different species of mushroom 31 of these genera are thought to be the best eating mushrooms. Only 200 of these are now being grown for research purposes, and 100 are being economically cultivated. Out of these, 60 are thought to be commercially significant, and only 10 have reached industrial scale production. However, due to the fact that mushrooms are a non-traditional crop, the rotational cultivation of various mushrooms is still uncommon in India. The vast majority of farmers only grow mushrooms during a specific season. Farmers cultivate mushroom during winter season while in summer, they cease cultivating mushrooms. Observing that India is mostly a tropical nation while primarily cultivating temperate mushrooms (*A. bisporus*) seems incongruous. Oyster (*Pleurotus* spp.), paddy straw (*Volvariella* spp.), milky (*Calocybe* spp.), reishi (*Ganoderma* spp.) and wood ear (*Auricularia* spp.) mushrooms are examples of tropical and subtropical mushrooms that are not widely cultivated. Like other field crops, mushrooms can also be grown all year round. There are 700 million tonnes of agricultural leftovers produced in India each year that can be profitably used for mushroom farming. Only 0.03% of these residues are being used in India to create 1.2 lakh tonnes of mushrooms. One percent of the world's total production of mushrooms comes from India. Growing mushrooms turns agricultural wastes into a source of easily assimilated protein that improves the human diet. Mushroom being rich in protein, vitamins and minerals can form an important ingredient of food for a balanced diet. They have been shown to promote immune function, boost health, lower the risk of cancer, inhibit tumor growth, help balancing blood sugar, ward off viruses, bacteria, and fungi, reduce inflammation, and support the body's detoxification



mechanisms. The substrate can be composted and added to the soil as an amendment to improve soil health after mushroom growing. Mushroom cultivation with labor-intensive, low-production methods has the potential to provide a large number of jobs and raise the income of the rural population.

CONSTRAINTS FACED BY FARMERS IN ADOPTION OF PROTECTED CULTIVATION TECHNOLOGIES IN KALYANA KARNATAKA REGION OF KARNATAKA

Shashikala S Ruli^{1*}, Goudappa, S.B², Prabhakar Itagi³, Ganeshagouda I. Patil⁴

¹Department of Social and Allied Science, UHS, Bagalkot, Karnataka

²Department of Agricultural Extension Education, UAS, Raichur, Karnataka

*Email: shashikalaalagond80@gmail.com

Abstract

Improved technologies have been continuously being introduced in India such High-tech horticulture in general and protected cultivation particular among the farming community with an intention to grow the horticultural crops in off-season also by reducing post-harvest losses. Still the agricultural productivity has potential to be achieved hence the present study was conceptualized to understand the constraints faced by the farmers. The study was conducted in Koppal and Ballari districts of Kalyana Karnataka region in Karnataka during the year 2020-21. The districts were selected purposively due to maximum area under protected cultivation and also more scope for protected cultivation in these districts. From each district, 60 farmers who have adopted protected cultivation technology were selected for the study. Thus, the total sample of 120 farmers was selected by using simple random sampling procedure. The data were collected by personal interview and the focused group discussion method was used wherever it was found suitable. The results indicated that scarcity of the water was the environmental constraints for 81.67 per cent of the respondents and majority (95.83%) of the respondents suggested for Increase in the financial support for drip and sprinkler irrigation hence, it is recommended to increase the financial assistance for establishing the irrigation structures. Lack of skilled labour was the major (93.33%) labour related constraint faced by the farmers hence, government may consider training the farmers on protected cultivation skills for skill development in protected cultivation. Lack of scientific knowledge was the major technical constraints for 90 per cent of the respondents hence, development departments, NGOs and other concerned department may conduct the education activities on protected cultivation for the benefit of the farming community.

CLIMATE CHANGE AND DISASTER MANAGEMENT

Saurabh* and Awadhesh Singh

Department of Agronomy, Bhagwant University, Sikar Road, Ajmer-305004 Rajasthan

Email: saurabh458796544@gmail.com

Abstract

In the period since the Industrial Revolution, human emissions of greenhouse from fossil fuel combustion, deforestation and agricultural practices have led to global warming and climate change. Observed and anticipated changes in the climate include higher temperature, changes in rainfall patterns, changes in the frequency and distribution of weather events such as droughts, storms, floods and heat waves, sea level rise and consequent impact on human and natural systems. Climate change has been recognized as the foremost environmental problem of the twenty first century and has become a subject of considerable debate. Despite being a natural phenomenon, human activity hastens climate change. Climate change risk assessment and management must be incorporated into development initiatives, which depends on a number of elements, including institutions, capacity, and the willingness to recognize climate change as a part of life. These circumstances do not yet prevail everywhere. It is highly unlikely that a focus that disregards improving capacity-building and resilience as a requirement for managing climate change risks could significantly lessen vulnerability to such risks. One important factor in lowering the risk of climate change is reducing vulnerability. To do this, it is necessary to adopt a new perspective on climate change risk and alter institutional structure and relationships. In all likelihood, focusing on development while ignoring to improve governance and resilience as a prerequisite for managing climate change risks won't accomplish anything to lessen exposure to those risks.



CONSTRAINTS ANALYSIS OF SHRIMPS FARMING IN KARNATAKA : RBQ APPROACH

Santhosha, K.M.^{1*} and A.D. Naik²

University of Agricultural Sciences, Dharwad, Karnataka, India.

*Email: santhoshkm347@gmail.com

Abstract

Shrimp farming are playing a pivotal role in the socioeconomic development of India. The state of Karnataka is the seventh largest shrimp producer amongst the shrimp farming states of India and contributed 8.43 lakh tonnes of produce in 2020-21. A study was undertaken in 2021 in Coastal Karnataka. The study area was selected purposively and the 120 Shrimps farmers, 30 Petty dealers, 30 Wholesalers and 30 Retailers were selected using a simple random sampling method. The study was conducted with the help of a personal interview schedule aided by well-structured and a pre-tested questionnaire consisting of 7 major domains of constraints. Rank Based Quotient (RBQ) technique was employed for the allotment of ranking to various constraints. The present study was undertaken to analyze the constraints analysis of shrimp farming in Karnataka. The findings showed that Constraints such as Lack of experience (Socio personal constraints), Lack of technical guidance (Technical constraints), High initial investment (Economic Constraints), Diseases outbreak (Environmental constraints), lack of quality standards (Management constraints), High fluctuation in price (Marketing Constraints) was the major constraints and the perishability of the product was the major constraints for marketing intermediary's in the study period. The study suggested that the regulating agencies such as Marine Product Export Development Authority (MPEDA) and Government may take appropriate remedial measures to combat the identified constraints for successful shrimp culture in the study area.

ATTITUDE OF FARMERS TOWARDS PROTECTED CULTIVATION TECHNOLOGY IN KALYANA KARNATAKA REGION OF KARNATAKA

Shashikala S. Ruli^{1*} and Goudappa S.B.²

¹Department of Social and Allied Science, UHS, Bagalkot, Karnataka

²Department of Agricultural Extension Education, UAS, Raichur, Karnataka

*Email: shashikalaalagond80@gmail.com

Abstract

The study was undertaken with the following objective to measure the attitude of farmers towards Protected Cultivation Technology and relationship between profile characteristics of respondents and attitude of respondents in Koppal and Ballari districts of Kalyana Karnataka region of Karnataka during the year 2020-21. Total sample of 120 farmers was selected by using simple random sampling procedure. The results show that majority (54.17%) of the respondents belonged to favourable attitude category followed by more favourable (33.33%) and less favourable (12.50%). Six variables viz. Social participation, extension orientation, mass media utilization, management orientation, scientific orientation and achievement orientation were found significantly related to attitude of respondents towards protected cultivation technology at one per cent level of probability and two variables viz. age and risk orientation were found significantly related at five per cent of probability. Since, most of respondents had favourable attitude level. The policy maker should prioritise the research on low cost protected cultivation structures and increase the subsidy on purchase of PCT materials. Hence the extension agency should further intensify the awareness extension activities like demonstration, training, discussion, meetings etc., particularly on improved protected cultivation technologies and motivated them to adopt these technologies. Such educational approach would enable them to develop favourable attitude towards PCT and also help the share the experience and relevant information with fellow farmers by having group discussion.

STABILITY STUDY IN FABA BEAN UNDER TERMINAL HEAT

Sourav Ranjan Nanda*, Jaylal Mahto, Krishna Prasad and C.S. Mahto

Department of genetics and plant breeding, Birsa Agricultural University, Ranchi, Jharkhand, 834006

*Email: souravranjan4572@gmail.com

Abstract



Faba bean (*Vicia faba* L.) is an important potential pulse crop in India. It contains 22-28% protein in seed and this crop fixed about 219-63 Kg/N/ha. Genotype and Environment (G×E) interaction is important in it's in a breeding program. In present investigation total 35 genotypes of faba bean (*Vicia faba* L.) were sown in Randomized block design in three sowing environments in rabi 2021-2022. Stability parameter based on the Eberhart and Russell model were study for the 15 quantitative characters. It was evident from the pooled analysis that, the mean sum square among the genotypes were highly significant for days to flower initiation, plant height, number of primary branches per plants, number of pods per plants, number of seeds per plants, seed yield per plant and 100-seeds weight indicating the considerable amount of genetic variability in the for these following characters. The $G \times E$ (linear) was also significant for plant height (cm), number of pods per plants, number of clusters per plant, number of seed per plant indicating there by genotype differed for linear response to the environment. The optimum temperature for flowering of faba bean is 22–23° C. Temperature above the 27° during pod development stage tends to reduces the seed weight. Late sown crop face very low temperature up to flowering stage and later stages had a face warmer temperature on pod development stage which cause decrease in yield due to decrease in seed weight. Based on high mean, unit regression ($b_i=1.0$ i.e., $b_i=S E m \pm 1$) and least deviation from regression coefficient $S-2d_i=0$ genotypes ET226420, ET226416, Hanma-1 were most stable for eight characters under three different environments.

GENETIC DIVERSITY STUDY IN FABA BEAN UNDER TERMINAL HEAT

Sourav Ranjan Nanda, Jaylal Mahto, Krishna Prasad and C.S. Mahto

Department of Genetics and Plant Breeding, Birsa Agricultural University, Ranchi, Jharkhand, 834006

*Email: souravranjan4572@gmail.com

Abstract

Pulses have been considered as an important constituent of Indian diet, because of their high protein content (20-28%). Faba bean (*Vicia faba* L.) is one of the oldest pulse crops in the world used as pulse. Genetic diversity is the base for survival of plants in nature and for crop improvement. Diversity in plant genetic resources provides opportunity for plant breeders to develop new and improved cultivars with desirable characteristics, which include both farmer-preferred traits (high yield potential, large seed, etc.) and breeder-preferred traits (pest and disease resistance and photosensitivity, etc.) and Jharkhand short duration genotypes. With changing climatic scenario, breeding of climate resilient varieties is becoming more important. The concept of genetic distance helps the plant breeders in the classification of the breeding material into groups. Genetic diversity is major which the heterosis breeding and isolation of transgressive segregants. So, based on the genetic distance present, the parents are selected for the breeding programme. Based on the mean values of D2 analysis of 35 genotypes of faba bean (*Vicia faba* L.) under 3 environments revealed the existence of considerable genetic diversity among them. In environment I hybridization between the genotypes RFB-14 (cluster x) with ET226414 (cluster xiv), ET226415 genotype (cluster xii) with ET226414 (cluster xiv), HFB-1 (cluster xii) with ET226414 (cluster xiv) may be exploited for development of varieties suitable for higher yield. In environment II hybridization between the any one genotypes of cluster I with Rebaya-40 (cluster III) may be exploited for development of varieties for higher yield. In environment III hybridization between the genotypes ET226430 (cluster X) with ET226426 (cluster XII), ET226417 genotype (cluster VIII) with ET226430 (cluster X) may be exploited for development of varieties for higher yield. These genotypes in the most divergent clusters may be able to take advantage of the maximum heterosis under different environment.

EFFECT OF IAA AND IBA APPLICATION ON LEAF CUTTINGS OF MEXICAN SNOWBALL (*ECHEVERIA ELEGANS*)

Seema Mourya* and Samir Ebson Topno

Deptt. of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.)-211007, India

*Email: seemamourya1166@gmail.com

Abstract

Succulents are on the rising trend of popularity due to its compromising behavior with watering, and durability indoors, creating a peaceful and healthy living condition. Thus, it is the need of the hour to find a suitable propagation method or use of exogenous substances with propagation to assist in regenerating new plants. Hence finding a better Rooting hormone



combination. The present investigation entitled Effect of IAA and IBA Application on leaf cuttings of Mexican Snowball (*Echeveria elegans*). Was conducted in the Research Field, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, from February/2021 to April/2021. The experiment was laid out in randomized block design (RBD) with 3 replications. The treatment in each replication was randomly allotted. There are 9 treatments having one variety used in this experimental design. The results revealed that among all the treatments, application of IAA + IBA (100 ppm + 500 ppm) in treatment (T8) took minimum days to root (9.00), number of leaves (16.56), number of shoots (2.56), shoot height (15.56 mm), shoot diameter (16.44 mm), root length (29.00 mm) and in an economic point of view treatment T8 IAA + IBA (100 ppm + 500 ppm) was found to be most economically viable in terms of gross return (Rs. 17,000), net return (Rs. 11,100) and benefit-cost ratio (2.88).

STATUS OF MICRONUTRIENTS DEFICIENCIES IN THE SOILS OF KAITHAL AND SIWAN BLOCK, DISTRICT KAITHAL

Shabnam^{*1}, Rohtas Kumar¹ and Gaurav Verma²

¹Department of Soil Science, ²Department of Agronomy, CCSHAU, Hisar

*Email: sainishabnam718@gmail.com

Abstract

Indian soils have become deficient not only in macronutrients but also in micronutrients. Their deficiencies in Indian soils emerged as one of the major constraints to soil health and crop productivity. Micronutrient deficiencies are now frequently observed in intensively cultivated soils mainly where cereals are grown. The intensive cultivation of the rice-wheat monocropping system in Kaithal has led to deficiency of iron, copper, manganese etc. which has threatened in sustaining higher food production. Thus, there is an urgent need to rectify the individual nutrient deficiency through soil testing, to arrest its further spread. Through the use of soil testing and plant analysis, micronutrient deficiencies have been verified in many soils. A study conducted on the two blocks of the Kaithal district i.e. Kaithal and Siwan blocks to access the micronutrient status of the soil. Fifty soil samples were collected from each block using a hand-held GPS. The results revealed that for DTPA extractable zinc, 22 and 24% of samples were found deficient in Kaithal and Siwan block respectively. The reason for less deficient samples could be the frequent usage of zinc sulphate fertilizers in the area. For DTPA extractable iron 48 and 30% samples, for extractable copper 12 and 20% and DTPA extractable manganese, 88 and 96% samples were found under the deficient category in Kaithal and Siwan blocks respectively. These micronutrient deficiencies need immediate attention to increase crop productivity and sustain soil health and fertility.

BIOFORMULATIONS FOR COMBATING PHYTOPATHOGENS: A SUSTAINABLE APPROACH

Shaik Munnysha^{1*}, Kinjal Mondal² and Ramavath Abhi³

¹Deptt. of Plant Pathology, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur

²Deptt. of Molecular Biology and Biotechnology, Maharana Pratap University of Agriculture and Technology, Udaipur

³Deptt. of Nematology, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur

*Email: munnysha118@gmail.com

Abstract

The agro-economy has gained new insights into the role of microbes in sustainable agriculture, and one of the benefits is a reduction in the use of chemical pesticides and fertilizers. The continuous use of these chemicals not only had negative effects on agro-ecosystems but also put people and animals at risk for health problems. Microbe-based formulations also known as bioformulations are more robust than synthetic chemicals as the formulation product of a single microbe may involve direct interactions with pathogens, and numerous mechanisms take part in disease suppression and plant growth promotion. In recent years, microbial bioinoculants have been developed as an option for promoting plant growth and eliminating illness, but a broader aspect of their application as formulatory products has remained in its infancy, especially in impoverished nations. This green strategy is struggling and falls far behind its rivals, the synthetic fertilisers and pesticides, on an economic and social level as well. The majority of the time, it has been found that bioformulations made for a certain crop do not produce outcomes as good as those produced in a lab. Various workers all over the world are continuously engaged in developing formulation products which could be easier to use, show enhanced activity toward phytopathogens, and may cover more target crops. It is necessary to review the entire bioformulation development process, from microbe screening to product



development and deployment. The major goal is to describe the different aspects of bioformulations that are used, their effectiveness in the field.

ADVANCE NOVEL TECHNOLOGIES FOR CROP IMPROVEMENT

Shalakha John* and Nishant Kumar Salam

Department of Genetics and Plant Breeding, Indira Gandhi Krishi Vishwavidyalaya, Raipur-492012, Chhattisgarh

*Email: shalakhajohn@gmail.com

Abstract

A multifaceted approach is needed to solve the complicated agricultural problems ensuring a sustainable and secure supply of agricultural goods, involving advancements in crop genetics, agronomic procedures, and post-harvest systems. The fields of plant breeding and genetics have undergone a revolution due to the development of DNA markers. DNA markers have a variety of uses in plant breeding, such as marker-assisted selection (MAS). It is an indirect selection process of selection of trait of interest based on a Marker (morphological, biochemical or DNA variation) linked to a trait of interest (e.g. productivity, disease resistance, abiotic stress tolerance, and quality), rather than the trait itself. It includes various methods like Marker-assisted backcrossing (MABC), Marker-assisted recurrent selection (MARS), and Genomic selection (GS). Plant genetic engineering has provided new approaches to tackle specific needs by opening new avenue to modify crops. Transgenic plants are obtained involving tissue culture and genetic engineering techniques can solve specific crop issues like disease or insect resistance and provide high commercial values to crops. This also involves cisgenics which is the use of rDNA technology to introduce genes from related and crossable donor plants, isolated from the existing genome for centuries. Genome editing is another technology developed for precisely and site-specific modification of gene of interest from genome. Genome editing comprises ZFNs (zinc- finger nucleases), TALENs (transcription activator-like effector nucleases), and CRISPR/Cas (clustered regularly interspersed short palindromic repeats) systems. ZNFs have been successfully used to express inserted site-specific cassette to develop herbicide tolerance in corn. Nanotechnology is another novel and vast scientific technology which can be used for designing, development and application of materials at nanometre scale. For example in 2009, it was reported that the germination of seed of tomato plant was enhanced by the penetrance of carbon nanotubes (CNTs). The seed germination in this case was enhanced due to the water uptake ability of CNTs.

PREPARATION AND CHARACTERIZATION OF ENRICHED LAKE BIOMASS COMPOST USING DIFFERENT SOURCES

Shalini*, A. Sathish, Vimalashree H. and Rudresh T.M.

Department of Soil Science and Agricultural Chemistry, GKVK, UAS, Bengaluru-65, Karnataka, India

*Email: shalinisomanakatti@gmail.com

Abstract

An experiment was carried out in Department of Soil Science and Agricultural Chemistry, University of Agricultural Sciences, Bangalore to study the preparation and characterization of enriched lake biomass compost using different sources for the urban users. For the compost preparation lake biomass such as water hyacinth and alligator weed were collected from the selected lakes and used as raw materials. Cow dung, the main accelerator for compost preparation and microbial inoculum *Pleurotus sajorcaju*, *Phanerochaete chrysosporium*, and *Trichoderma harzianum* were used as additives to hasten the rate of decomposition. Initial chemical composition and prepared lake biomass compost (LBC) were analysed for physico-chemical and biological changes during different stages of composting process. The matured compost was nearly neutral (6.93) with dark brown colour and there was increase in nutrient composition of compost during all the stages of composting process, high nutrient concentration of nitrogen (1.73 %), phosphorus (0.92 %) and potassium (2.87 %) along with secondary and micronutrients was obtained along with reduction in lignin and cellulose content at the end of composting process. Further, the LBC was enriched with different sources (neem cake, single super phosphate and microbial consortium) for 15 days. After enrichment compost was analysed for different parameters. Results of the study revealed that there was increase in nutrient composition of enriched compost compared to without enriched compost. Maximum nutrient concentration was recorded in MNSE-LBC (microbial consortium + neem cake + SSP enriched lake biomass compost) followed by SSPE-LBC (single super phosphate enriched lake biomass compost) with maximum nitrogen, phosphorus and potassium of 1.91, 1.52 and 3.10 per cent



respectively. Hence lake biomass compost can serve as best source of nutrients for urban farmers and the waste generated from the lakes can be better utilized.

THE INGENIOUS ALTERNATIVES FOR VEGAN EGGS

Shreeja Kulla

PJTS Agricultural University, Hyderabad, India

Email: shreeja.sri25@gmail.com

Abstract

Nowadays, demand for the plant-based replacers to egg, meat and dairy products has shown significant growth across the world. It evidenced from growth of sales in the U.S. from \$3.1 billion in 2017 with a growth rate of 8.1 % in the same year. According to Mintel's Global new products database, 102 new vegan egg products have been launched to the global market from 2016 to 2021. Evolution of the plant-based eggs have been driven many factors including the problems related to sustainability, egg allergies, cholesterol content, salmonella outbreak in 2015 in the United States and Fipronil scandal in 2017 in the European Union. Poultry eggs can perform many different attributes viz. coagulation, gelation, emulsification, coagulation, thickening, binding, humectancy, foam stabilization and crystallization, and sensory properties like mouthfeel, browning, flavor, clarification and glossy texture in food industry depending on the use and experience of consumer. These properties must be met with plant-based egg alternatives too, by including individual ingredients or ingredient blends. Natural colors like annatto, lycopene, turmeric and red palm oil can be used to mimic egg yolk color. Emulsification effect can be provided through lecithin (soy, sunflower & canola). Himalayan black salt may impart egg-like sulfur flavor to the product. Such a way each alternate ingredient must be selected to replace egg; examples of such are flax seed powder for binding; gums and starches for binding, thickening and mouthfeel; banana puree, sugars, dextrin and syrups for humectancy; soy protein isolates for protein; millets and algal flour for protein, fiber and oil.

ROLE OF MICRO-RNA (MIRNAS) AND LONG NON-CODING RNA (LNCRNAs) IN DROUGHT STRESS

Shivangi Rahangdale¹, Niyati Jain, Deepika Parte and Akash Barela

Department of Plant Breeding and Genetics, Jawaharlal Nehru Krishi Vishwa Vidyalyaya, Jabalpur (M.P.) India-482004

Email: shivangirahangdale@gmail.com

Abstract

The scope of the RNA sequencing era has been broadened as a result of the significant advancements made in the high-throughput sequencing of small RNA libraries as opposed to the extensive identification of non-coding RNA molecules. It is important for the regulation of many biological processes, such as the maintenance of genome integrity and the development, metabolism, and adaptive responses to environmental stresses. Long noncoding RNAs (lncRNAs), which are thought to control the transcriptional regulation of drought-responsive genes, are implicated in modulating the drought stress response in plants as per many evidence. There have also been reports of the drought-responsive lncRNAs in a number of plant species, including Arabidopsis by Ben et al. (2009), tomato by Zhang et al. (2011), rice by Chung et al. (2016), and maize by Zhang et al (2014). Similarly, 44 drought-responsive miRNAs that encode zinc finger family protein, serine/threonine-protein kinase, and kelch-containing F-box protein were discovered by Barrera-Figueroa et al. (2011) in cowpea. Paul and Pal (2017) identified 56 potentially conserved microRNAs and 88 potential miRNA target transcripts belonging to 28 families, in which 3 miRNAs viz., vra-miR160a, vra-miR162b and vra-miR398b were validated. Wu et al. (2017) obtained 16 drought-responsive miRNAs and the corresponding target genes related to TFs and protein kinases in common beans. These expected transcripts were discovered to be involved in several metabolic, stress, and development processes. These methods of integrating multi-omics approaches will aid in increasing the breeding effectiveness and creating climate smart drought tolerant cultivars in field crops.

MANAGEMENT OF APHID INFESTING BLACK GRAM UNDER FIELD CONDITION

Shanti Kurly* and P.K. Singh

Department of Entomology, Faculty of Agriculture, Birsa Agricultural University, Kanke, Ranchi-834006 Jharkhand, India



*Email: shantikurly@gmail.com

Abstract

Among the pulse crops, black gram [*Vigna mungo* (L.) Hepper] is one of the important crop. It infested by various numbers of insect pests out of which sucking pest aphid is one of them. It takes role in yield losses due to sucking the plant sap and also contributes in spread of viral diseases. To validate the objective of the experiment ten treatments with three replications was taken in randomized block design at research farm of Birsa Agricultural University, Ranchi for the period of two years *kharif* 2016 and 2017. The treatments were T₁ (thiamethoxam 25 WG + propiconazole 25 EC @ 0.2g+1.0ml/L), T₂ (thiamethoxam 25 WG + propiconazole 25 EC @ 0.3g+1.0ml/L), T₃ (spinosad 45 SC + propiconazole 25 EC @ 0.5ml+1.0ml/L), T₄ (spinosad 45 SC + propiconazole 25 EC @ 0.6ml+1.0ml/L), T₅ (NSKE 5%+ propiconazole 25 EC @ 5%+1ml/L), T₆ (thiamethoxam 25 WG @ 0.3g/L), T₇ (spinosad 45 SC @ 0.6ml/L), T₈ (NSKE 5% @ 5%), T₉ (propiconazole 25 EC @ 1.0 ml/L) and T₁₀ (control). The application was done 30 and 40 days after sowing and observation recorded one day before spray and 3, 7 and 10 days after each spray. Among these ten treatments, T₂ combination of thiamethoxam 25 WG and propiconazole 25 EC @ 0.3g+1.0ml/L and T₆ thiamethoxam 25 WG @ 0.3g/L were identified as highly efficient to manage aphid by reducing 0.85 and 1.04 number of aphid/ top 5 cm shoot against control with 7.68/ top 5 cm shoot. The next best effective treatment was T₁ with minimizing 1.41 number of aphid / top 5 cm shoot. The maximum yield 1080 kg/ha recorded in T₄ with combination spinosad 45 SC + propiconazole 25 EC @ 0.6ml+1.0ml/L followed by 1052 kg/ha. in T₃ (@ 0.5ml+1 ml/L dose of same combination.

ROLE OF BIOTECHNOLOGY IN AGRICULTURE

Shalvi Aishwarya Verma, Abhimanyu Kumar and Sneha Bharti

Birsa Agricultural University, Ranchi

*Email: shalvi.verma9823@gmail.com

Abstract

As world is pacing against time with changing climate, land availability and increasing population, agriculture needs an immediate advancement for which biotechnology is the best and safest solution. Biotechnology till date have already improved our crop's production-protection, increased nutritional values, chemical tolerance and disease resistance. Biotechnology provides us with tools that help us to improve the above. A range of tools including breeding techniques that alter living organisms or parts of it, to make or modify products, develop microorganisms for specific agricultural uses, improve plants and using genetic engineering for crop improvement. Genetic engineering has shown remarkable results. Due to this we are able to save a lot of crops which were earlier destroyed due to the application of chemicals in adjacent crop or field. Modifying genes in lab using recombinant DNA technology has given us resistant crops like cotton (Bt cotton). This has allowed reduction in persistent, synthetic pesticide use that was contaminating groundwater and environment. For weed controlling also, herbicide tolerant soybeans, cotton and corn has reduced the negative effect of herbicides on main crop which were toxic to wildlife and humans. Crops can even be engineered to be resistant to specific plant disease or insect-pest. Biotechnology has reduced the dependency on nature, now we can use Tissue culture i.e. using nurturing fragments of plants in controlled environment where they can survive and continue to grow well. Biotech crops may provide enhanced quality traits such as increased level of beta-carotene in rice to enhance vitamin-A value. Biotechnology is also being used in conserving natural resources, genetically engineered plants are also being developed for a purpose known as phytoremediation in which the plants detoxify pollutants in the soil or absorb and accumulate polluting substances out of the soil so that the plants may be harvested and disposed of safely.

IMPACT OF SEED MYCOFLORA ON SEED HEALTH STATUS OF NATURALLY INFECTED CHILLI SEEDS

Sruthy M.* and Shivang S. Kansara

Department of Plant Pathology, NAU, Navsari, Gujarat

*Email: msruthy13@gmail.com

Abstract



Chilli (*Capsicum annuum* L.) is an important spice crop having commercial and therapeutic value. It is mainly grown for fruits, which are used in green as well as ripe red form for its pungency. Plant diseases produces serious losses to crop plants and from the various modes of spread of plant diseases, seeds play a vital role in the transmission of pathogens and development of plant diseases. Seed borne diseases can easily spread from one place to another and serve as an initial source of inoculum potential. The seeds of different varieties viz., GVC 101, GVC 111, GVC 121 and AVNP-C-131 were taken from the collected seed samples to assess seed health status. The loss in various parameters of seed health of chilli due to naturally infected seeds of different varieties were assessed. Maximum seed weight loss was recorded in GVC 101 (26.16%) followed by GVC 111 (18.52%), AVNP-C-131 (15.58%) and GVC 121 (15.45%). Maximum decrease in average seed germination was recorded in GVC 101 (55.44%) followed by GVC 111 (50.00%), GVC 121 (32.30%) and AVNP-C-131 (31.15%). Maximum decrease in average seedling length was recorded in GVC 111 (46.15%) followed by GVC 101 (41.51%), GVC 121 (29.70%) and AVNP-C-131 (28.74%). Maximum decrease in average seedling fresh weight was recorded in GVC 101 (54.55%) followed by GVC 111 (52.46%), GVC 121 (31.91%) and AVNP-C-131 (24.59%). Maximum decrease in average seedling dry weight was recorded in GVC 101 (58.82%) followed by GVC 111 (50.00%), GVC 121 (41.67%) and AVNP-C-131 (33.33%). Maximum decrease in average seedling vigour index was recorded in GVC 101 (73.42%) followed by GVC 111 (72.82%), GVC 121 (52.22%) and AVNP-C-131 (50.47%).

ANIMAL HUSBANDRY : ROLE IN POVERTY REDUCTION

Shubh Laxmi

College of Agricultural Sciences, Teerthanker Mahaveer University, Moradabad, 244001 Email: shubhlaxmi15@gmail.com

Abstract

Agriculture and animal husbandry have been a part of the Indian economy for a long. The livestock population of India is 536.76 million, which includes 193.46 Cattle, 148.88 Goat, 109.85 Buffalo, and 74.26 million sheep population (LC2019). The livestock sector sees an annual growth rate of 7 percent at constant prices, more than the crop sector growth rate which is 3.95%. Even the growth rate for the Livestock sector is more than the overall growth rate of the Agriculture & Allied sector which is 4.31% which draws special attention to the better performance of Livestock to drive the Indian economy (BAHS, 2020). The share of the livestock sector in the total value of the output of the agricultural sector increased from 21.79 percent to 28.36 percent during 2011-12 to 2019-20 at current prices (BAHS, 2020). India ranks first and contributes about 23 percent to world milk production (DAHD&F, 2020-21). India ranks 3rd and 5th in the world in terms of total egg and meat production respectively (FAO). Landless and marginal farmers have the majority of livestock holdings, which are a vital source of income for them. Crop production employs the rural workforce for 90 to 120 days, whereas dairy provides alternative employment opportunities throughout the 365 days of the year. About 69 percent of the agricultural households in rural India were estimated to have possessed less than 1 hectare of land, 17 percent had possessed between 1.00 hectares and less than 2.00 hectares of land, and 0.4 percent of the agricultural households were estimated to have possessed 10 hectares or more land (NSS, 70th report). Animal husbandry is the backbone of the economy of these farmers, bringing an additional and steady income. Livestock, though only half the size of crops, plays a crucial role in driving agricultural GVA growth.

PERCEPTION OF FARMERS TOWARDS OVER-EXPLOITATION OF IRRIGATION WATER IN HARYANA (INDIA)

Shubham*, Rati Mukteshwar and A.K. Rohila

Department of Extension Education, CCSHAU, Hisar-125004

*Email: shubham21334@gmail.com

Abstract

The study was conducted in the five districts of Haryana state was purposively, due to intensive agricultural practices followed in these districts. Mainly paddy-wheat cropping pattern is followed in these districts along with sugarcane and maize. The present study has made an attempt to know the perception towards over-exploitation of irrigation water. The data were collected from 150 respondents comprising 15 respondents from randomly selected ten villages through a well-prepared interview schedule. It was observed that most of the respondents agreed towards 'change in ground water availability' (3.00), 'ground water table goes down' (3.00) and 'mostly farmers stick with rice wheat cropping pattern' (2.89). More dependency



on ground water (2.87). Age, education, land holding, mass media exposure and extension contact were significantly correlated with perception of farmers. Age was negatively correlated while, education, land holding, mass media exposure and extension contact were positively correlated with perception of farmers and there is a need to organize awareness campaign and trainings to develop the favorable perception towards over-exploitation of water resources.

EFFECT OF PHOSPHOROUS AND SULPHUR LEVELS ON GROWTH AND YIELD OF MUNG BEAN (*Vigna radiata* L.)

Shubham Yadav

Department of Agronomy, National P.G. College, Barhalganj, Gorakhpur, India

Email: shy7310392015@gmail.com

Abstract

A field study entitled “Effect of Phosphorus and Sulphur levels on growth and yield of mung bean (*Vigna radiata* L.)” was carried out during Zaid season of year 2021 at research farm of the National P.G. College Barhalganj, Gorakhpur, India. A randomized block design (RBD) was considered for the experiment under 10 treatments and 3 replications with mung bean variety HUM-2 (Malviya Jagriti). Cultivation of pulses fit well to various cropping system and show climate-resilience. Pulses are low external input demanding, can fix atmospheric nitrogen biologically and improve soil health. Among different pulses, mung bean is considered as an important crop in India. Mung bean is also known as green gram belongs to the family Leguminosae, which fixes atmospheric nitrogen and improves soil fertility by adding 20-25 kgN/ha. Being a short duration and having wide adaptability, it can be grown in Kharif (rainy) as well as in Zaid (Summer) seasons. Phosphorous and Sulphur are the major essential elements required by the mung bean crop. Economic evaluation of the treatments was done on the basis of gross return, net return and benefit: cost ratio. It was observed that the treatment receiving Phosphorus at 40 kg ha⁻¹ along with Sulphur at 30 kg ha⁻¹ resulted the highest gross return (Rs 101716.23 ha⁻¹), net return (Rs 63635.23 ha⁻¹) and benefit: cost ratio (1.67) were observed in T₅. Whereas the lowest gross return (Rs 78471.58 ha⁻¹), net return (Rs 46291.58 ha⁻¹) was observed with T₀ (control) and lowest benefit cost ratio (1.12) was observed with T₆. The maximum response was noted significant at 40 kg Phosphorus with 30 kg Sulphur than rest of the other treatments in respect to benefit: cost ratio. The application of Phosphorus @ 40 kg. per ha. with Sulphur @ 30 kg per ha. has been found to be an ideal to exploit significantly grain production as well as quality of mung bean.

FERMENTATION DYNAMICS OF SELECTED PROBIOTIC ORGANISMS IN MILK- FLAXSEED-BASED COMPOSITE SUBSTRATE

Swetha Damodharan P.V*, Sangita Ganguly, Ashish Kumar Singh, P.N. Raju

Dairy Technology Division, ICAR-National Dairy Research Institute, Karnal, Haryana-132001, India

*Email: swethadamodharan50@gmail.com

Abstract

Flax lignans are biologically active agents which may provide multiple health benefits in estrogen deficient situation in females. Probiotic organisms, known for their multiple health beneficial effects, mostly grown on milk. Limited work has been carried out on growth studies of probiotic organisms using milk and flaxseed-based composite substrate. The current investigation reports the search for a composite substrate composed of milk and flaxseed components for probiotic organisms. Milk-flaxseed based Fermented food products containing probiotic organisms can be a very attractive option for overall health management of female population. Milk can be a source of calcium, whereas, flaxseed can provide phytoestrogen and probiotic can be useful in digestion, nutrient absorption and overall health management for female. The study had been conducted on the fermentation dynamics of selected probable probiotic organisms such as *Lactocasei* bacillus rhamnosus (NCDC 610, 296, 18, 24), *Lactobacillus acidophilus* (NCDC 13, 14), and *Lactiplanti* bacillus plantarum (NCDC 20, 21) in milk -flaxseed -based composite substrate. Based on the maximum specific growth rate and minimum generation time four probiotic organisms were selected (NCDC 20, 21, 296 and 610). Different levels of roasted flaxseed (1-3%) was added in composite substrate and it was observed that increasing levels of flaxseed had a positive effect on the fermentation dynamics, as indicated by higher specific growth rate and hence, optimum flaxseed level was selected as 3% (w/v). Further, inoculum levels (1-4%) was increased to reduce fermentation time to 8-9h to save time and avoid off-flavour generation. Increased inoculum level had a positive effect on fermentation dynamics, and a 3% level of inoculum was selected to restrict the



fermentation time to 8-9 h. At 3% inoculum level after 9h of fermentation time resulted a pH of 5.4-5.6 of composite substrate with a probiotic count of 108 CFU/ml. A base model for probiotic fermented formulations containing milk and flaxseed with quick fermentation, high probiotic counts and a suitable pH range was established during the investigation. This model can be applied in multiple milk-flaxseed-based probiotic food products preparation like probiotic beverages (sweet or spicy), porridges, gruels and set and/or stirred yoghurt-like products. These products would be a cost-effective functional food addressing female health.

NOVEL TOOLS FOR IDENTIFYING AND ANALYZING PLANT DISEASE

Shubham Mishra, Sanjeev Kumar

Department of Plant Pathology, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya Jabalpur, M.P., India

**Email: shubag14@gmail.com*

Abstract

There is a critical need for more sustainable agricultural approaches to increase food yields to meet the demands of a population that is rapidly growing. However, as the climate changes, farmers face additional difficulties like drought and harsh predicted temperature swings, pests, and diseases. The ability to take remedial action soon after pathogen detection would aid in disease management. Farmers currently use a variety of agricultural techniques and technology to increase yields, including crop rotation to promote soil health, the use of genetically modified seeds, and sensor plantings to check for pests and diseases on plants. Numerous harmful “foreign” species, such as viruses, phytoplasmas, bacteria, fungi, insects, nematodes, and weeds, travel freely around the world with humans and commodities (including plant materials). As a result, agriculture is significantly affected and confronted with numerous obstacles. As a result, early detection of plant pathogens is becoming increasingly crucial for plant health monitoring to control disease infections at various stages of development, reduce disease transmission risk, and avoid the introduction of new ones. To identify diseases, a variety of diagnostic tools are used. The development of on-field molecular techniques would drastically cut decision times, preventing the spread of diseases to other plants or the entry into new geographic regions. Nanotechnology has the potential to benefit agriculture in a variety of ways, including agrichemical and nano fertilizer formulation, new techniques of agrichemical delivery, nanosensors for disease detection, nanodevices for genetic change, and postharvest crop management. Direct diagnosis techniques method includes Fluorescence in-situ hybridization (FISH), Enzyme-linked immunosorbent assay (ELISA), Polymerase chain reaction (PCR), Flow cytometry, and Immunofluorescence. With today’s technological breakthroughs in the field of plant diagnostics, several modern plant pathology techniques for the detection of plant pathogens causing diseases have opened up several options.

OPTIMIZATION OF WHOLESOME NUTRITIOUS BEVERAGE PREPARED FROM VITAL INGREDIENTS USING RESPONSE SURFACE METHODOLOGY

Shubham Kumar^{1*}, Rekha Chawla¹, S. Sivakumar¹, Sunil Kumar Khatkar¹ and Narender Kumar²

¹*Department of Dairy Technology;*

²*Department of Dairy Engineering*

College of Dairy Science and Technology, GADVASU

**Email: shubham18h@gmail.com*

Abstract

Smoothies are characterized as beverages having better nutritional and functional properties due to added variety of ingredients. These can be dairy and non-dairy based depending upon the choice of ingredients. Owing to its high nutritional value, the processing parameters play an important role in product development to retain the wholesomeness in the final product. In the present study, the milk-based smoothie was developed with vital ingredients constituting oats, chia seeds, honey, and antioxidant-rich fruit-the blueberries, in this, the broad range was selected by the prelim trials from which the oats honey and blueberries concentration was selected 2.5, 6 and 4 which was further optimized with the help of the mathematical tool of response surface methodology (RSM). The chia seeds concentration 2% and milk fat 3% & SNF 8.5 % were kept constant. The estimation of a comprehensive quadratic model with interaction effects was made possible by using a Box-Behnken experimental design with three levels on the three most important parameters. The results were analyzed on the basis of sensory scores which includes colour and appearance, mouthfeel and consistency, sweetness, flavour and overall



acceptability. It was observed that the concentration of all parameters (oats, honey and blueberries) having significant effect on the sensory attributes ($P=0.05$). The trail with 1.5 % (W/V) oats, 6.5% (w/v) honey and 6% (w/v) blueberries were show the most desirability which was 0.929, more towards 1. The final results between predicted value and observed value was assured by t test and it showed non-significant difference.

USE OF MOBILE-BASED INFORMATION COMMUNICATION TECHNOLOGY TOOLS BY DAIRY FARMERS IN WESTERN MAHARASTRA

Kiran Jadhav, Smita Kolhe*, Milind Nande and Rahul Kolhe

Department of Veterinary and Animal Husbandry Extension Education, KNP College of Veterinary Science Shirwal, MAFSU, Dist Satara Maharashtra, 412801

*Email: drsmi@rediffmail.com

Abstract

This study was conducted in the Pune and Satara districts of Western Maharashtra to know the socio-economic profile, knowledge level, extent of use, and constraints faced by dairy farmers while using mobile-based ICT tools. Almost all the variables studied viz. age group (68.32%), family size (39.17), land holding (48.33%), herd size (45.00%), experience (69.17%), social participation (75.84%), extension contacts (70.00%) and knowledge level (72.50%) could be grouped under medium level. Overall, the extent of use of 24 mobile-based ICT tools and their utilization for dairy farming was analyzed. Results showed that dairy farmers were mostly aware of voice calls (90.83%), Whatsapp (82.50%) and financial apps for e-transaction (65%). All the respondents were completely unaware of Twitter, Skype, Instagram, Bluetooth and GIS applications. Over 95 percent of the respondents didn't use e-literature, multimedia, video recorder facilities, mobile applications, Facebook, e-mail, etc. to acquire information regarding dairy-related activities. Likewise, most of the respondents never used video calls (73.34%), SMS facility (70.84%), and mobile for taking photographs (64.16%) related to dairy farming. Most of the farmers were daily using Whatsapp followed by voice calls and financial apps. On a weekly and monthly basis, a lower number of respondents were using mobile-based ICT tools. Most of the dairy farmers use mobile-based ICT tools primarily for social purposes with less involvement in its use in order to improve dairy farming activities. Major constraints faced by dairy farmers while using mobile-based ICT tools were the unavailability of relevant information in the local language, lack of reliable, useful, and location-specific content, lack of repairing services and centers in the village, etc. There is a need to popularize the use of mobile-based ICT tools and impart competence and skills in using mobile-based ICT tools among dairy farmers.

EFFECT OF MAJOR NUTRIENTS AND ORGANIC MANURE ON GROWTH AND YIELD OF AJWAIN (*TRACHYSpermum AMMI* L.)

Shubham Yadav^{1*}, Nishant Yadav² and Deepanshi Deora³

¹Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture (Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior) Mandsaur, Madhya Pradesh, India

²Deptt. of Genetics and Plant Breeding, College of Agriculture (Agriculture University, Kota), Ummedganj-Kota, Rajasthan

³Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture (Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior) Mandsaur, Madhya Pradesh, India

*Email: yadavsbm@gmail.com

Abstract

The present field experiment entitled "Effect of major nutrients and organic manure on growth and yield of ajwain (*Trachyspermum ammi* L.)" was conducted at Horticulture Research Farm of the division of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture, Mandsaur, RVSKVV, Gwalior, (M.P.) from November 2021 to April 2022 with eleven treatments i.e., T₁-Absolute control, T₂-25t/ha FYM, T₃-40:20:20 kg/ha NPK +5t/ha FYM, T₄-40:25:20 kg/ha NPK +10t/ha FYM, T₅-40:30:20 kg/ha NPK +15t/ha FYM, T₆-45:20:20 kg/ha NPK +5t/ha FYM, T₇-45:25:20 kg/ha NPK +10t/ha FYM, T₈-45:30:20 kg/ha NPK +15t/ha FYM, T₉-50:20:20 kg/ha NPK +5t/ha FYM, T₁₀-50:25:20 kg/ha NPK +10t/ha FYM and T₁₁-50:30:20 kg/ha NPK +15t/ha FYM in Randomized Block Designs. All the parameters were recorded at 45, 90 DAS and at harvest. Significant influence was observed among all the growth, yield and yield attributing parameters. However, T₁₁ - 50:30:20 kg/ha NPK+15 t/ha FYM was recorded with superior values of plant height (9.19, 75.76 and 133.81 cm), number of



branches plant⁻¹ (5.39, 14.60 and 15.26), fresh weight (11.27, 199.57 and 220.59 g plant⁻¹), dry weight (2.44, 37.56 and 46.68 g plant⁻¹), number of umbels plant⁻¹ (260.09), number of umbellates umbel⁻¹ (19.52), number of fruitumbel⁻¹ (437.83), number of fruit umbellate⁻¹ (22.42), seed yield g plant⁻¹ (19.34), seed yield q ha⁻¹ (14.32), biological yield q/ha (33.82), test weight (1.14 g) and harvest index (42.44%) as compared to T₁-absolute control.

EFFECT OF DIFFERENT SOIL AMENDMENTS, FUNGICIDES, PLANT EXTRACTS AND BIOAGENT AGAINST WILT DISEASE OF LINSEED (*LINUMUSITATISSIMUM* L.)

Shubham Singh* and Ramesh Singh

Department of Plant Pathology, T.D.P.G. College, Jaunpur (U.P.) 222001

*Email: shbhmsingh40@gmail.com

Abstract

Flax (*Linum usitatissimum* L.) belongs to the Linaceae family, also known as flax, which is one of the oldest cultivated plants. However, it is generally accepted that flax originated in an area East of the Mediterranean towards India and was probably domesticated there for the first time. In India, the wilt disease was first reported from Madhya Pradesh in 1923. Since then, it has been found in other linseed growing areas of the country. The reported losses upto 80 per cent under favorable conditions for wilt development. In view of these facts a field trial and pot culture was conducted in both the consecutive year 2018-19 and 2019-20 for screening out best effective soil amendments and fungicides against disease. Pot culture was conducted in wire house, amendment consists Neem cake, Mustard cake and Linseed cake among them Neem cake was found best effective treatment both the year 2018-19 and 2019-20 with percent disease control 10.66 % and 20.00% respectively. In field trial the treatments taken are Raxil, Vitavax, Propiconazole, Hexaconazole, Neem, Tulsi, Panchagavya and *Trichoderma*. Among the tested treatments Raxil was found to be most effective against disease and overall yield character in both the year 2018-19 and 2019-20. In 2018-19 the percent disease control (62.15%), yield contributing character recorded such as plant population (258.33), seed yield (0.966 Kg./ha.), thousand grain weight (9.10 gm.), benefit cost ratio (0.88). Similarly in year 2019-20 percent disease control (45.10 %), plant population (250.00), seed yield (0.95 kg./ha.), Thousand grain weight (9.30 gm.), and benefit cost ratio (0.88).

HONEY BEE FORAGING ACTIVITY AND BEE STRENGTH CORRELATES WITH HIVE VOLUME

Simran Bhatia^{1*}, Kiran Rana¹ and Meena Thakur¹

¹Department of Entomology, Dr.Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, H.P., India

*Email: simranuhf@gmail.com

Abstract

The size and volume of the honey bee colony nest have a significant role in determining the performance and productivity of the colony. The investigation was undertaken during July, 2020 to June, 2021 in *Apis mellifera* L. colonies at university apiary in the Department of Entomology, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. The hives with different volumes were 20-liter (Modified BIS Type A), 25-liter (5-frame), 30-liter (6-frame), 33-liter (8-frame) and Standard Langstroth hive 42-liter (10-frame). The investigations were carried out to determine the relationship between bee strength in hives with different volume and bee activity in Himachal Pradesh's mid hills. According to the findings, bee activity notably peaked in an 8-frame hive when bee strength was at its highest, while when bee strength was at its lowest, bee activity in Modified BIS Type A hives was reduced significantly. The results depicted that bee strength showed a positive correlation with the bee activity in all the treatments. It is concluded that the bee strength and foraging activity of a colony is influenced by the hive volume and is consequently important for the honey bee colony's foraging activities and honey production.

ZINC MANAGEMENT STRATEGIES IN WHEAT (*TRITICUM AESTIVUM*)

Simarjot Singh^{1*}, Dr. Kanwaljit Singh² and Dr. Bhupendra Mathpal³

^{1,3}Department of Agronomy, School of Agriculture, Lovely Professional University, Phagwara-144411, Punjab, India

²Department of Agriculture, Khalsa College Amritsar, 143001, Punjab, India

*Email: simarjotsingh@yahoo.in



Abstract

The present investigation entitled, “Zinc management strategies in wheat (*Triticum aestivum*)” was carried out at Student’s Research Farm, Khalsa College, Amritsar during the rabi season of 2018-19. The field was laid out in Split-plot design with three replications consisted three main plot treatments P₁ [100 % RD of P], P₂ [120 % RD of P] and P₃ [80 % RD of P] and six subplot treatments Z₁ [0 (Control)], Z₂ [100 % (RD of Zn) Soil application], Z₃ [1 Foliar Spray (0.5% of ZnSO₄) b/w anthesis and early grain development], Z₄ [2 Foliar Spray (0.5% of ZnSO₄) b/w anthesis and early grain development], Z₅ [50% RD of Zn in Soil + 1 Spray (0.5% of ZnSO₄) b/w anthesis and early grain development] and Z₆ [50% RD of Zn in Soil + 2 Spray (0.5% of ZnSO₄) b/w anthesis and early grain development]. The results showed application of 100% RDP (62.5kg/ha) led to maximum number of effective tillers m⁻² (344.9), spike length (11.1 cm), grains per spike (48.6), test weight (41.1), grain yield (50.8 q/ha) and straw yield (72.4 q/ha). This led to 8.1% increment in grain yield over 80% RDP (50 kg/ha). Among zinc levels, 62.5 kg Zn ha⁻¹ (recommended) produced maximum number of effective tillers m⁻² (346.7) whereas other yield attributing characters like spike length (11.8 cm), number of grains per spike (50.2), test weight (41.8), grain yield (52.4 q/ha) and straw yield (72.0 q/ha) were maximum for 50% (RD of Zn) Soil + 2 Spray (0.5% of ZnSO₄) b/w anthesis and early grain development. The increase in grain yield over control was 15.7%. Application of phosphorus at recommended rate of 62.5 kg/ha in combination of 50 % recommended dose of Zinc in soil with two foliar sprays at anthesis and early grain development stage gave higher grain yield.

CLIMATE CHANGE, GLOBAL WARMING AND THE SUSTAINABLE DEVELOPMENT CHALLENGES IN INDIA

Sita Ram Bijarnia*, Jitendra Kuri, Kamlesh Choudhary

Research Scholar, Department of Agricultural Extension & Communication, Swami Keshwanand Rajasthan Agriculture University, Bikaner 334006

*Email: sitarambijarnia7@gmail.com

Abstract

Climate change has deeply affected the life of every individual more or less. The change in atmospheric characteristics known as a result of global warming has resulted in disturbed rainfall pattern, floods, earthquakes etc. Among the developing countries of the world, India is also facing the catastrophic impact of this change in the form of natural calamity. Although the necessary steps have been initiated to minimize its impact, efforts are still ongoing to find a suitable solution to this problem. In view of the myriad challenges of sustainable development, the country is still confused in terms of incorporating climate change adaptation and mitigation into the political agenda and integrating it into ongoing schemes along its applied connotations. This paper is aimed at addressing climate change issues in India. It will also highlight proposals for developing relevant policies to combat the futuristic impact of climate change.

ASSESSMENT OF KNOWLEDGE, ATTITUDE AND PRACTICES OF DAIRY FARMERS ON USE OF ANTIBIOTICS AND ANTIMICROBIAL RESISTANCE

Mahesh Dhangar, Smita Kolhe*, Vikas Waskar, Rahul Kolhe A.V. Khanvillkar and Gokul Sonowane

Department of Veterinary & Animal Husbandry Extension Education, KNP College of Veterinary Science Shirwal, MAFSU, Dist Satara Maharashtra, 412801

*Email: drsmi@rediffmail.com

Abstract

The study was undertaken with the objective of assessing the knowledge attitude and practices followed by dairy farmers towards antibiotic use and antimicrobial resistance. A total of 120 respondents were purposively selected from Pune and Satara district of Maharashtra and data was collected through a structured interview schedule. Collected data were exposed to statistical analysis, KAP index and results were interpreted. Almost all the variables studied viz. age group (67.50%), education level (61.66%), annual income (74.17%), landholding (48.33%), herd size (75.00%), experience (71.66%), milk production (79.16%), social participation (80%), extension contacts (53.33%), knowledge level (80.33), attitude (68.33%) and practices (78.33%) could be grouped under medium level. Dairy farmer’s understudy had a low to medium level of knowledge towards



antibiotics and their use while little knowledge regarding antimicrobial resistance. The majority of the respondents used antibiotics for the treatment of animals, however, knowledge on the specific use of antibiotics, dose regime, storage, expiry, residual effect, risk of spread to humans was low to moderate. Thus, there is enough scope for improvement of the dairy farmer's knowledge regarding appropriate antibiotic use and antimicrobial resistance. The majority of dairy farmers had an unfavorable attitude and followed low to medium levels of good practices towards the use of antibiotics and antimicrobial resistance. A significant association between education, social and extension contact of the respondents with knowledge, social and extension contact with attitude and practices score was observed. Also, among all socioeconomic variables only education, extension contact and social participation are highly significant with KAP of the dairy farmers towards antibiotics, its use and antimicrobial resistance. Thus, applicable informative interventions should be intended to reach and educate the farmers about the rational use of antibiotics and the development of antimicrobial resistance taking into account the social and extension context. Periodic training programs, awareness campaigns, workshops, demonstrations, etc. are desirable to generate a paradigm shift in the perceptions of the dairy farmers and to raise awareness about antibiotics, rational drug use, and resistance with specific consideration to public health.

CURRY LEAVES : AN AUSPICIOUS LEAFY SPICE FOR THE DEVELOPMENT OF β -CAROTENE RICH UPMA

Sonia^{1*}, Varsha Rani² and Sangeeta C. Sindhu³

Department of Foods and Nutrition, COHS, CCSHAU, Hisar-125004 (Haryana), India

*Email: soniagn01@gmail.com

Abstract

This study was undertaken to develop and analyze β -carotene rich upma supplementing with curry leaves powder. *Murraya koenigii* is an amazing leafy spice having medicinal, culinary, and nutritional properties. Fresh leaves contains ample amount of β -carotene i.e. 7663 μg , richest source of Pro-vitamin A, and retention of β -carotene was witnessed up to 80-90 per cent after steam cooking. It was aimed to standardize the development of Pro-vitamin A enriched upma by supplementing 5, 7.5 and 10 per cent of curry leaves powder. Leaves were blanched for 15 seconds and freeze dried. The control products upma were prepared using semolina and all other required ingredients. Semolina was substituted with 5, 7.5 and 10 per cent of curry leaves powder in experimental (Type-I, Type-II and Type-III) upma. Developed upma was subjected to sensory evaluation by a panel of semi-trained judges. Proximate composition, dietary fibre, minerals and β -carotene were analysed in developed upma. Data was statistically analysed using SPSS and OPSTAT software. Upma prepared by incorporating 7.5 per cent of CLP was more acceptable as compared to the one that containing 10 per cent CLP. Results revealed that the protein content of control upma was 11.10 per cent which increased significantly up to 12.07 per cent with incorporation of CLP. Crude fibre and ash content in upma supplemented with CLP had increased significantly as compared to control upma. Total dietary fibre content ranged from 20.48 to 23.70 per cent in supplemented upma whereas control upma contained 19.14 per cent. β -carotene content of T3 upma (9528.28 $\mu\text{g}/100\text{g}$) was highest followed by T2, T1 and control upma which was 30 to 60 times higher than β -carotene concentration of control upma. Additionally, a tremendous increase in calcium (142.60 to 253.22 %) and iron (4.13 to 5.24%) was observed in supplemented upma.

THE IMPACT OF RISING TEMPERATURE AND CLIMATE CHANGE ON AGRICULTURE PRODUCTION

Soniya Rishi

Department of Extension Education Rajasthan College of Agriculture, MPUAT, Udaipur

Email: soniyarishi97@gmail.com

Abstract

Any systematic change in the long-term statistics of climate elements (such as temperature, pressure, or winds) sustained over several decades or longer. Climate change may be due to natural external forcing, such as changes in solar emission or slow changes in the earth's orbital elements; natural internal processes of the climate system; or anthropogenic forcing." (IPCC) Temperature increased 0.68 $^{\circ}\text{C}$ in the last century, to increase 1.4-5.8 $^{\circ}\text{C}$ by 2100. Rainfall to increase 10% by 2050 with an increased variability causing frequent floods and droughts. Sea level risen 10-25 cm, to rise 50 cm by 2100. Retreating glaciers in the Himalayas. Shortened Rabi season. More incidences of diseases and pests. Global warming occurs mainly due



to human activities. Changes in climate will have several implications in agriculture, *i.e.* change in the location of optimal growing area of particular crops. Increase in flood frequencies and accelerated coastal erosion, inundation and salt water intrusion. Shift in the geographical area of forest in natural ecosystem. Agriculture scenario is surely going to change due to effect on photosynthesis, input use efficiency, pest population dynamics, land use and land cover changes etc. There is need for intensive research in this regard so that the sustainability of agriculture can be maintained.

ESTIMATING HEART RATE AND TEMPERATURE (FEVER) OF OLIVE FLOUNDER (*PARALICHTHYS OLIVACEUS*) WITH SURGICALLY INSERTED BIO-LOGGER

Showkat Ahmad Dar^{1*}, Sung-Ju Jung², Naresh Raj Keer¹ and Lakan Lal Meena¹

¹College of Fisheries Kishanganj, Bihar Animal Science University- 855107

²Department of Aqualife Medicine, Chonnam National University, Yeosu 59626, Republic of Korea

*Email: Showkatdar53@gmail.com

Abstract

The present study was carried to learn the surgical studies in commercially important olive flounder (*Paralichthys olivaceus*). Further, the experimental trial was carried to know the heart rate and body temperature (fever) in olive flounder using bio-loggers. Two weeks after surgery, all fish survived with normal skin color but inner part of surgery, peritoneum side, revealed hemorrhages. Total six fish were surgically inserted temperature DST micro-HRT logger. After surgery the fish were monitored daily for one week and were kept in circular tanks with round the clock aeration. After 6 days three fishes were given intraperitoneal injection of FCA @ 100µl/kg and kept as treatment group. The results reveal that the temperature recorded by the bio-loggers was absolutely good in comparison to our manual recorder. While the heart rate was found better in 100 htz compared to 80 and 100 htz using the highest quality index (QI). The expression studies reveal that the HSP genes were significantly induced by temperature rise due to treatment of FCA. The results showed that all the immune genes were induced significantly in both kidney and spleen. The immune genes TNF- α , IL-1, and IL-8 showed significant fold change with respect to control non treated group. The TNF- α gene showed very high about 12 times fold change and higher induced expression compared to the other immune genes. During the study, the immunogenic high gene expression responses showed the impact of temperature rise along with cytokine role in fever responses. The study paves way to study more in fish fever and related responses in the field of fisheries science to open the new aspects for research and development. This research will serve as guide to help researchers to increase their understanding of the febrile response in fishes and the underlying mechanisms that boost their knowledge of the critical roles that fever plays in the modulation of host immunity.

STUDY ON QUALITY PARAMETERS IN ADVANCED LINES OF RICE (*ORYZA SATIVA* L.)

Sreelakshmi Ch.*, Paramasiva I., Vineetha U. and Madhusudhan P.

Agricultural Research Station, ANGRAU, Nellore, Andhra Pradesh-524003

*Email: ch.sreelakshmi@angrau.ac.in

Abstract

With the effect of green revolution, India has achieved self sufficiency in food grain production due to continuous efforts of breeders across the country and now it was reached to a yield plateau. Due to the continuous changes in consumer's preference the aim of the breeder was slightly changed to consumers view *i.e.* development of rice varieties with good cooking quality. In rice generally quality means milling quality (hulling%, milling% head rice recovery %), cooking quality of rice (Kernal elongation ratio, volume expansion ratio, water uptake) keeping quality of rice, chemical quality (amylose content, alkali spreading value, gel consistency) and nutritional quality (zinc content, iron content, protein content etc.). The milling and cooking qualities were mainly focused for millers and nutritional and chemical qualities were focused for consumer in general. In view of the above at Agricultural Research Station, Nellore, ANGRAU 105 advanced uniform lines were evaluated for its milling, cooking and chemical quality traits during 2019 kharif season. Out of 105 genotypes only 4 genotypes exhibited more than 4 as the grain length to breadth ratio. 64 genotypes recorded grain L/B ratio in between 3 to 4. The size of the rice kernel is determined by its kernel L/B ratio. In the present study 49 and 51 genotypes exhibited L/B ratio as more than 3 and between 2.5 to 3 respectively. From the miller point of view high head rice recovery is the prime component. 12 genotypes recorded more than 60% recovery and 33 genotypes fell in between 55 to 60%. 42 genotypes gave 42% head rice recovery. Alkali spreading value indirectly indicates the time taken for cooking. In this study 6 genotypes recorded the ASV score of 7



followed by 68 genotypes recorded 2 score and 17 genotypes recorded 1 score only 3 genotypes recorded 7 score and 4 genotypes recorded 4 score. increased uptake of water by the kernel upon cooking is the desirable feature for rice. Among 105 genotypes studied, 38 genotypes recorded 250 ml for 100g of rice followed by 19 genotypes which recorded 300ml, 7 and 3 genotypes recorded more than 350 and 400 respectively. High head rice recovery, more water content. Medium ASV and kernel L/b ratio of 3 is needed for the rice for better miller and consumer acceptability. Out of 105 genotypes 9 genotypes found to have acceptable qualities with respect to head rice recovery, water uptake, Alkali spreading value and kernel L/B ratio.

STUDY OF YIELD AND PHYSIOLOGICAL TRAITS IN SELECTED EARLY KHARIF RICE GENOTYPES

Sreelakshmi Ch.*, Paramasiva I., Vineetha U. and Madhusudhan P.

Agricultural Research Station, ANGRAU, Nellore, Andhra Pradesh-524003

**Email: ch.sreelakshmi@angrau.ac.in*

Abstract

Early kharif season is a peculiar season of rice cultivation mainly concentrated in southern districts in Andhra Pradesh state where short duration rice varieties were raised from april first fort night onwards under assured irrigation facility. This season is characterized by hot winds coupled with high temperatures during crop growth period till flowering. To study the yield and physiological attributes of seven popularly cultivated short duration rice varieties viz., NLR 34449, MTU 1010, NLR 3354, NLR 30491, NLR 33358, NLR 40024 and ADT 37 an experiment was planned at Agricultural Research station, Nellore, ANGRAU during 2021 early kharif season with three replications. The main parameters studied were days to reach different growth stages, plant height, biomass partitioning at different growth phases, leaf area index along with grain yield. All the genotypes recorded significant differences for all the traits studied. NLR 33358 comes to flowing at 85days after sowing followed by NLR 30491 (89 days) and NLR 40024 (90 days). Plant height showed significant differences at all the 3 dates of data recorded viz., 30, 60 and 90 day after sowing. NLR 34449 recorded less plant height at all the three dates followed by NLR 3354 and NLR 40024. High tiller number including number of productive tillers per plant was recorded by NLR 34449 followed by NLR 40024 and NLR 3354. more panicle length was recorded by MTU 1010, NLR 33358 and NLR 30491 here all the three recorded 23cm lengthy panicle. high grain yield was recorded by NLR 3354 followed by NLR 40024 and NLR 34449. high leaf area index was recorded by NLR 34449 at all the three different stages of data collection followed by AT 37 and NLR 40024. From this experiment it can be inferred that NLR 3354, NLR 40024 and NLR 34449 found to be the good yielders with better physiological attributes.

STUDY OF ADVANCED RICE GENOTYPES FOR ITS YIELD AND DISEASE RESISTANCE

Sreelakshmi Ch.*, Ramesh Babu P., Madhusudhan P., Paramasiva I. and Vineetha U.

Agricultural Research Station, Nellore, ANGRAU, Andhra Pradesh-524003

**Email: ch.sreelakshmi@angrau.ac.in*

Abstract

Rice is the life and it is the staple food for two third of world's population. After green revolution, due to introduction of dwarf and semi dwarf high yielding varieties of rice and continuous breeding efforts lead to a yield plateau. Now the focus of a breeder has changed to development of rice varieties for correcting defects of already existing popular varieties. In this context, at Agricultural Research Station, Nellore, research on rice was going for development of rice varieties suitable for late kharif season i.e., sowings were taken up during the month of September. Out of 25 advanced breeding lines studied under field conditions against three checks (NLR 33892: Yield check, NLR 3041: Blast resistant check, BPT 5204: blast susceptible check) for yield and disease components viz., leaf blast, neck blast and bacterial leaf blight, NLR 3475 recorded high yield compared with the yield check (5273 kg/ha, check yield: 3979 kg/ha, leaf blast score: 3, neck blast score: 5, BLR score: 5). It also recorded high mean grain yield of 6540 kg/ha (check yield: 5039 kg/ha) and 3 score for leaf blast disease for two consecutive seasons. It has duration of 155 days and 108 cm plant height with a panicle length of 23cm. The second best genotype is NLR 3473 (4288 kg/ha), which recorded 3 score for all the 3 diseases studied. It recorded an average grain yield of 5554 kg/ha for two consecutive years and blast score of 2 and 3 in the respective years. The resistance may be due to the reason



that the presence of NLR 34449, a pollen parent used in the above two cultures possesses strong blast resistance. NLR 3477 recorded 4142 kg/ha and the 3 score for all the diseases except BLB which recorded a score of 5. A total of 11 genotypes recorded significantly superior yield performance over the check variety. Nine genotypes recorded 3 score for leaf blast disease whereas 18 genotypes recorded 3 score and one genotype (NLR 3472) recorded 1 score for neck blast disease. Five genotypes each recorded 1 and 3 score for BLB respectively.

POPPING AND PUFFING OF MILLETS : A REVIEW

Sreenivas Y.N.

NIFTEM, Kundli, Haryana, India

Email: srinivasaseenu77@gmail.com

Abstract

Consumption of Ready-to-eat foods are increased significantly worldwide as they are simple to digest, light and crisp, and most importantly, ready to consume in nature; grains are becoming more and more popular in modern society. The demand for these goods is steadily rising. An integrated study on food grain expansion helps to understand these processes. Popping is a combination of starch gelatinization and expansion process, while grains are subjected to high temperature for short time. During this process super-heated vapour heated vapour produced inside the grains by instantaneous heating, grains get cooked and expands the endosperm suddenly breaking out the outer skin. puffing is similar process; differ from popping as a process in which controlled expansion of kernel is carried out, while the vapour pressure escapes through the micro pores of the grain structure due to high pressure or thermal gradient. Popping and puffing imparts acceptable taste and desirable aroma to the snacks. There are different methods of popping and puffing used, conventional methods of dry heating, sand and salt treated, hot air popping, gun puffing, popping in hot oil and by microwave heating. Though a wide range of millets such as sorghum, ragi, pearl millet, foxtail millet, kodo millet are used for popping and puffing; only few of them pop well. The reason behind this internal factors which influences popping and puffing qualities of millets such as the physicochemical properties like moisture content, composition of the grain, hardness of the grains, types of endosperm, genetic variety of grains, different methods of popping and puffing. And this popping and puffing methods leads positive changes in the physicochemical characteristics like composition and physical parameters.

EFFECT OF ORGANIC MANURES IN PEST AND DISEASES SUPPRESSION IN BRINJAL (*SOLANUM MELONGENA* L.)

Suraj Bhan*, Kuldeep Thakur, B.S. Thakur and Simran Bhatia

Department of Vegetable Science, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, H.P., India, 173230

*Email: sbhan619@gmail.com

Abstract

Organic manures plays a dynamic role in enhancing the plant health by strengthening the plant defense mechanism against insects, pests and diseases. The studies were carried out at Organic block of Vegetable Science, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan (HP) during Kharif season of 2019 to know the effect of organic manures in fruit borer and alternaria leaf blight suppression in Brinjal. The eight treatments used were T₁: Absolute control, T₂: FYM @ 10 t/ha, T₃: Vermicompost (VC) @ 5 t/ha, T₄: FYM @ 5 t/ha + VC @ 2.5 t/ha, T₅: Beejamrit (Seed treatment) + Jeevamrit (Drenchings + Foliar spray), T₆: FYM @ 10 t/ha + Beejamrit (Seed treatment) + Jeevamrit (Drenchings + Foliar spray), T₇: VC @ 5 t/ha + Beejamrit (Seed treatment) + Jeevamrit (Drenchings + Foliar spray), T₈: FYM @ 5 t/ha + VC @ 2.5 t/ha + Beejamrit (Seed treatment) + Jeevamrit (Drenchings + Foliar spray). Among different organic nutrient sources, application of Vermicompost (VC) along with Beejamrit and Jeevamrit (T₇) showed the minimum incidence of fruit borer and lower severity of alternaria leaf blight in Brinjal. Hence, application of Vermicompost @ 5 t/ha along with beejamrit and jeevamrit (T₇) for least pest and diseases incidence and resulted in enhanced yield.

CHARACTERIZATION OF BREWER'S SPENT GRAIN, AN AGRO-INDUSTRIAL WASTE AND DESIGNING AN EFFICIENT PRE-TREATMENT PROCESS TO MAXIMIZE SUGAR RELEASE FOR BIOTECHNOLOGICAL APPLICATION



Srishti Mathur* and Dinesh Kumar

Shoolini University, India

*Email: srishtimathur.sm@gmail.com

Abstract

Brewer's Spent Grains (BSG) are a major byproduct of the beer brewing industries that are high in lignocellulosic biomass (cellulose, hemicellulose, and lignin). Proximate analysis were done of Moisture (6.12 ± 0.06), pH (7.37 ± 0.18), Fat (11.01 ± 0.02), Protein (19.6 ± 0.23), CHO (59.49 ± 1.03), Crude fibre (15 ± 0.15), Ash (3.1 ± 0.05), Hemicellulose (21.5 ± 0.32), Cellulose (25.5 ± 0.40), Lignin (10 ± 0.56), Total solid (93.88 ± 0.54), respectively. A key driver for long-term LCB biorefineries is economic conversion to value-added products. If we aim for BSG in the biotechnological route for valorizing alcohol sugars such as xylitol, erythritol, and others for future use in other industries. It has the potential to alter the course of the game. The current work demonstrates the characterization of Brewer Spent Grain in order to determine hemicellulose concentrate for targeting with various pre-treatments in order to study the effect on sugar yield. Under optimized conditions, two pre-treatments were performed and compared: acid hydrolysis and hydrothermal (water bath) treatment. Acid hydrolysis was discovered to be an effective procedure, yielding a total of 30.97 ml per 100 ml in 30 minutes, the highest out to be calculated in comparison to water bath treatment, which yielded 11.33ml per 100 ml. As a result, one can conclude that acid hydrolysis is the most effective pre-treatment for BSG in terms of maximizing sugar release.

DIFFUSION PATHWAY OF A TRANSFERRED TECHNOLOGY IN SELECTED VILLAGES OF WEST BENGAL THROUGH SOCIAL NETWORK ANALYSIS

Subhadip Mondal¹, Shehanaz Alam² and Debabrata Basu³

Department of Agricultural Extension, BCKV, Mohanpur, Nadia, West Bengal-741252

*Email: shehanaz4u@gmail.com

Abstract

Diffusion of innovation research has high impact on extension practices. Conventionally and popularly collection of diffusion data is sourced from individual adopters, ignoring their social networks they belong to. Social Network Analysis is a field of data analytics that uses networks and graph theory to understand social structures which has been less tried in interpreting diffusion data. The present study utilized the Social Network analysis as a tool to explore the diffusion pathways of a newly adopted technology in West Bengal. In addition, a comparatively new PRA tool named Innovation Tree has been applied to visualize and analyze the way in which an innovation is spread over time between the community members. It helped in identifying not only to distinguish between various adopter categories, but also as a way of helping both outsiders and the community to understand some of the social and psychological dimensions that influence the adoption and diffusion of an innovation within that community. This study was conducted in Sekati and Chhoto Sehana Village of Gaighata CD block in North 24 Parganas District, West Bengal. The village was selected to study the diffusion of mechanical rice transplanter in the light of social network analysis. Total enumeration of the mechanical rice transplanters in the village was done for the study. Both qualitative and quantitative data were collected from 65 respondents who were the adopters of the Mechanical Rice Transplanter. Data analysis was done using UCINET and NETDRAW software and Innovation Tree was generated with local participation. The study revealed that neighbors, friends, input dealers were the main source of information for the respondents. The results showed that the key persons, around whom the networks are centralized, had higher educational background, high land holding, and high degree of cosmopolitaness. This study helped us in visualizing the diffusion pathway along with the key actors who had emerged as the main source of dissemination of the technology that paves the way for effective extension with limited paid extension manpower belonging to the government system.

PROCESSING AND PRESERVATION OF HORTICULTURE PRODUCTS

Subhash Verma

Department of Vegetable Science, Bihar Agriculture University, Sabour, Bhagalpur, Bihar

Email: subhashverma052@gmail.com

Abstract



It's essential to process horticultural crops to add value to products which, due to their size, shape, and nature, are unsuitable for the fresh market. In India, a large quantity of horticultural products is wasted each and every day due to their being unaccepted by the consumer. To overcome this problem, the government of India established different processing industries, such as CFTRI, the first fruit and vegetable processing industry established in Mumbai in 1935 and the first fruit preservation and canning institute in Lucknow in 1949. In the maximum case, the fruit is harvested at a mature stage, while in the case of vegetables, they are harvested at either a mature or immature stage. Various horticultural products are prepared, including beverage and non-beverage products; sauce; pickle chutney; squash, cordial, marmalade; jam, jelly, preserve, fruit syrup, fruit juice, RTS, glazed fruits; tomato puree, paste, juice, soup, ketchup, sauce, nira, feni, cider, and other products. Sauerkraut is prepared by combining cabbage with microbes such as *Leuconostoc* and *Lactobacillus*, and a famous product prepared by black carrot is known as kanji. Different preservatives are used to preserve products for a long time, such as sulphur dioxide salt, KMS (potassium metabisulphite) used against bacteria and moulds (fungus), and benzoic acid is also used as a preservative against a variety of other products also used for preservatives, such as salt (10–25%), sugar, and acetic acid (1–5%) concentration. For salt preservation known as brining for vegetables; sugar preservation known as syrumping for fruit, such as candied fruit such as pointed gourd, ash gourd, petha, jelly marmalade, and so on; different food additives are also used for processing, such as BHA, SnCl_2 , monosodium phosphate, CMC, BHT, pectin, monosodium glutamate, etc.

IMPACT OF CLIMATE CHANGE AND ITS MITIGATION STRATEGIES ON VEGETABLE CROP PRODUCTION

Sudha Singh* and Sakshi Singh

Dr.Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, H.P.-173230

*Email: sudhasingh230795@gmail.com

Abstract

The tremendous growth of population and climate change are the major challenges of 21st century. It is now widely accepted that the change in climate is occurring at a faster rate than before. Climate change has adversely affected the agricultural crops, vegetable crops not being an exception to it. Unlike any other crop, vegetable crops are being negatively impacted by changing climatic situations such as rise and decrease in temperature and also by an overall increase or decrease in rainfall at different growth stages of the crops. Other stress factors include CO_2 and Relative Humidity. Air pollutants such as CH_4 and CFC's are the major causes to the trends in global warming. Nitrogen and sulphur dioxides are the major contributors to the reduction of ozone layer. Physiological, morphological and enzymatic activities are dependent on temperature. Climate change affects both quality and production of vegetable crops as vegetable crops contain high amount of water i.e., more than 90% which makes it highly sensitive to these environmental changes. Vegetables are significant component of human diet and are known as protective food as they supply essential nutrients, vitamins and minerals to the human body as well as the best asset for defeating micronutrient deficiencies. They are also good remunerative to the farmers as they fetch higher price in the market. Several initiatives are undertaken to mitigate the possible impact of climate change on vegetable production. These include selection of higher adaptable genotypes, genetic manipulation to beat extreme climatic stresses, measures to enhance water and nutrient-use efficiency and exploiting the beneficial effects of CO_2 enhancement on crop growth. Furthermore, global warming and climate change problems can be mitigated by adoption of organic agriculture. It has been observed that the adverse impact of climate change on agricultural production depends on specific region and is more severely observed in developing countries. Thus, organic agriculture is a good option to reduce emission of greenhouse gases and increase carbon sequestration in soil.

MARKER-ASSISTED SELECTION FOR PRECISION PLANT BREEDING

Suman Kalyani* and Ranvir Kumar

Bihar Agricultural University, Sabour, Bhagalpur, Bihar

*Email: kalyanipbg@gmail.com

Abstract

Since beginning the Plant breeding has made remarkable progress in crop improvement and it is critical that this continue with



advancement of new agricultural technology. It seems clear that current breeding programmes continue to make progress through commonly used breeding approaches. The term 'precision' is being widely used by agricultural scientists now a day in their research like precision crop production, precision plant breeding etc. By using DNA markers to assist in plant breeding, efficiency and precision could be greatly increased. The use of DNA markers in plant breeding is called marker-assisted selection (MAS) and is a component of the new discipline of 'molecular breeding. This MAS is a new approach for precision plant breeding in the twenty-first century. DNA markers have enormous potential to improve the efficiency and precision of conventional plant breeding via marker-assisted selection (MAS). MAS could greatly assist plant breeders in reaching this goal although, to date, the impact on variety development has been minimal. For the potential of MAS to be realized, it is imperative that there should be a greater integration with breeding programmes and that current barriers be well understood and appropriate solutions developed. The exploitation of the advantages of MAS relative to conventional breeding could have a great impact on crop improvement. The high cost of MAS will continue to be a major obstacle for its adoption for some crop species and plant breeding in developing countries in the near future. Specific MAS strategies may need to be tailored to specific crops, traits and available budgets. New marker technology can potentially reduce the cost of MAS considerably. If the effectiveness of the new methods is validated and the equipment can be easily obtained, this should allow MAS to become more widely applicable for crop breeding programme.

MILLET IMPROVEMENT FOR CLIMATE RESILIENT AGRICULTURE

Suman Kalyani and Ranvir Kumar

Bihar Agricultural University, Sabour, Bhagalpur, Bihar

*Email: kalyanipbg@gmail.com

Abstract

The Green Revolution in India encouraged and subsidized the production of rice and wheat and become the most popular amongst grains as staple in India. But in recent, with changing in climate, India and Bihar State in particular, time to time experienced drought and flood. For which Bihar state government emphasizing in self sufficiency in food production so that government have one year buffer stock of food grains to meet any kind of food shortage in the state. And as such, it is expected by the government that SAU/CAU/ICAR have to provide scientific inputs/ research outcome to cope of this condition. Transfer the agriculture of Bihar through its commercialization. Policy for commercialization of agriculture is also the need of hour. Considering the changing climate and ensuring profitability in farming; Government should give immediate emphasis for crop diversification and emphasis on cultivation of Millet. By improvement in Millet in the present climate changing scenario, we can feed the people. Millets such as sorghum (jowar), pearl millet (bajra), foxtail millet (kangni), finger millet (ragi), Barnyard millet, Kodo mille, Little Millet, Proso are nutritious as well as climate resilient agriculture. Millet can be traced as far back as the Stone Age and in fact, many types of millet have even been found in Mohen-jo-daro and Harappan civilization since beginning. Millet are amongst the healthiest grains available and are the alternative of present climate change. Millets are environmentally friendly and by consuming them, we encourage farmers in arid and semi arid areas to grow crops best suited for those regions. Now, many farmers practicing millet in a mixed cropping system that increases on-farm biodiversity and sustainability. This mixed cropping with millet increases farm productivity by improving soil fertility and making plants stronger, thus enabling them to fight off pests and diseases. Thus, there is need of improvement in millet to cope up the climate change in India and state also for nutritional food security.

NEED OF SOIL HEALTH MANAGEMENT FOR FOOD AND NUTRITIONAL SECURITY

Suman Kalyani* and Ranvir Kumar

Bihar Agricultural University, Sabour, Bhagalpur (Bihar)

*Email: kalyanipbg@gmail.com

Abstract

With the rising population of India, food security was focal point and productivity of the crop was major issue. With passes of the time, food plus environmental security become the most prominent issue with the planner and focused on productivity with soil health management. Again, food, environment and nutritional security entail the scientist on productivity, soil health, and environment. With this paradigm shift in agriculture, now a day the thrust areas are: productivity, soil health, environment plus



nutritional security. Soil quality affects the crop yield and quality. Biological, Physical and Chemical attributes constitute the soil quality. Soil Management is needed for better yield, soil health and environment safety. Physical management of soil helps in more water retention and availability, better root growth and cover crop, reduce erosion and avoid compaction whereas chemical management of soil improve nutrient retention, high nutrient reserves, buffering against acidification, manage salt affected soils and soil amendments. However, Biological management of soil maintain biodiversity, nutrient cycling, degradation of pollutants, carbon enrichment etc. To yield more, chemical fertilizers (NPK) is being applied to crop either in over or under use. The ideal fertilizer consumption ratio should be 4:2:1 but the present consumption is highly skewed towards nitrogen. As per the statistics, about 85 percent of the total fertilizers are consumed in 290 districts and only 15 percent is consumed in remaining 449 district (Fert. Statistics 2018-19) which necessarily attract the attention for judicious use of fertilizer in the country for human, & soil health and environment.

PHENOTYPIC AND BODY MEASUREMENT TRAITS OF SAHIWAL AND CROSS BREED CATTLE

Sumit Gangwar^{1*}, Shive Kumar¹, R.K. Sharma¹, S.K. Singh¹, Jyoti Palod¹, A.K. Ghosh², Manoj Kumar Singh¹, Sachin Dongare¹ and Ankit Sharma¹

¹Department of Livestock Production Management, College of Veterinary and Animal Sciences, GBPUAT, Pantnagar, U.K

²Department of Animal Genetics and Breeding, College of Veterinary and Animal Sciences, GBPUAT, Pantnagar, U.K

*Email: s.gangwar026@gmail.com

Abstract

The present study was conducted at Instructional Dairy Farm Nagla, College of Veterinary & Animal Science, G. B. Pant University of Agricultural & Technology Pantnagar. A total of 150 adult Sahiwal pure breed cattle and 160 adult Cross breed cattle were selected to study their phenotypic and body measurement traits. The Phenotypic characteristics were visually recorded and body measurements were taken with a measuring tape. Coat colour and face colour of the Sahiwal ranged from reddish brown but few predominant red and Cross breed cattle varied in grey, black, whitish brown and reddish. The body measurement traits in Sahiwal and Cross breed cattle were recorded as Heart girth, Paunch girth, Body length, Ear length, Face length, Height at withers, Distance between neval to ground, Length of fore leg, Length of hind leg, were found to be 158.53±1.79 and 173.91±1.08, 171.83±1.22 and 191±1.69, 136.63±0.68 and 145.74±1.59, 19.97±0.39 and 23.53±1.27, 42.58±0.98 and 46.83±1.21, 124.33±0.88 and 127.73±1.99, 47.83±0.78 and 48.33±1.57, 82.43±1.77 and 85.93±1.09, 84.33±0.98 and 88.83±1.29, cm respectively. The relative information about phenotypic and body measurement traits of pure breed Sahiwal and Cross breed cattle may help full for the identification of good animal's early stage of dairy herds.

INFLUENCE OF INTEGRATED PLANT NUTRIENT SYSTEM ON PHOSPHORUS SOLUBILISATION AND PRODUCTIVITY OF WHEAT IN VERTISOLS

Suresh M. Dalvi, R.M. Ghodpage and Sagar S. Patil*

Soil Science and Agricultural Chemistry Section, College of Agriculture, Nagpur, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra)

*Email - sagarpatil4597@gmail.com

Abstract

The current study, titled "Influence of Integrated Plant Nutrient System on Phosphorus Solubilization and Productivity of Wheat in Vertisols" was carried out at the Botany Farm at the College of Agriculture in Nagpur during the rabi growing season of 2019–20. The findings showed that ghanjivamrut @ 5 t ha⁻¹ at incorporating green manure in combination with 50% RD of chemical fertilizers + biofertilizers is the suitable nutrient source for maintaining soil available phosphorus nutrient at physiological growth stage and fertility status and it also improves nutrient uptake and wheat yield. With the IPNS approach, wheat grain production increased by 3.63, 4.52, and 14.40 per cent over 100% RDF + green manuring, saving 50% of chemical fertilizers and increasing solubility.

ASSESSMENT OF SOIL PHYSICAL PROPERTIES FROM DIFFERENT BLOCKS OF JAIPUR DISTRICT, RAJASTHAN, INDIA



Surykant Sharma^{1*},

Department of Soil Science and Agriculture Chemistry, [Naini Agricultural Institute]

Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj – 211007, U.P., India

**Email: surykantsharma.ag@gmail.com*

Abstract

The year 2021-2022, An analysis experiment was done for identification physical properties from the Rajasthan state at the Jaipur district area. For further study, twenty-seven soil samples were taken from farmer's fields in different three blocks of Jaipur district at depths 0-15 cm, 15-30 cm and 30-45 cm. The soil texture in the examined region was sandy loam. The difference of soil color also noticed in both the Air-dry condition and Moist condition and the color was light yellowish brown (10YR6/4) to brownish yellow (10YR5/8) and bulk density was from 1.24-1.34 Mg m⁻³, The range of particle density was from 2.27-2.34 Mg m⁻³ and the pore space 37.77 to 43.65 %. The water retaining capacity % (WRC %) of soil ranged between 43.56 to 57.28 %. The specific gravity of soil ranged between 2.33 to 2.46. The manure and organic fertilizers are suitable for good soil health and maximum crop production at the farmer's field.

BIOLUMINESCENCE IN INSECTS PEST AND ITS IMPORTANCE

Sushila Choudhary

Department of entomology SKNCOA Jobner 303328 (Rajasthan)

Email: Sushilachoudhary221995@gmail.com

Abstract

The production and emission of light by a living organism is known as bioluminescence which is known to be a one of the oldest and interesting field of scientific study. In Greek word 'bios means life or living matter and Latin word 'lumen' means light and 'essence' means process that changes a state. This phenomenon occurs when there is a pigment called Lucifer and an enzyme called luciferase with a source of oxygen. As a result of the reaction, a compound called (oxyluciferin) is produced and emits light. Luciferase is a key compound that catalyzes the luminescence reaction in bioluminescence. It is a biological process which occurs naturally where the energy is released by a chemical reaction in the form of light emission. During the process, chemical energy is converted into light energy. The organisms like bacteria, fungi, mushroom, phytoplankton, marine protista, annelids, mollusks, centipedes, millipedes, crustacean and chordates exhibit luminescence. Apart from this, some of the unique insects also exhibit light. Though bioluminescence is generated by various organisms, it is highly developed in insects which play a significant role in courtship, predation and defense. Moreover, there are no luminous flowering plants, birds, reptiles, amphibians or mammals in nature.

STUDY ON SURVIVAL RATE OF *IN VITRO* PROPAGATED SUGARCANE CULTIVAR

Shweta* and Sridevi tallapragada

Department of Botany and Plant Physiology, CCS Haryana Agricultural University, Hisar

**Email: rawalshweta25@gmail.com*

Abstract

Sugarcane (*Saccharum officinarum* L.) the most significant industrial crop in the world, cultivated in over 100 countries, including developing countries with high export value. It is C4 perennial grass with clumps made up of succession of internodes and nodes. It belongs to a large grass family *Poaceae* (*Graminae*); tribe *Andropogonae* and originated in New Guinea (Liu, 1984). The demand for sugar for the increasing population has created a challenging situation for sugarcane growers and researchers because of the lack of healthy, infection free elite resistant cultivars. There is also a lack of quality seed material and implementation of advanced technologies in sugarcane propagation. For every new cultivar to achieve quick shoot formation, shoot proliferation, root formation, and enlargement, an efficient technique is required (Jai *et al.*, 2014). Sugarcane is commercially cultivated through multiple cutting of stalks which show low multiplication rate, many pathogens accumulate generation after generation, which cause diseases like- red rot, whip smut, grassy shoot disease, and adversely reducing cane output as well as the quality (Schenck and Lehrer, 2000; Sengar *et al.*, 2011).



In the modern world, micro propagation is a well-established, viable and successful method for bulk propagation of elite, homogeneous plant material and conservation of the existing germplasm. Micropropagation is aseptic technology suitable for rapidly multiplying pest-free plant materials derived from desired plant organs, tissues, and cells (Vuytsteke & De Langhe, 1985). Plant tissue culture is a promising technology that may be used as an alternative to improve the quality of seed. So, by the conventional propagation method we are unable to produce true-to-type plant material. The investigation was carried out to study the effect of different energy sources on *in vitro* multiplication of sugarcane cultivar. The maximum shoots were observed on medium enriched with table sugar.

ASSOCIATION STUDIES OF GLAUCCOUSNESS WITH VARIOUS MORPHO-PHYSIOLOGICAL AND AGRONOMICAL TRAITS UNDER DROUGHT AND HEAT CONDITIONS

T. Harisha^{1*}, Hari Krishna², Nivedita Sinha², Rahul Gajghate², Neelu Jain², P.K. Singh² and G.P. Singh³

¹Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Iruvaki, Shivamogga

²Division of Genetics, Indian Agricultural Research Institute, New Delhi

³Indian Institute of Wheat and Barley Research, Karnal, Haryana

*Corresponding author: harish96.mdhl@gmail.com

Abstract

Drought and heat stress are the major abiotic stresses which cause losses in wheat productivity in major growing regions worldwide, and both the occurrence and the severity of these events are likely to increase with global climate change. The only sustainable approach for overcoming these stresses and achieving self-sufficiency in the production of food grains is the development of tolerant cultivars. Glauccousness, is a light bluish appearance on flag leaf, stem, and spikes due to deposition of epicuticular wax crystals on these surfaces, which has previously been found to increase the yield of grain and dry matter under drought and heat stress environment in wheat. In this study, a set of hundred (100) genotypes consisting of recombinant inbred line (RILs) (derived from cross between synthetic46 and HD2932), mutant lines and germplasm lines were screened under irrigated (control), restricted irrigation (drought) and late sown (heat stress) environments for different morpho-physiological and agronomic traits to find association of glauccousness with days to heading (DH), normalized difference vegetative indices (NDVI), canopy temperature (CT), stomatal conductance (STC), chlorophyll content (SPAD), grain size parameter like grain length (GL) and grain width (GWD), thousand grain weight (TGW) and grain weight per thirty spike (GWPS). Glauccousness was positively correlated with GWPS and negatively correlated with NDVI in all the three environments. Glauccousness was significantly negatively correlated with NDVI values in all the three conditions. It also displayed positive correlation with SPAD in controlled and drought condition and also positively correlated with GWD in drought scenario. Therefore, GWPS and SPAD chlorophyll content can be used as a proxy trait for indirect selection of glauccous as well as drought tolerant genotypes.

DESIGN AND DEVELOPMENT OF TWO ROWS POWER OPERATED GARLIC PLANTER

Tarun Kumar Maheshwari*, Hemant Kumar and Jitendra Kumar

Farm Machinery and Power Engineering, College of Agricultural Engineering and Technology, Etawah, U.P.

*Email: maheshwari_tk@yahoo.com

Abstract

Garlic is a semi perishable vegetable cash crop. The production of garlic in Etawah district is about 50-100q/ha. In this study an innovatively designed engine operated garlic planter, triple unit, row crop precision planter capable of planting two rows of garlic (*Allium sativum* L.) cloves on each raised bed was designed, fabricated and tested. The major components of this planter include chassis and transport wheels, engine, seed hopper, seed chain and spoon type metering, seed tube, furrow openers and seed coverers. The chain and spoon are driven by engine operated ground wheels through a chain conveyor system. The laboratory evaluation of the planter components, especially the seed metering mechanism revealed a satisfactory performance of the planter components. The type of soil was sandy loam having initial moisture content was 16.3 % and the bulk density of experimental plot after seed bed preparation was 1.52 g/cm³. This designed self-propelled precision garlic planter capable of planting two rows of garlic cloves at a spacing of 10×15cm was designed, fabricated and tested. The average seed rate manually operated garlic planter and power operated was 330 kg/ha and 418 kg/ha respectively. The average



plant population was 70 plants/m² of garlic sown by power operated garlic planter whereas the plant population was 76 plants/m² of garlic sown by traditional method. A 3-hp petrol engine was used as prime mover of the garlic planter but average germination of power operated garlic planter was 90% but traditional method was 93% after 20 days of sowing. The theoretical field capacity was calculated as 0.08 ha/h at a speed of 1.8 km/h, whereas, the actual field capacity was found to be 0.065 ha/h with field efficiency of 79.84 %. The average yield obtained by traditional method and power operated were 40.1 q/ha and 42.2 q/ha respectively. The man-h/ha by manual operated was 166.8 and whereas power operated were 543.79. It was observed that the placement of garlic cloves was at uniform depth under a range 4.2 cm to 5.2 cm with a minimum standard deviation and coefficient of variance of 0.33 cm and 6.92 % respectively. The germination percentage of traditional method was 89.6 whereas power operated was 93.6 percentages respectively. While operating the power operated garlic planter average missing of cloves were 11% and doubling of 14% respectively.

STUDIES ON THE EFFECT OF LAND CONFIGURATION AND SPOT APPLICATION OF ORGANIC MANURES ON THE GROWTH, YIELD AND QUALITY OF *BT* COTTON (*GOSSYPIMUM HIRSUTUM* L.) IN ALFISOLS

T.M. Rudresh*, B.R. Jagadeesh and H. Vimalashree

Department of Soil Science and Agricultural Chemistry, College of Agriculture, UAS, Dharwad-580005, Karnataka

*Email: rudreshmallikarjuna@gmail.com

Abstract

A field experiment was conducted to study the effect of land configurations and spot application of organic manures on the dynamics of potassium in **Alfisols** in *Bt* cotton at College of Agriculture, Hanumanamatti, Karnataka during *kharif* 2019. The experiment was laid out in split plot design with two main plot treatments, ridge and furrow method of sowing (M_1) and flat bed method of sowing (M_2) and six sub plot treatments (S_1 : RDF-Control, S_2 : RPP-Package of practice, S_3 : S_1 + Blanket application FYM @ 5 t ha⁻¹, S_4 : S_1 + Spot application FYM @ 5 t ha⁻¹, S_5 : S_1 + Blanket application vermicompost @ 2.5 t ha⁻¹, S_6 : S_1 + Spot application vermicompost @ 2.5 t ha⁻¹) replicated thrice. Soil samples collected and were analyzed for physical and chemical properties, major nutrients as well as different forms of K, K fixation capacity and K releasing characteristics. The plant samples were analyzed for nutrients concentration after harvest of the crop then nutrient uptake was calculated. The results revealed that plants grown under ridge and furrow method (M_1) of sowing had significantly higher growth and growth attributes, yield and yield attributes, nutrient uptake and soil nutrient status after harvest of crop. Sub-plot treatment, (S_6) RDF+ spot application vermicompost @ 2.5 t ha⁻¹ recorded significantly higher values for growth and growth attributes, yield and yield attributes, nutrient uptake and soil nutrient status, different forms of potassium and their release characteristics after harvest of crop. Among different treatment interactions ($M_1 \times S_6$), plots supplied with RDF+ Spot application of vermicompost @ 2.5 t ha⁻¹ (S_6) under ridge and furrow method of sowing (M_1) found to be effective over other treatment combinations in the above mentioned parameters. Hence, spot application of vermicompost with full dose of chemical fertilizers under ridge and furrow method of sowing is possible to get better yield and improved soil physical conditions as well as fertility status.

HYDROGEL TECHNOLOGY—A TOOL FOR SUSTAINABLE AGRICULTURE IN ARID AND SEMI-ARID REGIONS

Chakravarthy Thejesh¹ and Bhupendra Mathpal²

Department of Agronomy, School of Agriculture, Lovely Professional University, Phagwara-144411 Punjab

*Email: chakravarthythejesh17@gmail.com

Abstract

Currently, worldwide the issues like rapid increment in population has been building up pressure on the food demand to fulfill the needs and problems like biotic and abiotic stresses due to the peaking pace of urbanization, deforestation, land degradation and global warming. With these situations, the accessibility to freshwater resources is declining and the agriculture sector holds the lion's share in water consumption, on priority basis water management has engrossed the attention. Many water management practices like micro irrigation have been under execution but they are not sufficient to handle the water scarcity. Contradicting the tendency of existing water resources and food demand has put food security at stake. The employment of SAP (Super Absorbent Polymers) like hydrogel has shown some drastic changes in the arid and semi-arid regions by perking



up the water use efficiency (WUE). They are synthetic polymers that are cross-linked with water-absorbing capacity by forming bonds with water molecules. It enhances the moisture availability in the rhizosphere by tumbling the runoff, percolation and evaporation losses. When they come in contact with water by rainfall or irrigation, the hydrogel granules tend to swell from their original size and mitigate the water demand of the crop by slowly releasing them under drought conditions. When soil amended they improve the soil physical properties like structure, permeability, porosity, infiltration rate and water holding capacity and they reduce the soil compaction. They are eco-friendly and biodegradable in nature that no residues are left in soil or crop produce. It has numerous roles in conserving the soil and water, improving fertilizer use efficiency (FUE), controlling agents for pests and diseases, seed coating and also improving the growth and yield of various crops. Hence deploying these hydrogel polymers are viable and propitious technology to amplify the productivity of crops under adverse conditions.

KNOWLEDGE OF TRIBAL FARMERS ABOUT VDVK ACTIVITIES IN ANDHRA PRADESH

Tummala Naga Satya Sai Srivani^{*}, Parvez Rajan, Rajesh Sarkar

Division of Agricultural Extension, College of Agriculture, JNKVV, Jabalpur, Madhya Pradesh, India

**Email: tnssrivani@gmail.com*

Abstract

Van Dhan Vikas Kendra's were formed as a part of Pradhan Mantri Van Dhan Vikas Yojana (PMVDVY) scheme, which constitutes of around 300 members in each VDVK. In VDVK activities like value addition to various forest products, trainings etc., were done in order to provide employment opportunities, avoid exploitation by the middlemen and to improve the livelihood of the tribals. The present study i.e., Knowledge of tribal farmers about VDVK activities in Andhra Pradesh was conducted under ITDA-Rampachodavaram which was situated in Andhra Pradesh in the year 2021-2022. Out of the seven tribal mandals, only two mandals i.e., Rampachodavaram, Mareduilli mandals were selected randomly and from each mandal four villages were selected by simple random sampling method. By using proportionate sampling method, a sample size of 105 was taken. Through the findings, it was revealed that majority of the beneficiaries were young age group and belonged to female gender. Most of the beneficiaries were illiterates, having low annual income and small land holdings. Majority of the beneficiaries had moderate level of utilisation of source of information, with medium extension contact and having medium awareness regarding PMVDVY. While knowledge about VDVK activities, majority of the beneficiaries comes under medium category.

HETEROSIS AND INBREEDING DEPRESSION STUDIES IN MUNGBEAN [*VIGNA RADIATA* (L.) WILCZEK]

V.B. Rathod^{*} and H.G. Kanara

Main Dry Farming Research Station, Junagadh Agricultural University, Targadia-360023 (Gujarat)

**Email: rathodviraj21@jau.in*

Abstract

Twenty eight mungbean hybrids derived from 8 x 8 diallel excluding reciprocal crosses were studied to know the magnitude of heterobeltiosis, standard heterosis and inbreeding depression for yield and its component characters in mungbean. The magnitude of heterobeltiosis and standard heterosis was high for seed yield per plant, number of pods per plant, number of clusters per plant and number of primary branches per plant. The crosses Vaibhav x Asha for heterobeltiosis and K 851 x OUM 11-5 for standard heterosis showed significant and the highest value for seed yield per plant and its important component traits. Only one heterotic cross i.e. K 851 x Pant-M 4 for seed yield did not show inbreeding depression for same trait. Further this cross did not show inbreeding depression for most of the characters.

PERCEPTION OF FARMERS ON CUSTOM HIRING SERVICES IN JABALPUR DISTRICT OF MADHYA PRADESH

Upali Kisku^{1*}, Kamini Bisht² and Seema Naberia²

¹Extension Section, ICAR-National Dairy Research Institute, Eastern Regional Station, Kalyani, Nadia, West Bengal, India



²Department of Extension Education, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur

*Email: upalikisku84@gmail.com

Abstract

Custom Hiring Services (CHS) are an excellent concept for farmers who do not own farm power and machinery. Farm mechanisation has been lacking in Indian agriculture, resulting in insufficient production and productivity in various portions of the country. The current study used a descriptive research design to realize farmers' perceptions of Custom Hiring Services in Madhya Pradesh's Jabalpur region. Patan was selected out of the seven blocks and 80 respondents from ten villages were selected using a proportionate random sampling technique. Farmers actively engaged in agricultural operations and utilizing the CHS were selected purposively. The respondents were interviewed personally using a pre-planned interview schedule. The majority of the farmers belonged to the small and marginal group, had a primary level of education, performed agriculture as their primary source of income, and cultivated crops in either of the two seasons of the year. Family size, annual income, farm power/implements, farming experience, social participation, communication behaviour, economic motivation, and the extent to which CHS was utilised were all assessed as medium levels. CHS offered access to implements such as a tractor, thresher, rotavator, straw reaper, raise bed planter, reversible plough, cultivator, seed cum fertiliser drill etc. Majority of the respondents (75%) had a moderate perception of the CHS, indicating advantages such as cost and time savings, drudgery and workload reduction. Major constraints were reported to be a lack of sufficient knowledge about the centres and the unavailability of equipment. Proper guidance and timely training of farmers on CHC implements and services will be effective in boosting their interest in mechanisation.

PERFORMANCE EVALUATION OF TRACTOR OPERATED TWO ROW SEMI AUTOMATIC BELT TYPE POTATO PLANTER

Uttam Kumar* and Gourav Sahu

College of Agricultural Engineering, Birsa Agricultural University, Ranchi, Jharkhand

*Email: uttam.bauranchi@gmail.com

Abstract

Potato (*Solanum tuberosum* L.) is the fourth most important food crop in India after rice, wheat and maize. It is the cheapest and richest source of nutrients and calories with comparatively higher carbohydrate, fibre, vitamin C and Vitamin B than other major food crops. The major Potato producing states are Uttar Pradesh, West Bengal, Bihar, Gujarat, Madhya Pradesh, Punjab, Assam, Haryana, Jharkhand and Chhattisgarh. Traditional planting of potato is a labour-intensive requires about 145 man days for cultivation of 1 ha of land. One of the main problem faced by potato growers in the state is high labour requirement for planting, earthing up and intercultural operations. Non availability of adequate labour during the planting season in winter necessitates the mechanization of potato planting. Tractor operated two-row semi-automatic belt type potato planter was tested at BAU farm as well as farmers field covering an area of 3.50 ha. The effective field capacity of the planter was 0.18 ha/h at an operating speed of 2.05 km/h. The labour requirement was 16.67 man-h/ha. It was observed that tubers in 5% cups were missing. There was bridging of cut tubers at the opening of hopper. Two persons are employed to regulate the flow and fill the missing cups. The cost of operation for planting potato by machine is Rs 3360 /ha whereas by traditional method the cost of operation was Rs. 45000 / ha. The machine works satisfactory during field condition and saving of labour, time and cost of operation. This machine is suitable for small farmers of the state.

INDOLE ACETIC ACID (IAA) PRODUCTION EFFICACY OF NATIVE *TRICHODERMA* SPP. ISOLATED FROM MARATHWADA REGION, MAHARASHTRA

V. Krishnaveni* and K.D. Navgire

Department of Plant Pathology, VNMKV, Parbhani, Maharashtra-431402

*Email: varalakrishnaveni4444@gmail.com

Abstract

Indole acetic acid (IAA) is one of the major phytohormone produced by several plant growth promoting microorganisms which plays greater role in plant growth promotion. In the present study, eight native *Trichoderma* spp. isolated from



Marathwada region (Maharashtra) were used for IAA production under *in vitro* condition with amendment of L-tryptophan at different concentrations 0.1, 0.5, 1.5 and 2 per cent in Potato dextrose broth. Results revealed that all *Trichoderma* spp. showed positive results for IAA production and based on quantitative estimation of IAA at different concentrations of L-tryptophan, there was a gradual increase in the IAA production with respective to L-tryptophan concentration from 0.1 to 1 per cent after 7 days of incubation. *Trichoderma yunnanense* (CTA₂) yielded maximum IAA 116 µg/l at 1 per cent concentration of L-tryptophan, followed by *Trichoderma yunnanense* CTP₄, *Trichoderma yunnanense* (CTJ₁), *Trichoderma yunnanense* (CTN₂) with IAA with production 111.03 µg/l, 92.8 µg/l, 88.87 µg/l respectively. While *Trichoderma rifai* (CTL₂), *Trichoderma yunnanense* (CTO₂), *Trichoderma simmonsii* (CTB₁), *Trichoderma pleuroticola* (CTB₂) showed comparatively less production of IAA with 46.33 µg/l, 47.67 µg/l, 51.67 µg/l and 61.67 µg/l, respectively. However, the very high concentration of L- tryptophan @1.5 per cent lowered IAA production significantly in all the *Trichoderma* spp. which proved the negative effect of higher concentrations of L-tryptophan in indole acetic acid production.

AGROFORESTRY FOR MITIGATING CLIMATE CHANGE

Vrushali R. Mahala* and Suyog A. Bagade

Deptt. of Forest Products, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni-Solan (HP)– 173230
SRS Institute of Agriculture and Technology, Vedasandur Dist. Dindigul, Tamil Nadu

*Email: vrushalimahala0594@gmail.com

Abstract

The most ecologically sustainable system of land usage is agroforestry. When food and tree crops are combined, the yield is increased. One of the most obvious land use systems is the impact of industrial agriculture, climatic change, and agroforestry. It offers carbon revenue, and wood energy increases soil fertility and improves local climate conditions. The three primary strategies to change climate change mitigation for agroforestry are to reduce greenhouse gas emissions, sequester carbon in soil biomass, and avoid emissions by reducing fossil fuels and energy usage. The carbon cycle, biological diversity, and water quality are among the production and conservation technologies that aid in the integration of forestry and agricultural endeavors. The term “agroforestry” refers to ecosystem component modifications made in response to climate change. The increase in temperature brought on by a greater concentration of greenhouses in the atmosphere is a common characteristic of the greenhouse effect. The increase in carbon dioxide levels brought on by climate change is one such occurrence that shortens the growing season and lowers crop productivity. The effects include increased global warming; unpredictable precipitation patterns; frequent natural disasters; and agricultural consequences. Agroforestry helps community members become less reliant on trees for their resource needs. It also has high bioenergy potential because it provides the locals with fuelwood. Another development in agroforestry is the cultivation of novel cultivars of common species. The right, higher-quality plant material, both indigenous to India and imported from elsewhere, is a crucial component of the application of agroforestry.

EFFECT OF CLIMATE CHANGE IN AGRICULTURE

Vandana S. Madke¹, P.R. Manapure¹, P.V. Shende¹, Sapna B. Baviskar¹ and Gajanan D. Chandankar²

¹College of Agriculture, Nagpur (Dr. P.D.K.V., Akola),

²Reginal Research Centre, Amravati (Dr. P.D.K.V., Akola)

Email: vandanarg2004@yahoo.co.in

Abstract

The effect of climate change can be classified into two groups i.e. positive and negative based on the results observed in related fields. The average increase in global temperature by global warming, has become a notable trend that will lead to significant global changes in the future. Changes beyond the average atmospheric condition that are caused both by natural factors such as the orbit of earth's revolution, volcanic activities, and crustal movements and by artificial factors such as the increase in the concentration of greenhouse gases and aerosol' are referred to as Climate changes. The positive effects of global warming include the increase in crop productivity due to fertilization effect caused by the increase in carbon dioxide concentration in the atmosphere, expansion of the areas available for production of tropical and/or subtropical crops, expansion of two-crop farming due to the increased cultivation period, reduction of damages of winter crops by low temperature, and reduction of heating value for agricultural crops grown in the protected cultivation facilities. The temperature



fruits like apple, peach, plum and cherry gave higher yield due to extreme chilling. Negative impacts of global warming include reduced crop quantity and quality due to the reduced growth period following high levels of temperature rise; reduced sugar content, bad coloration, and reduced storage stability in fruits; increase of weeds, blights, and harmful insects in agricultural crops; reduced land fertility due to the accelerated decomposition of organic substances; and increased soil erosion due to the increased rainfall. The year 2003 was denoted as the year of heat and cold waves across the world. Food grain production in India has taken a tremendous growth due to the Green Revolution. There have been similar revolutions in the production of milk, fish, eggs, sugar, and a few other crops. India is now the largest producer of milk, fruits, cashew nuts, coconuts and tea in the world, the second largest producer of wheat, vegetables, sugar and fish, and the third largest producer of rice. As the forests act as a sink to the increasing amount of CO₂; the higher rate of deforestation mainly for development and agriculture, have imbalanced the natural process of carbon cycle. The increasing demand of food due to ever growing population have resulted in intensive agricultural practices i.e. use of agro-chemicals, livestock generation for meat and other source of income, exploitation of water resources etc. This has led the undesired situation by release of greenhouse gases due to agricultural activities and resulting in pollution of natural resources.

EFFECT OF PLANTING DENSITY AND NUTRIENT LEVELS ON THE PRODUCTIVITY OF POPCORN HYBRIDS

V. Sujatha^{1*}, I. Sudhir Kumar², S.L. Jat³ and A.K. Singh⁴

^{1,4}Agricultural Research Station, Peddapuram, Kakinada, ANGRAU, Guntur, Andhra Pradesh

^{2,3}ICAR-Indian Institute of Maize Research, PAU Campus, Ludhiana

*Email: sujatha.agro12@gmail.com

Abstract

Maize is the third most important cereal crop after wheat and rice in India. Diverse types of corns flint corn, dent corn, flour corn, sweet corn, pop corn etc. are grown in India of which pop corn is the only corn that pops. Pop corn (*Zea mays everta*) an important type of corn which is prominently used for popped form; green cobs for table purpose and widely used in preparation of snacks in meals in different parts of world. Demand of pop corn is increasing day by day with the changing food preferences in Indian life style. Technological interventions viz., genotypes, planting density, water and nutrient management and pest and disease management etc. influence the yield of crops to a greater extent. Amongst, genotypes, planting density and nutrient management play a vital role in increasing the yield of popcorn. Therefore, A field experiment was conducted at Agricultural Research station, Peddapuram, Kakinada District, Andhra Pradesh during *Kharif*, 2018 to study the response of popcorn hybrids to varying planting density and fertilizer levels. The experiment was carried out in split-split plot design with two planting densities (60 x 20 cm and 50 x 20 cm) as main plots, two fertilizer levels (RDF and 150% RDF) as sub plots and five popcorn hybrids as sub- sub plots and replicated thrice. The results revealed that DPCH-306 was found to be the best suitable pop corn genotype under 50 x 20 cm spacing with 150 % RDF (120:90:75 kg NPK/ha) recorded higher grain yield of 3582 kg ha⁻¹ and net returns of Rs. 73,908 ha⁻¹ during *kharif* season in godavari region of Andhra Pradesh.

VARIABILITY, HERITABILITY AND EXPECTED GENETIC ADVANCE IN LATHYRUS GENOTYPES IRRADIATED WITH GAMMA RAYS IN M₃ GENERATIONS

Vandana S. Madke¹, P.R. Manapure¹, Amey P. Jambulwar^{1*}, and Gajanan D. Chandankar²

¹College of Agriculture, Nagpur (Dr. P.D.K.V., Akola)

²Reginal Research Centre, Amravati (Dr. P.D.K.V., Akola)

*Email: ameyjam7@gmail.com

Abstract

Mutation breeding is an effective approach in improvement of the crop having a narrow genetic base such as soybean by creating variability. Therefore, the present study was conducted with an objective to estimate variances between family and within family, to estimate genetic parameter and identify superior mutants for utilization at experimental farm of Agricultural Botany Section, College of Agriculture Nagpur during *rabi* 2019 in M₃ generation. In *rabi* 2019, 123 mutants along with two checks (NLK-73 and Ratan) were evaluated in three replications. Data were recorded on germination percentage, mortality



percentage, days to first flower, days to maturity, plant height, number of branches plant⁻¹, number of pods plant⁻¹, 100 seed weight and seed yield plant⁻¹. Analysis of variance indicated that the mean square due to between family were highly significant for all traits, which revealed the presence of significance genetic variability between the families. Intra class correlation (t) lead the inference that differences between individual within family is large and each family differentiated distinctly from the other at lower level in M₃ generation hence, equal weightage to ²f and ²w were suggested to be considered for selection in M₃ generation. High genotypic and phenotypic coefficient of variation was recorded for seed yield plant⁻¹ and 100 seed weight and moderate for other characters. High heritability was recorded for number of branches plant⁻¹, days to 1st flower, seed yield plant⁻¹ and moderate for others. Genetic advance as a percentage of mean was high for seed yield plant⁻¹, 100 seed weight, number of branches plant⁻¹ and plant height. Seed yield plant⁻¹ was the only character which recorded high GCV, PCV, heritability and genetic advance hence this character was considered for selection in M₃ generation as influenced by additive gene action.

PERFORMANCE OF PRE-RELEASE MEDIUM MATURITY MAIZE GENOTYPES UNDER VARYING PLANTING DENSITY AND NUTRIENT LEVELS

V. Sujatha^{1*}, I. Sudhir Kumar², S.L Jat³ and A.K. Singh⁴

^{1,4}Agricultural Research Station, Peddapuram, Kakinada, ANGRAU, Guntur, Andhra Pradesh

^{2,3}ICAR-Indian Institute of Maize Research, PAU Campus, Ludhiana

*Email: sujatha.agro12@gmail.com

Abstract

Maize (*Zea mays* L.) is one of the important cereals, next to wheat and rice in the world. The yield potential of maize depends on its genetic makeup and the environment. There are so many factors that are directly responsible for yield traits in maize crop whereas planting density and nutrient management play a vital role in increasing yield. Planting density decides the yield of a crop and should be maintained to avert yield loss as it is one of the major causes which directly affect the yield. Maize being an exhaustive crop requires more nutrients during different phenological phases. Hence, Field studies were carried out at Agricultural Research Station, Peddapuram, Kakinada District during *Kharif*, 2018 in sandy loam soils to study the effect of varying planting density and nutrient levels on pre release medium maturity maize genotypes. The pre-release maize genotypes were tested at two densities (60 x 20 cm and 50 x 20 cm) and two nutrient levels (RDF and 150% RDF). The experiment was laid out in split-split plot design with three replications. The results revealed that the medium maturity maize genotype DKC-9179 under 50 x 20 cm spacing with 150 % RDF (300:90:75 kg NPK/ha) recorded higher grain yield (6613 kg ha⁻¹) and net returns (Rs. 58,232 ha⁻¹) in maize.

POTENTIAL FORAGE GRASSES OF BHAGALPUR DISTRICT (BIHAR), INDIA

Vani Suman

University Department of Botany, T.M. Bhagalpur University, Bhagalpur-812007 (Bihar), India

E-mail: vanisuman@gmail.com

Abstract

Plants play an important role in animal husbandry concerned with raising of livestock for their products. The increasing livestock population to meet high demand of their products need more feed which is supplemented by using wild plants. Forage grasses which are being grazed or harvested for domestic use at the time of maturity deserve special attention of people. They are rich in nutrients and ideal as feed for cattle, sheep, horses, goats, etc. During the study of such grasses of Bhagalpur district (Bihar), more than twenty grasses have been found to be utilized as forage. These grasses grow luxuriantly as wild plants mainly during rainy season in the diverse habitats of the district. Some forage grasses occur as weeds in crop fields round the year. The most common and potential forage grasses of Bhagalpur district (Bihar) are *Bothriochloa intermedia* (Forest blue grass), *Bothriochloa pertusa* (Hurricane grass) *Cenchrus purpureum* (Napier grass), *Cynodon dactylon* (Bermuda grass), *Dactyloctenium aegyptium* (Egyptian crowfoot grass), *Dichanthium annulatum* (Marvel grass), *Digitaria abludens* (stalked crabgrass), *Digitaria ciliaris* (Summer grass), *Heteropogon contortus* (Black speargrass), *Iseilema laxum* (Musal grass), *Paspalum distichum* (Knot grass), *Paspalidium flavidium* (Yellow watercrown grass), *Pennisetum glaucum* (yellow foxtail), *Sorghum halepense* (Johanson grass), etc. Of these, *Cynodon dactylon* is the most palatable and lavishly used grass



whereas *Cenchrus purpureum*, *Digitaria abludens* and *Paspalidium flavidium* are good forage grasses used to increase milk production. Other common and valuable forage grasses include *Brachiaria ramosa* (Brown top millet), *Echinochloa colona* (Awnless barny grass), *Echinochloa crusgalli* (Barnyard grass), *Ischaemum indicum* (Indian muriana grass), *Oryza rufipogon* (Wild rice), *Pennisetum pedicellatum* (Desho grass), *Saccharum spontaneum* (Thatch grass), etc. *Saccharum spontaneum* is the favourite grass of buffaloes. *Echinochloa crusgalli* reduces milk production. *Cynodon dactylon* and *Saccharum spontaneum* are the dominant grasses of the region. The information is expected to be useful for local people especially milkmen.

LAMENESS AND ECONOMIC TRAITS IN KARAN FRIES CATTLE

Vandana Yadav*, S.M. Deb¹, I.D. Gupta, Vikas Vohra, Gopal Gowane, Shivam Bhardwaj and Narendra Pratap Singh

ICAR-NDRI Karnal, Haryana

¹ICAR-NDRI Kalyani, West Bengal

*Email: dryadavvandana@gmail.com

Abstract

Lameness has been considered as the third most economically important health problem in dairy herds after infertility and mastitis. It has an adverse effect on the economics of farm. Economic loss due to lameness costs around 4-5% of total farm income. So, the present study was conducted in Karan Fries cattle in order to deduce the effect of lameness on important economic reproductive traits. For this study, data spread over a period of 20 years (1999 to 2019) was utilized to find out the effect of lameness and various other factors on economically important reproduction traits i.e. age at first service (AFS) and calving to first insemination (CFI). The effect of lameness and different other non-genetic factors on important reproductive traits was estimated based on least-squares model-I of Harvey (Harvey, 1990). The effect of lameness on age at first service (AFS) was found to be non-significant ($p < 0.05$). The overall least squares means of AFS was 745.782 ± 7.419 days. The effect of season of birth on AFS was found to be non-significant in Karan Fries cattle. This study observed a significant effect of period of birth on AFS ($p < 0.001$). A lower heritability estimate of 0.114 ± 0.00259 for AFS was obtained in this study. On similar lines, there was no significant effect of lameness on calving to first insemination. The overall least squares means of CFI was 74.239 ± 1.942 days. The effect of season of calving and period of calving on calving to first insemination (CFI) was also found to be non-significant. A much lower heritability estimate of 0.041 ± 0.00247 for calving to first insemination (CFI) was obtained in this study. This study concluded with non-significant effect of lameness prevalence on the age at first service and calving to first insemination interval.

ADVANCES IN MANAGEMENT OF INSECT-PESTS OF STORED GRAINS

Vasu Mehta

Department of Entomology, CSK Himachal Pradesh Agricultural University, Palampur, Himachal Pradesh-176062

Email: vasumehta31@gmail.com

Abstract

Post-harvest losses at the storage stage, particularly the losses resulting due to the attack of various pests, are considered most critical in developing countries. Among biotic and abiotic factors, insects play a major role in the deterioration of food grains causing both quantitative and qualitative losses (30%-40%) in the grains. Nearly 100 species of insect-pests of stored grains and products cause economic losses. These are mostly coleopterans, a few lepidopterans and psocopterans. The pests attacking sound grains are termed as primary storage pests (e.g. khapra beetle, rice weevil etc.) and those attacking already damaged grains are termed as secondary storage pests (e.g. red rust flour beetle, rice moth etc.). Since commencement of the settlement of the world, the search for food had been uppermost, thereby, practicing the conservation of food is a basic need for ensuring its ample supply to human being. Man has adopted various systems of storage which included traditional storage practices e.g. use of ash, common salt, neem leaves, cow dung, underground structures, matkabin, thekas etc. These days modern storage structures are being used which gives better storage capacity and easiness in storage e.g. coal tar drums, Hapur bin, PKV bin, Pusa bin, silos etc. For the management of stored grain pests, both preventive and curative measures are practiced. Preventive measures include sanitation, handling of grains, proper stacking, disinfestation of storage structures and legal restrictions. On the other hand, curative measures include different aspects viz. ecological, physical, mechanical,



biological, chemical and use of botanicals for the control of stored grain insect-pests. Several new methods have also been developed for the efficient management of stored grain pests. These include ozonation, nanotechnology, irradiations, aeration systems, microwave technology, fumigation using external fans, host resistance and use of low risk pesticides etc. Fumigation is the most commonly used method for the insect-pest control in stored grains. But in recent years, some insects have gained resistance to phosphine in some countries and on the other hand methyl bromide has been phased out due to ozone layer depletion and control failures. To overcome this, certain alternate fumigants have been recommended e.g. sulfuryl fluoride, Ethyl formate, Ethane dinitrile, EDB+ (EDB+ CCL₄) etc. About 10 gadgets for stored grain insect-pest monitoring and management namely, TNAU Pitfall Trap, TNAU Probe Trap, Two-in-one Model Trap, Indicator device, TNAU automatic Insect Removal Bin, UV-light Trap, Stack Probe, Air Bin and Egg Removal Bin has been developed. Today, as the population is increasing rapidly and so is the demand for food, we cannot rely upon the old management procedures and practices. Therefore, there is a need for advancements in storage methods, structures and techniques for efficient storage of grains and products.

ASSESSMENT OF GENETIC VARIABILITY, CHARACTER ASSOCIATION AND PATH ANALYSIS FOR YIELD AND QUALITY TRAITS IN ZINC RICH LANDRACES OF RICE

Venkata Ratnam T.^{1*}, Ravi Kumar, B.N.V.S.R.², Subba Rao, L.V.³, Srinivas, T.² and Anand Kumar A.D.V.S.L.P.⁴

¹Department of Genetics and Plant Breeding, Agricultural College, Bapatla, ANGRAU, Andhra Pradesh

²Department of Genetics and Plant Breeding, RARS, Maruteru, ANGRAU

³AICRP & Crop Improvement, ICAR-IIRR, Hyderabad, Telengana, India

⁴Regional Agricultural Research Station, Maruteru, ANGRAU, Andhra Pradesh, India

⁴RARS, Maruteru, ANGRAU

*Email: venkataratnamtata@gmail.com

Abstract

In rice (*Oryza Sativa* L.) production yield barriers have been overcome by high-yielding rice varieties, but micronutrient malnutrition is a severe threat to children aged under five and pregnant women. Among the micronutrients, zinc (Zn) and iron (Fe) are vital for several cellular functions in plants and animals. In addition, selection is one of the factors when identifying the source of genetic variability in the landraces. Frequent understanding of the extent of genetic variability and the genetic relationship between the genotypes are prerequisites for successful plant breeding. Therefore, we need to find out the nutrient rich genotypes along with higher yields to overcome the problem of hidden hunger. The present investigation was carried out with 37 genotypes of rice in a randomized block design with two replications and observations were recorded on grain yield, yield components, quality and nutritional traits. Analysis of variance revealed significant differences among the genotypes for all characters studied. The studies on variability, heritability and genetic advance as per cent mean revealed moderate GCV and PCV coupled with high heritability and genetic advance as per cent mean was recorded for days to 50 per cent flowering, plant height, zinc content, iron content and grain yield plant⁻¹ indicating a scope for simultaneous improvement of these traits along with grain yield per plant. The results on character associations and path analysis revealed positive and significant association coupled with high positive direct effect for grains panicle⁻¹, zinc content and productive tillers plant⁻¹ indicating the effectiveness of direct phenotypic selection for these traits in improvement of grain yield plant⁻¹.

INFLUENCING FACTORS AMONG COLLEGE GOING STUDENTS TOWARDS BRAND PREFERENCES OF SANITIZERS

Varnam Radhika¹ and Swetha Kodali^{2*}

¹Department of Resource Management and Consumer Sciences, College of Community Science, Professor Jayashankar Telangana State Agricultural University, Hyderabad, India

²Department of FRM, College of Community Science, AICRP-WIA, PG&RC, PJTSAU, Rajendranagar, Hyderabad, India

*Email : swethakodali0788@gmail.com

Abstract

In recent scenario due to pollution, climate change and pandemic situations there is a high risk of spreading infections and diseases. Thus people are habituated to use different sanitizers to protect themselves from the germs and viruses due to this



reason there is an evolution of different brands available in the market. Especially college going students prefer different brands of sanitizers which are easily available in the market. An attempt was made to know about the major influencing factors contributing to purchase hand sanitizers. The main objective of the study was to find the influencing factors contributing to purchase the hand sanitizers. A structured questionnaire was developed to collect the data from the respondents. Present study was intended for college going students' and purposive sampling technique was adapted for the same. Home Science College was selected for the present study. From the total 40 respondents, 36 responses were received. Statistical tools such as Pearson's correlation coefficient and Pearson's chi-square tests were used to analyze the results. From the major findings it was found that there was a significant relationship between marketing communication with age and education. Social factors and marketing factors were found to be the most influencing factors among college going students.

TEMPERATURE INDUCTION RESPONSE TECHNIQUE: A SCREENING TOOL FOR EVALUATION OF URDBEAN GENOTYPES FOR THERMOTOLERANCE.

Vijay Laxmi¹, Tiwari T.N.² and Rinki Devi³

¹Basic science division, ICAR-Indian Institute of Pulses Research, India

²National institute of abiotic stress management, Pune, Maharashtra India

³Indian institute of pulses research Kanpur, regional centre, Bikaner, Rajasthan

Email: vijaylaxmi01@yahoo.com

Abstract

Screening and identification of cultivars for high temperature stress conditions is essential under changing environment. Pulses are more sensitive to high temperature stress at reproductive stage. Urdbean is an important source of protein and widely used in daily diet. Temperature induction response (TIR) technique, is based on the principle of subjecting seedlings to sublethal temperatures and subsequent exposure to challenging temperatures, and further assessing growth and recovery. The standardization of induction temperature and lethal temperature is based on per cent growth reduction and survival percentage at the end of recovery period. The induction temperature was standardized at 36 to 46⁰C for 3 h and the lethal temperature as 52⁰C for 3 h. This study were conducted during 2020-2021 and 2021-2022 at Indian Institute of Pulses Research, Kanpur in augmented design in field under irrigated conditions. A total of six selected urdbean genotypes were screened and evaluated for thermo tolerance. By using standardized optimum induction and challenging temperature, cellular level tolerance was assessed in all the urdbean genotypes. Based on root length and shoot length of induced seedlings over control seedlings, the cellular level tolerance in terms of least reduction in growth and highest survival percentage was calculated. Thermotolerant genotypes PGRU 95014 and PGRU 95016 has shown intrinsic heat tolerance and therefore they can be explored as donor source in breeding programme aimed for global warming.

ISOLATION AND CHARACTERIZATION OF ENDOPHYTIC BACTERIA FROM WHEAT (*TRITICUM AESTIVUM*)

Vikram Singh^{1*}, P.K. Sharma², Palika Sharma³, Rahul Tripathi³ and Ashwani Kumar¹

¹Department of Plant Pathology, Chaudhary Charan Singh Haryana Agricultural University, Hisar 125004, Haryana, India

²Department of Plant Protection, Chaudhary Charan Singh University, Meerut 250001, Uttar Pradesh, India

³Division of Crop Protection, Indian Institute of Wheat and Barley Research, Karnal 132001 Haryana, India

*Email: vikramrohilla56@gmail.com

Abstract

Present investigation was carried out at IIWBR, Karnal, Division of Crop Protection to exploit diverse endophytic bacteria from 8 recommended wheat varieties as follows:- SONALIKA, HD2985, UP2950, AGRA LOCAL, PBW 723, WB-2, DBW 168, and HD3272. Total 101 endophytic bacteria were isolated, 40 from leaf, 30 from stem and 31 from root tissues of wheat on nutrient agar, *pseudomonas* and *actinomycetes* selective media. Out of all, further 8 endophytic strains were screened for multiple Plant Growth Promoting (PGP) traits viz. production of HCN, ammonia, amylase, phosphate (P) and zinc (Zn) solubilization and tolerance of fungicide. Strains like WB2-5, UP2950-7, HD3272-18, and UP2950-PL4 were positive for HCN. Strains WB2-1, WB2-5, UP2950-7, HD3272-L2, WB2-PL3, HD3272-18 and UP2950-PL3, produced ammonia. All strains were positive for amylase production. Six strains solubilised phosphate with PSI ranging from 0.5-1.8 maximum was



shown by strain HD3272-18. Five strains viz. WB2-5, UP2950-7, WB2-PL3, HD3272-L2 and HD3272-18 solubilised zinc, maximum solubilisation was shown by HD3272-18. All endophytic bacterial strains viz. WB2-1, WB2-5, UP2950-7, HD3272-L2, WB2-PL3, HD3272-18, UP2950-PL3 and UP2950-PL4 showed tolerance of fungicide (vitavax ultra). The 16S rDNA gene sequences of three endophytes WB2-5, UP2950-7 and HD3272-18 strains available from NCBI showed higher similarity with *Bacillus subtilis*, *Bacillus cereus* and *Bacillus subtilis subsp. subtilis* based on nucleotide homology and phylogenetic analysis.

EVALUATION OF SALT STRESSED ON GROWTH AND DEVELOPMENT OF OKRA CULTIVARS

Sarathi and Vishal Johar

Department of Horticulture, School of Agriculture, Lovely Professional University, Phagwara (Punjab)-144111

Email: vishal.26021@lpu.co.in

Abstract

Soil salinization is a serious challenge that restricts and decreases the growth and productivity of agricultural production all over the world. Worldwide, over 800 million hectares of soil have been influenced by salts. The existence of superfluous salt in water and soil is a serious environmental challenge that negatively influenced the development of plants and reduces the quantity and quality of the fruits. Considering, the above-mentioned facts the present study has been planned to determine the effects of salinity on the growth and productivity of okra (*Abelmoschus esculentus* L.). The study would be consisting of 5 different levels of salinity viz., 0 dS m⁻¹, 2 dS m⁻¹, 4 dS m⁻¹, 6 dS m⁻¹, and 8 dS m⁻¹, with 20 different genotypes to evaluate the genotypes for various growth and yield parameters such as Shoot length (cm), Root length (cm), Shoot fresh weight (g), Root fresh weight (g), Shoot dry weight (g), Root dry weight (g), Number of leaves/ plant, Plant height (cm), Leaf area index, Crop growth rate (CGR) (g/m²/day), Bud Initiation, Days to 1st flowering etc. Further, the genotypes would be evaluated for different biochemical parameters to assess and categories the different genotypes as salt tolerant, moderately tolerant and susceptible genotypes. Therefore, the study would be helpful for screening and development of suitable genotype for the salt effected lands in India and further would be helpful for doubling the farmer's income and improving the socio-economic status of farmer.

PREHARVEST APPLICATION OF ZINC IN THE AGRONOMIC BIOFORTIFICATION OF CARROT

Vivek Kumar Tiwari^{1, 2}, Khushboo Kathayat² and Avantika¹

¹Defence Institute of High-Altitude Research-DRDO, C/O 56 APO, Leh-Ladakh (India)

²Lovely Professional University, Jalandhar, Punjab (India)

Email: vivektiwari200012@gmail.com

Abstract

Micronutrient malnutrition is an important issue in the all over world but mainly developing continents of Asia and Africa where millions of school-going children and pregnant women are affected. Poor people are more exposed to risks of malnutrition and hidden hunger due to intake of carbohydrate rich but micronutrient deficient plant-based food. Zinc deficiency is found in about 50% of the land area of India. Different interventions could be used to overcome malnutrition, but biofortification is most impactful, convenient, sustainable and acceptable intervention. Agronomical fortification is considered as highly cost-effective intervention to improve dietary intake of micronutrients. Zinc is an essential mineral that body does not make on its own. It aids growth, DNA synthesis, immune function and more. Zinc (Zn) deficiency associated with low dietary intake is a well-documented public health problem, resulting in serious health and socioeconomic problems. The main objective of this experiment is to investigate the possible effects of a Zn biofortification in phytochemicals content in a root vegetable, such as carrot which can fulfil the amount of vitamin 'A' in our body. However, Bio-fortification of vegetables is relatively new concept in India and to alleviate malnutrition problem, it is the best option to improve the quality of the plants through the addition of the desired minerals to food stuffs.

ECO-ENVIRONMENTAL VULNERABILITY EVALUATION OF MAHARASHTRA STATE ON GEOSPATIAL PLATFORM

Vikash Singh^{1*}, Arpit Chouksey² and Anupam Kumar Nema¹

¹Farm Engineering Department, Banaras Hindu University, Varanasi, U.P, India



²Water Resources Department, Indian Institute of Remote Sensing (ISRO), Dehradun, U.K. India

*Email: vksingh.swc.bhu@gmail.com

Abstract

Maharashtra, the second largest state by population & third by size, is prone to various disasters such as drought, floods, cyclones, and earthquake. Communities in this region are poor and face extreme conditions of water stress. This study has been carried out to analyze and quantify climatic and anthropogenic effect on eco-environmental vulnerability dynamic change. To achieve that, technologies of remote sensing (RS) and GIS, are adopted, and a numerical model is set up consisting of eight factors that are elevation, land use, drought, slope, NDVI, soil-type, soil erosion (water), and population density index & has been evaluated using the method of spatial principle component analysis (SPCA). The integrated eco-environmental vulnerability index (EVI) of study area is estimated to analyse spatial-temporal dynamic vulnerability changes in the 11 years gap from 2000 and 2011. The results show that the study area has become eco-environmental vulnerable slightly (about 80% of the region) with an increased eco-environmental vulnerability integrated index (EVSI) value by more than 50% (i.e., about 74%) and the driving force of dynamic change is mainly caused by socio-economic activities. of the area have. In general, the research concludes that the method, supported by RS, GIS, using SPCA to evaluate eco-environment vulnerability in plain-mountainous region, can't only represent distinctly the input spatial distribution of plain-mountain-belt feature, but also respect the whole river-valley as a single unit.

ANTIFUNGAL ACTIVITIES OF *EUCALYPTUS* OIL AGAINST LIGNOLYTIC FUNGI (*ASPERGILLUS FLAVUS*, *ASPERGILLUS PARASITICUS*, *COLLECTORICUM CAPSICI*) INVADING LEATHER

Virendra Tiwari¹, Rashmi Singh¹ and A.K. Pandey²

¹Department of Botany, Government Autonomous P.G. College, Satna-485001, India

²ICAR-National Bureau of Fish Genetic Resources, Canal Ring Road, Lucknow-226002, India

*Email: akpandey_cifa@rediffmail.com

Abstract

Deterioration of leather due to invasion of lignolytic fungi is of great concern in India. These fungi metabolize substances in leather causing serious damage such as pigmented stain that is difficult to remove, deface, surface roughness and loss of physical and mechanical resistance affecting quality of the final product. An attempt has been made to evaluate the anti-fungal effect of *Eucalyptus* oil against growth of three common lignolytic fungi (*Aspergillus flavus*, *Aspergillus parasiticus* and *Colletotrichum capsici*) with objective for application of this oil as biocides for protection of leather against the bio-deterioration caused by these fungi. Growth of fungal hyphae of three lignolytic fungi on leather treated with *Eucalyptus* oil (EO) was visually estimated. EO was applied by well diffusion method and the fungal growth inhibition was measured. In this study, 1200 mg/L was the minimum inhibitory concentration (MIC) for *Colletotrichum capsici*, *Aspergillus parasiticus*, *Aspergillus flavus* and the growth of the fungus was invisible at a concentration 1,200 mg/L. The maximum zone of inhibition by fungicide (Fluconazole) was recorded towards *Aspergillus flavus*. The maximum zone of inhibition was 14±2.1, 12±3.1 and 11±0.9 for fungal isolate *Aspergillus flavus*, *Colletotrichum capsici* and *Aspergillus parasiticus*, respectively. The maximum zone of inhibition by *Eucalyptus* oil was 16±4.1 for *Colletotrichum capsici* followed by 16±4.1, 12±3.1 and 0.8±0.4 for *Colletotrichum capsici* a *Aspergillus parasiticus* and *Aspergillus flavus*, respectively. The data were significantly different at the level $p < 0.05$. The chemical constituents of the EO were analyzed by GC/MS, which showed presence of amino acid, protein, lipids such as 1,8 cineole, camphor, camphene, -pinene and -pinene, -fenchone and -eudesmol, phenolic compounds, thymol, carvacrol, p-cymene, and c-terpinene to complete inhibition against the growth of lignolytic fungi isolated from the leather. These findings support the potential use of EO for wood protection against lignolytic fungi infestation for surface-treatment or fumigation of leather products of cultural and historical properties.

HETEROSIS ANALYSIS IN WHEAT (*TRITICUM AESTIVUM* L.) UNDER TIMELY SOWN IRRIGATED CONDITION

Vishal Kumar Gupta

Genetics and plant Breeding COA (IGKV), Raipur-492012, (C.G.), India

*Email: vishalgupta030794@gmail.com



Abstract

The present investigation entitled “Heterosis analysis in wheat (*Triticum aestivum* L.) under timely sown irrigated condition” was carried out during Rabi 2015-16 and 2016-17 at the All-India Co-ordinated Wheat & Barley improvement project, B.T.C. College of Agriculture and Research Station, Bilaspur (C.G.). The experiment was conducted in RBD involving ten lines, four testers and 40 F₁s hybrids of wheat with two replications for study of character associated with combining ability for yield and yield contributing traits and the magnitude of heterosis in wheat under timely sown irrigated condition. Very high heterosis was recorded with the parents DL 803-3 and HW 2045 for number of tillers per plant. The cross GW 322 X GW 2013-507 show highest heterosis for number of spikelets per spike and HW 2045 X DBW 14 for number of grains per spike. MP 1202 X PBW 585 showed positive heterosis for 1000 seed weight. Out of the 40 crosses fifteen crosses showed significant positive heterosis for seed yield per plant and cross GW 391 X WH 1021 recorded the maximum heterosis for seed yield per plant. LOK 1 is the earliest flowering parent, however HI 1544 maturity earliest. Most of the parents are 2D plant height (85 ± 5 cm). GW 391 have high number of tillers per plant, Highest number of grains per spike was recorded with DL 803-3 and Chattisgarh gehu 03 recorded highest harvest index. LOK 1 recorded highest 1000 seed weight and GW 2013-507 have highest seed yield per plant.

STUDIES ON THE EFFECT OF DIFFERENT SOURCES OF POTASSIUM-ON-POTASSIUM FRACTION IN ALFISOLS

Vimalashree H.* Shivanna M., Rudresh T.M. and Shalini

*Email : vimalashreeh11@gmail.com

ABSTRACT

The investigation entitled Studies on the effect of different sources of potassium on forms and distribution, release kinetics and fixation characteristics in Alfisols was conducted during 2019-20 at UHS campus, College of Horticulture, GKVK, Bengaluru. The experiment was laid out in RCB with 8 treatments replicated thrice. Different sources of potassium (Sulphate of potash, Muriate of potash, Potassium nitrate, Sulphate of Potash magnesia, Opifol maturation, Plantafol, Potassium schoenite and Sulphate of potash magnesia) were applied at the rate of 63 kg ha⁻¹. The results revealed that treatment T₂ contains high amount of water-soluble potassium (WS-K) and Exch-K in surface (14.84 and 91.87 mgkg⁻¹). In sub surface high amount non-exchangeable potassium (NE-K) and lattice-K (169.91 and 3570.75 mgkg⁻¹) and total-K in both surface (3573.71 mgkg⁻¹) and sub-surface (4039.31 mgkg⁻¹). The results showed that K Supplied through sulphate of potash had recorded significantly high potassium fixation capacity in both surface (0.53 meq 100 gm⁻¹ soil) and sub-surface (0.70 meq 100 gm⁻¹ soil). The potassium release was faster in the initial stage up to 5th extraction and later it released less amount of K and finally reached constant by 10th or 11th extraction. The highest amount of total step K was recorded in the treatment which received sulphate of potash (755 mgkg⁻¹). The per cent contribution of different fractions of K to total-K were followed in the order of lattice-K (92.18 %), NE-K (4.8 %), Exch-K (2.6 %) and WS-K (0.42 %) in surface.

DETERMINATION OF SOIL SEDIMENTATION PERIODS ON PERFORMANCE OF RICE TRANSPLANTERS

William Boney Hansda and Uttam Kumar*

Department of Agricultural Engineering, Birsa Agricultural University, Ranchi, Jharkhand

*Email: uttam.bauranchi@gmail.com

ABSTRACT

Rice is one of the most important crops of India. The mechanical rice transplanting has been considered as the most promising option because it reduces the labor requirement, saves time and cost of transplanting and maintains desired plant density. In puddled soil condition, soil sedimentation periods is the most prominent factor affecting the performance of rice transplanters. The combination of first ploughing with tractor drawn M.B. Plough, 2nd ploughing with tractor drawn cultivator and final puddling with tractor drawn puddler was used for performance evaluation of four selected rice transplanters i.e., 4 row manually operated rice transplanter (CRRI design), 2 row power operated rice transplanter (Kisan Kraft design), 8 row self-propelled rice transplanter (VST Yanji Shakti) and 2 row manually operated rice transplanter (for root washed type



seedling) were also evaluated with puddling by tractor drawn puddler at soil sedimentation periods of 36, 48 and 60 hours. In sandy loam soil, 36 hours of soil sedimentation period was most suitable for transplanting with 4 row manually operated rice transplanter (CRRI design), 2 row power operated rice transplanter (Kisan Kraft design) and 2 row manually operated rice transplanter (for root washed type seedlings), while 8 row self-propelled rice transplanter (VST Yanji Shakti) required 48 hours of soil sedimentation periods. Whereas in sandy clay loam soil, 48 hours of soil sedimentation periods is most suitable for transplanting with 4 row manually operated rice transplanter (CRRI design) and 2 row power operated rice transplanter (Kisan Kraft design), while 8 row self-propelled rice transplanter (VST Yanji Shakti) and 2 row manually operated rice transplanter (for root washed type seedlings) works satisfactory in 60 hours and 36 hours of soil sedimentation, respectively.

QUALITY AND RHEOLOGY CHARACTERIZATION OF SPRAY DRIED TOMATO POWDER

Wungshim Zimik¹, Mahesh Kumar², Lalita^{2*} and Alka Mishra³

¹School of Engineering Technology and Management, Nagaland University-797112

²Processing and Food Engineering, Punjab Agricultural University, Ludhiana-141004

³Agro produce processing Division, Central Institute of Agricultural Engineering, Bhopal-462038

*Email: lalitapfe@gmail.com

Abstract

This study investigates the quality evaluation of spray dried tomato juice and rheology property of reconstitute juice. The powder was obtained at 140-160°C inlet air temperature, 2.1-4.1 ml/min feed flow rate and 27.5-30 % maltodextrin concentration. Moisture content, packed bulk density, titrable acidity, total soluble solids and color were the parameters for the quality evaluation of tomato powder. The rheological characteristics of concentrate juice and reconstitute juice were determined at different temperatures and range of shear rates. The non-Newtonian behavior of samples has been demonstrated using different rheological models. The flow characteristics have been determined by applying Power law and Herschel-Bulkley model in terms of flow behavior index (n), consistency coefficient and yield stress. The effect of temperature on flow characteristics was studied by using Arrhenius equation.

IMPORTANCE AND NEED OF NATURAL INSECT REPELLENTS IN AGRICULTURE

A.N. Warghat^{1*}, S. S. Munje² and G.D. Chandanakr³

¹Department of Entomology, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.), India- 211007

²Department of Entomology, RRC, Amravati (M.S.), India- 444603

³Department of Plant breeding, RRC, Amravati (M.S.), India- 444603

*Corresponding author Email : anandwarghat07@gmail.com

Abstract

The insects are the part of earth since from developments of flora and fauna. The control of insect pest and domestic animal's pests has economic importance in agriculture. Since earlier civilizations, people have utilized plant-based repellents to defend themselves from arthropods pests that are looking for hosts. For the creation of new natural goods, indigenous plants studies' understanding of plants used as traditional repulsive is a great resource as well as in agriculture.

Commercially, pyrethrum and neem seem to be well, plant-based essential oil-based pesticides have just recently come onto the market, and neurotoxicity (rotonone) use appears to be waning. A multitude of plant secondary metabolites have been investigated for use as insect antifeedants or repellents, although besides a few naturally occurring mosquito repellents, there has not been much commercial success for plant compounds that disrupt invertebrate behaviour. There should be some specificity to need why using insect attractants are important is Insect repellents are used to ward off biting insects like flies, ticks, mosquitoes, and ticks. Mosquitoes can spread the disease like West Nile virus, malaria, and Zika. Rocky Mountain Spotted Fever, Lyme disease, and other infections can be conveyed by ticks. In order to prevent bites as well as the spread of disease, repellents work by keeping pests away rather than by eradicating them. The working mechanism of the insect repellents are found within the case and research studies world widely, Mosquitoes and ticks are drawn to our exhaled carbon dioxide and skin smells. In addition, they search for a potential host using heat, movement, and visual clues. In order to keep



insects from seeking an animal or human host, repellents conflict with their instincts of taste and smell. Insect repellents may cause unfavourable adverse interactions with natural systems that have the potential to result in harmful effects, especially intermediate metabolites, based on a developing collection of studies. An important phenomenon for the hazardous response of these molecules may be the practices have the potential followed by bioavailability. There is increasing concern about the potential toxicity in environment leading to health problems caused by random use of insect repellents. An increasing number of evidence suggests that insect repellents may trigger hazardous interactions with biological systems. Biotransformation followed by bioaccumulation may be an important phenomenon for toxic response of this chemicals. The current state of knowledge includes biochemical pathway alteration under in vitro and in vitro conditions considering different classes of organisms.

PATH ANALYSIS AND CORRELATION STUDIES IN ONION

Yogita

Department of Vegetable Science, Maharana Pratap Horticultural University, Karnal, Haryana

Email: yogita3006@gmail.com

Abstract

The investigation was conducted in 30 onion genotypes, including the check cultivar Nasik Red to find out the variability, correlations, path coefficient and divergence analysis. The research was carried out at the experimental farm of the Department of Vegetable Sciences, Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan (HP) during the Rabi season of 2019-20 and 2020-21. The experiment was laid out in a Randomized Complete Block Design (RCBD) in a plot of size 1.5×1.0m² with three replications at spacing of 15×10cm. The data were recorded for different characters viz., plant height (cm), number of leaves per plant, leaf length (cm), neck thickness (cm), polar diameter (cm), equatorial diameter (cm), bulb shape index, bulb skin colour, days to 50 per cent neck fall, days to harvest, dry matter (%), total soluble solids (°B), doubles/deformed bulb (%), average bulb weight (g), bulb yield per plot (kg), bulb yield per hectare (q) and disease incidence. All the genotypes reflected a wide and significant spectrum of variability was found for all the traits studied. UHF-ONI-13, UHF-ONI-15 and UHF-ONI-16 performed better than other genotypes for yield and other imperative horticultural characters. Bulb yield had significant and positive correlation with average bulb weight, equatorial diameter, plant height, neck thickness, leaf length, polar diameter, number of leaves per plant, days to harvest and days to 50 per cent neck fall. Positive direct effect on bulb yield was highest for average bulb weight followed by equatorial diameter, bulb shape index, neck thickness, total soluble solids, plant height and leaf length.

IMPACT OF TRAINING IMPARTED BY KVKs ON ADOPTION BEHAVIOUR OF LIVESTOCK FARMERS TOWARDS ANIMAL HUSBANDRY PRACTICES IN ODISHA

Vijiya K. Shweta, P. Swain, B.C. Das, S.K. Dash and Pankaj Seth

Email : bulbul.shweta@gmail.com

Abstract

Now-a-days training has become an important vehicle to facilitate the flow of knowledge and skills in the development process. Among various training institutes, KVKs as per the mandates, conduct training programs regularly for the skill and knowledge enhancement of the livestock farmers. Therefore, the present study was conducted to know whether the training imparted by the concerned KVKs has brought some observable changes in the technology adoption behaviour among the livestock trainee farmers or not? Out of 33 KVKs in Odisha, Angul, Ganjam and Jharsuguda KVKs were selected purposively. A total of 120 livestock farmers who had undergone training in the respective KVK at least 1 year prior to the data collection were selected randomly. The data was collected with the help of a pre-structured schedule on 3-point continuum scale. The findings of study revealed an overall medium level of adoption (31.47±0.35) among trainee farmers with maximum adoption in health care practices followed by housing, feeding, breeding and marketing practices, respectively. The poultry trainee farmers showed medium level of overall adoption with maximum adoption in health care practices followed by housing, feeding, breeding and marketing practices, respectively. The overall adoption level of dairy farmers was medium with 100% adoption in breeding practices followed by high level adoption in health care, housing, feeding and low level in marketing practices, respectively. The overall adoption level of goat farmers was medium with maximum adoption of health care



practices followed by housing, feeding, breeding and marketing practices, respectively. The poor contribution by marketing component in the adoption level of trainee farmers may be attributed by poor knowledge in marketing practices because an individual's adoption level is correlated with his knowledge level. Therefore, an appropriate strategy should be developed to strengthen this component to get better impact of training in terms of increased adoption level of the trainee farmers for benefitting the livestock farming community in general.

CONSTRAINTS FACED BY THE CASTOR GROWERS IN ADOPTION OF CASTOR PRODUCTION TECHNOLOGY

K.V. Chaudhry^{1*}, S.P. Pandya² and K.N. Raval¹

¹Department of Agril. Extension and Communication, CPCA, SDAU, Gujarat

²Directorate of Research, SDAU, Gujarat

*Email: kalachaudhry1811@gmail.com

Abstract

Production of a new technology is generally not the major problem now-a-day in our country. The agricultural scientists are capable of producing appropriate technology. The main problem as it exists today is that of diffusion and adoption of new farm technologies among the farmers. Diffusion of knowledge is relatively an easy task. Getting people to understand, accept and apply is the difficult one. The present study was purposively undertaken in the three talukas viz., Patan, Saraswati and Harij talukas of Patan district of Gujarat state. The ex-post facto research design and multistage sampling technique were followed for present study. Five villages were randomly selected from each taluka having castor cultivation. Thus, total fifteen villages were selected. From each selected village, ten farmers were selected randomly by making a sample of 150 respondents. The study revealed that majority constraints faced by the castor growers in the adoption of castor production technology were; unavailability of certified seed at local level, shortage and high wages of labor, high cost of fertilizers, inadequate finance, high cost of seed, attack of pests and diseases, lacking of technical guidance and non remunerative price of production. The most important suggestions expressed by castor growers to overcome the constraints faced by them in maximum adoption of recommended castor production technology were; reasonable price should be given to agricultural produce, certified seed should be made locally, price of agricultural inputs should be minimized, timely technical guidance should be provided and crop loan should be provided to the farmers.

EFFECT OF AGE OF SEEDLINGS, CROP GEOMETRY AND NANO-FERTILIZERS ON YIELD AND ECONOMICS OF *KHARIF* RICE IN KONKAN REGION OF MAHARASHTRA

Y.S. Chavan^{1*}, A.P. Chavan¹, V.A. Rajemahadik¹, V.G. Chavan¹ and S.S. Kinge²

^{1*}Department of Agronomy, BSKKV Dapoli, Maharashtra

²Department of Agronomy, VNMKV Parbhani, 431402

Email: chavanyashpal68@gmail.com

Abstract

A field experiment was conducted to study the effect of age of seedlings (10 days old seedlings, 20 days old seedlings and 30 days old seedlings), crop geometry (20 cm x 15 cm and 25 cm x 25cm) and nano-fertilizers (Water spray, Spray of Nano-Phosphorous, Spray of Nano-Potassium, Spray of Nano-Phosphorous + Nano-Potassium) on yield and economics of *kharif* rice var. Ratnagiri-6 in lateritic soil at Agronomy Farm, Department of Agronomy, College of Agriculture, Dapoli. Dist. Ratnagiri during *kharif* season of 2018. The experimental results revealed that, the transplanting of 10 days old seedlings was at par with transplanting of 20 days old seedlings and they were significantly superior than transplanting of 30 days old seedlings in case of grain and straw yield ha⁻¹. The seedlings transplanted at 20 cm x 15 cm spacing along with the spray of nano-phosphorous + nano-potassium produced significantly higher grain and straw yield than rest of the treatments. In respect of the economics, the transplanting of 20 days old seedlings along with the spray of nano-phosphorous + nano-potassium gave the highest cost of cultivation, gross returns, net returns and B:C ratio than rest of the treatments. The 20 cm x 15 cm spacing gave the highest cost of cultivation, gross returns, net returns than 25 cm x 25 cm spacing. However, the 25 cm x 25 cm spacing gave higher value of B:C ratio than 20 cm x 15 cm spacing.



CROPPING SYSTEM INDIGENOUS TECHNICAL KNOWLEDGE : POLICIES AND PROFITABILITY OF ECONOMIC AGRICULTURE

Yonika Saini

Department of Agronomy, Agriculture University, Kota, Rajasthan

Email: yonikasaini66@gmail.com

Abstract

The potential for innovation in indigenous technical knowledge (ITK) is enormous. India is a nation made up of indigenous communities, the majority of which have their own distinct traditional knowledge and technological foundation. India's population is expanding quickly, and so is the country's appetite. ITK is the totality of all knowledge and practices that are unique to a certain culture and are based on people's cumulative experiences in handling circumstances and issues in all facets of life. The total socio-economic development of the communities can be significantly influenced by these traditional knowledge and technology. Indigenous Technical Knowledge (ITK) of many cultures, many of which are on the verge of extinction, has been identified to be in urgent need of documentation and preservation. A genuine fusion of indigenous knowledge practices with contemporary knowledge is lacking. Concerns about intellectual property rights are quite significant. The possibility for society to profit greatly from a proper integration of old and modern knowledge and technology systems. The agricultural sustainability, as well as the security of food and nutrition, may be maintained by these ITKs.

IMPACT OF MAIZE RESIDUE MANAGEMENT ON PRODUCTIVITY, PROFITABILITY AND NUTRIENT CONCENTRATION OF WHEAT CROP WITH DIFFERENT RATE OF POTASSIUM APPLICATIONS UNDER MAIZE-WHEAT CROPPING SYSTEM.

Kajal Arora

ICAR-Indian Agricultural Research Institute, New Delhi 110012

Email: kajal.arora2k19@gmail.com

Abstract

Crop residues are key natural and eco-friendly resource for the stability of diverse agricultural systems. The addition of residues into the soil environment and the study of the changes associated with their addition are important in planning cultural operations and developing appropriate soil management strategies. Therefore, the field experiment was conducted with the objective to determine better crop residue and potassium management practices for enhancing the productivity, profitability and nutrient concentration of wheat crop. The experiment was laid out in split-plot design with three replications having single wheat cultivar HD 3086 with three residue management treatments in main plot and five potassium management practices in sub-plot. Results indicated that the crop residue retention @ 3t/ha recorded the highest grain yield (5.98 t/ha). The net (109138 ?/ha) and gross (152404?/ha) returns along with monetary efficiency (769? / ha/ day) was found to be maximum with maize residue retention @ 3t/ha. However, The crop residue incorporation @ 3t/ha recorded the highest concentration of N, P and K (1.68, 0.38 and 0.53%) in grain and straw (0.57, 0.19 and 1.75 %) respectively. Among the potassium management treatments the values for all the parameters found to be maximum with the split application of 100 % RDK ($\frac{1}{2}$ at basal + $\frac{1}{2}$ top dress at 25 DAS). However, split application of 50 % of recommended dose of potassium showed the results at par with 100 % RDK followed by 50 % RDK and control.

EFFECT OF ARJUNA BARK POWDER SUPPLEMENTATION ON HAEMATO-BIOCHEMICAL PARAMETERS OF UTTARA CHICKEN

Kalicharan Nayal, Anil Kumar and Ankit Sharma

Deptt. of Livestock Production Management, College of Veterinary and Animal Sciences, BPUAT, Pantnagar, Uttarakhand

Email: ankit291994@gmail.com

Abstract

Terminalia arjuna in Ayurvedic medication is used as a heart tonic to keep the heart healthy, blood pressure normal and cholesterol levels low. A total of 96, aged 6 month Uttara layers were taken and randomly assigned to four treatment groups,



each of which contained four replications with six chicks each. Chicks were fed T₀ (control) basal diet and 3 treatment groups as T₁, T₂, T₃ with 1, 2, 4 % Arjuna bark powder in each group respectively. Data collected divided into two phases, the first of which end on the 6th week of the experiment and the second on the 12th week. The average hemoglobin, PCV, TLC, TEC and MCHC value increases significantly (P=0.05) in Arjun bark supplemented group as compared to control group in Phase I, Phase II and overall period. There was no significant (P=0.05) difference observed in average MCV and MCH value in Phase I, Phase II and overall period among different treatment groups. The average glucose, cholesterol, and LDL values decreased significantly (P=0.05) in Arjun bark supplemented group as compared to control group in Phase I, Phase II and overall period. The average HDL value increased significantly (P=0.05) in Arjun bark supplemented group as compared to control group in Phase I, Phase II and overall period. There was no significant difference observed in the average total protein, average albumin and average globulin value in Phase I, Phase II and overall period among various treatment groups. The average serum immunoglobulin concentration increases significantly (P=0.05) in Arjun bark supplemented group as compared to Control group. Thus research trial reveal that supplementation of Arjun bark powder resulted in increase in hematological parameters and decrease in glucose, cholesterol and LDL.

EFFECT OF SUPPLEMENTATION OF *MORINGA OLEIFERA* LEAF AND ARJUNA BARK POWDER ON THE GROWTH PERFORMANCE OF KADAKNATH CHICKEN

Ankit Sharma^{1*}, Anil Kumar¹, Kalicharan Nayal¹, Sumit Gangwar¹ and Londhe Arvind Sudhakar²

¹Department of Livestock Production Management, College of Veterinary and Animal Sciences, GBPUAT, Pantnagar, Uttarakhand

²Department of Animal Nutrition, College of Veterinary and Animal Sciences, GBPUAT, Pantnagar, Uttarakhand

Email: ankit291994@gmail.com

Abstract

Moringa oleifera is a phytobiotic with antibacterial and immunomodulatory effects. *Terminalia arjuna* in Ayurvedic medication is used as a heart tonic to keep the heart healthy, blood pressure normal, and cholesterol levels low. The goal of the study was to see how *Moringa oleifera* leaf and Arjuna (*Terminalia arjuna*) bark powder administration affected the growth performance of indigenous fowl. Day old chick (n=72) were distributed into six treatment groups, having three replicates of 4 birds each. The study was conducted during 0-20 weeks of age. Chicks were fed T₀ (control) basal diet and 5 treatment groups as T₁, T₂, T₃, T₄, T₅ supplemented with 1, 2, 3, 4, 5% *Moringa oleifera* leaf powder respectively and 1% Arjuna bark powder in each group respectively. Weekly body weight was significantly higher (P<0.01) in the T₃ group as compared to the control group from 5 to 20 week of age. Further, weekly body weight was apparently higher in all treatment groups than control groups throughout the experiment. Weekly body weight gain was also significantly higher (P<0.01) in the T₃ group. Weekly feed intake was significantly higher (P<0.05) in the control group than other treatment groups from 6 to week of age. Weekly feed conversion ratio of the T₃ group was significantly better (P<0.01) as compared to the control group. Thus, it may be concluded that dietary supplementation of *Moringa oleifera* leaf @3% and Arjuna bark powder @1% resulted in better growth performance in Kadaknath chicken.

INNOVATIVE TECHNOLOGY FOR CROP IMPROVEMENT, BIOTECHNOLOGY AND GENETIC ENGINEERING

Kamlesh Kumar Jat*, Himansuman, Himanshi Jhalora and Prachi Mahla

Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan

*Corresponding Email: kkjat050701@gmail.com

Abstract

The improvement of woody fruit species by traditional plant breeding techniques has several limitations mainly caused by their high degree of heterozygosity, the length of their juvenile phase and auto-incompatibility. The development of new biotechnological tools (NBTs), such as RNA interference (RNAi), trans-grafting, cisgenesis/intragenesis, and genome editing tools, like zinc-finger and CRISPR/Cas9, has introduced the possibility of more precise and faster genetic modifications of plants. CRISPR-Cas9 is a gene editing tool that allows researchers to cut DNA and paste in genetic material of their choosing,



creating genetically modified organisms. Biotech crops may provide enhanced quality traits such as increased levels of beta-carotene in rice to aid in reducing vitamin A deficiencies and improved oil compositions in canola, soybean, and corn.

Biotechnology is being used to address problems in all areas of agricultural production and processing. This includes plant breeding to raise and stabilize yields; to improve resistance to pests, diseases and abiotic stresses such as drought and cold; and to enhance the nutritional content of foods. Genetic Engineering refers to the deliberate modification of the characteristics of an organism by manipulating its genetic material while genetic modification refers to the artificial alteration of the genetic material of an organism to produce a desired characteristic. Speed-up the multiplication process for vegetative propagated crops, detect diseases transmitted by seed or planting material, eradicate diseases transmitted by planting material, protect seed with biological control agents.

EFFECT SOME NEWER INSECTICIDES ON THE NATURAL ENEMIES COMMONLY FOUND IN TOMATO (*LYCOPERSICUM ESCULENTUM* L.) ECOSYSTEM UNDER FIELD CONDITION

Kaushik Pramanik¹, Radhe Shyam Meena² and Pranabesh Nandi¹

¹Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal

²Department of Entomology and Agricultural Zoology, Institute of Agricultural Science, BHU, Varanasi, U.P.

Email : kpramanik.kaushik@gmail.com

Abstract

The field experiment was carried out on tomato in the Rabi season of 2019-20 at the Vegetable Research Farm, Institute of Agricultural Science, Banaras Hindu University, Varanasi, India. The crop variety, Arka Vikas (Selection 22) was selected to evaluate the bioefficacy of nine different insecticidal treatments against the major insect- pest complex and the natural enemies in tomato under field conditions. Two sprays at 15 days intervals of ten treatments with three replications were applied. The treatments were Diafenthiuron 50% WP, Abamectin 1.8% EC, Buprofezin 25% SC, Indoxacarb 14.5% SC, Spinosad 45% SC, Chlorantraniliprole 18.5% SC, Pymetrozine 50% WG, Flonicamid 50% WG, and Lancer Gold (50 + 1.8) % SP and control (water spray). Observations were recorded one day before and 1st, 3rd, 5th, 7th, 10th, and 15th days after each spray. The collected data over the effect of insecticides on NEs showed that Flonicamid 50% WG and Lancer Gold (50 + 1.8) % SP seemed to be the harmless insecticides against NEs (spider and coccinellids). However, the NEs were significantly higher after the first spray but noticeably lower after the second application of insecticides. Chlorantraniliprole 18.5% SC and Indoxacarb 14.5% SC were proved somehow toxic to NEs population.

EFFECTIVENESS OF NEWER INSECTICIDES AGAINST THE FRUIT BORER, *HELICOVERPA ARMIGERA* (HÜBNER) ON TOMATO (*LYCOPERSICUM ESCULENTUM* L.) IN THE EASTERN REGION OF UTTAR PRADESH

Kaushik Pramanik¹, Radhe Shyam Meena² and Pranabesh Nandi¹

¹Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia-741252, West Bengal

²Department of Entomology and Agricultural Zoology, Institute of Agricultural Science, Banaras Hindu University, Varanasi-221005, Uttar Pradesh.

Email : kpramanik.kaushik@gmail.com

Abstract

An experiment was performed in field conditions at Vegetable Research Farm, Institute of Agricultural Science, Banaras Hindu University, Varanasi, India during the Rabi season of 2019-20 by using the tomato variety, Arka Vikas to evaluate the bioefficacy of nine different insecticidal treatments against tomato fruit borer *Helicoverpa armigera* (Hübner) under field conditions. The treatments were Buprofezin 25% SC, Abamectin 1.8% EC, Indoxacarb 14.5% SC, Spinosad 45% SC, Chlorantraniliprole 18.5% SC, Flonicamid 50% WG, Pymetrozine 50% WG, Diafenthiuron 50% WP, Lancer Gold (50 + 1.8) % SP and control (water spray). Two sprays at 15 days intervals of ten treatments with three replications were applied. Observations were recorded one day before and 1st, 3rd, 5th, 7th, 10th, and 15th days after each spray. The results showed that all the insecticidal treatments were superior in controlling *H. Armigera* (Hübner) over the control plot and Indoxacarb 14.5% SC was found best among all. Spinosad 45% SC and Chlorantraniliprole 18.5% SC recorded the second and third highest



mortality respectively of this pest whereas Pymetrozine 50% WG and Flonicamid 50% WG, revealed relatively low efficacy among all the insecticidal treatments.

KNOWLEDGE OF THE FARM WOMEN REGARDING ORGANIC FARMING PRACTICES

Komal Singh, Vishakha Bansal* and Prakash Panwar

College of Community and Applied Sciences, MPUAT, Udaipur, Rajasthan

*Email : bvishakha29@yahoo.com

Abstract

The present study was planned to study knowledge of the rural women regarding organic farming practices. The study was conducted in purposively selected Badgaon and Girwa panchayat samiti of Udaipur district, Rajasthan. Total 4 villages were selected on basis of random sampling technique. A sample of 30 farm women from each village was selected for the study. The total sample of study consisted of 120 farm women. For accomplishing the present investigation, interview technique was used to collect information from the rural women. The findings of the study revealed that majority of the respondents (65%) possessed medium level knowledge regarding organic farming technologies with MPS of 57.66 followed by 18.33 per cent respondents who possessed low level of knowledge with MPS of 34.02. Only 16.67 per cent respondents belonged to high category of knowledge with MPS of 57.36.

EFFECT OF ANTI-BROWNING AGENTS AND DRYING METHODS ON MACRONUTRIENT COMPOSITION OF COCONUT INFLORESCENCE POWDER

Keerthy Chandran* and Sonia N.S.

Deptt. of Plantation Crops and Spices, College of Agriculture, Vellayani, Thiruvananthapuram (Kerala Agricultural University)

Email: keerthychandran97@gmail.com

Abstract

Indigenously coconut inflorescence harvested at immature stage are used for dietary supplement preparation. This study was done to quantify the macronutrient content in the coconut inflorescence powder. The inflorescence samples were soaked in anti-browning agents (one per cent citric acid (B1), one per cent sodium chloride (B2) and combination of one cent citric acid and one per cent sodium chloride (B3) for different duration [five minutes (S1) and ten minutes (S2)] and dried by different drying methods viz., sun drying (D1), Hot-air oven drying at 60°C (D2) and Hot-air oven drying at 80°C (D3). Good quality coconut inflorescence powder having optimum macro-nutrient composition [carbohydrate (4.67 g 100 g⁻¹), protein (8.82 g 100 g⁻¹), fat (1.96 g 100 g⁻¹)] can be prepared by pre-treating the chopped inflorescence with anti-browning agent combination citric acid (1%) + sodium chloride (1%) by soaking for five minutes and drying in hot-air oven drying at 60°C (B3S1D2).

EFFECT OF ANTI-BROWNING AGENTS AND DRYING METHODS ON MACRONUTRIENT COMPOSITION OF COCONUT INFLORESCENCE POWDER

Keerthy Chandran* and Sonia N.S.

Department of Plantation Crops and Spices, College of Agriculture, Vellayani

Email: keerthychandran97@gmail.com

Abstract

Indigenously coconut inflorescence harvested at immature stage are used for dietary supplement preparation. This study was done to quantify the macronutrient content in the coconut inflorescence powder. The inflorescence samples were soaked in anti-browning agents (one per cent citric acid (B1), one per cent sodium chloride (B2) and combination of one cent citric acid and one per cent sodium chloride (B3) for different duration [five minutes (S1) and ten minutes (S2)] and dried by different drying methods viz., sun drying (D1), Hot-air oven drying at 60°C (D2) and Hot-air oven drying at 80°C (D3). Good quality coconut inflorescence powder having optimum macro-nutrient composition [carbohydrate (4.67 g 100 g⁻¹), protein (8.82 g 100 g⁻¹), fat (1.96 g 100 g⁻¹)] can be prepared by pre-treating the chopped inflorescence with anti-browning agent combination citric acid (1%) + sodium chloride (1%) by soaking for five minutes and drying in hot-air oven drying at 60°C (B3S1D2).



EFFECT OF ORGANIC AMENDMENTS ON STEM AND ROOT ROT INCIDENCE AND SEED YIELD OF SESAME UNDER FIELD CONDITIONS

Lalita Lakhran

Assistant Professor (Plant Pathology) Agricultural Research Station, Mandor, Jodhpur 342304

Corresponding Author's Email: Lalitalakhran782@gmail.com

Abstract

Sesame is an important oil seed crop in Rajasthan. It is generally called as "Til" and popularly known as "Queen of oilseeds". It has good quality parameters and resistance to oxidation. Sesame seed enriched with 50% edible oil, 20% protein and good source of linolic acid and oleic acid. The presented result shows that all the tested organic amendments significantly reduced incidence of stem and root rot over control during both the years as well as under pooled basis. Neem cake was observed most effective organic amendment in reducing the disease incidence (25.22%) followed by vermicompost (28.72%) and mustard cake (29.86%). Therefore, being at par with Neem cake, Vermicompost and mustard cake proved their self as second and third most effective organic amendments. The disease also moderately reduced with soil application of poultry manure (30.97%) and goat manure (32.91%). Poultry manure and goat manure were found at par with mustard cake in reducing the incidence of disease in field. Whereas, FYM (36.66%) was found least effective organic amendments in reducing the root rot incidence. The significantly maximum disease incidence (51.25%) was observed under control. The result of two year pooled data revealed that all the tested organic amendments were significantly enhanced the seed yield over control during both the years as well as under pooled basis. The significantly maximum seed yield (395 kg/ha) was recorded with the application Neem cake. However, being at par with Neem cake, vermicompost gave statistically similar seed yield (362.50 kg/ha) with Neem cake.

SPECTROPHOTOMETRIC METHOD FOR ESTIMATION OF PHYTOSTEROLS IN OILSEED BRASSICA

M.S. Sujith Kumar, Ibandalin Mawlong and Reema Rani

Directorate of Rapeseed-Mustard Research, Bharatpur, Rajasthan-321303

Email: sujithkumaragri@gmail.com

Abstract

Sterols are isoprenoid derived molecules that have essential functions found mainly in plant cell walls and membranes. Phytosterols carry out functions in plants equivalent to those of cholesterol in animals. There are about 44 phytosterols known to exist in plants, most abundant being β -sitosterol, campesterol and stigmasterol. A spectrophotometric method was developed for estimating total phytosterol content in rapeseed/mustard oil. The method involves a colorimetric reaction between phytosterols and ferric ions. Phytosterols reacts in the presence of sulphuric acid and undergoes oxidation and is then sulphonated to form the red/purple color. The intensity of the color is dependent upon the amount of phytosterol present in the sample. 50 germplasm accessions of Brassica carinata were analyzed and it was found that 11 accessions have phytosterol content more than 2% in oil. Phytosterol content among different species ranged from 0.7 (DRMR-171) to 1.572 (Pusa swarnim) %. *B. carinata* varieties showed high levels followed by Brown sarson and *Brassica napus*. *Eruca sativa* varieties had low levels.

AN INTERVENTION TO CREATE THE AWARENESS OF RURAL WOMEN REGARDING ILL EFFECT OF TOBACCO CONSUMPTION ON HEALTH

Madhulika Gautam

Department of Home Science, Dayalbagh Educational Institute (Deemed University), Dayalbagh, Agra U.P.

Abstract

The study was done to know the pattern of tobacco consumption and to create the awareness of rural women regarding ill effects on their health due to use of tobacco and bidi smoking. Agra district was selected as the locale of the study. Hundred twenty women were selected by multistage random sampling technique. A self prepared schedule was used for collecting the base line and post intervention awareness of women regarding ill effects of tobacco consumption. Comparison of baseline and



post intervention score was done using 't' test. The results revealed a significant increase in awareness of women from base line to post intervention stage ($t=2.80$).

PRECISION FARMING AS A TOOL FOR SUSTAINABLE AGRICULTURE DEVELOPMENT

Mahendra Anjna¹, Vinod Kumar², Venkateshwar Jallaraph³, Chandrika Sharma³

¹Department of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, (MP)

²Department of Genetics and Plant Breeding, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, (MP)

³Department of Agricultural Extension, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, (MP)

Abstract

Precision farming is an approach where inputs are utilized in precise amounts to get increased average yields, compared to traditional cultivation techniques. In India, one major problem is the small field size. Only in the states of Punjab, Rajasthan, Haryana and Gujarat do more than 20 per cent of agricultural lands have an operational holding size of more than four ha. Precision Agriculture (PA) can help in managing crop production inputs in an environmentally friendly way. By using site-specific knowledge, PA can target rates of fertilizer, seed and chemicals for soil and other conditions. To reduce water use, stop water wasteful practices, and stop additional pollution, agriculture must adapt and become much more efficient. This adjustment entails enhancing irrigation systems, growing crops appropriate for the soil and environment, and putting best practices to use in preventing water contamination. For sustainable agriculture, use less pesticide and avoid fertilizer runoff into natural bodies of water. By creating a productive irrigation system, water usage for crop production and processing may be measured and optimized. Soil conservation is the prevention of soil loss from erosion or prevention of reduced fertility caused by over usage, acidification, salinization or other chemical soil contamination. Slash, Burn and other unsustainable methods of subsistence farming are practiced in some lesser developed areas. A sequel to the deforestation is typically large scale erosion, loss of soil nutrients and sometimes total desertification. Crop rotation, cover crops, conservation tillage, and installed windbreaks are methods for better soil conservation that have an impact on both erosion and fertility. Plants that die decompose and mix with the soil.

SOILS NUTRIENTS VARIABILITY OF TEA GROWING SOILS UNDER YOUNG ALLUVIAL PLAIN THROUGH MACHINE LEARNING

Mamta Kumari¹, Rajkishore Kumar², Y.K. Singh², Rajeev Padhbushan and Brajendra Parmar³

¹Department of Soil Science and Agricultural Chemistry, Institute of agricultural Sciences, Banaras Hindu University, Varanasi-221005

²Department of Soil Science and Agricultural Chemistry, Bihar Agricultural University, Sabour-813210

³ICAR-IIRR, Rajendranagar, Hyderabad, India

Email: mamta.kr05@gmail.com

Abstract

Geospatial design can greatly benefit from the use of machine learning (ML) to forecast the specific characteristics of the soil. ML algorithms directly learn the relationships between the governing input variables and the studied soil properties. The use of digital agriculture can pave the way of scientific learning of predictions or judgment without any explicit programming. The study of soil properties through this tool can help researchers and policymakers to predict the fertility status as well as to plan appropriately proper management practices without any explicit program through modelling. Keeping this in view, prediction modelling is developed using different algorithms such as the Circular model, Spherical model, Exponential model and Gaussian model which is an integral part of the Semivariogram model and the governing factors of the spatial distribution of available P with different soil properties using Random Forest model. The present study also develops the prediction map after comparing the Random Forest model (RFM) with best-fitted model of geostatistics through OK method. This model could accurately confirm for every soil property based on ME (Mean error), Root Mean Square Error (RMSE), Mean Standardized Error (MSE), and Root Mean Square Error (RMSSE), respectively. The results revealed that RFM could be widely used for predictions or judgement on soil properties due to ability to high nonlinear dimensional relationships, resistance to "overfitting" and further ability to determine the relevance of the variables, and ordinary kriging (OK) interpolation method of unknown soil properties. Moreover, the exponential model was best fitted model for prediction of



available phosphorus with good accuracy level (RMSE value ~ one). RFM using different spectral and environmental data increased the prediction results for all soil properties ($R^2 > 0.90$) when compared to OK method. All RFM-based prediction maps of soil available nutrients with medium range value showed towards lower side and deficient range in the upper side of the study area. The Pearson's correlation confirmed that available phosphorus was significantly correlated with soil organic carbon ($r=0.29$) and iron ($r=22$) at $p=0.05$. Principal component analysis (PAC) illustrated that soil available soil nutrients governed more loading factor in PC_1 (37.6%) and PC_2 (18.5) components. Therefore, this study supports that a growing amount of sophisticated data from remote sensing, particularly proximal sensing, allows agricultural planners to bridge the gap between data and decisions, which ultimately leads to decision-making processes for nutrient's management in the soil.

SEMIVEROGRAM MODEL, TEA GROWING SOILS, SUGARCANE WASTE UTILIZATION: AN APPROACH FOR REDUCING ENVIRONMENTAL RISK

Manish Kumar¹, Lalita Rana² and Jitendra Rajput³

¹Institute of Agricultural Sciences, Banaras Hindu University, Uttar Pradesh

²Sugarcane Research Institute, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar 848 125

³Division of Agricultural Engineering, ICAR-IARI, New Delhi 110 012

Abstract

The sugar industry has enormous potential to create jobs and add sustainability to the nation's economic growth. Sugarcane is known to be one of the best converters of solar energy into biomass and is a source of food (sucrose, sugar syrup, Jaggery), fibre (cellulose). Sugarcane produces huge amount of crop residue during harvesting and post-harvesting. These residues become menace to our environment if not properly managed, so proper utilization of the residue is very crucial for reducing environmental risks and pollution as residues of the crop is generally burned resulting in hazards to fauna and flora. Sugarcane can be used as fodder (green leaves and cane tops) after harvesting, organic manure (bio-compost press dust, spent wash), fuel (bagasse and sugarcane trash). Sugarcane waste provides high concentrations of nutrients from plants and it is also used for making vermicompost, bio manure and carrier for biofertilizer. Sugarcane by product can be utilized for many value added products viz. Bio-compost, paper and energy production in addition to sugar production. The sugar industry by-products have vast potential reserves for human as well as animal consumption. By using the by-products and crop residue, environmental hazards can be minimized.

INCLUSION OF LEGUME FOR SUSTAINABLE PRODUCTION AND SOIL HEALTH

Roop Narayan Bairwa¹ and Lalita Rana²

¹Department of Agronomy, PGCA, Department of Agronomy, Dr. Rajendra Prasad Central Agricultural University, Pusa, 848 125 Samastipur, Bihar

²Department of Agronomy, Dr. Rajendra Prasad Central Agricultural University, Pusa, 848 125, Samastipur, Bihar

Abstract

Legume plant play important role in production of indigenous nitrogen. Some legumes have the capacity to solubilize phosphate that would otherwise be inaccessible by releasing organic acids from their roots, in addition to enhancing soil fertility and restoring soil organic matter. The atmospheric nitrogen fixes by the legume crops and germinates in the presence of rhizobia microorganism in the soil, the bacteria penetrate the root hairs and cross into the root itself. The bacteria multiply, and causing the swelling in root is known as root nodules. The effective root nodule is red to pink colour in center and elongated in shape and 2-8 mm in size. The distribution of effective nodule on primary root in clustered form. The micro-organism feed carbohydrates which are formed by above ground part of plant in the photosynthesis process. N required for crop production is obtained through N-fixation by legumes. The bacteria are capable of reducing nitrogen (N_2) to ammonia (NH_3) with the help of an enzyme is called nitrogenase. This process is known as biological nitrogen fixation (BNF). Rhizobium fixes atmosphere nitrogen into NH_4^+ . N fixed by rhizobium is translocated to xylem of host plant as asparagine and some extent as glutamine. Globally, total annual biological N fixation is $130-180 \times 10^6$ Mt (50% is due to rhizobia). Rhizobium inoculation increases 15-25% yield and 5-20 % protein in plants. Legume-rhizobium live in symbiosis association, inoculation with proper strain will benefit the crop plant. Legumes have a number of benefits for soil quality, including



increasing soil organic matter, enhancing soil porosity, recycling nutrients, enhancing soil structure, lowering soil pH, and diversifying the microorganisms that live in the soil.

SUGARCANE WASTE UTILIZATION: AN APPROACH FOR REDUCING ENVIRONMENTAL RISK

Manish Kumar¹, Lalita Rana² and Jitendra Rajput³

¹Institute of Agricultural Sciences, Banaras Hindu University, Uttar Pradesh

²Sugarcane Research Institute, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar 848 125

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Abstract

The sugar industry has enormous potential to create jobs and add sustainability to the nation's economic growth. Sugarcane is known to be one of the best converters of solar energy into biomass and is a source of food (sucrose, sugar syrup, Jaggery), fibre (cellulose). Sugarcane produces huge amount of crop residue during harvesting and post-harvesting. These residues become menace to our environment if not properly managed, so proper utilization of the residue is very crucial for reducing environmental risks and pollution as residues of the crop is generally burned resulting in hazards to fauna and flora. Sugarcane can be used as fodder (green leaves and cane tops) after harvesting, organic manure (bio-compost press dust, spent wash), fuel (bagasse and sugarcane trash). Sugarcane waste provides high concentrations of nutrients from plants and it is also used for making vermicompost, bio manure and carrier for biofertilizer. Sugarcane by product can be utilized for many value added products viz. Bio-compost, paper and energy production in addition to sugar production. The sugar industry by-products have vast potential reserves for human as well as animal consumption. By using the by-products and crop residue, environmental hazards can be minimized.

IMPACT OF CLIMATE CHANGE ON FOOD SECURITY: CURRENT CHALLENGES

Shiv Poojan and Amit Kumar Sharma

Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar-848125

Abstract

Climate change is now having an influence on global agriculture and food production. Nevertheless, the direct relationship between climate change and federal food security is largely unexplored. Food security must only be affirmed and improved through a combination of interventions spanning multiple activities, from production to distribution and allocation. Despite numerous studies showing the importance of both policy and institutional intervention strategies in ensuring food security following a shock, the consequences of climate change and adaptation community has been slow to recognize these lessons. Climate-related factors might affect food safety via a variety of pathways, including changes in precipitation and temperature patterns, increased frequency and intensity of extreme weather events, ocean warming and eutrophication, and changes in individualized transport pathways, among others. Changes in climate may also have an impact on socio-economic status aspects of food systems such as agriculture, animal production, global trade, demographics, and human behavior, all of which have an effect on food security. Given the critical threats to food security, the emphasis must shift to a framework agenda in order to potentially deal with current challenges. As a result, by scrutinizing all factors, this review seeks to have a more objective perspective and thus interpret the integration association between food and climate change.

EFFECT OF DIFFERENT DOSES OF PANCHGAVYA ON GROWTH OF MOTH BEAN [*VIGNA ACONITIFOLIA* (JACQ.) MARECHAL]

Manju Choudhary and Mahipal Singh Choudhary¹

Department of Agronomy, Anand Agriculture University, Anand-388 110, Gujarat

¹Department of Agronomy, Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan, India 313 001

Email: manjuchoudhary0897@gmail.com

Abstract

Moth bean [*Vigna aconitifolia* (Jacq.) Marechal] is native to India and Pakistan, grown for food production and as a forage and



cover crop. The usage of chemicals such as fertilizers and pesticides for the improvement of the productivity of crops is rampant in the recent past. The green revolution, no doubt, has significantly contributed to the increase in crop productivity but it has also become a cause of great concern by the adverse effects on ecosystem and biotic system. This eventually, leads to high demand for organic farming to protect soil and plant health. Panchgavya, an organic product has the potential to play the role in promoting growth and providing immunity in the plant system. Hence, this study was carried out to assess the fertilization effect of panchgavya on growth parameters of moth bean in semi-arid environment. A field investigation entitled was conducted during the rainy (*Kharif*) season of 2019 at Sri Karan Narendra Agriculture University, Jobner, Rajasthan, India. The soil of experimental field characterized as loamy sand, low in organic carbon and available N, medium in available P and exchangeable K. Application of panchgavya 5% at 20 DAS + 35 DAS produced the best results in terms of the moth bean yield (919 kg ha⁻¹) and improves nutrient quality. A significant increase in growth parameters viz., plant height (35.54 and 37.37 cm), dry matter accumulation (86.45 and 103.99 g m⁻¹ row length) at 50 DAS and harvest, root nodules (14.65) at 40 DAS, were recorded under the application of panchgavya 5% at 20 DAS + 35 DAS over control, panchgavya 7.5%, panchgavya 2.5%.

ROLE OF FOOD PROCESSING IN AGRIBUSINESS

Manpreet Kaur* and Ramandeep Singh

School of Business Studies, Punjab Agricultural University, Ludhiana

Email : manpreetrai1310@gmail.com

Abstract

The food processing sector in India plays crucial role as it fosters vital connections between the two economic pillars agriculture and industry. A recent phenomenon includes the transformation of agriculture through the development of forward and backward links with industry. The food processing sector is claiming a special place in the Indian economy because of its ability to create employment opportunities, raise farmer incomes, and expand exports. For the rural economy to thrive inclusively, the focus on value addition in the agriculture sector is crucial. As the result various technological advancements in food processing such as high-pressure processing, Pulsed Electric fields, ultrasound and plasma treatment have emerged. The food processing industry have revolutionary changed due to adoption of emerging technologies. However, significant development of food processing industry will lead to improvement in both the social and physical infrastructure of rural India. The potential for growth of this industry is supported by a number of encouraging factors, but there are still some substantial obstacles that, if not resolved sooner, could hinder the industry's prospects for expansion in India. However, some factors that prevent industries from utilising emerging technologies includes high investment, low-quality equipment, lack of scientific data and funding. Therefore food processing industry has massive potential in India which can be exploited through strategic planning of resources and wise utilization of emerging technology.

RELATIVE ABUNDANCE OF ORGANIC CARBON POOLS IN RELATION TO NUTRIENT MANAGEMENT PRACTICES UNDER BASMATI-WHEAT CROPPING SYSTEM IN SOILS OF INDIAN PUNJAB

Dhram Prakash, Sunita Sheoran and Parmod Kumar Yadav

Department of Soil Science, CCS HAU, Hisar, Haryana, India

email: dhramprakashteotia@gmail.com

Abstract

A field experiment was initiated during *rabi* 2006-2007 on basmati (*Oryza sativa* L.)-wheat (*Triticum aestivum* L.) cropping systems at Research farm of Punjab Agricultural University (PAU), Ludhiana, India. Experiment was conducted with different nutrient management practices viz. organic amendments involving farmyard manure (FYM), rice straw compost (RSC), vermicompost (VC), chemical fertilizers (NPK) either alone or in combination with FYM (INM). A green manure crop Sunhemp was raised in INM and purely organic amended plots. The effect of treatments on soil organic carbon (SOC) and its labile pools including water-extractable organic C (WEOC), hot water-soluble organic C (HWSC), microbial biomass C (MBC), potassium permanganate oxidizable organic C (KMnO₄-C) were investigated. The mean data (six and half yr) showed that total organic C (TOC) increased significantly in soils receiving manure alone or INM treatment. The magnitude of this



increase in TOC was significantly higher in soils receiving organic manures alone (FYM, RSC and VC), compared to INM. Generally, plots receiving inorganic fertilizers or organic amendments showed significant increase in labile C pools, compared to unfertilized plots. Impacts of different treatments on SOC and its labile pools, followed the order FYM, VC, RSC, INM and NPK. Therefore, application of FYM in these alluvial soils has more potential to C sequestration. On an average, WEOC, HWSC, MBC and $\text{KMnO}_4\text{-C}$ comprised 0.53-0.60%, 4.50-4.67%, 2.53-3.05% and 11.5-17.4% of TOC concentration, respectively.

CARBON MINERALIZATION FROM THE SOILS UNDER BASMATI-WHEAT CROPPING SYSTEM IN PUNJAB

Dhram Prakash, Sunita Sheoran and Parmod Kumar Yadav

Department of Soil Science, CCS HAU, Hisar, Haryana, India

Email: dhramprakashteotia@gmail.com

Abstract

Recently, organic farming has been recommended as an alternative form of agriculture to obtain high-quality food in an environment friendly manner. The key characteristics of organic farming include protecting the long-term fertility of soils by maintaining soil organic matter (SOM) levels through nutrient management and selection of cropping system. In this connection, a field experiment was started during *rabi* 2006-2007 on basmati (*Oryza sativa* L.)-wheat (*Triticum aestivum* L.) cropping systems at Research farm of Punjab Agricultural University (PAU), Ludhiana, India. Experiment involved the use of organic amendments viz. farmyard manure (FYM), rice straw compost (RSC), vermicompost (VC), chemical fertilizers (NPK) either alone or in combination with FYM (INM). The impact of various treatments on carbon mineralization was investigated. The soils under different treatments were incubated for 36 d at 25 and 35°C for estimating carbon mineralization. Cumulative amount of $\text{CO}_2\text{-C}$ evolved from soils under different treatments ranged between 362.7 and 700.4 mg C kg⁻¹ at 25°C, and between 500.2 and 1020 mg C kg⁻¹ at 35°C. Cumulative C evolved from the soils, regardless of the incubation, followed the order FYM>VC>RSC>INM>NPK>CK. The time course of C mineralization showed that mineralization was rapid during initial period of incubation followed by a relatively slower rate. Carbon mineralization was higher at 35°C, than at 25°C, but the magnitude varied with the treatment. Regardless of the temperature, C mineralization was lower in unamended soils and increased with inorganic and organic fertilizers applications. This indicates that the increase in temperature may leads to SOC depletion in semi-arid, sub-tropical conditions.

RESPONSE OF SOIL PHOSPHORUS STOCKS TO NUTRIENT MANAGEMENT PRACTICES UNDER RICE-WHEAT CROPPING SYSTEM

Dhram Prakash, Sunita Sheoran and Parmod Kumar Yadav

Department of Soil Science, CCS HAU, Hisar, Haryana, India

Email: dhramprakashteotia@gmail.com

Abstract

A field experiment was conducted for 7 years under rice (*Oryza sativa* L.)-wheat (*Triticum aestivum* L.) cropping system at Research Farm, Department of Soil Science, Punjab Agricultural University Ludhiana. The soil samples with three replicates were tested for total phosphorus (Total P), inorganic P and organic P; and their stocks in soils were calculated using respective soil depths and bulk densities. In surface soil (0-7.5 cm), highest inorganic P and organic P stocks (668 and 79 kg ha⁻¹) were observed in plots amended with farmyard manure (FYM) and rock phosphate (RP) and the lowest (405 and 32 kg ha⁻¹) in control (CK) plots. Total P stocks ranged between 443 and 758 kg ha⁻¹ under different treatments. Total P and inorganic P stocks were significantly higher in plots receiving fertilizer P in combination with FYM (F_1P_{30RP}) than those receiving FYM alone (F_1P_0). However, the effect of fertilizer P sources viz. single super phosphate and rock phosphate on soil P stocks was not significant. Plots treated with P in wheat (F_0P_0) showed significant increase in total P and inorganic P stocks compared to absolute control. Application of fertilizer P to wheat (F_0P_0) significantly increased organic P stocks by 34.3% compared to CK. Application of FYM and rock phosphate (F_1P_{30RP}) significantly increased organic P stocks compared to FYM alone application (F_1P_0). Irrespective of the treatment, soil P stocks decreased with depth. In subsurface (7.5-15 cm) soil, effects of different treatment on soil P stocks were similar to those observed in surface soil (0-7.5 cm). Under different treatments,



inorganic P, organic P and total P stocks ranged between 340 to 523, 26 to 60 and 370 to 591 kg P ha⁻¹, respectively. Increase in soil P stocks in treated plots may be due to supply of P through various sources. So, application of FYM coupled with RP may be beneficial for build up the P in these alluvial soils under rice wheat cropping

EFFECT OF ENHANCED FRESHNESS FORMULATION (EFF) ON SHELF LIFE OF BITTER GOURD

A. Nithya Devi, K.R. Vijayalatha and P. Paramaguru

Horticultural College & Research Institute for Women, Tamil Nadu Agricultural University, Tiruchirappalli, Tamil Nadu

Email : nithyadevi.a@tnau.ac.in

Abstract

Bitter gourd (*Momordica charantia* L.) is an important vegetable under Cucurbitaceae family, known for its nutritional and medicinal value. Bitter gourd is climacteric and exhibits marked changes in physiological aspects during the period of maturation and ripening. The rise in respiration and evolution of ethylene are accompanied by losses in quality and reduced shelf life. Major challenge is to develop techniques that will effectively extend the shelf life while ensuring the quality. There are many chemicals available commercially to control the ethylene biosynthesis. Hexanal is one such chemical used to delay the ripening which is produced naturally through the lipoxygenase pathway in plants. Hexanal is considered as Generally Regarded as Safe (GRAS) compound for food use by US FDA. Laboratory study was undertaken in the Horticultural College and Research Institute for Women, Trichy to study the effect of a nano-emulsion carrying hexanal, an enhanced freshness formulation (EFF), as pre harvest spray and post-harvest dip technology to minimize the post-harvest losses and to extend the shelf life of bitter gourd. The experiment was carried out with 5 treatments viz., Control, pre harvest spray- EFF 1% and 2% and postharvest dip – EFF 1% and 2%. During the experiments, the fruit's physical, physiological, and biochemical parameters were periodically evaluated. The treated fruit had lower physiological loss of weight and higher firmness throughout the study period, regardless of maturity level at the start. Treated fruit had higher total soluble solids and total sugars, and less acidity indicating improved fruit quality during storage, in addition to an extended shelf life. Though in all the treatments tried there is a significant increase in shelf life, the shelf life extension was higher in the pre harvest spray than postharvest dip because the stage of application in pre harvest spray coincides with the increase in phospholipase D enzyme activity. Pre harvest spray 2% have been identified as effective treatment. The study demonstrates that the use of enhanced freshness formulation (EFF) viz., pre harvest spray, post harvest dip could be used for extending the shelf life without any harmful effect.

FOOD PROCESSING VALUE ADDITION AND POST HARVEST TECHNOLOGY

Abhijeet Kuderia¹, Ram Naresh², Prince Kumar¹ and Vikas Tiwari³

¹Department of Agriculture Extension,, Mmhatma Gandhi Chitrakoot Gramodaya Vishwavidyalya Satna (M.P.)

²ICAR-ATARI, Zone III, Kanpur, Uttar Pradesh

³Department of Agronomy, Mmhatma Gandhi Chitrakoot Gramodaya Vishwavidyalya Satna (M.P.)

Email : kuderiaabhijeet@gmail.com

Abstract

Food processing industries help in checking post-harvest losses, provide food and nutrition security, allow enjoyment of food over longer shelf life. Enable consumers across the world to enjoy foods sourced from anywhere, ensure safety of food products. India has always been pinned as one of the greatest agriculture-based countries of the world. A large section of its economy is generated through agriculture produce and manufacture. In spite of the large produce, India has not been able to harness completely the power of food processing and value addition. The different kinds of losses incurred during the processing activities cause the loss of essential nutrients from the food products. This research will deal with the different ways in which the food products can be enhanced in terms of nutrient value and quality. An enriched food is a food to which nutrients have been added. Typically, the added nutrients were present in the food in its original form, but were removed at some point during processing. White bread — to which certain vitamins are added after the bleaching process depletes them — is a commonly-consumed enriched food. While it is true that both fortification and enrichment refer to the addition of nutrients to food Value addition is a technique which should be readily used in today's generation. With the advent of ready-to-cook foods, it is highly essential that a technology and set of guidelines are set up for the nutrient requirements of any



food product. Also, it does not only help in nutrient enhancement but also in reducing the post production losses. Thereby, the idea of value addition should be incorporated in the current food processing industries and new innovations should be made so as to produce a better quality and a more economical product.

PRINCIPAL COMPONENT ANALYSIS OF CMS BASED WHEAT HYBRIDS FOR YIELD AND ITS CONTRIBUTING TRAITS

Ajay Jaiswal¹, Manoranjan Biswal², Archana Rani³, R.S. Shukla⁴ and Vinod kumar⁵

Department of Plant Breeding and Genetics, JNKVV, Jabalpur, Madhya Pradesh, India

Abstract

The present study comprised of 10 A-line, 10 B-line, 5 R-line and 3 check varieties. The crosses were made during *Rabi* 2019-20 and 50 crosses were made and evaluate during *Rabi* 2020-21 in randomized complete block design with three replications in two different environments *i.e.* timely and late sown conditions. In this study, principal component analysis was carried out for yield and yield attributing traits on wheat hybrids. Out of thirteen only four principal components (PCs) exhibited more than 1.0 Eigen value, and showed 72.64% variability among the traits studied. The first principal component showed the highest variation (34.76%) followed by PC2 (18.75%), PC3 (10.44%) and PC4 (8.69%) among the genotypes for the traits under study. On the basis of principal component analysis, 4 principal components (PCs) showed about 72.64 % variability and genotypes *viz.*, CMS85A*Res936, CMS88A*Res9, CMS89A*Res9 and CMS97A*Res9 have been identified as promising genotypes as they possess higher values PC scores for yield and yield contributing traits. Thus, breeder can select lines with highest score having desirable combination of yield attributing traits. The PCs dominated with yield and yield contributing traits, selection of genotypes from that PCs would be more effective for the identification of genotypes contributing high yield.

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BIOTECHNOLOGICAL TOOLS FOR IMPROVING GENOTYPING IN PLANT BREEDING

Akash Barela

M.K. Shrivastava, Pawan K. Amrate, Yogendra Singh and Shivangi Rahangdale

Department of Plant Breeding and Genetics, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) India

Email : akashbarelagpb@gmail.com

Abstract

The rapid development and increasing affordability of novel research tools in plant genetics and biotechnology have opened



up previously unexplored avenues for manipulating plant genetic diversity in agriculture. The specific issue was launched to demonstrate how new technologies are improving genotyping and phenotyping methods, allowing us to uncover crop diversity and use genetic variability for plant breeding with remarkable precision and speed. Three thematic reviews provide updates on scientific, technological, and legal developments in plant diversity and agriculture. Three contributions provide specific examples of how different types of genetic resources, ranging from landraces to mutant populations, have been exploited. Six research articles are illustrative of the use of molecular and/or phenotypic diversity to answer fundamental or applied questions in various plant species.

EFFECT OF FOLIAR APPLICATION OF NANO-FERTILIZERS ON SOIL HEALTH AND PRODUCTIVITY IN TRANSPLANTED RICE (*ORYZA SATIVA* L.)

Dev Narayan Yadav and Robin Kumar

Department of Soil Science and Agricultural Chemistry, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya

Email : devnryn4522@gmail.com

Abstract

A field experiment was conducted during Kharif season of 2019-20 at Main Experimental Station of Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.). The experiment consisted 6 treatment viz T1: Control, T2: 100 % NPK & 100 % Zinc application (RDF), T3: 50 % N; 100 % P & K + 2 spray of Nano Nitrogen, T4: 0 % Zn, 100 % NPK + 2 spray of Nano Zinc, T5: 50 % N & 0% Zn; 100 % P & K + 2 spray of Nano N mixed with Nano Zn and T6: 50 % N & 0% Zn; 100 % P & K + 2 spray of Nano N mixed with Nano Zn & Nano Cu in Randomized Block Design with 4 replications. The results of experimental revealed that the highest grain yield was recorded with T6: 50 % N & 0% Zn; 100 % P & K + 2 spray of Nano N mixed with Nano Zn & Nano Cu which was at par with T5: 50% N & 0 % Zn; 100% P & K + 2 spray of Nano N mixed with Nano Zn and T4: 0 % Zn, 100% NPK + 2 spray of Nano Zinc. The highest gross return (Rs 119841 ha⁻¹), net return (Rs. 64711 ha⁻¹) and benefit cost ratio (2.17) as well was obtained T6: 50 % N & 0% Zn; 100% P & K + 2 spray of Nano N mixed with Nano Zn & Nano Cu. The nitrogen (%), phosphorus (%), potassium (%), copper (%) and zinc(ppm) content in grain & straw are highest in grain & straw content was recorded under T6: 50 % N & 0% Zn; 100% P & K + 2 spray of Nano N mixed with Nano Zn & Nano Cu of central Uttar Pradesh. Key words: Seed yield, stover yield, harvest index, economics and uptake and content.

GENETIC DIVERSITY AND PRINCIPAL COMPONENT ANALYSIS UNDER LIMITED IRRIGATION IN DURUM WHEAT (*TRITICUM DURUM* L.)

A.R. Donga, K.N. Prajapati, P.A. Goswami, K.D. Gajjar

Abstract

Drought is one of the major environmental factors affecting the yield and plant architecture of durum wheat. Days to heading, days to maturity, number of grains per spike, spike length, peduncle length, number of effective tillers per meter, plant height, protein content, sedimentation value, chlorophyll content, canopy temperature after 5 days and 15 days of anthesis like morphological, biochemical, physiological traits were measure in this study. In the current study, ten clusters of forty different durum wheat genotypes were formed, with the highest distance between clusters 6 and 10 ($D^2 = 373.85$) followed by clusters 9 and 10 ($D^2 = 331.09$). A total of around 73.82 percent of the overall variation seen across the forty durum wheat genotypes was explained by five main components, each having an eigenvalue ranging from 1.21 to 4.93. Different clusters 6, 9, and 10 include genotypes with particular characteristics. These genotypes may produce desirable genetic recombinants that help breeders create drought-tolerant cultivars. The PC1, PC2, PC3, PC4 and PC5 involve characters of major economic traits viz., plant height, number of grains per spike, spike length, peduncle length, 1000 grain weight, chlorophyll content, biological yield per plot, grain yield per plot, canopy temperature after 5 and 15 days of anthesis. The results of the entire experiment showed that the genotypes of durum wheat evaluated under limited irrigation circumstances had a sufficient amount of variability and diversity. Keywords durum wheat, genetic diversity, principal component analysis, restricted irrigation conditions.



CO₂ EMISSION, TRENDS AND ECONOMIC GROWTH IN BRICS COUNTRIES: A PANEL DATA ANALYSIS

Amita Kiran¹ and R. Kushawaha²

¹Department of Botany, Lalitnarayan Mithila University, Darbhanga, India

²School of Economics, University of Hyderabad, India (500046)

Corresponding author Email : amita_bhu@yahoo.com

Abstract

The present research examines the relationships between CO₂ emissions and trends in climatic vulnerability consumption across BRICS nations over the period of 1990 to 2017. Using the panel data least square dummy variable model (LSDV) model, it was found that the LSDV1 model is statistically significant, meaning that every country followed different trends, perhaps, due to the differences in the availability of energy resources. It was found that China and India followed a similar pattern in the CO₂ emission, and in aggregate, the relationship between per capita income and CO₂ emission has a negative relationship and it is also highly statistically significant. Other variables i.e. per capita electricity consumption, per capita energy consumption, gross capital formation, and gross fixed capital formation are major determinants for CO₂ emission and countries with high per capita income are exhibiting better trends in order to reduce CO₂ emission.

ROLE OF AGROFORESTRY IN ENVIRONMENTAL AMELIORATION

Amreena Akhter¹ and Humaira Jan²

¹Division of Silviculture and Agroforestry, Faculty of Forestry, Sher e Kashmir University of Agricultural Sciences and Technology, Benhama, Ganderbal

²Division of Genetics and Plant breeding, Sher e Kashmir University of Agricultural Sciences & Technology, Wadura, Sopore

Abstract

The increased pressure on world natural resources which arises from population growth as well as economic pressure has led to unsustainable use of natural resources and environmental instability. This fluctuating nature of the world climate has caused lot of environmental problems. These negative effect on world ecosystem requires a pivotal attention. Carbon management is a serious concern confronting the world today. A number of summits have been organized regarding this subject. The current level of carbon in the atmosphere is about 416 ppm. It is estimated that if the carbon increases in the atmosphere at the present rate and no constructive efforts are pursued to lessen the same, the level of carbon in the atmosphere would go upto 800-1000 ppm by the end of year 2100 which may create havoc for all living creatures on earth. The issues related to environment management have been given requisite importance in the overall policy and planning for balanced development of the country. Article-48 A of the constitution under part IV- Directive principles of state policy prescribes for protection and improvement of environment and safeguarding of forests and wildlife. Agroforestry plays an important role in reducing level of greenhouse gas emissions vis-à-vis atmospheric CO₂ via carbon sequestration. Carbon sequestration potential of agroforestry systems has attracted worldwide attention following the recognition of agroforestry as a greenhouse gas mitigation strategy under the Kyoto Protocol. Agroforestry can play a remarkable role in the adaptation to climate change because it improves microclimate, protect the soil loss, improve soil fertility, reduce carbon emission and increase carbon sequestration. Hence Agroforestry systems are highly recommended as solution to environmental problem and to promote the mitigation and adaptation synergy in addressing climate change.

IMPACT OF CLIMATE CHANGE ON CROP PRODUCTION

Anil Jakhar*, Rahul Jakhar and Sunita Kanwar

Department of Agronomy, SKNAU, Jobner (Raj.)

Department of Agronomy, SKRAU, Bikaner (Raj.)

*Email : aniljakhar78912@gmail.com

Abstract

Climate change is happening now, and it is the most serious threat to life on our planet. Climate change refers to long term shifts in temperatures and weather patterns. These shifts may be natural, such as through variations in solar cycle. Human



activities have been the main driver of climate change. Burning of fossil fuels like coal, oil and gases generates greenhouse gas emissions that act like a blanket wrapped around the earth, trapping the sun's heat and raising temperatures. Climate change can disrupt food availability, reduce access to food, and affect food quality. For example, due to increase in temperature, precipitation patterns changes, changes in extreme weather events, and reduction in water availability may all result in reduced agricultural productivity. Crops need suitable soil, water, sunlight, and heat to grow. Increasing temperature affects the length of growing stages of crops. Flowering and harvesting stages of many crops are happening several days earlier in season, which may cause reduction in crop production. Core to all climate change solutions is reducing greenhouse gas emissions,, which must get to zero as soon as possible. Because both forests and oceans play vitally important roles in regulating our climate, increasing the natural ability of forests and oceans to absorb carbon dioxide can also help stop global warming. There are many ways to stop climate change are to pressure government and business to keep fossils fuels in the ground, switch to sustainable transport, protect forest and ocean, reduce plastic uses etc.

PREVALENCE OF HEALTH RISK BEHAVIOR AMONG WORKERS ENGAGED IN FOOTWEAR MANUFACTURING

Anjali Gairola* and Deepa Vinay

Department of FRM, College of Home Science, GBPUAT, Pantnagar

Corresponding Author's Email : Anj.10.gairola@gmail.com

Abstract

Researches indicate that industrial workers were more likely than general workers to engage in a number of health risk behaviours. Using a pre-tested questionnaire, the prevalences of several health risk behaviours among footwear industry workers were evaluated. For the study, a sample of 150 workers who worked in the shoe manufacturing industry was chosen. Manufacturing workers were much more likely to smoke, drink excessively, do little recreational physical activity, or not always buckle their seatbelts. The majority of them regularly smoked cigarettes and occasionally drank alcohol. Ninety-five percent of respondents reported engaging in this conduct when they were between the ages of 18 and 25. Workers in the footwear industry may benefit from initiatives to minimize certain health risk behaviours due to their high prevalence, especially given the high frequency of several health risk behaviours and the possible exposure to occupational hazards, interventions to reduce these behaviours may be beneficial for those who work in the footwear manufacturing industry.

EFFECT OF SUPPLEMENTATION OF *MORINGA OLEIFERA* LEAF AND ARJUNA BARK POWDER ON THE GROWTH PERFORMANCE OF KADAKNATH CHICKEN

Ankit Sharma^{1*}, Anil Kumar¹, Kalicharan Nayal¹ and Sumit Gangwar¹

¹Department of Livestock Production Management, College of Veterinary and Animal Sciences, GBPUAT, Pantnagar, Uttarakhand, INDIA

*Corresponding author Email : ankit291994@gmail.com

Abstract

Moringa oleifera is a phytobiotic with antibacterial and immunomodulatory effects. *Terminalia arjuna* in Ayurvedic medication is used as a heart tonic to keep the heart healthy, blood pressure normal, and cholesterol levels low. The goal of the study was to see how *Moringa oleifera* leaf and Arjuna (*Terminalia arjuna*) bark powder administration affected the growth performance of indigenous fowl. Day old chick (n=72) were distributed into six treatment groups, having three replicates of 4 birds each. The study was conducted during 0-20 weeks of age. Chicks were fed T₀ (control) basal diet and 5 treatment groups as T₁, T₂, T₃, T₄, T₅ supplemented with 1, 2, 3, 4, 5% *Moringa oleifera* leaf powder respectively and 1% Arjuna bark powder in each group respectively. Weekly body weight was significantly higher (P<0.01) in the T₃ group as compared to the control group from 5 to 20 week of age. Further, weekly body weight was apparently higher in all treatment groups than control groups throughout the experiment. Weekly body weight gain was also significantly higher (P<0.01) in the T₃ group. Weekly feed intake was significantly higher (P<0.05) in the control group than other treatment groups from 6 to week of age. Weekly feed conversion ratio of the T₃ group was significantly better (P<0.01) as compared to the control group. Thus, it may be concluded that dietary supplementation of *Moringa oleifera* leaf @3% and Arjuna bark powder @1% resulted in better growth performance in Kadaknath chicken.



SOIL ENZYMATIC ACTIVITIES RESPONSE TO DIFFERENT NUTRIENT MANAGEMENT PRACTICES AFTER GARDEN PEA (*PISUM SATIVUM*) CULTIVATION

Apurva, Dhram Prakash and Sunita Sheoran

Department of Soil Science, CCS Haryana Agricultural University Hisar-125004

Email : bhimaniya7680@gmail.com

Abstract

A field experiment conducted in Rabi, 2019 with eight treatments i.e. FYM₁₀₀, vermicompost₁₀₀, FYM+ CUBOF, vermicompost+CUBOF, FYM₅₀+CUBOF, vermicompost₅₀+CUBOF, RDF (NPK:: 30:50:0 kg ha⁻¹) and control plot and three replications at Research Farm, Department of Vegetable Science, CCS Haryana Agricultural University, Hisar was selected to determine the response of soil enzymatic activities to different nutrient management practices after garden pea (*Pisum sativum*) cultivation. The experimental results indicated that the dehydrogenase, alkaline phosphatase, urease and arylsulfatase activity in the soil varied from 17.58 to 38.92 µg TPF g⁻¹ 24h⁻¹, 142.72 to 357.85 µg PNP g⁻¹ h⁻¹, 11.2 to 20.07 µg NH₄⁺-N g⁻¹ h⁻¹ and 4.82 to 10.84 µg PNP g⁻¹ h⁻¹, respectively. The highest dehydrogenase, alkaline phosphatase and urease activity were observed with the application of RDN through vermicompost combined with CUBOF, however, the highest arylsulfatase activity was observed with the application of RDN through FYM along with CUBOF. Addition of RDN through vermicompost reported numerically higher dehydrogenase activity (35.58 µg TPF g⁻¹ 24h⁻¹) in soil as compared to RDN applied through FYM (34.83 µg TPF g⁻¹ 24h⁻¹) but did not differ significantly. Application of half RDN through FYM or vermicompost along with CUBOF (270.38 and 288.25 µg PNP g⁻¹ h⁻¹, respectively) recorded significantly higher alkaline phosphatase activity as compared with the application of RDN through FYM or vermicompost (223.54 and 230.47 µg PNP g⁻¹ h⁻¹, respectively). Incorporation of recommended dose of fertilizers (17.66 µgNH₄⁺-N g⁻¹ h⁻¹) in soil recorded numerically higher urease activity as compared to RDN applied through FYM or vermicompost (15.92 and 16.8 µgNH₄⁺-N g⁻¹ h⁻¹, respectively) but did not differ significantly. Addition of RDN through FYM or vermicompost (8.91 and 8.75 µg PNP g⁻¹ h⁻¹, respectively) recorded significantly higher arylsulfatase activity in soil as compared to RDF treatment (7.06 µg PNP g⁻¹ h⁻¹). Application of half or full RDN through FYM or vermicompost alone or in combination with CUBOF recorded significant higher enzymatic activities in soil over RDF treatment.

ASSESSMENT OF STERILIZING AGENTS FOR CLEAN *IN VITRO* CULTURES FOR MICROPROPAGATION IN SOURSOP (*ANNONA MURICATA* L.).

Archana S.¹, Kulapati Hipparagi² and D.P. Prakasha³

¹Department of Fruit Science, College of Horticulture, UHS, Bagalkot, Karnataka

²MHREC, UHS, Bagalkot, Karnataka

³College of Horticulture, Sirsi, UHS, Bagalkot, Karnataka

Email: sriarchi510@gmail.com

Abstract

Annona muricata L. called 'soursop' is one of the tropical species with edible fruit which is used in the areas of medicine, particularly in treating respiratory and digestive ailments, nutrition, preserving ecosystems and they provide real opportunities for socioeconomic application. It is a small, upright evergreen tree growing 5 to 6 meters in height. The production of seedlings can be realized using seed (sexual), or vegetative method (especially grafting), the seed propagation is slow, uneven, and not very significant germination and more restricted to obtaining rootstocks. Layering, budding, grafting, shoots, and root cuttings are among other traditional methods of propagation, are very expensive and slow. Being its sexual propagation of limited agronomic value due to the high degree of heterozygosity, the *in vitro* tissue culture methods of micropropagation can be applied successfully. Sterilization is a key and essential part of micropropagation because it enables the *in vitro* propagation of selected genotype progenies free from outside and internal contamination. In order to assess the efficacy of three sterilizing agents (NaOCl, HgCl₂, and ethanol), varying concentrations of each were utilized with variable exposure times. Nodal explants collected from plants were firstly washed in the running water for 15 minutes and then they are soaked in the solution containing Bavistin (0.2 %) and cetrinide (0.05 %) along with few drops of tween 20 for 4 hours after that treatments were imposed. The 4% NaOCl is exposed for 3 to 10 minutes and among these three best treatments were selected then it was combined with 0.025, 0.05, 0.1% concentrations of HgCl₂ for 3, 5 and 8 minutes and its best three were finally treated with



70% ethanol for 15, 30 and 45 seconds. From the results, the best three NaOCl, HgCl₂ and 70% ethanol treatments were identified (4% NaOCl for 7 min + 0.05% HgCl₂ for 5 min + 70% ethanol for 15 sec, 4% NaOCl for 6 min + 0.05% HgCl₂ for 3 min + 70% ethanol for 45 sec and 4% NaOCl for 6 min + 0.1% HgCl₂ for 3 min + 70% ethanol for 15 sec,) which were found effective in establishing clean cultures of 95, 86 and 78 %, respectively.

NITROGEN UPTAKE TRANSITION FROM NITRATE TO AMMONICAL FORM AT SEEDLING STAGE IN RICE (*ORYZA SATIVA* L.)

Ankit Yadav and Dimple Gor

*Department of Agriculture Biotechnology, B.A. College of Agriculture, Anand Agricultural University, Anand-388110, Gujarat
Email: ankityadav@student.aau.in*

Abstract

There are majorly two forms of nitrogen available for plants uptake. Rice plant prefers ammonical form of nitrogen. At the early stage of the growth that is seedling stage rice is grown under aerobic condition where it uses nitrate form of the nitrogen which is easily available in this condition. As plants absorb ammonical form and metabolize, it releases excess hydrogen ion into the soil and creating acidic environment. While plant uptake nitrate it releases OH⁻ ion into the soil and higher pH can be seen in medium. We evaluated rice plant for different nitrogen forms under hydroponic condition. The pH of the root exudates was recorded regularly upto 30 days of sowing in all the three treatments viz., ammonical, nitrate and both. We found that under ammonical form of nitrogen pH of the root exudates has a decreasing trend and in nitrate treatment pH tend to increase while in mixed form of nitrogen, initially pH increases up to 22-24 days of sowing then after it start decreasing. This suggests that rice plant prefer nitrate form of nitrogen in the initial period of growth and development and then it switches to the ammonical form of nitrogen for uptake. This is the stage when rice is usually exposed to anaerobic conditions with agronomic, soil and water management where ammonical form of nitrogen is predominant, indicating the evolutionary significance of stage specific switch.

AGROFORESTRY FOR SUSTAINABLE RURAL LIVELIHOOD

Ashish Raja Jangid

*Deptt. of Agronomy, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur
Email : ashishjangid1651@gmail.com*

Abstract

Adequate and sustainable access to income and resources such as adequate access to food, drinking water, health facilities and education to meet basic needs is a lifeline. Maintaining a livelihood is a major challenge facing policymakers and decision-makers in the current situation. In this context land-use measures that maintain livelihood security and reduce climate and climate change are needed (Basu, 2018). Agroforestry can play a key role in bringing about the desired level of diversity, agricultural productivity and sustainability. Agroforestry has the potential to provide food security and help reduce poverty and its contribution to environmental protection i.e. soil conservation, carbon intake is very important. Traditional farming and management such as agro-forestry may offer livelihood options by simultaneously producing food, fodder and firewood and minimizing the impact of climate change. Agroforestry contributes to sustainable rural livelihoods provinces where the predominant means of livelihoods is rural subsistence farming and agriculture (Zerihun, 2021).

ZINC-FORTIFICATION OF VEGETABLE PEA THROUGH ZINC AND ZSB SOLUBILISER

Archika Awasare, Y.M. Sharma, G.S. Tagore and F.C. Amule

Department of Soil Science, Jawaharlal Nehru Krishi Vishwa Vidyalyaya, Jabalpur, India

Abstract

The investigation was carried out in the pot experiment during 2021-2022 at the Department of Soil Science, College of Agriculture, JNKVV, Jabalpur, to study Zinc Fortification of vegetable pea through Zinc and ZSB Solubiliser. There were fourteen treatments viz. T₁-Absolute control, T₂-RDF (30 N, 60 P₂O₅ and 30 K₂O kg ha⁻¹), T₃-(T₂ + Soil application of 25 kg



ZnSO₄.7H₂O ha⁻¹), T₄-(T₂ + Seed treatment ZnSO₄.7H₂O @ 3g kg⁻¹ of seed), T₅-(T₂ + Foliar application @ 0.5% ZnSO₄.7H₂O, at flowering and pod formation stage), T₆-(T₃ + T₅), T₇-(T₄ + T₅), T₈-(T₃ + T₄ + T₅), T₉-(T₂ + Soil application of 2 L⁻¹ Acre (liquid ZSB), T₁₀-(T₂ + Seed treatment (Liquid ZSB) @10 ml kg⁻¹ of seed), T₁₁-(T₂ + Foliar application of 2 L⁻¹ Acre (liquid ZSB) at flowering and pod formation stage), T₁₂-(T₉ + T₁₁), T₁₃-(T₁₀ + T₁₁) and T₁₄-(T₉ + T₁₀ + T₁₁). The treatments were replicated three times in a completely randomized design (CRD). The vegetable pea (PSM - 3) was grown in rabi season. Results revealed that the maximum plant height and yield, of were recorded with treatment T₃ (RDF (100%) + Soil application of 25 kg ZnSO₄.7H₂O ha⁻¹) which was more response compared to that of from T₁ control. The maximum zinc content in seed and stover was 40.54 and 17 mg kg⁻¹ at treatment of T₅ (T₂+Foliar application @ 0.5% ZnSO₄.7H₂O, at flowering and pod formation stage), which was 65.26 and 80.57% higher than the control (24.53 and 9.41 mg kg⁻¹ Zn). The maximum zinc uptake by seed and stover was 937.9 and 667.7µg pot⁻¹ was observed in same treatment. Zinc fortification showed the maximum yield and zinc content and uptake by vegetable pea were obtained with 100% of RDF + Foliar application @ 0.5% ZnSO₄.7H₂O, at flowering and pod formation stage. The maximum N and P uptake were also obtained at same treatment but maximum K uptake by seed and stover at treatment of T₈ and T₆, respectively. Treatment 100% of RDF + Foliar application @ 0.5% ZnSO₄.7H₂O, at flowering and pod formation stage also maintained the soil health in terms of pH EC and organic carbon and availability nutrients and Zn in soil which were better than control.

SUPPLEMENTATION EFFECT OF BYPASS FAT AND FIBROLYTIC ENZYMES ON BLOOD BIOCHEMICAL PROFILE IN SURTI BUFFALO CALVES

Londhe Arvind Sudhakar, Brishketu Kumar, Anshu Rahal, V.K. Singh and V.R. Patel

Department of Animal Nutrition, College of Veterinary and Animal Sciences, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, India.

Email- drarvindlondhe@gmail.com

Abstract

Calves are usually raised on poor quality fodders or agricultural by-products with limited amounts of concentrates low in protein and energy. To increase the efficient use of dietary protein and fat, bypass nutrients play an important role. Exogenous fibrolytic enzymes have role in efficient utilization of fiber from the feed. The present trial was conducted to assess the effect of bypass fat supplementation and fibrolytic enzymes on blood biochemical profile of Surti buffalo calves. Total eighteen female Surti buffalo calves (6-9 months) were selected for 90 days feeding trial and randomly divided into three homogenous groups of six calves in each group based on their body weight. The treatments given were as follows: Treatment 1 (T1) group- basal diet consisting of compound concentrate mixture, green roughages (green jowar) and dry roughages (jowar straw) as per requirements; Treatment 2 (T2) group - basal diet along with supplementation of bypass fat @3% of DMI and Treatment 3 (T3) group- basal diet along with bypass fat @3% of DMI with 2.5 g of exogenous fibrolytic enzymes (cellulase and xylanase) per kg DMI per calf per day. Blood biochemical profile revealed that blood glucose, total protein and low-density lipoprotein did not vary among three treatment groups but, triglycerides, cholesterol and very low-density lipoprotein were higher (P<0.05) in T2 and T3 treatment groups. It was concluded that supplementation of bypass fat affects lipid profile in Surti buffalo calves.

LOW INPUT MICROPROPAGATION STRATEGIES FOR PRODUCTION OF DISEASE FREE PLANTING MATERIALS AND ENTREPRENEURSHIP DEVELOPMENT THEREIN

Awadhesh Kumar Pal, Shahnishan Tabassum, R.D. Ranjan and Shashikant

Department of Plant Physiology and Biochemistry, Bihar Agricultural University, Sabour, Bhagalpur-813210, India

Email : awapal@gmail.com

Abstract

The technique of disease free planting materials production through micropropagation has proved to be a boon for the commercial production of vegetatively growing plants whose seeds either are not viable viz. banana, bamboo, pointed guard, seed potato, strawberry, pineapple etc. or appears after a very long period like bamboo. Business men, commercial plant growers and entrepreneurs find tremendous utility of this technique. For establishment of a tissue culture laboratory the input cost involves equipments, manpower, electricity apart from the land and construction. The total cost on the inputs may range



from twenty five lakhs to seven crores, depending on the number of plants produced annually and the same may be minimised at various level of the operation. The low cost equipments are available in the market which can be purchased initially and later on can be moved on the expensive one. The knowledge of the works performed at different stages of this operation viz. the sub-culturing work in laminar hood or nutrient media preparation or hardening of plants at polyhouse and nethouse may further lead to reduction of cost by managing different low cost means. After undergoing some basic training, entrepreneurs are able to establish their own laboratories, wherein they can produce large number of plants for commercial purpose. Trained manpower is the primary requisite, so there is a great scope for the entrepreneurs. Entrepreneurs may primarily be involved in marketing of tissue cultured raised plants. Government at the central and state level have been continuously supporting the entrepreneurs by training or by providing subsidies in different form i.e. on tissue culture raised plants or for setting up of new laboratories or polyhouses or nethouses. Conclusively, tissue culture operation has tremendous scope and opportunity for the youth and entrepreneurs for good earning and livelihood.

PLANT INVASION AND SPECIES DIVERSITY

Ayyappa, Girish G, Suvarna, Akshaya Kumar and Umesh Babu B.S.

Department of Genetics and Plant Breeding, University of Agricultural Sciences, Raichur 584104 Karnataka

Email : umeshbs888@gmail.com

Abstract

Invasion is an act of entering as an enemy. Invasion by alien plant species have increased rapidly throughout the world during the present century and responsible for the homogenization of floras which have had caused a substantial threat to biodiversity and ecological integrity of native habitats and ecosystem. Invasion by the species cause extensive effect on the habitats they invade like impact on indigenous species diversity, soil nutrient composition, altering cycles of forest fire and loss of productivity of ecosystems which have been invaded. Plant invasion dramatically affects the distribution, abundance and reproduction of many native species. Plant invasion are human introduced or of natural means like wind, birds, animals, water etc. Four types of evolutionary changes that might promote or constrain rapid adaptation during the invasion process, such as hybridization, polyploidy, bottlenecks, and stress induced modification of the genome. Polyploidy can be an important factor in species invasion success through a combination of pre-adaptation, where by polyploidy lineages are predisposed to conditions in the new range and therefore, have higher survival rates and fitness in the earliest establishment phases. The possibility for subsequent adaptation due to a larger genetic diversity that may assist the 'evolution of invasiveness.' restoring sexual reproduction following hybridization or conversely, asexual reproduction in the absence of suitable mates. The severity of the invasion problem has grown tremendously as the global economy has reached into virtually all corners of earth planet. As significant global problem with negative impact on all countries, the problem of invasive alien species is destroying of a significant global response. There is a great deal that can be done to control them effectively, using biocontrol and other means. New introduction the place which is accelerating fast can be prevented, and newly introduced species can be eradicated before they become established.

ROLE OF HEAT SHOCK PROTEINS IN THERMO-TOLERANCE OF CHILLI

Umesh Babu B.S., Tembhurne B.V., Pruthviraj G. and Ayyappa

Department of Genetics and Plant Breeding, University of Agricultural Sciences, Raichur 584104 Karnataka

Email : umeshbs888@gmail.com

Abstract

Environmental stresses can alter the physiological mechanisms of plants by dysfunctioning proteins which is a major consequence of less crop productivity. Heat stress high temperature (HT) is one of the major abiotic stresses that cause damage to the plant tissues and limits the crop production by altering developmental growth, metabolism and productivity. In the molecular level, the plant's survival strategy in HT condition is to change the expression of gene during transcription/translation process resulting in the generation of heat shock proteins (HSPs). Hsfs have a modular structure, despite a considerable variability in size and sequence, their basic structure and mode of promoter recognition are conserved throughout the eukaryotic kingdom with typical feature such as DBD, OD, NLS, NES, AHA₁/AHA₂. Examples of Hsfs are HsfA1, HsfA2, HsfB1, HsfB5, HsfC. Upon stress treatment HsfA1a is released from the complex of Hsp70/Hsp90, HsfA1



and HsfB1 cooperate in immediate action of HS-inducible genes. The A1/B1 transcription complex recruits HAC histone acetyl transferase to the transcription machinery. Heat shock proteins are classified based on their protein size into five subfamilies including small Hsp (sHsp), Hsp60, Hsp70, Hsp90, Hsp100. Hsps are involved in maintaining the cellular equilibrium, protein conformation, preventing aggregation, and hence preserving the nonnative protein in a competent state for further remodeling, which is attained by other Hsps/ chaperones. Some Hsps accompany the signal transduction and transcription switch on the synthesis of Hsps. Heat stress acts upon the quaternary structure of folding protein, activity of which is lost due to elevated temperatures, which have deleterious effects on plant metabolism. This results in the removal of connections between the signaling pathways. Therefore further elucidation is required to understand how plants better respond to heat and other major abiotic stresses from the physiological and molecular perspectives.

PHYSICO-CHEMICAL ANALYSIS OF SOIL PROFILE IN *BAMBUSA VULGARIS* PLANTATIONS IN KHURDHA DISTRICT OF ODISHA

B.K. Parmanik¹, T.L.Mohanty² and M.C. Behera²

¹KVK, Boudh, OUAT, Bhubaneswar, Odisha

²College of Forestry, OUAT, Bhubaneswar, Odisha

Abstract

The physico-chemical properties of soil profile under Bamboo plantation area was studied in the present investigation. Soil samples were collected from 0-15, 15-30, 30-45, 45-60, and 60-75cm depths of the bamboo plantation in Large livestock farm, OUAT, Bhubaneswar. Soil samples were air-dried, ground, passed through 2mm sieves and analysed for necessary physical and chemical properties. Soil texture at different layers of the profiles varied from sand to sandy loam. Sand content ranged from 84.8% to 90.0% and silt content from 4.6% to 6.8%. Clay content varied from 5.4 to 8.4% in the area under bamboo plantation. There was gradual increase in clay content from surface down the profiles. Bulk density of the soils varied from 1.50 to 1.6g/cm³ at different layers of the profile. Particle density remained around (2.66g/cm³) in all the layers of the profile. Water holding capacity of the soils varied from 25.2 to 30.4% and % pore space from 39.85% to 42.97% in different layers of the profile. Both bulk density and water holding capacity of the soils increased consistently with depth of the profiles. The soils at different layers of the profiles were strongly acidic. Electrical conductivity of the soils varied from 0.420 to 0.426 dS/m. Percentage organic carbon is low in the profile. Mineralizable N, available P and K in different layers of the profile varied from 61.3 to 93.8; 1.34 to 2.82 and 10.5 to 18.1 mg/kg. respectively. The strongly acidic soil of the area under bamboo plantation needs liming for successful plant growth.

EFFECT OF INCORPORATION OF FLAXSEED OIL AND BRAHMI LEAVES ON FATTY ACID PROFILE OF HERBAL COW GHEE

Binod Kumar Bharti¹, Anamika Das², J. Badshah¹ and Sonia Kumari¹

¹Sanjay Gandhi Institute of Dairy Technology (Bihar Animal Sciences University) Patna, Bihar

²Warner College of Dairy Technology (SHUATS) Prayagraj, U.P.

Email : bkbharti30@gmail.com

Abstract

Ghee is a traditional Indian dairy product. Ghee is generally prepared from cow milk and buffalo milk and it has a typical pleasing and appetizing aroma flavour. In the present study, investigation was made to observe the chemical changes of cow ghee supplemented with flaxseed oil and brahmi herbs. The sample of herbal cow ghee was analyzed for monounsaturated fatty acids. In the present investigation, flaxseed oil was added in three different concentrations viz. 5%, 10% and 15% and brahmi leaves were added @5%, 10%, 15% and 20% in cow ghee samples. The samples were analysed for Palmitoleic acid and oleic acid. The highest mean value for Palmitoleic acid (% of Total Fat) was recorded 1.57 for sample T12 and treatments T11, T10, T9, T8, T7, T5, T6, T3, T2, T4, T1 and T0 has the mean value of 1.56, 1.53, 1.52, 1.37, 1.35, 1.34, 1.33, 1.08, 1.07, 1.04, 1.02 and 0.22 respectively. It has been observed that when cow ghee samples were incorporated with 5% Brahmi leaves and the level of flaxseed oil increased from 5% to 15%, then the Palmitoleic acid was found to increase significantly ($P < 0.05$) from 1.02 to 1.52. When cow ghee samples were incorporated with higher level 10% Brahmi leaves and the level of flaxseed oil increased from 5% to 15%, then the Palmitoleic acid was found to increase significantly ($P < 0.05$) from 1.07 to 1.53. In



another monounsaturated fatty acid, the highest mean value for Oleic acid (% of Total Fat) was recorded 22.33 for sample T12 and treatments T11, T10, T9, T8, T7, T6, T5, T1, T2, T3, T4 and T0 has the mean value of 22.31, 22.29, 22.28, 21.59, 21.55, 21.53, 21.52, 21.08, 21.07, 21.06, 21.05 and 20.40 respectively. It has been observed that when cow ghee samples were incorporated with 5% Brahmi leaves and the level of flaxseed oil increased from 5% to 15%, then the Oleic Acid was found to increase significantly ($P < 0.05$). When cow ghee samples were incorporated with 10% Brahmi leaves and the level of flaxseed oil increased from 5% to 15%, then the Oleic Acid was found to increase significantly ($P < 0.05$) from 21.07 to 22.29.

ROLE OF HEAT SHOCK PROTEINS IN THERMO-TOLERANCE OF CHILLI

Umesh Babu B.S., Tembhurne B.V., Pruthviraj G. and Ayyappa

Department of Genetics and Plant Breeding, University of Agricultural Sciences, Raichur 584104 Karnataka

Email : bvttembhurne@gmail.com

Abstract

Environmental stresses can alter the physiological mechanisms of plants by dysfunctioning proteins which is a major consequence of less crop productivity. Heat stress high temperature (HT) is one of the major abiotic stresses that cause damage to the plant tissues and limits the crop production by altering developmental growth, metabolism and productivity. In the molecular level, the plant's survival strategy in HT condition is to change the expression of gene during transcription/translation process resulting in the generation of heat shock proteins (HSPs). Hsfs have a modular structure, despite a considerable variability in size and sequence, their basic structure and mode of promoter recognition are conserved throughout the eukaryotic kingdom with typical feature such as DBD, OD, NLS, NES, AHA₁/AHA₂. Examples of Hsfs are HsfA1, HsfA2, HsfB1, HsfB5, HsfC. Upon stress treatment HsfA1a is released from the complex of Hsp70/Hsp90, HsfA1 and HsfB1 cooperate in immediate action of HS-inducible genes. The A1/B1 transcription complex recruits HAC histone acetyl transferase to the transcription machinery. Heat shock proteins are classified based on their protein size into five subfamilies including small Hsp (sHsp), Hsp60, Hsp70, Hsp90, Hsp100. Hsps are involved in maintaining the cellular equilibrium, protein conformation, preventing aggregation, and hence preserving the nonnative protein in a competent state for further remodeling, which is attained by other Hsps/ chaperones. Some Hsps accompany the signal transduction and transcription switch on the synthesis of Hsps. Heat stress acts upon the quaternary structure of folding protein, activity of which is lost due to elevated temperatures, which have deleterious effects on plant metabolism. This results in the removal of connections between the signaling pathways. Therefore further elucidation is required to understand how plants better respond to heat and other major abiotic stresses from the physiological and molecular perspectives.

PLANT INVASION AND SPECIES DIVERSITY

Ayyappa, Girish G, Suvarna, Akshaya Kumar and Umesh Babu B.S.

Department of Genetics and Plant Breeding, University of Agricultural Sciences, Raichur 584104 Karnataka

Email : ayyutalkeri@gmail.com

Abstract

Invasion is an act of entering as an enemy. Invasion by alien plant species have increased rapidly throughout the world during the present century and responsible for the homogenization of floras which have had caused a substantial threat to biodiversity and ecological integrity of native habitats and ecosystem. Invasion by the species cause extensive effect on the habitats they invade like impact on indigenous species diversity, soil nutrient composition, altering cycles of forest fire and loss of productivity of ecosystems which have been invaded. Plant invasion dramatically affects the distribution, abundance and reproduction of many native species. Plant invasion are human introduced or of natural means like wind, birds, animals, water etc. Four types of evolutionary changes that might promote or constrain rapid adaptation during the invasion process, such as hybridization, polyploidy, bottlenecks, and stress induced modification of the genome. Polyploidy can be an important factor in species invasion success through a combination of pre-adaptation, where by polyploidy lineages are predisposed to conditions in the new range and therefore, have higher survival rates and fitness in the earliest establishment phases. The possibility for subsequent adaptation due to a larger genetic diversity that may assist the 'evolution of invasiveness.' restoring sexual reproduction following hybridization or conversely, asexual reproduction in the absence of suitable mates. The severity of the invasion problem has grown tremendously as the global economy has reached into virtually all corners of earth planet.



As significant global problem with negative impact on all countries, the problem of invasive alien species is destroying of a significant global response. There is a great deal that can be done to control them effectively, using biocontrol and other means. New introduction the place which is accelerating fast can be prevented, and newly introduced species can be eradicated before they become established.

STRUCTURAL INDICES OF SOILS UNDER DIFFERENT CROPS AND MANAGEMENT PRACTICES

Himagirish K.M., Balanagoudar S.R., Ravi M.V., Bhat S.N. and Ananda N.

*Department of Soil Science and Agricultural Chemistry and ⁵Department of Agronomy
University of Agricultural Sciences, Raichur-584104*

Abstract

A study was conducted for fifteen different profile sites where same crop was grown for several years under AICRP projects and under different establishment systems at Main Agricultural Research Station, Raichur. The samples were analysed for different soil structural indices like mean weight diameter, percent aggregates >0.25 mm aggregate stability and along with physicochemical properties of soil at different depths. The results revealed that the mean weight diameter was significantly higher in organic-amended plots when compared to non-organic plots. Some crops like legumes viz, groundnut and pigeon pea were found beneficial in improving these properties. The per cent aggregates >0.25 mm and per cent aggregate stability also varied to a greater extent. The mean weight diameter in the soil sites varied from 0.58 to 0.27 mm. Even the per cent aggregates >0.25 mm and per cent aggregate stability varied from 61.16 to 89.62 per cent and 32.56 to 87.07 per cent respectively. The adjacent field was also studied for the same properties as control treatment for comparison for soil properties. The soils were medium to high in free calcium carbonate content.

AGRI TOURISM: STATUS, FUTURE PROSPECTUS AND SCOPE IN INDIAN CONDITION: A REVIEW

Chandrika Sharma¹, Venkateshwar Jallara¹, Vinod Kumar² and Mahendra Anjna³

¹Deptt. of Extension Education, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (MP)

²Deptt. of Genetics and Plant Breeding, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (MP)

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EMPOWER EVERY FARMER IN EVERY CORNER: EXTENSION AND KNOWLEDGE DISSEMINATION FOR DOUBLING FARMER'S INCOME

Venkteshwar Jallarah¹, Chandrika Sharma¹, Vinod Kumar² and Mahendra Anjna³

¹Deptt. of Extension Education, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (MP)

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Abstract

India is today not only self sufficient in demand of food, but is also an exporter of agricultural products; occupying seventh position globally. We are the top producers of cereals, fruits, vegetables, milk, meat and fish; thanks to production gains over the decades. But we are deficit of pulses and oilseeds. The impressive agricultural growth stands as to tribute to the agricultural technology and the hard slog of the farming community. The farmer's resilience to multiple challenges and their determination to serve and secure the nation's demand for food and raw materials to its agro-industries deserves appreciation and gratitude. Doubling farmer's income by 2022 is important not only to improve the welfare of the farmers; but also to sustain interest in farming and providing incentive to raise growth trajectory of agriculture. This requires a paradigm shift in the approach towards the agricultural sector. The same is applicable in the arena of extension and knowledge dissemination. It is high time that stakeholders of agricultural sector keep aside the superfluous arguments on the likelihood of achieving it; and devote attention to activities which can realize the same. Though doubling the farmer's income is the set goal; a rise in income at noticeable levels shall do more good to the agricultural sector of India in the coming decades.

PROOF-OF-CONCEPT FOR DEVELOPING CRISPR/CAS9 MUTANTS IN INDIAN MUSTARD

Vinod Kumar¹, Mahendra Anjna², Venkteshwar Jallarah³ and Chandrika Sharma³

¹Department of Genetics and Plant Breeding, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur; (MP)

²Department of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur; (MP)

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Abstract

CRISPR/Cas9 is a dynamic, versatile tool that allows us to target nearly any genomic location. This genome editing technique provides a precise and an easy mode of DNA editing that has found tremendous applications in crop science. *Brassica juncea* (Indian Mustard) is an important oilseed crop in India and acts as a hyper-accumulator of heavy metals. The mechanism of phyto-remediation mediated by mustard is poorly understood. The present study attempts to design a construct that will be useful for CRISPR/Cas9 mediated deletions in the small subunit gene (rbcS) of RuBisCO. Such mutants developed by CRISPR/Cas9 system can be useful in studies pertaining to impact of heavy-metals on the process of import of rbcS into the chloroplast in a better and accurate manner. The gene was amplified, cloned in a sequencing vector and its sequence obtained by Sanger sequencing. Three guide RNA target sequences was designed by an online guide RNA design software, adjacent to NGG PAM sequences, to target the gene towards its 5' end taking into account the specificity score, efficiency scores, out of frame scores, number of off-targets and the presence of restriction sites. Each guide RNA target sequence was cloned into the guide RNA scaffold of the expression vector harboring Cas9. Further, Agrobacterium-mediated leaf disc transformation will be performed and the induced mutation/deletion can be confirmed by restriction digestion of PCR amplified on-target sequences. This study may be considered as proof-of-concept for developing CRISPR/Cas9 mutants in *Brassica juncea*.



PRECISION FARMING AS A TOOL FOR SUSTAINABLE AGRICULTURE DEVELOPMENT

Mahendra Anjna¹, Vinod Kumar², Venkateshwar Jallaraph³ and Chandrika Sharma³

¹Department of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, (MP)

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Abstract

Precision farming is an approach where inputs are utilized in precise amounts to get increased average yields, compared to traditional cultivation techniques. In India, one major problem is the small field size. Only in the states of Punjab, Rajasthan, Haryana and Gujarat do more than 20 per cent of agricultural lands have an operational holding size of more than four ha. Precision Agriculture (PA) can help in managing crop production inputs in an environmentally friendly way. By using site-specific knowledge, PA can target rates of fertilizer, seed and chemicals for soil and other conditions. To reduce water use, stop water wasteful practices, and stop additional pollution, agriculture must adapt and become much more efficient. This adjustment entails enhancing irrigation systems, growing crops appropriate for the soil and environment, and putting best practices to use in preventing water contamination. For sustainable agriculture, use less pesticide and avoid fertilizer runoff into natural bodies of water. By creating a productive irrigation system, water usage for crop production and processing may be measured and optimized. Soil conservation is the prevention of soil loss from erosion or prevention of reduced fertility caused by over usage, acidification, salinization or other chemical soil contamination. Slash, Burn and other unsustainable methods of subsistence farming are practiced in some lesser developed areas. A sequel to the deforestation is typically large scale erosion, loss of soil nutrients and sometimes total desertification. Crop rotation, cover crops, conservation tillage, and installed windbreaks are methods for better soil conservation that have an impact on both erosion and fertility. Plants that die decompose and mix with the soil.

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STUDY OF CORRELATION AND PATH COEFFICIENT ANALYSIS IN BITTER GOURD (*MOMORDICA CHARANTIA*)

D. Triveni

Anurag University

Email : triveni23dharoor@gmail.com

Abstract

A study was conducted to assess the correlation coefficient and path co-efficient analysis of twenty-nine bitter gourd genotypes. Twenty-nine genotypes of bitter gourd were grown in Augmented Block Design. The correlation coefficient indicated that there was a highly significant and positive correlation between fruit yield per vine and fruit yield per hectare (0.998), average fruit weight (0.827) and fruit length (0.627) while the association was significant for number of fruits per vine (0.412). The path analysis indicated that average fruit weight (0.615), number of fruits per vine (0.442), fruit length (0.227), days to opening of first male flower (0.089), days to first fruit harvest (0.060), number of primary branches (0.019) and node at which first female flower appeared (0.016) had direct positive effects on fruit yield per vine. Based on overall findings of the present study, it was concluded that for selecting superior genotypes primary emphasis should be given on fruit yield per vine followed by number of fruits per vine, average fruit weight and fruit length.

EFFICACY OF DIFFERENT INSECTICIDES AGAINST FALL ARMYWORM, *S. FRUGIPERDA* IN MAIZE

D.V. Chaudhary, P.S. Patel, P.K. Thakar and D.H. Padhiyar

Abstract

To evaluate the efficacy of different insecticides against fall armyworm *S. frugiperda*, the experiment was carried out at Agronomy Instructional Farm, C. P. College of Agriculture, S. D. Agricultural University, Sardarkrushinagar, during *kharif*, 2020. Different nine insecticides were evaluated against fall armyworm in maize. Results revealed that application of emamectin benzoate 5 SG @ 0.0025%, spinosad 45 SC @ 0.014% and chlorantraniliprole 18.5 SC @ 0.0055% were found more effective in checking the larval population and plant damage in maize which also reflected on grain yield as well.

HIGH-THROUGHPUT PHENOTYPING

Deeksha Chauhan, Sachin Bhanot

RCA, MPUAT, Udaipur-313001

Email : dikshuchauhan.2106@gmail.com

Abstract

Increasing the productivity of major food and feed crops has always been a concern worldwide. Researchers are realizing that present breeding projects would not be adequate enough to cope up with the anticipated future food demands in the current



climate scenario. Screening of different traits that contribute to better yield under field conditions requires immediate attention. Phenotyping of key agricultural characteristics such as yield, nutritional quality, and stress tolerance is conventionally recorded and is generally considered as strenuous activity. High-throughput phenotyping (HTP) technologies offer the ability to non-destructively image large number of plants over time, capturing morphological and biophysical traits under controlled or field environments, and linking these phenotypes to genomic expression

Visual technology is any technology that captures, analyzes, filters, displays or distributes visual data. It typically leverages computer vision, machine learning or artificial intelligence. Visual data includes photos, videos, thermal images, X-ray, hyperspectral images and much more. Excitingly, visual technology is revolutionizing phenotyping, unblocking the bottleneck and bringing us to the next generation of plant breeding. Advances in camera and sensor technology are now enabling faster and more reliable indoor phenotyping through a wide range of imaging sensors, including multi-angle, 2D, 3D, RGB, fluorescence, near-infrared (NIR), thermal infrared (TIR) and hyperspectral.

Some of the techniques are explained below: 3D imaging: shoot mass, leaf number, shape and angle, leaf colour, leaf health. Near infrared: water content Fluorescence: photosynthesis efficiency, Hyperspectral: physiological trait response, stress response, Thermal imaging: leaf surface temperature. HTP is an emerging area with numerous applications that combines plant biology, sensing technology, and robotics aiding crop improvement programs.

DIVERSITY OF SUBFAMILY MIMOSOIDEAE DC. IN TROPICAL AND SUBTROPICAL REGION OF KUMAUN UTTARAKHAND, INDIA

Deepa Dhami and D.S Rawat

Department of Biological Sciences, College of Basic Sciences and Humanities, GBPUAT, Pantnagar

Email : deepdhami1996@gmail.com

Abstract

Fabaceae Lindl. (*Leguminosae* Juss.) is commonly called as the pea, bean or legume Family. With ca. 770 genera and 19,500 species the family is the third largest angiosperm family. Bentham placed all legumes in the order Rosales and three subfamilies. Hutchinson and Cronquist recognized these subfamilies as three different families under the order Fabales or Leguminales. The most recent classification of legumes by LPWG have divide the family into 6 subfamilies. The plants of the subfamily are mostly herbs, shrubs or trees, leaves are usually compound with pulvinous base, flowers usually actinomorphic, stamens 4-many, ovary superior, fruit a lomentum or pod. Plant specimens of subfamily Mimosoideae DC. were collected from different localities of the study area. The specimens were prepared as herbarium sheets and submitted to Biological Sciences department's herbarium at G.B. Pant University. Collected specimens contains important information suggested by Simpson, Jain and Rao. There are 20 species present in the tropical and subtropical region of kumaon under 10 genera. *Albizia* was the largest genus with 4 species, *Adenothera*, *Leuceana*, *Calliandra*, *Pithecellobium*, *Dictrostachys*, *Prosopis* and *Indopiptadena* are the 7 genera which have single species, keys of the genera and species if genera having more than one species will given.

BIO-DECOMPOSITION OF PADDY STRAW TO RESTORE SOIL HEALTH AND CLIMATE

Deepika Dhanda¹, Baljeet Singh Saharan² and Vishal Ahlawat³

¹Dept. of Botany & Plant Physiology (Environmental Sciences), College of Basic Sciences & Humanities, CCS HAU, Hisar

²Department of Microbiology, College of Basic Sciences & Humanities, CCS HAU, Hisar

³Department of Soil Science, College of Basic Sciences & Humanities, CCS HAU, Hisar

Email: baljeetsaharan@hau.ac.in

Abstract

In today's world, climate change is the major concern which is contributing substantially to food insecurity in future, by reducing food production and increasing food prices. Climate change mitigation efforts may increase energy prices so that food may become more expensive. Rice (*Oryza sativa*) is the second highest worldwide staple food for a large part of the world's human population, especially in Asia. Paddy straw is considered an agricultural waste product, which is used as fodder, animal bedding or either burned openly in farm. If paddy straw is left in the field without proper management, it can



cause many problems such as air pollution, the spreading of disease, decrease soil health and quality. The burning of paddy straw in field releases harmful gases and particulate matter into the atmosphere, which increase air pollution, global warming and ultimately leads to the climate change. There is a link between air pollution and the risk of several health problems, the harmful effects of air pollution range from eye and skin irritation to severe respiratory, cardiovascular, neurological diseases. Paddy straw contains a large amount of plant nutrients and one ton of paddy straw is reported to contain 0.5-0.8% N, 0.16-0.27% P₂O₅, 1.4-2.0% K₂O, 0.05-0.10% S on dry matter basis. It consists of digestible organic matter, cellulose (47.2%), soluble phenolic compounds (4.3%) and lignin (3.0%). Paddy straw burning affects soil productivity due to the losses of essential nutrients inside the soil, i.e. Nitrogen, Phosphorus, and Potassium. The burning of rice straw leads to a loss of about 0.445 Mt of NPK, 0.144 Mt. Straw burning increase the soil temperature up to 42 °C, thus the important microorganisms in the soil are displacing or killing at a depth of about 2.5 cm. The pollutants and soil infertility may affect agricultural productivity directly or indirectly. Direct effects include injury to leaves, grains, or assimilation of heavy metals and indirect effects include the formularization of favorable conditions for the growth of pests or diseases. Burning is not the best way to deal with paddy straw so that biodecomposition is very useful and environmental friendly to deal this problem. Bio-decomposition of rice straw using effective microorganisms, as an accelerator to speed up the decomposition process and increased nutrients in the soil. Besides, technology the incorporation and bio-decomposition of paddy is more important to reduce the climate change and it is much more eco-friendly.

EFFECT OF FLY ASH, LIME AND VERMICOMPOST APPLICATION ON PHYSICO-CHEMICAL PROPERTIES OF HEALTH OF SOIL

Dev Narayan, Rahul Raj and Yogendra Kumar

Department of Agronomy, IGKV, Raipur (C.G.)

Email : devnarayansahu78@gmail.com

Abstract

The present experiment entitled “Effect of fly ash, lime and vermicompost application on physico-chemical properties of health of soil” was conducted during *Kharif* 2021 in an *Inceptisol* at KVK, Katghora, Korba, (Chhattisgarh). The treatments comprised of control, 100% RDF, 75% RDF + 2 t/ha Lime, 75% RDF + 2 t/ha Vermicompost, 75% RDF + 20 t/ha Fly ash, 75% RDF + 20 t/ha Fly ash + 2 t/ha Lime, 75% RDF + 20 t/ha Fly ash + 2 t/ha Vermicompost, 75% RDF + 20 t/ha Fly ash + 2 t/ha Lime + 2 t/ha Vermicompost, 75% RDF + 40 t/ha Fly ash, 75% RDF + 40 t/ha Fly ash + 2 t/ha Lime, 75% RDF + 40 t/ha Fly ash + 2 t/ha Vermicompost and 75% RDF + 40 t/ha Fly ash + 2 t/ha Lime + 2 t/ha Vermicompost. The treatments were laid out in Randomized Block Design (RBD) with three replications. The results showed that the application of fly ash with lime and vermicompost could be a viable option for enhancing the production of crops under acidic soil conditions. The results indicated that application of 75% RDF + 40 t/ha Fly ash + 2 t/ha Lime + 2 t/ha Vermicompost recorded highest rice grain (38.30 q ha⁻¹) and straw (59.40 q ha⁻¹) yield as compared to 100% RDF (33.15 q ha⁻¹ grain & 52.92 q ha⁻¹ straw) and control (22.80 q ha⁻¹ grain & 29.13 q ha⁻¹ straw). The application of fly ash with lime and vermicompost @ 75% RDF + 40 t/ha Fly ash + 2 t/ha Lime + 2 t/ha Vermicompost was found to decreased bulk density of surface soil (0-15 cm) from 1.61 Mg m⁻³ to 1.50 Mg m⁻³. It was also recorded that application of 75% RDF + 40 t/ha Fly ash + 2 t/ha Lime + 2 t/ha Vermicompost retain higher moisture in soil after harvest of crop till 7th day. The soil pH, available NPK significantly increased with the application of fly ash with lime and vermicompost, while no effect on electrical conductivity, particle density and organic carbon was recorded. The experiment resulted that total uptake of N, P and K in plant was significantly increased with the application of 75% RDF + 40 t/ha Fly ash + 2 t/ha Lime + 2 t/ha Vermicompost. However, nutrient content (%) of N, P and K in plant was not influenced by application of fly ash with lime and vermicompost.

EFFECT OF SULPHUR AND BORON APPLICATION ON YIELD, YIELD ATTRIBUTES, NUTRIENTS UPTAKE AND QUALITY PARAMETERS OF MUSTARD

Ravindra Kumar¹, Devendra Singh¹, Y.K. Singh², Arvind Kumar³ and S.B. Pandey¹

Department of Soil Science and Agricultural Chemistry^{1&2}, AICRIP on Rice², KVK Kannauj³

C.S. Azad University of Agriculture and Technology, Kanpur (U.P.)-208002

Abstract

A field experiment was conducted during 2017 to 2019 at Fertilizer Research Farm Uttaripura of C. S. Azad University of



Agriculture and Technology, Kanpur with the high yielding variety of mustard Varuna was taken as test crop. The maximum plant height 173.5 cm, siliquae per plant 166.7, grain per siliquae 16.6, test weight 5.7 gram, grain yield 25.2 q ha⁻¹ and stover yield 70.2 q ha⁻¹ was recorded with the application of RDF+60 kg S + 3 kg B ha⁻¹ and minimum in recommended dose of fertilizers treatment. The maximum oil and protein content of mustard grain was recorded 43.2 and 21.8 percent respectively, with the application of RDF+60 kg S+3 kg B ha⁻¹ and lowest in recommended dose of fertilizers. The beneficial role of combined application of sulphur and boron in increasing seed protein concentration. The maximum uptake of N, P, K, S and B 75.4, 18.7, 20.2 q ha⁻¹ and 86.7 mg kg⁻¹ in grain and 55.4, 24.6, 20.5 q ha⁻¹ and 176.8 mg kg⁻¹ in stover respectively with the application of RDF+ 60 kg S+3 kg B ha⁻¹ and minimum in recommended dose of fertilizers. This increase may be attributed to increased nitrogen concentration and grain and stover yield. The considerable changes in available nutrients of experimental soil after three years with the application of different treatments. The maximum changes in available nitrogen, phosphorus, potassium, sulphur and boron was recorded 207.5, 20.3, 148.8, 24.3 kg ha⁻¹ and 0.36 mg kg⁻¹ from initial values of 172.3, 10.2, 123.7, 10.2 kg ha⁻¹ and 0.18 mg kg⁻¹ respectively with the application of RDF+60 kg S+3 kg B ha⁻¹ treatment.

PERFORMANCE OF YIELD, NUTRIENTS UPTAKE AND QUALITY PARAMETERS OF CHICKPEA UNDER DIFFERENT LEVELS OF PHOSPHORUS AND ZINC

Devendra Singh, Ravindra Kumar¹, Y.K. Singh, and S.B. Pandey²

AICRIP on Rice ¹ & ², Department of Soil Science and Agricultural Chemistry²

C.S. Azad University of Agriculture and Technology, Kanpur (U.P.)-208002

Abstract

A field experiment was conducted during 2020-21 and 2021-22 at Student Instrumental Farm of C.S. Azad University of Agriculture and Technology, Kanpur with RGV-203 variety of chickpea was taken as test crop. The maximum pod per plant 61.26 and 60.89, grain per pod 1.73 and 1.71, test weight 20.20 gram and 19.82 gram, grain yield 18.85 q ha⁻¹ and 18.24 q ha⁻¹, straw yield 23.25 q ha⁻¹ and 22.96 q ha⁻¹, biological yield 42.20 q ha⁻¹ and 41.20 q ha⁻¹, harvest index 44.67 percent and 44.27 percent and protein concentration in grain 20.9 percent and 20.87 percent was recorded with the combined application of P (60 kg ha⁻¹) + Zn (9 kg ha⁻¹) and P (40 kg ha⁻¹) + Zn (6 kg ha⁻¹) respectively. The uptake of nitrogen was recorded highest under P (60 kg ha⁻¹) + Zn (9 kg ha⁻¹) over control treatment by grain and stover of chickpea were 63.15 and 33.16 kg ha⁻¹, respectively. The uptake of phosphorus in grain and stover increased with the application of P (60 kg ha⁻¹) + Zn (9 kg ha⁻¹) to the tune of 51.8 percent and 47.1 percent respectively over P₀ and Zn₀ level. The maximum uptake of K by the crop was recorded with the application of P (60 kg ha⁻¹) + Zn (9 kg ha⁻¹) and minimum in control treatment. The highest uptake of zinc by grain 49.91 kg ha⁻¹ and straw 52.67 kg ha⁻¹ was recorded with the combined application of P (60 kg ha⁻¹) + Zn (9 kg ha⁻¹) treatment.

HISTOCHEMICAL STUDY OF OVARIAN DEHYDROGENASES SDH AND GLUCOSE-6-PHOSPHATE DURING VARIOUS PHASES OF REPRODUCTIVE CYCLE IN INDIAN LEAF-NOSED BAT HIPPOSIDEROS SPEORIS (SCHNEIDER)

Dharna Bisen¹, Pratibha Bisen², Aparna Jaiswal³ and Shraddha Karcho⁴

¹Department of Entomology, College of Agriculture Balaghat

²Department of Plant Breeding and Genetics, College of Agriculture Balaghat

³Department of Extension and Education, College of Agriculture Balaghat

⁴Department of Plant Pathology, College of Agriculture Balaghat

Email : dharna.bisen@gmail.com

Abstract

The present study describes cyclical changes in dehydrogenases of glycolytic and tricarboxylic acid (TCA= Krebs cycle) G-6-PDH and SDH in the bat ovary. Hipposideros speoris is an insectivorous monotocous and monoestrus microchiropteran bat, which breeds once in a year. The female genitalia are morphologically bilaterally symmetrical but sinistral dominance exists hence for the present study all left ovaries were utilized. These two ovarian dehydrogenases found to show variations during different stages of reproductive cycle, in all types of growing follicles and all three types of interstitial glands (Igc) including thecal, stromal and epithelial cords, however, a specific change in the enzyme profile was observed during each



phase of reproductive stage. Histochemical shift in the enzymatic activity during different reproductive phases correspond to change in the metabolic requirements as well as in the process of steroidogenesis.

HISTOCHEMICAL ANALYSIS OF THE THECAL INTERSTITIAL GLAND DURING THE REPRODUCTIVE CYCLE IN THE OVARIES OF A MICROCHIROPTERAN BAT, *HIPPOSIDEROS SPEORIS* (SCHNEIDER)

Dharna Bisen¹, Sharad Bisen², Pratibha Bisen³ and Pooja Goswami⁴

¹Department of Entomology, College of Agriculture Balaghat

²Department of Horticulture, College of Agriculture Balaghat

³Department of Plant Breeding and Genetics, College of Agriculture Balaghat

⁴Department of Agronomy, College of Agriculture Balaghat

Email : dharna.bisen@gmail.com

Abstract

A study of ovaries during a complete reproductive cycle in mature females of *Hipposideros speoris* showed the presence of thecal type interstitial gland tissue during late-recrudescence (October to early-November) and breeding (late-November to December). Luteal-like transformation of fibroblasts of thecae of multilaminar atretic follicles results into formation of thecal interstitial gland tissue. This interstitial tissue undergoes a variety of cellular alterations till its complete differentiation and are very transient in nature since after persisting for some time in the wall of degenerating follicles they revert back to stromal cells. Cyclical variations in the histochemical visualization of lipids, 3 -hydroxysteroid dehydrogenase (3 -HSD), 17 -hydroxysteroid dehydrogenase (17 -HSD) succinic dehydrogenase (SDH) and Glucose-6-phosphate dehydrogenase (G-6-PDH) were observed since histochemical shift in the enzymic and substrate activity during reproductive cycle correspond to changes in the metabolic requirements as well as in the process of steroidogenesis suggest their role in ovarian physiology.

PRELIMINARY SURVEY ON DIVERSITY ANALYSIS OF *TINOSPORA CORDIFOLIA* (WILLD) HOOK.F & THOMSON FROM DIFFERENT AGRO-ECOLOGICAL UNITS OF KERALA

Dhyana T. and Sonia N.S.

Department of Plantation Crops and Spices, College of Agriculture, Vellayani, Thriruvananthapuram-695 522

Email : dhyanaagr@gmail.com

Abstract

Tinospora cordifolia (Guduchi in Sanskrit/ Giloy in Hindi), is a climber used extensively in Ayurveda and traditional medicine. It belongs to the family Menispermaceae. It is termed as “amritha”, the name denotes both its significance in Ayurveda as a rejuvenator. As part of diversity analysis of Giloy (*Tinospora cordifolia* (Willd.)) among seven different agro ecological units (AEU's) of Kerala viz., AEU 7 (Kaipad Lands), AEU 13 (Northern Foothills), AEU 15 (Northern High Hills), AEU 18 (Attappady Hills), AEU 19 (Attappady Dry Hills), AEU 21 (Wayanad Eastern Plateau) and AEU 23 (Palakkad Eastern Plain), a survey was conducted in different locations viz., Cherukunnu, Kannur (11°59'46.4"N and 75°19' 6.6" E), Nilamboor, Malapuram (11°21'56.1"N and 76°17'03.7"E), Kelakam, Kannur (11°52'50.5"N and 75°48'05.6"E), Attapadi, Palakkad (10°36'26.7"N and 76°44'33.0"E), Attapadi (Agali) Palakkad (11°6'20.5"N and 76°39'13.3"E), Pulpalli, Wayanad (11°48'34.2252"N and 76°9'51.1848"E) and Pattancherry, Palakkad (10°39'12.24"N and 76°43'50.16"E) from the respective AEU's for knowing the indigenous uses of *Tinospora cordifolia* (Willd) Hook.f & Thomson.

Inhabitants in Cherukunnu, Kannur opined that Giloy stem pounded along with whole plant of *Emilia sonchifolia* [Muyalcheviyan] could cure headache when applied over forehead. The natives from Nilamboor, Malapuram believed that Giloy stem juice (one and a half tsp) added with honey to taste (one tsp) is an anti-pyretic agent when consumed two times a day for two to three days. A traditional medicinal practitioner from Kelakam, Kannur described the use of Giloy stem decoction containing one tenth portion of *Sida cordifolia*/ [Kurunthotti] roots and *Cedrus deodara* (heart wood) [Devadaru], consumed once daily after dinner is effective for relieving pain and inflammation in joints. The villagers from Attapadi, Palakkad advised that the Giloy stem juice [half tsp – one tsp] added with honey to taste [one fourth tsp, if required] when



consumed twice daily cures urinary infection. A traditional practitioner opined that pounded Giloy stem (15 cm piece) soaked overnight in water (one glass) and the filtrate when consumed in empty stomach is a proven remedy for treating diabetes. A tribal medicinal practitioner from Pulpalli, Wayanad, had revealed the potential of Giloy for controlling complications of dengue fever and other important fevers. Giloy stem, tulasi leaves and thippali spikes, at 1:1:1 ratio is made into a decoction (adding four times volume of water, boiling to reduce it to one fourth volume) and consumed (warm) for two to three times a day could work well. The locals from Pattancherry, Palakkad opined that daily consumption (for a particular time period) of Giloy stem juice (10-15 ml) could be used as a liver tonic. Hence this prestigious plant material can serve as a research material for crop improvement as well as pharmacological research.

ASSESSMENT OF GENETIC DIVERSITY IN DIFFERENT CHILLI (*CAPSICUM ANNUUM* L.) GENOTYPES USING BIOCHEMICAL AND MOLECULAR CHARACTERS

Dimple Gor¹, Diwakar Singh² and Ankit Yadav¹

¹Department of Plant Molecular Biology and Biotechnology, B.A. College of Agriculture, Anand Agricultural University, Anand-388110, Gujarat

²Department of Plant Molecular Biology and Biotechnology, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari- 396450, Gujarat

Email : dvg0204@gmail.com

Abstract

Twenty genotypes of chilli were characterized for determining variability using biochemical and molecular markers. Total five biochemical characters were analysed which grouped the genotypes into two clusters, producing highest genetic dissimilarity (19%) between genotypes KTPL-19 and 2011/CHIVAR-3 & genotype KTPL 19 and 2011/CHIVAR-9. For excluding the environmental effect of biochemical markers, molecular markers viz., 13 RAPD and 10 EST-SSR primers were used in the study. RAPD analysis showed 72.22% polymorphism with PIC 0.88, highest genetic dissimilarity (53%) between genotypes 2011/CHIVAR-1 and Pant chilli-3 and grouped the genotypes into three clusters. EST-SSR primers produced mean of 3.8 alleles per primer, PIC 0.56, highest genetic dissimilarity (25%) between genotypes 2011/CHIVAR-2 and 2011/CHIVAR-9 and grouped the genotypes into two clusters. The combined study of molecular markers produced highest dissimilarity (72%) between genotypes 2011/CHIVAR-3 and 2011/CHIVAR-7 and grouped the genotypes into two clusters. Molecular characterization based on RAPD and EST-SSR thus is more precise to find out genetic diversity among chilli genotypes and the results produced in this study could be utilized by a chilli breeder for genetic improvement programme of chilli genotypes.

BIOLOGICAL PERFORMANCE OF DIFFERENT TUBEROSE CULTIVARS UNDER MALWA PLATEAU

Ekta Rajput¹, Saransh Saxena² and Yogendra Singh³

¹Department of Floriculture and Landscape Architecture, PDKV, Akola, MH

²Department of Horticulture, JNKVV, Jabalpur, MP

³Department of Plant Breeding and Genetics, JNKVV, Jabalpur, MP

Email : saranshsaxena220@gmail.com

Abstract

An experiment entitled “Biological performance of different tuberose cultivars under Malwa Plateau” was carried out during 2019-20. Experiment consisted 10 cultivars and these treatments were replicated three times in Randomized Block Design (RBD) and analyzed. Data revealed that V₇ showed the best performance with respect of most of the parameters i.e., maximum plant height 26.33 cm at 30 and 60 DAP, spike length 93.27 cm, spike girth 1.04 cm, rachis length 31.00 cm, number of florets per spike 48.87, number of spike per plant 6.53, length of florets 6.27 cm, number of open florets per spike 39.87, percentage of open florets per spike 89.33%, fresh weight of spike 94.33 g and dry weight of spike 6.20 g, where as the maximum number of leaves 25.93 at 30 and 60 DAP and maximum vase life 12.60 were recorded in cv. Mexican Single. The minimum water uptake at 3rd of vase 13.93 ml was observed in cv. GK TC-4 and minimum water uptake at senescence stage 22.03 ml was observed in cv. Phule Rajani. The minimum days taken to spike emergence 107.80 days, days taken to opening of first floret 128.30 days and maximum diameter of florets 4.63 cm was observed under the cultivar cv. Arka Nirantra.



SCENARIO OF ARTIFICIAL INTELLIGENCE / INFORMATION TECHNOLOGY IN CONTEXT TO INDIAN AGRICULTURE

G.D. Chandanakra³, A.N. Warghat¹ and S.S. Munje²

¹Deptt. of Entomology, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.), India-211007

²Department of Entomology, RRC, Amravati (M.S.), India-444603

³Department of Plant breeding, RRC, Amravati (M.S.), India-444603

Email : anandwarghat07@gmail.com

Abstract

Agriculture is one of the fastest growing sectors in the world with huge volumes of data generated every day via both structured and unstructured format via IoT (internet of things) These relate to data on historical weather pattern, soil reports, new research, rainfall, pest infestation, images from drones and so on. Cognitive IOT solutions can sense all this data and provide strong insights to improve yield. Digital mandis could offer an excellent way for transactions between farmers and customers. The e-mandi concept has previously been tested in different parts of India, and would add transparency and efficiency to the whole marketplace. It could bring the kisan back to his glory days as the nation rebuilds its economy after the current crisis. Technology powered by Artificial intelligence is ensuring the sustainability of quality food production for the coming decades. Drones, hydroponics, artificial lights and AI-powered cameras are protecting crops from wild animals. The contribution of artificial intelligence in agriculture is only set to increase with agri-tech startups cropping up in Bengaluru, Hyderabad and New Delhi. Cognitive computing in particular, is all set to become the most disruptive technology in agriculture services. It can understand, learn, and respond to different situations (based on learning) to increase efficiency. Some of them can be services for the producers. For example, the chatbot that pops up when you visit a banking website could be incorporated into a kisan app. Proximity Sensing and Remote Sensing require sensors to be built into airborne or satellite systems, but proximity requires sensors in contact with soil. This helps in soil characterization based on the soil below the surface in a place. Drone-based imagery can help in in-depth field analysis, crop monitoring, scanning of fields and so on. They can be combined with computer vision technology and IOT to ensure rapid actions by farmers. These feeds can generate real time weather alerts for farmers. Images of various crops are captured using Computer Vision Technology under white/UV-A light. Farmers can then arrange the produce into separate stacks before sending it to the market. Pre-processing of images ensures the leaf images are segmented into areas for further diagnosis. Such a technique would help identify pests more distinctly. Cognitive computing makes recommendations to farmers on the simplest choice of crops and seeds. This technology will monitor crops along their entire life-cycle and generate reports for detecting anomalies, if any. Remote sensing techniques alongside hyper spectral imaging and 3D laser scanning are essential to create crop metrics across thousands of acres. Farmers in the southern Indian state of Andhra Pradesh received AI-sowing app advisory text messages for the first time in 2016, with a 30% increase in their crop yields per hectare. In 2017, the pilot was expanded to more than 3,000 farmers in the state and neighbouring Karnataka. Karnataka Agricultural Price Commission (KAPC) and Microsoft worked together to develop a multi-variate commodity price forecasting model by combining artificial intelligence, cloud machine learning, satellite-imaging and other advanced technologies. The Karnataka government and Microsoft signed a memorandum of understanding (MoU) in October 2017 reaffirming their commitment to creating technology-oriented smart farming solutions for farmers in India. The model uses satellite imagery and other data to produce predictions about arrival dates and crop volumes. It is now ready to be applied to other crops and other regions around the country. In conclusion of that, India's Agri-tech start-ups are hungry for CSR funding to give wings to their dream tech that will turn deserts into fertile farmlands. Although the implementation of artificial intelligence in agriculture in India is still at an early stage, they have been hailed as promising success stories.

MICRO-GRAFTING : A PROMISING TOOL FOR OBTAINING VIRUS FREE PLANTS

Gagan Mehta, Anil Kumar Godara, R.K Goyal, Akash Sharma and Rajesh Kumar

Maharana Pratap Horticulture University, Karnal (Camp Office: CCS HAU, Hisar Campus)

Abstract

Micro-grafting is an *in vitro* grafting technique which involves the placement of a meristem or shoots tip explants onto a decapitated rootstock that has been grown aseptically from seed or micro-grafted cultures. The technique has great potential



for improvement and large scale multiplication of fruit plants. Successful micrografting protocols have been developed for various fruit crops including almonds, apple, cherry, chestnut, citrus, grapes, mulberry, olive, peach, pear, walnut etc. The percent among various methods of micrografting, slit or wedge grafting has been found most suitable in case of fruit crops. *In Vitro* shoot tips are better as compared to *in vivo* shoot tips for carrying out micrografting resulting in higher grafting success, less contamination, less vitrification, lower shoot tip necrosis of micrografts. The technique has great potential for improvement and large scale multiplication of fruit plants. It has been used on commercial scale for production of virus free plants in fruit crops and viroid free plants in citrus. Micrografting has also been used in prediction of incompatibility between the graft partners, histological studies, diseases indexing, resistance to soil borne pathogens, safe germplasm exchange between countries and multiplication of difficult to root plants.

CORRELATION STUDIES FOR YIELD AND WATER USE EFFICIENCY RELATED TRAITS IN F₃ GENERATION OF THE CROSS GKVK6 × KCG2 IN GROUNDNUT (*ARACHIS HYPOGAEA* L.)

H.C. Sowmya

Genetics and Plant Breeding, UAS, Raichur, Karnataka

Email: hc.sowmya@gmail.com

Abstract

In the present scenario of climate change we need to develop high water use efficient genotypes which give higher yield under drought condition. Groundnut is one of the important oilseed crops of the world. Kernels are rich source of edible oil (44-55%), dietary protein (25-33%), carbohydrate (20%), B-complex vitamins, especially thiamine and nicotinic acid but deficient in fat soluble vitamins A and D and almost lacking vitamin C. It also contains a higher proportion of unsaturated fatty acids including essential fatty acids like linolenic acid and linoleic acids. Thus, the crop has great future as oilseed as well as food crop. Haulm is an excellent fodder and oilcake is used for animal feed. Correlation study was carried out in the segregation generation to study association of different traits with pod yield per plant and for further selection of high yielding and water use efficient genotypes based on selection of highly correlated traits. The F₃ generation of the cross GKVK6 × KCG2 and their parents were evaluated. Observations were recorded on F₃ generation plants for days to first flowering, plant height, primary branches per plant, SCMR, SLA, pods per plant, pod yield per plant, kernel yield per plant, Shelling *per cent* and SMK *per cent*. Correlation and path analysis was carried out in F₃ generation using the recorded data. Kernel yield/plant (0.9350), pods/plant (0.7088) were having significant high positive correlation with pod yield per plant whereas SLA (-0.3638) was having significant negative correlation with pod yield per plant. Kernel yield per plant (0.7922) has shown high positive direct effect on pod yield per plant. The selection for kernel yield per plant, pods per plant and SLA will intune leads to improve the pod yield per plant as these characters had strong desirable association with pod yield per plant.

ASSOCIATION AND PATH ANALYSIS STUDIES FOR YIELD AND WATER USE EFFICIENCY RELATED TRAITS IN F₃ GENERATION OF THE CROSS GKVK13 × KCG2 IN GROUNDNUT (*ARACHIS HYPOGAEA* L.)

H.C. Sowmya

Department of Genetics and Plant Breeding, UAS, Raichur, Karnataka

Email : hc.sowmya@gmail.com

Abstract

Groundnut is one of the important oilseed crops of the world. Due to climate change, strategies have to be developed to develop high water use efficient genotypes which can give higher yield under drought condition. Correlation study was carried out in the segregation generation to study association of different traits with pod yield per plant and for further selection of high yielding and water use efficient genotypes based on selection of highly correlated traits. The F₃ generation of the cross GKVK13 × KCG2 and their parents were evaluated. Observations were recorded on F₃ generation plants for days to first flowering, plant height, primary branches per plant, SCMR, SLA, pods per plant, pod yield per plant, kernel yield per plant, Shelling *per cent* and SMK *per cent*. Correlation and path analysis was carried out in F₃ generation using the recorded data. Kernel yield/plant (0.9284), pods/plant (0.8143), SCMR (0.7456) were having significant high positive correlation with pod yield per plant whereas SLA (-0.6894) was having significant negative correlation with pod yield per plant. Kernel yield per



plant (0.6595) was having high positive direct effect on pod yield per plant. The selection for kernel yield per plant, pods per plant, SCMR and SLA will inturn leads to selection of water use efficient and high yielding genotypes as these traits have strong association with pod yield per plant.

CORRELATION AND PATH ANALYSIS FOR YIELD AND WATER USE EFFICIENCY RELATED TRAITS IN F₃ GENERATION OF THE CROSS GKVK16

H.C. Sowmya

Department of Genetics and Plant Breeding, UAS, Raichur, Karnataka

Email : hc.sowmya@gmail.com

Abstract

Groundnut is one of the important edible oilseed crops of the world and also in India. Recent climatic change has lead to low productivity of the crop. In order to cope up with changing climate conditions, there is a need to develop climate resilient genotypes especially drought tolerant genotypes. In order to identify drought tolerant genotypes, estimation of Water Use Efficiency through its related traits is one of the ways. Correlation and path analysis was carried out to understand the relation between yield attributing and water use efficient traits with pod yield per plant. The F₃ generation of the cross GKVK16 × KCG2 and their parents were evaluated. Observations were recorded on F₃ generation plants for days to first flowering, plant height, primary branches per plant, SCMR, SLA, pods per plant, pod yield per plant, kernel yield per plant, Shelling *per cent* and SMK *per cent*. Correlation and path analysis was carried out in F₃ generation using the recorded data. Kernel yield/plant (0.950), pods/plant (0.855) were having significant high positive correlation with pod yield per plant whereas SLA (-0.3075) was having significant negative correlation with pod yield per plant. The Kernel yield per plant (0.8834) having high positive direct effect on pod yield per plant. The selection for kernel yield per plant, pods per plant and SLA will inturn leads to selection of water use efficient and high yielding genotypes.

METABOLIC DISORDERS : A GATEWAY FOR IMPAIRED FERTILITY IN BOVINES

Harshit Saroha¹, Maharajan Lavanya¹, Sakhare Abhijeet Chandrakant¹, S. Jeyakumar², Aditya Kumar³, Arbind Singh⁴, Vijay Singh⁵

¹Department of Veterinary Gynaecology and Obstetrics, ICAR-NDRI, Southern Regional Station, Bengaluru

²Livestock Research Centre, ICAR-NDRI, Southern Regional Station, Bengaluru

³Department of Veterinary Medicine, College of Veterinary and Animal Sciences, GBPUAT, Pantnagar

⁴Department of Veterinary Medicine, College of Veterinary and Animal Sciences, SVPUAT, Meerut

⁵Department of Veterinary Gynaecology and Obstetrics, College of Veterinary and Animal Sciences, SVPUAT, Meerut

Abstract

Three weeks before and after parturition are very important because dramatic physiological and metabolic adaptations take place during this phase – called transition phase. With the advancement of gestation, dry matter intake (DMI) and body condition score (BCS) in parallels declines and is at its lowest at parturition. Simultaneously, with the growth of foetus the nutrient requirements increase and are at their peak during pre- and post-parturition. Due to inherent high production potential of modern dairy cows, extra burden of peri-parturient events, and associated endocrine and metabolic changes occur causes negative-energy balance (NEBAL) in postpartum cows which are associated with excessive fat mobilization and production of non-esterified fatty acids (NEFAs), -hydroxy butyric acid (BHBA), growth hormone (GH) and low blood glucose, insulin, hepatic-GH and insulin-like growth factor-1 which act as a gateway for several metabolic diseases. Along with the additional burden of hypocalcemia, ruminal acidosis, and high protein metabolism, NEBAL cause compromised health and reproductive performance including oocyte development, impaired ovulation, corpus luteum development, changes in follicular biochemistry influencing LH and estrogen secretion, delay resumption of estrus cycle, low progesterone concentration associated with unsuccessful development of competence of fertilized oocytes, high lipopolysaccharides altered neuroendocrine axis causing impaired GnRH, LH and Prostaglandin synthesis, high level of proinflammatory cytokines and toll-like receptors alters immunosuppression further cause uterine infection. The transition phase can be eased by increasing DMI, feed conversion efficiency, density of ration, and protein supplements rich in rumen undegradable protein, anionic mineral mixture, optimizing roughage and concentrate (R:C) ratio, optimum physically effective fibre length of forages/silage/hay, dietary



buffers, feed additives such as inflammation modulators, protected nutrients, microbials/probiotics and by following phased feeding programme. Monitoring of DMI & Body weight, blood glucose, calcium, NEFA and ketones, feed evaluation, milk yield-composition and rumen and urine pH are essential to predict the incidence of metabolic disorder during transition period.

BREEDING FOR HEAT TOLERANCE IN WHEAT

Himanshi Jhalora¹, Himansuman², Kamlesh Kumar Jat³ and Abhay Dashora⁴

¹Department of Genetics and Plant Breeding, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan

²Department of Genetics & Plant Breeding, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan

³Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan

⁴Department of Genetics & Plant Breeding, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan

Abstract

Wheat (*Triticum aestivum* L.) is one of the major cereals grown worldwide. Wheat is sensitive to heat stress. Abiotic stresses like heat, drought and salinity are the major threats to sustainable wheat production. Slight increase in the temperature can adversely affects the global wheat production. For every 1°C increase in temperature, global wheat production is reduced by 4.1% to 6%. With regards to global estimates, 20% of yield losses occurred due to the heat stress. Terminal heat stress showed higher severity at booting and heading stage than anthesis and grain filling stage. As a cool season crop wheat has an optimum daytime growing temperature of 15°C during the reproductive stage. Farmers in north-western and central India are shifting to earlier sowings to take advantage of residual moisture. Heat tolerance mechanism which includes heat shock proteins and an antioxidative enzyme essential to formulate appropriate breeding strategies to develop varieties tolerant to the heat stress. Heat stress influences various morphological factors, for instance, hinders seed germination, reduces dry mass and shoots and root length. Heat stress increases the production of sterile spikelets, declines the number of grains per ear, number of grains per spikelet, grain weight and mean grain weight per spikelets. Heat stress also affects physiological factors such as photosynthesis and respiration and biochemical factors such as starch and amylose content. Improvement in grain yield under heat stress implies selecting genotypes for grain size and rate of grain filling. The integration of conventional breeding with the genetic engineering further enhances the development of novel heat tolerant varieties.

THE CHECKLIST OF SPIDER FAUNA (ARANEAE) IN CHARKHET NAINITAL DISTRICT, UTTARAKHAND.

Himanshu Pande Lohani

Department of Zoology, D.S.B. Campus, Kumaun University, Nainital

Email : dr.himanshulohani@gmail.com

Abstract

The spiders are one of the most widely recognized groups of arthropods among invertebrate animals that play a significant role in maintaining biological homeostasis of nature as one of the most varied and functionally important predators regulating the terrestrial populations. They are distributed almost every ecological conditions except air, open sea and Antarctica region. Thus, their high abundance and high diversity in almost all microhabitats make them effective monitoring in the environment. About 47,099 described species are known currently globally including 4,073 genera and 113 families. Spiders play important role as the predator, especially the predator of insects and therefore they contribute to control the insect population. Spiders play vital role in agro ecosystem as pest control agent. The present study was conducted in Nainital, located in hilly area of Kumaun region of Uttarakhand. The sample is obtained using hand picking method and sweep net method. Three month sampling is done. The data analysis includes the Simpson Indices, Shannon-Weiner's diversity and species richness of species. 21 species and 194 individuals are found in the study area duration of three months. Five families are identified Araneidae, Lycosidae, Oxyopidae, Salticidae, Tetragnathidae. Araneidae is the most dominant family. *Paradosa pseudoanulata* is the



most dominant species of the study area. The major guild structure observed from study site was Orb weavers, branch dweller, ground dwellers and foliage dwellers. The most dominant guild was an orb weaver comprises 45% of total species. The results of the study revealed that the study area is favourable for spiders. Present study provide the baseline information over the diversity status, habitat preference etc. which is important to identify the threat faced by the spider species and taking appropriate mitigation measures from conservation point of view. As spider often prefer diverse landscape and use several habitat type, structurally more complex herbs and shrubs can support a more diverse spider community.

EFFECT OF FERTILITY LEVELS AND LIQUID BIOFERTILIZERS ON BIOLOGICAL PROPERTIES OF SOIL UNDER WHEAT (*TRITICUM AESTIVUM* L.) CROP

Hansa Kumawat

Department of Soil Science and Agricultural Chemistry, Maharana Pratap University of Agricultural and Technology,
Udaipur, Rajasthan-313001, India

Abstract

The aim of the present investigation is to study the effect of fertility levels and liquid biofertilizers on biological properties of soil under (*Triticum aestivum* L.) crop. The field experiment was conducted during *Rabi* 2019 at Instructional Farm of Agronomy, Rajasthan College of Agriculture, Udaipur, which is located in Rajasthan's agro-climatic zone IV-a. The experiment consisted of 16 treatments combinations comprising of four levels of fertility (Control, 75%, 100% and 125% RDF) and four levels of liquid biofertilizers (Control, *Azotobacter*, PSB and *Azotobacter* + PSB). Experiment was conducted under factorial randomized block design replicated thrice taking wheat var. Raj.-4238 as test crop. The Recommended dose of fertilizer (RDF) was 100:60:40 kg ha⁻¹ of N:P₂O₅:K₂O. Results showed that significant increase in soil microbial biomass carbon and nitrogen, microbial population (bacteria, fungi and actinomycetes) as well as the dehydrogenase and alkaline phosphatase enzyme activity in post harvest soil of wheat was observed with the combine application of 100% RDF and *Azotobacter* + PSB.

STUDIES ON ANTIBACTERIAL, ANTIOXIDANT ACTIVITIES AND PHYTOCHEMICAL CONSTITUENTS OF *JUNIPERUS MACROPODA*

Jagriti Rana*, Jyoti rana and Anand Sagar

Department of Biosciences, HPU, Shimla, H.P.

*Email : jagritiranag@gmail.com

Abstract

Plants produce a diverse range of bioactive molecules, making them rich source of different types of medicines. In present investigation antibacterial and antioxidant activities with phytochemical constituents of one of the medicinal plants i.e., *Juniperus macroпода* of Lahaul valley of Himachal Pradesh were analyzed. Results displayed antibacterial activity of acetone extract towards *Staphylococcus aureus* and methanol extract towards *Listeria monocytogenes*, *Escherichia coli* and *S. aureus*. Methanol extract also revealed higher antioxidant activity than acetone extract. Except saponins all the tested phytochemicals (alkaloids, flavonoids, tannins, terpenoids) were found to be present in both the extracts and GCMS analysis unveiled presence of 68 and 97 peaks in methanol and acetone extracts.

NEXT GENERATION SEQUENCING : A GATEWAY TO IMPROVE THE WHEAT CROP

Himansuman*, Parul Gupta, Abhay Dashora and P.B. Singh

Department of Genetics and Plant Breeding, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan

*Corresponding Email: bhalothiahimansuman@gmail.com

Abstract

Bread wheat (*Triticum aestivum* L.) is a crop plant of great importance. Although wheat production has been steadily increasing in recent years, further improvement in its productivity is still necessary to cope with the increasing demand for



food. The development of agricultural biotechnology could be a key method for significant improvement in wheat production to feed the population in an environmentally sustainable way. A better understanding of the genetics of wheat crop is necessary to breed improved varieties, that has been revolutionised with advancements in sequencing technologies. Next-generation sequencing (NGS) has become the main tool for developing millions of novel molecular markers for identifying genes of agronomic importance. It has enabled the creation of high-density genetic maps, mass genome and transcriptome sequencing, and high-resolution surveys of genome-wide epigenetic variation that would empower the development of better varieties and may lead to a second green revolution. Here, the cost of sequencing is a key obstacle. However, the cost has been reduced considerably in recent years and is expected to drop more in the near future. Another challenge is that the functions of many genes identified by genome sequencing remain unknown and the genetic control of the majority of agronomic traits has yet to be determined. Although the development of bioinformatics tools and storage space for large sequence data is still a challenge for NGS, the speed of crop improvement will be much faster than before because the third generation of sequencing platforms, such as Ion Torrent, have already been developed.

MODELING OF OVERALL HEAT TRANSFER COEFFICIENT DURING EVAPORATION OF WORKING LIQUID OF BUFFALO MILK AND SUGAR FOR SWEETENED CONDENSED MILK IN A HORIZONTAL THIN FILM SCRAPED SURFACE HEAT EXCHANGER UNDER VACUUM

J. Badshah¹, B.K. Bharti¹ and R.K. Kohli²

¹SGIDT, Patna (BASU, Patna)

²Dairy Engineering division of NDRI, Karnal

Abstract

An experiment was conducted at NDRI Karnal to study the heat transfer with phase change during evaporation of working liquid (Forewarmed Buffalo milk and sugar in a ratio to manufacture sweetened condensed milk of total solid from 28-30 %) in a horizontal thin film scraped surface heat exchanger (TF-SSHE). The mass flow rate of working liquid varied from 0.01595 to 0.04785 kg/s; the staggered bladed rotor speeds were 2.33, 3.00 and 4.00 rps and steam pressure in the jacket of TFSSHE were 0.25, 0.5, 1.0 and 1.5 kgf/cm² gauge. The modeling of overall heat transfer coefficient (U_o) was developed with reference to mass flow rate (M_f), Steam temperature (T_s) and linear velocity of rotor (V_c) utilizing Box Wilson experimental design. The t- test of all the coefficients indicated that the regression coefficients were not affecting significantly, however the correlation coefficient was calculated as 0.77. The ANOVA and least square means of U_o with independent variables showed that U_o was significantly affected by independent variables at $P = 0.01$, however the interaction effects were not significantly affecting the U_o . With the increase of rotor linear speed from 2.98 to 5.10 m/s, the U_o increased from 757.6 to 958.8 W/m² K. With the increase of T_s from 106.5 to 133.2 °C, the LS mean value of U_o decreased from 982.8 to 728.4 W/m² K. As the decrease in U_o values were not observed at low values of delta T but the decrease was observed after a critical delta T was supplied to the evaporation process under vacuum upto 650 mm Hg vacuum. This was mainly due to the shifting of nucleate boiling phenomenon to the film boiling phenomenon on product side of TFSSHEs.

CATEGORIZATION OF WIDE RANGE OF WHEAT VARIETIES (*TRITICUM SPP.*) AND ANCESTRAL SPECIES (*AEGILOPS SPP.*) INTO DIFFERENT RESISTANCE LEVELS AGAINST CORN LEAF APHID, (*RHOPALOSIPHUM MAIDIS* FITCH)

Jayant Yadav^{1,2}, Poonam Jasrotia^{1*}, Maha Singh Jaglan², Prem Lal Kashyap¹, Sudheer Kumar¹, Gyanendra Pratap Singh¹, Surender Singh Yadav²

¹ICAR-Indian Institute of Wheat and Barley Research, Karnal, India-132001

²Department of Entomology, CCS Haryana Agricultural University, Hisar, India-125004

*Corresponding author Email : poonamjasrotia@gmail.com

Abstract

Aphids are considered as one of the most destructive insect pests of the wheat crop and more than 11 aphid species have been reported to attack wheat crop in India. Among these, corn leaf aphid (*Rhopalosiphum maidis* Fitch) is a serious biotic stress problem of wheat crop in North Western plains of India and responsible for causing significant wheat yield loss. *R. maidis* suck sap from leaves and leaves turn yellow. Also, sooty mould is developed on honeydew excreted and interferes with



photosynthesis of leaves. Instead of using pesticides, incorporation of genetic resistance in wheat varieties is the best alternative to manage aphids as it is sustainable, cost-effective and environmentally safe. Therefore, to identify sources of genetic resistance, the present studies were investigated to categorize 63 wheat varieties from *Triticum spp.* and 152 wheat genotypes from *Aegilops spp.* into different resistance levels on the basis of aphid population, leaf chlorosis and leaf rolling. Among the wheat varieties and wild accessions, on the basis of aphid population, 1 and 0 genotypes were highly resistant, 24 and 36 genotypes were resistant, 34 and 90 genotypes were moderately resistant, and 4 and 26 genotypes were susceptible, respectively. On the basis of leaf chlorosis, 25 and 36 genotypes were highly resistant, 34 and 86 genotypes were resistant, and 4 and 30 genotypes were moderately resistant, respectively. On the basis of leaf rolling, 59 and 36 genotypes were resistant, and 4 and 116 genotypes were susceptible, respectively. However, no wheat genotype was found to be immune against the aphid infestation.

USE OF E-RESOURCES BY THE STUDENTS AND RESEARCHERS OF FACULTY OF SKRAU, BIKANER

Jitendra Kuri^{1*}, Sita Ram Bijarnia¹, Kamlesh Choudhary¹, Jitendra Kumar² and Ramlal Degra²

¹Department of Agricultural Extension and Communication. Collage of Agriculture, SKRAU, Bikaner Rajasthan

²Department of Extension Education. Rajasthan Collage of Agriculture, MPUAT, Udaipur Rajasthan

*Corresponding Author Email : Kurijitendracoa@gmail.com

Abstract

The study aimed at finding the use of e-resources by the post graduate students and research scholars of Faculty of Swami keshwanand Rajasthan Agriculture University Bikaner. A questionnaire was distributed among the Research scholars and Post-Graduate Students to collect desired data. A total of 200 questionnaires were distributed to the selected sample of Faculty of agriculture 180 Valid samples were collected. The study found that the majority of users are aware about the availability of e-resources. The Result reveals that 47.78 % of respondents want to access only electronic version whereas only 32.78% users want to read the Printed journals but 19.44% respondents want to use both electronic and printed version. Majority of the respondents 76.66% Use e-resources for writing papers. The analysis reveals that many of the respondents search e-resources through linking Facility available on the library website

ACCESSIBILITY AND UTILIZATION PATTERN OF MASS-MEDIA AMONG THE FARM WOMEN IN HANUMANGARH DISTRICT

Jyoti Rajvi and Neena Sareen

Department EECM, SKRAU, Bikaner, Rajasthan

Abstract

Mass media are important in bringing about large scale directed social change. For transmitting knowledge, disseminating facts and directing various emotional appeals to influence public opinion, the mass media has assumed vital importance. The present study was conducted in randomly selected six villages of Hanumangarh and Tibbi panchayat samities of Hanumangarh district. 120 farm women selected randomly constitute the sample. Data were collected through interview schedule. Majority of the respondents belonged to young age group, educated upto secondary, belonged other backward caste, joint family having more than 8 members and medium annual income.

Majority of farm women were found using mobile phone for less than one hour and majority watched television for 2 to 3 hours. About eighty eight per cent farm women read newspaper for less then one hour. High majority of farm women watch television during after noon hours followed by night hours. There was no fix time of using mobile phone among farm women. Hundred per cent of farm women were found watching television for viewing entertainment programmes *i.e.*, dharavahik, advertisements and films. Major purpose of using mobile phone and internet by majority of farm women was making and receiving calls and chatting. Utilization of print media was made by limited number of respondents and that was mainly for reading news, advertisement followed by reading fashion tips, recipes and beauty tips. Major constraints perceived were programme time does not suitable to our free time, lack of time, lack of knowledge for using phone, lack of interest and lack of knowledge for using internet. All independent variables except age showed highly significant and positive correlation with accessibility and utilization level of electronic and print media. Age showed significant but negative correlation and caste



showed non significant correlation. Accessibility and utilization showed highly significant and positive correlation with each other. It is recommended that women should be motivated to have access to mass media for educational purpose also and it is also recommended that farm women should be trained for using internet and mobile for getting knowledge based information.

NUTRITIONAL EVALUATION AND PASTING PROPERTIES OF GLUTEN-FREE FLOURS

K.C. Mahajan¹, S.K. Garg², Ashish Shrivastava³, S.K. Sharma³ and Shivbilas Maurya¹

¹Deptt. of Food Science & Technology, College of Agriculture, JNKVV, Jabalpur, Madhya Pradesh, India

²Faculty of Agriculture, JNKVV, Jabalpur, Madhya Pradesh, India

³College of Agriculture, Ganjbasoda, Madhya Pradesh, India

Corresponding Author Email: kcmahajan2007@rediffmail.com

Abstract

The only effective treatment for celiac disease patients is strictly adherence to gluten-free diet. Gluten-free maize flour, Finger Millet (Ragi) flour and quinoa flour were used as raw materials for the experiment. Crude protein and ash content was estimated using AOAC approved method of analysis. The pasting properties of flour samples were determined with a Rapid Visco Analyzer (RVA). Results of nutritional analysis of gluten-free flours indicated higher protein content in quinoa followed by maize and ragi while ash content highest for ragi flour and lowest for maize flour among the investigated flours. The higher amount of protein in quinoa and higher ash content in ragi flour makes these flours a good alternative among other flours to develop healthier food products. Higher peak viscosity observed for ragi compared to maize and quinoa flour may be due to lower protein content and higher ash content present in ragi flour. The final viscosities ranged from 889 to 2354 cP with highest for ragi flour followed by maize and quinoa flour. FV decreased significantly with increase in protein content. The greater breakdown viscosity was found for ragi flour followed by maize and quinoa flour depicting that ragi flour have a low ability to withstand shear stress and heat. Lower setback value indicate low rate of starch retrogradation and syneresis in quinoa flour. The greater pasting temperature was shown by maize flour, depicting the higher energy and time required for cooking, correlating with higher amylose content.

VERTICAL GARDENING OF VEGETABLE CROPS

Meenakshi Badu

Faculty of Agriculture, Sri Sri University, Cuttack, Odisha, India

Abstract

We are all aware of the exponential increase in world population and its grave outcomes. The time is not far when earth would see a definite reduction in cultivable land and a spiraling food demand due to the land crisis and space crunch. Increasing urbanization is particularly evident among Indian cities, which face a massive influx of rural migrants seeking jobs and settling down in burgeoning urban sprawls. The UN estimates that by the year 2050, close to 70% of the world's population will live in urban areas and the total population of the world will increase by 3 billion people. There is an urgent need to solve the double-edged problem of shrinking arable land and providing food to an ever-increasing population.

“Vertical gardening” is a method of growing plants in an upright form by making use of stakes, cages, bamboo and other vertical supports. The purpose of an intensively grown garden is to harvest the most produce possible from a given space. Father of vertical garden is Patrick Blanc. It is a new concept of gardening developed in Switzerland. Different types of vertical vegetable gardens are salad tower, hanging garden, pallet garden, gutter garden and window box wall. Plants like climbing vines, trailing vines, cole crops, solanaceous vegetables, root and bulb vegetables, greens, micro-greens and baby greens can be grown in vertical garden. “Arka vertical garden” has been developed by IIHR, can be accommodated in floor area of one square meter and is used by anyone who desires to grow vegetables, medicinal and flower crops using vertical space. Vertical farming is a component of vertical garden. “Concept of vertical farming” was given by Dickson Despommier in 1999 (Royston and Pavithra, 2018). This is of three different types such as type 1 - tall structures with several levels of growing beds, type 2 - on the rooftops of old and new buildings and type 3 - multistorey building (Despommier, 2011). All vertical farms use one of three soil-free systems for providing nutrients to plants those are hydroponics, aeroponics or aquaponics. Vertical garden- contributes towards household food security, reuses and recycles biodegradable wastes and grey water, helps in temperature insulation by growing plants on the walls of houses, reduces food miles and transportation cost,



gives excellent opportunity to grow food in areas where space is limited, an effective and sustainable method and can be easily implemented with locally available material at low cost. But unpleasant odours may appear during the irrigation with grey water.

Start-up costs can be high, technology is still relatively new. Unquestionably, the concept of vertical gardening (VG) carries number of advantages and it is beneficial for both; human beings and the planet, but at the beginning, it must be kept in mind that VG is not the panacea to all farming woes. Hence, state and central agricultural universities should be focused on vertical gardening research to improve the productivity, to develop suitable hybrid and varieties and good agricultural practices.

A COMPARATIVE STUDY ON FUSARIUM WILT RESISTANT AND SUSCEPTIBLE GENOTYPES OF PIGEONPEA (*CAJANUS CAJAN* L.)

Meet H. Padhiyar¹, Smita Singh¹, Anil R. Prajapati²

¹Department of Biochemistry, College of Basic Science and Humanities, SDAU.

²Statement of Grade for Faculty of Science and Humanities, SPU

Abstract

Pigeonpea (*Cajanus cajan*) L. Millsp. is an important legume crop widely used as food grain as it is rich source of protein, carbohydrate, essential amino acids, minerals and fibres. Pigeonpea is susceptible to a number of pathogens, among which *Fusarium udum* is considered as the most important fungal pathogen causing considerable economic loss in India and all over the world. Biochemical changes were studied in Fusarium wilt resistant (ICP-8863, BDN-1 and BDN-2) and susceptible (ICP-2376 and BAHAR) genotypes of pigeonpea after 7 days of infection. The average percent decrease in total soluble sugar content of the resistant genotypes and the susceptible genotypes was found to be 10.29 % & 27.56 % respectively. The fold decrease in total soluble sugar in resistant genotypes was found to be 1.24 as compared to susceptible genotypes. The average percent increase in protein content of the resistant genotypes and the percent decrease in susceptible genotypes was found to be 14.43 % & 6.74 % respectively. The protein content was increased in resistant genotypes in comparison to the susceptible genotypes after infection (1.23 fold). Among all the genotypes, maximum increase in percentage protein content was recorded in the wilt resistant genotype BDN-2 with 22.01 % over healthy and maximum decrease was observed in wilt susceptible genotype BAHAR with 18.21 % over healthy. The average percent increase in total phenol content of the wilt resistant and the susceptible genotypes was found to be 22.02 % & 4.79 % respectively. There was an increase of 1.16 fold in total phenol content in resistant genotypes as compared to susceptible genotypes. The average percent increase in flavonoids content of resistant genotypes over healthy was found to be 29.89 % whereas the average percent decrease in the susceptible genotypes over healthy was recorded as 2.27 %.

BIOFORTIFICATION OF RICE (*ORYZA SATIVA*) THROUGH FOLIAR ZINC APPLICATION

Megha Panwar and S.K. Guru

Department of Plant Physiology, College of Basic Sciences and Humanities, GBPUAT, Pantnagar-263145

Abstract

Micronutrient malnutrition is known to affect more than half of the world's population and considered to be among the most serious global challenges to humankind. Zinc is an important micronutrient for the growth and development of plants and animals. Due to prevalence of zinc deficiency in developing countries 61% of the population is at an increased risk of low dietary zinc intake. In cereals, zinc is required in lower but critical concentrations to allow several key plant physiological pathways to function normally. However, many agricultural soils are unable to supply the Zn required by crop plants, making Zn deficiency a nutritional disorder widespread, and particularly in calcareous soils. Biofortification, the process of increasing the bioavailable concentrations of essential elements in edible portions of crop plants through agronomic intervention or genetic selection, may be the solution to malnutrition or hidden hunger mitigation. Foliar application of Zn is an effective strategy to enhance the concentration of Zn in the grains. To explore the effects of foliar application of zinc sulfate (0, 0.25, 0.5, 0.75 and 1% concentration) on the concentration of zinc in the grain and yield in rice, a field experiment was conducted using rice variety PD-12. Zinc treatment through foliar spray increased the grain yield in a concentration dependent manner, spray of 0.75% concentration of ZnSO₄ was effective than other treatments. Foliar zinc application significantly improved the concentration of zinc in grains.



ORGANIC FARMING FOR SUSTAINABLE AGRICULTURE IN INDIA

Monika Choudhary

Deptt. of Agronomy, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur
Email : monika11choudhary@gmail.com

Abstract

Organic farming can provide quality food without adversely affecting the soil's health and the environment; however, a concern is whether large-scale organic farming will produce enough food for India's large population. Certified organic products including all varieties of food products including basmati rice, pulses, honey, tea, spices, coffee, oilseeds, fruits, cereals, herbal medicines, and their value-added products are produced in India. Non edible organic products include cotton, garments, cosmetics, functional food products, body care products, and similar products. The production of these organic crops and products is reviewed with regard to sustainable agriculture in India.

Today, the burgeoning population pressure has forced many countries to use chemicals and fertilizers to increase the farm productivity for meeting their ever-increasing food requirements. The prolonged and over usage of chemicals has, however, resulted in human and soil health hazards along with environmental pollution. Farmers in the developed countries are, therefore, being encouraged to convert their existing farms into organic farm.

Organic farming is completely a natural process; it takes from nature and gives back to nature. It is a modern way of agriculture which helps to produce disease free crops, vegetables, fruits etc. with its nutritional value intact. Organic farming is comparatively costly than conventional agriculture due to extended time period, expensive organic seeds etc., hence organic product are also expensive which helps in increasing the economy of country. Farmers in India are unaware of organic farming that is why they face many problems like fertility of soil, financial problem, market scenario etc.

POST TRANSCRIPTIONAL GENE SILENCING

N. Yamini Sousheel

PJTSAU, Rajendranagar, Hyderabad
Email : nysousheel1308@gmail.com

Abstract

The RNA silencing mechanism is a powerful tool to develop crop species resistant to viruses. The expression of virus derived sense or antisense RNA in transgenic plants conferring RNA mediated virus resistance appears to induce a form of post transcriptional gene silencing (PGTS). It's a nucleotide sequence specific process that includes mRNA degradation, RNA silencing, an evolutionary mechanism protecting cells from pathogenic RNA and DNA, is viewed as an adaptive immune system of plants against viruses. Several lines of research indicate that RNA silencing can be induced locally and then spread throughout the organisms, and this aspect of the process likely reflects its role in viral defense.

EFFECT OF MOISTURE CONSERVATION PRACTICES ON YIELD OF LINSEED VARIETY UNDER RAINFED CONDITION OF CENTRAL UTTAR PRADESH

Mulayam Singh, A.H. Warsi, Yogesh Kumar, Omnarayan and Prem Kumar

C.S. Azad University of Agriculture & Technology Kanpur-2
Email : sarvesh200517@rediffmail.com

Abstract

Linseed is a rainfed farming cool season crop. Moderate temperature (21-26⁰C) is ideal at the time of flowering. The crop yield can be increased manifold by adopting recommended package of practices including high yielding cultivars, balanced fertilizer, and moisture conservation. However the moisture conservation could be greatly increased by imposition of mulches on soil surface. Mulch particularly restricts the transport of water vapor from soil surface to microclimate, which diminish the direct evaporation loss of soil water by (Yuan *et al.* 2009) and increase the availability of soil water to the crop. Keeping in view the present experiment entitled "Effect of different moisture conservation practices on growth and yield of linseed variety under rainfed condition of Central Uttar Pradesh" was conducted during Rabi season of 2015-2016 at Soil



Conservation and Water Management” Farm of the Chandra Shekhar Azad University of Agriculture and Technology Kanpur. The treatments consisted of 3 varieties i.e. (i) T-397, (ii) Padmini, (iii) Shekhar and 3 moisture conservation practices i.e. (i) control or farmer’s practice (one weeding by Khurpi at 20 DAS) (ii) dust mulching created by hand hoe after one weeding by Khurpi at 20 DAS (iii) organic residue mulch (paddy stover) @ 4t/ha at 20 DAS were tested in the experiment. The results obtained from experimentation clearly showed that seed yield was significantly influenced by main effect of both treatment factors but their interaction effect was non-significant. Among varieties, ‘Shekhar’ gave significantly higher seed yield (9.96 q/ha) than other varieties. Variety ‘Padmini’ ranked next in order of merit, proving significantly better than ‘T-397’. Variety ‘Shekhar’ brought out 1.54 (18.20%) and 2.95 (40.08%) q/ha higher seed yield than ‘Padmini’ and ‘T-397’ varieties, respectively. Significantly higher seed yield of linseed was recorded in the treatment receiving organic residue mulching than farmer practice. Dust mulching ranked next in order of merit being statistically at par with farmer practice. Organic mulching produced 1.07 (12.77%) and 1.89 (25.00%) q/ha higher seed yield than dust mulching and farmer practice, respectively.

PARTICIPATORY MESSAGE DESIGNING FOR AGRICULTURAL INFORMATION SHARING THROUGH WHATSAPP GROUP

Netrapal Malik

Extension, Krishi Vigyan Kendra (CSAUAT, Kanpur) Aligarh, U.P.

Email : netrapalmalik1@gmail.com

Abstract

There is a limited reach of extension personnel-mediated extension education services. According to an estimate, public extension services reach only 6.8 per cent of farmers. Another survey indicated that of the 40.6 per cent of households who received extension assistance, only 11 per cent of the services came from physical government machinery extension agents, Krishi Vigyan Kendras and agricultural universities. In this situation, Information and Communication Technologies (ICTs) mediated extension has the potential of minimizing this gap. The development of telecommunication infrastructure has facilitated the access of farmers to web-based communication tools.

At present lots of information is being shared through WhatsApp. Agricultural information also might be shared with the farmers through creating WhatsApp groups. WhatsApp groups have the potential of generating discussion among the farmers. It is also helpful in farmer-to-farmer extension. There is a vast diversity in the social, cultural and farming situations of the farmers. A single message cannot cater the information need of all the farmers. There is a need to keep in view the socio-psychological and agro ecological profiles of the farmers before designing messages on farm advisory. The first step in designing the message is situation analysis. First of all extension agent must analyze the situation of the farming community with whom he/ she is going to share the farm advisory through WhatsApp groups. Tools like Participatory Rural Appraisal (PRA), Focused Group Discussion (FGD), In-depth Interviews, interviews, online surveys etc. can be used for situation analysis. After analyzing the situation extension agent must identify the best suitable and available technology to address the problem or information needs of the particular farming community. The next step is to give the most preferred treatment to the message identified for sharing through WhatsApp groups. There is a need of pre-testing the message before sharing it. After sharing the message through WhatsApp, the next step is assessing the overall effectiveness of the message. In this way, we can harness the full potential of WhatsApp for sharing farm advisories with the farmers. The present paper discusses in detail the procedure for message designing for agricultural information sharing through WhatsApp.

PRECISION FARMING USING REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM TECHNIQUES

Nandani Jairath* and Sukhmani Virk

School of Business Studies, Punjab Agricultural University, Ludhiana, Punjab, India

**Email : nandinijairath.97@gmail.com*

Abstract

A new approach to farm management called precision farming is redefining the way people farm there is a growing determination to reduce agriculture’s dependency on excessive chemical inputs. An objective that is associated with



sustainable agriculture, several technologies have been used to make agricultural products safer and to reduce their negative environmental effects. Precision farming is the practice of using geographic data to assess field variability, assure the best possible use of inputs, and increase farm output. After it was discovered that various fields of land have varied qualities, precision farming became more and more common. The types of soil, moisture content, availability of nutrients, and other factors often vary spatially across large areas of land. Therefore, farmers can more accurately decide what inputs to put where and in what quantities by using remote sensing (RS), geographic information systems (GIS), and global positioning systems (GPS). This knowledge assists farmers in making more effective use of resources like fertilizer, insecticides, and herbicides. Farmers who employ this technique would ultimately increase revenues by enhancing yields while lowering operating costs. In order to maximize yields, this study focuses on how geo-spatial data is gathered, evaluated, and used in the decision-making process. It presents a quick overview of the possibilities for precision farming, the use of geo-spatial technology which will soon take center stage in agriculture.

EXTENT OF INFORMATION UTILIZATION BEHAVIOR OF VEGETABLE GROWERS REGARDING INTEGRATED PEST MANAGEMENT PRACTICES

Narendra Kumar Choudhary

Department of Extension Education, Rajasthan College of Agriculture (MPUAT), Udaipur, Rajasthan 313001

Email : mrnarendra.choudhary@gmail.com

Abstract

The present study was undertaken in the Jaipur district of Rajasthan. Chomu and Amber tehsil were selected for the research purpose as Chomu and Amber have the maximum number of vegetable growers in the Jaipur district. Villages in the selected Tehsils were prepared, out of which, eight villages have the maximum number of vegetable growers from the two identified Tehsils. From the selected village a sample of 15 respondents was selected randomly from each village. Thus, a total of 120 respondents were selected for the study. It is evident from the study that the highest level of utilization was found in respect of the application of "Culture practices" was summer ploughing followed by crop rotation. "Mechanical/physical practices" mass trapping of pests followed by use of pheromone traps. "Biological practices" use of predators followed by use of beneficial insects. "Chemical practices" use of pesticides followed by safe application of pesticides.

SUCKING PEST MEALY BUG MANAGEMENT IN SUGARCANE CROP A CASE STUDY

Neelam Kureel and Viresh singh

Sugarcane Research Centre Muzaffarnagar-251001

Email : neelam_kureel@yahoo.in

Abstract

Sugarcane cultivation is considered as sweet culture due to its sweetness not only due to taste but also it is a diuretic which means that it helps treat urinary tract infections, kidney stone and ensure proper functioning of kidney. According to ayurveda sugarcane juice helps strengthen our liver and is suggested as a remedy of jaundice and also used in many cosmetics products etc. Sugarcane, a vegetatively propagated crop exposed to a complex of depredatory during the course of its germination to harvest. The pest damage at grand growth and maturity, it reduces crop quality as well as quantity. Based on feeding habits insects are grouped as borers (shoot borer, top borer, plassy and stalk borer as well as Gurdaspur borer), sap sucker (pyrilla), white flies, scale insects, mealy bug etc) Mealy bug (*Sacchricoccus sacchri*) popularly known as the pink mealy bug, the species is most commonly occurring throughout the sugarcane growing areas in country. Their infestation starts as discrete colonies, just below the nodes on the side opposite to the bud, later spreading to the internode as well as the first one or two nodes and internodes in the top portions of the cane are generally free from crawlers. Because the closely adhering leaf sheath does not permit them to enter and settle beneath them, gregarious in nature. *Aspergillus paraciticus* pathogenic to *S. sacchri* (David, 1964), *Charatocerus* spp., *C. timbriae* Hayal, *Anagurus sacchricola* are parasites of pink mealy bug. As well as *Nephus* spp. and *Cryptolaemus montrozieri* are predators of *S. sacchri*. The most effective measure is planting with uninfected setts. Before planting the adhering leaf sheath from the sets may be removed. Such sets are then to be treated with either chemical solution or soaked in water for 72 hours, cutting the cane close to round, removed and destruction of crop residue from heavily infested fields before replanting or ratooning. Alternative hosts near the sugarcane fields may be destroyed in grown



crop, if heavy infestation of pink mealy bug detracting is advocated and followed by spraying of insecticides if necessary, avoidance of overdose of nitrogenous fertilisers. If infestation in the month of June spraying with Imidacloprid 17.8S.L.@200 ml/ha mixed with 625 litres of water. Incidence of pink mealy bug is also known to be influenced by the nature of leaf sheath in a variety. varieties with loose clasping, leaf sheath harbours higher level of mealy bug compared to those in which the leaf sheath are of the tight clasping nature, self-striping varieties are less prone for mealy bug infestation.

BENEFITS IN AGRICULTURE SYSTEMS FROM UNDERSTANDING CONTEMPORARY MOLECULAR DIAGNOSTIC TECHNOLOGIES.

Niharika Sheoran*, Vinod Kumar Malik and Garima

Department of Plant Pathology, CCS Haryana Agricultural University, Hisar-125004

**Email : niharikamailid@gmail.com*

Abstract

For agricultural systems to manage disease strategically and sustainably, plant pathogens must be identified. For producers, diagnosticians, extension workers and other scientists who work with crops, this knowledge is essential. The mechanisms of plant-pathogen interactions and host specificity have been studied using genomics. Utilizing genotyping techniques to comprehend disease transmission is a crucial part of managing outbreaks. Genome sequencing is being widely employed in research labs due to the development of high-throughput sequencing, which has faster speeds and better output-to-cost ratios. Whole-genome sequencing (WGS) of pathogens has recently improved in affordability and accessibility as a method for genotyping. WGS analysis of the full pathogen genome may offer previously unheard-of clarity in distinguishing even closely related disease lineages, revolutionising outbreak analysis. However, because to the high cost and complexity of early sequencing systems, plant pathologist has long been unwilling to use WGS in outbreak assessments. The output and analysis speed of WGS have improved quickly, and the overall prices have decreased, thanks to recent advancements in sequencing technologies and analytic tools. Additionally, it aids in taxonomy, non-cultured pathogen investigation, causal agent identification, single cell sequencing, population genetics, population diversity, and meta-transcriptomic research. In general, genomics has greatly increased our knowledge of how plants and microbes interact. Therefore, the farmer, diagnostician, phytopathologist and taxonomist can all benefit from the power of molecular techniques in precisely detecting plant disease.

COAT COLOUR VARIATIONS AND THEIR CORRELATION WITH PHYSIOLOGICAL PARAMETERS IN INDIAN DROMEDARY CAMEL

Nistha Yadav¹, Ved Prakash², Urmila Pannu¹, Basanti Jyotsana², Manju Nehara¹ and Gayatri Gujar¹

¹College of Veterinary and Animal Science, RAJUVAS, Bikaner, Rajasthan, India.

²ICAR-National Research Center on Camel, Bikaner, Rajasthan-334001

Email: nisthayadav145@gmail.com

Abstract

Heat stress is one of the major concerns in the tropics, in response of this living beings have developed several adaptive mechanisms. The body exhibits heat stress adaptation with an observable variety of coat colours, as skin is the primary organ that has direct contact with light, and heat. In order to understand this adaptive phenomenon, we conducted a study on variation in coat colour, its distribution pattern in population and their relationship with thermoregulatory parameters in Indian Dromedary camels. The coat colour was recorded. The thermoregulation related parameters namely rectal temperatures (T_r), and surface temperatures (T_s) using digital and infrared thermometers were collected for 100 camels from four breeds namely Bikaneri, Jaisalmeri, Kachchhi, and Mewari. The breed-wise highest proportion of coat colour was shades of brown (43.75%) in Bikaneri, yellow/wheat (59.09%) in Jaisalmeri, brown (82.14%) in Kachchhi, and yellow/wheat (55.56%) colours in Mewari. Mean T_r and T_s were significantly affected by effects of breed, colour, and sex in our work. Mean T_r and T_s was varying in a narrow range (37.060 ± 0.027 - 37.329 ± 0.026 and 37.520 ± 0.064 - 38.563 ± 0.068) for considered breeds and (37.062 ± 0.048 - 37.417 ± 0.026 and 37.267 ± 0.119 - 38.373 ± 0.056) colour patterns respectively. The T_r values were highest for Jaisalmeri breed and red shades while lowest for Kachchhi breed and black shades; T_s values were highest for Mewari breed and yellow shades while lowest for Kachchhi breed and white shades. Mean for T_r and T_s ($^{\circ}\text{C}$) in male animals (37.59 ± 0.019 and 39.019 ± 0.046) were slightly higher as compared to considered female animals (36.76 ± 0.017 and 36.804 ± 0.042). The T_r



was found significantly correlated with body T_s but not significantly correlated with coat colour. Results of our study provide evidence for variation in coat colours in different camel breeds with predominance of brown colour in Bikaneri and Kachchhi breeds and yellow/wheat in Jaisalmeri and Mewari as well as its inheritance pattern and association with physiological parameters. Lower T_r and T_s values for Kachchhi breed, and female animals indicates inherent genetic ability for such camels to regulate temperature without affecting thermal activities. However, internal core and surface adaptation was different with coat colour as black and white shades had lowest T_r and T_s values respectively. Further phenotype-genotype association studies by considering molecular markers can be done for various insulating properties of coat on thermoregulation, heat tolerance and for its traditional uses in camels.

DETERMINATION OF OPTIMAL DOSE OF BACTERIOPHAGE LYSATE VACCINE FOR THE CONTROL OF SALMONELLOSIS IN POULTRY

P. Kerketta*¹, R.K. Agarwal² and M. Rawat³

¹Division of Veterinary Public Health, Indian Veterinary Research Institute, Bareilly

²Division of Bacteriology & Mycology, Indian Veterinary Research Institute, Bareilly

³Division of Biological Standardization, Indian Veterinary Research Institute, Bareilly

*Corresponding Email: priscillavph@gmail.com

Abstract

Salmonella Typhimurium and *Salmonella* Enteritidis are the most frequently isolated serovars from foodborne outbreaks throughout the world. Fowl typhoid is caused by *Salmonella* Gallinarum, pullorum disease is caused by *Salmonella* Pullorum and paratyphoid is caused by diverse serovars related to foodborne illness in human. Increase in meat and poultry consumption has raised the potential risk of *Salmonella* infection through contaminated food commodities. Effective *Salmonella* control in poultry is important to ensure food safety and quality to the consumer and promote the healthy living of birds. It has been reported that bacteriophage lysates could be effective at eliciting protective immunity against a variety of bacterial strains. To evaluate protection efficacy in birds in each group, 15 birds were immunized with different doses of 10 μ l, 25 μ l and 50 μ l of lysates of *S. Typhimurium* phage (STP), *S. Enteritidis* phage (SEP) and *S. Gallinarum* phage (SGP) and control group (unvaccinated group). Each immunized and control group were challenged with 2×10^{12} CFU/ml of *S. Typhimurium*, *S. Enteritidis* and *S. Gallinarum*, respectively. The group of birds immunized with 25 μ l showed maximum survivability percentage of 80 - 82.3%. IgG antibody titers detected by ELISA showed no significant different on 7th day among the vaccinated and unvaccinated, whereas slight rise was observed on 15th day, which gradually increased on 21st day. In all the treatment groups the antibody level was maximum on 28th day. The antibody level differed highly significantly among the vaccinated groups at $P < 0.05$ level, when compared with control groups.

SPEED BREEDING : A PROMISING APPROACH TO PLANT BREEDING

Parul Gupta*, Himansuman, Abhay Dashora and Payal Agarwal

Department of Genetics & Plant Breeding, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan

*Corresponding Author Email: parulagrawal229@gmail.com

Abstract

The expanding human population and the changing environment have raised significant concern for global food security as the current rate of improvement of several important crops is insufficient to fulfill future demand. The slow improvement rate assigned partly to the lengthy generation times of crop plants. However Speed Breeding has completely impacted the world by shortening generation times and accelerating breeding and research initiatives to boost up the production of crop varieties. In the absence of an integrated pre-breeding programme breeding novel, high-performing cultivars with market-preferred attributes can take more than 10 years. Speed breeding has the ability to shorten the time, it takes to develop, market, and commercialize cultivars. Instead of 2-3 generations per year under normal glasshouse conditions, speed breeding can produce up to 6 generations per year for spring wheat (*Triticum aestivum*), durum wheat (*T. durum*), barley (*Hordeum vulgare*), chickpea (*Cicer arietinum*), and pea (*Pisum sativum*), and 4 generations for canola (*Brassica napus*). Speed breeding can hasten plant development for research objectives, such as phenotyping adult plant features, mutant studies, and



transformation, in fully enclosed, controlled-environment growth chambers. The use of cost saving additional lighting (LEDs), in a glasshouse environment allows rapid generation cycling through single seed descent (SSD) and potential for adaptation to more extensive crop enhancement programme. In future we have to exploit enormous possibilities for merging speed breeding with other contemporary crop breeding technologies, including as high-throughput genotyping, genome editing, and genomic selection. In order to accelerate the rate of crop improvement

FARMER'S PRODUCER ORGANIZATIONS – A WAY FORWARD FOR SMALL AND MARGINAL FARMERS OF PUNJAB

Parul Gupta* and Balbir Singh Khadda

Krishi Vigyan Kendra, S.A.S. Nagar (Mohali), Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana

Abstract

Punjab as a state comprises of largely fertile lands with a cultivable area of approximately 4.20 million hectares out of which around 97 percent that is 4.03 million hectares is the net sown area. The state's farm land holdings comprise of 18.7 percent as marginal farmers with 2.04 lakh land holdings and 1.83 lakh farmers i.e. around 16.7 percent are part of small farmers. The total comes out to be 35.4 percent which is more than one third of the total land holdings in Punjab (*Punjab Farmer's Guide*, Department of Agriculture & Cooperation Mechanisation and Technology Division, Ministry of Agriculture, Government of India). As per a Study by Punjab Agricultural University in Punjab which tracked the rise in farm incomes for farmers in Punjab found a direct link with increase in income of small, marginal and semi-medium farmers after they joined a Farmers Producer Organization. As per the study, there was only a marginal increase in labour employment permanently, whereas the income of farmers had increased by 15.71 percent considerable after joining the FPO's. This was mainly led by factors like shift in cropping patterns and improved and effective use of farm inputs (Vasudeva, 2021). As per the data by Ministry of Agriculture and Farmers Welfare, there are 122 registered FPO's in Punjab by agencies like NABARD, Small Farmers Agri Business Consortium and other Implementing Agencies as on 09th of March, 2022 (Farmer Producer Organizations, 2021). The membership of FPO's led to increased awareness among farmers which leads to decreased input costs and efficient utilisation of resources, thereby leading to agripreneurship among farmers. FPOs link farmers with strong managerial capabilities to national /global markets in sustainable manner. The As per the Punjab Government's policy, FPO's has to be supported and encouraged by the government with the support of funds from both central and state government schemes (*Farmer Producers Organizations (FPOs) Policy for State of Punjab*). The support that these FPOs provide to the farmers is very important and it can help in building uniform production system and post-harvest management of agriculture and allied sectors. The current study will be an attempt to study the impact that FPOs can have on the small and marginal farmers so that they can improve their incomes especially through the marketing support initiatives taken by the FPOs as marketing is the biggest challenge that the FPOs confront when they start facing the actual competitive forces in the market.

GROWING OF CROPS UNDER ORGANIC SYSTEM

Pooja Goswami¹, Pratibha Bisen¹, Shraddha Karcho¹ and Vinod Ramesh Bharati²

¹College of Agriculture, Balaghat, JNKVV, Jabalpur

²G.H. Rasoni University, School of Agricultural Sciences, Saikheda, Chindwara

Abstract

Concept of organic farming is not new for India. It has existing here before the initiation of modern techniques of farming. Organic farming is totally based on minimal use of off farm inputs. On management practices which restore, maintain and enhance ecological harmony. It realize on ecological processes, biodiversity and cycles adopted to local conditions rather than the use of external inputs with adverse effects. International Federation of Organic Agriculture Movements (IFOAM) defined Organic farming defined "Organic farming as a production system that sustain the health of soils, ecosystems and people. Organic Agriculture combines traditions, innovations and science to benefit the shared environment and promote fair relationship to good quality of life for all involved. A good organic farm is a mimic the diversity of nature through: Intercropping and companion crops, Establishment of beneficial habitat, Crop rotation, Better chance for supporting beneficial macro and micro organisms, Encourage the diversity among the enterprises, Various enterprises like crop husbandry, dairy, poultry, fishery, piggy, sericulture, culture of mushroom etc. these enterprises will helps in achieving



sustainability in productivity while minimizing the risk involved in conventional cropping system where crop failure due to natural calamities. The crop rotation should be remunerative and sustainable. The networking project on organic farming of ICAR have identified the suitable cropping systems. Soybean- Berseem / Mustard / Chickpea, Rice-Wheat / Potato / Mustard / Lentil, Soybean- Durum Wheat / Mustard / Chickpea. The inclusion of legumes has been found beneficial in almost all cropping systems.

In the rice wheat cropping system rice and wheat cropping system rice and wheat straw particularly in the rice straw has become surplus and is mostly burned into the field. The burning of residues disturbed the biological activities in the soil, thus in the long run crop residues has to be incorporated in the soil, it will help to improve the soil fertility and gave sustain production. Soil and water conservation practices reduces the losses of plant nutrients caused by run off and leaching. Water harvesting techniques and development of irrigation leads to the efficiency of nutrients and water use. Protection of soil against erosion through the soil and water conservation means to enhance and restore soil fertility and productivity of organic system. Conservation tillage is beneficial for conserving or adding organic matter, reduces the soil erosion and compactness. Weeds are alternate hosts plants for different insect's pests and diseases. Apart from create the competition for nutrients, air, water and light . Hence it is very essential to manage the weeds under such production systems. Cultural methods like tillage combined with appropriate application of irrigation water, seeding dates, use of weed free seeds, selection of cultivars, cropping systems, mulching, hoeing, weeding, flooding, may be adopted to manage the weeds, manipulation of planting geometry.

GENETIC DIVERGENCE ANALYSIS IN GREEN GRAM [*VIGNA RADIATA* (L.) WILCZEK] GENOTYPES

Prachi Mahla¹, Manohar Ram² and P.B. Singh¹

¹MPUAT, Udaipur

²SKNAU, Jobner

Abstract

A study was conducted for 44 genotypes of green gram to analyse genetic divergence among the genotypes. The genotypes were subjected to Mahalanobis D² statistics and grouped into seven clusters. Cluster I contained maximum number of genotypes *i.e.*, 29 genotypes followed by cluster II which contained 10 genotypes, whereas in rest of the clusters *i.e.*, cluster III, IV, V, VI and VII, there was only one genotype in each cluster. Maximum intra cluster distance was recorded in cluster II. Maximum inter-cluster distance was observed between cluster IV and cluster VI. The cluster means helps in identifying the diverse genotypes for genetic manipulation. The mean for seed yield per plant was highest in cluster III followed by cluster II. Mean values for seed yield per plant (g), 1000-seed weight (g), seeds per pod and pod length (cm) was highest in cluster III (AKM 1801). Thus, this genotype can be used in further crop improvement programme in green gram. Contribution of individual character towards divergence was estimated highest for 1000-seed weight (g), clusters per plant, chlorophyll content (SPAD meter) and plant height (cm).

EFFECT OF VARIOUS INSECTICIDES AGAINST YELLOW MITE, *POLYPHAGOTARSONEMUS LATUS* BANKS AND THE YIELD OF CHILLI IN THE NEW ALLUVIAL ZONE OF WEST BENGAL

Pranabesh Nandi* and Kaushik Pramanik

Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal-741252

*Corresponding Author Email : pranabeshnandi5@gmail.com

Abstract

Chilli is one of the important vegetable and condiment crop grown throughout year, is attacked by a complex of sucking insect pests, with yellow mite being the most significant, as nymphs and adults caused direct damage by sucking the cell sap and devitalize the plants and caused deformities like thickening, brittleness and shortening, twisting, downward curling and crumpling of young leaves. Also, the plant becomes stunted with rosette symptoms, leads to a reduction in significant yield. This has prompted the necessity of the introduction of the newer molecules that are safer, quickly degradable with known insecticidal alternatives. Therefore, field trials were undertaken to evaluate the bioefficacy of different insecticides at C Unit Farm, Kalyani, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal, during the *Kharif* 2019 season. Among the



seven treatments tested to determine their effect on chilli mite, Propargite 57 EC 850 g a i ha 1 recorded the highest mortality Whereas, Diafenthiuron 50WP@ 300 g a i ha 1 and Fipronil 5 SC 50 g a i ha 1 recorded the highest yield among all the other treatments of insecticides.

SEASONAL OCCURRENCE OF MAJOR SUCKING PESTS OF CHILLI (*CAPSICUM ANNUM* L.) CROP AND THEIR CORRELATION WITH WEATHER PARAMETERS

Pranabesh Nandi* and Kaushik Pramanik

Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal-741252

*Corresponding Author Email : pranabeshnandi5@gmail.com

Abstract

Chilli is the most widely used universal spice, named as wonder spice In India, Chilli was grown in an area of 309 thousand hectares with a production of 3592 thousand tones and the productivity was 11.62 tonnes per hectare in 2017 -18 (NHB, 2018). The prevalence and build-up of these sucking insect pests of chilli crop viz. yellow mite, thrips and aphid is mostly governed by weather parameters like temperature, relative humidity, rainfall, sunshine hours. Furthermore, the weather parameters vary greatly from place to place and season to season Thus, the knowledge of the influence of weather parameters of chilli will help to develop a forecasting system and to implement timely plant protection measures. A field study was conducted at C Unit Farm, Kalyani, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal to determine the weather parameters on the major sucking insect pests of chilli. The results revealed that that the insect pests were recorded on chilli crop just after transplanting and the peak population of insect pests was reached in the 34th to 36th Standard Meteorological Week. Most of the parameters like rainfall, relative humidity & sunshine hours have showed a positive significant correlation with the population of insect pests.

DIVERSITY AMONG COMMON BEAN LANDRACES IN TRIBAL PART OF BALAGHAT DISTRICT (MP)

Pratibha Bisen*, Pooja Goswami, Shraddha Karcho and Dharna Bisen

Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, (M.P.), India

*Corresponding Author : prratibha08@gmail.com

Abstract

The incredible diversity is observed in 60 landraces of common bean (*Phaseolus vulgaris* L.) collected from Baihar, Birsa, Paraswada, Lanji, and Kirnapur tribal blocks of Balaghat district of Madhya Pradesh. A landrace is a dynamic population of a cultivated plant species; a heterogeneous group that evolved in a certain eco-geographical zone and is adapted to the edaphic and climatic conditions as well as to the local management regimes and the traditional modes of use. The high variability was observed in morphological traits like seed color, shape, size, twining habit, time of flowering, anthocyanin pigmentation in stem, leaflet size, flower color, flower size, and 100-seed weight. The food, agricultural and ecological values of leguminous crops are tremendous, and the common bean has a major role in all these. Among other things, a landrace is distinguishable by its adaptability to a particular environment, resilience, cultural values, and organoleptic properties. It is a population having a historical origin, and distinct identity and lacks formal crop improvement being locally adapted and associated with traditional farming systems. Conservation of this remarkable genetic diversity is recommended for future propagation, breeding, and the investigation of genetic relationships.

DIVERSITY AMONG COMMON BEAN LANDRACES IN TRIBAL PART OF BALAGHAT DISTRICT (MP)

Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, (M.P.), India

*Corresponding Author : prratibha08@gmail.com

Abstract

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SALICYLIC ACID (SA) : A DOUBLE-EDGED SWORD FOR THE PLANT DEFENSE SYSTEM

Pranabesh Nandi* and Kaushik Pramanik

Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal-741252

**Corresponding Author Email : pranabeshnandi5@gmail.com*

Abstract

Through morphological, physiological, and biochemical pathways, the plant hormone salicylic acid (SA) plays a significant part in the induction of plant defense against a variety of biotic and abiotic stressors. It functions as an endogenous signal mediating local and systemic plant defense responses against pathogens and has been the subject of extensive investigation in recent years. Plants produce salicylic acid in response to a variety of phytopathogen challenges, and it is crucial for the development of both systemic and local acquired resistance (SAR). Pathogenesis-related (PR) protein increase is brought on by salicylic acid application. Pathogen susceptibility to both avirulent and virulent pathogens is increased by mutations that either result in decreased salicylic acid production or impaired perception of salicylic acid. Additionally, it has been discovered that salicylic acid contributes to how plants react to abiotic challenges such heat, osmotic stress, drought, and toxicity from heavy metals. In this regard, salicylic acid looks to be an “effective therapeutic drug” for plants, just as it is for mammals. However, we only have a basic understanding of the main signaling elements that activate salicylic acid production and relate to the accumulation of PR proteins. In addition to its involvement in regulating physiological and biochemical processes during biotic and abiotic stress, salicylic acid is essential for the regulation of these processes throughout the plant’s entire lifecycle.

PREDICTING SHRIMP MONTHLY EXPORT PRICE FORECASTING USING TIME SERIES APPROACH

Prema Borkar

Gokhale Institute of Politics and Economics (Deemed University), Pune-411004 Maharashtra

Email: prema.borkar@gipe.ac.in, premaborkar@rediffmail.com

Abstract

Fishing is a key economic industry in India, with numerous development potential. This is due to the country’s vast resources and possibilities. Shrimp are invertebrate marine animals with elongated bodies that are commonly consumed as food. This is a nutritious food because it contains proteins, selenium, vitamins, phosphorus, magnesium, copper, iron, and vitamin B12. India is the world’s second-largest producer of white leg shrimp (13 percent of worldwide production), and Seafood Watch rates 98 percent of farmed shrimp produced in India as Avoid. The United States is India’s largest export market, accounting for 41% of all shrimp imported into the United States in 2019. Andhra Pradesh is the leading shrimp grower, accounting for more than half of the overall output. To reduce the environmental impact of shrimp aquaculture, the Indian government is pushing sustainable shrimp farming practices to produce high-quality sustainable shrimp. Furthermore, the Seafood Exporters Association of India (SEAI) and the Marine Goods Export Development Authority (MPEDA) are encouraging the export of shrimp, particularly ready-to-eat and ready-to-cook products.

In this study, monthly export prices of shrimp from India were gathered from the index mundi website between July 2013 and September 2022. The ARIMA model was used to fit the data and forecast future export prices. For forecasting, the Box-Jenkins (1970) ARIMA methodology has been applied. The data was calculated using autocorrelation and partial



autocorrelation functions. The R programming software was used to estimate model parameters. The performance of the fitted model was examined by computing various measures of goodness of fit viz., AIC, BIC, and MAPE. According to empirical findings, the ARIMA (2,1,1) model was best suited to anticipate monthly shrimp export prices to India. Based on the chosen model, projections for the period from October 2022 to March 2023 are computed. The monthly export prices of shrimp are found to be increasing based on the fitted model. The results of the monthly shrimp export prices are shown numerically and graphically. Forecasting is a critical phase in the process of advising policymakers. When developing, planning, and executing marketing strategies, strategists consider the most accurate forecasting models. These projections are particularly helpful for modifying their marketing and policy initiatives in order to account for changes in the future.

SOIL HEALTH MANAGEMENT AND PRACTICES : KEY FACTOR FOR CROP PRODUCTIVITY

Prince Kumar¹, Ram Naresh², Vikas Tiwari³ and Abhijeet Kuderiya¹

¹Department of Agriculture Extension, Mmhatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Satna, M.P.

²ICAR-ATARI, Zone III, Kanpur, Uttar Pradesh

³Department of Agronomy, Mmhatma Gandhi Chitrakoot Gramodaya, Vishwavidyalaya, Satna, M.P.

Email : princesingh3191@gmail.com

Abstract

There are three basic needs of human beings i.e. food, clothes and shelter. Among these needs for food, somehow people depend on agriculture. Due to excessive use of chemical fertilizer and climate changes get disturbed the soil health. To overcome this issue there is need to provide all essential nutrient in optimum quantity, an approach called integrated nutrient management should be followed where organic, inorganic and biological improvement are combined used as nutrient sources. This helps to enhance nutrient use efficiency, soil health and control nutrient losses, and they're by sustainable crop production can be accomplish. The main objective of integrated nutrient management comprise the use of all possible source of nutrient to optimize their inputs, match soil nutrient supply with the precision of crop requirement spatially and temporally, reduce nutrient loss while increasing crop yield. Essential nutrient of the crop cannot be fulfilled by using any one source of nutrient, but it can be fulfilled by integrating all the component of the nutrient like organic manures, green manuring, biofertilizer, chemical fertilizers, a combination of all these as nutrient source maintain the better ecological balance in the soil and helps in maintaining interactions of beneficial microbes and plants. So that effectively biotic stress can be easily managed. Thereby proper nutrient requirement of the crop is satiated without causing any environmental pollution, and improve soil health, soil physical-chemical and biological property can be well maintained, which is important for crop productivity.

LIFE CYCLE ASSESSMENT IN AGRICULTURE

Priya and Sandeep Kapur

Doctoral Student, School of Business Studies, Punjab Agricultural University, Ludhiana, Punjab

Abstract

A vast range of essential goods is produced by the diverse industry of agriculture. Competition for natural resources will put further pressure on the agricultural output of food, fibre, energy, and numerous high-value byproducts as the world's population continue to rise. The effects of agriculture on the environment are coming to the attention of consumers and society at large. A life cycle assessment (LCA) methodology can be used to identify areas of greatest impact and compare mitigation solutions for agricultural systems in light of increased concerns about environmental consequences tied to the requirements of a growing population. The complexity of determining the effects of agricultural production is increased by a number of elements, such as the production of many products from a single system, regional and crop-specific management strategies, temporal fluctuations (seasonally and annually), and a significant number of nonpoint emission sources, spatial variations. This study introduces the Life-Cycle Assessment environmental impact analysis methodology (LCA). To more effectively address environmental problems, LCA can be used to identify and quantify them. In addition to describing how LCA can be used to assess agricultural systems, this paper offers suggestions for interpreting and applying LCA results to one's own farming operation. The following section of this paper goes into LCA applications in agriculture and provides a summary of an LCA agricultural case study. The final section then discusses the difficulties and potential directions for the LCA application.



IN VITRO EFFICACY OF ORGANIC AMENDMENTS AGAINST *SCLEROTIUM ROLFSSII*, CAUSING COLLAR ROT OF BELL PEPPER

Bade R.B.¹, Mulekar V.G.¹, Sahane P.A.^{2*} and Kolhe D.B.¹

¹Department of Plant Pathology, College of Agriculture, V.N. Marathwada Krishi Vidyapeeth, Parbhani-431402

²Department of Plant Pathology College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli-415712

*Email : sahanepawan77@gmail.com

Abstract

Collar rot of bell pepper (*Capsicum annum* L.) caused by *Sclerotium rolfsii* is most important and destructive disease causing accountable qualitative and quantitative losses. As the pathogen exclusively soil borne, its management with alone chemicals is uneconomical as well as harmful to ecosystem. The use of organic amendments is one of the indirect potential approaches of non-chemical means to control soil borne plant pathogens/diseases which not only reduces the disease incidence, but also increase soil fertility and microbial activity in general and particularly the antagonists activity. Therefore, in present study about seven organic amendments were evaluated as pre-sowing soil application to assess their efficacy against *S. rolfsii*, by sick soil method in polybags, under screen house conditions. The results obtained on per cent mortality reductions over untreated control. Results revealed that among organic amendments evaluated *in vitro*, neem seed cake found most effective with minimum average mortality (18.38%) followed by poultry manure (23.45%), cotton cake (33.12%), sunflower cake (39.41%), farm yard manure (40.29), vermicompost (44.31%) and groundnut cake found least effective with 59.16% mortality. Whereas, untreated control showed maximum mortality (69.68%).

EVALUATING APPLICATION METHODS OF SUPERABSORBENTS ON SOIL WATER AVAILABILITY AND CROP PRODUCTIVITY IN CLUSTER BEAN (*CYAMOPSIS TETRAGONOLOBA*) UNDER RAINFED CONDITION

R.S., Dadarwal¹, Vishal Ahlawat², Vinay Rawal¹, M.K. Jat³ and Kavita¹

¹Department of Agronomy, College of Agriculture, CCS HAU, Hisar, Haryana-125004, India

²Department of Soil Science, College of Agriculture, CCS HAU, Hisar, Haryana-125004, India

³Regional Research Station, Bawal, CCS HAU Haryana-123501, India

*Corresponding author : vahlawat@hau.ac.in

Abstract

Cluster bean (*Cyamopsis tetragonoloba* L. Taub) alias guar is one of the important multifaceted, African originated, legume crops in India. It is utilized as vegetable, fodder and gum producing leguminous crop. The present investigation was carried out to Evaluating Application Methods of Superabsorbents on Soil Water Availability and Crop Productivity in Cluster bean (*Cyamopsis tetragonoloba*) under Rainfed Condition. A field experiment was laid out in split-plot design comprising four level of superabsorbents (3 kg/ha Pusa hydrogel, 3 kg/ha Gond katira, 3 kg/ha Gum *sterculia* and control) in sub-plots and four levels of superabsorbents application methods (Mixing at plough depth, furrow application, seed coating and mixing at plough depth and seed coating and furrow application) in main-plots, replicated thrice. Improvement in water productivity, water use efficiency and yield were witnessed with Pusa hydrogel application under seed coating and furrow application method. Furthermore, application of superabsorbents through seed coating and furrow application method was evinced economically and ecologically sustainable in the rainfed condition of Haryana, India. Superabsorbents are to be leveraged for utilizing existing water potential vis-à-vis to advance crop productivity, which ensure minimum inputs imply maximum output in a sustainable genre.

A STUDY ON OCCUPATIONAL HEALTH PROBLEMS FACED BY HANDLOOM WEAVERS IN INDIA

Rupanagudi Unesha Fareeq* and Seema Kwatra

*Department of Family Resource Management, College of Home Science, GBPUAT, Pantnagar-263145 Uttarakhand

Email : unirupanagudi@gmail.com

Abstract

The study provided an insight on various kinds of occupational health problems experienced by the handloom weavers.



During the weaving operation handloom workers adopt awkward postures, which is one of the most important factor of their poor working efficiency and prevalence of musculoskeletal disorders. Handloom weaving activity requires workers to indulge in repetitive hand movement to move the shuttles, along with repetitive leg movement to operate the pedals WMSDs are the most common occupational health problems among Weavers in handloom industry. The main reasons for WMSDs are awkward working posture due to ergonomically poor design of workstation. The studies on handloom weaving activity revealed that intensity of health problems is associated with increased number of years of work experience and hours of working. The workers are exposed to environmental parameters such as light, noise, temperature and humidity. The factors influencing the occupational health problems among weavers are musculoskeletal problems, postural discomforts, job satisfaction, work stress. Most of the weavers experienced discomfort and pain in neck, low back, shoulder and knee from moderate to severe and waist and ankle pain, finger pain from low to moderate. Ergonomic factors such as provision of a backrest and frequent rest periods could lessen the musculo-skeletal discomfort among handloom weavers. Majority of the studies reported that handloom weavers has poor knowledge on the effect of occupational health hazards leading to musculoskeletal disorders. There is a need for reducing the postural strain of weavers and also suggest the ergonomic design and intervention into weaver workstations to minimize the adverse effect of their current working postures.

CHARACTERIZATION OF GUAVA F1 HYBRIDS FOR QUANTITATIVE TRAITS

Pushpendra Rajput*, Rajesh Kumar, V.P. Singh, Satish Chand, Rajat Sharma and Poonam¹

Department of Horticulture, G.B. Pant University of Agricultural and Technology, Pantnagar, Uttarakhand-263145

¹*Department of Horticulture, Rajmata Vijayaraje Scindia Agricultural University, Gwalior, Madhya Pradesh-474002*

*Corresponding author: nd.pushpendra1@gmail.com

Abstract

The present study was conducted at Horticulture Research Centre, Patharchatta, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, during the years 2019-22. About two-year-old total 15 F1 hybrids were evaluated for different quantitative traits. Among all of them maximum plant height was found in Sangareddy × Arka Kiran (160.1 cm) then Sangareddy × Pant Prabhat (157. cm) and minimum in Red Fleshed × Local Germplasm (59.7 cm) and in Hissar Surkha × L-49 (124.3 cm). In case of plant girth range varies from highest in KG-1 Guava × Local Germplasm (57.6 mm) and lowest in Red Fleshed × Pant Prabhat (25.5 cm) were recorded. In terms of leaf blade length maximum in Hissar Safeda × L-49 (13.6 cm) and Hissar Surkha × Lalit (13.4 cm) and minimum in Hissar Surkha × L-49 (9.8 cm) and Hissar Safeda × Lalit (9.9 cm) were noted, while range of leaf blade length varies highest 6.2 cm (Hissar Safeda × Lalit and Hissar Surkha × Local Germplasm) to 4.8 cm (Sangareddy × Pant Prabhat). In terms of plant spread and plant volume highest plant spread were recorded in Red Fleshed × Local Germplasm (1.13 m) and KG-1 Guava × Local Germplasm (0.84 m) followed by Hissar Safeda × L-49 (0.74 m) and highest plant volume were noted in KG-1 Guava × Local Germplasm (2.27 m³) then Hissar Safeda × L-49 (1.80 m³) followed by Sangareddy × Arka Kiran (1.46 m³), while minimum plant spread and plant volume were found in Hissar Safeda × Lalit (0.49 m and 0.59 m³ respectively) and Hissar Surkha × Pant Prabhat (0.50 m and 0.66 m³ respectively) followed by in Red Fleshed × L- 49 (0.51 m and 0.78 m³ respectively). The overall better performance was found in Hissar Safeda × L-49 and Sangareddy × Arka Kiran.

EFFECT OF PANCHAGAVYA LEVELS AND TIMING OF APPLICATION ON GROWTH, YIELD AND NUTRIENTS CONTENT OF MOTH BEAN [*VIGNA ACONITIFOLIA* (JACQ.) MARECHAL]

Rahul Jakhar and Rajesh Choudhary

Swami keshwanand Rajasthan Agriculture University, Bikaner (Raj.) 334006

Abstract

A field experiment entitled “Effect of Panchgavya on Growth, Yield and Quality of Moth bean [*Vigna aconitifolia* (Jacq.) Marechal]” was conducted at Agronomy Farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during kharif 2021-22. The soil of the experimental site was loamy sand with 124.6, 16.10 and 150.23 kg/ha available nitrogen, phosphorus and potassium, respectively in 0-30 cm soil depth with pH 8.26 and 0.24 per cent organic carbon. The experiment was conducted in randomized block design with three replications and assigning 10 treatments consisting of control and three levels of panchgavya with stage of application (panchgavya 5% at 20 DAS, 35 DAS and 20 DAS + 35 DAS, panchgavya 7.5% at 20



DAS, 35 DAS and 20 DAS + 35 DAS, panchgavya 10% at 20 DAS, 35 DAS and 20 DAS + 35 DAS) as growth promoter. p The mothbean variety RMO-435 was sown on 13th July 2021 at 30 cm row to row spacing by using recommended seed rate of 15 kg/ha. A significant increase in growth parameters viz., plant height, dry matter accumulation was recorded under the application of panchgavya 7.5% at 20 DAS + 35 DAS over control, panchgavya 10%, panchgavya 5%. Similarly, the yield and quality parameters like test weight, seed yield, straw yield and biological yield, nitrogen and phosphorus contents in seed and straw and their uptake and protein content in seed were also higher under the application of panchgavya 7.5% at 20 DAS + 35 DAS. The significantly higher seed yield (920 kg/ha) and net return (24091/ha) of mothbean was found with the application of panchgavya 7.5% at 20 DAS + 35 DAS. Application of panchgavya had no significant effect on harvest index of mothbean. The available nitrogen of soil significantly increase under the application of panchgavya 7.5% at 20 DAS + 35 DAS over control, panchgavya 10%,

STUDY OF DEFICIT TRICKLE IRRIGATION, MULCHING AND MICRONUTRIENT AND THEIR IMPACT ON VEGETATIVE, YIELD AND WATER MANAGEMENT OF LITCHI CV. ROSE SCENTED

Rajat Sharma*, Satish Chand, Ranjan Srivastava and Pushpendra Rajput

Department of Horticulture, College of Agriculture, GBPUAT, Pantnagar, Uttarakhand

Email: rajathorti10@gmail.com

Abstract

The experiment entitled “Study of deficit trickle irrigation, mulching and micronutrient and its impact on vegetative, yield and water management of Litchi cv. Rose Scented” was conducted at Horticulture Research Centre, Patharchatta, GBPUAT, Pantnagar during 2018-19 and 2019-20 on year age tree planted at a spacing of 5m x 5m. There experiment comprised of application of water through drip irrigation at 25%, 50%, 75%, 100% and 125% of estimated water requirement (ER), mulch along with foliar spray of borax or copper sulphate. However, the control was given surface irrigation. The experiment was laid out on randomized block design comprising of three replication. The pooled data showed that among the vegetative parameter, tree height (m) was found to be non-significant while stem girth and canopy volume (m³) were significant and maximum values were recorded with 125% ER with Plastic Mulching and Borax spray. While minimum was recorded for 25% ER and copper sulphate spray. Number of fruits and fruit yield for both the years and pooled data was noted significant. The number of fruits/tree and yield (kg/tree) were found to be significantly influenced by drip irrigation, mulching and micronutrient and their interaction. Maximum number of fruits and fruit and yield were found with 75% ER irrigation coupled with Mulch and Borax application. While least were obtained with control and 25% ER irrigation coupled with Mulch and Borax application. Water Use Efficiency was found best with 25% ER with Plastic Mulching and copper sulphate spray. However, minimum was noted with 125% ER with Plastic Mulching and Borax spray. Water Productivity was maximum with 125% ER with Plastic Mulching and Borax spray and least was obtained with 25% ER with Plastic Mulching and copper sulphate spray.

EFFECT OF CLIMATE CHANGE ON SUSTAINABLE AGRICULTURE

Rajesh Choudhary* and Rahul Jakhar

Department of Agronomy, Swami Keshwanand Rajasthan Agricultural University, Bikaner 334006

**Corresponding author Email : rajeshchoudhary6323@gmail.com*

Abstract

Global climate change is a burning issue for all over the world. It caused by greenhouse gases and ozone layer depletion. Both are two key space environmental issues of the present decade. All over the world there is growing concern about the far-reaching consequences of the continuing build-up of greenhouse gases in the atmosphere and depletion of ozone layer in the stratospheric region of the atmosphere. Climate change in our environment is generated by several causes such as population growth, pollution from industrialization, urbanization, carbon dioxide from rotting trees, the burning of coal, ozone layer depletion, natural gases and fossil fuels lead to methane travelling into the Earth's atmosphere any transportation vehicles, water vapor, and many other little things which contribute to make global climate change even worse. The average global temperature rose by 0.74 °C during last century. This is the largest and fastest warming trend in the history of the Earth that scientists have been able to discern. Current projections show that trend will continue and will accelerate. The best



estimate indicates that the Earth could warm by 3 °C during the 21st century. Therefore, science and technology education is need of 21st century for better work to safeguard environmental, social and economic wellbeing for both in the present and for future generation. Scientists are now certain that most of the change is due to human activities that emit greenhouse gases. Greenhouse gases, of CO₂ are the most important, trap heat in the Earth's atmosphere, leading to the overall rise of global temperatures, which are liable to disrupt natural climate patterns. Climate change is already having significant impacts in all over the world, particularly in developing countries, and on most ecosystems. This is based on evidence of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.

UTILIZATION OF KRISHIKOSH BY PG STUDENTS OF S.K.N. AGRICULTURE UNIVERSITY, JOBNER-JAIPUR (RAJASTHAN)

Ramlal Degra

Department of Extension Education, Rajasthan College of Agriculture, MPUAT, Udaipur

Email : ramlaldegra11@gmail.com

Abstract

An study was conducted in S.K.N. Agriculture University, Jobner, which comprises two institutes namely S.K.N College of Agriculture and RARI Durgapura Jaipur where M.Sc. and Ph.D. courses are offered, so both were selected purposively. Then, a list of all M.Sc. and Ph.D. students was prepared with the help of student section record of the college. There were 158 M.Sc. students (77 male and 81 female) and 107 Ph.D. students (61 male and 46 female) i.e. a total of 265 male and female M.Sc. and Ph.D. students were registered in the first semester during session 2018-19 in SKN College of Agriculture, Jobner and RARI Durgapura. Out of these 50 per cent students will be selected by using simple random sampling technique after dividing population into male and female of M.Sc. & Ph.D. Data were collected through interview schedule. Thereafter, data were classified, tabulated and statistically analyzed which led to following findings. It was found that majority of the M.Sc. and Ph.D. students belong to middle age category having age between 22 to 25 years and 24 to 29 years had obtained medium OGPA in the range from 7.00 to 8.00, completed their schooling in Hindi medium, had annual family income less than 1 lakh rupees per year, were from rural family background, their father's main occupation was farming, father were secondary education and mother's occupation was house wife, had illiterate mothers and were having laptop as computer devices.

VARIABILITY AND GROWTH RATE IN PRODUCTION OF WHEAT IN MALWA PLATEAU OF MADHYA PRADESH

Ramphool Ahirwar, Nahar Singh Khedkar, Om Prakash Dhurve and Satish Kumar Sharma

JNKVV, College of Agriculture, Ganj Basoda, Vidisha (MP)

Correspondence Email: ramahirwar@jnkvv.org

Abstract

The present study has been concerned to the relative change, variability and growth rate in area, production and productivity of wheat in Malwa plateau of Madhya Pradesh. The time series data on area, production and productivity of wheat were collected from Department of Farmer Welfare and Agriculture Development, Madhya Pradesh for last 20 years from 2001-02 to 2020-21. Wheat is most important crop in cereal crops which is used for human consumption in the form of chapatti, dalia, puri, paratha, halwa and upma etc. Wheat is a major ingredient in such foods as bread, crackers, biscuits, muesli, pancakes, pasta, noodles, pie, pastries, pizza, cakes and cookies etc. The highest relative change in area was noticed in Rajgarh (677.11%) as well as the relative change in production was found maximum in Mandsaur (1531.46%) but the highest relative change in term of productivity was 192.33 per cent in Indore. The relative change in area, production and productivity of Madhya Pradesh were 151 per cent, 586.08 per cent and 174.17 percent, respectively. The variability in area, production and productivity of wheat were 34.44 per cent, 76.27 per cent and 39.15 per cent, respectively in state. The Rajgarh showed highest variability (67.34%) in area and lowest in Indore (29.60%) was observed. The highest variability in production was recorded in Shajapur (97.81%) as well as the highest variability in productivity was noticed in Indore (41.04%). The highest positive and significant growth rate in area of 10.55 per cent and production of 13.70 per cent were observed in Rajgarh but highest positive and significant growth rate in productivity of wheat was noticed in Indore (5.23%). The Malwa plateau showed positive and significant growth rate in area (7.46%), production (11.58%) and productivity (4.81%) of wheat during



entire period of study. The positive and highly significant growth rate in area, production and productivity of wheat of Madhya Pradesh were 5.27 per cent, 11.18 per cent and 6.13 per cent, respectively. The all districts of Malwa plateau showed positive and significant in area, production and productivity of wheat during entire period of study.

CLIMATE CHANGE : A THREAT TO FOOD SECURITY

Richa Singh

Department of Food Science & Nutrition, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, U.P.

Email : richa81196@gmail.com

Abstract

The advancements gained in the battle against hunger and malnutrition so far are at risk due to climate change. Climate change increases and worsens risks to food security for the most vulnerable countries and populations, as noted by the Intergovernmental Panel on Climate Change's (IPCC) most recent assessment report. Four of the eight major threats brought on by climate change that the IPCC AR5 identified directly affect food security: (a) Loss of rural livelihoods and income, (b) loss of livelihoods associated with marine and coastal ecosystems, (c) loss of livelihoods associated with terrestrial and inland water ecosystems, (d) loss of livelihoods associated with food insecurity and the collapse of food systems. The most susceptible nations and populations, such as those in arid and semi-arid regions, landlocked nations, and small island developing states, are those that are affected first and most severely. In addition to its potential to increase dangers to human health, climate change will also have larger consequences on price stability, food markets, and trade flows. To protect the ability of food systems to guarantee global decent security, significantly increased responses to climate change are required right away. Multiple actions, ranging from social protection to agricultural techniques and risk management, are required to increase food security's resilience in the face of climate change. Investments, regulations, and institutions across many fields will be required to make the adjustments on the ground necessary for agriculture and food systems adaptation to climate change for food security and nutrition.

INCLUSION OF LEGUME FOR SUSTAINABLE PRODUCTION AND SOIL HEALTH

Roop Narayan Bairwa¹ and Lalita Rana²

¹Department of Agronomy, PGCA, Department of Agronomy, Dr. Rajendra Prasad Central Agricultural University, Pusa, 848 125 Samastipur, Bihar

²Department of Agronomy, Sugarcane Research Institute, Department of Agronomy, Dr. Rajendra Prasad Central Agricultural University, Pusa, 848 125, Samastipur, Bihar

Abstract

Legume plant play important role in production of indigenous nitrogen. Some legumes have the capacity to solubilize phosphate that would otherwise be inaccessible by releasing organic acids from their roots, in addition to enhancing soil fertility and restoring soil organic matter. The atmospheric nitrogen fixes by the legume crops and germinates in the presence of rhizobia microorganism in the soil, the bacteria penetrate the root hairs and cross into the root itself. The bacteria multiply, and causing the swelling in root is known as root nodules. The effective root nodule is red to pink colour in center and elongated in shape and 2-8 mm in size. The distribution of effective nodule on primary root in clustered form. The micro-organism feed carbohydrates which are formed by above ground part of plant in the photosynthesis process. N required for crop production is obtained through N- fixation by legumes. The bacteria are capable of reducing nitrogen (N₂) to ammonia (NH₃) with the help of an enzyme is called nitrogenase. This process is known as biological nitrogen fixation (BNF). Rhizobium fixes atmosphere nitrogen into NH₄⁺. N fixed by rhizobium is translocated to xylem of host plant as asparagine and some extent as glutamine. Globally, total annual biological N fixation is 130-180 x 10⁶ Mt (50% is due to rhizobia). *Rhizobium* inoculation increases 15-25% yield and 5-20 % protein in plants. Legume-rhizobium live in symbiosis association, inoculation with proper strain will benefit the crop plant. Legumes have a number of benefits for soil quality, including increasing soil organic matter, enhancing soil porosity, recycling nutrients, enhancing soil structure, lowering soil pH, and diversifying the microorganisms that live in the soil.



EFFICACY OF DIFFERENT INSECTICIDAL TREATMENTS AGAINST *EXELASTIS ATOMOSA* IN DIFFERENT GENOTYPES OF PIGEONPEA

Raushan Kumar^{1*}, Binay Kumar¹, P. Kumari², P.K. Singh¹, H.C. Lal³, Niraj Kumar⁴

¹Department of Entomology, Birsa Agricultural University, Ranchi-834006, Jharkhand

²Department of Agrometeorology and Environmental Science, Birsa Agricultural University, Ranchi-834006, Jharkhand

³Department of Plant Pathology, Birsa Agricultural University, Ranchi-834006, Jharkhand

⁴Department of Genetics and Plant Breeding, Birsa Agricultural University, Ranchi-834006, Jharkhand

*Corresponding and presenting author Email : rk9631995377@gmail.com

Abstract

Pigeonpea (*Cajanus cajan*) (L.) Millsp. is a tropical and subtropical plant that is especially well adapted for rainfed agriculture in semi-arid environments because of its deep taproot, heat tolerance, and quick growth habit. It is thought that Asia is where the pigeonpea originated. According to reports, it is a legume that contains 20–24% protein, 1.2% fat, 65% carbohydrates, and 3.8% ash. In India, behind chickpea, it is the second most significant pulse crop. In order to realize the projected yield, weather and the insect pest damage constitutes one of the serious limiting factor in pigeonpea production. When the insect population rises over the economic threshold level, pesticides should only be used as a last resort for pest control. In the process of experiment four treatments will be applied randomly to all three replications: Flubendiamide 480 SC, Chlorantraniliprole 18.5 SC, *Bacillus thuringiensis* var *kurstaki* 0.5% WP, Emamectin benzoate 5%SG, and untreated control. The effectiveness of the all three genotypes BAU PP-16-38, Birsa arhar-1, and JKM-189 against *Exelastis atomosa* was evaluated. Each treatment was applied twice, separated by 14 days, beginning when the crop had reached 50% bloom. After two sprayings, the overall mean larval count showed that T1- Flubendiamide 48 SC and Chlorantraniliprole 18.5 SC was the most effective treatment for reducing the larvae population of the *Exelastis atomosa* with the JKM-189 genotype.

RESPONSE OF CHEMICAL AND BIOFERTILIZERS ON GROWTH AND YIELD OF WHEAT (*TRITICUM AESTIVUM* L.) IN BUNDELKHAND REGION

Rajesh Kumar and V.K. Singh

Department of Agronomy, Brahmanand Post Graduate College, Rath (Hamirpur) U.P.-210431

*Corresponding author Email: vksinghbnb@gmail.com

Abstract

The field experiment was conducted during Rabi season of 2019-20 at the Research farm of Brahmanand Post Graduate College Rath (Hamirpur) U.P. to evaluate the response of chemical and bio-fertilizers on growth and yield of wheat (*Triticum aestivum* L.). There were three chemical levels including control i.e. C₀ (control), C₁(50:25:25kg NPK ha⁻¹) and C₂ (100:50:50kg NPK ha⁻¹) and five bio-fertilizers including control viz; B₀ (control), B₁ (Biopline @ 1.00 litre ha⁻¹), B₂ (Phosfert@0.375 litre ha⁻¹), B₃ (vitormone @ 2.5 litre ha⁻¹) and B₄ (Biopline@1.00 litre + Phosfert @ 0.375 + vitormone @2.5 litre ha⁻¹) were arranged in factorial R.B.D design with three replications. Amongst the chemical levels, the C₂(100:50:50 kg NPK ha⁻¹) and Bio- fertilizers B₄ (biopline @ 1.00 + phosfert @ 0.375+ vitormone @2.5 litre ha⁻¹) were found to Produce higher values of growth and yield attributes such as height of the main shoot (cm), no of functional leaves plant⁻¹, fresh weight(g), dry weight(g) and no. of tiller plant⁻¹ Test weight(g), Total economic yield(q/ha), Total biological yield (q/ha) Total produce(q/ha) and Harvest index (%).

EFFECT OF BIOFERTILIZER AND FOLIAR SPRAYING OF ZINC ON GROWTH PERFORMANCE IN CUCUMBER (*CUCUMIS SATIVUS* L.)

Ritu and Diptimayee Dash*

Deptt. of Agricultural Microbiology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, (C.G) 492012

*Corresponding Author Email : mdpt.dash@gmail.com

Abstract

An experiment was carried out at Indira Gandhi Krishi Vishwavidyalaya, Raipur, during 2021-22 to see the effect of biofertilizer (Inoculation of *Azotobacter* and PSB) and foliar spraying of Zinc on Cucumber (*Cucumis sativus* L.). The



experiment was laid out in Completely Randomized Design with six treatments and four replications. As per biochemical characteristics, both isolates responded positively to the starch hydrolysis test, catalase test, urease test, and oxidase tests. Both the isolates were Gram negative. Treatments consist of T₁ [Inorganic fertilization], T₂ [IF + Bioinoculants], T₃ [IF + Bioinoculants + Foliar spray of Zinc (10 ppm)], T₄ [IF + Bioinoculants + Foliar spray of Zinc (20 ppm)], T₅ [IF + Foliar spray of Zinc (10 ppm)], T₆ [IF + Foliar spray of Zinc (20 ppm)] with four replicates. Each experimental unit consists of 12 plants, and means comparing at probability level 0.05. Significantly highest growth of Cucumber was observed under the treatments T₄ [IF + Bioinoculants + Foliar spray of Zinc (20 ppm)]. The results showed significantly higher growth parameters such as plant height (160.7 cm), Maximum number of leaves (27.5), chlorophyll content (15.4 mg/g) and plant shoot dry biomass (82.2 g plant⁻¹), & plant root dry biomass (5.2 g plant⁻¹) with the foliar spray of zinc at 20 ppm and application of bioinoculants of *Azotobacter* and PSB. When bioinoculants were given along with Zinc treatment at level (20 ppm) as foliar spray was significantly exceeded in vegetation growth characters as the plant height, biomass accumulation and plants chlorophyll content.

PERCEPTION OF TRIBAL AND NON-TRIBAL DAIRY FARMERS TOWARDS THE DAIRY FARMING IN THE CENTRAL INDIAN STATES OF CHHATTISGARH: STRUCTURAL EQUATION MODELING APPROACH

Ravi Kumar Gupta¹, Anindita Saha¹, Digvijay Singh Dhakre² and Ankur Gupta¹

¹Department of Agricultural Extension, Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati (A Central University), Sriniketan, West Bengal, India

²Department of Agricultural Statistics, Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati (A Central University), Sriniketan West Bengal, India

Corresponding Author Email : raviguptaphd@gmail.com

Abstract

Dairy farming is a secondary occupation for millions of farmers in the central Indian state of Chhattisgarh. This study uses principal component analysis (PCA) and structural equation modeling (SEM) to determine how tribal and non-tribal dairy farmers in Chhattisgarh feel about dairy farming and what makes them feel that way. In this Research, the data was gathered from the dairy farmers in 2020–21. The results of the paired sample t-test show that both tribal and non-tribal farmers are performing significantly. In the Principal Component Analysis, KMO's sample adequacy test result was 0.724, which means there were enough signs in each element to study. Twelve items of dairy farmers' perceptions were conglomerated into three factors: rational perception, opportunistic perception, and scientific perception. The results of the SEM showed that the absolute fit indices match the sample data and that the proposed model is a good fit because it matches the values of the perception items. This study shows that policymakers should use a concentric approach that includes targeted research, sharing information, building infrastructure, and creating dairy technical institutions to increase income diversity and improve the way of life of dairy farmers.

NUTRITIONAL BENEFITS OF NIGER SEED

Roshni Sahu* and Rajani Bisen

Project Coordinating Unit Sesame and Niger, JNKVV, Jabalpur

*Email: roshnisahujbp@gmail.com

Abstract

Niger is a minor oilseed crop which has received limited research efforts. It is more so from the quality angle. It is grown mainly in India and Ethiopia. It can give dependable yields even under unfavourable agro-climatic conditions. Niger seed on an average contains 40% oil with a range of 30-43% and 20% protein in the range of 10-30%. The soluble sugars range from 7-18% with an average value of 12%. The seed also contains 10% crude fibre and 4% ash. The oil is usually extracted from the seeds by mostly traditional methods like *ghani* extraction and hydraulic pressing. Niger oil is pale yellow in colour and may have a bluish tint. It is nutty in taste with a sweet odour. The raw oil has low acidity and can be used directly for cooking. The oil normally has a poor shelf life and becomes rancid on storage. The oil contains 0.5 to 1.0% unsaponifiables and 0.4 to 3% free fatty acids. The fatty acid composition of niger oil is similar to that of sunflower and safflower. Linoleic acid is the major



fatty acid followed by oleic acid. It contains 5-13% palmitic, 2-11% stearic, 6-40% oleic and 45-77% linoleic acids. Niger oil is consumed in the locations where it is produced. It is a premium oil because of its high linoleic acid and its good taste and aroma. It is sometimes used as a substitute for sesame oil. Low grade oil is utilised in the manufacture of soaps and paints. It is also used as a lubricant and body massage oil. Niger cake is dark in colour. It contains 24-34% protein, 4-14% oil, 8-24% crude fibre, 20-28% sugars and 8-12% ash. Niger cake is mostly utilised as animal feed. Quality oil is used as an illuminant and also for preparation of soaps and detergents. It is also used as a body oil for smooth skin and supple joints.

HOW MUCH HEALTHIER IS THE CONSUMPTION OF FAST FOODS? THE STUDY ON FACTORS AFFECTING THE CHOICE OF FAST FOODS AMONG TEENAGERS OF SABOUR BLOCK IN BHAGALPUR DISTRICT OF INDIA

Ruchi Kumari^{1*}, Mamta Kumari¹ and Ravi S. Singh²

¹PG Department of Home Science-Food and Nutrition, Tilka Manjhi Bhagalpur University, Bhagalpur-812 005

²Department of Plant Breeding and Geneics, Bihar Agricultural University, Sabour, Bihar-813 210

*Corresponding Author Email : ruchi.msb@gmail.com

Abstract

We are witnessing rapid shift in life-style of people due to change in standard of living, income, work culture, hectic work schedule, free-thinking and global perspective, as a consequence, the fast foods impact on our dietary pattern and routine food consumption. As fast food is generally considered rich in calorie, fat, sugar, salt and poor in other nutrients, it has contributed to rise of many non- communicable diseases, metabolic diseases such as obesity and over-weight, diabetes mellitus, hypertension and cardiovascular diseases among more common. The present study was conducted to find the factors affecting the choice of fast food (Indian Fast Food, IFF; Western Fast Food, WFF) among teenagers using questionnaire-cum-structured interview schedule. In response to the influence of nutritional information about fast foods on the teenager's choice of fast food, in case of IFF, the response was rarely (girls, 30%, boys, 19.6%), sometimes (girls, 40.4%, boys, 45.6%), most of time (girls, 20%, boys, 20.8%), and always (girls, 9.6%, boys, 6.4%), while in case of WFF, the response was rarely (girls, 20%, boys, 19.2%), sometimes (girls, 45.2%, boys, 42.4%), most of time (girls, 17.2%, boys, 20.8%), and always (girls, 15.2%, boys, 6.4%). In response to query on awareness for chemicals and preservatives present in fast food, respondents considered fast food as a healthy food in case of IFF response was yes (girls, 61.2%, boys, 53.6%), and no (girls, 37.2%, boys, 49.2%); while in case of WFF Always (girls, 57.6%, boys, 46.4%) and no (girls, 37.2%, boys, 49.2%). Regarding having prior knowledge of nutritive value of fast foods, in case of IFF, the response was as follows, "Yes, it has high nutritive value" (girls, 40.4%, boys, 44.4%), and "Yes, it has low nutritive value" (girls, 22%, boys, 19.6%), "no I don't know" (girls, 35.2%, boys, 26.8%); while in case of WFF, "Yes it is high in calorie" (girls, 17.6%, boys, 17.2%), "Yes it has low calorie" (girls, 35.6%, boys, 31.2%), and "no I don't know" (girls, 43.2%, boys, 45.6%). This valuable information would be useful for preparing strategies or policy-guideline related to fast food consumption among teenagers and their social, health and economical issues.

SELF-REGULATION DURING LATE ADOLESCENCE

Ruchi Singh* and Suman Audichya

Dept. of Human Development and Family Studies, College of Community and Applied Sciences, MPUAT, Udaipur, Rajasthan

*Corresponding Author (Ruchi Singh) : singhruchi2696@gmail.com

Abstract

The ability to self-regulate or control emotions, thoughts, and behaviors is essential for healthy development in late adolescence since they may be subject to peer pressure and participate in harmful behaviors. Even though the value of self-regulation abilities in many facets of life has long been acknowledged. From mental health and emotional wellbeing to academic accomplishment, physical health, and socioeconomic success, self-regulation is the cornerstone for lifelong functioning in a wide range of areas. Being able to comprehend and control your conduct as well as your responses to your feelings and the world around you is known as self-regulation. There are three types of self-regulation included in it: behavioral, emotional, and cognitive. Supporting the development of self-regulation in late adolescence is an investment in society since better self-regulation is associated with higher income, better financial planning, a reduction in risky behaviors including substance use and aggression, and a reduction in health care expenses. Self-regulation, or the ability to learn from



mistakes, was a highly significant predictor of coping and confidence, tenacity and adaptation, and tolerance to challenging circumstances (resilience).

ROLE OF TILLING AND ECO-TILLING IN CROP IMPROVEMENT

Rukoo Chawla, Hemlata Sharma and Amit Dadheech

Department of Genetics and Plant Breeding, MPUAT, Udaipur, Rajasthan

Abstract

To feed the expanding world population, yields must be significantly increased. New breeding techniques must be implemented to increase the average phenotypic values of crops. The identification and manipulation of genes for yield improvement can be accomplished through the use of induced mutations in conjunction with advanced genomics technologies. While Eco-TILLING locates single nucleotide polymorphisms within a natural population and links these differences with features of breeding interest, the high throughput TILLING (Targeting Induced Local Lesions IN Genomes) approach discovers mutations in mutagenized populations. A broad reverse approach called TILLING combines chemical mutagenesis with PCR-based screening to identify point mutations in areas of interest. Making EMS-mutagenized populations, using PCR primers to target specific genes, and looking for rare mutants within a large population are the core tenets of TILLING. Single-strand cleaving endonucleases are currently utilized to identify mismatches in heteroduplexes, although initially denaturing HPLC was used to detect single base pair variations. The mismatches generated in heteroduplexes are recognized and cleaved by a number of single-strand specific nucleases that belong to the S1 nuclease family, such as CEL I and mung bean nuclease. The mismatches generated in heteroduplexes are recognized and cleaved by a number of single-strand specific nucleases that belong to the S1 nuclease family, such as CEL I and mung bean nuclease. TILLING guarantees broad applicability. Additionally, TILLING is appealing for agricultural applications as well as functional genomics since it does not entail transgenic alterations. TILLING is being used to identify various mutations and allelic series in a variety of crops, including maize, rice, wheat, brassica, cotton, etc. To sum up, due of its reliance on technology that identifies sequence variation, TILLING may benefit from upcoming developments in SNP detection and DNA sequencing. As a result, we may anticipate further development of TILLING in the upcoming years.

VEGETATIVE GROWTH PERFORMANCE OF ONE YEAR OLD PROPAGULES RAISED FROM TWO YEAR OLD CULM CUTTINGS OF *BAMBUSA VULGARIS* VAR. WAMIN

S.K. Rout¹, T.L. Mohanty¹, S. Behera² and R. Premila¹

¹College of Forestry, OUAT, Bhubaneswar

²AICRP on Agroforestry, OUAT, Bhubaneswar

Abstract

Bambusa wamin is also called “Dwarf Buddha belly bamboo” is a tropical and subtropical open clumping bamboo. It is mainly propagated by vegetative mean as it does not produce viable seeds. Among all vegetative methods of propagation “culm cutting” is the most suitable one. The present investigation was carried out in the nursery of college of forestry, OUAT in the year 2022. The experiment was laid out in CRD design with 9 treatments with 3 replications. Maximum height(172.54cm) and minimum height (103.2cm) were recorded in T1(second year basal one node) and T8(second year top two node) respectively. Maximum collar diameter of 3.3 cm obtained in T6 (second year middle three node) and lowest collar diameter of 1.2 cm obtained in T8 (second year top two node). Highest number of culms(8) obtained from T8 (second year top two node) and lowest(3) in T4 and T5(middle 1 node and middle 2 node). The maximum number of rhizomes (5.33 no.s) was observed in T6 (middle three node). The maximum number of nodes (29) of T1 (basal one node) and the minimum(21) were found to be in T2 (basal two node). Highest number of branches(43) was obtained from T7(top one node) and minimum(11) obtained from T8 (top two node).The internodal length was found to be highest in T7 i.e 11.5cm (top one node) and lowest in T8(top two node)(4.13cm). The root length was found to be highest in T3(52.78).Spread of root was highest(66.3cm) in T9 (Top 3 node). Total fresh weight was found to be highest in top 3 node i.e 2.42 kg and minimum was found to be in top 2 node i.e 0.49 kg . The total dry weight was found to be highest in the top 3 node ie 1.2 kg and lowest in top 2 node i.e 0.24 kg . The highest seedling quality index was 20.33 in T6 (middle three node) which was followed by T9(18.76) (Top 3 node). SQI was found to be positively correlated with height, collar diameter, above and below ground biomass.On the basis of SQI data, middle three noded culm cuttings were superior planting material among all the treatments studied.



FIELD SOIL SALINITY TOLERANCE TRAIT DISCOVERY IN CULTIVATED BARLEY PROGENITOR *HORDEUM SPONTANEUM*

S.K. Bishnoi*, R.P.S. Verma, Dinesh Kumar, Chuni Lal and Omvir Singh

ICAR-Indian Institute of Wheat and Barley Research, Karnal

Abstract

Hordeum spontaneum the wild barley is considered to be the progenitor species of the cultivated barley and as such forms the part of primary gene pool of *Hordeum vulgare* along with the landraces and varieties. Because natural crossing can occur and the hybrids formed are vigorous and fertile, therefore, *H. spontaneum* is a very important donor of alleles to the cultivated barley and had been a regular feature of the barley breeding programmes aimed at both abiotic as well as biotic stresses. Among the abiotic stresses, soil salinity affects the crop production and productivity globally and the area under salinity is on the rise. Barley is one of the most salt tolerant crops; however the agronomically superior released varieties exhibit lesser degree of tolerance to soil salinity stress due to which the productivity is hampered when the crop is grown in marginal areas with high salt concentration. In the present study, 27 accessions of *H. spontaneum* were evaluated for soil salinity tolerance under field soil salinity conditions (13.33 dS/mEC) at the Hisar Experimental Farm of the ICAR-IIWBR, Karnal during *rabi* 2021-22. The salinity tolerance score was recorded on a scale of 0-5 where 0 indicated failure of germination while 5 indicated highly tolerant accession with normal maturity. Seven accessions out of the total were having a salinity tolerance score of 5 and could be classified as highly tolerant ones while 8 accessions had a score of 4 which were classified as tolerant ones. Remaining 12 accessions had a score of either 3 or 2 and were classified as moderately tolerant/susceptible and susceptible. The study concluded that *H. spontaneum* as a species possesses significant diversity for salinity tolerance which can be successfully utilized for introgression of this trait into agronomically superior varieties.

EFFECT OF MOTHER CROP NUTRITION ON THE STORABILITY OF *AMARANTHUS POLYGONOIDES* VAR PLR1

S. Pozhilarasi^{1*}, R. Geetha¹ and R. Ranjith²

¹Department of Seed Science and Technology, Agricultural College and Research Institute, Madurai-625104, Tamil Nadu

²Department of Agronomy, Agricultural College and Research Institute, Madurai-625104, Tamil Nadu

*Corresponding Author's Email : pozhilarasi7@gmail.com

Abstract

The present investigation was carried out during 2017-2018 to identify the effect of mother crop nutrition on the storability of *Amaranthus polygonoides* var PLR 1. The well dried amaranthus seeds packed in cloth bag and aluminium foil pouches with different treatment. Thus, the study revealed that the rate of seed deterioration in Amaranthus can well be minimized by storing the seeds in aluminum foil pouches, apart from nourishing the mother crop by way of foliar spraying with 1% sulphate of potash to have better storability of seeds under ambient condition. The seed quality parameters viz., germination, shoot length, root length and dry matter and vigour index were also maximum in aluminum foil pouches compared to cloth bag after eight months of storage in Amaranthus.

STUDY ON POST-EMERGENCE APPLICATIONS AGAINST WEEDS AND YIELD OF SUGARCANE (*SACCHARUM OFFICINARUM* L.)

S. Thiruvvarassan¹, M. Jayachandran², E. Jamuna and V. Vijaya Geetha, S. Thiruvvarassan¹, M. Jayachandran², E. Jamuna³ and R. Kanjanarani⁴

¹Oilseeds Research Station, Tindivanam, Tamil Nadu Agricultural University

²Sugarcane Research Station, Cuddalore, Tamil Nadu Agricultural University

³Agricultural College and Research Institute, Thiruvananthapuram, Tamil Nadu Agricultural University

*Author for correspondence Email : thiruvvarassan@rediffmail.com

Abstract

Field investigations were carried out during early seasons of both 2017 and 2018 at Sugarcane Research Station, Cuddalore to ascertain the bio-efficacy of ALH 516 against broad spectrum of weeds in both plant and ratoon crop of sugarcane and its



residual effect on succeeding black gram. The highest weed control efficiency of 86.9 and 75.6 per cent respectively on 30 and 90 days after planting during 2017 and with 83.2 and 76.8 per cent respectively on 45 and 105 days after ratoon during cropping seasons II were recorded. The maximum millable canes of 1, 16,500 and 1, 10,400/ha, 282 and 272 cm of cane length, 2.9 and 2.5 cm of girth, 27 no 25 no. of nodes/cane and 1.54 and 1.40 kg of individual cane weight in respective cropping seasons were resulted with the Po.E application of ALH 516 @3000 g/ha. However, the above values are comparable with its next lower dose of ALH 516 @ 2500 kg a.i/ha. In both the seasons the decreased values of the above yield parameters were recorded with the unweeded control. Regarding cane yield the maximum cane yield of 127.3 and 122.6 t/ha which was 33.5 and 34.8 per cent higher than the unweeded check in the respective cropping years. The consistent enhancements with varied sugarcane yield attributes with Post emergence application of ALH 516 @3000g/ha might have positively reflected upon the maximum cane yields in both plant and ratoon crop.

CONSTRAINTS EXPERIENCED BY FARMERS ON INTEGRATED FARMING SYSTEM IN TELANGANA STATE

S. Kavitha¹, G. Samuel², I. Sreenivasa Rao³, M. Goverdhan⁴ and D. Srinivasa Chary⁵

¹Department of Agricultural Extension, College of Agriculture, Rajendranagar, PJTSAU, Telangana

²PJTSAU, Rajendranagar, Hyderabad-500030

³EEL, Rajendranagar, Hyderabad-500030

⁴ARS, Kampasagar, Nalgonda-508 207

⁵Department of Statistics and Mathematics, College of Agriculture, Rajendranagar, Hyderabad-500 030

Abstract

Agriculture plays a vital role in many rural farm families. Crop alone enterprises may not sufficient to lead meaningful life. Hence, it is suggested to keep related enterprises of backyard poultry, goat, milching cow, mushroom and other activities as subsidiary which deliver regular income. Considering the multiple activities suitable various eco systems, the present study was conducted to identify the constraints expressed by farmers in Integrated Farming System An exploratory research design was employed for the investigation. The total sample size was 180 respondents. Data was collected by using well-structured interview schedule. Data were analysed by using percentage analysis and rank order method. The results of the study revealed that constraints faced by Integrated Farming System (IFS) farmers were categorized into three viz., technological, operational and marketing constraints. Poor knowledge on suitable cropping systems in Integrated Farming System and their interaction (86.67%), lack of knowledge on usage of ICT tools in farming (80.00%) were major technological constraints, irrigation and labour problem (90.00% and 86.67%) were major operational constraints, lack of skills and knowledge on online marketing (90.00%), price fluctuations (76.67%) were important marketing constraints experienced by IFS farmers. Adequate training and necessary marketing intervention needs to be facilitated to enhance farmers interest and sustaining the farm enterprises.

DIAPAUSE AND COLD HARDINESS IN INSECTS: BIOCHEMICAL ASPECTS

Sachin and Sheenam Bhateja

MPUAT, Udaipur

Abstract

Diapause is genetically programmed pre-emptive developmental response to changing seasons and environmental conditions. It is an environmentally adaptive dormancy that can occur during any stage of development (egg, larva, pupa or adult) but the diapausing stage is consistent and specific within a species. Diapause can be categorized according to seasonal variations as aestivation (summer diapause) or hibernation (winter diapause); or according to life stages as an egg (embryonic), larval, nymphal or adult (imaginal, reproductive) diapause; or according to the influence of environmental factors as obligatory and facultative diapause. Obligate diapause is often universal, resulting in strictly univoltine life cycle with every individual in every generation experiencing diapause, irrespective of any possible environmental variations. On the other hand, facultative diapause occurs due to environmental variations and results in a multivoltine life cycle (Gill *et al.*, 2018). Most commonly, insects have a facultative diapauses, in which there is a developmental stage this is responsive to specific environmental 'cues' (the sensitive stage) that programme the diapause. Thus, the sensitive stage marks the physiological decision to either diapauses or delay entry into diapauses for another generation (Denlinger, 2002). Further, diapause in insects is characterized



by low metabolic rate and the induction, initiation, determination, maintenance and termination of diapause under the control of endocrinological mechanisms mediated by environmental stimuli (Kostal, 2006). Significant Biochemical changes like glycogen accumulation, sugar level changes and change in glycogen accumulation rate was reported in silkworm diapausing eggs by Singh *et al.* (2013). Diapause can be controlled by many ways including hormones, chemicals, wounding, alteration in chromosomes and modifications of environment factors, including moisture, temperature, photoperiod and oxygen. A hormone named 24-aa neuropeptide, also called as diapause hormone (DH) is known for regulating diapause (Gill *et al.*, 2018). Many species of insects that establish in temperate or colder climate areas enhance their cold tolerance before the onset of winter and spend the winter in diapause in a characteristic life stages. Based on physiological investigations, it is often stated that there are three main strategies for survival as diapausing at low temperatures in winter, which are chill-susceptible, freeze-tolerance, and freeze-avoidant. According to this classification, the freeze-intolerant (or freeze avoiding) insects are capable of decreasing their supercooling points (SCPs) under cold temperature stress, but freeze-tolerant initiates ice formation in extracellular spaces. For the unfavorable thermal conditions, an insect synthesizes and accumulates various types of low-molecular-weight compounds, such as polyhydric alcohols (polyols), sugars, and some of the amino acids. The synthesis of these compounds whose main task is to inhibit the growth of ice lattice has been reported in some insects for resistance to future hazardous changes of environmental conditions (Mohammadzadeh *et al.*, 2017).

GREEN SYNTHESIS AND CHARACTERIZATION OF MAGNESIUM OXIDE NANOPARTICLES FROM LEAF EXTRACTS OF *AMARANTHUS RETROFLEXUS* AND *AZADIRACHTA INDICA*

Sagar Dhage S.^{1*}, D.P. Biradar¹, Y.R. Aladakatti¹, S.S. Chandashekhar² and Ravikumar Hosamani³

¹Department of Agronomy, University of Agricultural Sciences, Dharwad-580 005, Karnataka, India

²Department of Seed Science and Technology, University of Agricultural Sciences, Dharwad-580 005, Karnataka, India

³Department of Agricultural Entomology, University of Agricultural Sciences, Dharwad-580 005, Karnataka, India

*Corresponding author : sagardhage013@gmail.com

Abstract

Among plant extracts, neem leaf extract was found effective for successful synthesis of MgO nanoparticles. The main phytochemicals present in neem leaf extract acts as reducing and capping agents for synthesis of MgO nanoparticles. The bio reduced MgO nanoparticles were characterized by using surface plasmon resonance analysis (UV-Vis spectroscopy), particle size and distribution analysis (PSA), surface morphology analysis (SEM) and elemental distribution analysis (EDX). The UV-Vis spectral analysis confirmed that the maximum absorption at 279 nm range corresponds to the intrinsic band gap of MgO nanoparticles. Particle size analyzer confirmed synthesized particles are of nanoscale *i.e.*, 48.1 nm. SEM images confirmed synthesized nanoparticles were found to be relatively oval shaped and EDX confirmed peak is of MgO nanoparticles. This is a simple and effective method which could be an alternative for chemical and physical methods for the large-scale production of MgO nanoparticles.

RECENT ADVANCES IN PLANT PHENOMICS

Sk. Sameera*, M. Reddissekhar, P. Shanthi, V. Lakshminarayana Reddy, Ch. Sree Lakshmi, P. Maheswar Reddy, Sk. Nafeez Umar and P. Srivalli

S.V. Agricultural College, Tirupati, Chittoor, (ANGR Agricultural University, Guntur, Andhra Pradesh)

*Email : s.sameera@angrau.ac.in

Abstract

The world population is expected to grow to 8.30 billion by the end of 2030 and surpass 9 billion by the end of 2050. To feed the world population, the crop yields are required to grow at an annual rate of 2.4% (Ray *et al.*, 2013). Further, changes in the disease and insect-pest scenario and their shifts among regions and production systems also pose a serious threat to agricultural production. Therefore, addressing these challenges requires the development of climate-resilient varieties of crop plants (Leakey *et al.*, 2009) by connecting genotypes with phenotypes so that the fullest potential of a genotype can be realized in given environments. Phenotyping of valuable agricultural traits such as grain yield, abiotic stress tolerance, and nutritional quality is widely recognized as the most laborious and technically challenging because replicated trials are necessary across multiple environments over a number of seasons. The bottlenecks in field phenotyping have driven intense interest over the



past decade and hence efforts have been made on development of new high throughput phenotyping tools and techniques such noninvasive imaging, spectroscopy, image analysis, robotics and high-performance computing for phenotyping. UAV-based phenotyping platforms are flexible and easy to operate with low hardware cost and high efficiency in comparison with ground-based platforms. Exploiting the advantages of ground and aerial platforms by combining the two is likely to offer flexible crop phenotyping in the near future. Pasala and Pandey (2020) highlighted the usage of different plant phenotyping techniques in stress identification, study of physiological processes, rapid and efficient screening, dissection and confirmation for understanding the genetic basis of different traits, genes and aspects which can be utilized in forward and reverse genetics. Therefore, for efficient use of phenotyping techniques providing proper training to the next generation researchers and multidisciplinary communication along with public-private partnerships can enhance the genomic and phenomic advancements that can assist in establishing food security.

ECONOMICS OF RAPESEED AND MUSTARD PRODUCTION IN BEGUSARAI DISTRICT OF BIHAR

Sachin Rathour^{1*}, Meera Kumari², Sarita Nakhakpam², C.K. Panda² and S.K. Behra

¹Department Of Agricultural Economics, BHU Varanasi-211005

²Bihar Agricultural University Sabour-813210

*Corresponding Author Email : sachinrt86@gmail.com

Abstract

India ranked third in the rapeseed-mustard production after China and Canada with 16 per cent of world's total production whereas Bihar ranked ninth in the country in rapeseed-mustard production, with a growth rate of 7.34%. The area, yield and price of rapeseed-mustard play a greater role in enhancing of rapeseed-mustard cultivation. Therefore, the present study was undertaken to analyze the trend in area, production and productivity along with the cost and return from rapeseed-mustard production. Further the constraints faced by the famers were also documented and ranked. Primary data to estimate costs and return were collected from 120 rapeseed-mustard farmers of Begusarai district from a cluster of three villages each from two blocks for the agricultural year 2020-21 through SRSWOR Technique and secondary data were collected from DES, Govt. of Bihar. The sample was dominated by semi-medium farmers followed by medium, marginal & small and large farmers. A negative growth rate (CAGR) in area (-0.05%) was observed while the growth in production and productivity of rapeseed-mustard during 1998-99 to 2018-19 in Bihar were positive and significant, whereas in Begusarai district growth in the area, production and productivity, during the same period were positive and significant. The average total cost of cultivation of rapeseed-mustard in study area was estimated as Rs. 63873.1 per ha and the average gross income obtained was Rs. 83746.92 per ha. The return to cost ratio was 1:1.39, implying that rapeseed-mustard fetched an additional return of 39 paisa on each rupee spent. The constraints faced by the farmers were identified using Garrett's Ranking Technique and was found that, out of ten identified constraints lack of good variety of seed and high transportation cost with 89.3 and 76.58 Garrett Score, respectively were two major constraints in study area. Study suggested that the outreach of most modern crop production technology and processing units may be facilitated up to the last farmers for better future of rapeseed-mustard in the study area.

PINE NEEDLES PARTICLE BOARD : A SUSTAINABLE SUBSTITUTE TO WOODEN BOARDS

Sangya Singh and Deepa Vinay

Department of Family Resource Management, GBPUAT, Pantnagar

Abstract

Particle boards are wood composite prepared from wood waste, leaves, stalks, wood shaving, polymeric resin etc. The use of alternative raw materials such as agricultural biomass and recycled wood waste and by-products in particleboard production is a viable approach to respond to the increased global demand for wood-based materials, and it is a key circular economy principle as well. This leads to a growing tendency of recycling waste materials and using them in the production of particle boards. Particle Boards are produced from Municipal solid waste, agro-waste materials such as rice husk, jute sticks, waste wood, sugarcane waste, kitchen waste, etc. The world is leading towards sustainable development thus use of particle board can help us in achieving a small part of it. The physical and mechanical properties of these boards are then determined by



using a series of tests like moisture content test, water absorption properties, thickness swelling, tensile test, etc. Properties of these raw materials were also compared in terms of their physical as well as mechanical parameters. The results from this study indicated that technically waste paper could be a potential substitute material for particleboard manufacture and hence the board thus prepared is environment friendly.

EFFECT OF MOISTURE CONSERVATION, NUTRIENT MANAGEMENT AND IRRIGATION ON PLANT HEIGHT AND YIELD OF CHANDRASUR (*LEPIDIUM SATIVUM* L.) IN CENTRAL UTTAR PRADESH

S. Kumar, Rajnish Kumar, M. Kumar, K. Kumar, R. Singh and P. Singh

Chandra Shekhar Azad University of Agriculture and Technology, Kanpur

Email : sarvesh200517@rediffmail.com

Abstract

A field experiment was carried out during two consecutive rabi season of 2015-16 and 2016-17 at Soil Conservation and Water Management Farm of CSAUAT, Kanpur to assess the effect of nutrient management and irrigation on growth and yield of chandrasur (*Lepidium sativum* L.) under different moisture conservation practices. The result shows that root development parameters viz., depth of root (cm), number of root plant-1, and yields viz., seed, stover and biological yield of chandrasur was significantly increased with irrigation applied at 35 and 70 days after sowing as compared to irrigation given at 35 and 60 days after sowing and irrigation applied at 35 days after sowing during both the years of study. Fertilizer dose 75% N through fertilizer + 25% N through vermicompost + PSB produced significantly highest all growth parameters and yield of chandrasur than the application 75% N through fertilizer + 25% N through FYM and 100% N through fertilizer during both the years of study. Under different moisture conservation practices, higher root development parameters viz., depth of root (cm), number of root plant-1, and yields viz., seed, stover and biological yield of chandrasur produced higher with weeding and hoeing + organic residue mulch @ 4 t ha⁻¹ than organic residue mulch @ 4 t ha⁻¹ and control during 2015-16 and 2016-17.

DAIRY PRODUCTS FOR LIVELIHOOD SECURITY AND SUSTAINABLE AGRICULTURE

Seema Singh, Lalit Kumar Das and Anvi Kumud

KVK, Dhanbad Jharkhand, SHUATS, Prayagraj

Abstract

Burfi, Peda and Kalakand are the most popular indigenous milk sweets of India. Besides their memorable taste and aroma, sweets are rich sources of milk proteins, minerals, energy and growth promoting factors. Milk sweets trade has remained in the hands of who do not pay any attention to hygienic conditions during production and marketing. Except for the use of paperboard, cartoons practically no modern packaging ideas are employed. No conscientious efforts have so far been made to overcome, the problems associated with milksweets, Indian dairy scientists have conducted microbiological analysis on Khoa and khoa based sweets. At FAO sponsored international workshop on Indigenous Milk Products held in Anand, India (1991). The individual characteristics of milk products indigenous to India were highlighted, the traditional processes employed for manufacturers of the commercially important indigenous milk products. Based on the delicious taste and high nutritional value of indigenous milk sweets, it is important to maintain the quality made everyday requirements of everyone by regulating the extent of drying and proper sanitary care taken during and after preparation to minimize all defects of microbiological and non micro bial origines. The study was carried out. A total 75 samples of khoa based sweets i.e. Peda, Burfi & Kalakand sold in Allahabad city from five different locations and from different directions were collected and carried out in laboratory of Departments of Biological Sciences of AAI, now it is SHUATS, Prayagraj to study the microbiological quality for enumeration of Standard Plate counts, Proteolytic counts, Lipolytic counts, yeasts and Moulds counts and presumptive coliform test. The observations were made that average microbiological loads of peda were significant in comparison to burfi and kalakand, comparative standard plate counts, proteolytic and lipolytic counts, yeasts and mould counts were lower in these samples collected from different locations and different directions of Allahabad city. The higher microbiological loads of Burfi in comparison to Peda & Kalakand was found. The observations of average SPC, PC, LC, Yeast & Mould counts per gm of peda were between 12.2- 16.8x 10³ to the power four, 1.8 - 4.4 x 10⁴ (4), 1.4 -4.4x10⁴(4), and 1.4 -9.2 x 10⁴(4) found respectively. It can be concluded that regular awareness programs, training, method demonstrations, for quality assessment



with good dairy farming and indigenous milksweets making practices in convergence with government and non governmental departments and KVKs would pave the way to maintain food safety and quality from local to global food, nutrition and wellness security. It was found that decreases in total number of microorganisms during storage in Modified Atmospheric packing (MAP) and normal oxygen scavenger packing (Kumar, Bandyopadhyay and Punjra,1997).

Based on the research findings & recommendations Training programmes on role of farmwomen in dairy farming, its indigenous milk products preparations and its marketing were conducted the participation level of farmwomen in dairy farming for food diversification in farm families were found encouraging. Training programme imparted to dairy farmwomen at Dairy Development centre for six districts of Santhal Paragana Region of Jharkhand State during 2010-14. 200 dairy farmers/farmwomen were interviewed purposely for the adoption level. Training on dairy farming, financial management, insurance of cattle, nutrient management, organic farming of fodder, ecofriendly vermicomposting, precautionary measures for cattle value addition of milk & its marketing were imparted. The results showed that majority of dairy farmers/farmwomen had very low level of knowledge about improved dairy practices its value addition and marketing. Dairy farmers/farmwomen had highly found significant difference after the training, extension contact, change in attitude, gain knowledge, extent of awareness, mass media exposure, economic motivation attitudes towards dairy farming and knowledge about improved dairy practices its value addition and marketing. While technological high impact observed in increase in adoption of new milch producing varieties increase in income, increase in milk production by the dairy farmers/farmwomen its value addition. In view of the importance attached to farmwomen role in agricultural activities for food diversification in farm families is required thru effective extension services to further emphasize the relevance of agricultural extension services and to increase farmwomen's access to information, land resources, credit and subsidized inputs. There is a need to utilize diverse information sources for obtaining more dairy farming information by the dairy farmers/farmwomen for livelihood security & sustainable Agriculture in farm families from local to global promotion in convergence with all the agriculture and allied sectors of Government & non government departments.

EFFECT OF FOLIAR NUTRITION ON GROWTH, YIELD AND ECONOMICS OF LITTLE MILLET

Senthamil E.^{1*}, C. Kalaiyarasan² and S. Jawahar²

¹Department of Agronomy, University of Agricultural Sciences, Dharwad-580 005

²Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar-608 002

*Corresponding author Email : elasenthamil@gmail.com

Abstract

A field experiment was conducted during July - September 2020 at Achalvadi village, Harur block of Dharmapuri district in Tamil Nadu to study the effect of foliar nutrition on growth, yield and economics of little millet. Experiment consisted of ten treatments and three replications was laid out under randomized block design. Application of RDF(44:22:0 kg of NPK ha⁻¹) + EFYM @ 750 kg ha⁻¹ + foliar application of 2% urea at 30 DAS + foliar application of Silixol plus @ 1 ml/litre at 45 DAS (T₇) produced the maximum values of growth parameters viz., plant height of 41.66 and 71.30 cm at 30 and 45 DAS respectively, leaf area index of 3.1 at flowering stage, dry matter of 28.70 g plant⁻¹ at harvest stage and earliness in days to 50% flowering of 50.33 days, yield attributes viz., no of tillers plant⁻¹ (4.73), no of productive tillers plant⁻¹ (4.46), panicle length (32.86 cm) and yield viz., grain yield (1612 kg ha⁻¹) and straw yield (4632 kg ha⁻¹) over the other treatments. With regard to economics of crop, the same treatment has recorded maximum values for gross income (Rs.48360 ha⁻¹), net income (Rs.35221 ha⁻¹) and B:C ratio (3.68). This treatment was followed by application of RDF + EFYM @ 750 kg ha⁻¹ + foliar application of 1% KCl at 30 DAS + foliar application of Silixol plus @ 1 ml/litre @ 45 DAS (T₉). Lower values of growth parameters, yield attributes and yield were recorded under the control treatment (T₁).

INSECT RESISTANCE TO BT TOXINS AND ITS MANAGEMENT

Sheenam Bhateja and Sachin

MPUAT, Udaipur

Abstract

Bacillus thuringiensis (Bt) is a gram positive, rod-shaped and sporulating bacterium that produces a wide variety of insecticidal proteins active against larvae of very diverse insect orders. After ingestion by a herbivorous insect, the crystal



dissolves in the alkaline environment of the insect midgut, releasing one or more insecticidal crystalline proteins (ICPs), also known as a delta-endotoxin (Bravo *et al.*, 2007). ICPs can be activated by midgut proteases. Once activated, the ICPs interact with larval midgut epithelial cells and destroy membrane integrity, ultimately leading to insect death. More than 70 kinds of Cry genes (Cry1 up to Cry70) are described (Kebede, 2020). Cry1A family is the most commonly used *Bt* toxins, especially Cry1Ac in transgenic *Bt* cotton and Cry1Ab in transgenic *Bt* corn. Genetic modification of plants has helped the agricultural system flourish but unfortunately, the field population of pests evolved resistance to different *Bt* toxins and the number of resistant species is going to increase, which is threatening to the continuous success of *Bt* crops (Elzaki, 2016). The number of resistant species has been increased worldwide, 13 cases of field-developed resistance to 5 *Bt* toxins in transgenic corn and cotton have been reported (Sheikh *et al.*, 2017). Insect pests develop resistance to *Bt* toxins by different mechanisms. Therefore, understanding of the molecular and genetic basis of resistance to *Bt* could help in designing a suitable management approaches to delay the resistance development in the insect pests (Ferre and Van Rie, 2002). To prevent the onset of resistance, it is essential that farmers understand and implement Insect Resistance Management (IRM) practices. Two or more strategies can be combined together by deploying one or several genes (Gene strategies), high dose of the endotoxin (Dose strategies) and may be grown along with refuges, as mixtures or separate.

IMPACT OF CLIMATE CHANGE ON FOOD SECURITY : CURRENT CHALLENGES

Shiv Poojan and Amit Kumar Sharma

Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur Bihar -848125

Abstract

Climate change is now having an influence on global agriculture and food production. Nevertheless, the direct relationship between climate change and federal food security is largely unexplored. Food security must only be affirmed and improved through a combination of interventions spanning multiple activities, from production to distribution and allocation. Despite numerous studies showing the importance of both policy and institutional intervention strategies in ensuring food security following a shock, the consequences of climate change and adaptation community has been slow to recognize these lessons. Climate-related factors might affect food safety via a variety of pathways, including changes in precipitation and temperature patterns, increased frequency and intensity of extreme weather events, ocean warming and eutrophication, and changes in individualized transport pathways, among others. Changes in climate may also have an impact on socio-economic status aspects of food systems such as agriculture, animal production, global trade, demographics, and human behavior, all of which have an effect on food security. Given the critical threats to food security, the emphasis must shift to a framework agenda in order to potentially deal with current challenges. As a result, by scrutinizing all factors, this review seeks to have a more objective perspective and thus interpret the integration association between food and climate change.

HAPLOTYPE BLOCK ANALYSIS REVEALS QTLS FOR MILK PRODUCTION AND REPRODUCTION TRAITS IN KARAN FRIES CATTLE

Shivam Bhardwaj, Yaser Mushtaq Wani, Oshin Togla, Jigyasha, Sabyasachi Mukherjee & Anupama Mukherjee

Animal Genetics and Breeding Division, ICAR-National Dairy Research Institute, Karnal-132001 (Haryana)

Abstract

At NDRI, a crossbreed of native and foreign cattle breeds was developed as the Karan Fries strain in 1982. Six generations of composite cattle have already passed, and it's time to assess the genomic characteristics of this recently established breed in terms of the selection signatures for long-term genetic improvement. The present study explored the genomic distribution and the patterns of haplotype blocks based on SNPs in 48 Karan Fries cattle using 777k Bovine Bead Chip array. Standard quality checks on the genotypic data were performed. The largest average block structures (16.63 Kb) were found on BTA5, suggesting a strong SNP propagation. A total of 4,09,541 SNPs were found in blocks with 40% genome coverage. The top 1% of all blocks in terms of haplotype length that were found and annotated against the cattle QTL database revealed that the bulk of long haploblocks are related to QTLs for diverse economic traits. Reproduction and milk production features were shown to have the most associations. QTL enrichment ($p < 0.05$) showed maximum QTLs for calving ease, milk fat yield, milk yield, non-return rate, and gestation length. These findings expand our knowledge about genomic diversity in terms of haploblock



structures in composite cattle and provide helpful information to organize their breeding programs and for sustainable development.

FOOD PACKAGING TECHNOLOGIES IN POST-HARVEST

Shivangi Jain* and Ramandeep Singh

School of Business Studies, Punjab Agricultural University, Ludhiana

*Corresponding Author's Email: shivangi-2058007@pau.edu

Abstract

Supporting agriculture in developing nations is the most effective way to enhance the lives of millions of people living in poverty. In agriculture, post-harvest handling activities are indeed, responsible for preserving food quality as it travels through the supply chain. Food packaging plays an important role in controlling post-harvest loss right from crop harvesting to its final consumption. In order to keep up with the highly competitive world, changing consumer preferences, technological advancements, environment and food safety concerns, packaging industry has grown and innovated. As a result, certain advancements in food packaging technology such as active packaging, intelligent packaging, smart packaging, nanotechnology etc. have emerged. Such advancements have revolutionised the food packaging industry from mere packaging to an experience today. However, environmental issues associated with packaging waste have grown dramatically in recent decades. Such issues call for a more sustainable approach towards food packaging material in order to set foot in the virtuous loop of circular bio-economy. With further developments in sustainable or eco-friendly food packaging, the environmental impact of packaging can be significantly reduced via the use of biodegradable or edible materials, agricultural waste, plant extracts, bionanomaterials, etc. Apart from human health considerations, the carbon, energy, water, and land footprints must be considered while developing new food packaging materials.

THE STUDY ON CONTINGENT EFFECT OF ONLINE FOOD HABIT AMONG STUDENTS

Shivani Singh, Mukta Singh and Nidhi Singh

Department of Food Science and Nutrition, Banaras Hindu University, U.P.

Department of Food Science and Nutrition, Chandra Shekhar Azad University of Agriculture and Technology Kanpur UP,

Email : shivinduat1996@gmail.com

Abstract

The data obtained from responses to the questionnaire and tabulated and analyzed the data for this purpose was collected with the help of readily available tools. The purpose of this study was to find out students perception toward online ordering food among different hostels in BHU. From the observation, I have concluded that 50% student using swiggy app in comparison of other food online services, 13% students ordering meal for dinner, 10% students order food occasionally and 15% students order fast food, 14% students have normal health status after consuming food. 75% students are normal, 15% are overweight and 10% Obese according to their health status.

SURVEILLANCE PROGRAMME OF LSD IN THE STATE OF JHARKHAND

Shreya Sinha¹, Bipin Bihari Mahtha², Swati Sahay¹ and Susuvi Kumari¹

¹Ranchi Veterinary College Kanke Ranchi Jharkhand,

²Institute of Animal Health and Production, (IAHP) Kanke, Ranchi Jharkhand

Abstract

Lumpy skin disease (LSD) is an infectious viral disease of cattle and buffaloes caused by capripox virus of family poxviridae. It is transmitted by arthropod vectors such as mosquitoes, biting flies and ticks. The disease is characterized by mild fever for 2-3 days followed by development of stiff, round cutaneous nodules (2- 5 cm in diameter) on the skin all over the body. Symptoms may include lesions in mouth, pharynx and respiratory tract, emaciation, enlarged lymph nodes oedema of limbs reduction in milk production, abortion, infertility and sometimes death. Representative samples (EDTA blood and skin biopsies/scabs) from animals in LSD suspected outbreaks should be referred to ICAR NIHSAD/ NIVEDI Bengaluru for laboratory testing. From Ranchi, Latehar and Palamu district serum, skin scab and nasal swab were sent to NIVEDI



Bengaluru. Out of eighteen serum samples from Latehar twelve samples were found positive for partial p32 gene capripox virus nucleic acid and six samples were found negative. All twenty nasal swab samples from Khallari and Chanhoo block of Ranchi district were subjected for partial p32 gene capripox based PCR by NIVEDI Bengaluru and found positive. Similarly twelve scab samples from Palamu district were found positive for partial p32 gene capripox virus and ten blood samples were found negative. Since several emerging diseases have animals as reservoir the disease surveillance in animals has added advantage of protecting human land by early detection prevention and control of zoonotic disease.

USE OF ORAL IVERMECTIN IN THE MANAGEMENT OF AMITRAZ RESISTANT GENERALIZED DEMODICOSIS IN DOG

Abhishek Kumar, Shubham Kumar, Vikash Kumar and Puja Mukherjee

Department of Veterinary Medicine, Ranchi Veterinary College, Ranchi

Abstract

Canine demodicosis is a common parasitic dermatoses caused by *Demodex canis*. Six dogs that were confirmed as case of generalized demodicosis which had failed to respond to weekly application of topical amitraz solution over a period of 6-8 week were selected in this study. The common clinical signs exhibits were scaling, hair fall, erythema, pustules and crusty lesions all over the body and more pronounced in the region like perioral, periorbital, paws and on dorsal aspect of the tail. All these dogs were treated with tab. ivermectin @600µg/kg b.wt. orally once daily. No parasitocidal agent was used topically or systemically during the course of treatment. Physical examination and deep skin scrapping examination were performed every 2 weeks. Improvement in condition was observed as evidenced by skin scraping and resolution of clinical signs. Five out of six cases showed improvement in resolution of clinical signs and skin scraping examination was found to be negative for mites by mean duration of 6.6 week (6 to 8 week) and after that treatment was continued for 3 more weeks. Five dogs were re-examined after withdrawal of treatment and all these dogs did not develop any skin lesions and were considered as cured. One dog was considered as failure which showed only slight improvement and failed to be free from mites on deep skin scraping examination. Hence, oral ivermectin @600 µg/kg b.wt. orally once daily proved effective in treatment of canine generalized demodicosis.

NATURAL FARMING AND ITS ROLE IN AGRICULTURE

Siddhant Tomar*, Divisha Chaudhary, Shashank Tomer and Lalit Kumar

Department of Soil Science and Agricultural Chemistry, SVPUAT, Meerut, U.P.

*Email : lalit1997@ymail.com

Abstract

Natural farming is a unique farming approach introduced by Masanobu Fukuoka. Though green revolution adopted in mid-1960's helped in over-coming the food shortage in the country, but intensification of agriculture has led to severe impact on soil health and environment and also lead to increase in cost of production and ultimately decrease net returns to farmers. Organic farming also seems to be less attractive due to non availability of sufficient dung or other raw materials besides to incurred high input cost to manage and maintain the organic resources. Therefore, now a day's natural farming concept is becoming more popular among the farmers. Natural farming is a chemical free farming method that integrates crops, trees and livestock allowing functional biodiversity and has very less input cost hence can be termed as an agro-ecological based diversified system (The Hindu Business line, 2021). In this respect in India, Padma Shri Subhash Palekar has developed a Zero budget natural farming model by comprising of various naturally derived components viz., beejamrit, jeevamrit, whapasa and mulching for crop production besides some of the plant protection preparations such as neemastra, brahmastra, agniastra, dashaparni ark & fermented buttermilk for insect and disease control of the various crops. First systematic study on natural farming being conducted by NAARM, revealed that, natural farming has not shown higher yield than conventional farming but leads to increase in microbial activity, improve in the soil physical structure, besides makes the crop resilient to various biotic and abiotic stress (Ranjit *et al.* 2020). Shyam *et al.* in 2019 reported to increase in soil microbial activity and physical conditions as a result of natural farming. Adoption of natural farming is low due to lesser yield, non-availability of efficient markets etc. & there is a need for long term field experiment to understand the scientific facts behind the natural farming and to eliminate the demerits of the same. Therefore it may be concluded that combining natural farming with the present farming



practices may increase the efficiency of farm inputs as natural farming increases the microbial activity in soil but without having a good scientific background, launching any process over large scale may cause a serious threat to food security of the country.

OPTIMIZATION OF DESIGN PARAMETERS OF METERING ROLLER FOR UREA SUPER GRANULE (USG)

Sidhartha Sekhar Swain*, Tapan Kumar Khura, Pramod Kumar Sahoo and Harilal Kushwaha

Division of Agricultural Engineering, Indian Agricultural Research Institute

*Email : swainsidharthsekhar@gmail.com

Abstract

Fertilizer is an important input in agricultural production system. The most used fertilizer is nitrogenous fertilizer, however the fertilizer use efficiency is about 25-40 percent. The use efficiency of inputs can be enhanced through precision application and metering. The cell-type metering system was designed and operation parameters such as cell size, speed of operation, and level of fill in the hopper were optimized for cell fill and broken percentage of cell-type metering mechanism for Urea Super Granule (USG). The aim of this study was to investigate their effect on the cell fill and broken USG percentage. The recorded experimental observations were analysed through central composite design of RSM technique. The cell fill was significantly affected by the cell size ($P < 0.001$), while other two parameters were also affecting the response variables significantly. Similarly, broken USG percentage was significantly affected by speed and cell size was at 1% ($P < 0.001$), and 5% ($P < 0.05$) level of significance, respectively. While the level of hopper fill had not affect the broken percentage of USG. It was found that cell size of 1044 mm², speed of 0.37 m/s and hopper at nearly half full (49.1 % fill) was optimized operational parameter for cent per cent cell fill and minimum broken percentage of USG.

CHITOSAN FROM CRUSTACEAN WASTE-A BIOSTIMULANT FOR TRANSPLANTED GINGER (*ZINGIBER OFFICINALE* ROSC.)

Ann Sneha Baby¹ and Jalaja S. Menon²

¹Department of Plantation Crops and Spices, Kerala Agricultural University, Thrissur, Kerala, India-680 656

²Cashew Research Station, Madakkathara, Kerala Agricultural University, Thrissur, Kerala, India-680 656

Email of corresponding author : annsneha02@gmail.com

Abstract

An experiment was undertaken to know the biostimulant effect of chitosan on growth and yield of transplanted ginger. Chitosan is a cationic biopolymer, well known for its biostimulant property and produced from marine waste such as crustacean shells. Commercial grade chitosan flakes at different concentrations viz., 0 (control), 1, 3, 5 and 7 gL⁻¹ were given as foliar spray at monthly interval for five months in transplanted ginger plants. Morphometric characters such as height and number of tillers were significantly and positively influenced by chitosan application. Photosynthetic rate and leaf area were found highest in plants sprayed with chitosan. Plants sprayed with chitosan 5 gL⁻¹ was found superior in terms of fresh weight of rhizome (353.417 gplant⁻¹). Results obtained from the study indicate that, foliar application of chitosan was beneficial for improving the morpho-physiological characters and yield attributes in ginger.

GENETIC PARAMETER STUDIES IN INTERSPECIFIC AND INTERGENERIC PROGENY CLONES IN SUGARCANE

Sonali Gaur, A.S. Jeena, Rohit, and Divya Chaudhary

Department of Genetics and Plant Breeding, G.B.P. University of Agriculture and Technology, Pantnagar, Uttarakhand

Abstract

Sugarcane varieties grown commercially are polyploid complexes of cultivated and wild species of *Saccharum*. This crop's heterozygous and polyploid origin has resulted in a higher level of genetic diversity. Estimates of genetic progress can indicate the efficiency of breeding programs and to start an efficient selection program, knowing the nature and extent of variability



present in the genetic material is a prerequisite. An experiment was conducted for preliminary evaluation of 18 advanced interspecific and intergeneric sugarcane clones along with three standard checks viz. CoPant 97222, CoPant 5224 and CoPant 90223. The experiment was laid out in randomized block design with two replications at Norman E. Borlaug Crop Research Centre of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand (India), during 2020-21. Observations were recorded on metric data of sixteen quantitative traits, including yield components and juice quality parameters such as germination percent (45 days after planting), the number of tillers ('000/ha) at 90 days, and the number of millable canes ('000/ha) at 300 days, Brix percent, sucrose percent in juice, juice purity percent and commercial cane sugar (CCS) percent at 10 months and 12 months stage, cane height (cm), cane diameter (cm), single cane weight (kg), cane yield (t/ha) and commercial cane sugar (CCS) yield (t/ha) at time of harvest. Employing the standard statistical procedures and data revealed the extent of genetic variability, heritability, and the genetic advance under selection among the clones. Analysis of variance revealed significant differences among all the traits, except for purity% at 10 months. The Variability studies showed the high GCV and PCV for the number of tillers per plant (38.24 % and 39.83 %, respectively), followed by single cane weight at 12 months (32.02% and 33.18%, respectively), NMC at 10 months (29.74% and 31.65%, respectively), CCS (27.40 % and 28.46%, respectively), single cane weight at 10 months (26.57% and 27.60 %, respectively), Germination percent (24.60% and 26.82%, respectively) and Cane yield (22.51% and 23.24%, respectively) indicating the presence of high order of variability for major yield component and offering scope for selection. High heritability was exhibited by most of the traits under study, out of which high heritability coupled with high genetic advance as a percent of mean was observed for no. of tillers (92.13 % and 75.61 %, respectively), SCW at 12 months (93.12 % and 63.66 % respectively), NMC at 8 months (88.31% and 57.58 %), CCS at 12 months (92.68 % and 54.35%), SCW at 8 months (92.71% and 52.72 %), germination percent (84.15 % and 46.49 % respectively) and cane yield (93.85 % and 44.93 %, respectively). These results direct that additive gene action had a chief role in the expression of these major yield components. Consequently, selection could be productive in the improvement of these traits in the desired direction. The hybridization between these clones will certainly lead to transgressive segregants, resulting in the development of superior high-yielding sugarcane.

STABILITY ANALYSIS IN ADVANCED CLONES OF SUGARCANE FOR CANE YIELD

Divya Chaudhary, A.S. Jeena, Rohit, and Sonali Gaur

Department of Genetics and Plant Breeding, G.B.P. University of Agriculture and Technology, Pantnagar, Uttarakhand

Abstract

Sugarcane is an important cash crops as it is one of the most important sources of white sugar. Stability of performance is one of the most important characteristics of varieties to be in cultivation for longer duration. Hence, present study was designed to estimate stability of cane yield performance of fourteen sugarcane genotypes through multi-environment experiment, conducted at two locations for two years i.e., G. B. Pant University of Agriculture and Technology, Pantnagar and KVK, Dhanuari (Haridwar) during the 2020–21 and 2021–22 crop seasons. Data were recorded for cane yield. Analysis of variance indicated that the main environmental effects, genotypic effects as well as interaction effects were significant for this trait, indicating that the performance of most of the genotypes was not the same across the environments. Based on the stability analysis of the Eberhart and Russell model, two genotypes viz., CoPant17221 ($b = 0.35$, $S^2_{di} = 3.85$) and CoPant16223 ($b = 0.69$, $S^2_{di} = 26.37$) were found to be stable across the environments for cane yield. These genotypes had high cane yield with a unity regression coefficient and deviation from regression equal to zero. Hence, these genotypes can be recommended for cultivation in these locations. Whereas, for the genotype CoPant13224 ($b = 2.19$), a significant b value ($b > 1^*$) was found. So, this variety is highly responsive and suitable for a favorable environment.

PADDY STRAW FOR IMPROVED SOIL FERTILITY USING FARM MACHINERY

Sripriyanka S. Nalla*, Santosh, Harshavardhan P., Harish V. and Srinidhi

*Department of Farm Machinery and Power Engineering, College of Agricultural Engineering,
University of Agricultural Sciences, Raichur, Karnataka, India*

**Corresponding author email: sripriyanka1112@gmail.com*

Abstract

Globally, the rice production is 756.7 million tons and rice straw production was approximately 800-1000 million tons, in



which about 600-800 million tons per year was produced in Asia. This continues to rapidly increase due to shorter turnaround time required for intensified rice cropping. Paddy straw has been the major problem for immediate sowing of crop. Hence, majority of farmers choose burning of straw in the field which causes the greater risk to soil as well as environment. Straw incorporation in soil for fertilization in intensive systems is also not possible with two to three crops per year because the turnaround time is too short for decomposition, resulting to poor soil fertilization properties which ultimately hinders crop establishment. To avoid these drawbacks, straw management machinery can be replaced to have safer sowing for the next crop. Incorporation of rice straw into paddy soil can maintain and enhance soil fertility with a proper management. However, ineffective management of straw incorporation can result in a decrease in production efficiency and increased greenhouse gas emissions. Shredders, mulchers, balers, happy seeders and straw reapers are the alternatives that can be used in the paddy fields for management of rice straw. All these machinery are used to either spread the paddy stubbles on the surface or incorporate within the soil.

MICROENCAPSULATION OF NATURALLY ACIDIFIED SUGARCANE JUICE USING SPRAY DRYING TECHNIQUE

Sristi Vats*, Manisha Kaushal, Devina Vaidya, Anil Gupta, Faruk Ansari and Priyanka Chauhan

Department of Food Science and Technology, College of Horticulture, Dr. Yashwant Singh Parmar University of Horticulture & Forestry Nauni, Solan, H.P.

*Corresponding author: sristi.vats@gmail.com

Abstract

Sugarcane (*Saccharum officinarum* L., Poaceae), one of the largest agro-industrial cash crop is cultivated in tropical and subtropical regions of the world. Sugarcane used as juice are valued for their nutritional and medicinal properties. Fresh sugarcane juice has a short shelf life due to the quick degradation induced by high rates of microbiological and enzymatic reactions that occur soon after extraction. Reduction in pH below 4.6 is a crucial action to inhibit the growth of most pathogenic microorganisms. Therefore, reducing the probability of spoilage blending with fruit juice with low pH like kiwi juice pH (3.0-3.5) will decrease the pH value. Among various methods for drying fruit juice indicated spray drying to be one of the most efficient, owing to its quick processing time and high-quality output with excellent reconstitution and sensory qualities. Hence, methods for preservation involving a reduction in the pH of sugarcane juice by acidification and spray drying technology can maintain the marker to the utmost extent. The present study highlights the standardization of the concentration of kiwi juice for acidification in sugarcane juice and the optimization of process variables for microencapsulation by spray drying. Sugarcane juice was stabilized with kiwi juice to reduce the pH by incorporating 18-20% of the juice. Microencapsulation of sugarcane juice is only possible with the addition of a carrier agent. Therefore, maltodextrin at a 12-14% concentration was optimized based on optimal product yield. In addition, an intake air temperature of 170-190 °C, an output temperature of 80-110°C, and a feed rate of 10-14 ml/min were discovered to be optimal for spray drying operations. Moreover, microencapsulation by spray drying proved to be one of the potential technologies to provide a shelf-stable convenience processed product, and the products were found to be appreciably more nutritional.

COMPARATIVE STUDY OF BIOCHAR PRODUCTION WITH BIOCHAR KILNS ON DIFFERENT CROP RESIDUES

Subham Shankar, Uttam Kumar and Asha Kumari Sinha

College of Agricultural Engineering, Birsa Agricultural University, Ranchi-834006 (Jharkhand), India

Abstract

Major crop residues produced in India are rice husk, wheat husk, maize stalk and cobs, millet, sorghum, pulses, oilseed crops, cotton, jute sticks, sugarcane trash, fibrous materials, roots, branches and twigs of varying sizes, shapes, forms and densities. A comparative study of produced biochar in developed BAU biochar kiln, CIAE charring kiln and muffle furnace was characterized in terms of available nitrogen, Available Phosphorus, Available Potassium, pH, Cation Exchange Capacity, Water Holding Capacity, and Bulk Density. Muffle furnace was used as reference for calculating of crop residues of wheat husk, maize stalk, maize cob and rice husk.



Available Nitrogen of all biochars (rice husk biochar, maize cob biochar, and wheat husk biochar) except maize stalk biochar produced by developed biochar kiln was significantly higher than that of CIAE charring kiln. Available Nitrogen obtained by developed biochar kiln were 47.35% (wheat husk), 36.55% (Maize stalk), 60.25% (Maize cob) and 75.08% (Rice husk) in reference of muffle furnace. Biochar produced from wheat husk in the developed BAU biochar kiln were found as available N (5.82 g/kg), available P (3.47 g/kg), available K (92.23 g/kg), pH (10.73), cation exchange capacity (78 cmol kg⁻¹), water holding capacity (71 %) and bulk density (0.55 g/cm³). Similar results were found in other selected crops residues such as rice husk, maize cob and maize stalk.

EFFECT OF FLOORING SURFACE ON FOOT AND LEG PROBLEM IN DAIRY BUFFALOES

Subhash Kachhawaha

Krishi Vighyan Kendra, ICAR-Central Arid Zone Research Institute, Jodhpur-342005 (Rajasthan)

Email : drsubhashcazri@gmail.com

Abstract

Housing of dairy animals are presently made up of bricks, concrete and earthen because it is durable, cheap and resistance to wear and hygienic. However, hard floor surface negatively affect hoof health and comfort, predisposes to pain and lameness and ultimately affect productivity. The present investigation was done to evaluate the foot and leg disorders of buffaloes reared by farmers. The study revealed that leg and foot disorders were maximum in bricks bedded floor (73 %) in comparison to concrete (58 %) and earthen (7%) floor. The leg and foot disorders in earthen floor was significantly ($P<0.01$) lower than both concrete and bricks bedded floor. In case of bricks bedded floor, elongation of hooves, abrasions, hygroma of knee and sole ulcers-bruising were found to be 33, 28, 9 and 3 percent respectively. In concrete floor were 23,12,7 and 16 percent and earthen floor 0.8, 3, 1 and 2.2 percent respectively. The higher levels of leg and foot disorders in bricks bedded and concentrate type floors might be due to their hardness and lack of sufficient movement of buffaloes, as they were mostly kept in confinement housing system without provision of adequate exercise.

STABILITY OF RIVLIN - ERICKSEN FLUIDS IN THE PRESENCE OF SUSPENDED PARTICLES

Subodh Kumar Rana

Department of Mathematics, M.M. College, Modinagar-201204, India

Email : skrmmpg@gmail.com

Abstract

In the present paper we examine, The Rayleigh-Taylor instability of a Newtonian viscous fluid containing suspended particles in a porous medium is considered. The stability criterion is independent of the effect of viscosity and viscoelasticity and is independent on the orientation and magnitude of the magnetic field. The presence of magnetic field stabilizes a certain wave – number band, whereas the system is unstable for all wave numbers in the absence of the magnetic field. The effects of a variable horizontal magnetic field and a uniform rotation are also considered.

IN VITRO SEED CULTURE AND SEEDLING DEVELOPMENT OF *ARNEBIA BENTHAMII* (WALL. EX G. DON) JOHNSTON – A CRITICALLY ENDANGERED HIMALAYAN HERB

Sugandha Pant* and P. Chaturvedi

Department of Biological Sciences, College of Basic Sciences and Humanities, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar(U.S. Nagar)-263145

*Corresponding AuthorEmail: sugandhapant15@gmail.com

Abstract

Arnebia benthamii (Wall. Ex G. Don) Johnston of family Boraginaceae is a high-altitude perennial herb distributed in the subalpine to alpine Himalaya (3000 to 3900 m). This plant has high medicinal value; different parts (root, stem, leaves, flowers, seeds) are traditionally used to cure cardiac disorders. The flowering shoots are used in syrup and jam preparation, which are useful in diseases and high fevers. Roots produce red dye shikonin which has several medicinal properties and is



marketed under the trade name Ratanjot. Extracts of *A. benthamii* have shown radical scavenging, antioxidant, cytotoxic and wound healing activities. Due to overexploitation, the population size of this plant has depleted in natural habitats and the plant is Red listed under the category of critically endangered plants of IUCN. *A. benthamii* regenerates through seeds and roots. The seeds of *A. benthamii* show a very low percentage of germination (31.66%). Considering this, the present work was carried out to improve seed germination under *in vitro* conditions using different plant hormones. Seeds were collected from Bedani (3,354 m), Chamoli, Uttarakhand. The germination experiment was carried out using half and full-strength Murashige and Skoog (MS) media supplemented with or without plant growth regulators with Gibberellic acid (5-30 μ M), 6-Benzyladenine (2-12 μ M), and Sodiumnitroprusside (2-12 μ M). The culture conditions were maintained at 25°C with 24 hrs. of photoperiod using white fluorescent light (40 μ mol m⁻² s⁻¹). Germination percentage, average shoot length, average leaf width, average leaf no. per seedling and seed vigor index were observed. GA₃ at 30 μ M concentration gave the maximum seed germination percentage which was 80% (control=55%) and also the highest value of average length of shoot which was 2.5 cm (control=1.5cm). BA at 12 μ M gave the maximum average no. of leaves per plant. The present findings have implications in conservation of this endangered plant.

MARKETING PRACTICES ADOPTED BY COMPANIES MANUFACTURING HYDROPONIC SYSTEM AND BUSINESS MODEL OF ENTREPRENEURS ENGAGED IN HYDROPONIC CULTIVATION OF CROPS

Sunminder Kaur, Babita Kumar, Savita* and Gagandeep Banga

School of Business Studies, PAU, Ludhiana, Punjab

*Corresponding Author Email : bhumblasavita1995@gmail.com

Abstract

The present study was undertaken to understand the marketing practices of companies manufacturing hydroponic system and business model of entrepreneurs engaged in hydroponic cultivation of crops and also problems and constraints faced by hydroponic companies (installers) and entrepreneurs. The data was collected from 5 hydroponic companies and 17 entrepreneurs engaged in hydroponic cultivation of crops. They were selected on convenience basis and their willingness to respond. The data was collected through two well-designed and structured questionnaire. Case studies were developed to study the business model of hydroponic companies (Installers). Finding revealed that out of 5 hydroponic companies (Installers), 4 companies were micro enterprises and Nutrient Film Technique was mostly installed by these hydroponic companies. Entrepreneurs and farmers are the target market for selling the system. The promotional strategies used by them were personal selling and direct marketing. Some companies got premium prices for their system. Eleven Entrepreneurs/farmers who were engaged in hydroponic cultivation of crops had micro enterprises and 6 were small enterprises. Mostly entrepreneurs did the protected cultivation. They grew both seasonal and off season crops. Tomatoes, Bell-pepper, cucumber, lettuce, spinach, basil, mint were most commonly grown by these entrepreneurs. They used the Nutrient Film Technique system and solid substrate for growing the crops. RO water was used by them for irrigating the plants. They used drip irrigation method for irrigating the plants. They purchased seeds from the seed companies. Entrepreneurs used their own fertilizer recipe to feed the plants. They sold their crops direct to customers. They got fixed prices for crops. The promotional strategies used by them were direct marketing and advertising for selling the crops. Plastic containers are used by them for packing the produce. The study concluded that hydroponic is catching up fast in India as consumer is demanding quality or pesticide free fruits and vegetables and it is likely to grow as an alternative medium of cultivation of fruits and vegetables.

ADAPTATION STRATEGIES FOLLOWED BY THE FARMERS DUE TO CLIMATE CHANGE IN UDAIPUR DISTRICT OF RAJASTHAN

Sumit Kumar Yadav

Department of Extension Education, Rajasthan College of Agriculture, (MPUAT), Udaipur; Rajasthan 313001

Email : syadav12150@gmail.com

Abstract

The present study was undertaken in Udaipur district of Rajasthan in order to identify the adaptation strategies of climate change related to agriculture and allied activities. A sample of 120 respondents from two tehsils (Girwa & Kotra) and eight



villages (Alsigarh, Karget, Pai, Panduna, Mamer, Asawara, Samoli and Ghata) were selected on the basis of random sampling technique. The result revealed that wallowing in animals in summer season for control heat stress, use of improved varieties, use of short duration varieties, crop-livestock diversification, conserving soil moisture through appropriate tillage practices, follow contour practices in hilly areas are most suitable strategies followed by the farmers due to climate change of Udaipur district.

DEVELOPMENT AND ASSESSMENT OF PAPAD BAR FROM JACKFRUIT

Sunita Kumari Kamal* and Sunita Kandeyang

Krishi Vigyan Kendra, Latehar

*Emails : Sunitakamal43@gmail.com

Abstract

India stands second in production of jackfruit in the world, producing 14.36 lakh tones from 1, 02,000 hector. Jharkhand ranks eight in jackfruit production producing 117.46 tones and share is 6.78%. It is underutilized and over produce crop which lacks producing. Raw fruits fetch low income, there by processing of jackfruit is promoted for enhancing the income and shelf life. Entrepreneurship development in rural areas developed value added products from jackfruits. Preparation of papad bar from raw jack fruits were farmer's field is on farm trial by scientific methods. Two types of papad bar was developed by selecting 30 farm women and assessing the nutritive value, storage period and sensory evolution test among rural areas in venerable groups. First type of papad bar was developed by only 100 per cent Jackfruit pulp and second type of papad bar was developed by 75 per cent jackfruit pulp and 25 per cent raw mango pulp with some spices and preservatives. Evaluation of Jackfruit papad bar in sensory evaluation test by 5 point hedonic scale. Colour, Flavour, Taste, Texture and overall acceptability was tested by venerable groups of age between 18-45 yrs in farmers fields. During sensory evaluation test it was observed that more than 86 percent people liked the taste, flavor, texture and colour of mango mix jackfruit papad bar in respect of 84 percent people liked jackfruit papad bar. Storage period of both developed papad bar was fully safe for 6-8 months and cost of production of both developed papad bar was very low and preserves major micronutrients in off season.

IMPACT OF DIFFERENT MODES, LEVELS OF FYM AND FERTILIZER N ON VARIATION OF SOIL PH AND ELECTRICAL CONDUCTIVITY DURING GROWTH STAGES OF PEARL MILLET

Sunita Sheoran*, Dhram Prakash and Parmod Kumar Yadav

Department of Soil Science, CCS Haryana Agricultural University Hisar-125004

*Email: sheoransunita27@gmail.com

Abstract

A long-term field experiment consisting of 3 levels (5, 10 and 15 Mg ha⁻¹), 3 modes (rabi, kharif and both) of FYM and 2 levels of fertilizer N (0 and 120 kg ha⁻¹) was established in 1967 at research farm, CCS Haryana Agricultural University, Hisar. The results showed that regardless of the modes, long-term addition of FYM alone or in combination with N fertilizer decreased the mean soil pH as compared to chemical fertilizers applied alone, however, decrease in mean soil pH was more pronounced when FYM was applied in combination with N fertilizer. At sowing time soil pH ranged from 7.40 to 7.78 among different treatments. Irrespective of modes and levels of FYM and N fertilizer, soil pH was decreased with the progression of growth stages of pearl millet as compared to sowing time; however, the trend was irregular. At tillering and heading stage, soil pH ranged between 7.29 to 7.72 and 7.09 to 7.70, respectively. Irrespective of the modes of FYM and fertilizer N levels, soil pH decreased significantly with increased dose of FYM. The plots dressed with FYM and fertilizer N in both season showed significantly lower soil pH compared to rabi or kharif season application. At maturity stage, soil pH ranged from 7.37 to 7.76 and after harvest of pearl millet, it ranged between 7.33 to 7.74 under different treatments. Mean soil EC showed the irregular trend during different stages of pearl millet. Irrespective of modes and levels of FYM and N fertilizer, soil EC was highest at heading stage and regularly decreased thereafter. At sowing mean soil EC ranged from 0.28-.53 dS m⁻¹ under different treatments. Irrespective of the modes, soil EC increased with increasing application rate of FYM and addition of fertilizer N. At tillering stage, the soil EC ranged between 0.30 to 0.60 dS m⁻¹, while, it varied from 0.32 to 0.62 dS m⁻¹ at heading stage. At maturity stage, soil EC ranged from 0.26 to 0.47 dS m⁻¹ among different treatments and varied between 0.23-0.44 dS m⁻¹ after harvest of pearl millet. Mode of application exhibited significant increase in soil EC and followed the trend as both>kharif>rabi season.



INFLUENCE OF LONG TERM APPLICATION OF MANURE AND FERTILIZER ON CARBON DYNAMICS DURING DIFFERENT GROWTH STAGES OF PEARL MILLET

Sunita Sheoran*, Dhram Prakash and Parmod Kumar Yadav

Department of Soil Science, CCS Haryana Agricultural University Hisar-125004

*Email: sheoransunita27@gmail.com

Abstract

An on-going long-term field experiment consisting of 3 levels (5, 10 and 15 Mg ha⁻¹), 3 modes (*Rabi*, *Kharif* and both) of FYM and 2 levels of fertilizer N (0 and 120 kg ha⁻¹) started in 1967 at research farm, CCS Haryana Agricultural University, Hisar was selected for the present study. The study was conducted after 51 years of experimentation under pearl millet-wheat cropping sequence. The results showed that irrespective of modes of FYM, mean dissolved organic carbon (DOC) and soil organic carbon (SOC) increased up to the heading stage of pearl millet and continuously decreased thereafter. Irrespective of stages, highest and lowest DOC and SOC was observed when 15 Mg ha⁻¹ FYM along with 120 kg N ha⁻¹ was applied in both season and absolute control, respectively. At sowing of pearl millet, DOC content ranged from 50.5 to 243.1 mg kg⁻¹ among different treatment combinations. At tillering and heading stage of pearl millet, DOC content ranged between 66.1 to 282.5 and 69.0 to 298.5 mg kg⁻¹, respectively under different treatments. At maturity and after harvest of pearl millet, DOC content ranged from 57.5 to 277.3 and 45.6 to 268.6 mg kg⁻¹, respectively, among different treatments. Irrespective of modes of application, increasing application rate of FYM and addition of fertilizer N significantly increased the DOC and SOC content in soil. Mode of applications exhibited significant impacts on increase in DOC and SOC content in soil and followed the order both season>khariif>rabi. At sowing SOC ranged from 0.48-1.90% under different treatment combinations. At tillering and heading stage of pearl millet, the SOC ranged between 0.52 to 1.98 and 0.53 to 2.04%, respectively, among different treatments. At maturity of pearl millet, SOC content ranged from 0.50 to 1.97% and after harvest it varied between 0.46 to 1.96% among different treatments. The interaction of mode x FYM was found significant in increasing DOC and SOC content with both seasons application as compared to either single season. The interaction of mode x N was found significant in increasing DOC and SOC content in soil when applied in both seasons or rabi season.

EFFICACY OF STERILIZING AGENTS ON CLEAN CULTURE ESTABLISHMENT IN MICROPROPAGATION OF LIME (*CITRUS AURANTIFOLIA* SWINGLE)

Supreetha B.G.^{1*}, Kulapati Hipparagi² and D.P. Prakasha³

¹Department of Fruit Science, College of Horticulture, UHS, Bagalkot, Karnataka

²MHREC, UHS, Bagalkot, Karnataka

³College of Horticulture, Sirsi, UHS, Bagalkot, Karnataka.

*Corresponding Author Email : supreethagowda15@gmail.com

Abstract

Lime (Citrus aurantifolia Swingle) is one of the major citrus fruits and widely consumed all over the world. The lime majorly propagated through seed, which results in wide variation in the performance due to sexual and asexual (polyembryonic) seedlings. This issue can be solved by *in vitro* propagation. Plant *in vitro* propagation is constantly threatened by microbial and fungal contamination, either from the environment or from the explants. Before inoculating the tissue onto nutritional media, it must be carefully sterilized to avoid infection. It is critical to understand that surface sterilants are harmful to plant tissue at greater concentrations. To reduce tissue death, the concentration of the sterilizing agent and the period of treatment should be regulated. In this study, experiments were designed to establish clean cultures. Treatments included citrimide 0.5 and 0.25 mg/L and mercuric chloride 0.1 and 0.05 % for 5, 8, 10, 12 and 15 minutes. The explants (young nodal, matured nodal and leaf) were collected from the field grown lime plants and first they were washed with running tap water for 20 minutes and then soaked in the solution containing bavistin (2g/L) + citrimide (0.25g/L or 0.5 g/L) + 1 or 2 drops of tween 20 for one hour. Then washed with the sterile water for two times and then treated with the mercuric chloride solution (0.1%) for five min and again washed for three times in sterile water. Then, explants were taken inside Laminar Air Flow chamber and mercuric chloride treatments were imposed. The results found that citrimide 0.5g/L and mercuric chloride 0.05% for 5 minutes was effective in establishing clean cultures (100 %) in young nodal explants and leaf. Whereas, citrimide 0.5mg/L and mercuric chloride 0.05 % for 15 minutes was best in case of matured nodal explants (98 %). The health of the explants was also good and they showed shoot induction and callus formation in nodal and leaf explants, respectively.



EFFECT OF LONG TERM APPLICATION OF FARMYARD MANURE AND FERTILIZER NITROGEN ON SOIL SOLUBLE IONS AFTER PEARL MILLET HARVEST

Sunita Sheoran*, Dhram Prakash and Parmod Kumar Yadav

Department of Soil Science, CCS Haryana Agricultural University Hisar-125004

*Email: sheoransunita27@gmail.com

Abstract

A long-term field experiment consisting of 3 levels (5, 10 and 15 Mg ha⁻¹), 3 modes (*Rabi*, *Kharif* and both) of FYM and 2 levels of fertilizer N (0 and 120 kg ha⁻¹) was established in 1967 at research farm, CCS Haryana Agricultural University, Hisar. The results showed that content of all the water soluble cations after pearl millet harvest were higher with *kharif* application of FYM as compared to *rabi* season application. Content of water soluble potassium, sodium, calcium and magnesium in soil varied from 0.18 to 1.23, 0.62 to 1.35, 0.33 to 1.14 and 0.57 to 1.37 m Eq l⁻¹, respectively, among different treatments. The higher soluble cations content was noticed with both seasons application as compared to applied in *rabi* or *kharif* season only. Among different modes of application, soluble magnesium content followed the order: both seasons>*kharif* season>*rabi* season. Regardless of the mode of application, the soluble cations content were found significantly increased with the increasing application rate of FYM from 5 to 15 Mg ha⁻¹. Addition of 120 kg N ha⁻¹ along with FYM also significantly increased the calcium and magnesium content as compared to FYM applied alone. Soluble chloride, bicarbonate, sulphate content in soil varied from 0.21 to 0.65, 0.11 to 0.47, 1.56 to 3.18 mEq l⁻¹, respectively, under different treatments. Regardless of mode of application, the soluble anions content was found significantly increased with increasing application rate of FYM from 5 to 15 Mg ha⁻¹. Addition of 120 kg N ha⁻¹ along with FYM significantly increased the chloride content as compared to FYM applied alone. In reverse to chloride, addition of 120 kg N ha⁻¹ along with FYM decreased the sulphate and bicarbonate content as compared to FYM applied alone, however, the effect was non-significant. Among different modes of application, water soluble anions content followed the order: both seasons>*kharif* season>*rabi* season.

ESTABLISHMENT OF EFFICIENT STERILIZATION PROCEDURE FOR *IN VITRO* MICROPROPAGATION IN FINGER LIME (*CITRUS AUSTRALASICA* F. MUELL)

Supreetha B.G.^{1*}, Kulapati Hipparagi² and D.P. Prakasha³

¹Department of Fruit Science, College of Horticulture, UHS, Bagalkot, Karnataka

²MHREC, UHS, Bagalkot, Karnataka

³College of Horticulture, Sirsi, UHS, Bagalkot, Karnataka

*Corresponding Email : supreethagowda15@gmail.com

Abstract

Finger lime (*Citrus australasica* F. Muell) is a native Australian species. Finger limes are compact thorny understory shrubs or small trees growing up to 6 m tall in their natural habitat. The fruit is distinctively finger-shaped, can grow up to 12 cm in length. Recent reports suggest that finger lime is tolerant to a devastating citrus disease, Huanglongbing (HLB), also known as citrus greening. Hence, it is an excellent alternative crop under HLB prevalent conditions. Moreover, finger limes unique visual characteristics and high nutrient profile makes it potentially desirable to consumers. It can be grown from seed, cuttings or grafting. They are slow growing and if grown from seed may take up to 15 years to mature. Further, it is important to use fresh seeds. Semi-hardwood cuttings, like seedlings, are slow to grow and have a low success rate. Therefore, grafting on to *Citrus trifoliata* or on a range of other citrus rootstock is preferable. This is advantageous in preventing disease spread but can lead to a shortage of available material for propagating newly released or experimental germplasm. Since, finger limes are monoembryonic and contain only a single zygotic embryo, propagation *via* the seed is not an option. In finger lime, a suitable micropropagation technique could provide a method to rapidly produce plant materials. In micropropagation, sterilisation is a crucial and fundamental component because it enables the *in vitro* propagation of chosen genotype progenies free from external and internal contamination. In this study various concentration of three sterilizing agents (NaOCl, HgCl₂ and ethanol) were used with different timings of exposure to test the effectiveness. The explants (Nodal explants and shoot tip) collected from the polyhouse were firstly washed in the running water for 15 minutes and then they are soaked in the solution containing bavistin (0.2 %) and citrimide (0.05 %) for 3 hours and after that treatments were imposed. The 4% NaOCl is exposed for 3 to 9 minutes and among these three best treatments were selected and it was combined with 0.025, 0.05, 0.1% concentrations of



HgCl₂ for 3, 5 and 8 minutes. The best three NaOCl and HgCl₂ treatments were combined with different exposure timings of 70% ethanol (15, 30 and 45 sec). From the results, the best three combinations were identified (4% NaOCl for 6 min + 0.05% HgCl₂ for 8 min + 70% ethanol for 30 sec, 4% NaOCl for 5 min + 0.05% HgCl₂ for 3 min + 70% ethanol for 30 sec and 4% NaOCl for 4 min + 0.05% HgCl₂ for 5 min + 70% ethanol for 15 sec) which were found effective in establishing clean cultures of 94, 88 and 75 %, respectively.

ESTABLISHMENT OF EFFICIENT STERILIZATION PROCEDURE FOR *IN VITRO* MICROPROPAGATION IN FINGER LIME (*CITRUS AUSTRALASICA* F. MUELL)

Supreetha B.G.^{1*}, Kulapati Hipparagi² and D.P. Prakasha³

¹Department of Fruit Science, College of Horticulture, UHS, Bagalkot, Karnataka

²MHREC, UHS, Bagalkot, Karnataka

³College of Horticulture, Sirsi, UHS, Bagalkot, Karnataka

*Corresponding Email : supreethagowda15@gmail.com

Abstract

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EFFECT OF NUTRIENT ENRICHED COMPOST AND ZINC APPLICATION ON NUTRIENT UPTAKE BY MAIZE (*ZEA MAYS* L.) CROP

Surendra Dhayal

Department of Soil Science and Agricultural Chemistry, Maharana Pratap University of Agricultural and Technology, Udaipur, Rajasthan-313001

Email: sur9694010185@gmail.com

Abstract

The aim of the present investigation is to study the interactive effect of nutrient enriched compost and zinc levels on nutrient uptake by maize seed (*Zea mays* L.). The field experiment was conducted in *Kharif* 2020 at the Instructional Farm (Agronomy), Rajasthan College of Agriculture, MPUAT, Udaipur. The treatments including the four levels of nutrient-enriched compost (NEC) viz., control (NEC₀), 2.0 t NEC ha⁻¹ (NEC₁), 4.0 t NEC ha⁻¹ (NEC₂), and 6.0 t NEC ha⁻¹



(NEC₃) and four levels of zinc application viz., control (Zn₀), 10 kg basal ZnSO₄ + foliar spray of 0.5% ZnSO₄ (Zn₁), 15 kg basal ZnSO₄ + foliar spray of 0.5% ZnSO₄ (Zn₂) and 20 kg basal ZnSO₄ + foliar spray of 0.5% ZnSO₄ (Zn₃) taken in factorial RBD with three replication. The result of the study showed that the increasing level of nutrient enriched compost and zinc upto 4 t ha⁻¹ (NEC₂) and 15 kg ZnSO₄ + foliar spray of ZnSO₄ 0.5% ha⁻¹ (Zn₂), respectively significantly increased (P=0.05) nitrogen (68.59 kg ha⁻¹), phosphorus (18.72 kg ha⁻¹), potassium (21.55 kg ha⁻¹) and zinc (119.33 kg ha⁻¹) uptake by maize seed. From the above result it was concluded that the optimum dose for better nutrient uptake by maize on the Typic Haplustept was the application of nutrient enriched compost @ 4 t ha⁻¹ + basal application of 15 kg ZnSO₄ along with foliar spray of 0.5 % ZnSO₄.

GENETIC DIVERSITY STUDIES IN OAT (*AVENA SATIVA* L.) FOR FORAGE YIELD AND QUALITY PARAMETERS

Swati

Department of Genetics and Plant Breeding, Birsa Agricultural University, Ranchi, Jharkhand

Abstract

Oat (*Avena sativa* L.) is an important winter dual purpose crop, grown for green fodder as well as grain purpose. The experimental material for present study consisted of 34 genotypes of oat. Observations were recorded on eleven quantitative and four quality parameters during Rabi 2021-22 at RVC Farm BAU, Kanke (Jharkhand). Estimates of high heritability (broad sense) was obtained for Days to 50% flowering, Dry matter yield(%), Leaf stem ratio, Crude Protein(%) and Acid Detergent Fibre(%). The magnitude of PCV was greater than corresponding GCV for all characters indicating importance of environment in expression of characters. Green Fodder yield(q/ha) varied from 385.55 to 602.22. This study gives an insight into variability pattern of advance oat lines which will be helpful for further utilisation.

SUSTAINABLE APPROACH FOR WEED MANAGEMENT

Swati Kunjam, Monika Choudhary, Ashish Raja Jangid

Rajasthan College of Agriculture, MPUAT, Udaipur

Email : kunjamswati@gmail.com

Abstract

In the last few decades, the increase in the world's population has created a need to produce more food, generating, consequently, greater pressure on agricultural production. In addition, problems related to climate change, water scarcity or decreasing amounts of arable land have serious implications for farming sustainably. Weeds can affect food production in agricultural systems, decreasing the product quality and productivity due to the competition for natural resources. On the other hand, weeds can also be considered to be valuable indicators of biodiversity because of their role in providing ecosystem services. In this sense, there is a need to carry out an effective and sustainable weed management process, integrating the various control methods (*i.e.*, cultural, mechanical and chemical) in a harmonious way, without harming the entire agrarian ecosystem. Thus, intensive mechanization and herbicide use should be avoided. Herbicide resistance in some weed biotypes is a major concern today and must be tackled. On the other hand, the recent development of weed control technologies can promote higher levels of food production, lower the amount of inputs needed and reduce environmental damage, invariably bringing us closer to more sustainable agricultural systems.

ROLE OF MICROBES IN SOIL HEALTH MANAGEMENT AND PRACTICES: A GATEWAY TO SUSTAINABLE AGRICULTURE

Swati Meel and Baljeet Singh Saharan*

Department of Microbiology, CCS Haryana Agricultural University, Hisar 125 004, INDIA

*Corresponding author : Baljeetsaharan@hau.ac.in

Abstract

In the modern era, our soils are facing the problem of nutrient deficiency. Therefore, we should look into alternative approaches and plant growth promoting rhizobacteria (PGPR) is very important among them. PGPR are the bacteria of



rhizosphere that help in enhancing the plant growth by various processes like production of 1-Aminocyclopropane-1-carboxylate deaminase (ACC), volatile organic compounds (VOCs) and phytohormones. In addition to production, they also help in phosphate solubilization, siderophore production and by exhibiting antifungal activity. In near future, the use of pesticides and chemical fertilizers may be reduced due to the increased potentiality of PGPR. A variety of microbial communities are supported in soil due to moist environment and availability of reduced carbon. The microbial colonization is also favoured due to diverse form of root exudates and presence of plant cell debris. To enhance the plant growth and production, different indigenous PGPR are enriched in respective soils using natural farming practices. PGPR show direct and indirect ways to enhance growth of plant. The direct method is being used for growth enhancement using mineral acquisition and growth augmentation. The indirect method uses a variety of ways to protect plant from pathogen attack by favouring competition and antibiosis. The main problem for farmers is the abiotic stress which adversely affects the plant growth. PGPR having enzyme ACC deaminase helps in conversion of ACC into α -ketobutyrate and ammonia. PGPR produce different VOCs like terpenes, nitrogen-containing compounds and fatty acid derivatives. These mainly helps in the chemical communication between bacteria and plants. These are the most important growth regulators having a great impact on metabolism of plant and stimulation of plant defense response mechanisms in case of stress conditions. PSB strains solubilizes mineral phosphate into soluble form by releasing low molecular weight organic acids by which their carboxyl and hydroxyl groups chelate the cations bounded to phosphate. Siderophores having low molecular weight compounds which are mainly produced under iron-limiting conditions and transport of Fe into microbial cell takes place by chelating the ferric ion (3+) with high specific activity. Indirect mechanism of PGPR, includes production of phenazine, 2,4-Diacetylphloroglucinol (DAPG), pyrrolnitrin and pyoluteorin helps in suppression of different pathogenic fungi and bacteria. Emphasis should be given to explore the potential of isolated PGPR from natural farming conditions and to demonstrate their biocontrol capabilities.

SHORTAGE OF GREEN FODDER AND IT'S MITIGATION AS A MAJOR ISSUE IN DAIRY INDUSTRIES

Tajwar Izhar^{1*}, Shushama Majhi², Ravindra Kumar¹ and Sushil Prasad¹

¹Department of LPM, Birsa Agricultural University, Kanke, Ranchi, Jharkhand

²Department of Agronomy, Birsa Agricultural University, Kanke, Ranchi, Jharkhand

*Corresponding author's email : tajwar_bau@rediffmail.com

Abstract

Livestock is a major source of livelihood security for the poor in most of the developing countries. Apart from being an important source of human nutrition, livestock is also a source of crop nutrition, power for agricultural tillage and rural transportation and a valuable asset, which can be easily encased during emergencies. Livestock has a direct influence on agricultural production. A wide range of products generated from livestock enable farmers to diversity their sources of income and bear risk. In arid and semi-arid regions, livestock is the only source of livelihood, particularly when agriculture fails to withstand the drought.

India inhabits 15% of world livestock on 2% geographical area with 5.23% cultivated fodder area. Feeding accounts 60-70% of total cost of milk production. Livestock share to the total Indian agriculture gross value product is increasing gradually over the years. The growth rate of livestock sector is higher than the crop sector due to assured high income and increasing demand for milk and milk products. But the critical challenge is, per animal productivity with the existing feeding strategy and management practices. Main factor for lower livestock productivity in India is availability of quality feed and it alone contributes nearly 60 % of the total milk production cost. The efficient utilisation of both cultivable and non-cultivable lands helps to improve the yield and system productivity for ensured fodder security

BIOSOLIDS AND ITS IMPACT ON SOIL PROPERTIES AND CROP GROWTH

Utkarsha V. Amolic and Ritu S. Thakre

Department of Soil Science and Agriculture Chemistry, MPKV Rahuri, Maharashtra, India

Abstract

World production of biosolids is continuously increasing due to global urbanization of society and the increase in wastewater treatment coverage. Now a days, the accumulation of biosolids poses a growing environment problem. Waste management



has become a major environmental challenge, and land application of biosolids is generally considered the best option of disposal because it offers the possibility of recycling plant nutrient, provides organic material, improves a soils chemical and physical properties, and enhance crop yield. With the recent banning of ocean disposal and new stringent landfilling regulations, much more biosolids are now beneficially reused.

Biosolids are solid organic matter recovered from sewage treatment process and used as fertilizer. Generally, the term “Sewage sludge” and “Biosolid” are used interchangeably but the term sludge refers to a liquid, produced by WRRFs, that does not submitted to further treatments. However, for EPA (2019), the term Biosolids indicator a sludge that had received one or more treatments, which can be : aerobic or anaerobic digestion, alkaline stabilization, thermal drying, acid disinfection, composting etc. In the past, it was common for farmer to use animal manure to improve their soil fertility but from 1920s, the farming community began also to use sewage sludge from local wastewater treatment plants. Scientific research over many years has confirmed that these biosolids contain similar nutrient to those in animal manures. Biosolids contains essential plant nutrient particularly N,P,K, micronutrients which can supplement inorganic fertilizer inputs to agriculture production system and these biosolids applied at higher rates can produce better crop yield than NPK fertilizer alone. It constitutes an important organic mass for the formation of steady humus and contributes to the improvement of the fertility of soil. However the benefits from biosolids application have to be weighed against potential application deleterious effect such as risk of excessive leaching of nitrate, contamination of soils and crop with human pathogens and heavy metals, nutritional disorders in crop, increase of soil salinity, contamination of groundwater with pesticides, hormones, and pharmaceuticals, and decreased stability of native soil organic matter. For this reasons, this special issue focuses on the agronomic and environmental implication of soil application of biosolids and presents the most recent scientific information on the subject. So by considering this aspect the release of nutrients from biosolids and their effect on soil properties and crop growth were studied.

CONSTRUCTION OF SELECTION INDICES FOR YIELD IMPROVEMENT IN BREAD WHEAT (*TRITICUM AESTIVUM* L.)

Urvashi C. Mangroliya¹, Himalay R. Patel^{2*} and Nikunj A. Parmar¹

¹Department of Genetics and Plant Breeding, College of Agriculture, Junagadh Agricultural University, Junagadh

²Department of Agriculture, Faculty of Science, Marwadi University, Rajkot

*Email: patelhimalay0@gmail.com

Abstract

The current experiment was planned to construct selection indices in 50 genotypes of bread wheat (*Triticum aestivum* L.) by discriminant-function technique under normal sown condition. Thirty one selection indices, involving grain yield per plant and four yield components, were constructed using the discriminant function technique. As there is an inclusion of more number of characters in the index, the efficiency of selection increased. The selection index based on two characters viz., biological yield per plant and harvest index was the most efficient one for obtaining higher yielding lines and results showed that maximum weightage should be given to these attributes while making selection for yield related traits in bread wheat.

EFFECT OF ORGANIC NUTRIENT MANAGEMENT PRACTICES ON GROWTH, YIELD AND QUALITY OF BRINJAL

Uttam Shivan

Department of Horticulture, Rajasthan College of Agriculture, MPUAT, Udaipur 313001

Email : uttamshivran2002@gmail.com

Abstract

Brinjal (*Solanum melongena* L.) is one of the most common tropical vegetables grown in India and is known by a wide range of nomenclatures such as aubergine (French), eggplant, baingan (Hindi), etc. Immature brinjal fruits are used to prepare a variety of curries and dishes. Fruits are moderate sources of vitamins and minerals like phosphorous, calcium and iron and nutritive value varies from variety to variety.

Vermicompost is also another widely used organic manure rich in both macro and micronutrients, besides promoting plant production, microbial humus and nitrogen fixers (Banoet *al.*,1987). Vermicompost is a stable organic fine granular matter,



when applied to the soil, it loosens the soil and enhances the passage to the air inlet. Neem cake is a concentrated organic manure of plant origin mainly obtained from fresh fruits of Neem (*Azadirachta indica* L.) after extraction of oil (as a residue). Neem cakes To live in the environment, the earthworms secrete body fluid through the dorsal pores. The body fluid obtained from the earthworm is called vermiwash, without hurting them. It contains enzymes that are secretion which promote crop growth and yield and also help to establish resistance in crops receiving this spray; these preparations will definitely have soluble plant nutrients other than some organic acids and earthworm and microbial mucus contain not only nitrogen but also some phosphoric acid, besides large quantity of potash.

ASSESSMENT OF GROWTH PERFORMANCE OF DIFFERENT CLONES IN TWENTY FIVE YEAR OLD TEAK CLONAL SEED ORCHARD IN ODISHA

T.L. Mohanty, A. Pradhan, M.C. Behera, H. Nayak and S.G. Nair

College of Forestry, OUAT, Bhubaneswar, Odisha

Abstract

The present study was undertaken to assess the performance of 25 years old clonally propagated teak stand in Odisha. 25 clones were planted in the year 1995 in RBD with 3 replications at Berbera forest in Khurda district of Odisha. Observations on growth characters of different clones showed that plant height was maximum in clone UP-H (18.90m) and minimum height in clones TNT-7(16.55m) and MHSL-A-J-2(16.55m). clone ORPUB-33 recorded maximum volume (1.67m^3) and the minimum volume (0.76m^3) in clone MHSL-A-J-2. Clone ORPUB-6 recorded maximum no. of branches (7.67) and minimum(3.67) in clone MHAL-P-2 and APNPL-11. recorded Maximum inter-nodal length (2.50 m) was recorded in clone MHAL-P-2 and minimum Inter-nodal length (0.80 m) was found in clone TNT-7. Clone MHAL-P-2 recorded maximum clear bole length(6.40m) while the minimum clear bole length was recorded in clone ORNAP-7(3.75m). Clone UP-H recorded maximum crown length (15.10m) and the minimum crown length was recorded in clone ORPUB-19(10.45m). clone APKCC-2 recorded maximum crown width (9.25m) and minimum crown width was recorded in clone ORPUB-12(6.20m). Clone APKCC-2 recorded maximum DBH (0.44m) and the minimum(0.31m) was found in clone MHSL-A-J-2. Clone ORPUB-33 recorded maximum basal area (0.16m^2) and minimum basal area was recorded in clone MHSL-A-J-2(0.07m^2). The volume was found maximum 1.67m^3 in clone ORPUB 33 followed by the clone APKCC-2 (1.59m^3) and the maximum diameter at breast height (0.45 m) was also recorded in clone ORPUB 33 followed by APKCC-2 (0.44 m). The above two clones showed promise in growth performance which needs genetic assessment for improvement programme.

PRECISION HORTICULTURE : MODERN APPROACH TO INCREASE FARMER'S INCOME

¹Vani N.U, ²P.C. Tripathi, ³parvathi Bennurmth

¹Department of Horticulture, IGKV, Raipur

²Division of Fruit crops, ICAR-IIHR, Bengaluru Bengaluru

³Division of flower and medicinal crops, ICAR-IIHR, Bengaluru

*Email : nuvani26@gmail.com

Abstract

Due to a rise in farmer suicides and unstable farmer income, doubling farmers' income has been the government's top priority and sustainable production of horticulture is the key goal. To achieve this, ICAR aims to create and scale up location-specific, affordable, environmentally friendly, and climate resilient technologies and to promote grassroots farm innovations to boost production, productivity, and profitability in the horticulture sector and raise farmers' income. Improved productivity per unit of land, water, and time needed on a socioeconomic level can be addressed with precision horticulture. Management of spatial and temporal variability in fields using information, models and communication technologies is known as precision horticulture. Simply it is the idea of "doing the right thing in the right place at the right time" and provides a novel approach to current horticultural challenges like the need to strike a balance between productivity and environmental considerations as it incorporates methods to satisfy site-specific needs. It rationalizes the use of natural resources and other inputs, gives farmer greater information, early warning on the status of crops, improved production projections and quickly identify the effect of climate change on production and helps to take the necessary steps. In many developing nations, precision farming is still merely an idea, so it requires thoughtful assistance to encourage its quick adoption. Bringing down precision farming



strategies to small scale horticulture farms is needed with the ability to find the knowledge required to lead the new technologies will ultimately have a big impact on how effectively and soon precision horticulture succeeds in doubling the farmer's income.

BIOLOGY OF FALL ARMYWORM, *SPODOPTERA FRUGIPERDA* (J.E. SMITH) (LEPIDOPTERA: NOCTUIDAE) ON SORGHUM

Veena K., B. Riyana Begum and Neethu Roy D.

Department of Agricultural Entomology, College of Agriculture, University of Agricultural Sciences, Raichur-584104

Abstract

Fall armyworm, *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae), that has become a major threat by causing severe damage to maize. Therefore, studying its biology plays a major role. The life history of *S. frugiperda* was studied on sorghum during 2019-20 under the laboratory conditions at the Department of Agricultural Entomology, College of Agriculture, UAS, Raichur, Karnataka. Gravid female was observed laying eggs with the fecundity ranging from 201-731 eggs. Preoviposition, oviposition, incubation, total larval, pupal and adult period were observed to be from 3-4, 2-3, 2-3, 14-23, 7-12 and 7-11 days, respectively. To complete its life, it has taken 37-40 days. The morphometric data revealed that the mean larval length from first instar to six instar was 1.20 ± 0.10 , 3.86 ± 0.97 , 6.79 ± 0.97 , 15.78 ± 0.95 , 20.73 ± 0.92 and 26.65 ± 0.98 mm, respectively. The pupal length was 16.78 ± 0.80 and 17.73 ± 0.84 mm for male and female, respectively. The mean body length for male and female was 14.37 ± 1.00 and 15.66 ± 0.89 mm, respectively.

EMPOWER EVERY FARMER IN EVERY CORNER: EXTENSION AND KNOWLEDGE DISSEMINATION FOR DOUBLING FARMER'S INCOME

Venkteshwar Jallara¹, Chandrika Sharma¹, Vinod Kumar², Mahendra Anjna³

¹Deptt. of Extension Education, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, M.P.

²Deptt. of Genetics and Plant Breeding, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, M.P.

³Deptt. of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, M.P.

Abstract

India is today not only self sufficient in demand of food, but is also an exporter of agricultural products; occupying seventh position globally. We are the top producers of cereals, fruits, vegetables, milk, meat and fish; thanks to production gains over the decades. But we are deficit of pulses and oilseeds. The impressive agricultural growth stands as a tribute to the agricultural technology and the hard slog of the farming community. The farmer's resilience to multiple challenges and their determination to serve and secure the nation's demand for food and raw materials to its agro-industries deserves appreciation and gratitude. Doubling farmer's income by 2022 is important not only to improve the welfare of the farmers; but also to sustain interest in farming and providing incentive to raise growth trajectory of agriculture. This requires a paradigm shift in the approach towards the agricultural sector. The same is applicable in the arena of extension and knowledge dissemination. It is high time that stakeholders of agricultural sector keep aside the superfluous arguments on the likelihood of achieving it; and devote attention to activities which can realize the same. Though doubling the farmer's income is the set goal; a rise in income at noticeable levels shall do more good to the agricultural sector of India in the coming decades.

USE OF SPECTRAL SIGNATURES IN PEST DIAGNOSIS

Vidya Madhuri E.¹, Rupali J.S.¹, Rajna S.¹, Subhash Chander² and Venkatesh Y.N.¹

¹Division of Entomology, ICAR-Indian Agricultural Research Institute, New Delhi

²ICAR-National Centre for Integrated Pest Management, New Delhi

Abstract

Timely detection and efficient management of the pest depends on frequent pest monitoring. Early detection of the pest infestation can help in timely management of the pest in a cost-effective manner, and thereby reducing food production costs and avoiding environmental hazards. A promising way to assess the extent of insect damage is made possible by the high



spectral resolution offered by hyperspectral remote sensing in the VIS (visible) and NIR (near-infrared) areas. Crop stress brought on by both abiotic and biotic causes has been identified using the remote sensing approach. The word “spectral signature” refers to the reflectance from a plant surface, It holds considerable promise for pest management in commercially significant agricultural crops to use non-destructive spectroradiometer approaches to identify vegetation stress at an early stage of its development. The spectral signatures can be used to track pest activity and a quick survey of broad regions with noticeable savings in labour and expense, allowing growers to be forewarned of potential pest problems promptly. An autonomous agricultural vehicle with spectroscopic and imaging capabilities might be integrated to offer data on the early identification of stress and its spatial distribution, allowing for the delivery of pesticides with spatially targeted sprays. However, there is limited evidence available in India about the use of this technology to identify plant biotic stress. Therefore, it was thought necessary to create spectral signatures for different pests and investigate the idea of determining the extent of the pest damage using crop reflectance.

ADULT PLANT STAGE GERMPLASM SCREENING OF THE WHEAT FOR YELLOW RUST RESISTANCE

Venkata Ravishankar Lekkala^{1*}, M.K. Pandey¹, Kanik Kumar Bansal¹ and Satendra Kumar Sharma²

¹Division of Plant Pathology, Sher-e-Kashmir University of Agriculture Science and Technology, Jammu-180009

²Division of Agronomy, Sher-e-Kashmir University of Agriculture Science and Technology, Jammu-180009

*Email : lvrsreddy@gmail.com

Abstract

Wheat is the second most important cereal followed by rice, India is the second leading producer of wheat followed by China, yellow rust is the most predominant cereal rust caused by *Puccinia striiformis* majorly affecting the wheat growing belt across the wheat growing regions the losses due to the wheat rust have been recording 70% in the case of the severe epidemics even it was estimated as 100 % losses, the host plant resistance is most important factor in the controlling the disease by exploiting the novel genetic resource by using the breeding techniques and the host plant resistance is the most feasible method for the controlling the rusts without any harm to the environment, a total of 90 wheat germplasms were screened for seedling resistance, slow rusting genes or durable resistance genes at adult plant stage. The results indicated that out of 90 germplasms AUPDC values < 100 was observed in 25 germplasms, AUPDC > 400 was observed in 15 lines whereas the germplasm lines sowing 0 was observed in 22 germplasm lines consisting of seedling resistance, the slow rust resistance was observed in the 18 germplasms, Whereas 10 germplasms shows immune response, the latent period of infection in the screened germplasms 13 days for moderately resistant to resistant lines whereas the susceptible germplasms shows the latent period of infection recorded as 8 days in the susceptible cultivars, the apparent rate of infection was noticed for 0.0000 for the lines showing immune response, the resistant cultivars 0.0046 to 0.00648, whereas the moderately resistant lines recorded the rate of infection 0.0543 to 0.0723, whereas the susceptible lines shows the rate of infection > 0.00893, the correlation and regression values shows the strong correlation between the AUPDC and r rate of infection shows the R^2 value of 0.89.

CONVENTIONAL AND AUTOMATED METHODS FOR IDENTIFICATION OF TREES BASED ON LEAVES

Vidya Arora

GBPUAT, Pantnagar

Abstract

Tree identification by their leaves is difficult and involves a lot of work. However, it is easier than the identification by their fruits or flowers because leaves are visible throughout the year. Different techniques are used to identify leaves involving number of steps that include specimen collection, preservation, maintenance, taxonomic key creation and comparison with previously published research. Botanists and other experts utilized the traditional way to identify leaves by focusing on their distinctive characteristics. Besides, the conventional methods, other methods are also employed nowadays due to which even a computer engineer and a prudent lover of nature can also identify leaves. These methods involve different kinds of neural networks based on which image-based identification of leaves of trees is done. The traditional identification techniques and neural networks like support vector machine (SVM), artificial neural network (ANN), convolutional neural networks (CNN)



and k-nearest neighbor (KNN) are used to identify tree species based on their leaves. The comparison of conventional and automated techniques provides all the information needed to identify trees. This study will benefit students, academics, and lovers of the outdoors by expanding their understanding on how to recognize trees by their leaves.

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Tree identification by their leaves is difficult and involves a lot of work. However, it is easier than the identification by their fruits or flowers because leaves are visible throughout the year. Different techniques are used to identify leaves involving number of steps that include specimen collection, preservation, maintenance, taxonomic key creation and comparison with previously published research. Botanists and other experts utilized the traditional way to identify leaves by focusing on their distinctive characteristics. Besides, the conventional methods, other methods are also employed nowadays due to which even a computer engineer and a prudent lover of nature can also identify leaves. These methods involve different kinds of neural networks based on which image-based identification of leaves of trees is done. The traditional identification techniques and neural networks like support vector machine (SVM), artificial neural network (ANN), convolutional neural networks (CNN) and k-nearest neighbor (KNN) are used to identify tree species based on their leaves. The comparison of conventional and automated techniques provides all the information needed to identify trees. This study will benefit students, academics, and lovers of the outdoors by expanding their understanding on how to recognize trees by their leaves.

PRECISION HORTICULTURE FOR AUGMENTING FARMER'S INCOME

Vikas Tiwari¹, Ram Naresh², Prince Kumar³, and Abhijeet Kuderiya³

¹Department of Agronomy, Mmhatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya Satna (M.P.)

²ICAR-ATARI, Zone III, Kanpur, Uttar Pradesh

³Department of Agriculture Extension, Mmhatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya Satna (M.P.)

Email : Vikas7478@gmail.com

Abstract

Precision in Horticulture sector provides a best opportunity in augmenting the income of the farmers. A significant shift towards horticulture is presumed in the state with an increase in area and production after the launch of the RKVY scheme. Despite the scope and importance for cultivation of various horticulture crops, the sector is yet to make break-through in the productivity fronts and market chain for many reasons. This is because of the fact that the farmer in mass are not adopting the latest production technologies comprising of Precision Horticulture Practices related to soil, water and selection of planting material. The irrational application of important inputs and non adoption of improved technologies lead to less production as well as productivity per unit area. The challenge is to increase productivity by increasing the factor productivity of all the horticultural production inputs, and at the same time sustaining it by adoption of better practices and precision agriculture principles. Hence, situation specific modern technologies should be identified and disseminate.

Transformation of present farming system with horticulture crops, availability of micro irrigation, resource use efficiency, increase in cropping density, and hybrid technology has capacity to revolutionize the production of vegetable crops and demand for hybrid seeds is continuously increasing. Appropriately selected rootstocks have potential to modify the architecture of plants for efficient utilization of resources. Genetically dwarf cultivars in mango, banana, papaya, sapota and dwarfing rootstocks in mango, guava, citrus, ber suit high density planting system for accommodating more plants, increasing output and income. Precision horticulture is an approach where inputs are utilized in precise amounts to get increased average yields, compared to traditional cultivation techniques. Sustainable Precision horticulture is this century's most valuable innovation in farm management that is based on using Information and Communication Technologies (ICTs). This is the modern innovation technology based on sustainable agriculture and healthy food production and it consists of profitability and increasing production, economic efficiency and minimized the side effects on the environment.



DIAPAUSE AND HIBERNATION IN PEST MANAGEMENT : BIOCHEMICAL ASPECTS

Vikram

Department of Entomology, MPUAT, Udaipur, Rajasthan

Abstract

Diapause is genetically programmed pre-emptive developmental response to changing seasons and environmental conditions. It is an environmentally adaptive dormancy that can occur during any stage of development (egg, larva, pupa or adult) but the diapausing stage is consistent and specific within a species. Diapause can be categorized according to seasonal variations as aestivation (summer diapause) or hibernation (winter diapause); or according to life stages as an egg (embryonic), larval, nymphal or adult (imaginal, reproductive) diapause; or according to the influence of environmental factors as obligatory and facultative diapause. Obligate diapause is often universal, resulting in strictly univoltine life cycle with every individual in every generation experiencing diapause, irrespective of any possible environmental variations. On the other hand, facultative diapause occurs due to environmental variations and results in a multivoltine life cycle (Gill *et al.*, 2018). Most commonly, insects have a facultative diapause, in which there is a developmental stage this is responsive to specific environmental 'cues' (the sensitive stage) that programme the diapause. Thus, the sensitive stage marks the physiological decision to either diapause or delay entry into diapause for another generation (Denlinger, 2002). Further, diapause in insects is characterized by low metabolic rate and the induction, initiation, determination, maintenance and termination of diapause under the control of endocrinological mechanisms mediated by environmental stimuli (Kostal, 2006). Significant Biochemical changes like glycogen accumulation, sugar level changes and change in glycogen accumulation rate was reported in silkworm diapausing eggs by Singh *et al.* (2013). Diapause can be controlled by many ways including hormones, chemicals, wounding, alteration in chromosomes and modifications of environment factors, including moisture, temperature, photoperiod and oxygen. A hormone named 24-aa neuropeptide, also called as diapause hormone (DH) is known for regulating diapause (Gill *et al.*, 2018). Many species of insects that establish in temperate or colder climate areas enhance their cold tolerance before the onset of winter and spend the winter in diapause in a characteristic life stages. Based on physiological investigations, it is often stated that there are three main strategies for survival as diapausing at low temperatures in winter, which are chill-susceptible, freeze-tolerance, and freeze-avoidant. According to this classification, the freeze-intolerant (or freeze avoiding) insects are capable of decreasing their supercooling points (SCPs) under cold temperature stress, but freeze-tolerant initiates ice formation in extracellular spaces. For the unfavorable thermal conditions, an insect synthesizes and accumulates various types of low-molecular-weight compounds, such as polyhydric alcohols (polyols), sugars, and some of the amino acids. The synthesis of these compounds whose main task is to inhibit the growth of ice lattice has been reported in some insects for resistance to future hazardous changes of environmental conditions (Mohammadzadeh *et al.*, 2017).

META-ANALYSIS STUDY ON *TRYPANOSOMA EVANSI* PREVALENCE IN ECONOMICALLY IMPORTANT LIVESTOCK IN INDIA : R-SOFTWARE APPROACH

Vinay Kishor Tiwari¹, Rohit Kumar², Sachin Kumar³

¹Division of Parasitology, Indian Veterinary research Institute, Izatnagar, Bareilly-243122

²Division of Veterinary Pathology, Indian Veterinary research Institute, Izatnagar, Bareilly-243122

Abstract

Surra is an economically important disease caused by an extracellular haemoprotozoa *Trypanosoma evansi*. It is mainly transmitted by flies viz. Tabanus, Stomoxys, Haematopota, infection also spread by infected needle and blood transfusion. *Trypanosoma evansi* parasitise a vast range of domesticated animals including wild animals. Cattle and buffalo act as reservoir hosts of surra. *T. evansi* zoonotic importance has been reported all across the world including India. Prevalence of Surra causes a substantial financial loss by reducing the production, mortality and immunosuppression which may leads to secondary infection and vaccination campaigns failure. In our meta-analysis-based prevalence study on the prevalence of *T. evansi* conducted in the cattle, buffalo, equine and camel species. The prevalence data was collected irrespective of animal health status, sex, breed, season, geographical location and diagnostic test. Study selection was based upon the published results that were limiting to cross-sectional and longitudinal studies conducted on animals. The published studies from 1980 to 2020 were retrieved from different data base. In present meta-analysis study pooled prevalence of *T. evansi* was calculated by using R-software with random intercept logistic regression model and simultaneously calculated the Clopper-Pearson confidence



interval for individual studies and due to more heterogeneity in the sample size random effect model was taken in consideration. The forest plot analysis was carried out and presented the meta-analysis results for better understanding and determination of heterogeneity between the various studies. The pooled prevalence of surra in cattle was 12% with 72702 sample, in buffalo was 12% with 67041 sample. The estimated pooled prevalence in equine and camel was 11% and 19% with 23411 and 5059 samples respectively. This metanalysis study will be helpful in the calculation of estimated economic loss caused by prevalence of surra.

EFFECT OF MULCHING WITH DRIP IRRIGATION ON WATER USE EFFICIENCY AND YIELD OF BITTERGOURD

Vinay Kumar, U.K. Singh, Anil Kumar, A.K. Sinha and Neena Bharti
Krishi Vigyan Kendra, B.A.U. Ranchi, Jharkhand

Abstract

The field experiment was conducted in Bittergourd crop in Bokaro district of Jharkhand during the cropping season March-May in three consecutive year 2016, 2017 and 2018. The study was investigated the effects of non mulch and plastic mulch (25 microne) of black and silver colour with drip irrigation in bittergourd to evaluate the yield, water use efficiency and economic feasibility of bittergourd. The analysis reveals that the silver plastic mulch recorded highest fruit weight (6.7 kg/plant), highest yield (402q/ha), highest water use efficiency (3284 kg/ha/cm) and highest B: C ratio (3.21) in comparison to other treatments. Thus this study suggests silver plastic mulch as an effective mulching material which increases the yield (26.4 percent) and water use efficiency (89.6 percent) in comparison to without mulch in bittergourd.

PROOF-OF-CONCEPT FOR DEVELOPING CRISPR/CAS9 MUTANTS IN INDIAN MUSTARD

Vinod Kumar¹, Mahendra Anjna², Venkateshwar Jallaraph³ and Chandrika Sharma³
¹Department of Genetics and Plant Breeding, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, (MP)
²Department of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, (MP)
³Department of Agricultural Extension, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, (MP)

Abstract

CRISPR/Cas9 is a dynamic, versatile tool that allows us to target nearly any genomic location. This genome editing technique provides a precise and an easy mode of DNA editing that has found tremendous applications in crop science. *Brassica juncea* (Indian Mustard) is an important oilseed crop in India and acts as a hyper-accumulator of heavy metals. The mechanism of phyto-remediation mediated by mustard is poorly understood. The present study attempts to design a construct that will be useful for CRISPR/Cas9 mediated deletions in the small subunit gene (rbcS) of RuBisCO. Such mutants developed by CRISPR/Cas9 system can be useful in studies pertaining to impact of heavy-metals on the process of import of rbcS into the chloroplast in a better and accurate manner. The gene was amplified, cloned in a sequencing vector and its sequence obtained by Sanger sequencing. Three guide RNA target sequences was designed by an online guide RNA design software, adjacent to NGG PAM sequences, to target the gene towards its 5' end taking into account the specificity score, efficiency scores, out of frame scores, number of off-targets and the presence of restriction sites. Each guide RNA target sequence was cloned into the guide RNA scaffold of the expression vector harboring Cas9. Further, Agrobacterium-mediated leaf disc transformation will be performed and the induced mutation/deletion can be confirmed by restriction digestion of PCR amplified on-target sequences. This study may be considered as proof-of-concept for developing CRISPR/Cas9 mutants in *Brassica juncea*.

PERFORMANCE OF PEARLMILLET BASED INTERCROPPING SYSTEM UNDER RAINFED CONDITION

Virendra Kumar, Manoj Kumar Bansala* and Pradeep Kumar Mishra
Department of Agronomy, Dolphin (PG) Institute of Bio-Medical and Natural Sciences, Manduwala, Dehradun, U.K.
*Corresponding Author Email : bansalamanoj87@gmail.com

Abstract

India has about 85 million hectares of rainfed area which constitutes about 60% of net cultivated area. These areas have a large



share of cropped area under rice (42%), pulses (77%), oilseeds (66%) and coarse cereals (85%). Rainfed agriculture contributes to 42% of the national food grain production, mainly through millets and pulses. Most countries depend primarily on rainfed agriculture for their food grains. About 30% of the world's land surface, or 4.2 billion ha is suitable for rainfed agriculture. India ranks first among the countries that practice rainfed agriculture both in terms of extent and value of production. Rainfed agriculture supports nearly 40% of India's estimated population of 1210 million in 2011. Pearlmillet [*Pennisetum glaucum* (L.)] is the fourth most important cereal after rice, wheat, and maize in India. While, India is the largest producer of pearlmillet, both in terms of area (9.43 mha) as well as production (10.8 m tones) with an average productivity of 10.69 q ha⁻¹. Pearlmillet is the most widely grown type of millet because of its tolerance to difficult growing conditions such as drought, low soil fertility, high temperature, soil moisture deficit and minimum inputs. India continues to be the single largest producer of pearlmillet in the world, although the area has been declining in the traditional growing states of Gujarat, Rajasthan and Haryana. Pearlmillet is usually grown as a dryland dual purpose grain and fodder crop.

The main concept of intercropping is to get increased total productivity per unit area and time, beside equitable and judicious utilization of land resources and farming inputs including labour. One of the main reasons for higher yield in intercropping is that the component crops are able to use more efficiently natural resources than grown separately. Intercropping has long been recognized as a kind of biological insurance against risks under aberrant rainfall behaviours in dryland environment. There is reduction of insect/mite pest populations due to the diversity of crops grown and reduction of plant diseases because the distance between plants of the same species is increased due to the planting of other crops between them. One important reason for intercropping is the improvement and maintenance of soil fertility. Fertilizers are more efficiently used in an intercropping system, due to the increased amount of humus and the different rooting systems of the crops as well as differences in the amount of nutrients taken up. Weeds compete with the crop plants for the essentials of growth, interfere with the utilization of land and water resources, and thus, adversely affect the crop production. Weeds depleted 30 – 40% of applied nutrients from soil and compete with the crop plants for soil moisture and sun light too.

ROLE OF PLANT BIOTECHNOLOGY FOR THE CROP IMPROVEMENT

Yogendra Singh*, Akash Barelaand Shivangi Rahangdale

Department of Plant Breeding and Genetics, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) India

*Corresponding authors email : yogendrasinghbt@gmail.com

Abstract

The potential applications of biotechnology in the improvement of farming systems in the next millennium and reviews some of the highlights of modern plant biotechnology. Plant biotechnology will make it easier to grow crops with multiple long-lasting pest and disease resistance, especially in the absence of pesticides. Similarly, transgenes or marker-assisted selection may aid in the development of high yielding crops, which will be required to feed the world while saving land for plant biodiversity conservation in natural habitats. As a result, crops should be engineered to meet consumer demands and needs. By incorporating biotechnology tools into conventional breeding, the genetic base of crop production can be preserved and expanded. Similarly, specific genotypes can be targeted to specific cropping systems.

EFFECT OF NANO ZINC OXIDE ON PHENOPHASES, YIELD AND YIELD COMPONENT OF SOYBEAN [*GLYCINE MAX* (L.) MERRILL]

Alok Kumar Gupta, R.K. Samaiya, Yogendra Singh¹* Shiv Ramakrishnan and Shivangi Rahangdale¹

Department of Plant Physiology, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, (M.P.)

¹*Department of Plant Breeding and Genetics, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, (M.P.)*

*Corresponding Author's Email: yogendrasinghbt@gmail.com

Abstract

The field experiment was conducted at Seed technology research center, Department of Plant breeding and Genetics, JNKVV-Jabalpur Kharif-2021. Phenological studies revealed superior performance of treatment nano -ZnO @ 500mg L⁻¹ in terms of higher days to flower initiation, days to 50% flowering, days to pod initiation, days to physiological maturity and days to physical maturity. In terms of variety, JS 20-116 showed highest days to flower initiation (62.37), days to 50% flowering (67.62), days to pod initiation (72.37 days), days to physiological maturity (83.75), and days to physical maturity (97.08 days)



as compared to variety JS 20-98. Yield and yield attributes studies showed superior performance of seed treatment with nano-ZnO @500mg L⁻¹ for plant height, no. of branches per plants, no. of pods per plant, no. of seeds per pod, seed index, seed yield, biological yield and harvest index with respect to 5.90%, 13.51%, 29.16%, 26.20%, 14.72%, 16.25%, 20.26%, 8.57% enhancement respectively over control. Varietal studies revealed superior performance of variety JS 20-116 for plant height (36.21cm), no. of branches per plants (4.22), no. of pods per plant (54.28), no. of seeds per pod (2.47), seed index (8.55g), seed yield (8.84g plant⁻¹, 1502.41kg ha⁻¹), biological yield (15.60g plant⁻¹, 2841.66ha⁻¹) and harvest index (56.64%). This results justifies that the seed treatment with nano formulation in the form of ZnO @ 500mg L⁻¹ will stabilize seed yield and enhance seed quality of soybean through improvement of growth analytical attributes and yield and yield attributes.

NEW PERSPECTIVES IN PROTECTING ANIMAL HEALTH AGAINST MICROORGANISMS

Vishakha Singh and Raju Prasad

Dept. of Pharmacology and Toxicology, Ranchi Veterinary College, BAU, Ranchi

Abstract

India has the highest livestock population in the world. To maintain animal health and high productivity antibiotics are used inadvertently. India is the fourth largest consumer of antibiotics in animal food production globally. Such uncontrolled use of antibiotics contributes to growing antibiotic resistance in the environment. As bacteria grow resistance against conventional antibiotics, alternatives are being investigated among which antimicrobial peptides, probiotics, bacteriophages and antibodies are currently gaining attention. Antimicrobial proteins (AMP) provide protection to organisms against pathogens. They are very diverse group of molecules, have small size and bear positive charge. Bacterial AMPs (bacteriocins) are active in very low concentration, in a wide pH range and show tolerance to high thermal stress.

Bacteriophages are viruses that are natural killers of bacteria. Production of bacteriophages has a long history. The best-known phages are in the area of veterinary medicine, especially applicable to living farm animals. Phage therapy utilises the natural mechanism of bacterial cell lysis at the site of infection. Bacteriophage cocktails are being tried against microbes to minimize the risk of resistance development. Plant-derived antimicrobial compounds are the part of primary defence mechanism in the plants against pathogens. Plants are natural and rich source of promising biologically active agents such as polyphenols, phenols, alkaloids, flavonoids, essential oils etc. There are over 30,000 active antimicrobial substances identified in plants. Many of them are known antimicrobials since long. Some of these plant based compounds act on bacterial biofilms also. Probiotics are substances that contribute to the growth of microorganisms that are advantageous for their host. The use of probiotics as agents against foodborne pathogens is becoming increasingly popular. Lactobacillus, Bifidobacteriaceae and Streptococcus comprise the main groups of probiotic bacteria. These microorganisms act for both prevention and control of pathogenic bacteria.

INFORMATION SOURCE UTILIZATION BY TRIBAL WOMEN OF MIZORAM

Zohmingmawii Sailo and J. Longkumer

Department of Agricultural Extension, NU:SASRD

Abstract

A study was conducted to find the information source utilization by tribal women in Mizoram. For the present study 3 districts viz., Lunglei, Aizawl and Serchhip and 6 blocks were purposively selected. A total of 300 respondents were selected based on proportionate sampling from 12 villages. Appropriate statistical tools were applied for analysis. The study revealed that among the mean score of different sources of information utilization, interpersonal cosmopolite sources ranked first, which is followed by personal localite and personal cosmopolite sources. In case of interpersonal cosmopolite sources, smart phones is the most often used (89%) source of information followed by internet (65.34 %). Among personal cosmopolite sources, Panchayat member are most often contacted for information source by 56.67 per cent of the respondents, which is followed by 47.34 per cent of the respondents who use progressive farmers as the source of information. Friends, relatives and neighbours also play an important role in disseminating information among women in the villages. It has also been found that for 33 per cent of the respondents, Mzsrml is most often used source of information among personal cosmopolite sources. VFAs/VLWs were also contacted often by 25.67 per cent of the respondents. It is also found that majority i.e. 69 per cent of the respondents



have medium level utilization of all information sources, which is followed by 16.67 per cent belonging to the high level utilization category and 14.33 per cent are under low level utilization category.

GENE SILENCING FOR REGULATING THE TARGET GENE

Yogendra Singh*, Akash Barela and Shivangi Rahangdale

Department of Plant Breeding and Genetics, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) India

*Corresponding authors email id: yogendrasinghbt@gmail.com

Abstract

Gene silencing is one of the most efficient and promising functional genomics tools, as it precisely regulates gene expression and has a significant impact on crop improvement. A target gene can be silenced at two levels: transcriptional and post-transcriptional. In a broader sense, transcriptional gene silencing occurs through repression of the transcription process, whereas post transcriptional gene silencing can occur through mRNA degradation. Small RNA molecules such as siRNAs and miRNAs are key players in the gene silencing mechanism. These small RNA molecules are produced by Dicer digestion of endogenous or exogenous dsRNA, which activates RISC (RNA induced gene silencing complex), which inhibits gene expression.

INCIDENCE OF *GALLERIA MELLONELLA* LINN. IN *APIS MELLIFERA* LINN. COLONIES UPON TREATMENT OF BOTTOM BOARD WITH VARIOUS BOTANICALS

Jagjeet Singh*, Yuvraj Singh Pandha, Jaspal Singh, Amit Choudhary and Pardeep Kumar Chhuneja

Department of Entomology, Punjab Agricultural University, Ludhiana 141004, Punjab

*E-mail: jagjeetkartik28@gmail.com

Abstract

Honey bees are essential for the health of people as honey and other hive products like propolis and bee venom have medicinal properties in addition to it, their role as pollinator makes them vital for food security. Honey bees are attacked by many pests. Out of which, *G. mellonella* is a ubiquitous pest. Its female moths enter the bee hives during night and start laying eggs. The larvae from these initially feed on debris of bottom board and later on started damaging combs. These makes silken tunnels in the combs and under severe infestation damage the combs fully. In the present study, bottom board were treated with various botanicals such as Neem oil (3, 5 and 7%), Neem Seed Kernel Extract (3, 5 and 7%), Dhrek Seed Kernel Extract (3, 5 and 7%), Azadirachtin 3,000 ppm (1%), Azadirachtin 10,000 ppm (1%). These bottom boards were then given to 8 bee-frame strength *A. mellifera* colonies. Data recorded on incidence of *G. mellonella* larvae on bottom board as well as per cent comb area damage. It was found that significantly the lowest mean incidence (number of larvae per bottom board) of *G. mellonella* larvae (1.71) was on bottom board treated with NSKE (7%). It was significantly at par with mean incidence of 1.80 larvae per bottom board in Azadirachtin 10,000 ppm (1%). The lowest mean per cent comb damage (9.56) was recorded in *A. mellifera* colonies having bottom board treated with NSKE (7%) whereas the highest per cent comb damage (40.44) was observed in untreated control. Therefore, bottom board treated with NSKE 7 % had least infestation of greater wax moth.

TANK MIX FORMULATION OF ATRAZINE AND NEW GENERATION HERBICIDES AGAINST COMPLEX WEED FLORA OF MAIZE (*ZEA MAYS* L.)

Ganga Ram Mali, A. Verma, Bharat D. Malunjker and Manish Bera and Piyush Choudhary

Rajasthan College of Agriculture, Maharana Pratap University of Agriculture & Technology, Udaipur, Rajasthan 313001

Corresponding Authors Email : gm01051994@gmail.com

Abstract

A field experiment was conducted on clay loam soil during *kharif*, 2017 at Instructional Agronomy Farm, Rajasthan College of Agriculture, Udaipur to find out the Effect of tank mix formulation of atrazine and new generation herbicide against complex weed flora of maize (*Zea mays* L.). The results of the experiment revealed that the lowest total weed density at 30 DAS was recorded with tank mix application of atrazine 0.5 kg/ha+ tembotrione 0.125 kg/haPoE at 15 DAS. All the weed



control treatments were also found significantly superior in reducing dry matter of monocot, dicot and total weeds compared to weedy check at 30 DAS. The minimum total weed dry matter at this stages (2.85, g/m²) were observed under atrazine 0.5 kg/ha + tembotrione 0.125 kg/haPoE at 15 DAS and it was closely followed by atrazine 0.5 kg/ha + topamezone 0.025 kg/haPoE at 15 DAS (3.89, g/m²). An application of atrazine 0.5 kg/ha + tembotrione 0.125 kg/haPoE at 15 DAS resulted in maximum weed control efficiency of 96.99% at 30 DAS. The application of atrazine 0.5 kg/ha + tembotrione 0.125 kg/ha as PoE at 15 DAS recorded the tallest plants (47.0 cm) with greatest dry matter accumulation per plant (18.04g) at 30 DAS. The maximum gross and net return (71009/ha and benefit cost ratio (2.57) were also obtained under application of atrazine 0.5 kg/ha + tembotrione 0.125 kg/haPoE at 15 DAS, leading all other treatments significantly behind.

GENETIC VARIABILITY FOR YIELD AND YIELD ATTRIBUTING TRAITS IN LINSEED UNDER RAINFED SOWED CONDITIONS

V.K., Choudhary^{1*}, Ravikant¹, Rajesh Kumar¹, R.K.Srivastava¹, Shanti Bhushan² and A.K Choudhary³

¹Directorate of Seed and Farms, Dholi, Muzaffarpur, RPCAU, Pusa, Samastipur, Bihar

²Department of Plant Breeding and Genetics, Veer Kunwar Singh College of Agriculture, Dumraon (Buxar), Bihar

³Department of Plant Breeding and Genetics, Bhola Paswan Shastri Agricultural College, Purnea, Bihar

*Email of corresponding author : vkchoudharypat12@gmail.com

Abstract

A trial of Linseed having 19 entries was conducted in Randomized Block design during Rabi 2021-22 at TCA Dholi farm under RPCAU, Pusa with an objective to know the genetic variability for yield and yield attributing characters. Analysis revealed that out of 19 entries five entries (BRLS 109-2, RL 18112, NL 371, SLS 140, RL 18102) showed significant earliness for days to flowering, 3-entries (BRLS 109-2, RL 18112, & SLS 140) had significant earliness for days to maturity, two entries (LMS-2019-R-8 & RL 18102) exhibited significant more number of seeds/capsule and 3 entries (LMS-2019-R-4, BRLS109-2 & SLS140) were significantly higher oil in yield over check while all the entries exhibited significantly superiority for 1000 seed weight (g.) and only one entry (LCK 2140) showed significantly higher Seed Yield (Kg./ha) over check.

VARIABILITY IN CHICKPEA (*CICER ARIETINUM* L.) GENOTYPES IN ACIDIC SOIL OF JHARKHAND UNDER DRYLAND CONDITION

Kamleshwar Kumar¹, Yogendra Prasad¹, Ravi Kumar¹, Shanti Bhusan² and Sanjay Kumar³

¹Department of Genetics and Plant Breeding, Birsa Agricultural University, Ranchi, Jharkhand

²Department of Plant Breeding and Genetics, Veer Kunwar Singh College of Agriculture, Dumraon (Buxar), Bihar Agricultural University, Bihar

³Department of Plant Breeding and Genetics, MBAC, Agwanpur, Saharsa, Bihar

*Email for correspondence : kamlesh.rani_bau@rediffmail.com

Abstract

Chickpea (*Cicer arietinum* L.) is cultivated in almost all parts of the world more than 50 countries spread over Europe, North America, South America, Australia, Africa continents and it is the second most important food legume crop after common bean. In India, Chickpea is grown almost in all parts of the country mainly as rainfed crop. In India both desi and kabuli type chickpea varieties are grown. The experiment was laid out during Rabi season 2018-19 with 44 genotypes along with checks in the western section of Birsa Agriculture University, Research Farm, Kanke to study the variability in acidic soil. The results of the analysis of variance for the twelve characters in 44 genotypes of chickpea revealed highly significant differences. High heritability coupled with comparatively high genetic advance was obtained for days to 50 % flowering, days to maturity, number of pods per plant and 100 seed weight (g), indicates the predominance of additive gene action. The correlation studies revealed that days to 50 % flowering, days to maturity, number of pods per plant and grain yield per plant exhibited highly significant positive correlation. Hence, the simultaneous selection of these traits will improve the seed yield.

The results revealed that a wide range of variation was observed among the forty four genotypes with high GCV and PCV with respect to number of primary branches per plant, number of seeds per pod, wilt incidence, survival percentage, germination percentage, plant ht., infestation of pod borer, yield per plant, 100-seed weight and number of pod per plant were more



variable characters. It was observed from the results that high genotypic and phenotypic variances were recorded for 100-seed wt., days to 50 % flowering, days to maturity, plant height, grain yield/plant, wilt incidence, germination percentage, number of pod/plant and survival percentage. However low phenotypic variance was observed for number of primary branches per plant, number of pods per plant and infestation of pod borer whereas, genotypic variance was low for number of primary branches per plant, number of seeds per pod and infestation of pod borer recorded. An estimate of high heritability was recorded for 100 seed wt, days to 50 % flowering, days to maturity, grain yield/plant and number of pod/plant. However, it was moderate for germination %, plant height. High to moderate genetic advance were recorded for number of pods/plant, 100 seed weight, number of seeds/pod, days to 50 % flowering and days to maturity. While it was low for infestation of pod borer, germination % and plant height which may be due to additive gene effect and selection would be rewarding for these traits.

QUALITY SEEDS FOR SUSTAINABLE AGRICULTURE

Ravi Kumar¹, Kamleshwar Kumar², Yogendra Prasad², Shanti Bhushan³ and Sanjay Kumar⁴

¹Department of Genetics and Plant Breeding, DSF, Birsa Agricultural University, Ranchi, Jharkhand

²Department of Genetics and Plant Breeding, Birsa Agricultural University, Ranchi, Jharkhand

³Department of Plant Breeding and Genetics, Veer Kunwar Singh College of Agriculture, Dumraon (Buxar), Bihar Agricultural University, Bihar

⁴Department of Plant Breeding and Genetics, MBAC, Agwanpur, Saharsa-852201, Bihar

*Email for correspondence: ravi_bau@yahoo.co.in

Abstract

Quality seed provides foundation to productive agriculture. It is the key input for enhancing agricultural production and productivity. The country has been accordingly given priority to the seed production and supply system. It constitutes the very basic and cheapest inputs and play important role to enhance agriculture production and productivity as well. Simply by using quality seed along the yield can be increased up to 20-25 % in different crops, under optimum management with recommended package and practices. The productive agriculture totally depends upon quality seed. Indian seed production system is a robust route to mitigate the seed requirement of the country. The seed class involves nucleus, breeder, foundation and certified seed with different seed quality standard at different levels to safe-guard the production of large quantity of quality seed for sustainable agriculture.

The maintenance breeding is a mandatory step for the institute who are involved in development of variety. The role of developer is to maintain the seed purity of released varieties. Now a days seed grower faces the climatic problems, the varieties should be developed to meet the changing climate. Availability of quality seed at right time wherever it is needed with reasonable price plays a key role in the highest grain production. The Indian seed delivery system which is backed by both formal and informal seed system has a good structural network for sufficient availability of seed but the seed replacement rate and the varietal replacement rate are under desirable limit. State Govt. should look into this matter and enhance the replacement rate activity of the farmers. Involvement of new improved varieties within ten years plays a great role in improvement of quality seed production.

MIGRATION : IT'S EFFECT ON AGRICULTURE AND SUSTAINABLE DEVELOPMENT

Aditi Dutt¹, Akriti Dutt² and Varun Kumar Singh³

¹Deptt. of HDFS, Maharani Avantibai College of Home Science, C.S.A. University of Agriculture and Technology, U.P.

²Department of GPB, College of Agriculture, A.N.D. University of Agriculture & Technology, Uttar Pradesh

³Department of Agronomy, Brahmanand Post Graduate College, Rath, Hamirpur, Uttar Pradesh

*Presenting Author Email : aditidutt001996@gmail.com

Abstract

Migration plays the most important role in forming the current society. It plays an important role in exchanging ideas and culture as well as enhancing the economic and political status of people. The literature shows that migration occurs at both internal and international levels in developing and developed countries. Major factors responsible for migration are lack of employment and economic factors as well as climate change, environmental degradation, poverty, strife and emergencies. These factors are responsible for creating the idea of migration in the minds of rural people. This review paper examines the



association between migration and agriculture in addition to migration and sustainable development. These papers also discuss the effect of migration on agriculture and sustainable development.

It was found that since the 1960s, due to the pace of structural transformation from an agriculture-based economy to an industry-based economy the percentage of the rural population declines from 70% to about 50% in East and South-East Asia as a result of migration. It reflects that migration (rural to urban) had caused a shortage of labour in the rural agriculture sector and influenced the household distribution of labour in rural families. Migration also creates unlimited opportunities for sustainable development.

INDUCED CHLOROPHYLL MUTATIONS IN CHICKPEA (*CICER ARIETINUM* L.)

Anand Kumar^{1*}, Dinkar¹, Ravi Ranjan Kumar², Anil Kumar¹, Rakesh Deo Ranjan³, Satyendra¹, Mankesh Kumar¹, S.P. Singh¹, Sanjay Kumar¹, Tushar Ranjan² and Ramesh Nath Gupta⁴

¹Department of Plant Breeding and Genetics, Bihar Agriculture University, Sabour, Bhagalpur, Bihar

²Dept. of MBGE, Bihar Agriculture University, Sabour, Bhagalpur, Bihar

³Dept. of PPB, Bihar Agriculture University, Sabour, Bhagalpur, Bihar

⁴Dept. of Plant Pathology, Bihar Agriculture University, Sabour, Bhagalpur, Bihar

Corresponding Author: dranandpbgbasour@gmail.com

Abstract

Chickpea, an important pulse crop, is attracting the attention of plant breeders to reconstruct it genetically. The mutagenic effect is reflected in the segregation of chlorophyll mutants, these mutations were evaluated in order to determine the effectiveness and efficiency of chemical mutagens in two varieties of chickpea. Seeds (9% moisture content) of two chickpea varieties GCP 105 and PG 186 were exposed to six doses (20 to 70 KR) of gamma rays or treated with four concentration of ethyl methanesulphonate (0.1 to 0.4%). A broad spectrum of chlorophyll mutations was obtained in M₂ generation by using gamma and EMS in two varieties viz; GCP 105 and PG 186 of chickpea (*Cicer arietinum* L.). The range was greater with EMS than with gamma rays or combined treatments. The spectrum of chlorophyll mutations consisted of *albina*, *chlorina*, *tigrina*, *viridis* and *xantha*. Of these chlorophyll mutations, *xantha* type was predominant in both the mutagenic treatments. The spectrum and frequency of chlorophyll mutations increased with increase in doses gamma rays. Moderate concentrations of EMS gave higher frequency of chlorophyll mutations. Total (pooled) chlorophyll mutation frequency was found maximum with EMS treatments followed by gamma rays. 'xantha' followed by 'chlorina' out numbered other types of chlorophyll mutants in both the varieties. In both the varieties, the order of mutagenic effectiveness was: EMS > gamma rays. Three criteria viz; seedling injury (Mf/I), pollen sterility (Mf/S) and meiotic abnormalities (Mf/Me) were taken into account for estimation of mutagenic efficiency. The order of efficiency in both varieties with regard to Mf/I and Mf/S was: EMS > gamma rays. The different types of morphological mutants were induced. The chlorophyll deficient and flower colour mutations are of hardly any economic importance, but the compact, dwarf, early, large pod size and collar rot resistant mutants are agronomically desirable which may be utilized in future breeding programme.

MORPHOLOGICAL AND MOLECULAR MARKER BASED DIVERSITY ANALYSIS OF LENTIL (*LENS CULINARIS* MEDIK.) GENOTYPES

Shashi Kumar¹, Gupta Anil Kumar¹, Anand Kumar^{1*} and Ravi Ranjan Kumar²

¹Department of Plant Breeding and Genetics, Bihar Agriculture University, Sabour, Bhagalpur, Bihar

²Dept. of MBGE, Bihar Agriculture University, Sabour, Bhagalpur, Bihar

*Corresponding Author : dranilbau@gmail.com

Abstract

Lentil is an autogamous, diploid (2n = 2x = 14) crop belonging to Viciaeae tribe of Fabaceae family and have haploid genome size of 4063 Mbps. It has been cultivated as a pulse crop for over 8,000 years. The fertile crescent region of the Near East is the area where lentils were first cultivated, and they were later spread to other regions of Europe, the Middle East, and Africa. Understanding the exploitable genetic variation is essential to increase the yield of cultivated lentil and protect it from biotic and abiotic stresses. The present investigation was conducted at BAC Farm, Bihar Agricultural University, Sabour (Bhagalpur), Bihar during Rabi 2021-22 to study the genetic variability, correlation, direct and indirect inter-relationship in 39



lentil genotypes for yield and its attributes. Analysis of variance revealed significant differences among all the genotypes taken under study. High heritability coupled with high genetic advance were observed for number of secondary branches, number of pods per plant, number of effective pods per plant, grain yield per plant and biological yield per plant. Grain yield per plant exhibited highly significant positive correlation with number of primary branches, number of secondary branches, number of pods per plant, number of effective pods per plant, 100 seed weight, biological yield per plant and harvest index. Path coefficient analysis revealed that biological yield per plant followed by number of pods per plant, harvest index, hundred seed weight and number of primary branches exhibited positive direct effect on grain yield per plant. On the basis of Mahalanobis D2 statistics, the 39 genotypes were grouped into five clusters. Among the five clusters, cluster I constituted maximum number of genotypes (28) followed by cluster III (5), cluster V (3), cluster IV (2) while cluster II found to be monogenotypic. Maximum inter cluster distance (2871.77) was recorded between cluster IV and cluster V. For molecular diversity study, 30 SSR markers were used, out of which 9 turned out to be polymorphic, dividing the total genotypes in 2 cluster and 4 sub-cluster at similarity coefficient of 0.1. The size of amplified alleles varied from 170 to 300 bp. Polymorphism information content (PIC) ranged from 0.18 to 0.63 with an average of 0.42. The result revealed diversified lentil genotypes that can be utilized in further crossing programme for exploring maximum yield potential of lentil.

IN-VITRO EVALUATION OF DIFFERENT FUNGICIDES, BIO-AGENT AND PLANT EXTRACT AGAINST BROWN LEAF SPOT OF RICE (*HELMENTHOSPORIUM ORYZAE* L.)

Anand Kumar Prajapati*, Ramesh Singh, Shubham Singh, Saurabh Yadav and Gaurav

Department of Plant Pathology, T.D.P.G. College, Jaunpur

*Corresponding Email: prajapatianand222@gmail.com

Abstract

Rice (*Oryza sativa* L.) has shaped the culture, diet and economic of thousands of millions of peoples, for more than half of the humanity. "Rice is Life" considered its importance position, the United Nation designated year 2004 as "International year of rice". Rice belong to the family Poaceae (Gramineae), tribe Oryzae. The several diseases are effects the rice crop viz., Leaf blast, Narrow brown leaf spot, Sheath blight, False smut and Brown leaf spot. The disease brown leaf spot of rice caused by *Helmenthosprium oryzae* (Breda de Haan) Shoemaker is one of the most important pathogens occurring in all rice growing areas of the world. Among tested fungicides, bio-agent and plant extract, Thiophanate methyl proved to be most effective fungicide as they inhibition the growth of the pathogen (100%) and Chlorothalonil (63.93%), Azoxystrobin (51.45%) and Propineb (46.66%). The Mancozeb was least effective and showed the minimum (43.41%) inhibition over control. The bio-agent *Trichoderma viride* was recorded (3.91mm.) radial growth and its inhibition over control (33.16%). The botanical extract *Neem* was least effective showed (30.76%) inhibition over control.

INCREASED CULTIVATED AREA, PRODUCTION AND PRODUCTIVITY OF RAINFED MUSTARD IN CHHINDWARA, MP

Chanchal Bhargava* and Sarita Singh

JNKVV-KVK, Chhindwara, M.P.

*Email : chanchalm11@gmail.com

Abstract

Chhindwara is major largest district of MP in terms of agricultural diversity also, covering an area of 11815 km². Chhindwara is known as corn city, it covers almost all crops including mustard also. Mustard is becoming popular rabi crop in Chhindwara district. Mustard seeds are small round and varies from yellowish brown to black in colour and about 1 to 2 millimetres (0.039 to 0.079 in) in diameter. It is an important spice in India as well as used for oil also. The botanical differentiation included black mustard (*Brassica nigra*), brown Indian mustard (*B. juncea*), and white or yellow mustard (*B. hirta/sinapis alba*). India's mustard oil production is expected to touch 40 lakh tonnes (LT) by 2021-22, driven by sustained rise in crop acreage. In MP, the district of Morena leads in mustard production, with a share of 27% to the state's total production. Mustard seeds are a rich source of oil and protein. Mustard contains dietary fiber 12.2 gm, Vitamin C 7.1 mg, Energy 508 kcal, Saturated fatty acids 1.989 gm. The seed has oil as high as 46-48%, and whole seed meal has 43.6% protein. Mustard has covered an area of 2.80 ha in the year 2021-22. Farmers are taking it as major rainfed crop of district with well adopted cultural practices.



QUINOA-A RISING SUPER FOOD

Chanchal Bhargava* and Sarita Singh

JNKVV-KVK, Chhindwara, M.P.

*Email : chanchalm11@gmail.com

Abstract

Quinoa is herbaceous annual flowering plant of Amaranth family having edible seeds. The seeds are rich in protein, fibre and minerals. That's why it is called a super food. Popularly using for mal-nutritional children. Many thousand year ago it was used as fodder feed. More than 70 countries are doing cultivation of it. Quinoa plants do best in sandy, well-drained soils with a low nutrient content. The genome of quinoa was sequenced in 2017 by researchers, through traditional selective breeding and, potentially, genetic engineering, the plant is being modified to have higher crop yield, improved tolerance to heat and biotic stress, and greater sweetness through saponin inhibition. Raw, uncooked quinoa contains 13% water, 64% carbohydrates, 14% protein, and 6% fat. Quinoa seeds are gluten-free. Traditionally, quinoa grain is harvested by hand. Harvest needs to be precisely timed to avoid high seed losses from shattering. In 2019, world production of quinoa was 161,415 tonnes.

PERFORMANCE ANALYSIS OF ELECTRET FOR AUTOMOTIVE APPLICATIONS

Falit Goyal

Dept. of Electronics and Communication Engineering, RJIT Tekanpur, Gwalior, M.P. India

Email : falitgoyal@gmail.com

Abstract

The major developments in Electronics engineering have been studied. The structure of polymers and their thermo- electrical properties. In recent times, the ability to manufacture polymers has been developed, although there is still much more to be learnt about "tailor made" polymers. Mankind since time immemorial has been in look out for new materials. Nature of the Electret depends upon the intermolecular properties of the material. Polyvinyl carbazole and malachite green produces excellent results for charge accumulation technology. Performance analysis is studied for energy and environment in this case. PVK doped malachite green sensitized samples represents characteristics peaks and vibrations of pairs or small groups of atoms in the molecules.

EXPRESSION OF CRBP IV GENE IN VARIOUS TISSUES AND ITS ASSOCIATION WITH EGG PRODUCTION IN ASEEL NATIVE CHICKEN

Manjari Pandey^{1*}, Sanjeev Kumar², Gautum Kolluri³, Chandrahas⁴ and S.K. Bhanja⁵

¹Animal Genetics and Breeding, Ranchi Veterinary College, BAU, Ranchi, Jharkhand

²Department of Avian Genetics and Breeding, ICAR-CARI Izatnagar, Bareilly, U.P.

³Division of Avian Physiology and Reproduction, Avian Medicine section (Joint Appointment), ICAR-CARI, Izatnagar Bareilly, U.P.

⁴Department of LPM, ICAR-CARI, Izatnagar, Bareilly, U.P.

⁵Department of PHM, ICAR-CARI, Izatnagar, Bareilly, U.P.

*Corresponding author Email : mnpandey155@gmail.com

Abstract

Aseel, a popular game bird is well known for its hostility, high stamina, majestic gait and fighting qualities. Aseel is also one of the most reared birds in backyard poultry farming. The annual egg production however, needs to be improved to make it economically viable. Various candidate genes have been identified which are specific to egg production and their level of expression in tissues of birds belonging to different egg production groups can be used as early selection criteria for further breeding and flock improvement. Present investigation on expression of *CRBP IV* gene in tissues like kidney, liver and oviduct of Aseel birds is one of the first studies of this kind in India. The egg production up to 40 weeks were recorded in 180 pedigreed Aseel birds kept at Desi fowl unit of ICAR-CARI, Izatnagar, Bareilly. The birds were grouped in two groups i.e. high egg producing and low egg producing. Top 4 and bottom 4 birds were slaughtered from respective groups and tissues were collected. Quantitative Real Time- Polymerase Chain Reaction (qRT-PCR) was used to study the mRNA expression of



CRBP IV gene in three tissues viz., kidney, liver and oviduct of the two egg production groups. The data retrieved was analyzed using JMP-SAS (2010). It was found that the mRNA expression of *CRBP IV* gene differ significantly among the two egg production groups in liver at 15% level of significance. Fold expression of *CRBP IV* gene studied via $2^{-(\Delta\Delta Ct)}$ method revealed that *CRBP IV* gene was expressed 1.59, 1.2 and 1.17 folds more in kidney, liver and oviduct, respectively of high egg producing group compared to low egg producing group. The level of expression of *CRBP IV* gene (two levels based on deviation from average $40-\Delta Ct$ values) in liver ($P < 0.05$) of Aseel chicken had significant effect on egg production up to 40 weeks. Full sib selection for improvement in egg production up to 40 weeks can be done on the basis of level of expression of *CRBP IV* in liver of Aseel native chicken.

IMPACT OF FOLIAR APPLICATION OF NANO NITROGEN AND NANO ZINC ON YIELD ATTRIBUTES AND YIELD OF MUSTARD (*BRASSICA JUNCEA* L.)

Kriti Sharma

Department of Soil Science and Agricultural Chemistry, Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan

Abstract

The aim of this present investigation is to study the effect of foliar application of nano N and Zn on yield attributes and yield of mustard (*Brassica juncea* L.) crop. The field experiment was carried out during October to March 2022 season at Instructional Farm, Rajasthan College of Agriculture, MPUAT, Udaipur which lies in agro-climatic zone IV-A of Rajasthan, India. The field was designed in a randomized block design having 10 treatments which were replicated thrice. The treatments include the various combination RDF and nano fertilizers of N and Zn. The application treatment T₆ (100% NPK Zn + 1st spray of Nano N and Zn at 30 DAS + 2nd spray of Nano N and Zn at 45 DAS) has significantly increased plant height, the number of siliqua plant⁻¹, seeds siliqua⁻¹, test weight, grain yield and stover yield of mustard.

EVALUATION OF DIFFERENT PLANT EXTRACT AND BIO-AGENT AGAINST WILT OF CHICK PEA

Ramesh Singh, Shubham Singh, Anand Kumar Prajapati and Chandramani Patel

Department of Plant Pathology, T.D.P.G. College, Jaunpur (U.P.) 222002

Corresponding author e-mail: ramesh.ramesh.singh@gmail.com

Abstract

Chickpea is one of the major *Rabi* pulse grown in India. It is rich in source of protein, minerals and vitamins for human nutrition and straw is also valued animal feed. The maximum inhibits the radial growth (16.33 mm and 76.66%), (26 mm and 62.85%) and (34.00 mm and 51.42 %) at 30, 20 and 10% concentration respectively against *Fusarium oxysporum* f.sp. *ciceri* was showed in Neem extract. Onion extract was least effective which showed 48.33, 49.00 and 58.66 mm radial growth and 30.95, 30.00 and 16.20 % inhibits mycelial growth at 30, 20 and 10 % concentration respectively. Out of the five fungal anatagonists tested *Trichoderma viride* was found to be most effective and recorded least mycelial growth (16.66 mm) with highest mycelial inhibition (74.36 %) of *Fusarium oxysporum* f.sp. *ciceri*. The least effective fungal bio-agent were *Trichoderma virens* (22.33 mm and 65.64 %) and *Trichoderma hamatum* (31.33 mm and 51.80 %) over control. The bacterial anatagonist *Bacillus subtilis* was comparatively least effective than the fungal bio-agent and observed (38.33 mm and 41.03 %) against *Fusarium oxysporum* f.sp. *ciceri* as compared to untreated control. The fungal growth range varied from 16.66 to 38.33 mm and these were showed all the bio-agents suppressed the colony growth of the pathogen.

PRECISION FARMING WITHIN THE FRUITS AND VEGETABLES AND VITICULTURE SECTORS

Mahendra Kumar Gora

Department of Horticulture, Rajasthan College of Agriculture, MPUAT, Udaipur (Raj.) India

Email : mahendragora31@gmail.com

Abstract

Precision farming is an approach where inputs are utilised in precise amounts to get increased average yields compared to



traditional cultivation techniques. Hence it is a comprehensive system designed to optimize production by using a key element of information, technology, and management, so as to increase production efficiency, improve product quality, improve the efficiency of crop chemical use, conserve energy and protect environment. In fruit and vegetable farming the recent rapid adoption of machine vision methods allows growers to grade products and to monitor food quality and safety, with automation systems recording parameters related to product quality. These include colour, size, shape, external defects, sugar content, acidity, and other internal qualities. Additionally, tracking of field operations such as chemicals sprayed and use of fertilizers can be possible to provide complete fruit and vegetable processing methods. This information can be disclosed to consumers for risk management and for food traceability as well as to producers for precision agriculture to get higher quality and larger yields with optimized inputs. In recent years several new approaches were developed that consider the actual size of the tree, the condition of the crop, but also the environmental conditions. The development and adoption of PA technologies and methodologies in viticulture (termed Precision Viticulture, PV) is more recent than in arable land. However, driven by the high value of the crop and the importance of quality, several research projects already exist in wine production areas of the world. Grape quality and yield maps are of great importance during harvest to avoid mixing grapes of different potential wine qualities. The parcels with greatest opportunities for PV are those which reveal a high degree of yield variation. A high degree of variation will mean higher VRA of inputs and, therefore, greater economic and environmental benefit in comparison with uniform management.

DESIGNING OF PARALLEL COUPLED MEANDERED BANDPASS FILTER

Shally Goyal

Dept. of Electronics & Communication Engineering, Amity University Madhya Pradesh, Maharajpura Dang, Gwalior (MP)

Email : sgoyal@gwa.amity.edu

Abstract

In this paper, we worked with a parallel-coupled meander filter structure. This filter has a narrow pass band and a wide stop band. A parallel coupled line has been meandered in the proposed bandpass filter, which provides a notch pass band. The filter's total bandwidth has been split into two parts, first, 1 GHz–5.2 GHz, which is suitable for all Wi-Fi, WLAN, Bluetooth, and GPS applications; and second, 7.4 GHz–7.9 GHz, which is an narrow band of 0.5 GHz. The proposed filter has one stopband for rejecting standard and super-extended C-band applications from 5.6 to 7.2 GHz used for satellite uplinking and downlinking. The meander filter is constructed using a Fr4 substrate. Total filter dimension is 17.55X4.75mm². The proposed filter has a compact size and good wideband characteristics.

STUDY OF HETEROSIS AND COMBINING ABILITY OF FAB A BEAN (*VICIA FABA*)

Anuj Kumar Choudhary^{1*}, Shanti Bhushan², Ashish Ranjan³ and Mohan Kumar Sinha⁴

¹*Department of Plant Breeding & Genetics, Bhola Paswan Shastri Agricultural College, Purnea-854302, Bihar*

²*Department of Plant Breeding & Genetics, VKSCOA, Dumraon-802136, Bihar, India*

³*Department of Horticulture, Bhola Paswan Shastri Agricultural College, Purnea-854302, Bihar, India.*

⁴*Department of Agril. Engg., Bhola Paswan Shastri Agricultural College, Purnea-854302, Bihar, India*

**Email : anuj_choudhary23@yahoo.com*

Abstract

The present investigation was conducted during 2020-21 at Bhola Paswan Shastri Agricultural College, Purnea, Bihar in randomized block design with two replications row to row and plant to plant distance was maintained at 45 and 15 cm respectively. Among line and tester, Bak-3 had shown highly significant and positive GCA effects for traits viz; no. of pod/plant, green pod yield/plant and seed yield/plant followed by Bak-1 for the same trait. It indicated that these parents having additive effect and it might be included in the development of synthetic varieties. Similarly Bak-3/Bak-20 exhibited highly significant and positive SCA effects for traits viz; no. of pod/plant, green pod yield/plant and seed yield/plant followed by Bak-3/Bak-5 only for the trait no. of pod/plant. Most of the crosses were found significant negative and positive heterosis over mid parents for days to fifty percent flowering and yield attributing traits. It indicated that these traits were inherited for earliness and higher yield.



BLACK BENGAL, THE LEGACY OF JHARKHAND

Nandani Kumari^{1*}, Ujjawal kumar², Sushil Prasad³ and Ravindra Kumar⁴

¹Department of Animal Genetics and Breeding, R.V.C., B.A.U., Jharkhand, India.

²Department of Animal Genetics and Breeding, R.V.C., B.A.U., Jharkhand, India.

³Ranchi Veterinary College, B.A.U., Jharkhand, India.

⁴Department of Livestock Production And Management, R.V.C., B.A.U., Jharkhand, India.

*Corresponding Author Email : drnandanikumari3@gmail.com

Abstract

India ranks second in goat population with 148.88 million goats (census 2019). Around 80 % of global goat population is in developing countries out of the 34 breeds registered with NBAGR. Goat is an important asset for the livestock breeders as well as the poor farmers. Needless to say that it is the earliest ruminant domesticated around 9000 to 7000 B.C. Black Bengal goat found in the entire area of Jharkhand And adjoining state like Bihar, West Bengal, Orissa, Assam and parts of Tripura. This breed is usually black colored but it is also found in brown, white or grey. The Black Bengal goat is small in size but its body structure is tight with small horns and short legs. An adult male goat weights about 25 to 30 kg and female 20 to 25 kg. The Black Bengal goats gain sexual maturity at earlier age than most other breeds. Its prolificacy is high with the female goat becoming pregnant twice a year and giving birth to one to three kids. It is very popular in Jharkhand because of its low demand for feed and high kid production rate. This breed can adapt to any environment easily and its disease resistance is very high. It produces high-quality meat and skin, and is preferred for the skin and high proliferation rate. Black Bengal breed plays vital role in alleviating poverty and unemployment and income generation source.

Based on current study, the gene frequency ranged from 0.146 to 0.625 for allele 0 and from 0.375 to 0.854 for allele 1. Polymorphic information content (PIC) or expected heterozygosity scores varied from 0.278 to 0.496 with overall mean 0.413. Nei's gene diversity value 0.4022, Shannon's Information Index for Black Bengal goat 0.5898. In Jharkhand. Jharkhand black Bengal Goat shows significant gene diversity. Keeping these facts and figures into consideration, Black Bengal should be accorded a status of its own for its conservation and also breed upgradation of Black Bengal goats should be considered.

INTER-RELATIONSHIP BETWEEN DIFFERENT MORPHOLOGICAL AND BIOCHEMICAL PARAMETERS AND THEIR EFFECT ON KHARIF ONION BULB YIELD

Ashish Ranjan¹, Mohan Kumar Sinha² and Anuj Kumar Choudhary³

¹Department of Horticulture, Bhola Paswan Shastri Agricultural College, Purnea-854302, Bihar, India

²Department of Agril. Engg., Bhola Paswan Shastri Agricultural College, Purnea-854302, Bihar, India

³Department of Plant Breeding & Genetics, Bhola Paswan Shastri Agricultural College, Purnea-854302, Bihar, India

Email: aranjan1978@gmail.com

Abstracts

The eighteen onion genotypes were evaluated for growth, yield and quality parameters in a Randomized Block Design with three replications using ten randomly selected plants from each replication. The traits viz. plant height, double bulb percent, average bulb weight, dry matter content and pyruvic acid content traits exhibited high heritability coupled with medium to high genetic advance as percentage of mean indicated that these traits might be governed by additive gene action. Leaf length, leaf diameter, neck diameter and total soluble solid were exhibited moderate genetic advance as percentage of mean. The genotypic correlation coefficients and phenotypic correlation coefficients for leaf diameter, polar diameter, equatorial diameter, average bulb weight and marketable bulb yield exhibited significantly positive association with total bulb yield both at genotypic and phenotypic level. However the traits like number of leaves per plant, leaf length, double bulb percent and plant height were exhibited positive non- significant association with total yield. While the negative association was observed for neck diameter, days to maturity, total soluble solid, dry matter and pyruvic acid content traits. Among the fifteen growth, yield and quality traits average weight of bulb exerted highest direct effect on total yield followed by, polar diameter, leaf diameter, plant height and these characters also showed positive correlation with bulb yield. Considering these characters are more useful for breeder during making direct selection for improvement of bulb yield.



ROLE OF CROP RESIDUE IN ORGANIC FARMING

Akhilesh Kumar Singh*, A.K. Jain, V.C. Verma, Subodh Kumar and Anmol Kumar

V.K.S. College of Agriculture Dumraon, Buxar-802136

*Corresponding author- akhileshsingh19@gmail.com

Abstracts

Organic farming is a system that attempts to provide a balanced environment, in which the maintenance of soil fertility and the control of pests and diseases are achieved by enhancement of natural processes and cycles. A self sustaining system of agriculture like organic farming may offer solution to many sustainability problems affecting Indian agriculture today. Residue input plays an important role in setting a new organic matter equilibrium in the soil. The effect of crop residue on soil organic matter content is highly related to the amount and only weakly related to the type of residue applied. Crop residues can be an important source of nutrients to subsequent crops. It is well documented that different quantities of Nitrogen, Phosphorus, Potassium and other nutrients are removed from and returned to the soil depending on crop species concerned. Crop residues, its quantity and quality will clearly influence the build up of soil organic matter and the subsequent availability and timing of release of nutrients to following crops. Cereal straw, like wheat and paddy, contains only around 35 kg N/ha compared to more than 150 kg N/ha for some vegetable residues. C and N in soil respond linearly to increasing rates of residue addition. The latter can be advantageous in preventing N leaching between crops. The inclusion of crops with a different range of Carbon: Nitrogen ratios can help to conserve Nitrogen within the system. Crop residue management refers to maintaining the soil surface cover and protecting the soil from nutrient losses and erosion. In addition, it helps in improving different physical, chemical, and biological processes within soil. Residue decomposition is a fundamental factor in organic matter stabilization.

TO EVALUATE THE STORAGE PERFORMANCE OF WHEAT IN DIFFERENT STRUCTURES

Mohan Kumar Sinha^{1*}, Ashish Ranjan² and Anuj Kumar Choudhary³

¹Department of Agril. Engg., Bhola Paswan Shastri Agricultural College, Purnea-854302, Bihar, India

²Department of Horticulture, Bhola Paswan Shastri Agricultural College, Purnea-854302, Bihar, India

³Department of Plant Breeding & Genetics, Bhola Paswan Shastri Agricultural College, Purnea-854302, Bihar, India

*Corresponding Author: Mohan Kumar Sinha Email : mohansinhabau@gmail.com

Abstracts

Wheat is one of the most important cereal crops in India but the storage facilities are not satisfactory. Storage performance of wheat was carried out in three storage structures at College of Agricultural Engineering, Pusa, Bihar during 2007. The small capacity storage bins were developed viz; Concrete bin (S₁), Bamboo reinforced mud bin (S₂) and Metal bin (S₃). The variations in moisture content of wheat for five months storage period were analyzed under different storage conditions. The germination was lost 9, 16 and 17 percent under Metal (S₃), Concrete (S₁) and Bamboo reinforced mud bin (S₂) respectively after five months of storage. Metal bin (S₃) was found more effective against insect pests losses i.e. 3% followed by Concrete bin (S₁) 4.03% and Bamboo reinforced mud bin (S₂) 6.51% respectively. The polynomial equation of six degree was best fitted for using the observed moisture content as well as decrease in germination percentage of all bins. Among all the bins Metal bin (S₃) was found more effective storage for wheat at farm level.

SUITABILITY OF COTTONSEED OIL WITH RESPECT TO ITS DIFFERENT NUTRITIONAL COMPONENTS

Sunil Kumar^{1*}, Shanti Bhushan¹, Yogendra Prasad² and Sanjay Kumar³

¹Deptt. of Plant Breeding and Genetics, Veer Kunwar Singh College of Agriculture, Dumraon (Buxar), Bihar 802136, India.

²Deptt. of Genetics and Plant Breeding, Birsa Agricultural University, Kanke, Ranchi, Jharkhand 834 006, India

³Deptt. of Plant Breeding and Genetics, Mandan Bharti Agricultural College, Agwanpur, Agwanpur, Saharsa-852 201

*Corresponding author Email : sunilur@gmail.com

Abstracts

Cottonseed oil is a commonly used vegetable oil that's derived from the seeds of cotton plants. A whole cotton seed contains



about 15 to 20 percent oil. According to scientists of the Central Institute for Research on Cotton Technology (CIRCOT), ICAR, Mumbai, cottonseed oil is an excellent source of essential fatty acids comparable to corn, sesame, safflower and superior to groundnut, rapeseed, olive and almond. In terms of its major component fatty acids, cottonseed oil falls under the oleic-linoleic acid group of fats, with about 20 and 50 percent respectively of these components. Cottonseed oil also contains Vitamin E to a high degree and effective pro-vitamin A in the form of carotene and some Vitamin B complex. This oil also has the added advantage of greater stability due to its anti-oxidant activity. Cottonseed oil performs better by withstanding higher temperature for food items due to its high antioxidant content. For instance, chips and snacks fried in cottonseed oil may maintain a longer shelf life. It is a good option for preparing healthier foods. An important characteristic of cottonseed oil is its high stability. Refined and bleached cottonseed oil may be thoroughly deodorized and will still resist rancidity, if carefully packaged, for periods in excess of time normally required for movement through commercial channels. Crude cottonseed oil is much more stable than refined oil. Cottonseed oil has a lesser tendency than many other oils to undergo flavour reversion which is again a result of oxidation. The stability of cottonseed oil is due to the presence of small amounts of substances capable of inhibiting oxidation markedly. Tocopherol is found to be the most abundant of such inhibitors, and gossypol which is present in crude cottonseed oil has been shown to have strong antioxidant properties.

GENETIC DIVERSITY STUDIES IN OAT (*AVENA SATIVA* L.) FOR FORAGE YIELD AND QUALITY PARAMETERS

Yogendra Prasad¹, Swati¹, Kamleshwar Kumar¹, Ravi Kumar¹, Shanti Bhusan², S.V. Damame³, Sanjay Kumar⁴, D.N. Singh¹ and Tajwar Izhar⁵

¹Department of Genetics and Plant Breeding, Birsa Agricultural University, Ranchi, Jharkhand

²Department of Plant Breeding and Genetics, Veer Kunwar Singh College of Agriculture, Dumraon (Buxar), Bihar Agricultural University, Bihar, India

³Deptt. of Agricultural Chemistry (Biochemistry) and Soil Science, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra

⁴Department of Plant Breeding and Genetics, MBAC, Agwanpur, Saharsa, Bihar, India

⁵Department of Veterinary Science, RVC, BAU, Ranchi, Jharkhand, India.

*Email for correspondence : yogendra.prasad_bau@rediffmail.com

Abstract

Oat (*Avena sativa* L.) is an important winter dual purpose crop, grown for green fodder as well as grain purpose. Fodder crops are an important component of agricultural economy as they help sustainable development of livestock sector. In India, it is used as green fodder, hay and silage for animals. The experimental material for present study consisted of 34 genotypes of oat. Observations were recorded on eleven quantitative and four quality parameters during Rabi 2021-22 at RVC Fodder Farm BAU, Kanke (Jharkhand) in three replications with RBD design. Best sowing time for this crop in this zone was mid November.

Estimates of high heritability (broad sense) was obtained for Days to 50% flowering, Dry matter yield (%), Leaf stem ratio, Crude Protein (%) and Acid Detergent Fibre (%). Moderate heritability (broad sense) was observed in Plant height (cm), Number of tillers per metre length, Leaf length (cm), Leaf width (cm), Neutral Detergent Fibre (%) and IVDMD (%). The magnitude of PCV was greater than corresponding GCV for all characters indicating importance of environment in expression of characters. Green Fodder yield (q/ha) varied from 385.5 to 602.2. Maximum genetic advance as percent of mean was observed for crude protein (41.17 %). This study gives an insight into variability pattern of advance oat lines which will be helpful for further utilisation.

EFFECT OF ORGANIC MANURES AND LAND CONFIGURATION ON SOIL AND NUTRIENTS LOSE IN RICE BEAN (*VIGNA UMBELLETTA*) GROWN IN HILLY REGION

Tarama Chatterjee^{*1}, Binoy Saren¹ and R.K. Avasthe²

¹Palli Siksha Bhavan, Visva Bharati, Santiniketan, Bolpur, Birbhum, W.B.

²Natural Organic Farming Research Institute, Tadong, Gangtok, Sikkim

Abstract

Rice bean is an important traditional crop in Sikkim hills. It is a good source of protein and other nutrients, vitamins



(especially B- group) and mineral elements. As Sikkim is an organic state, there was need to have improved production technology for organic cultivation of important crops. The aim of the present study was to evaluate the effect of different land configuration practices and application of organic manure on magnitude of soil and nutrient loss from rice bean cropped area in Sikkim hills. Ridge and furrow method of land configuration practices reduce the soil and nutrient loss by 34.8 % in comparison to broad bed and furrow method and the minimum soil and nutrient loss was observed in flat bed method. Integrated application of different organic manure in OM₄ (¼ RDN through FYM + ¼ RDN through mixed compost + ¼ RDN through vermicompost + ¼ RDN through poultry manure) was one of the best treatment to reduce soil loss (15.2 %) and comparative nutrient loss. So combined application of organic manure and land configuration practices would have significant importance for cultivation of rice bean crop in sloppy areas of Sikkim Himalayan region.

A STUDY ON SOCIO-ECONOMIC STATUS OF MARINE FISHING COMMUNITY IN SASIHITHLU, DAKSHINA KANNADA DISTRICT, KARNATAKA

Swathi¹ and Vandana K.²

¹Department of Economics, CMR University Bangalore

²Department of Statistics, Collage of Fisheries, Mangalore

Abstract

The fisheries sector is one of the premium sectors which is playing a very important role in GDP, creating employment opportunities and contributing to national food security. The present study attempted to analyze the socioeconomic condition of marine fishing communities residing in the village of Sasihithlu, Dakshina Kannada district, Karnataka. For the study, 100 families of the Sasihithlu village were taken into consideration. The survey was conducted by a structured questionnaire which includes the name and address of the fishermen, age, sex, communities/caste, combined/nuclear family, number of members in the family, education, massmedia of members in the family, and food consumption pattern per month. The average of the respondents of the fishermen community was 38 years old and the population spread is 21-75 years. It was observed that there are 4 or more members in a family. The main occupation of the people is fishing. Over 5.6% are in business, 12.5% comes under the salaried category, 8.3% are involved in agricultural activity, 55.6% of people are engaged in fishing and allied activities and 18% are engaged in other works. The monthly income distribution of 1.4% of fishermen are ranging from Rs.50000 to 1,00,000, 19.4% goes to less than 50,000, and the majority of 79.2% fall under the income having less than 10,000. The study will help to understand the socio-economic status of the marine fishing community and major constraints for the welfare of the fishermen's community and also try to suggest some of the measures to improve the economic well-being of the marine fishing community.

EFFECT OF FERTILIZER AND CHELATED MICRONUTRIENT ON FLOWERING AND YIELD OF POMEGRANATE (*PUNICA GRANATUM*) CV. BHAGWA

S.B. Pavhane, G.M. Waghmare and V.N. Shinde

Department of Horticulture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, 431402

Email: sachinpavhane@gmail.com

Abstract

Experiment was carried out throughout two successive seasons of 2019-20 and 2020-21 on Bhagwa pomegranate trees grown under Mrig bahar season at the Department of Horticulture, VNMKV Parbhani. The selected trees were applied with organic and inorganic fertilizer through soil application i.e. F₁: 100% RDF; F₂: 80% RDF + 20% RDF through FYM and F₃: 60% RDF + 20% RDF through FYM + 20% RDF through neem cake and application of chelated micronutrients through foliar application i.e. M₁: Chelated mix formulation @ 3gm/lit; M₂: Chelated copper (Cu) @ 5gm/lit; M₃: Chelated manganese (Mn) @ 3gm/lit; M₄: Chelated zinc (Zn) @ 3gm/lit; M₅: Chelated boron (Bo) @ 5gm/lit and M₆: Chelated iron (Fe) @ 5gm/lit. The obtained results revealed that minimum days required for initiation of flowering (41.68), minimum days required for 50% flowering (20.75), maximum number of total flowers (141.58), minimum number of male flowers (60.92), maximum number of bisexual flowers (80.67), highest percentage of bisexual flowers (56.98), lower sex ratio (43.02), total number of fruit set (74.58), fruit set percentage (92.48) total number of fruit per plant (72.75), percent fruit retention (97.55), yield per plant (17.65) and yield per hectare (14.71) were recorded in F₃M₁ i.e. 60% RDF + 20% RDF through FYM + 20% RDF through neem cake + chelated



mix formulation @ 3gm/lit. While, minimum in treatment F₁M₆ i.e. combination of soil application of 100% RDF and foliar application of chelated iron (Fe) @ 5gm/lit.

ROLE OF DIGITAL LIBRARIES IN THE PRESENT ERA

Veerbhadra N.

Air Force School, Air Force Station, Bidar (Karnataka)

Abstract

Digital libraries give solutions to main challenges to traditional libraries such as storage. The concept of digital library and how it helps in conserving manuscripts and what type of equipments or software are required in this work. We want digital information in every field so that, every library should be a digital library. It highlights the necessity, challenges and issues in creating digital library, there are certain issues which should be taken care like copyright and Intellectual Property Right. This article also explores successful digital library project set up in India and what is the future of digital library in Indian scenario. Digital libraries are organizations that provide the resources, including the specialized staff to select, structure, offer intellectual access to interpret, distribute preserve the integrity of and ensure works so that they are readily and economically available for use by a defined community or set of communities. The concept of a digital library is not merely equivalent to a digitized collection with information management tools. It is rather an environment to bring together collections, services and people in support of the full life cycle of creation, dissemination, use and preservation of data, information and knowledge. Digital library to be an electronic collection of real or virtual resources, which may also be available elsewhere. These resources must be whole works, with which humans can have a complete cognitive or affective engagement. A digital library may allow either on-line or off-line access to the elements it organizes and houses, and may include multimedia as well as multilingual data.

SURGICAL MANAGEMENT OF UMBILICAL HERNIA IN BOVINE CALVES- A CASE REPORT

Sunil Oraon, A.K. Sharma, Reetu and Vinod Kumar

Department of Veterinary Surgery and Radiology, Ranchi Veterinary College Ranchi (BAU), Kanke, Ranchi, Jharkhand

Abstract

A three-month-old, indigenous male calf was brought to the clinical complex, R.V.C. department of veterinary surgery and radiology, the calf had no urine for 3 days and one day was offered. A tentative diagnosis was reached based on the history and palpation of the umbilical area. The instances' diagnoses, however, were verified. via exploratory penetration of the navel edema and display of intestine contents detection of the hernial ring with the index finger also helped in diagnosis. The surgical site was anesthetized using lignocaine HCL 2% local infiltration analgesia. The animal was placed in dorsal recumbency and the surgery site was clipped, shaved, and aseptically prepared for surgery. When the desired depth of anesthesia was obtained, an elliptical or circular skin incision was done. The incision was extended with a combination of blunt and sharp dissection to separate the skin and subcutaneous tissues from the internal hernial sac. The hernial rang was exposed and freshened before being sutured with interrupted horizontal mattress sutures made with a polydioxanone monofilament suture apposition before being sutured with no. 2 mersilk in a simple interrupted suture pattern. There was an excellent healing rate in calves treated with mesh herniorrhaphy with minor problems including wound infection hematoma development and one calf recurrence. In conclusion, these findings imply that mesh herniorrhaphy was safer and more effective than primary herniorrhaphy for repairing umbilical hernia in calves.

SURGICAL CORRECTION OF OBSTRUCTIVE UROLITHIASIS BY PERINEAL URETHROSTOMY IN A TOM CAT

Sunil Oraon, A.K. Sharma, Reetu and Vinod Kumar

Department of Veterinary Surgery and Radiology, Ranchi Veterinary College Ranchi (BAU), Kanke, Ranchi, Jharkhand

Abstract

A 4-year-old domestic tom cat weighing 3.5 kg was brought to the clinical complex, R.V.C. directed them to the department



of veterinary surgery and radiology. The past two weeks had seen a gradual decrease in appetite along with occasional vaginal licking, hematuria, and stranguria. Clinical examination indicated a bloated, tense abdomen, which on probing revealed bladder involvement that was unpleasant and refractory to manual decompression. A lateral and ventrodorsal abdominal radiograph revealed a swollen obstructive bladder as well as surrounding organs that had been displaced dorsally and cranially. the distal penile urethra was also blocked by a hyperechoic mass. Obstructive urolithiasis was a tentative diagnosis made for this case based on the radiological findings. The stone deposits were located close to the bladder and at the base and tip of the penis. The stone was removed by making an incision above the impediment in the penis' stone tip. The urethral procedure was used to insert ryle's tube no. 6 into the urinary bladder, which was where the stone's origin was. The urinary bladder was where the stone's base was located, and ryle's tube catheter was used to drain the urine.

INNOVATIVE TECHNOLOGY FOR CROP IMPROVEMENT, BIOTECHNOLOGY AND GENETIC ENGINEERING

Alice Bara^{1*}, Ravi Kumar¹, Nitu Kumari¹, Khushboo Jyotsna Baxla²

¹Department of Genetics and Plant Breeding, BAU, Ranchi

²Department of Soil science, BAU, Ranchi

*Corresponding Author : alicebara7@gmail.com

Abstract

Technological advancements in the agriculture sector meet the growing demand for farm automation, digitalization, and sustainability. Emerging agriculture trends mark a shift towards innovative farming techniques and efficient utilization of time and resources while reducing crop losses. Agriculture since past years has witnessed a great advancement in terms to science and technology which has led to betterment in fulfilling the demands of growing population. The science and technology led development in agriculture has resulted in many fold enhancements in productivity and production of different crops to match the pace of growth in food demand. Among the technologies, developments in biotechnology and marker assisted plant breeding contributed for huge production gains in crop varieties. Apart from this, RNA interference, next generation sequencing and nanotechnology have become new promising techniques for improving crop production according to future need. Application of biotechnological tools in agriculture and allied sectors could make agriculture food crops and commodities more robust to abiotic and biotic stress problems. It could bring revolution in the context of increasing of food production and quality enrichment of agriculture. Agronomic traits engineered to meet the need for an expanding global population will help us produce more food on the same amount of arable land. Quality trait engineering will help to alleviate nutritional deficiencies in populations with limited food selection. Genetic engineering is a powerful tool that gives a new direction to crop improvement.

STATUS OF MICRONUTRIENTS AND TRACE METALS IN RED AND LATERITIC SOILS OF EASTERN INDIA-A REVIEW

Juhi Tiwari^{1*}, Arvind Kumar¹ and Pallavi Bharti¹

¹Department of Soil Science, BAU, Ranchi

*Corresponding author : juhi.tiwari97@gmail.com

Abstract

Micronutrient concentrations are generally higher in the surface soil and decrease with soil depth. Eastern India has had been facing so many constraints that restrict the productivity and nutritional food security for the human being. Red and lateritic soil needs proper management for its potential utilization in crop cultivation. *Brassicas* and legumes are highly responsive to Molybdenum and Boron, whereas corn and other cereals are more responsive to Zinc and Copper. In spite of increased use of fertilizers, substantially more macronutrients are still being removed annually from the soil than are applied to it as mineral fertilizers. Some of the nutrients removed are replaced by those in straw, farmyard manure *etc.* but on the average the nutrient balance is likely to remain negative. Kumar (2019) worked on nickel application in leguminous crops in Jharkhand and showed increased growth parameters of pea, while Ni toxicity study is more important than its growth response. He reported that 20 mg kg⁻¹ Ni application in pea showed toxic/negative impact in both dominant soil series of red and lateritic soil and concluded a threshold value of Ni application to be fixed <10 mg kg⁻¹ for all



land situations in red and lateritic soil. Micronutrients and trace elements have not generally been applied regularly to soil in conjunction with common fertilizers and fertilizing soils with macronutrients only is likely to promote imbalances between these nutrient groups as well as between individual nutrients. Furthermore, increased yields, losses of micronutrients through leaching, liming, a decreasing proportion of farmyard manure compared with chemical fertilizers and the increasing purity of chemical fertilizers are among the factors contributing towards accelerated exhaustion of the supply of available micro and trace elements in soils.

CROP RESIDUE MANAGEMENT FOR IMPROVING SOIL QUALITY AND CROP PRODUCTIVITY IN INDIA-A REVIEW

Khushboo Jyotsna Baxla^{1*}, S.B. Kumar¹, Pallavi Bharti¹, Pooja Bharti¹, Chitrotpala Dehury² and Alice Bara³

¹Department of Soil Science, BAU, Ranchi

²Department of Agronomy, BAU, Ranchi

³Department of Genetics and Plant Breeding, BAU, Ranchi

*Corresponding author : khushboobaxla14@gmail.com

Abstract

India is facing various challenges in agriculture sector for sustaining soil fertility and food grains production, besides environmental degradation and food security of the country in the event of ever-increasing demands of food grains production with limited cultivable land. Cultivable land and maintaining its soil fertility are one of the major tasks which supports about 17.6% of its population and leads to strain of natural resources. As per Ministry of New and Renewable Energy, about 500 Mt of crop residues are generated annually in India, used as animal feeding, soil mulching, composting, mushroom production etc. As such, crop residues have tremendous plant nutrients, however, a large quantity of the crop residues (about 93 Mt) is burnt on-farm and primarily to clear the field for sowing of the successive crop and farmer also burn due to shortage of labour, farmer can't be able to manage the residues, so they burn it (NPMCR, 2019). Crop residues, usually considered a problem, when managed correctly can improve soil organic matter dynamics and nutrient cycling, thereby creating a favourable environment for plant growth. Three-fourth of the total residue are produced by rice, wheat and oil seed crops and remaining One-Fourth are from sugarcane and sorghum. Of the available residue for incorporation 53% are available in Kharif and 47% in Rabi season. The availability of crop residue in India would be 300, 343 and 496 million tonnes in 2000, 2010 and 2025, respectively. Crop residue (CR) is important components of low external input of sustainable agriculture without sacrificing productivity. It improves the physical, chemical and biological properties of soil and increases the crop productivity. It can be partially substituting the fertilizer nutrient but not completely replacing them. Crop residue has potential to improve fertility status of soil.

Proper use of crop residue can increase or maintain the physical and chemical properties of SOM and improve the quality of soil. Manure or crop residue alone may not be adequate to maintain SOC levels.

BACTERIAL WILT RESISTANCE IN SOLANACEOUS VEGETABLE CROPS: A REVIEW

Nancy Singh^{1*}, Sanyat Misra¹, Juhi Tiwari², Pooja Bharti² and Nitu Kumari³

¹Department of Horticulture, BAU, Ranchi

²Department of Soil Science, BAU, Ranchi

³Department of Genetics and Plant Breeding, BAU, Ranchi

*Corresponding author: nancy1995singh@gmail.com

Abstract

Solanaceous crops play an important role in human diet and the economy of nations. They are also called as “Nightshades”. This family is distributed throughout the world in all continents except Antarctica. Solanaceae family consists of 98 genera and 2700 species, with greater habitat, morphological and ecological diversity. The family Solanaceae includes number of commonly cultivated species. Most important genus of the family Solanaceae is “*Solanum*”, which includes Potato, Tomato, Brinjal, Chilli and Capsicum, that are used as food. They can grow in several conditions ranging from tropics to sub-tropics. In this diverse climatic conditions they are infested by several diseases, one among them is bacterial wilt caused by bacterium



Ralstonia solanacearum (most damaging plant pathogen). *Ralstonia solanacearum* has been reported to conquer 450+ plant species belonging to 54 different botanical families, the most susceptible hosts being solanaceous crops. Potato, tomato, brinjal and chilli are mostly affected by this bacterial wilt. Poor seed systems were a major contributor to the extensive spread, high incidence and high prevalence of this devastating disease. This topic focuses on etiology, epidemiology, diagnosis and management practices (physical, cultural, biological & chemical control measures) that are used in management of this disease and thus help in incorporating bacterial wilt resistance in solanaceous crops. However, wilt resistance is often overcome due to the considerable variation among pathogen strains and forms genetic basis for resistances in model plants.

FOOD PROCESSING, VALUE ADDITION, AND POST HARVEST TECHNOLOGY: A REVIEW

Nancy Singh^{1*}, Sanyat Misra¹, Juhi Tiwari² and Pooja Bharti²

¹Department of Horticulture, BAU, Ranchi

²Department of Soil Science, BAU, Ranchi

*Corresponding author : nancy1995singh@gmail.com

Abstract

With increased productivity of our vibrant agriculture sector, improved post-harvest handling and processing is essential to ensure high quality products that reach the markets. According to the FAO, food production would need to increase by 70% by 2050 to feed the world's population of 9 billion people. As a result, a thorough understanding of agro-ecosystem functions is required. Horticultural product, which is very perishable, requires significantly greater attention and tactics to guarantee that processing and value addition are promoted. To promote food safety and strengthen national food security, the value chain for processing has become a need. Pre-harvest factors, harvesting, market preparation (pre-cooling, sorting, grading, packaging, and on-farm storage), transportation, storage, value addition/processing, and by-product waste management are all part of the value chain in horticulture crop post-harvest management. Effective post-harvest management allows not only the minimization of losses but, also increases the value of the marketed agricultural products. Poor infrastructure for storage, processing and marketing contributes on an average 10-40% waste generation. Food processing covers all the processes that food items go through from the farm to the consumers plate. It aims to make the food even more nutritious and digestible. Food processing offers an opportunity for the creation of sustainable livelihoods and economic development for community.

INNOVATIVE TECHNOLOGY FOR CROP IMPROVEMENT, BIOTECHNOLOGY AND GENETIC ENGINEERING : A REVIEW

Nitu Kumari^{1*}, Kamleshwar Kumar¹, Alice Bara¹ and Nancy Singh²

¹Department of Genetics and Plant Breeding, BAU, Ranchi

²Department of Horticulture, BAU, Ranchi

*Corresponding author : nituroy2309@gmail.com

Abstract

With constant increase in global population, there is proportionate increase in the demand for food supply. To meet this constant increase in the demand new innovations and advance technologies are required along with the conventional method of plant breeding. Modern day technologies for crop improvement comprise the development in plant biotechnology, marker assisted plant breeding, genetic engineering and many others like nanotechnology which have become encouraging techniques in the field of agricultural sciences. In plant genetic engineering a major advancement in genetic modification was achieved with the discovery that *Agrobacterium tumefaciens* is natural genetic engineer that introduces a piece of its own DNA into the genome of the effected plant. Development of several GMOs was possible due to this technique. With advancement of time Marker assisted selection and genetic engineering came up with a significant increase in resiliency against biotic and abiotic stresses. It increases the genetic gain of crop breeding and genetic engineering enable to introduce desired traits to crops. With progress in genome editing techniques such as CRISPR-Cas9 which is immensely versatile due to its simplicity, efficacy and robustness has gained world-wide popularity as a powerful tool in crop genome editing. Several works show successful application of CRISPR-Cas9 tool for sorghum, wheat, maize, sweet orange, barley *etc.* Several other advance tools like nanotechnology and bioinformatics tools are being used for crop improvement which are flourishing in the in the new area of genomics-assisted molecular breeding. Although conventional breeding methods for crop improvement



permitted breeders to develop exceptional varieties of several crops but challenges remain and these emerging technologies show up potential to resolve many of these challenges.

APOMIXIS AND ITS GENETICS IN RELATION TO POTENTIAL USE: A REVIEW

Nitu Kumari^{1*}, Kamleshwar Kumar¹, Alice Bara¹ and Pooja Bharti²

¹Department of Genetics and Plant Breeding, BAU, Ranchi

²Department of Soil Science, BAU, Ranchi

*Corresponding author : nituroy2309@gmail.com

Abstract

Apomixis (asexual seed formation) is the result of a plant gaining the ability to bypass the most fundamental aspects of sexual reproduction: meiosis and fertilization. Without the need for male fertilization, the resulting seed germinates a plant that develops as a maternal clone. This dramatic shift in reproductive process has been documented in many flowering plant species, although no major seed crops have been shown to be capable of apomixis. The ability to generate maternal clones and therefore rapidly fix desirable genotypes in crop species could accelerate agricultural breeding strategies. The potential of apomixis as a next-generation breeding technology has contributed to increasing interest in the mechanisms controlling apomixis. In this review, we discuss the progress made toward understanding the genetic and molecular control of apomixis. Research is currently focused on two fronts. One aims to identify and characterize genes causing apomixis in apomictic species that have been developed as model species. The other aims to engineer or switch the sexual seed formation pathway in non-apomictic species, to one that mimics apomixis. When the genetic cause of apomixis is identified, apomixis could be applied to plant breeding programs as a means of permanently fixing hybrid vigor, or immediately capturing desirable genotypes. Several theories of the genetic control of apomixis have been put forth. Studies suggest one major gene or linkage group with the possibility of modifying genes. None of the theories have been proven to be completely satisfactory due to the lack of inheritance data, inaccurate progeny classification, and recombination.

QUALITY COMPOST PRODUCTION FROM SOLID URBAN WASTE : A REVIEW

Pooja Bharti^{1*}, B.K. Agarwal¹, S.B. Kumar¹, Nancy Singh²

¹Department of Soil Science, BAU, Ranchi

²Department of Horticulture, BAU, Ranchi

*Corresponding author : pooja3010952@gmail.com

Abstract

In India disposal of urban solid waste is major challenge for municipal authorities. More than 90% of these wastes are used for land filling and dumping on outside of town and cities, which have serious environmental problem. With a population of approximately 1210 million, the urban population in the country is more than 377 million constituting 31.16% of its total population. The municipalities with such rapid rate of urbanisation, facing an extra burden on the socio-economic and environmental prospects owing to migration and depletion of natural resources.

Solid waste management is a grave problem in most of the urban cities in India due to generation of its huge quantity and non-availability of suitable and cost-effective technologies for treatment and disposal. Composting is one of the best options available to reduce the amount of urban waste being directly transported to dumping sites. Composting is a natural process of biological decomposition and stabilisation of organic waste. The nutrient-rich final product, that can be applied to land as soil fertiliser or stabiliser, offers significant benefits to agroecological systems as it combines environmental protection with sustainable agricultural production. Compost is a good soil conditioner as it contains major plant nutrients (TN, TP and TK), plant micronutrients (Cu, Fe and Zn) and organic matter which improve soil properties by increasing soil aeration and water holding capacity. The various factors which determines the quality of compost are moisture content, nutrients availability, heavy metal content, water holding capacity, organic matter content, available pathogens. A work was done on the suitability of urban waste compost for agricultural purpose and showed that municipal solid waste management has become a serious problem in urban areas and the major portion is organic matter. He stated that the use of compost for agricultural purpose can be sustainable option of waste disposal. Before applying MSWC for agricultural uses, it is important to know quality of



compost to assess its toxicity. The objective of the study was to check the feasibility of compost produced in Pune city for agricultural purpose. The compost sample was selected from 3 different MSW plants. As per the result C:N ratio, Moisture content, Organic carbon, and pH were not within limits of Hadpsar site compost sample. To enhance the quality of compost different additives were added in compost. The combination of sludge and rock phosphate with MSW compost gives the maximum nitrogen. Samples have shown the decrease in C: N ratio with maturation period of 30 days. The results show that quality of compost can improve by adding different additives.

ADVANCEMENT OF AGRICULTURE IN INDIA VIA ICT

Deepak Kumar Patel^{1*}, Shashikant Divakar¹ and Avinash Kumar²

¹Department of Extension Education, Bihar Agricultural University, Bhagalpur, Sabour, Bihar

²Department of Extension Education, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar

*Corresponding Author : dkpbhu9915@gmail.com

Abstract

Use of ICT in agriculture is mainly to disseminate agriculture related information to the farmers. Agriculture is different from industry and plays a significant role in the economic development of a nation. ICT has become an integral part of Information & Technology and has played a great role in the development of society, education and civilization. Information Communication Technology (ICT) has great potential in knowledge transmission system. ICT help expand educational opportunities, enhance the quality of teaching and learning, sustain life-long learning, and improve efficiency and effectiveness in learning methodology Agriculture just like other sector has improved a lot due to ICT revolution and has made advancement in ICT in various ways. Millions of house hold own TV and mobile phone and acting as a tool of communication among rural and urban farmers or cultivators. These tools of ICT ranges to advanced modern technologies, such as GPS navigation, satellite communication, and wireless connectivity, to older technologies such as radio and television. More than 70% rural populations are dependent on agriculture. However, the rural people still lack basic communication infrastructure in accessing crucial information in order to make timely decisions. The application of ICT in agriculture has potential to meet out scientific information gap related to agricultural practice to rural people and also to promote the agricultural production by providing same information to them directly. Moreover, Farmers now need information about trend and technology needed in farming so as to produce more and participate effectively in setting price of their product. To make all this tools materialized farmer particularly rural, need to awaken and make them more familiar with the advance tools and technique of ICT.

BEESWAX WRAP AS AN ALTERNATIVE FOR SINGLE USE PLASTIC

Shweta Parida

Department of Food Science Technology and Nutrition, Sambalpur University, Jyoti Vihar, Burla, Sambalpur, Odisha, India

Email : shweta221185@gmail.com

Abstract

Single use plastics as in the form of bottles, bags, and food containers holds chemicals, which can easily leach out. These partially leached chemicals when enter in our body, act as endocrine disrupters that may leads to cancer, birth defects as well as interfere our immune system. Human beings have always chosen an easy and fast access to all our needs, whether it comes to transportation, communication and more importantly food. Fast food and online food delivery systems are the go-to options for cravings and it saves time as we can expect food on our plate within few minutes. But the wastes like paper/ butter paper/paperboards/ sachets/LDPE pouches/ PS mesh/ PP cups/straws contributed to the landfills which may take 500years to degrade and create more and more pollution over the years. Aluminum foil is an easy and low-cost option used for wrapping the food or storing them, but couldn't degraded easily and cannot be recycled due to heavy residues and its very small micron size. In India there was an approximate production 3.47 million tonnes of plastic waste in 2019-20 with the per capita waste growing from 700 gms to 2500 gms over the last five years. Out of which only 60% of it is collected as municipal waste material. The remaining 40 per cent plastic waste remains uncollected and goes directly to the environment as pollutants. The Ministry of Environment, Forest and Climate Change (MoEF&CC), notified the Plastic Waste Management Amendment Rules on August 12, 2021, which prohibited the use of identified single-use plastic (SUP) items with low utility and high littering potential w.e.f. from July 1, 2022. Even after the ban certain controversial substances like that of aluminum foil and



cling wraps are widely in use. In order to avoid single use plastic and to move towards a sustainable way of living, renewable and eco-friendly packaging alternatives can be put into action. Out of the entire most effective one is Beeswax wrap. Beeswax wrap is made by infusing or combining cotton with pine resin, food-grade beeswax and oil (commonly coconut and jojoba oil). The cotton is cut into desired shapes and the edges of the fabric are trimmed off. The melted mixture is spread evenly on both the sides of the cotton sheet, ensuring that the wax is spread evenly and to the corners of the cotton. Later the sheet is covered with wax paper and ironed; alternatively placing it on a baking tray and then in an oven. The wrap is heated at approximately 200°F or 93°C. Once it is clear the wax has melted into the cotton, and later kept for drying. Beeswax wrap is biodegradable, non-toxic, long lasting and can last for up to a year. Cling wrap and aluminum foil may seem less expensive but it can only be used once, making beeswax wrap more cost effective. Three-piece unit of beeswax wrap costs ₹350/-, whereas a year of cling wrap costs ₹1000/-.

This can be a good head start for moving towards a sustainable life style.

PLANT TISSUE CULTURE HARDENING BASED ENTERPRENURSHIP- A BOON FOR RURAL YOUTH OF VIDARBHA

D.R. Rathod, Prajakta V. Shelke, M.P. Moharil, P.V. Jadhav, B.S. Mundhe, D.A. Padole, P.R. Shingote, P.B. Kale, A.V. Rathod, G.D. Chandankar, V.S. Madke Arati Ghatole, Sayali Jamodkar and S.B. Sakhare

Biotechnology Centre, Department of Agriculture Botany, Post Graduate Institute, Dr PDKV Akola, MS

Email: drathod@pdkv.ac.in, prajaktashelke9@gmail.com

Abstract

Integrated and innovative farming has become need of the era to feed ever increasing global population. Farmers particularly with small land holdings require skill based technology to support their livelihood and raise earnings. Plant tissue culture (PTC) hardening can prove boon to the farmers as well as rural youth of Vidarbha region of Maharashtra. Entrepreneurship generation through skilled hardening of banana seedlings can provide employment to number of people as well as pave a way to encourage surrounding farmers in the region for banana cultivation. Banana growers can establish and use low cost protective structures like greenhouse and shadenet house to facilitate on-farm availability of ready to transplant disease free banana plantlets. During the field based training cum demonstration among the farmers and rural educated youth from rural areas, it has observed that 80-86% educated rural youths are shown their active participation followed by innovative farmers to the tune of 56-67% including 35% participation of women beneficiaries. Agriculturists will turn growers-cum-entrepreneurs in no time which will bring prosperity to the Vidarbha region. Imparting trainings, demonstrations and hands-on-trainings in workshops are powerful tools to meet the challenges like global feeding, unemployment as well as upliftment of marginal farmers in the region.

EFFICACY OF FOLIAR SPRAYS OF CHITOSAN ON CHEMICAL, BIOCHEMICAL AND YIELD CONTRIBUTING PARAMETERS OF PIGEONPEA

Darasing R. Rathod¹, Vandana S. Madke², Gajanan D. Chandankar³, Prashant R. Shingote⁴, P.B. Kale⁴ and T.H. Rathod⁵

¹*Biotechnology Centre, Dr PDKV, Akola,*

²*College of Agriculture, Nagpur Dr. P.D.K.V., Akola,*

³*Reginal Research Centre, Amravati (Dr. P.D.K.V., Akola)*

⁴*VNCOAB, Yavatmal*

⁵*Dept of Plant Physiology, PGI, Dr PDKV, Akola*

Email: drathod75@gmail.com

Abstract

Chitosan spraying was done two times i.e. on 45 and 65 DAS. and the effect of foliar sprays of chitosan (25, 50, 75, 100 and 125 ppm) and IBA (25, 50, 75, 100 and 125 ppm) on the chemical, biochemical and yield contributing parameters of pigeon pea cv. PKV-Tara was studied during *khari* 2017-2018 at farm of Botany section, College of Agriculture, Nagpur. Experiment was laid out in RBD design with three replications and eleven treatments. Observations about chemical and biochemical



parameters like leaf chlorophyll, N, P, K content in leaves, protein content in seed were also estimated. Observations on yield contributing parameters like 100 seed weight, number of pods plant⁻¹, number of seeds pod⁻¹, seed yield plant⁻¹, plot⁻¹ were recorded. Foliar sprays of 25 ppm 50 ppm chitosan significantly enhanced chemical and biochemical parameters and yield contributing parameters when compared with control and rest of the treatments under study.

STUDIES ON EFFICACY OF FOLIAR SPRAYS OF IBA ON CHEMICAL, BIOCHEMICAL AND YIELD CONTRIBUTING PARAMETERS OF PIGEONPEA

Darasing R. Rathod¹, Vandana S. Madke², Gajanan D. Chandankar³, Sapana V. Baviskar⁴, Prashant R. Shingote⁴, P.B. Kale⁵, S.M. Gogate⁵, N.W. Raut⁵ and T. H. Rathod⁵

¹Biotechnology Centre, Dr PDKV, Akola,

²College of Agriculture, Nagpur Dr. P.D.K.V., Akola,

³Regional Research Centre, Amravati (Dr. P.D.K.V., Akola)

⁴VNCOAB, Yavatmal,

⁵Dept of Plant Physiology, PGI, Dr. PDKV, Akola

Email: drathod75@gmail.com;

Abstract

Indol Butyric Acid commonly known as IBA spraying was done two times i.e. on 45 and 65 DAS. and the effect of foliar sprays of chitosan (25, 50, 75, 100 and 125 ppm) and IBA (25, 50, 75, 100 and 125 ppm) on the chemical, biochemical and yield contributing parameters of pigeon pea cv. PKV-Tara was studied during *kharif* 2017-2018 at farm of Botany section, College of Agriculture, Nagpur. Experiment was laid out in RBD design with three replications and eleven treatments. Observations about chemical and biochemical parameters like leaf chlorophyll, N, P, K content in leaves, protein content in seed were also estimated. Observations on yield contributing parameters like 100 seed weight, number of pods plant⁻¹, number of seeds pod⁻¹, seed yield plant⁻¹, plot⁻¹ were recorded. Foliar sprays of 25 ppm IBA significantly enhanced chemical and biochemical parameters and yield contributing parameters when compared with control and rest of the treatments under study.

SCENARIO OF INFORMATION TECHNOLOGY IN CONTEXT TO INDIAN AGRICULTURE

G.D. Chandanakra¹, Varsha. V. Tapre², S.S. Munje³, Vandana Madke⁴ and A.N. Warghat³

¹Soybean Breeder (AICRP), Regional Research Centre (Dr.PDKV), Amravati (M.S.)

²Regional Research Centre (Dr.PDKV), Amravati (M.S.)

³Regional Research Centre (Dr.PDKV), Amravati (M.S.)

⁴College of Agriculture, Nagpur (M.S.)

⁵Naini Agricultural Institute, SHUATS, Prayagraj (U.P.)

Corresponding author Email : gchandankar@rediffmail.com.

Abstract

Agriculture is one of the fastest growing sectors in the world with huge volumes of data generated every day via both structured and unstructured format via IoT (internet of things) These relate to data on historical weather pattern, soil reports, new research, rainfall, pest infestation, images from drones and so on. Cognitive IOT solutions can sense all this data and provide strong insights to improve yield. Digital mandis could offer an excellent way for transactions between farmers and customers. The e-mandi concept has previously been tested in different parts of India, and would add transparency and efficiency to the whole marketplace. It could bring the kisan back to his glory days as the nation rebuilds its economy after the current crisis. Technology powered by Artificial intelligence is ensuring the sustainability of quality food production for the coming decades. Drones, hydroponics, artificial lights and AI-powered cameras are protecting crops from wild animals. The contribution of artificial intelligence in agriculture is only set to increase with agri-tech startups cropping up in Bengaluru, Hyderabad and New Delhi. Cognitive computing in particular, is all set to become the most disruptive technology in agriculture services. It can understand, learn, and respond to different situations (based on learning) to increase efficiency. Some of them can be services for the producers. For example, the chatbot that pops up when you visit a banking website could be incorporated into a kisan app. Proximity Sensing and Remote Sensing require sensors to be built into airborne or satellite systems, but proximity requires sensors in contact with soil. This helps in soil characterization based on the soil below the



surface in a place. Drone-based imagery can help in in-depth field analysis, crop monitoring, scanning of fields and so on. They can be combined with computer vision technology and IOT to ensure rapid actions by farmers. These feeds can generate real time weather alerts for farmers. Images of various crops are captured using Computer Vision Technology under white/UV-A light. Farmers can then arrange the produce into separate stacks before sending it to the market. Pre-processing of images ensures the leaf images are segmented into areas for further diagnosis. Such a technique would help identify pests more distinctly. Cognitive computing makes recommendations to farmers on the simplest choice of crops and seeds. This technology will monitor crops along their entire life-cycle and generate reports for detecting anomalies, if any. Remote sensing techniques alongside hyper spectral imaging and 3D laser scanning are essential to create crop metrics across thousands of acres. Farmers in the southern Indian state of Andhra Pradesh received AI-sowing app advisory text messages for the first time in 2016, with a 30% increase in their crop yields per hectare. In 2017, the pilot was expanded to more than 3,000 farmers in the state and neighbouring Karnataka. Karnataka Agricultural Price Commission (KAPC) and Microsoft worked together to develop a multi-variate commodity price forecasting model by combining artificial intelligence, cloud machine learning, satellite-imaging and other advanced technologies. The Karnataka government and Microsoft signed a memorandum of understanding (MoU) in October 2017 reaffirming their commitment to creating technology-oriented smart farming solutions for farmers in India. The model uses satellite imagery and other data to produce predictions about arrival dates and crop volumes. It is now ready to be applied to other crops and other regions around the country. In conclusion of that, India's Agri-tech start-ups are hungry for CSR funding to give wings to their dream tech that will turn deserts into fertile farmlands.

STUBBLE BURNING : A PROBLEM FOR THE ENVIRONMENT, AGRICULTURE AND HUMANS

S.S. Munje¹, A.N. Warghat² and G.D. Chandankar³

¹RRC (Dr.PDKV), Amravati (M.S.)

²Naini Agricultural Institute, SHUATS, Praygaraj (U.P.)

³RRC (Dr.PDKV), Amravati (M.S.)

Corresponding authore Email : shyammunje@gmail.com

Abstract

Stubble burning seriously effects on air quality, soil fertility because of demolition nutrients presents in the soil for enriching the crop growth, and climate every season. The plant debris or stubbles could provide vast economic profits to the farmers if managed properly and protect the environment from the unembellished air pollution. Introduction The crop residues burnings are the new immerging threat to the human kind and southern part of India. The northern parts with states like Haryana, Punjab and Delhi NCR and western Uttar Pradesh are having big agricultural produce market as well as the Agricultural lands. Mostly the crop ecosystem like Wheat, potato and mustard are grown in massive number of lands. The farmers are widely adopting new technology and method for cultivation for better yield or production. The practice of removing plant debris and crop residues from previous crops may affects the new cropping system like spreading of soil bourn or seed borne diseases from previous plant material in new ecosystem, for avoid future upcoming challenges the farmers would mostly done this burning the previous crops residues in quicker ways in less period of time.

RECENT ADVANCES IN CROP IMPROVEMENTS

G.D. Chandanagr¹, Varsha. V. Tapre,² S. S. Munje³, Vandana Madke⁴ and A.N. Warghat³

¹Soybean Breeder (AICRP), Regional Research Centre (Dr.PDKV), Amravati (M.S.)

²Regional Research Centre (Dr.PDKV), Amravati (M.S.)

³Regional Research Centre (Dr.PDKV), Amravati (M.S.)

⁴College of Agriculture, Nagpur (M.S.)

⁵Naini Agricultural Institute, SHUATS, Prayagraj (U.P.)

Corresponding authore Email : gchandankar@rediffmail.com

Abstract

The introduction of applied genetics to agriculture through plant breeding led to the development of hybrid varieties with improved crop productivity. Genetic engineering holds the potential to broaden genetic diversity by the introduction of new genes into crops. But the random insertion of foreign DNA into a plant's nuclear genome often leads to transgene silencing.



Genome editing technologies have emerged as powerful tools to precisely modify the crop genomes at specific sites in the genome. This review focuses on the advances in crop breeding through precision genome editing. Review includes an overview of the different breeding approaches for crop improvement; genome editing tools and their mechanism of action and application of the most widely used genome editing technology, CRISPR/Cas9.

The domestication of plants helped increase food production, allowing the sustenance of populations in large settlements and they provide most calories in the human diet. They are also good sources of both therapeutic drugs and industrial feed stocks, while more recently they have been used to produce pharmaceutical proteins and biofuels. The need for increasing crop yields to provide food for a burgeoning world population has been recognized for centuries, since at least the time of Thomas Malthus. Plant breeders have managed to increase yields to keep pace with this growth and this should be celebrated as a triumph of agricultural biotechnology.

The introduction of genome editing and other techniques into all crops will be hugely helpful in allowing crop development. Until the 1990s this was dominated by marker assisted breeding, but since then transgenic and cisgenic technologies have made valuable contributions to increasing productivity. These include introducing knockout or missense mutations at targeted loci or even the introduction of epigenetic changes. The solution to improving crop yield will lie in a combination of different technologies including plant breeding, transgenesis, cisgenesis and genome editing. Many parts of the world have well-established frameworks, albeit often based on differing principles. Frontiers in Plant Science's Plant Biotechnology section aims to help applied plant scientists develop improved crops.

PREPARING FOR THE FUTURE OF DRONE ECOSYSTEM AND SELF EMPLOYMENTS IN INDIA

S.S. Munje¹, A.N. Warghat² and G.D. Chandankar³

¹RRC (Dr.PDKV), Amravati

²Naini Agricultural Institute, SHUATS, Praygaraj (U.P.)

³RRC (Dr.PDKV), Amravati (M.S.)

Corresponding Author Email : shyammunje@gmail.com

Abstract

Drones enable farmers to identify plants affected by diseases and pests at a faster space than when using traditional methods, to monitor water during the irrigation process, and to apply fertilisers in different areas of the farm according to the needs of the soil. Benefits of Agricultural Drone Uses as Productivity. Perhaps one of the most notable benefits of using drones in agriculture is their ability to meet the demands of an ever-growing population. Climate change adaptation. Farming operations are greatly affected by climate change and reduced Pollution. Today's agriculture routinely uses sophisticated technologies such as robots, temperature and moisture sensors, aerial images, and GPS technology. These advanced devices and precision agriculture and robotic systems allow businesses to be more profitable, efficient, safer, and more environmentally friendly. the main benefits of agriculture is in an agriculture and Food. Agriculture can help reduce poverty, raise incomes and improve food security for 80% of the world's poor, who live in rural areas and work mainly in farming.

IMPORTANCE AND NEED OF NATURAL INSECT REPELLENTS IN AGRICULTURE

A.N. Warghat¹, S.S. Munje² and G.D. Chandankar² and Vandana Madke³

¹Naini Agricultural Institute, SHUATS, Praygaraj (U.P.)

²RRC (Dr.PDKV), Amravati

³RRC (Dr.PDKV), Amravati (M.S.)

⁴College of Agriculture, Nagpur (M.S.)

Abstract

Corresponding author Email : anandwarghat07@gmail.com

The insects are the part of earth since from developments of flora and fauna. The control of insect pest and domestic animal's pests has economic importance in agriculture. Since earlier civilizations, people have utilized plant-based repellents to defend themselves from arthropods pests that are looking for hosts. For the creation of new natural goods, indigenous plants studies' understanding of plants used as traditional repulsive is a great resource as well as in agriculture. Commercially, pyrethrum and



neem seem to be well, plant-based essential oil-based pesticides have just recently come onto the market, and neurotoxicity (rotonone) use appears to be waning. A multitude of plant secondary metabolites have been investigated for use as insect antifeedants or repellents, although besides a few naturally occurring mosquito repellents, there has not been much commercial success for plant compounds that disrupt invertebrate behaviour. There should be some specificity to need why using insect attractants are important is Insect repellents are used to ward off biting insects like flies, ticks, mosquitoes, and ticks. Mosquitoes can spread the disease like West Nile virus, malaria, and Zika. Rocky Mountain Spotted Fever, Lyme disease, and other infections can be conveyed by ticks. In order to prevent bites as well as the spread of disease, repellents work by keeping pests away rather than by eradicating them. The working mechanism of the insect repellents are found within the case and research studies world widely, Mosquitoes and ticks are drawn to our exhaled carbon dioxide and skin smells. In addition, they search for a potential host using heat, movement, and visual clues. In order to keep insects from seeking an animal or human host, repellents conflict with their instincts of taste and smell. Insect repellents may cause unfavourable adverse interactions with natural systems that have the potential to result in harmful effects, especially intermediate metabolites, based on a developing collection of studies. An important phenomenon for the hazardous response of these molecules may be the practices have the potential followed by bioavailability. There is increasing concern about the potential toxicity in environment leading to health problems caused by random use of insect repellents. An increasing number of evidence suggests that insect repellents may trigger hazardous interactions with biological systems. Biotransformation followed by bioaccumulation may be an important phenomenon for toxic response of this chemicals. The current state of knowledge includes biochemical pathway alteration under in vitro and in vitro conditions considering different classes of organisms.

THE SIGNIFICANCE OF TRAP CROPS IN INTEGRATED PEST MANAGEMENT

A.N. Warghat¹, S. S. Munje² and G.D. Chandanar³ and Vandana Madke⁴

¹Naini Agricultural Institute, SHUATS, Praygaraj (U.P.)

²RRC (Dr.PDKV), Amravati (M.S.)

³RRC (Dr.PDKV), Amravati (M.S.)

⁴College of Agriculture, Nagpur (M.S.)

Corresponding authore mail anandwarghat07@gmail.com

Abstract

Trap cropping is a best practice in controlling the pest in different agro-ecosystems. It gives significant economic and environmental benefits, and its use can be achieved integrated with other cultural, biological, and chemical control methods. In present scenario, trap cropping is the also successful in gaining the rational and economically favorable. With the advance and modern scientific study of agriculture, the cultivation or conservation of trap crops may be achieved from prevention from reaching the pest from Economic Threshold Level ETL or one can attract the pest in one place for controlling them economically. Scientists have concluded that the life cycle of these insects, the damage they cause, and the discovery of chemicals that destroy them can help kill them. Technical development and adoption of biological methods in fields such as the identification, implementation, and removal of harmful residues from crop ecosystem like allelochemicals, and proper application of methods. It is alternative to indiscriminate use of chemical pesticides and insecticides shall increase gradually with the compact tendencies on chemicals in crop ecosystem.

D² ANALYSIS IN LATHYRUS

Gopal D. Nawale¹, Vandana S. Madke¹, Gajanan D. Chandankar² and D.R. Rathod³

¹College of Agriculture, Nagpur (Dr.P.D.K.V., Akola)

²Reginal Research Centre, Amravati (Dr.P.D.K.V., Akola),

³Deptt of Agril. Biotechnology, Dr.PDKV, Akola

Email: gchandankar@rediffmail.com

Abstract

Fifty seven genotypes were grown in randomized completed block design replicated thrice and observations were recorded for days to 50 % flowering, days to maturity, plant height (cm), number of primary branches plant⁻¹, number of pods plant⁻¹,



number of seeds pod^{-1} , 100 seed weight (g) and yield plant^{-1} (g). Mahalanobi's generalized distance for eight characters was used in this study for computing genetic divergence. To identify genetic diversity infifty-seven genotypes for the desirable and potential parents for *lathyrus* breeding programme were aimed at yield and earliness improvement. The analysis of dispersion for eight corrected variables using Wilk's criterion, revealed highly significant difference between genotypes for aggregate of the eight characters. The 57 genotypes were grouped into eight clusters by Tocher's method. The maximum inter cluster distance was recorded between cluster IV and cluster VIII (110.67). The canonical analysis indicated that the plant height at maturity, pods plant^{-1} , yield plant^{-1} , days to 50 % flowering, seeds pod^{-1} , number of primary branches and days to maturity were significant and important sources of variation in the vector I and in vector II. In vector III, days to 50 % flowering, days to maturity, number of seeds pod^{-1} and 100 seed weight were important sources of variation. The genotypes belonging to distant cluster exhibiting high performance in the desirable direction for plant height, yield plant^{-1} , days to 50 % flowering and pods plant^{-1} were identified as the potential parents for hybridization programme. The 20 genotypes viz., L-3, L-31, L-33, L-25, L-32, JRL-16, RLK-279, L-37, RLK-1045, L-44, L-14, L-07, L-08, RLK-240, L-39, L-05, RLK-602, L-16 and BioR-208 were identified as potential and diverse parents for their use in crossing programme.

LATHYRUS SATIVUS L. GRAIN AS A FODDER CROP

Gopal D. Nawale¹, Vandana S. Madke¹, Gajanan D. Chandankar² and D.R. Rathod³

¹College of Agriculture, Nagpur (Dr.P.D.K.V., Akola)

²Reginal Research Centre, Amravati (Dr. P.D.K.V., Akola)

³Deptt of Agril.Biotechnology ,Dr.PDKV,Akola

Email: gchandankar@rediffmail.com

Abstract

Lathyrus sativus L. is an important legume crop with low cost and easy cultivation grown in India, Bangladesh, China, Ethiopia, Nepal, and Pakistan for human food and animal feed. *Lathyrus sativus* L. is known as excellent feed and fodder crop for centuries as a main concentrate for horses (Anonymous, 1894). Inherently *Lathyrus* possesses resistance drought, excess moisture, salinity, diseases, and insect pests. As *Lathyrus* has an ambivalent reputation due to ODAP content in its plant parts, efforts are on to develop low or ODAPfree *Lathyrus* varieties with high biomass for dual purpose for human food and animal feed. Older published animal feeding studies are of limited use, since the presence and role of ODAP was unknown until the 1960s. More recent feeding studies indicate that low ODAP lines of *L. sativus* can be safely incorporated at inclusion rates up to 40, 30 and 70% of the diet of poultry, pigs and sheep, respectively, without growth reductions (Hanbury, *et.al*, 2000). Livestock is a key component of farming systems in South Asia and in Africa, and most particularly with small and marginal farmers, estimated about 678 million, and indicates importance of livestock to their livelihoods (ILRI, 2000). *Lathyrus* is increasingly recognized as an important feed and fodder crop by their source poor farmers of semi-arid and dry areas. Acceptability of low ODAP varieties by the farmers of non-traditional *Lathyrus* growing areas and high nutritional composition makes the *Lathyrus* a perfect dual purpose for crop securing food, feed and fodder security in the region. (Sarkar, *et.al.*, 2010). *L. sativus* are crops that should be considered in regions with suitable environments. (Hanbury, *et. al.*, 2016). As world demand for legume feed protein is likely to increase due to increasing demand for animal food products.

STUDIES ON THE TRAINING OF ASPERGILLUS FLAVUS FUNGI FOR INCREASING THEIR POTENTIAL TO ABSORB ZINC METAL IONS

Harish Pal Bhati¹, Gulgul², Shikha Raghav³, Dinesh Kumar⁴, Neetu Kumari⁵, Dinesh Panwar⁶ and Pradip Kumar⁷

¹Deptt. of Botany, Government Degree College (Constituent College of C.C.S. University, Meerut), Jewar, G.B.Nagar, U.P.,

²Department of Botany, CCS University, Meerut, U.P., India ³Department of Botany, I.P. College, Bulandshahr, U.P., India

⁴Department of Botany, M.S. College, Saharanpur, U.P., India ⁵Base Association, Meerut, U.P., India

⁶Department of Microbiology, CCS University, Meerut, U.P., India

⁷Department of Biotechnology, CCS University, Meerut, U.P., India Email: harishbhati21@gmail.com

Abstract

Water is one of the most precious natural resources crucial for life. It is impossible to think of life without water on this earth.



Since times immemorial, water availability has been taken for granted in most parts of the world, so much so that it has been exploited indiscriminately in an unplanned manner. Industrial effluents constitute one of the major pollutants of water bodies and soil as well. The effluents discharged from industries contain various pollutants, including dyes, heavy metals, phenols, sewage *etc.* While many organic pollutants are biodegradable, a large variety of these pollutants are non-biodegradable; these not only persist but also accumulate primarily through the food chain. Heavy metals comprise one such category of pollutants. The present study was carried out to isolate some soil fungi with the potential of resistance/tolerance to and good biosorptive efficiency for heavy metal and Zinc in single-metal and multi-metallic solutions. Such strains might be helpful in fabricating biosorption-based treatment plants for effluents carrying mixtures of heavy metals. Few species of fungi were exposed to increasing concentrations (50 ppm to 3000 ppm) of metal Zn amended media culture. The percentage biosorption of Zn by *A. flavus* biomass from aqueous solutions of higher concentrations was as follows: 39.37% to 86.55% (at 100 ppm), 35.67% to 72.20% (at 200 ppm) and 19.29% to 63.12% (at 300 ppm). Trained strains were further evaluated for their biosorption ability from binary and ternary solutions. The difference between the adsorption of metals by untrained biomass (AFLZn) and trained biomass (AFLZnT) was highly significant ($t=4.12; 5.02$). Thus, if a given fungal species is introduced for greater biosorption of a given metal, it may also increase its potential to adsorb other metals. Finally, it is concluded that training a fungal species against a given metal might yield strains that can work better than parental strains in single and multimetal systems.

ASSESSMENT OF CYTOGENOTOXIC POTENTIAL OF *AEGLE MARMELOS* (BAEL) ON SOMATIC CHROMOSOMES OF *PISUM SATIVUM*

Sangeeta Dayal

Department of Botany and Biotechnology, KVSCOS Swami Vivekanand Subharti University Meerut U.P

Abstract

Bael, *Aegle marmelos* (Family Rutaceae) is one of the oldest known fruit tree species native to India. Wide distribution of bael in Indian subcontinent and other parts of the world reflects its adaptation to a range of agro-climatic conditions. In addition to well-known nutritional and traditional medicinal benefits, the bael fruits have considerable processing and industrial values. In order to better utilize and improve the existing genetic resource, there is a need scrutinizing the studies related to genetic diversity, characterization, evaluation and conservation, taxonomy, phenology, floral biology and pollination. Bael is frequently used as homeopathic drug. The given dose of this drug is very small because of its mutagenic effect in higher dose. In the present investigation we want to access toxic effects of *Aegle marmelos* on somatic chromosomes of *Pisum sativum*. In order to determine the toxicity and mutagenic effects of *Aegle marmelos* on *Pisum sativum*, five conc. 10%, 20%, 30%, 40%, 50% were used for the treatment of the root tips of test plant. It had been noticed there were number of abnormalities/aberrations observed like stickiness of chromosomes, unorganization of chromosomes, fragmentation during separation of chromatids, multiple chromatin bridge formation etc. These types of abnormalities were increased with increased conc. and duration of treatment of this fragrance.

SURGICAL MANAGEMENT OF CONGENITAL EXTERNAL HYDROCEPHALUS AND SHUNT PLACEMENT IN A THREE-DAY OLD COW-CALF

Archana Kumari¹, Rajesh Kumar¹, Ramesh Tiwari and Bhavna²

¹Department of Veterinary Surgery and Radiology, Bihar Veterinary College, Patna

²Department of Veterinary Gynaecology and Obstetrics, Bihar Veterinary College, Patna

Abstract

Hydrocephalus comprises a swelling of the cranium due to an accumulation of fluid, which may be in the ventricular system or between the brain and the dura which affects all animals but most commonly seen in pigs, puppies and calves. A three-day old female cow-calf weighing 25 kgs was presented to the Department of Veterinary Surgery and Radiology, Bihar Veterinary College, Patna (Bihar). The animal was in lateral recumbency and had an abnormal large, round, fluid-filled external skin pouch over its frontal region of the head. The animal showed signs of weakness, poor suckling reflex, in co-ordinated movements and inability to sit or stand. Physical examination revealed that frontal bones in the area of attachment of the skin pouch were not formed. Neurological examination revealed that the calf was alert and responsive. Radiograph showed that the cavity was fluid-filled and had no part of brain inside it. After confirming that it was a case of congenital hydrocephalus, it was



decided to go for surgical treatment. A small stab incision was given in the middle of the skin pouch for draining the fluid slowly. After draining out two-third of the fluid, the skin at the base was incised. Then, a deep incision was made to remove the whole skin pouch. In order to prevent the accumulation of excessive fluid, if produced, a plastic shunt tube was placed. Post-operatively, the calf was given Inj. Cefotaxim @ 500 mg i/m daily for 5 days, Inj. Meloxicam @ 0.2 mg/kg body weight for 3 days. The animal started showing suckling reflex within 1 day while sitting and standing reflex within 2 days (Fig. 4) post-surgery. After 10 days, the calf showed uneventful recovery.

DOUBLING FARMERS INCOME THROUGH PRECISION HORTICULTURE

Ramdeen Kumar*, Amit Kumar and Yogendra Meena

Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, 221005 (U.P.) India

**Email : rdanand2018@gmail.com*

Abstract

Precision horticulture is a science where scientist or growers develop new technologies to optimize the management of crop production or increasing efficiency. precision horticulture is a science whereby growers use technology to fine-tune crop production practices. It helps growers determine exactly when and what to plant and what kind of inputs to use, how to control the environment, lighting, irrigation and nutrition for optimum yield and monitor how crops are growing, by greenhouse bay, zone and bench. The essential steps in horticulture precision farming are assessing variation and managing variation in crops. Factors and the processes that regulate or control crop performance in terms of yield vary in space and time. we can use the technology for the most part effectively. on a site specific variability organizations, we can use a GPS instruments, so that the site specificity is pronounced and management will be easy and economical. different component and facilitator of horticulture precision farming used to enhanced the crops yield like-computer and internet are the main components in enabling the precision farming possible and global positioning system (GPS) and geographical information system (GIS),remote sensing holds huge promise for precision farming. many technologies used for horticulture are important like crop scouting used observations of crop conditions and information management ,yield monitoring and mapping, grid soil sampling and variable rate fertilizer (VRT) applications used for cultivation for enhancing farmers income.

SUCCESSFUL TREATMENT OF PERIANAL FISTULA IN A GERMAN SHEPHERD

Smriti

Department of Veterinary Clinical Complex

Abstract

A 7 year old male German Shepherd weighing 30 kilograms was presented in the OPD of Veterinary Clinical Complex of Ranchi Veterinary College with clinical signs and symptoms of perianal fistula. Extreme itching was observed along with redness, serosanguineous discharge, swelling, anal oedema and pain. The patient was prescribed cyclosporine @ dose rate of 1mg/kg body weight (BW) twice daily along with Ketoconazole @ dose rate 10mg/kg BW once daily and Cefpodoxime proxetil @ dose rate of 10mg/kg BW orally once a day. The above treatment regimen was followed for 15 days at the end of which the clinical signs resolved completely.

THE IMPACT OF SOCIAL, ECONOMIC AND POLITICAL FACTORS ON AGRICULTURAL SYSTEMS

Richa Shukla¹, Atul Kumar² and Sujit Payla³

¹Deptt. of Political Science, Government College, (Constituent College of C.C.S. University, Meerut), Jewar, G.B. Nagar, U.P.

²Deptt. of Economics, Government College, (Constituent College of C.C.S. University, Meerut), Jewar, G.B. Nagar, U.P., India

³Deptt. of Sociology, Government College, (Constituent College of C.C.S. University, Meerut), Jewar, G.B. Nagar, U.P., India

Abstract

Agricultural systems are always embedded within larger social and political contexts, both of which have a significant impact on how those systems function. Understanding the ways in which social and political factors can impact agricultural systems



is essential if these systems are to be maintained for the long term. In order to identify and rank the importance of social and political factors on agricultural systems in the India, as well as to provide some insights into their impacts, interactions, and mechanisms of influence, an expert panel was utilized as a method of analysis. The panel was able to identify a wide variety of social and political factors that have an effect on agricultural systems. The factors were classified as falling into one of three categories: political, internal, or external social factors. There was no clear winner among the three groups, as evidenced by the fact that each of their respective factor categories achieved high rankings. There were varying points of view regarding the significance of certain factors; however, there was widespread agreement regarding a great deal of them. It has been determined that globalization and low margins, both of which require increased scale and efficiency, are the two most significant factors influencing agricultural systems. Several newly emerging factors as well as factors that require further research were identified. It is essential to have a comprehensive understanding of these factors in order to help direct scientific research in order to make discoveries that are beneficial and to ensure that policy decisions enhance the future sustainability of agricultural production.

SUCCESSFUL TREATMENT OF DEMODICOSIS IN DOG

Xaxa L.S.

Department of Veterinary Clinical Complex, RVC, BAU, Kanke, Ranchi, Jharkhand

Abstract

A 20 months old, male dog of 31 kg body weight was presented to Department of Veterinary Clinical Complex, R.V.C, Kanke with the history of skin infection and hairfall since 2 months. Physical examination revealed presence of erythema and alopecia on ventral and lateral portion of neck and other parts of body. The dog was previously treated with ivermectin @ 0.4mg/kg for a total of 2 occasions, but still the condition persisted with massive hairfall. Skin scrapping test has been done and was still positive for demodicosis. The dog was then treated with fluralaner along with 10% imidacloprid plus 2.5% moxidectin spot on along with vitamin A and omega 3 fatty acid supplementation. The dog showed drastic reduction in clinical signs on 12th day of review. After 40 days the pet recovered completely with proper hair growth.

FUTURE AGRICULTURE WITH ARTIFICIAL INTELLIGENCE, BLOCKCHAIN AND INTERNET OF THINGS

Praveen Kumar^{1*}, Priyanka Kumari² and Ankit³

¹*Division of Agricultural Extension, ICAR-IARI, New Delhi*

²*Division of Molecular Biology and Biotechnology, ICAR-IARI, New Delhi*

³*Division of Water Science and Technology, ICAR-IARI, New Delhi*

*Email : prvnkumr01@gmail.com

Abstract

Presently Agricultural industry is developed a lot with the help of technology and it became data-cantered and smarter. In such circumstance more efficient farming practices can be attained using the recent technological advancements and solutions to current bottlenecks in farming. A direct application of AI (Artificial Intelligence) or machine intelligence across the farming sector could act to be an epitome of shift in how farming is practiced today. The rapid growth of Internet of Things, Block chain and AI based technologies reshaped many industries including agriculture. Such a radical change dismantles existing farming practices and creates new opportunities along with some challenges. The applications of Internet of things in agriculture include smart farming automatic irrigation, spraying of pesticides and disease detection. Sensors can be deployed in various locations like the ground, water, and vehicles etc. for collecting data. The cloud systems are used for storing the collected data and mobile phones are used by the farmers for accessing the data via the internet. Applications are often fragmentary, lack seamless integration and especially more advanced solutions are in an experimental stage of development. Important challenges to overcome this situation include (i) integration of existing internet of things solutions by open internet of things architectures, platforms and standards. (ii) up-scaling the usage of interoperable IoT technologies beyond early adopters especially by the simplification of existing solutions and make it more affordable for end users, and (iii) further improvement of Internet of things technologies to ensure a broad usability in the diversity of the agri-food domain. Three challenges that need to be addressed in order for this technology to be popularized in markets are uneven distribution of



mechanization, the ability of algorithms to process large sets of data accurately and quickly, and the security and privacy of data, as well as the devices. Role of extension in providing up-to date information to the farmers regarding Artificial Intelligence, Internet of things and Blockchain devices, their processes and their applications to make agriculture profitable cannot be forgotten. So the extension systems have the potential to harness these technological opportunities to make the farmers and farming better off and so ultimately these technologies are solving several issues of the farmers by enabling them to take proactive decisions in their respective farms.

IMPACT OF CLIMATE CHANGE ON FOOD SECURITY

Pankaj Kr. Mandal, Sarvesh Kumar and Nirala Kumar

Department of Extension Education, BAU, Sabour, Bihar

Abstract

Food security is one of the major concerns related to climate change. Climate change affects agricultural production, agro-ecosystems, food chain, income and trade, with socio- economic impacts on livelihoods and food security. The observed climate change is already affecting food security through changing rainfall patterns, rising temperatures, and a greater frequency of some extreme events. Studies that isolate climate change from other factors affecting crop yield have shown that yields of some crops in many low-latitude regions have been negatively affected by the observed climate changes, while in many high-latitude regions yields of some crops have been positively affected in recent decades. The effects of climate change on our ecosystems are already severe and widespread, and ensuring food security is one of the most difficult challenges facing humankind from climate change. While some problems related to climate change are emerging, there is an urgent need for gradual action to allow sufficient time to build resilience in the agricultural production system. However, it is important to note that the net impact of climate change depends not only on the extent of climate shock but also on the underlying vulnerabilities. Reducing vulnerabilities is critical to minimizing net impacts on food security and nutrition, and to minimize long-term impacts.

IMPACT OF DIFFERENT SOURCES OF ZINC ON YIELD ATTRIBUTES AND YIELD OF BARLEY (*HORDEUM VULGARE* L.)

Yash Vardhan Singh

Department of Soil Science and Agricultural Chemistry,

Abstract

The aim of the present investigation is to study the effect of different sources of zinc on yield attributes and yield of barley (*Hordeum vulgare* L.) crop. The field experiment was carried out during *rabi* season of the year 2021-22 at Agricultural Research Sub-station, Vallabh Nagar, Udaipur (Rajasthan) which lies in agro-climatic zone IV-A of Rajasthan, India. The experiment was laid out in split plot design with three treatments in main plots *viz.* control, 5 kg Zn per hectare as soil application and seed treatment with zinc solubilizing bacteria (ZSB) @ 5 ml per kg of seed and four treatments in sub plots *viz.* control, one foliar spray of nano Zn @ 5 ml per litre of water at 15, 30 and 45 days after sowing which replicated thrice. The soil application of zinc @ 5 kg Zn ha⁻¹ along with foliar spray of nano Zn @ 5 ml per litre of water at 45 days after sowing had significantly increased number of effective tillers, length of ear, grains ear⁻¹, grain yield and straw yield of barley.

HYBRID EXTERNAL SKELETON FIXATOR FOR COMMINUTED AND COMPOUND LONG BONE FRACTURE IN LARGE ANIMALS

Reetu^{1*}, A.K. Sharma¹, B. Bhushan¹, S. Oraon¹ and S.S. Kullu²

¹Department of Veterinary Surgery and Radiology, Ranchi Veterinary College, BAU, Kanke, Ranchi, Jharkhand

²Department of Animal Nutrition, Ranchi Veterinary College, BAU, Kanke, Ranchi, Jharkhand

*Correspondence Author Email : reetutirkey@gmail.com

Abstract

Long bone fracture is a major concern in large farm animals. Owing to their heavy weight and limited technique for proper



fracture fixation, complete and comminuted fractures mostly becomes fatal for large animals. External skeletal fixation is commonly used technique in humans and small animals especially for comminuted and compound fractures. Linear and circular fixators can be used for less weighing calves however; heavy weight is a concern in case of adult cattle. Hybrid External skeletal fixator using linear and circular construct has been used successfully in heavy and adult cattle. Open fractures of long bones can be repaired using combination of full rings, half rings and side bars supporting the linear bone pins crossed through proximal and distal bone segments. This technique has an additional advantage of early ambulation after fracture fixation and animal is able to bear weight on affected limb just after the fixation. Hybrid fixators are well documented to have better in vitro biomechanical properties and have been found promising in clinical cases. The only constrain till now is the cost of construct and availability. However need of efficient fracture fixation technique for large animal may bring this technique to regular practice.

TUBE CYSTOSTOMY : AN OUTSTANDING SURGICAL TECHNIQUE TO OVERCOME UNEXPECTED ECONOMIC LOSS IN GOAT FARMING

Reetu^{1*}, A.K. Sharma¹, B. Bhushan¹, S. Oraon¹ and S.S. Kullu²

¹Department of Veterinary Surgery and Radiology, Ranchi Veterinary College, Birsa Agricultural University, Kanke, Ranchi, Jharkhand

²Department of Animal Nutrition, Ranchi Veterinary College, Birsa Agricultural University, Kanke, Ranchi, Jharkhand

*Correspondence Author Email : reetutirkey@gmail.com

Abstract

Goat farming has emerged as a sustainable source of income for livelihood in rural areas. Almost 40 % of population below poverty line at rural areas depends upon goat rearing. Disease control is one the most important aspect in livestock farming to prevent financial loss due to treatment cost and sometimes loss of animals. Major emphasis has been given to viral, bacterial and parasitic diseases however; managemental diseases can also lead to huge losses in small enterprises. Obstructive urolithiasis is such a problem which mainly occurs in early castrated male goats in which urine outflow is completely obstructed due to lodgment of urinary calculi in urethra. The incidence rises up in winter season due to less water intake by the animals which are maintained at more concentrated diet. Site of calculi lodgement is at urethral process or sigmoid flexure in goats. If calculi is lodged at urethral process it can be easily removed by excision of urethral process. Calculi lodged at sigmoid flexure can be treated by tube cystostomy, a small surgical procedure for placement of transabdominal Foleys catheter to bypass urine flow directly through the catheter and kept as such for at least 15 days. Meanwhile calculi at urethra get dissolved with the help of ammonium chloride or homeopathic medications. The technique is quick, economical and efficient. In absence of treatment suffered animal collapse within 4-5 days of illness causing huge economical loss to the farmers. Thus, tube cystostomy is needed to be practiced more frequently at field level for better utilization of this technique.

BEESWAX WRAP AS AN ALTERNATIVE FOR SINGLE USE PLASTIC

Shweta Parida

Department of Food Science Technology and Nutrition, Sambalpur University, Jyoti Vihar, Burla, Sambalpur, Odisha, India

Email : shweta221185@gmail.com

Abstract

Single use plastics as in the form of bottles, bags, and food containers holds chemicals, which can easily leach out. These partially leached chemicals when enter in our body, act as endocrine disrupters that may leads to cancer, birth defects as well as interfere our immune system. Human beings have always chosen an easy and fast access to all our needs, whether it comes to transportation, communication and more importantly food. Fast food and online food delivery systems are the go-to options for cravings and it saves time as we can expect food on our plate within few minutes. But the wastes like paper/ butter paper/paperboards/ sachets/LDPE pouches/ PS mesh/ PP cups/straws contributed to the landfills which may take 500years to degrade and create more and more pollution over the years. Aluminum foil is an easy and low-cost option used for wrapping the food or storing them, but couldn't degraded easily and cannot be recycled due to heavy residues and its very small micron size. In India there was an approximate production 3.47 million tonnes of plastic waste in 2019-20 with the per capita waste growing from 700 gms to 2500 gms over the last five years. Out of which only 60% of it is collected as municipal waste



material. The remaining 40 per cent plastic waste remains uncollected and goes directly to the environment as pollutants. The Ministry of Environment, Forest and Climate Change (MoEF&CC), notified the Plastic Waste Management Amendment Rules on August 12, 2021, which prohibited the use of identified single-use plastic (SUP) items with low utility and high littering potential w.e.f. from July 1, 2022. Even after the ban certain controversial substances like that of aluminum foil and cling wraps are widely in use. In order to avoid single use plastic and to move towards a sustainable way of living, renewable and eco-friendly packaging alternatives can be put into action. Out of the entire most effective one is Beeswax wrap. Beeswax wrap is made by infusing or combining cotton with pine resin, food-grade beeswax and oil (commonly coconut and jojoba oil). The cotton is cut into desired shapes and the edges of the fabric are trimmed off. The melted mixture is spread evenly on both the sides of the cotton sheet, ensuring that the wax is spread evenly and to the corners of the cotton. Later the sheet is covered with wax paper and ironed; alternatively placing it on a baking tray and then in an oven. The wrap is heated at approximately 200°F or 93°C. Once it is clear the wax has melted into the cotton, and later kept for drying. Beeswax wrap is biodegradable, non-toxic, long lasting and can last for up to a year. Cling wrap and aluminum foil may seem less expensive but it can only be used once, making beeswax wrap more cost effective. Three-piece unit of beeswax wrap costs ₹ 350/-, whereas a year of cling wrap costs ₹ 1000/-. This can be a good head start for moving towards a sustainable life style.

NANO-TECHNOLOGY : A NOVEL APPROACH IN IMPROVING PLANT QUALITY, QUANTITY AND PROFITABILITY OF WHEAT (*TRITICUM AESTIVUM* L.) CROP

Y.K. Singh¹, Shikhar Verma¹, Bal Veer Singh¹ and Mausmi Rastogi²

¹Department of Agronomy COA, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (U.P.) 208002

²Department of Agronomy, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut (U.P.)

*Corresponding Author's Email : shikharsaurabh@gmail.com

Abstract

Wheat (*Triticum aestivum* L.) is one of the most important staple food crops in the world. As it provides 21% of the food calories and 20% of the protein to more than 4.5 billion people. A fertilizer (Urea, DAP & MOP) being a major determinant of yield has gained much attention in research since long time. The research has achieved high productivity; still the nutrient use efficiency is low. The nutrient use efficiency of N, P and K still stands at 30-35%, 18-20%, and 35-40%, respectively. Despite improvements in agriculture, plants are inefficient users of conventional chemical fertilizers which also increase cost of cultivation. Thus, nano-biostimulants and nano-fertilizers could provide nutrients to the crop in better way with higher nutrient use efficiency. While organic fertilizers prolong nutrient release and reduce mineral content, inorganic fertilizers volatilize and lose leaching. These issues might be resolved in agriculture via nanotechnology. Nanoparticles are being utilized in wheat biofortification to eliminate environmental difficulties, enhance nutrient uptake and absorption, increase grain output and profitability, and provide the proper amount of fertilizer at the right time. Through nano-biofortification, in wheat, as it is an important field crop, can reduce human hunger and nutrient shortages. Nano bio-fortification of wheat plants has been widely explored. Reviewing wheat development techniques and nutritional supply, both at macro and micro level. Understanding nanoparticle safety and future prospects may improve their economic and nutritional use of wheat crop after utilizing nano-fertilizers and nano-biostimulants in biofortification.

BIO-FORTIFICATION THROUGH TRANSGENIC CROP

¹Saurabh and Anjali²

¹Department of Agronomy, Bhagwant University, Ajmer (Rajasthan)-305023

²Deptt. of Genetics and Plant Breeding, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, U.P.

Abstract

Concerns over global food security have a significant bearing on the Sustainable Development Goals of the United Nations, which are largely centered on the elimination of world hunger by the year 2030. According to the Global Food Security Index of 2019, it has been reported that 88% of countries claim there is enough food supply in their countries. However, the horrifying reality is that according to the index, every one in three countries is facing insufficient availability of food supply, which means that more than 10% of the population is malnourished. Ever since the beginning of agriculture, human beings have been manipulating plant genetics in order to produce more desirable offspring. However, conventional breeding takes



place over the course of several generations and cannot be utilized to increase just one particular characteristic. The process of breeding can be streamlined with the help of precision technologies such as transgenic techniques *ie.* genetic engineering and genome editing, which can also bring qualities to crops that cannot be greatly enhanced by traditional breeding methods. Regarding this matter, bio-fortified food crops, particularly cereals, legumes, vegetables, and fruits, are delivering enough quantities of micronutrients to the populations that were intended to get them. Even though there is a larger focus being placed on studies with transgenic technique, the success rate and acceptance of breeding is far higher. In spite of the obstacles, bio-fortified crops have a very promising future as a potential solution to the problem of hunger.

FOOD NANO-TECHNOLOGY

Bal veer Singh^{1*}, Y.K. Singh¹, Shikhar Verma¹ and Shakti Singh²

¹Department of Agronomy, C.S.A. University of Agriculture and Technology, Kanpur (U.P.), 208002

²Agricultural Biochemistry, C.S.A. University of Agriculture and Technology, Kanpur (U.P.), 208002

*Corresponding Author Email : bvs955rajpoot@gmail.com

Abstract

Nanotechnology in the food industry is a new and exciting field. It offers endless opportunities in the food business. Nanotechnology is being used to strengthen plastic material barriers, incorporate active components that can deliver functional qualities beyond those of conventional active packaging, and detect and communicate relevant information about the food inside the package. Nanomaterials used in food packaging have the potential to release preservatives, mend tears in the packaging, and increase the shelf life of the food inside. Nanotechnology has many potential uses in the food sector, including the detection of pathogens in packaging, improved flavour and colour quality, and increased safety due to improved barrier qualities. It's clear that nanotechnology has the potential to improve the food industry from both the inside and outside. As quickly as nanotechnology opens up new opportunities for innovation in the food business, however, new questions and health concerns are also beginning to surface. European Union, World Trade Organization, and international laws governing nanotechnology in food are inadequate. Furthermore, the current law does not seem to be tailored to the unique needs of nanotechnology.

UTILIZING NANOTECHNOLOGY TO IMPROVE SOIL FERTILITY AND NUTRIENT MANAGEMENT

Bal Veer Singh¹, Shikhar Verma¹ and Shakti Singh²

¹Department of Agronomy, C.S.A. University of Agriculture and Technology, Kanpur (U.P.), 208002

²Department of Agricultural Biochemistry, C.S.A. University of Agriculture and Technology, Kanpur (U.P.), 208002

*Corresponding Author's Email : bvs955rajpoot@gmail.com

Abstract

Nanotechnology has emerged as a breakthrough science in order to meet the growing need for food for the world's population, which is projected to reach 9.6 billion by 2050. The fertility and productivity of farmlands on a global scale have been substantially impacted by human activities and cultural changes in lifestyle. In the near future, these changes may prove catastrophic, resulting in famine and starvation, particularly in developing nations. The use of nanotechnology in environmentally friendly farming practices and ensuring adequate food supplies holds tremendous promise. Not only do conventional chemical fertilizers contribute to the degradation of our ecosystem, but they also have poor nutrient uptake efficiency, making them both expensive and unfriendly to the natural world. In this regard, nanotechnology makes use of nanoparticles (NPs) that range in size from 10 to 100 nanometers and have a large surface area to volume ratio. These NPs are utilized by agricultural plants in an efficient manner in comparison to the usage of conventional fertilizers. The subject of nano-nutrition of crop plants is a new one, and numerous NPs have been successfully exploited as macro- and micronutrients to improve soil fertility, nutrient uptake by the crop plants, and ultimately the productivity of the crop plants. On the other hand, there are concerns about the toxicity of these NPs in crop plants. In this context, more attention needs to be paid to the optimization of doses for normal development and productivity, the synthesis of NPs, and the utilization of nutrients derived from organic or natural sources that can be broken down quickly.



INTEGRATED OMICS APPROACHES FOR ENHANCING YIELD AND NUTRITIONAL QUALITY IN PULSES

Sandhya Sharma and Kishor Gaikwad

ICAR-National Institute for plant Biotechnology, New Delhi-110012

Abstract

The world's population is steadily expanding, and by 2050, it may have surpassed nine billion. Crop yields/food production must increase by 70% by 2050 in order to feed the growing global population. The ability to produce and provide food with improved nutrition to the world's rising population will determine the health of future generations. Therefore, superior traits for crops, such as higher yield, abiotic and biotic stress tolerance, and improved nutritional qualities, are increasingly in demand. In the recent decade, the legume research group has made remarkable success in terms of the development of genetic and genomic resources. With the advancement of high throughput Next generation sequencing technology, whole genome sequences are now available not only for model legume species like *Glycine max* (soybean) and *Medicago truncatula*, but also for low-profile poor legumes like *Cajanus cajan* (pigeonpea) and underutilised *Cyamopsis tetragonoloba* (clusterbean) etc. To better understand complicated biological processes, researchers must use a multi-omics approach that highlights the interrelationships of the involved biomolecules, associated pathways, and the molecular mechanism of legume evolution and its relevance to biologically important traits.

CO₂ EMISSION, TRENDS AND ECONOMIC GROWTH IN BRICS COUNTRIES: A PANEL DATA ANALYSIS

Amita Kiran^{1*} and R. Kushawaha²

¹Department of Botany, Lalitnarayan Mithila University, Darbhanga

²School of Economics, University of Hyderabad, India

*Corresponding Author Email : amita_bhu@yahoo.com

Abstract

The present research examines the relationships between CO₂ emissions and trends in climatic vulnerability consumption across BRICS nations over the period of 1990 to 2017. Using the panel data least square dummy variable model (LSDV) model, it was found that the LSDV1 model is statistically significant, meaning that every country followed different trends, perhaps, due to the differences in the availability of energy resources. It was found that China and India followed a similar pattern in the CO₂ emission, and in aggregate, the relationship between per capita income and CO₂ emission has a negative relationship and it is also highly statistically significant. Other variables i.e. per capita electricity consumption, per capita energy consumption, gross capital formation, and gross fixed capital formation are major determinants for CO₂ emission and countries with high per capita income are exhibiting better trends in order to reduce CO₂ emission.

INDUCED CHLOROPHYLL MUTATIONS IN CHICKPEA (*CICER ARIETINUM* L.)

Anand Kumar^{1*}, Dinkar¹, Ravi Ranjan Kumar², Anil Kumar¹, Rakesh Deo Ranjan³, Satyendra¹, Mankesh Kumar¹, S.P. Singh¹, Sanjay Kumar¹, Tushar Ranjan² and Ramesh Nath Gupta⁴

¹Department of Plant Breeding and Genetics, Bihar Agriculture University, Sabour, Bhagalpur, Bihar

²Dept. of MBGE, Bihar Agriculture University, Sabour, Bhagalpur, Bihar

³Dept. of PPB, Bihar Agriculture University, Sabour, Bhagalpur, Bihar

⁴Dept. of Plant Pathology, Bihar Agriculture University, Sabour, Bhagalpur, Bihar

*Corresponding Author Email : dranandpbgbausabour@gmail.com

Abstract

Chickpea, an important pulse crop, is attracting the attention of plant breeders to reconstruct it genetically. The mutagenic effect is reflected in the segregation of chlorophyll mutants, these mutations were evaluated in order to determine the effectiveness and efficiency of chemical mutagens in two varieties of chickpea. Seeds (9% moisture content) of two chickpea varieties GCP 105 and PG 186 were exposed to six doses (20 to 70 KR) of gamma rays or treated with four concentration of



ethyl methanesulphonate (0.1 to 0.4%). A broad spectrum of chlorophyll mutations was obtained in M₂ generation by using , gamma and EMS in two varieties viz; GCP 105 and PG 186 of chickpea (*Cicer arietinum* L.). The range was greater with EMS than with gamma rays or combined treatments. The spectrum of chlorophyll mutations consisted of *albina*, *chlorina*, *tigrina*, *viridis* and *xantha*. Of these chlorophyll mutations, *xantha* type was predominant in both the mutagenic treatments. The spectrum and frequency of chlorophyll mutations increased with increase in doses gamma rays. Moderate concentrations of EMS gave higher frequency of chlorophyll mutations. Total (pooled) chlorophyll mutation frequency was found maximum with EMS treatments followed by gamma rays. 'xantha' followed by 'chlorina' out numbered other types of chlorophyll mutants in both the varieties. In both the varieties, the order of mutagenic effectiveness was: EMS>gamma rays. Three criteria viz; seedling injury (Mf/I), pollen sterility (Mf/S) and meiotic abnormalities (Mf/Me) were taken into account for estimation of mutagenic efficiency. The order of efficiency in both varieties with regard to Mf/I and Mf/S was: EMS>gamma rays. The different types of morphological mutants were induced. The chlorophyll deficient and flower colour mutations are of hardly any economic importance, but the compact, dwarf, early, large pod size and collar rot resistant mutants are agronomically desirable which may be utilized in future breeding programme.

BIOSORPTION OF BASIC FUCHSIN DYE BY MYCOMASS OF DYE-TOLERANT FUNGAL STRAINS ISOLATED FROM DYE-TREATED SOILS.

Amit Kumar^{1*}, Sanjay Kumar¹, Harish Pal Bhati², Raj Singh³, Ashu Tyagi⁴ and Permod Kumar⁵

¹Department of Botany, Maharaj Singh College, Saharanpur (U.P.)

²Department of Botany, C.C.S. University, Meerut (U.P.)

³Department of Biotechnology, Maharshi Markandeshwar University Mullana, Ambala (Haryana)

⁴Department of Botany, C.C.S. University, Meerut (U.P.)

⁵Department of Botany, Swami Vivekanand Shubharti University, Meerut (U.P.)

*Email: amitsaini.saini421@gmail.com

Abstract

The dead biomass of *A. flavus* and *A. niger* could adsorb the dye basic fuchsin much more efficiently than *P. glabrum*. The increase in contact time from 10 to 20 minutes resulted in the decline in biosorption but exposure for 30 minutes led to increase in the efficiency. The increase in temperature from 25° C to 45° C resulted in an increase in adsorption percentage in case of *A. flavus* and *P. glabrum*. In case of *A. niger*, the biosorption efficiency declined at 35° C but finally increased at 45° C. The ability of biomass of all the three fungal species declined when the biomass dose was raised from 10 mg/100 ml to 20 mg/100 ml but the efficiency improved as the dose was raised to 30 mg/100 ml. The percentage biosorption of dye was decreased with increase in initial basic fuchsin concentration from 100 ppm to 500 ppm. Thirty minutes of contact time between dye solution and biomass, 10 mg/100 ml biomass dose, and dilute solution of dye (100 ppm) were found to be most appropriate for the biosorption of dye. An increase in temperature from 25° C to 45° C can improve the efficiency.

MORPHOLOGICAL AND MOLECULAR MARKER BASED DIVERSITY ANALYSIS OF LENTIL (*LENS CULINARIS* MEDIK.) GENOTYPES

Shashi Kumar¹ Gupta Anil Kumar¹ Anand Kumar^{1*} and Ravi Ranjan Kumar²

¹Department of Plant Breeding and Genetics, Bihar Agriculture University, Sabour, Bhagalpur, Bihar

²Dept. of MBGE, Bihar Agriculture University, Sabour, Bhagalpur, Bihar

*Corresponding Author Email : dranilbau@gmail.com

Abstract

Lentil is an autogamous, diploid (2n=2x=14) crop belonging to Viciae tribe of Fabaceae family and have haploid genome size of 4063 Mbps. It has been cultivated as a pulse crop for over 8,000 years. The fertile crescent region of the Near East is the area where lentils were first cultivated, and they were later spread to other regions of Europe, the Middle East, and Africa. Understanding the exploitable genetic variation is essential to increase the yield of cultivated lentil and protect it from biotic and abiotic stresses. The present investigation was conducted at BAC Farm, Bihar Agricultural University, Sabour (Bhagalpur), Bihar during Rabi 2021-22 to study the genetic variability, correlation, direct and indirect inter-relationship in 39 lentil genotypes for yield and its attributes. Analysis of variance revealed significant differences among all the genotypes



taken under study. High heritability coupled with high genetic advance were observed for number of secondary branches, number of pods per plant, number of effective pods per plant, grain yield per plant and biological yield per plant. Grain yield per plant exhibited highly significant positive correlation with number of primary branches, number of secondary branches, number of pods per plant, number of effective pods per plant, 100 seed weight, biological yield per plant and harvest index. Path coefficient analysis revealed that biological yield per plant followed by number of pods per plant, harvest index, hundred seed weight and number of primary branches exhibited positive direct effect on grain yield per plant. On the basis of Mahalanobis D2 statistics, the 39 genotypes were grouped into five clusters. Among the five clusters, cluster I constituted maximum number of genotypes (28) followed by cluster III (5), cluster V (3), cluster IV (2) while cluster II found to be monogenotypic. Maximum inter cluster distance (2871.77) was recorded between cluster IV and cluster V. For molecular diversity study, 30 SSR markers were used, out of which 9 turned out to be polymorphic, dividing the total genotypes in 2 cluster and 4 sub-cluster at similarity coefficient of 0.1. The size of amplified alleles varied from 170 to 300 bp. Polymorphism information content (PIC) ranged from 0.18 to 0.63 with an average of 0.42. The result revealed diversified lentil genotypes that can be utilized in further crossing programme for exploring maximum yield potential of lentil.

GENETIC PARAMETERS STUDIES IN BARLEY (*HORDEUM VULGARE* L.)

Aliza Mariyam, Abhay Dashora, Parul Gupta, Himanshuman and Avadhoot Dharmadhikari

*Department of Genetics and Plant Breeding, Rajasthan College of Agriculture,
MPUAT, Udaipur, Rajasthan*

Abstract

Barley is one of the most important food grains since historic times. Knowledge of genetic variability, genotypic and phenotypic coefficient of variation, heritability and genetic advance of yield contributing traits is important for efficient planning of crop improvement programmes of barley. The experiment of the present investigation was conducted to evaluate the 35 barley genotypes to estimate the genetic parameters for yield and its contributing traits. The genotypes were evaluated in Randomized Block Design using three replications at Instructional Agronomy Farm, Rajasthan College of Agriculture, MPUAT, Udaipur. The analysis of variance revealed highly indicated significant differences among genotypes for all the 13 traits under investigation thereby indicating the existence of substantial genetic variation among genotypes for all the yield and its contributing traits. The high genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) was exhibited by the number of grains per spike, 1000-grain weight, grain weight per spike, grain yield per plant and biological yield per plant. The PCV was found higher than GCV which indicates the important role of the environment in the expression of the characters. High heritability coupled with the high genetic advance in the traits *viz.*, number of grains per spike, 1000-grain weight, grain weight per spike, biological yield per plant and grain yield per plant indicated that these traits are governed by additive gene action and thus direct selection of these traits could be effective in crop improvement programme of barley.

TECHNOLOGICAL AND POLICY OPTIONS FOR RAISING THE FARMERS INCOME IN RANCHI REGION OF JHARKHAND

Singh Anand* and Jaiswal Siddharth

Department of Business Planning and Development, Birsa Agricultural University, Ranchi, Jharkhand

*Email : anand.manager@gmail.com

Abstract

The development of agriculture and allied sector in India has focused only lifting the food production for improving food security and reduce the hunger across the country. The production and productivity increases through the implementing modern agricultural technologies and adoption of good quality seed, fertilizers, irrigation and agro-chemicals etc of the cultivated land area. However, the population of our country's is rising very fast, as per first population census 1951, the population in our country was only 36 crores, which is increased 123 crores in 2011 according to census report of government of India. However, the present population of 132 crores is probably to increase 145 crores by 2030 and 2050 probably to be increase 166 crores in the country. The data indicates since 60 years the population reached to 100 crores and the estimated growth rate in 1951-2010 was 3.5 percent and 1.2 percent in 2010-19. the demand of foods will be increasing for diversified



production of food grains, pulses, fruits, vegetable, milk, and livestock's by 2030 in country. The projected cereal demand expected to increase 11 percent, demand for vegetable grow by 37 percent milk and dairy by 52 percent and poultry by over 100 percent by 2030. Thus, the need to produce 300 million tonnes of food grains against the present level of food grains production 284.95 million tonnes and 350 million tonnes of fruit and vegetables against 314.67 tonnes will be fulfil the basic requirement for growing population in our country by 2030. The production growth can only possible to increase the present level of productivity up to 30 percent by adoption of newer technology and innovation of high yielding varieties during the 1951-2019 the food grain production of our country has increases 5.61 times, pulse 2.78, times, oilseed 6.25 times, cotton 9.38 times, sugarcane 7.01 times, horticulture 3.2 times milk 9.38 times, fish 15.21 times, egg 47.57 times and meat 3.88 times respectively. While the overall all average variation rate in agriculture and allied sector are about 11 times which shows improvement of food security, nutritional security and income security to farming population and non-farming population in country. Furthermore, the country has made not only self-sufficient at aggregate level, also maintaining the buffer stock and exporting several agricultural products to other countries.

EFFECT OF FOLIAR APPLICATION OF BORON ON PHYSIOLOGICAL, YIELD AND YIELD RELATED ATTRIBUTE IN WHEAT

Anjali* and S.K. Guru

Department of Plant Physiology, College of Basic Sciences and Humanities, G.B. Pant University of Agriculture and Technology, Pantnagar-263145, Uttarakhand

*Corresponding Author's Email : anjali pawar951@gmail.com

Abstract

Wheat, along with rice and maize, is an important cereal crop for human food security. Wheat is the staple crop for an estimated 35% of the world population. Micronutrients comprising zinc, copper, iron, manganese, boron, molybdenum and chlorine are though required by plants in much smaller amounts, yet are as essential as the major nutrients such as nitrogen, phosphorus, potassium etc. Micronutrient deficiency still remain a major public health problem in many countries worldwide with more than two billion people suffering from one and more micronutrient deficiencies. Boron is one of the seven essential micronutrients required for the normal growth of most of the cereal, fruit and vegetable crops. B deficiency is considered as a nutritional disorder that adversely affects the metabolism and growth of plants. Boron deficiency has been realized as the second most important micronutrient constraint in crops after that of zinc (Zn) on global scale. It causes severe reductions in crop yield, due to severe disturbances in B-involving uptake and transport processes, cell wall synthesis, cellular membrane functions. Foliar B application is an effective strategy for improving B supply to plants especially when root growth is restricted due to dry soil conditions. Foliar application is done at later stages of crop growth and this method of B application has been found more effective in yield improvement and grain enrichment. To find out the effect of foliar spray of boron (109.25, 113.30, 218.50 and 226.60 mg/l) in wheat, an experiment was conducted in the year 2020-21 at Crop Research Centre, G. B. Pant University of Agriculture and Technology Pantnagar. From the above results there is significant increase was observed in chlorophyll content, nitrate reductase activity, grain yield and 1000 grain weight with two sprays of boron at 30 and 60 DAE.

TO STUDY THE RESISTANCE MECHANISM OF DIFFERENT CITRUS GENOTYPES TO *XANTHOMONAS CITRI* PV. *CITRI* INCITED CITRUS CANKER SEVERITY UNDER ARTIFICIAL INOCULATION CONDITIONS

Ashok Kumar Mahawer¹, R.M. Sharma¹, Dinesh Singh² and Jagdish Yadav²

¹Division of Fruits and Horticultural Technology, ICAR-Indian Agricultural Research Institute, New Delhi -110012

²Division of Plant Pathology, ICAR-Indian Agricultural Research Institute, New Delhi 110012

*Corresponding Author Email : ashokmahawer2012@gmail.com

Abstract

In the present study, 19 different citrus genotypes, including 13 acid lime, 4 lemons, and 2 grapefruit, were screened out against *Xanthomonas citri* pv. *citri* (*Xcc*) under artificial inoculation. Moreover, all the lemon and grapefruit genotypes showed a high level of resistance. However, acid lime cultivars exhibited a variable reaction to *Xcc*. The range of the average



percentage of disease incidence (PDI) for two years varied from 0.00% to 62.33%. ALC-35 expressed the maximum average PDI (61.50%), followed by the genotypes ALC-107 (55.17%) and ALC-111 (51.83%). Kagzi Kalan showed immune to the canker disease, while Pusa Lemon-1, LS-3, Konkan Seedless, Marsh seedless and Redblush grapefruit had minimum PDI under artificial inoculation. On the basis of average PDI, ALC-35, ALC-107, and ALC-111 were categorised as highly susceptible, whereas 10 genotypes were classified as susceptible to *Xcc*. The average of two years area under disease progression curve (AUDPC) ranged from 0.00 to 1300. The genotype ALC-35 proved highly susceptible to *Xcc* with 1281.67 AUDPC, followed by ALC-107, ALC-111, and ALC-83. The present investigations also studied various physiological responses of *Citrus* spp., including, photosynthetic rate (*A*), transpiration rate (*E*), stomatal conductance (*g_s*), intrinsic water use efficiency (*iWUE*) and stomatal observation. *Xcc* inoculation significantly decreased *A*, *E*, *g_s*, while increasing *iWUE*. The highest reduction rates of *A* (-41.16%), *E* (-41.26%) and *g_s* (-55.26%) were found in ALC-35, and the lowest reductions of *A* (-6.31%), *E* (-10.78%) and *g_s* (-15.38%) were registered in Kagzi Kalan after inoculation. ALC-35 exhibited highest stomatal density, stomata pore (length and width), stomata area, stomata complex area, stomatal conductance index and lowest was in Kagzi Kalan. Konkan seedless had highest stomata complex (length and width), and stomatal index. The PDI showed significantly positive correlations with stomatal area (0.98), stomata pore length and width (0.96 and 0.95), stomata complex index (0.95), stomatal index (0.71) and stomata complex length (0.67).

A STUDY ON PRACTICES FOLLOWED BY COLLEGE STUDENTS WHILE USING FACEMASK AGAINST CORONA VIRUS

Rupanagudi Beena Fareq* and Rupal Babel

Department of Textiles and Apparel Designing, College of Community and Applied Sciences, MPUAT, Udaipur, Rajasthan

Email : beenarupanagudi@gmail.com

Abstract

Covid-19 pandemic caused by Corona virus can cause anyone to get very ill or pass away at any age, however, being knowledgeable about the illness and the virus's propagation is the greatest strategy to stop or slow down transmission. The aim of the study is to analyze the precautionary steps followed by students while wearing a facemask against corona virus. 200 students (100-girls and 100-boys) were randomly selected as sample from colleges of MPUAT, Udaipur, Rajasthan. There was found to be significant difference between boys and girls habit of (i)cleaning hands with soap &water or sanitizer before touching the mask, (ii)checking for any damage of facemask and regarding (iii)molding or adjusting mask to cover face without leaving gaps on any side. The study concludes that most of the students have always followed the safe precautionary steps to be taken against, getting infected by corona virus.

ASSESSMENT OF URDBEAN GENOTYPES FOR DURABLE RESISTANCE TO YELLOW MOSAIC DISEASE

Sangita Sahni¹* and Bishun Deo Prasad²

¹Department of Plant Pathology, Tirhut College of Agriculture, Dholi, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur-848125, Bihar, India

²Department of Agricultural Biotechnology and Molecular Biology, College of Basic Sciences and Humanities, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur-848 125, Bihar, India

*Email : sangita@rpcau.ac.in

Abstract

Urdbean [*Vigna mungo* (L.) Hepper], an Indian native pulse crop, is grown throughout India and Southeast Asian countries. In India, urdbean is also referred to as black gram or urad dal and about 70% of its global production is produced there. Due to its wide adaptability and climate resilience, it is grown in all the cropping seasons in India. Despite being the largest producer and consumer of urd beans, India has been unable to keep up with the demand of the world's population, which is expanding quickly. A total 100 urdbean genotypes were screened against mungbean yellow mosaic virus (MYMV) under natural field conditions in the augmented design by planting 2 rows of two test entries each alternated with one row of susceptible check. Out of 100 genotypes tested, only one genotype, NDU 12-1 was found to be disease free, twenty seven genotypes found to be highly resistance and four genotypes showed resistance consistently for four consecutive seasons (two summer and two



Kharif) during 2017-2018. However, four genotypes were found to be superior for seed yield among all the genotypes tested as well as resistant to MYMV. Further, selected genotypes which showed disease free, highly resistant, resistant, moderately resistance and susceptible reaction in field screening were used to molecular markers associated with MYMV resistance in urdbean.

DISSECTING THE ROLES OF BRASSINOSTEROID IN ARSENIC MITIGATION IN RICE (*ORYZA SATIVA* L.)

Bishun Deo Prasad^{1*} and Sangita Sahni²

¹Department of Agricultural Biotechnology and Molecular Biology, CBSH, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar, India

²Deptt. of Plant Pathology, TCA, Dholi, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar, India

*Email : bdprasad@rpcau.ac.in

Abstract

Rice is the staple food for more than half the world's population and a key to food security in most of the Asian countries. However, the potential risk of arsenic contamination associated with rice has become a threat to the health of millions of people worldwide. In India, the Gangetic basin, a well-known rice-growing region, is heavily contaminated with arsenic. Flooded irrigation is the method of growing rice that is utilised the most frequently; in the absence of rain, groundwater is employed. Arsenic has accumulated in soil over time as a result of repeated usage of groundwater that is high in the metal. When compared to other cereal crops like wheat and maize, rice can accumulate as in quantities that are several times greater. Arsenic uptake and transportation in rice plants utilizes either silica (Si) or phosphate transporter. A handful of genes associated with arsenic uptake and transport in rice plants have been identified and characterized using reverse genetics approaches. Brassinosteroids (BRs) are plant steroid hormones, which play essential roles in plant growth and development and also confer tolerance to a wide range of abiotic stresses. Considering the growing importance of the role BRs in stress responses and protective role against toxicity of heavy metals in plants, we undertook a study to analyse of the ten genes associated with arsenic accumulation and transportation in BR treated rice plants grown in naturally arsenic contaminated soil. Expression profiling of the genes involved in arsenic uptake and its translocation were performed using qRT-PCR analysis. We have shown downregulation of *Lsi2* gene upon BR treatment, which has been linked previously to decrease arsenic accumulation in rice shoot and grain. The identification and characterization of BR responsive genes involved in arsenic accumulation and transportation of arsenic in rice plant, open doors for further analysis of these genes as targets for reducing arsenic absorption in rice.

BIOCHEMICAL CHARACTERIZATION OF ENDOPHYTIC BACTERIA ISOLATED FROM SUGARCANE VARIETIES BO-91 AND CO-P 16437

Aman Jaiswal^{1*}, Geeta Kumari², Himani Priya³, Vivekananthan T.⁴, Anupam Amitabh⁵ and Vikas Kumar Rai⁵

¹Deptt. of Microbiology, CBS&H, RPCAU, Pusa

²Deptt. of Microbiology, CBS&H, RPCAU, Pusa

³ICAR-Indian Agricultural Research Institute, Hazaribagh, Jharkhand

⁴SRI, RPCAU, Pusa

⁵Deptt. of Soil Science, RPCAU, Pusa

*Email : amanjaiswal1989@gmail.com

Abstract

Endophytic bacteria colonizing internal parts of the plants benefit the crop plants by enhancing their growth and development. These beneficial organisms are documented in almost all plants. Sugarcane also colonizes diverse endophytic bacteria and these bacteria benefit the sugarcane crop through plant growth promoting activities. Therefore, a study was conducted to isolate endophytic bacteria from different parts of two sugarcane varieties, BO-91 and Co-P 16437, and to examine them for their morphological characterization and biochemical behavior. Sugarcane samples, roots, stems and leaves were collected and further subdivided into upper, middle and lower portions. One gram of the sample from each sub portion was surface sterilized and subjected to an isolation process on nutrient agar and Luria Bertani agar plates. A total of 71 endophytic bacteria



of different morphotypes were isolated from roots, stems and leaves of both varieties, out of which 45 isolates were obtained from BO-91 and 26 isolates from Co-P 16437. Isolates were subjected to morphological characterization on the basis of colony morphology and microscopic features. Most of the isolated colonies were of small size, circular shape with regular margins, smooth texture and yellow or orange color colonies on nutrient agar and Luria- Bertani agar plates. 41 isolates were identified as Gram-negative and 30 isolates as Gram-positive bacteria, out of which 17 were endospore producers based on Gram staining, endospore staining and microscopic observations and most of the isolated cells were of rod shape. Isolates were further tested for biochemical activities, in which most isolates were able to utilize citrate and showed positive response to the oxidase test, whereas few isolates showed positive response to the methyl red test and Voges-Proskauer test. Future work will be done on nutrient solubilization and biocontrol activities of promising isolates.

PYOMETRA IN BITCH : A CASE STUDY

Hanuman P. Yadav* Anand Kumar and Umesh Kumar

Department of Veterinary Gynaecology and Obstetrics, Ranchi Veterinary College, Birsa Agriculture University, Kanke, Ranchi-834006, Jharkhand

**Email : hanumanvets9885@gmail.com*

Abstract

A 4.5 year old Labrador bitch weighing 23.0 kg came to the Veterinary clinical complex of Ranchi Veterinary College, Ranchi, Jharkhand. According to History, bitch was suffering from anorexia since 5 days and the whitish muco-purulent with foul smell discharge comes from the vagina since last 8-10 days. On clinical examination found trace amount of purulent vulvar discharge during vaginal examination and increases respiration rate, pulse rate and body temp. (102.2 °F). On the basis of radiographical examination, uterus largely visualized distended and filled with the pus on caudal and mid-abdomen area. Ultrasonography examinations revealed that of an enlarged and tortuous uterine horn filled with an anechoic to hypoechoic fluid and cytological examination degenerative neutrophils with intracellular bacteria present in vaginal discharge. The bitch was treated using course of antibiotic Inj- Cefotaxim @ 20 mg/kg B.Wt., I/M, 7 days, Tab- Cabgolin- @ 5µg/kg B.Wt., OD for 7 days, Inj- Neohepatax @ 1.5ml, Inj- Pheneramine maleate @ 0.5mg/kg B.Wt., I/M for 5 days. The animal was recovered and healthy after 7 days.

THE CHECKLIST OF SPIDER FAUNA (ARANEAE) IN CHARKHET NAINITAL DISTRICT, UTTARAKHAND

Himanshu Pande Lohani

Dept. of Zoology, D.S.B. Campus, Kumaun University, Nainital

Email : dr.himanshulohani@gmail.com

Abstract

The spiders are one of the most widely recognized groups of arthropods among invertebrate animals that play a significant role in maintaining biological homeostasis of nature as one of the most varied and functionally important predators regulating the terrestrial populations. They are distributed almost every ecological conditions except air, open sea and Antarctica region. Thus, their high abundance and high diversity in almost all microhabitats make them effective monitoring in the environment. About 47,099 described species are known currently globally including 4,073 genera and 113 families. Spiders play important role as the predator, especially the predator of insects and therefore they contribute to control the insect population. Spiders play vital role in agro ecosystem as pest control agent. The present study was conducted in Nainital, located in hilly area of Kumaun region of Uttarakhand. The sample is obtained using hand picking method and sweep net method. Three month sampling is done. The data analysis includes the Simpson Indices, Shannon-Weiner's diversity and species richness of species. 21 species and 194 individuals are found in the study area duration of three months. Five families are identified Araneidae, Lycosidae, Oxyopidae, Salticidae, Tetragnathidae. Araneidae is the most dominant family. *Paradosa pseudoanulata* is the most dominant species of the study area. The major guild structure observed from study site was Orb weavers, branch dweller, ground dwellers and foliage dwellers. The most dominant guild was an orb weaver comprises 45% of total species. The results of the study revealed that the study area is favourable for spiders. Present study provide the baseline information over the diversity status, habitat preference etc. which is important to identify the threat faced by the spider species and taking



appropriate mitigation measures from conservation point of view. As spider often prefer diverse landscape and use several habitat type, structurally more complex herbs and shrubs can support a more diverse spider community.

EFFECT OF FOLIAR APPLICATION OF HISTIDINE ON PHYSIOLOGICAL RESPONSES OF TOMATO (*SOLANUM LYCOPERSICUM* L.) UNDER GREENHOUSE CONDITION

Mahendra Meena^{1*}, K.K. Meena¹, N.K. Gupta², Vinod Saharan³, O.P. Garhwal¹, Shalini Pilania⁴, Damyanti Prajapati³, Mital³, Piyush Chandel⁴, Kuldeep Haryana⁴

¹Department of Horticulture, Rajasthan Agricultural Research Institute, SKNAU, Jobner, Rajasthan, India

²Department of Plant Physiology, SKNAU, Jobner, Rajasthan, India

³Department of Molecular Biology and Biotechnology, Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan, India

⁴Department of Horticulture, Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan, India

*Corresponding Author Email : mahendra966795@gmail.com

Abstract

The aim of the present study was to study the effect of arginine foliar application on wheat crop to measure physiological responses under field condition. Arginine formulation were prepared by dissolving arginine into DI water and apply on wheat crop into different concentrations of arginine (100, 200, 300, 400 and 500 ppm) and water (control) under field condition. Arginine were used on wheat crop for evaluate 9 parameters related to growth and yield. The result showed that 200 ppm concentration of arginine significantly increased the growth and yield parameters (except no. of tillers/m row length) as compared with control and other concentration (100, 300, 400 and 500 ppm) of arginine. Outcome of the study related to foliar application of arginine (200 ppm) increased the growth and yield of wheat crop.

GEOSPATIAL VARIABILITY OF SOIL PHYSICO-CHEMICAL PROPERTIES OF MORIDHAL WATERSHED IN DHEMAJI DISTRICT OF ASSAM, INDIA

Prem Kumar Bharteey^{1*}, Bipul Deka², Marami Dutta³, Jonali Goswami⁴ and Rituparna Saikia⁵

^{1,3}Department of Soil Science, Assam Agricultural University, Jorhat-785013, Assam,

¹C.C.R. (P.G.) College Muzaffarnagar-251001, Uttar Pradesh

²AICRP on IWM, Assam Agricultural University, Jorhat-785 013, Assam

⁴North Eastern Space Applications Center, Department of Space, Government of India, Umiam-793103, Meghalaya

⁵Krishi Vigyan Kendra, Kamrup, Assam

*Corresponding Author Email : preambharti406@gmail.com

Abstract

Remote sensing and GIS has opened new vistas towards understanding spatial variability of properties of the soil and ensure resource use in a sustainable manner. The current study was conducted to assess the variability of physical, chemical, and current status of flood-prone soils in the Moridhal watershed in the Dhemaji district of Assam. The watershed was delineated using toposheets (1:50,000) and geocoded FCC of resourcesat-2, LISS-4. Four physiographic units of the Moridhal watershed were delineated. A total of 170 geo tagged soil samples collected from different physiographic units and physico-chemical properties were analyzed. Assessed physico-chemical properties of Moridhal watershed showed wide spatial variability. The results showed an increasing trend in the amount of very fine sand and silt from the upper piedmont plain to the floodplain. Respective bulk, particle, and porosity densities varied from 1.10 to 1.67 Mg m⁻³, 2.16 to 2.74 Mg m⁻³, and 24.99 to 54.68 percent, however, pH was extremely acidic to slightly acidic, EC range from 0.01 to 0.16 dS m⁻¹ which was almost negligible. Soils were found to be moderate to high in organic carbon. CEC soils range from 3.88 to 19.40 cmol (p +) kg⁻¹, Available N, P and K varied from low to high. The surface soils of the upper and lower piedmont plains were coarser than those of the alluvial and flood plains, which might be attributed to the loss of finer fractions owing to erosion from higher elevations and their subsequent deposition in lower, less sloppy locations. The pH of the soils in the different physiographic zones ranges from severely acidic to somewhat acidic, and the difference in pH across the four physiographic zones might be related to variations in organic matter content and erosion consequences. The soils in mountainous places have high organic carbon content due to the sluggish rate of mineralization caused by the lower temperature. The fertile soils of flood plain may be effectively utilized for crop diversification for attaining high productivity and profitability.



BRASSINOLIDE AND ZINC INFLUENCING PHYSIO-BIOCHEMICAL TRAITS OF GARDEN PEA (*PISUM SATIVUM* L.) UNDER WATER DEFICIT CONDITION

Jyotsnarani Pradhan^{1*}, Kartik Pramanik² and Hemlata Singh¹

¹Department of Botany, Plant Physiology and Biochemistry, College of Basic Science & Humanities, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar-848125

²Department of Vegetable Sciences, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar-751003

*Corresponding Author's Email : jyotsna.pradhan@rpcau.ac.in

Abstract

The study was aimed to evaluate the role of exogenously applied 24-epi-brassinolide (e-BL) and Zinc (Zn) concentrations on physio-biochemical processes in garden pea (*Pisum sativum* L.) under water-deficit stress. A poly-house experiment was framed with a Completely Randomized Design with three replications by e-BL pretreated seeds of garden pea genotype HUP-2 with 0.01 and 0.05 mM and/or Zn under induced water deficit stress in different stages of crop growth i.e. before and after anthesis. Garden pea seeds pre-treated with e-BL in addition to Zn micronutrient supply resulted positive response against water deficit in terms of membrane stability and various enzymatic activity. The effect post anthesis water deficit, which is more potent to yield loss, found to be lessened by e-BL and Zn. Seed pre treatment with e-BL and basal application of Zn are having potency against water deficit in HUP-2 genotype of garden pea.

SURVEY AND IDENTIFICATION OF TERMITE SPECIES ON WHEAT CROP IN THE SEMI-ARID EASTERN PLAIN OF RAJASTHAN

Rakesh Kumar Meena^{1*}, Vipin Kumar¹ and Rohit Kumar Nayak²

¹Division of Entomology, Rajasthan Agricultural Research Institute, Durgapura, (SKNAU, Jobner), Jaipur, Rajasthan

²Department of Entomology, SKN Agriculture University, Jobner, Jaipur- 302018, Rajasthan

*Email : rakeshmeena8392@gmail.com

Abstract

The survey on termite infesting wheat fields was carried out at 16 wheat fields located in different tehsil of Jaipur, Tonk, Ajmer and Dausa district. The average termite infestation in Rabi 2019-20, 2020-21 varied from 8.52 - 13.94, 10.01 - 14.21 per cent in different wheat fields. The maximum infestation was observed during end of February 2019 & 2020 (9th SMW) in all the fields. The lowest infestation was noticed during end of December 2019 & 2020 (52nd SMW) in all the fields. The overall infestation in Rabi 2019-20 was highest in field no. 3rd (13.94%) of Jaipur tehsil, whereas it was lowest in field no. 14th (8.52%) of Ajmer tehsil. While in Rabi 2020-21, the overall infestation was highest in field no. 3rd (14.21%) of Jaipur tehsil, whereas it was lowest in field no. 1st (9.87%) of Jaipur tehsil. As per the identification, *Microtermesobesi* (Holm) and *Odontotermesobesus* (Rambur) were found to damaging the wheat crop.

SURVEY FOR THE EXTENT OF LOSSES IN BRINJAL CAUSED BY BRINJAL SHOOT AND FRUIT BORER ON FARMER'S FIELDS IN DEORIA AND GORAKHPUR DISTRICT IN UTTAR PRADESH

Naveen Kumar¹, Rajnish Kumar² and Kishan Lal³

¹Department of Entomology, National P.G. College, Barhalganj, Gorakhpur-273402

²Department of Entomology, B.R.D.P.G. College Deoria-271201

³Department of Plant Pathology, National P.G. College, Barhalganj, Gorakhpur-273402

*Corresponding Email : saxenanveen2912@gmail.com

Abstract

A field survey conducted during Kharif 2020-21 and 2021-22 in several villages of different blocks in Uttar Pradesh's Deoria and Gorakhpur districts revealed that damage caused by brinjal shoot and fruit borer in the brinjal ecosystem. During Kharif 2020-21, the extent of damage caused by brinjal shoot and fruit borer was recorded to be the maximum percent of shoot damage observed in the field of Ramprasad Mishra (block- Rampur Karkhana, village- Kamdhenvan) with 45.13% shoot infestation. The highest fruit infestation (58.56%) was found in the field of Hari Shankar (block- Patardeva, village-



Kanthipatti) in the Deoria district. The field of Krishna Murari (block- Gogha, village- Rawat Par) had the highest percent of shoot damage in Gorakhpur district, with 45.12% shoot damage, while the field of Prabhu Nath (block- Gola, village- Bhawanipur) had the highest percent of fruit damage, with 56.46% fruit damage. Similarly, during Kharif 2021-22, the maximum percent of shoot damage (40.83% shoot damage) was recorded in the field of Ramprasad Mishra (block- Rampur Karkhana, village- Kamdhenvan). However, the maximum percent of fruit damage (54.19% fruit damage) was observed in the field of Prannath Yadav (block- Barhaj, village- Ruchapar) in the Deoria district. In Gorakhpur district, the maximum percent of shoot damage was observed in the field of Krishna Murari (block- Gogha, village- Rawat Par) with 42.43% shoot damage. While, the highest percent of fruit damage was recorded in the field of Durga Charan (block- Belghat, village- Ganeshpur) with 54.67% fruit damage. Extensive cultivation of brinjal as an intercrop or sole crop inflicted a higher incidence of the above insect and thereby greater damage while the lower incidence observed was mainly because of the crop grown marginally in isolated areas or around the high-valued crops.

G×E INTERACTION TO IDENTIFY THE STABLE GENOTYPES FOR DIFFERENT ECOSYSTEMS IN 118 RICE LINES

Padmashree R.^{1,2}, Kalyani M. Barbadikar^{1*}, Honnappa^{1,2}, Nakul Magar¹, Divya Balakrishnan¹, Lokesha R.², Chanappa Gireesh¹, Anantha M. Siddaiah¹ and Sheshu Madhav Maganti¹

¹ICAR-IIRR, Hyderabad 500030

²Department of Genetics and Plant Breeding UAS, Raichur 584104

*Corresponding Author Email : kalyani.mb@icar.gov.in

Abstract

Rice lines are grown and evaluated for yield and related traits to identify stable and high yielding lines under different agro-ecological locations to sustain the high productivity. With this aim, the multi-location trials were conducted to evaluate the stability in four different locations (E1-Dadesuguru *karif* 2019, E2-ICAR-IIRR-*Rabi* 2018, E3-ICAR-IIRR-*kharif* 2019, E4-ICAR-IIRR-*Rabi* 2020). The experimental material consists of 118 rice lines including landraces, germplasm, mutant lines, popular varieties, introgression lines. The experimental trial was laid out in a randomized complete block (RCB) design with three replications at each location for 118 rice lines. Data on yield traits were analyzed using the Additive Main Effect and Multiplicative Interaction (AMMI), Genotype and Genotype × Environment Interaction (GGE). The combined analysis of variance (ANOVA) manifested significant variations for tested genotypes, locations, years, genotype × year, and genotype × location interactions revealing the influence of environmental factors on yield traits. All the Four environments showed discrimination power, whereas E3 was found as the representative environment as it falls near to the Average-Environment Axis. The AMMI biplot shows PC1 contributes 85.7% variability and PC2 contributes 14.3% variability. From the ranking of environment G31 and G11 were found to be best genotypes. From which own where graph G8 and G18 were found to be best in E1, whereas G113 was found to be best in E2 and E4, G101 and G107 were found to be the best in E4. Based on the mean vs stability G31 and G11 were found to be stable among the given environments. In conclusion, this study revealed that G × E interactions were an important source of rice yield variation, and its AMMI and biplots analysis are efficient tools for visualizing the response of genotypes to different locations.

VULNERABILITY TO CLIMATE CHANGE AND OCCUPATIONAL DRUDGERY OF FARM WOMEN

Pratibha Pandey and Deepa Vinay

Deptt. of FRM, College of Home Science, G.B. Pant University of Agriculture and Technology, Pantnagar, U.K.

Email : pratihema2803@gmail.com

Abstract

Agriculture has been identified as one of the unorganised sector's drudgery-prone jobs where the majority of women are employed. Agriculture is one of the most vulnerable sectors to climate change impacts. Impacts of the climate are likely to have a greater impact on women than men, particularly in developing nations where women are heavily involved in agriculture. Farm women face a number of challenges, including depleted soil, inefficient water and input use, expensive and in-demand agricultural labour, limited access to credit and investment opportunities, and the sluggish spread of applicable technologies. Given their involvement in associated activities, women are expected to be more affected by climate change



effects such as reduced supply of crop residues and biomass for energy and livestock feed, rising severity of weeds, crop re-sowing/transplanting requirement, and loss of crop yields. The productivity of agriculture and the stability of rural communities' livelihoods are being threatened by erratic, unpredictable, and unexpected changes in the climate. Climate change and variability can affect food supply chains, access to food, and food quality. Understanding how climate change affects women requires taking into account not just their social, cultural, and economic traits, but also their roles and responsibilities in certain agricultural operations. According to research, the majority of women face obstacles like a lack of financial support, technical knowledge, marketing expertise, entrepreneurship expertise, a lack of self-confidence, mobility issues, and low levels of education or illiteracy.

ESTIMATION OF REPEATABILITY OF CERTAIN REPRODUCTIVE TRAITS IN VARIOUS GRADES OF JERSEY× RED SINDHI CROSSES.

Rajan Singh¹, Ram Pal Singh², Pramod Prabhakar³ and M. Catherine Rusta⁴

¹Nagaland Centre Agricultural University SASRD Medziphema Campus

²Deptt. of Animal Husbandry and Dairying, Sam Higginbottom University of Agriculture Technology and Science, Prayagraj

³Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

⁴Department of LPM School of Agricultural Science & Rural Development Nagaland University, Medziphema Campus

*Correspondence Author Email : rajan.gayasingh@gmail.com

Abstract

The likelihood that an animal will perform as well as or better than the herd average in her subsequent lactation than she did in her previous lactation is referred to as repeatability. Typically, it is measured as an intra-herd correlation or as a correlation between recordings made during different lactations of the same animal. Understanding the factors that affect reproduction is essential to maximizing the profitability of dairy crossbred cattle. A pedigree cum history sheet from the department of animal husbandry and dairying at Sam Higginbottom University of Agriculture, Technology and Sciences was used to examine 66 entries from 1935 to 1975, 66 entries were evaluated from a pedigree cum history sheet from the department of animal husbandry and dairying under Sam Higginbottom University of Agriculture, Technology and Sciences. Skilled people raised and cared for the animals in identical feeding and management conditions. Calving Interval (CI) and Service Period (SP) were the reproductive features investigated. The data revealed that the repeatability (r) with standard error (SE) for the Calving Interval recorded moderate repeatability and the service period recorded poor repeatability (0.69 ± 0.71 , 0.22 ± 0.11) and standard error was recorded (0.36 ± 14 , 0.33 ± 11). Calving Interval and Service Period had moderate and poor repeatability, respectively.

PERCEPTION OF TRIBAL AND NON-TRIBAL DAIRY FARMERS TOWARDS THE DAIRY FARMING IN THE CENTRAL INDIAN STATES OF CHHATTISGARH: STRUCTURAL EQUATION MODELING APPROACH

Ravi Kumar Gupta¹, Anindita Saha¹, Digvijay Singh Dhakre² and Ankur Gupta¹

¹Department of Agricultural Extension, Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati (A Central University), Sriniketan, West Bengal, India

²Department of Agricultural Statistics, Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati (A Central University), Sriniketan West Bengal, India

*Corresponding Author Email : raviguptaphd@gmail.com

Abstract

Dairy farming is a secondary occupation for millions of farmers in the central Indian state of Chhattisgarh. This study uses principal component analysis (PCA) and structural equation modeling (SEM) to determine how tribal and non-tribal dairy farmers in Chhattisgarh feel about dairy farming and what makes them feel that way. In this Research, the data was gathered from the dairy farmers in 2020–21. The results of the paired sample t-test show that both tribal and non-tribal farmers are performing significantly. In the Principal Component Analysis, KMO's sample adequacy test result was 0.724, which means there were enough signs in each element to study. Twelve items of dairy farmers' perceptions were conglomerated into three factors: rational perception, opportunistic perception, and scientific perception. The results of the SEM showed that the



absolute fit indices match the sample data and that the proposed model is a good fit because it matches the values of the perception items. This study shows that policymakers should use a concentric approach that includes targeted research, sharing information, building infrastructure, and creating dairy technical institutions to increase income diversity and improve the way of life of dairy farmers.

ENTHRALLING AFTERMATH OF ZN-CHITOSAN NANOPARTICLES ON GERMINATION INDICES OF PEARL MILLET GRAINS

Sonam Sihag^{1*}, Surbhi Sahewalla¹, Narender Mohan¹, Vinod Saharan² and Ajay Pal¹

¹Department of Biochemistry, College of Basic Sciences and Humanities, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, 125 004, India

²Department of Molecular Biology and Biotechnology, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, 313 001, India

*Corresponding Author Email : sonamsihag0711@gmail.com

Abstract

Millets are considered a Nutri-grain; however, they are the least exploited. Pearl millet [*Pennisetum glaucum* (L.)] grain is abundant in health-beneficial nutrients, making it suitable as a food and fodder crop. It is one of the most important staple food crops of most poor and small land holders in Asia and Africa. India accounts for half of the global millet production. Pearl millet cultivation in India is mainly confined to coarse-textured soils with poor moisture retention capacity and low soil fertility. Lack of improved practices, cultivation on poor and marginal lands of low fertility and poor and delayed germination due to soil crusting are some of the major constraints responsible for its poor yield. Germination is a biotechnological technique involved in improved enzymatic activity in cereals, increasing the nutritional value and degradation of the grains. Zinc (Zn) is an essential plant micronutrient since it serves various functions. It is a cofactor for over 300 enzymes and is vital for developing tryptophan, an auxin precursor. Zn deficiency in humans is a consequence of the consumption of micronutrient-deficient food. To study the effect of zinc on pearl millet grains, we evaluated Zn complexed chitosan nanoparticles (Zn-Ch-NPs) as a potential 'nanocarrier' suited for foliar fertilization. Spherical Zn-Ch-NPs (diameter 394 nm), which were positively charged (zeta-potential, +44 mV) with 0.31 poly-dispersity index were synthesized using the ionotropic-gelation method. Different concentrations of Zn-Ch-NPs (200, 400, 600, 800, and 1000 ppm) and bulk ZnSO₄ were applied to the seeds separately. These treatments were tested for their effects on seed germination, root & shoot length, and fresh & dry weight. The Zn-Ch-NPs enhanced shoot and root growth and the germination process. Our findings show that seed germination indices improved significantly when seeds were exposed to Zn-Ch-NPs (especially at 600 ppm). Future field/pot trials are needed to calculate the cost-effectiveness and adaptability of Zn-Ch-NP foliar exposure.

INTER-SPECIES DIFFERENCES IN EGG PRODUCTION AND QUALITY AMONG DIFFERENT SPECIES OF PHEASANTS FED DIETS CONTAINING TWO DIFFERENT LEVELS OF GREEN FORAGES

S.S. Kullu^{1*} and A. Das² and Reetu³

¹Department of Animal Nutrition, Ranchi Veterinary College, BAU, Kanke, Ranchi

²Centre for Advanced Faculty Training in Animal Nutrition, ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly

³Department of Veterinary surgery and Radiology, Ranchi Veterinary College, BAU, Kanke, Ranchi

*Corresponding Author Email : kullusingray@gmail.com

Abstract

This experiment was conducted to study the effect of carotenoids supply through green forage supplementation on egg production performance, and egg quality properties of five selected species of Galliformes namely Local bantam (LB) of Uttarakhand, India, Golden pheasant (GP), Lady Amherst's pheasant (LA), Kalij pheasants (KP) and Silver pheasant (SP). Adult hens of LB (n=16), GP (n=16), LA (n=16), KP (n=14) and SP (n=12) were randomly distributed into two treatment groups of equal number of replicates. Diet of the birds in group T1 and T2 contained, 5 and 10% of green forages (on DM basis), respectively. Average clutch size was highest (P<0.001) in GP followed by KP, LB, SP and was lowest (P<0.001) in LA. Highest (P<0.001) clutch weight was observed in SP, followed by KP, LB, LA and was lowest (P<0.001) in GP. Albumen



index and Haugh unit was lowest ($P < 0.001$) in GP. Clutch weight as proportionate to body size was also an allometric function of body weight with a negative slope of -0.45. Egg width, length, shell thickness and shape index were allometric function of body weight with a slope of 0.61, 0.48, 0.29, 0.72 and 0.19 for the five respective attributes. Average clutch size, clutch weight, egg mass, DM intake per kg egg mass during laying period and Roche egg yolk color score were higher in T 2 as compared to T 1. Clutch size and clutch weights as proportionate to body mass were higher in smaller species. Clutch size, clutch weight, egg mass production and Roche egg yolk color improved in birds of group T 2. Thus, it would be beneficial to increase the level of green forage to 10% in the diet of captive pheasants.

INTEGRATED OMICS APPROACHES FOR ENHANCING YIELD AND NUTRITIONAL QUALITY IN PULSES

Sandhya Sharma and Kishor Gaikwad

ICAR-National Institute for plant Biotechnology, New Delhi-110012

Abstract

The world's population is steadily expanding, and by 2050, it may have surpassed nine billion. Crop yields/food production must increase by 70% by 2050 in order to feed the growing global population. The ability to produce and provide food with improved nutrition to the world's rising population will determine the health of future generations. Therefore, superior traits for crops, such as higher yield, abiotic and biotic stress tolerance, and improved nutritional qualities, are increasingly in demand. In the recent decade, the legume research group has made remarkable success in terms of the development of genetic and genomic resources. With the advancement of high throughput Next generation sequencing technology, whole genome sequences are now available not only for model legume species like *Glycine max* (soybean) and *Medicago truncatula*, but also for low-profile poor legumes like *Cajanus cajan* (pigeonpea) and underutilised *Cyamopsis tetragonoloba* (clusterbean) etc. To better understand complicated biological processes, researchers must use a multi-omics approach that highlights the interrelationships of the involved biomolecules, associated pathways, and the molecular mechanism of legume evolution and its relevance to biologically important traits.

STUDY ON HETEROSIS AND COMBINING ABILITY IN CAULIFLOWER (*BRASSICA OLERACEA* VAR. *BOTRYTIS*)

Vivek Thapliyal^{1*}, Dharendra Kumar Singh¹, D.K Singh¹ and Pushpendra Rajput²

¹Department of Vegetable Science, G.B. Pant University of Agricultural and Technology, Pantnagar, Uttarakhand-263145

²Department of Horticulture, G.B. Pant University of Agricultural and Technology, Pantnagar, Uttarakhand-263145

*Corresponding Author Email : thapliyalvicky005@gmail.com

Abstract

The present study was conducted at Vegetable Research Centre (VRC), G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand during cropping season of 2019-20. The major objectives of the study were to estimate the extent of genetic variability, correlation and path analysis, heterosis, general and specific combining ability effects. The experiment was laid down in randomized block design with 3 replications; thirty crosses were evolved in line x tester mating design with 10 genotypes as female parents (lines) and 3 genotypes as male parents (testers). The analysis of variance revealed highly significant differences among genotypes for all the attributes under study. From the study of General Combining Ability effects, it was revealed that PC-25 (plant gross weight, marketable curd weight, curd size index, curd yield), PC-100 (plant height, number of leaf per plant, plant gross weight, stalk length, curd size index), COMP-3 (plant height, plant diameter, leaf length, leaf width, lamina length, petiole length, plant gross weight) were found to be good general combiners. Other lines which had significant gca effects for yield and attributing traits were PC-77, Inb-9-2 and PCF-65. The cross combinations PC-25 x PG-3 and DC-54-15 x PG-3 were found to exhibit maximum sca effects for yield and yield attributing traits. The F₁ cross combination PC-25 x PG-3 was found to be best heterotic combination for number of leaf per plant, lamina length, marketable curd weight, curd size index and curd yield (q/ha) over better parents. Other combinations showing significant value for all types heterosis were PCF-120 x Pusa Meghna, COMP-3 x PG-3, PCF-65 x PG-3, INB-9-2 X Sabour Agrim. The cross combination PC-25 x PG-3 and DC-54-15 x PG-3 showed maximum sca effects along with significant heterosis and hence, may be utilized in future breeding programme.



SUPPLEMENTATION OF DIETARY CAROTENOIDS INFLUENCE THE EGG PRODUCTION PERFORMANCE IN GALLIFORMES

S.S. Kullu^{1*} and A. Das² and Reetu³

¹Department of Animal Nutrition, Ranchi Veterinary College, BAU, Kanke, Ranchi

²Centre for Advanced Faculty Training in Animal Nutrition, ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly

³Department of Veterinary surgery and Radiology, Ranchi Veterinary College, BAU, Kanke, Ranchi

*Corresponding Author Email : kullusingray@gmail.com

Abstract

This experiment was conducted to study the effect of carotenoids supply through green forage supplementation on egg production performance, and egg quality properties of five selected species of Galliformes namely Local bantam (LB) of Uttarakhand, India, Golden pheasant (GP), Lady Amherst's pheasant (LA), Kalij pheasants (KP) and Silver pheasant (SP). Adult hens of LB (n=16), GP (n=16), LA (n=16), KP (n=14) and SP (n=12) were randomly distributed into two treatment groups of equal number of replicates. Diet of the birds in group T₁ and T₂ contained, 5 and 10% of green forages (on DM basis), respectively. Average clutch size was highest (P<0.001) in GP followed by KP, LB, SP and was lowest (P<0.001) in LA. Albumen index and Haugh unit was lowest (P<0.001) in GP. Clutch weight as proportionate to body size was an allometric function of body weight with a negative slope of -0.45. Egg width, length, shell thickness and shape index were also allometric function of body weight with a slope of 0.61, 0.48, 0.29, 0.72 and 0.19 for the five respective attributes. Average clutch size, clutch weight, egg mass, DM intake per kg egg mass during laying period and Roche egg yolk color score were higher in T₂ as compared to T₁. Clutch size, clutch weight, egg mass production and Roche egg yolk color improved in birds of group T₂. Thus, it would be beneficial to increase the level of green forage to 10% in the diet of captive pheasants.

SEASONAL INCIDENCE OF GRAM POD BORER, *HELICOVERPA ARMIGERA* (HUBNER) AND SPOTTED POD BORER, *MARUCA TESTULALIS* (GEYER) ON GREEN-GRAM

Sachin Kumar Yadav and Ram Singh Umrao

Department of Agricultural Entomology, Chandra Shekhar Azad University of Agriculture and Technology Kanpur, U.P.

*Corresponding author Email : sachincsak@gmail.com

Abstract

On the green gram variety of IPM-02-03, a field experiment was carried out to determine the seasonal occurrence of the gramme pod borer, *Helicoverpa armigera* (Hubner), and the spotted pod borer, *Maruca testulalis* (Geyer). Gram pod borer and spotted pod borer had beginning populations of 0.50 larvae per 10 plants and 0.66 larvae per 10 plants, respectively. The population progressively grew and peaked at 8.50 larvae per ten plants and 9.66 larvae per ten plants, respectively, in the 36th standard meteorological week, when the lowest, maximum, and relative humidity were, respectively, 22.9 °C, 30.5 °C, and 81.00%. The calculated correlation coefficient between the infestation of gramme pod borer and spotted pod borer on greengram crop and the highest temperature revealed a negative and significant correlation (r = -0.79 and -0.78, respectively).

EFFECT OF PLANTING DENSITY AND NUTRIENT LEVELS ON THE PRODUCTIVITY OF POPCORN HYBRIDS

V. Sujatha^{1*}, I. Sudhir Kumar², S.L Jat² and A.K. Singh¹

¹Agricultural Research Station, Peddapuram, Kakinada Dist.

²ICAR-Indian Institute of Maize Research, PAU Campus, Ludhiana

Acharya N.G. Ranga Agricultural University (ANGRAU), Guntur, Andhra Pradesh-531001

*Presenting Author Email : sujatha.agro12@gmail.com

Abstract

Maize is the third most important cereal crop after wheat and rice in India. Diverse types of corns flint corn, dent corn, flour corn, sweet corn, pop corn etc. are grown in India of which pop corn is the only corn that pops. Pop corn (*Zea mays everta*) an important type of corn which is prominently used for popped form; green cobs for table purpose and widely used in



preparation of snacks in meals in different parts of world. Demand of pop corn is increasing day by day with the changing food preferences in Indian life style. Technological interventions viz., genotypes, planting density, water and nutrient management and pest and disease management etc. influence the yield of crops to a greater extent. Amongst, genotypes, planting density and nutrient management play a vital role in increasing the yield of popcorn. Therefore, A field experiment was conducted at Agricultural Research station, Peddapuram, Kakinada District, Andhra Pradesh during *Kharif*, 2018 to study the response of popcorn hybrids to varying planting density and fertilizer levels. The experiment was carried out in split-split plot design with two planting densities (60 x 20 cm and 50 x 20 cm) as main plots, two fertilizer levels (RDF and 150% RDF) as sub plots and five popcorn hybrids as sub- sub plots and replicated thrice. The results revealed that DPCH-306 was found to be the best suitable pop corn genotype under 50 x 20 cm spacing with 150 % RDF (120:90:75 kg NPK/ha) recorded higher grain yield of 3582 kg ha⁻¹ and net returns of Rs. 73,908 ha⁻¹ during *kharif* season in godavari region of Andhra Pradesh.

PERFORMANCE OF PRE-RELEASE MEDIUM MATURITY MAIZE GENOTYPES UNDER VARYING PLANTING DENSITY AND NUTRIENT LEVELS

V. Sujatha^{1*}, I. Sudhir Kumar², S.L Jat² and A.K. Singh¹

¹Agricultural Research Station, Peddapuram, Kakinada Dist.

²ICAR-Indian Institute of Maize Research, PAU Campus, Ludhiana

Acharya N.G. Ranga Agricultural University (ANGRAU), Guntur, Andhra Pradesh-531001

*Presenting Author Email : sujatha.agro12@gmail.com

Abstract

Maize (*Zea mays* L.) is one of the important cereals, next to wheat and rice in the world. The yield potential of maize depends on its genetic makeup and the environment. There are so many factors that are directly responsible for yield traits in maize crop whereas planting density and nutrient management play a vital role in increasing yield. Planting density decides the yield of a crop and should be maintained to avert yield loss as it is one of the major causes which directly affect the yield. Maize being an exhaustive crop requires more nutrients during different phenological phases. Hence, Field studies were carried out at Agricultural Research Station, Peddapuram, Kakinada District during *Kharif*, 2018 in sandy loam soils to study the effect of varying planting density and nutrient levels on pre release medium maturity maize genotypes. The pre-release maize genotypes were tested at two densities (60 x 20 cm and 50 x 20 cm) and two nutrient levels (RDF and 150% RDF). The experiment was laid out in split-split plot design with three replications. The results revealed that the medium maturity maize genotype DKC-9179 under 50 x 20 cm spacing with 150 % RDF (300:90:75 kg NPK/ha) recorded higher grain yield (6613 kg ha⁻¹) and net returns (Rs. 58,232 ha⁻¹) in maize.

STUDY OF CORRELATION AND PATH COEFFICIENT ANALYSIS IN BITTER GOURD (*MOMORDICA CHARANTIA*)

Triveni D.^{1*}, Uma Jyothi K.² and Dorajee Rao A.V.D.²

¹School of Agricultural Sciences, Anurag University, Hyderabad, Telangana, 500088, India

²Department of Horticulture, College of Horticulture, Dr. Y.S.R. Horticultural University, Venkataramannagudem, West Godavari, Andhra Pradesh, 534101

*Corresponding Author Email : triveni23dharoor@gmail.com

Abstract

A study was conducted to assess the correlation coefficient and path co-efficient analysis of twenty-nine bitter gourd genotypes. Twenty-nine genotypes of bitter gourd were grown in Augmented Block Design. The correlation coefficient indicated that there was a highly significant and positive correlation between fruit yield per vine and fruit yield per hectare (0.998), average fruit weight (0.827) and fruit length (0.627) while the association was significant for number of fruits per vine (0.412). The path analysis indicated that average fruit weight (0.615), number of fruits per vine (0.442), fruit length (0.227), days to opening of first male flower (0.089), days to first fruit harvest (0.060), number of primary branches (0.019) and node at which first female flower appeared (0.016) had direct positive effects on fruit yield per vine. Based on overall findings of the present study, it was concluded that for selecting superior genotypes primary emphasis should be given on fruit yield per vine followed by number of fruits per vine, average fruit weight and fruit length.



OPPORTUNITIES AND CONTRIBUTION OF WOMEN TO LIVESTOCK SECTOR

Vivekin Pachauri¹ and S.K. Mishra²

¹Deptt. of Social Justice and Disabled Persons Welfare, Bhopal, M.P.

²JNKVV- Dryland Horticulture Research and Training Centre, Garhakota, Sagar, M.P.

Abstract

India is an agriculture based country and livestock sector is an integral component of it where, livestock production is largely in the hands of women. Livestock sector plays a significant role in the socio-economic development of India. It grows this pro-poor and inclusive. Livestock helps in generating a continuous flow of income and employment. The sector empowers women as they perform a large number of activities related to livestock production. According to working group report on animal husbandry and dairying, animal husbandry helps in improving gender equity. More than three-fourth of the labour requirement in livestock production is met by women. Most of the animal farming activities such as fodder collection, feeding, watering and health care, management, milking and household-level processing, value addition and marketing are performed by women. The outstanding demand for livestock products gives considerable opportunities for the rural women to escape poverty by diversifying livestock production. In this backdrop the study aims to highlight the role of Indian livestock sector in empowering rural women. It further estimates the contribution of animal husbandry vis-a-vis other agricultural activities in providing casual, regular and self employment to rural women.

BIOPESTICIDES FOR SUSTAINABLE AGRICULTURE

S.K.Mishra¹, Vivekin Pachauri² and R.K. Saraf³

¹Deptt. of Social Justice and Disabled Persons Welfare, Bhopal, M.P.

²JNKVV-Dryland Horticulture Research and Training Centre, Garhakota, Sagar, M.P.

³College of Horticulture, Rehli

Abstract

Biopesticides are derived from animals, plants and micro-organisms such as bacteria and viruses. The advantages of biopesticides are (1) They are inherently less harmful than chemical pesticides; (2) They are more target specific than chemical pesticides affecting only the target pests and their close relatives. In contrast, chemical pesticides often destroy friendly insects, birds and mammals. (3) They are often effective in small quantities. Also, they decompose quickly and do not leave problematic residues. The most commonly used biopesticides include *Bacillus thuringiensis* (Bt), Baculoviruses and neem. In addition to these, trichoderma, which is a fungicide, is also used. Biocontrol agents, such as Trichogramma, are parasites and predators of pests and their eggs. These biopesticides and bio-control agents viz: *Bacillus thuringiensis* (Bt), *Bacillus thuringiensis* is the most commonly used biopesticide globally. It is primarily a pathogen of lepidopterous pests which are some of the most damaging. These include American bollworm in cotton and stem borers in rice. When ingested by pest larvae, Bt releases toxins which damage the mid gut of the pest, eventually killing it. Baculoviruses. These are target specific viruses which can infect and destroy a number of important plant pests. They are particularly effective against the lepidopterous pests of cotton, rice and vegetables. Their large-scale production poses certain difficulties, so their use has been limited to small areas. They are not available commercially in India, but are being produced on a small scale by various IPM centres and state agricultural departments. Neem. Derived from the neem tree (*Azadirachta indica*), this contains several chemicals, including 'azadirachtin', which affects the reproductive and digestive process of a number of important pests. As neem is non-toxic to birds and mammals and is non-carcinogenic, its demand is likely to increase. However, the present demand is very small. Although more than 100 firms are registered to produce neem-based pesticides in India, only a handful are actually producing it. Furthermore, very little of the production is sold locally, most being for export markets. Trichoderma. Trichoderma is a fungicide effective against soil born diseases such as root rot. It is particularly relevant for dryland crops such as groundnut, black gram, green gram and chickpea, which are susceptible to these diseases. Trichogramma. Trichogramma are minute wasps which are exclusively egg-parasites. They lay eggs in the eggs of various lepidopteran pests. After hatching, the Trichogramma larvae feed on and destroy the host egg. Trichogramma is particularly effective against lepidopteran pests like the sugarcane internodes borer, pink bollworm and sooted bollworms in cotton and stem borers in rice. They are also used against vegetable and fruit pests. Trichogramma is the most popular bio-control agent in India, mainly because it kills the pest in the egg stage, ensuring that the parasite is destroyed before any damage is done to the crop.



BIOLOGICAL ACTIVITIES OF COMPLEXES OF CO(II)-POTASSIUM PROPAN-1,3-DIOL DI XANTHATE

Vivek Kumar and Raj Kumar

Department of Chemistry, J.V. Jain (P.G.) College, Saharanpur, Uttar Pradesh, India

Email : vkchem11@gmail.com

Abstract

Many essential biological chemicals are complexes. They play an important role in oxygen transport and in photosynthesis. Furthermore, many biological catalysts (enzymes) are complexes. In addition to their significance in living organisms, they are also economically important, both as products in themselves and as agents in the production of other chemicals. The fast developing field of bioinorganic chemistry is mostly centered on the presence of coordination compounds in living system. Complexes of Co(II)-Potassium Propan-1,3-Diol Di Xanthate (PPDDX) was studied to examine its biological activities by using disc diffusion method. The radial growth of *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus* was inhibited by this complex at 1000 ppm concentration. The complex is highly toxic against common pathogenic fungi such as *Aspergillus flavus*, *Aspergillus niger* and *Candida albicans* at all the concentration.

IMPACT OF MICRO-PLASTICS POLLUTION ON SOIL HEALTH AND ITS PRODUCTIVITY

Ankit^{1*}, Deachen Dolma¹, Praveen Kumar¹ and Sonia²

¹ICAR-IARI, New Delhi-110012

²CCSHAU, HISAR-125004

*Corresponding Author Email : ankitdahiya827@gmail.com

Abstract

The total amount of plastics manufactured worldwide in 2019 was approximately 3.6×10^8 tons. Due to their strong plasticity and durability, these are stable compound materials, widely applied in agricultural production, industrial manufacturing, clothing and medicine etc. Approximately 90 percent of plastic waste discharged directly or indirectly into soil and water. Prolonged exposure to ultraviolet radiation (UV), hydrolysis, mechanical wear and microbial action result in the progressive breakdown of plastic into countless smaller plastic particles, including microplastics (MPs). Soil microplastic separation based on NaBr density solution circulation, was developed and verified, providing a valuable tool for the separation and extraction of biodegradable and non-degradable microplastics. Pyrolysis at 500°C showed that the microplastics concentrations in sludge residues decreased significantly from 550.8-960.9 particles/g to 1.4–2.3 particles/g. The addition of 0.05-0.4% polyester, 1 mg kg⁻¹ PS, and 0.05 -0.4% polyacrylic particles stimulated negative impacts on the microbial activities (Machado *et al.*, 2018). Microplastic caused reduction in germination of *L. perenne* and also have an inhibitory effect of PLA on *L. perenne* shoot length. Microplastic have suppression effect of FDAse activity caused by PVC or PE, the urease and acid phosphatase activities was both stimulated by the MPs addition in the soil they also affect soil pH, respiration depending on microplastic shape and polymer type. Burrowing mammals (eg. earthworm) can also facilitate the incorporation of MPs in the soil via abrasion mechanism and lead to the incorporation of PS into the soil profile from the top surface. Transport of micro plastics also help to mitigation the effect by collembolan. Microplastics in soil and water ecosystems alters the soil structure and interact with other soil factors, significantly influencing soil function and organism abundance. Soil scientists suggest some positive aspects of MPs presence in soil. However, it should be more focused on hazardous substances derived from the plastics that deteriorate the quality and health of soil and ultimately human health via food chain.

EFFECT OF DIETARY INCLUSION OF RICE DISTILLERS DRIED GRAINS WITH SOLUBLES (RDDGS) ON COST ECONOMICS IN KUROIILER CHICKEN

Anuj Kumar* and D.K. Singh

Department of Livestock Production and Management

College of Veterinary and Animal Sciences, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut

*Corresponding Author Email : drvetanuj@gmail.com

Abstract

Many food processing, beverages, slaughter and pharmaceuticals industries leaves few by-products with appreciable nutritive



values that is being utilized by the poultry feed manufacturers to make the cost-effective poultry feed. Rice Distillers Dried Grains with Solubles (rDDGS) is a by-product of ethanol production which is used as alternative protein source in the poultry diet. Present investigation was conducted at Poultry Research and Training Centre, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (UP) to evaluate the growth performance, haemato-biochemical profile, carcass characteristics and production economics of Kuroiler chickens from January 24th, 2021- March 22nd, 2021. Feeding trial was designed into four dietary groups viz. T₀ (Control, without rDDGS), T₁ (7.5% rDDGS), T₂ (15% rDDGS) and T₃ (22.5% rDDGS) in different treatment groups along with basal corn soyabean diet. Significant differences due to supplemented rDDGS were recorded for feed cost, growth cost, profit, profit/kg growth and feed cost/kg growth during starter period. During finisher period only feed cost was found to have significant variations and rest of the parameters were observed statistically non- significant for varying levels of feeding rDDGS. Overall feed cost, growth cost, profit/kg growth and feed cost/kg growth were estimated as significantly influenced by feeding rDDGS. Maximum profit was estimated as Rs. 129.48 in T₂ followed by T₃ (Rs. 121.63), T₁ (Rs. 113.59) and T₀ (Rs. 105.33), respectively. It was concluded that rice based dry distiller grain with soluble is a good source of protein for poultry and it can replace costly conventional feedstuffs like soybean meal up to 15% level in diet of Kuroiler chicken.

IN VITRO SCREENING OF CHILLI (*CAPSICUM ANNUUM* L.) GENOTYPES FOR DROUGHT TOLERANCE USING POLYETHYLENE GLYCOL

Prashant Sharma¹, A.R. Kurubar¹, B.V. Thembhurne² and Shekar Patil¹

¹Department of Horticulture, University of Agricultural Sciences, Raichur, India

²Department of Genetics and Plant Breeding, University of Agricultural Sciences, Raichur, India

Abstract

In India, there is little information on the drought tolerance of chilli varieties. Chilli drought tolerance testing at the germination stage using osmotic polyethylene glycol (PEG) is an alternative method for conducting rapid screening to assembled drought-tolerant varieties. Ten seeds of each variety were transferred into sterilized petri dish with a diameter of 9 cm in which autoclaved germination paper were placed where seeds were kept. Then 2 ml of polyethylene glycol (PEG 6000) solution was added to each petri dish every 3rd day with different concentrations (5%, 10% and 15%) and a control was maintained using distilled water for drought screening at seedling stage. Under normal and drought conditions, sixteen different genotypes of chilli were evaluated for germination percentage, seed vigour index, shoot length, root length, seedling length, shoot dry weight, root dry weight, and seedling dry weight. The result revealed that the genotype UARChH 43, UARChH 42, and Arka Swetha were found to be drought tolerant as they recorded high germination percentage (86.67, 83.33 and 83.33 %), germination rates (4.13, 4.29 and 4.37), shoot length (1.42, 1.44 and 1.41 cm), root length (1.46, 1.45 and 1.44 cm), dry shoot weight (14.58, 14.59 and 14.57 mg), dry root weight (2.26, 2.27 and 2.25 mg), seedling vigour index I (263.67, 272.17 and 263.53) and seedling vigour index II (2799.53, 2808.20 and 2774.37), respectively. Among the 16 genotypes tested, UARChH 42, UARChH 43, and Arka Swetha were distinguished as drought tolerant genotypes.

STANDARDIZATION OF EMBRYO RESCUE TECHNIQUE IN CHILLI

Prashant Sharma¹, A.R. Kurubar¹, B.V. Thembhurne², Shekharagouda Patil¹ and Anusha³

¹Department of Horticulture, University of Agricultural Sciences, Raichur, Karnataka

²Department of Genetics and Plant Breeding, University of Agricultural Sciences, Raichur, Karnataka

³Department of Fruit Science, University of Horticultural Sciences, Bagalkot, Karnataka

Abstract

Even though reliable genetic materials resistant to anthracnose have been discovered within the *C. baccatum* germplasm, interspecific hybridization is required to introgress resistance genes from *Capsicum baccatum*, a related species of cultivated pepper (*C. annuum*). Hybrids could not be produced in traditional interspecific hybridization between two species due to embryo abortion, which has been identified as a post-fertilization genetic barrier. In these partially compatible crosses, the embryo rescue method was effectively used to produce hybrids. Immature seeds with torpedo or early cotyledonary embryos were excised 28-32 days after pollination and the embryos were cultured on MS medium with different concentration of plant growth regulators. The result revealed that half strength MS media supplemented with IAA, GA3 and 6 BAP at 0.01 mg l⁻¹,



half strength MS media supplemented with IAA, GA3 and 6 BAP at 0.05 mg l⁻¹ and control at full strength for UARChH 42 (86.67 %), PBC 80 (86.67 %) and interspecific hybrid (73.33 %) respectively showed highest plantlet formation percentage. Regarding survivability percentage of plantlet, results showed that for UARChH 42 (*Capsicum annuum*) highest survivability percentage (66.67 %) was found under half strength MS media supplemented with IAA, GA3 and 6 BAP at 0.01 mg l⁻¹ whereas for PBC 80 (*Capsicum baccatum*) highest survivability percentage (50.01 %) was found under, half strength MS media supplemented with IAA, GA3 and 6 BAP at 0.05 mg l⁻¹. However for interspecific hybrid highest survivability percentage (50.01 %) was found under control at full strength. Half strength of Murashige-Skoog (MS) with low concentration (0.01, 0.05 mg l⁻¹) growth regulators produced best result for UARChH 42 (*Capsicum annuum*) and PBC 80 (*Capsicum baccatum*) whereas for interspecific hybrid control it was at full strength MS media.

ESTIMATION OF HETEROSIS FOR GRAIN YIELD AND YIELD CONTRIBUTING TRAITS IN PEARL MILLET (*PENNISETUM GLAUCUM* (L.) R. BR.)

Monika Punia¹ and L.D. Sharma²

¹Department of Plant Breeding and Genetics, SKN College of Agriculture, SKNAU, Jobner, Rajasthan

²Division of Plant Breeding and Genetics, Rajasthan Agricultural Research Institute, Durgapura, Jaipur, SKNAU, Jobner

Abstract

An experiment comprised of ten inbred parents with their 45 hybrids was conducted under two environment at Rajasthan Agricultural Research Institute (RARI), Durgapura, Jaipur; in Kharif 2019 for studying the extent of heterosis over better parent for grain yield and its components. The desirable crosses selected on the basis of significant heterobeltiosis for grain yield and yield contributing traits across the environment were RIB-9205 x J-2340 for yield per plant, Fe content, protein content, days to 50% flowering, days to maturity, productive tillers per plant, test weight and dry fodder yield per plant, RIB-9185 x RIB-16324 yield per plant, Zn content, days to 50% flowering and dry fodder yield per plant, RIB-16300 x RIB-192 yield per plant, Fe content, Zn content, days to 50% flowering and harvest index, RIB-16300 x J-2340 yield per plant and Fe content, RIB-9205 x RIB-16300 yield per plant, Fe content and productive tillers per plant, RIB-9185 x RIB-9205 for yield per plant, days to 50% flowering and productive tillers per plant, RIB-9185 x RIB-192 yield per plant, and dry fodder yield. These crosses were considered promising for their use in yield improvement along with other quality traits improvement.

OCCUPATIONAL HEALTH HAZARDS AND SAFTY ISSUES AMONG FARM WOMEN IN INDIAN AGRICULTURE

Neha Kanojiya^{1*}, Ankita Yadav², Smita Tripathi¹, Mithilesh Verma¹

¹Deptt. of Extension Education and Communication Management, C.S.A. University of Agriculture and Technology, Kanpur

²Department of Textile and Clothing, CSA University of Agriculture and Technology, Kanpur, U.P.

*Corresponding Author Email : neharox2512@gmail.com

Abstract

The role of farm women in agriculture and allied activities has been increasingly recognized and appreciated over the decades. However, the nature and extent of their involvement varies from region to region and according to different agricultural conditions. Rural women bear the double burden of both farm and household activities but their contribution and hard work has not been fully recognized till date. The current working conditions in agriculture in India are having a very detrimental effect on the overall health of farm women, which in turn negatively impacts farm productivity, leading to a decline in the socio-economic status of farm women and their families. Some of the modern techniques developed ergonomically for farm women are innovative sickle, wheel hoe, hand riser, seed treatment drum, seed drill, maize sheller etc. and various precautionary measures suggested by home scientists like protective cap, mask, hand gloves, apron, boot etc. Global warming is continuously affecting not only the agricultural production of the country but also the health of farm women. If farm women are not made aware about the modern techniques and their safe use, they will be vulnerable to minor to major injuries like cuts and bruises to fatal accidents etc. So it becomes even more important for scientists, extension worker and policy makers to search for suitable strategies and measures so that women can easily perform their work with full enjoyment rather than an obligation or burden. This will improve their health as well as the overall productivity of their farm.



PERFORMANCE ANALYSIS OF FRONT LINE DEMONSTRATIONS IN MOTH BEAN [*VIGNA ACONITIFOLIA* (JACQ.) MARECHAL] IN RAINFED CONDITIONS OF RAJASTHAN

Manmohan Puniya

Krishi Vigyan Kendra, Phalodi, Jodhpur-II, Agriculture University, Jodhpur-342301

Email : mmpuniya2011@gmail.com

Abstract

Performance analysis in terms of gap analysis, yield enhancement and economic viability of improved production technologies of moth bean vis-a-vis farmer's practices was evaluated through frontline demonstrations at farmer's field during *kharif*, season 2021 and 2022. The Krishi Vigyan Kendra, Jodhpur-II has carried out frontline demonstrations on moth bean crop covering an area of 30 ha of farmer's field to exhibit latest production technologies and compared it with farmer's practice. The study in total 45 frontline demonstrations were conducted on farmer's fields in villages viz. Vijaynagar and Kheechan of Jodhpur district of Rajasthan, to demonstrate production potential and economic benefit of improved technologies comprising sowing method, nutrient management and chemical weed management and adoption of whole package of practices for crop. The findings of the study revealed that the demonstrated technology recorded a mean yield of 438 kg/ha which was 28.67 % higher than obtained with farmers practices (340 kg/ha). In per cent terms, scaling in productivity following improved technologies ranged from 27.94 to 29.41 %. Moreover, average yield gap for extension, technology and technology index were 98, 263 kg/ha and 37.49 per cent, respectively. Demonstrated technology also fetched average gross return of (? 23511/ha), net return(?13091/ha), and additional return (? 4037/ha) in comparison to farmers practices. Demonstration of improved technologies also resulted in realizing higher incremental cost benefit ratio (5.34) with a Benefit:cost ratio of (2.22) compared to the farmers practice (1.97) during two years of study period. The frontline demonstrations conducted on moth bean crop at farmers field revealed that the adoption of improved technologies significantly increased the yield as well as the net returns higher than the farmers practices. So, there is a need to disseminate the improved technologies among the farmers with effective extension methods like training and demonstrations. The farmers should be encouraged to adopt the recommended package of practices realizing for higher returns.

EFFECT OF SEED TREATMENTS AND PACKAGING MATERIALS ON STORABILITY OF WHEAT (*TRITICUM AESTIVUM* L.)

Anuradha Parmar

Faculty of Agriculture Science, MGU Bilkishganj, Sehore, M.P.

Email : parmaranuradha7@gmail.com

Abstract

Wheat is the most important winter cereal crop of India. The wheat being grown in India is spring type belonging to species *aestivum* (bread wheat). Wheat growing in India is divided into six zones, since they differ agro-ecologically. The Indo-Gangetic plain comprising the North Western Plains Zone and the North Eastern Plains Zone, forms the major wheat tract followed by the Central Zone and the Peninsular Zone. The Northern Hill Zone is still dominated by traditional cereal growing with varieties that mature in May/June, while the Southern Hill Zone has a miniscule area of few hundred hectares under tropical cold humid environment. Seed health is an important attribute to quality seed. A seed lot that meets high standards of germinations, vigour and purity but if it is contaminated with seed borne pathogens and insect pests, may be useless to farmers because it may result in severe yield loss of even crop loss in the entire area.

The experiment consisted of three genotypes viz., (V₁) DBW110, (V₂) MP 4106 and (V₃) MP 3288 as first factor and three treatments viz., Neem oil (T₁), Turmeric Powder (T₂) and Carbendazim 12% (T₃) with the untreated control (T₀) as second factor and seed samples were packed in polythene bags (C₁), and jute bags (C₂) as third factor and stored for 18 months. The seed quality parameters like germination percentage, root length, shoot length, seedling length, seedling dry weight, seedling vigour index, seed viability, field emergence, electrical conductivity of seed leachate and seed health test were determined. From the result, it is concluded that the genotype V₁ (DBW 110) showed better quality parameters even after 18 months of storage period than other genotypes. Polythene bag (700 gauges) was proved to be better packaging material in preserving the seed quality of Wheat seeds.



VALUE ADDITION FRUIT AND VEGETABLES : IMPROVE ECONOMIC CONDITION RURAL PEOPLES

Kanchan Devi* and Kirti Devi

Department of Extension Education and Communication Management, C.S.A. University of Agriculture and Technology Kanpur, U.P.

**Corresponding Author Email : kanchankirtisingh@gmail.com*

Abstract

India is among the topmost vegetable and fruit producer in the world. India's food processing sector covers fruit and vegetables. After harvest, fruits and vegetables are liable to accelerated physiological, chemical, and microbial processes that invariably lead to deterioration and loss of wholesomeness. It is then necessary to institute some measure of processing such as reduction in moisture content, denaturation of endogenous enzymes and microorganisms, or packaging in order to curtail perishability. The challenge of feeding the population of the world has always been a sustainable key issue for human societies. The development of agriculture /horticultural produce has enabled greatly expanded food production and allowed rapid growth of human populations. The long success of agriculture has confined much of the human population – now in large “metro cities” – from food production in rural areas, with an ever-shrinking proportion of the population involved in food production. For development of skills, groups should be set up and adequate training to be given by qualified persons. Emphasis should be on self-employment rather than on wage employment.

INTERNATIONAL TRADE RELATIONS WITH INDIAN FISH, CRUSTACEANS, MOLLUSCS, AND OTHER AQUATIC INVERTEBRATES

S.S. Pramod Nayak*, V. Pavan and Suman K.M.

Institute of Agri-Business Management, UAS, GKV, Bengaluru-560 056, Karnataka, India

**Corresponding Author Email : nayakpss767@gmail.com*

Abstract

India is the second-largest fish producer in the world, with a total production of 13.7 MMT (2018–19). This country contributes 1.07 percent of the global GDP and offers 14 million people significant employment opportunities along the entire value chain, including harvesting, processing, packaging, and distribution. As a secondary source of data, the ITC and OECD were used to compile statistics for the past 10 years about the trade in fisheries and allied products, specifically the trading of seven products with HS codes. Fish and fish products have lately become the largest group of agricultural exports from India, with 1.37 MT in volume and a value of Rs. 45,106.89 crore, or nearly 11 per cent of all exports and 5.00 per cent of the nation's agricultural GVA. In terms of the percentage of total exports, China is the top exporting country, followed by Japan (8.12%), China (18.12 %), and India (36.00%). China has a greater CAGR of 30.00 percent than the other top exporting countries. Bangladesh (23.12 %), Uzbekistan (20.34 %), and Myanmar (10.14%) are the top three exporters to India, in that order. With CAGR shares of 70.25 per cent and 59.87 per cent, respectively, Oman and China have the greatest proportions with India. Bangladesh and Myanmar have the highest import percentage share destinations among these countries that are near to India. With 9., 2.92, and 1.14 respectively, the nation has more than unit is comparatively more beneficial in products of mollusks, crustaceans, and frozen fish. Less than IUV's 10 USD million, live fish has 8.10 USD million. Exports of live fish will increase in comparison to imports, followed by those of crustaceans, fish fit for human food, dried fish, fish in salt or brine, etc. Here, products that have lower EUV than IUV of aquatic invertebrates like fish, crabs, mollusks, and fish can be lowered. These products have the respective HS Codes of 0307, 0308, 0303, and 03304.

NEXUS BETWEEN ECONOMIC GROWTH AND NUTRITIONAL SECURITY IN INDIA

S.S. Pramod Nayak*, V. Pavan and Suman K.M.

Institute of Agri-Business Management, UAS, GKV, Bengaluru-560 056, Karnataka, India

**Corresponding Author Email : nayakpss767@gmail.com*

Abstract

India is a large country with many different culinary traditions. However, despite significant progress in recent decades, the



country still has a number of food security-related problems. Because income levels and the reduction of poverty are important factors in determining access to food and a nutritious diet, economic growth and nutritional security are closely linked. India's economy has grown at a 7.5% annual pace in recent years, which is impressive. However, not all societal segments have seen a rise in nutritional stability as a consequence of this development. India ranks 94th out of 107 countries in terms of famine and malnutrition, receiving a score of 27.2 on the Global famine Index 2020. In addition, 14% are mentioned in the research. In India, 14.5% of the population is undernourished, and 37.4% of children under the age of five have limited growth. Despite several government programmes and initiatives including the Mid-Day Meal Program, Integrated Child Development Services, and the National Food Security Act, malnutrition remains a serious issue in India. Many factors, such as poor implementation, ignorance, and inadequate infrastructure, can be blamed for this. Hence, if India is to achieve nutritional security, it is essential to focus on economic development, reducing poverty, and increasing access to nutrient-dense foods. The goals of policy should be to expand agricultural investment, improve food distribution networks, increase economic opportunities for the impoverished, and promote the consumption of a variety of healthy foods. In India, the two are closely related in terms of both economic growth and food stability. Economic growth is important, but it must also be supported by policies that ensure everyone has access to wholesome food and address the root causes of malnutrition.

CLIMATE CHANGE : CURRENT GLOBAL SCENARIO AND ITS CONSEQUENCES ON FOOD SECURITY

Manoj S. Naware¹ and Gajanan D. Chandankar²

¹Department of Agricultural Botany, SSAC, Amravati (MS)

²AICRP, RRC (Dr. PDKV) Amravati (MS)

Email : manojnaware76@gmail.com

Abstract

Today every one is facing direct and indirect effects of global climate change. Direct and indirect effects of global climate change are seen on agricultural crops, soils, livestock & pests. Global ocean has absorbed 90% of excess heat generated by GHGs emission, this has led to anomalous ocean warming. Lands around the water bodies are fertile for agricultural crops & 51% of country's net sown area are rainfed & accounts for nearly 40 percent of the total food production. Global climate change is because of human-induced emissions of Greenhouse Gases (GHGs) & varying weather phenomena. The last 50 years show an increasing trend of 0.13°C per decade in global mean annual temperature & now higher since last ½ decade, mean sea level has risen by 10-20cm in last century & snow cover is decreasing. Intermittent or decline of precipitation in tropics & sub-tropics has led to frequent droughts. India is facing Pre-monsoon cyclones in Arabian Sea for four consecutive years. In May 2021 India faced two cyclones just a week apart, cyclone "Taukete" on Western Coast due to warming of Arabian Sea and cyclone "Yaas" on Eastern Coast arising from Indian Ocean, these cyclones have become a new normal in South Asian Regions. Tall & strong waves broke mud embankments inundated fields by water which altered the microclimate of existing crops (vegetables) & led to their shortage in market & hence their price hiked. Farmers are unable to grow next crops as the embankments need to be rebuilt, also the stagnant water carries diverse plant pathogens & insect pests harmful to agricultural crops. West Bengal has estimated damage to 221000 ha of agricultural land & 71560 ha of horticulture area due to cyclone. Hence, now owing to the alarming situation on the earth, it is of urgent need to focus on this issue very meticulously both by the governmental and as a citizen moral responsibility.

THE IMPORTANCE OF SECONDARY AGRICULTURE IN ENHANCING FARMER INCOME OF INDIA

S S Pramod Nayak*, Suman K.M. and V. Pavan

Institute of Agri-Business Management, UAS, GKV, Bengaluru-560 056, Karnataka, India

*Corresponding Author Email : nayakpss767@gmail.com

Abstract

The term "secondary agriculture" refers to operations like processing, packaging, storage, and selling that take place after the initial output of agricultural crops. By giving agricultural products more value and generating more job possibilities, it is essential for raising farmers' incomes in India. The Gross Value Added (GVA) of agriculture and related industries in India



was 17.8% in 2020–21, according to the Ministry of Agriculture and Farmers' Welfare. 8.6% of India's GVA in 2020–21 came from the secondary agriculture sector, which encompasses the food processing industry. The sector's Compound Annual Growth Rate (CAGR) from 2014–15 to 2019–20 was 8.8%, which is higher growth than that of primary agriculture. Increased demand for agricultural products as a result of the expansion of secondary agriculture has resulted in higher prices for producers. Additionally, especially in rural areas, the industry has produced job opportunities for both skilled and unskilled workers. The Pradhan Mantri Kisan Sampada Yojana (PMKSY), which will build infrastructure for the processing and preservation of agricultural products, the Agri-Business and Rural Entrepreneurship Development (ABRED) scheme, which will encourage agribusiness and rural entrepreneurship, and the National Mission on Food Processing (NMFP), which will promote food processing, are just a few of the actions the Indian government has taken to encourage the growth of the secondary agriculture sector. In conclusion, increasing farmer income in India depends on the expansion of the secondary agriculture industry. Farmers have a stage in this industry to add value to their products, command higher prices, and generate more jobs. In the upcoming years, the government's initiatives to support the sector's expansion are likely to increase its input to India's economy even more.

THE FARM LOAN WAIVER AND ITS ECONOMIC IMPLICATIONS IN KARNATAKA

S.S. Pramod Nayak*, Suman K.M. and V. Pavan

Institute of Agri-Business Management, UAS, GKV, Bengaluru-560 056, Karnataka, India

**Corresponding Author Email : nayakpss767@gmail.com*

Abstract

In the Indian economic landscape, the topic of farm debt waivers has frequently come up, and Karnataka is no exception. The Karnataka government recently unveiled a loan waiver programme for farmers to help them reduce their debt loads. With an approximated cost of around Rs. 9,500 crores, the programme is anticipated to help about 10 lakh farmers in the state. Farmers and their associations have hailed the announcement of the programme, but it has also sparked questions about its potential effects on the economy. According to experts, farm debt waivers may harm the state's economy, credit culture, and financial inclusion. The effect on the state's financial stability is one of the main issues. The plan is expensive and could put a strain on the state's resources, increasing the fiscal deficit and debt load. Additionally, this might limit the state's capacity to implement social welfare programmes and initiatives for development. The effect on the credit system is another issue. Farmers may cease making loan payments in the expectation of future waivers, according to experts, who contend that farm loan waivers could cause moral hazard. This might result in a rise in non-performing assets (NPAs), which would impact banks' ability to lend money and their profitability. The waiver might also affect financial equality, in addition. The waiver may deter farmers from pursuing credit from formal institutions in the future because it only applies to those who have borrowed money from them. This might cause informal borrowing to increase, which is frequently accompanied by high interest rates and abuse. While agricultural loan waivers can help distressed farmers, their economic effects must also be considered. To address the problem of farm distress, the Karnataka government must adopt a comprehensive strategy that boosts farmer output and income while fostering financial inclusion and ensuring fiscal sustainability.

THE IMPACT OF COVID -19 ON AGRICULTURAL PRODUCTION AND MARKETING OF PRODUCTS IN KARNATAKA, INDIA

Suman K.M., S.S. Pramod Nayak and V. Pavan

Institute of Agri-Business Management, UAS, GKV, Bengaluru-560 056, Karnataka, India

**Corresponding Author Email : nayakpss767@gmail.com*

Abstract

The COVID-19 pandemic outbreak in India has had a significant negative effect on the agricultural industry, which is the foundation of the nation's economy. In Karnataka, one of the major agricultural states in India, this research seeks to examine the effects of COVID-19 on agricultural production and product marketing. Lockdowns and travel bans enacted to stop the virus's spread disrupted the agricultural supply chain and caused a shortage of workers, vehicles, and storage space. A decline in demand and an increase in the cost of agricultural goods resulted from the closure of wholesale markets and export restrictions, which made the situation worse. According to a report by the Department of Agriculture, the state of Karnataka,



output of horticultural crops, such as fruits and vegetables, decreased by 10-15% during the lockdown. During the same time span, there was a 10% decrease in milk and milk product production. Farmers had trouble transporting and selling their produce, which had a significant impact on the marketing of agricultural goods. According to the Karnataka State Farmers' Union, during the lockdown, vegetable prices fell by 30–40%, causing farmers to suffer significant losses. As part of its efforts to lessen the effects of COVID-19 on agriculture, the Karnataka government established mobile markets, relaxed debt repayment requirements, and created the e-National Agriculture Market (e-NAM) platform to enable online trading of agricultural goods. The COVID-19 pandemic significantly affected Karnataka's agricultural industry, causing a decline in output, a drop-in demand and prices, and a disruption in the supply network. However, the industry has seen some relief thanks to the government's initiatives to help farmers and promote online trading platforms.

TRENDS, CAUSES, AND MITIGATION TACTICS FOR INDIAN AGRICULTURE'S GREENHOUSE GAS EMISSIONS

Suman K.M., S.S. Pramod Nayak and V. Pavan

Institute of Agri-Business Management, UAS, GKVK, Bengaluru-560 056, Karnataka, India

**Corresponding Author Email : nayakpss767@gmail.com*

Abstract

With about 18% of all GHG emissions in India coming from agriculture, the sector is a significant driver to global warming. Due to a number of factors, such as population growth and urbanization, dietary changes, and agricultural practices like crop residue burning, the sector has seen gradually rising emissions over the past few decades. According to recent data, India's overall GHG emissions rose by 3.1% in 2021, with the agricultural sector playing a major role. To meet the nation's climate goals and lessen the sector's environmental effect, India's agriculture must mitigate its GHG emissions. Several mitigation strategies can be used to address this problem, such as promoting sustainable farming practices, putting in place effective irrigation systems, cutting down on food waste, and encouraging the use of renewable energy sources. The creation of low-emission agricultural technologies and encouraging farmers to embrace sustainable practices can also aid in reducing GHG emissions from agriculture. In order to lessen the impacts of climate change, India's agriculture must reduce its GHG emissions. India can lower its agricultural GHG emissions while ensuring food security and long-term economic development by adopting sustainable agricultural practices and promoting low-emission technologies.

TRENDS IN IMPORTS OF AGRICULTURAL COMMODITIES FROM INDIA DURING PRE AND POST REFORM PERIOD

Chaitra Harkude* and R.A. Yeledhalli

Department of Agribusiness Management, College of Agriculture, University of Agricultural Sciences, Dharwad-580 005, Karnataka

**Email : chaitraharkude28@gmail.com*

Abstract

Indian agriculture has undergone a remarkable transformation in the second half of the twentieth century including the 1991 reforms and establishment of WTO. These reforms have caused agriculture to move in the direction of commercialization and diversification which has triggered the development and innovations in this sector. Thus, this study focuses on the trends in imports of agricultural commodities from India during Pre and Post reform period. Secondary data were collected from the various published sources like Economic Survey, Agricultural Statistics at Glance, Agriexchange, Indiastat and other related published sources etc. The data were grouped into Pre reform (1980-81 to 1990-91) and Post reform (1991-92 to 2019-20) period. In order to analyze the data we employed descriptive statistics and Compound Annual Growth Rate (CAGR) to identify growth over a period of time. The results revealed that during the pre reform period the average quantity and value of agricultural commodities imported was highest for other commodities, whereas, in the post reform period in terms of average quantity and value of agricultural commodities imported was highest for edible oils. The CAGR during pre reform period for the import of agricultural commodities in terms of quantity and value showed a positive and significant growth rate for crude rubber and cashew nuts (unprocessed), whereas, the negative and significant growth rate for cereals and cereal preparations and edible oils respectively. During post reform period, the CAGR for the import of agricultural commodities in terms of



quantity and value showed a positive and significant growth rate for all the selected agricultural commodities. Therefore, in the post reform period the edible oils constituted major import components to meet the nation's food shortfalls and also due to change in the consumption pattern in the Indian market demanded increased imports.

MARKET INTEGRATION AND PRICE TRANSMISSION AMONG CHICK PEA MARKET IN KARNATAKA

V. Pavan, S.S. Pramod Nayak* and Suman K.M.

Institute of Agri-Business Management, UAS, GKVK, Bengaluru-560 056, Karnataka, India

*Corresponding Author Email : nayakpss767@gmail.com

Abstract

India has achieved self-sufficient in cereal production however for importing pulse for fulfilling its domestic demands. The imports are very much capable in modulating the domestic prices of pulses and market prices all over the India which transmits other markets. Thus, the present study was carried out in Karnataka state to study the integration and price transmission for chick pea in Karnataka state. The Karnataka state is the major producer of chick pea among other southern states. The secondary data was collected from the Agmarknet portal for the chick pea crop stata software was used for the analysis of the retrieved data. The empirical techniques or econometric techniques was employed like unit root test, Johansen co integration test and Granger causality test was applied to find the results and conclusions of this study. The findings of the study. Chick pea prices of these 20 wholesale and retail markets are strongly integrated and most of the markets have a bi-directional relationship with each other. The wholesale and retail markets of Gulbarga and Raichur have positive relationship with the other markets while they have a bidirectional relationship between their own wholesale and retail market prices implies that they might be the markets where prices are discovered, as they are not found to be influenced by the other spatially separated markets.

MARKETING EFFICIENCY AND FACTORS AFFECTING OF MARKETING CHANNEL CHOICE BY RICE FARMERS IN RURAL INDIA : EVIDENCE FROM TUNGABHADRA COMMAND AREA

V. Pavan, S.S. Pramod Nayak* and Suman K.M.

Institute of Agri-Business Management, UAS, GKVK, Bengaluru-560 056, Karnataka, India

*Corresponding Author Email : nayakpss767@gmail.com

Abstract

Rice is the staple food crop and its significant source of income and employment for the farmers in the TBP command area and food security for small holders in the region. However, the better market access for the rice growers is essential to get remunerative rice thereby income and reduce the poverty level. This study aims to determine the best and most efficient marketing channel and what factors influencing marketing channel smallholder rice farmers by employing for Marketing efficiency by using Acharya and Aggarwal's composite index method. A multinomial logit model was used to analyse the marketing channel choices. The results showed that the miller-retailer marketing channel is the most efficient. The results show that most farmers in rural areas still sell their rice to local traders because crop pledge and also inability by farmers to venture out of the farm gate into the markets. The findings suggest that there is a need to improve rural infrastructure, market information systems in the region.

MILLETS FOR FOOD AND NUTRITIONAL SECURITY

Swati Dash* and Kushal

UAS, GKVK, Bengaluru, Karnataka

*Corresponding Author Email : dash95@gmail.com

Abstract

Millets are a group of small-seeded grasses that have been cultivated for centuries around the world, especially in Asia and Africa. They are an important source of food and nutrition for millions of people, particularly in regions where other crops are



difficult to grow. Millets are highly adaptable to harsh weather conditions, making them an excellent crop for regions with limited access to irrigation and unpredictable rainfall. Millets are a rich source of nutrients, including protein, dietary fiber, vitamins, and minerals. They are also gluten-free, making them a valuable alternative for people with gluten intolerance. Research has shown that regular consumption of millets can lower the risk of various chronic diseases, including diabetes, cardiovascular diseases, and cancer. Despite their numerous nutritional benefits, millets have been overshadowed by other grains in recent times. With the growth of urbanization and the adoption of westernized diets, the demand for traditional millets has decreased, and many farmers have shifted to other crops. However, there has been a recent resurgence of interest in millets due to their nutritional value, adaptability, and climate resilience. Promoting the cultivation and consumption of millets can contribute to food and nutritional security, especially in regions prone to drought and famine. Governments and development agencies should encourage small-scale farmers to grow millets by providing them with financial incentives and technical assistance. At the same time, public awareness campaigns should be launched to promote the nutritional benefits of millets and encourage people to include them in their diets.

MANAGEMENT OF HAILSTORM AFFECTED AGRICULTURE CROPS

Swati Dash* and Kushal

UAS, GKVK, Bengaluru, Karnataka

**Corresponding Author Email : dash95@gmail.com*

Abstract

Hailstorms can cause significant damage to agricultural crops, resulting in loss of yield and income for farmers. It is important to manage the aftermath of hailstorms effectively to minimize the impact on agricultural production and livelihoods. The first step in managing hailstorm-affected crops is to assess the extent of the damage. This can be done by conducting a visual survey of the affected fields to determine the percentage of crop loss. Once the damage has been assessed, farmers can decide whether to salvage the remaining crop or replant. For crops that can still be salvaged, it is important to take immediate action to prevent further damage. This may involve pruning damaged plants, removing debris, and applying fertilizers and pesticides to stimulate growth and protect the plants from pests and diseases. For crops that need to be replanted, farmers should take into consideration the time of year, availability of seeds and other inputs, and soil conditions. In addition, farmers may need to adjust their planting schedule to avoid future hail damage. Farmers can also take preventive measures to minimize the impact of future hailstorms. This may involve using hail nets or other protective coverings, planting crops that are less susceptible to hail damage, or diversifying their crops to reduce the risk of total crop loss. In conclusion, effective management of hailstorm-affected crops requires prompt action, careful assessment of damage, and appropriate measures to salvage or replant crops. By taking preventive measures, farmers can reduce the impact of future hailstorms and ensure the sustainability of their agricultural production and livelihoods.

C4 RICE FOR NUTRITIONAL SECURITY AND CLIMATE RESILIENCE

Swati Dash* and Kushal

UAS, GKVK, Bengaluru, Karnataka

**Corresponding Author Email : dash95@gmail.com*

Abstract

Rice is one of the most important staple crops in the world, providing food for billions of people. However, rice production is threatened by climate change, which can lead to decreased yields and lower nutritional value. To address these challenges, scientists are developing a new type of rice called C4 rice. C4 rice is a genetically modified variety that can photosynthesize more efficiently than traditional rice. This means that it requires less water and fertilizer, and can produce higher yields in warmer temperatures. In addition, C4 rice has higher levels of protein and essential amino acids, making it more nutritious than traditional rice. C4 rice has the potential to improve nutritional security and climate resilience in regions that rely on rice as a staple crop. By producing higher yields and requiring less water and fertilizer, C4 rice can increase food production while reducing the impact on the environment. In addition, the higher nutritional value of C4 rice can help to address malnutrition in regions where rice is a primary source of food. However, there are also concerns about the potential risks associated with genetically modified crops, including the impact on biodiversity and the potential for unintended consequences. It is important



to carefully evaluate the potential benefits and risks of C4 rice and ensure that appropriate safety measures are in place. In conclusion, C4 rice has the potential to improve both nutritional security and climate resilience in regions that rely on rice as a staple crop. However, it is important to carefully evaluate the risks and benefits associated with this new technology and ensure that appropriate safety measures are in place.

CHALLENGES AND OPPORTUNITIES IN HILLY REGIONS CEREAL-BASED FARMING SYSTEM

Kushal* and Swati Dash

UAS, GKV, Bengaluru, Karnataka

**Corresponding Author Email : kushalrathod321@gmail.com*

Abstract

Hilly regions present both challenges and opportunities for cereal-based farming systems. These regions are characterized by rugged terrain, limited availability of arable land, and variable climate, which can make it difficult to cultivate crops and raise livestock. However, hilly regions also have unique ecosystems and microclimates that offer opportunities for sustainable and diversified farming practices. One of the main challenges in cereal-based farming systems in hilly regions is the limited availability of arable land due to the steep terrain. This makes it difficult to use machinery for cultivation and harvesting, and the labour-intensive nature of cereal farming can be a barrier for small farmers. Climate change also poses a challenge, with unpredictable yields and crop failures due to changes in weather patterns. Additionally, the use of traditional farming practices can result in soil degradation and erosion, further reducing crop yields. Despite these challenges, there are opportunities for improving cereal-based farming systems in hilly regions. The adoption of conservation agriculture techniques such as reduced tillage, intercropping, and the use of cover crops can increase crop yields and improve soil health. The development of local value chains and processing facilities can help farmers capture more value from their crops, and promote sustainable farming practices. Hilly regions often have unique and specialized cereal crops, such as millets, which can be marketed as premium products, offering an opportunity to diversify income sources. Furthermore, hilly regions also offer opportunities for agroforestry, which involves integrating trees into farming systems to provide multiple benefits such as soil conservation, biodiversity conservation, and timber production. Agroforestry can also provide additional sources of income for farmers, such as from the sale of fruits, nuts, and other tree products. In conclusion, hilly regions present both challenges and opportunities for cereal-based farming systems. By adopting improved agricultural practices, developing local value chains, and promoting agroforestry, farmers in hilly regions can increase their income and improve their livelihoods while also promoting sustainable land use and environmental conservation.

ORGANIC FARMING : BOON OR BANE IN CLIMATE CHANGE

Kushal* and Swati Dash

UAS, GKV, Bengaluru, Karnataka

**Corresponding Author Email : kushalrathod321@gmail.com*

Abstract

Organic farming has been widely recognized as a sustainable agricultural system that minimizes the negative impacts of conventional farming on the environment. In recent years, organic farming has gained increasing attention as a potential solution to mitigate climate change impacts. However, the effects of organic farming on climate change are complex and multifaceted. While organic farming practices can reduce greenhouse gas emissions, they may also have some drawbacks. Organic farming reduces greenhouse gas emissions by reducing the use of synthetic fertilizers and pesticides, which contribute significantly to emissions. Organic farming also promotes carbon sequestration by using sustainable soil management practices, such as crop rotation, intercropping, and the use of cover crops. Additionally, organic farming can reduce energy consumption associated with transportation and synthetic fertilizer production. However, organic farming also has some potential drawbacks. It may require more land to produce the same amount of crops as conventional farming, resulting in deforestation and habitat loss. Organic farming may also have lower yields compared to conventional farming, which could lead to increased pressure on remaining natural ecosystems. Furthermore, organic farming may require more manual labour and may be less profitable for farmers, which could discourage adoption. In conclusion, organic farming can be a boon in mitigating climate change by reducing greenhouse gas emissions and promoting sustainable soil management practices. However, it also has potential drawbacks that need to be considered, such as the need for more land and labour,



lower yields, and potential negative impacts on natural ecosystems. Overall, the benefits of organic farming in mitigating climate change outweigh its potential drawbacks if implemented sustainably and with careful consideration of its impacts.

NUTRI-CEREALS AND THEIR ROLE IN HUMAN HEALTH

Kushal* and Swati Dash

UAS, GKV, Bengaluru, Karnataka

*Corresponding Author Email : kushalrathod321@gmail.com

Abstract

Nutri-cereals are a group of cereals that are nutrient-dense and have been traditionally grown in India for centuries. These cereals include millets such as sorghum, finger millet, pearl millet, and foxtail millet, among others. Nutri-cereals are rich in vitamins, minerals, dietary fiber, and antioxidants, making them an excellent source of nutrition for human health. The consumption of nutri-cereals has been associated with numerous health benefits, including the prevention and management of chronic diseases such as diabetes, cardiovascular disease, and obesity. Nutri-cereals have a low glycemic index, which means that they do not cause a rapid spike in blood sugar levels and are therefore beneficial for people with diabetes. They are also rich in dietary fiber, which helps regulate digestion and promotes a feeling of fullness, aiding in weight management. Moreover, nutri-cereals are rich in micronutrients like iron, calcium, and magnesium, which are essential for maintaining healthy bones and preventing anemia. They also contain antioxidants that protect the body against oxidative stress and inflammation, reducing the risk of chronic diseases. In conclusion, nutri-cereals are an important source of nutrition and have numerous health benefits. Incorporating them into the diet can help prevent and manage chronic diseases, promote healthy digestion, and provide essential micronutrients to the body.

STRIGA MANAGEMENT TO ENHANCE THE YIELD POTENTIAL IN SORGHUM

Kushal* and Swati Dash

UAS, GKV, Bengaluru, Karnataka

*Corresponding Author Email : kushalrathod321@gmail.com

Abstract

Striga, also known as witch weed, is a parasitic plant that poses a significant threat to sorghum production in many parts of the world. Striga infestation can cause up to 100% yield loss in sorghum, which is a critical food and feed crop in many countries. Hence, it is essential to develop effective management strategies to control Striga and enhance sorghum yield potential. The effective management of Striga in sorghum involves several cultural, biological, and chemical control methods. Cultural methods, such as crop rotation, intercropping with non-host crops, and the use of resistant sorghum cultivars, have shown promising results in controlling Striga and enhancing sorghum yields. Biological control methods, such as the use of mycoherbicides, have also been found effective in controlling Striga. Moreover, the use of chemical control methods, such as herbicides, has been found to be effective in controlling Striga in sorghum. However, the use of herbicides may have adverse effects on non-target organisms and the environment. Integrated Striga management approaches that combine two or more control methods have been found to be more effective than individual methods. For instance, the integration of resistant sorghum cultivars with intercropping and mycoherbicides has shown significant potential in controlling Striga and enhancing sorghum yields. In conclusion, the effective management of Striga in sorghum is crucial to enhance its yield potential. Integrated Striga management approaches that combine cultural, biological, and chemical control methods should be adopted to control Striga and improve sorghum productivity.

ROLE OF ARTIFICIAL INTELLIGENCE IN AGRICULTURE

Swati Dash* and Kushal

UAS, GKV, Bengaluru, Karnataka

*Corresponding Author Email : dash95@gmail.com

Abstract

Artificial intelligence (AI) has the potential to transform agriculture by improving crop yields, reducing costs, and increasing



efficiency. AI can be used to analyze vast amounts of data collected from sensors and other sources to provide insights that can help farmers make informed decisions about planting, harvesting, and pest control. One area where AI can be particularly useful is in precision agriculture. By collecting and analyzing data about soil quality, weather patterns, and other variables, AI can help farmers optimize irrigation, fertilization, and pesticide use. This can reduce waste and increase crop yields, while minimizing the impact on the environment. AI can also be used to improve crop breeding and genetic selection. By analyzing genetic data, AI can help identify traits that are associated with desirable crop characteristics, such as disease resistance, drought tolerance, and yield. This can speed up the process of developing new crop varieties that are better suited to local conditions. In addition, AI can be used to improve farm management and logistics. By analyzing data on crop production, inventory, and market demand, AI can help farmers make more informed decisions about when to plant, harvest, and sell their crops. This can help farmers maximize profits and reduce waste. However, there are also challenges associated with the use of AI in agriculture, including the need for reliable data, the cost of implementing AI technologies, and the potential for unintended consequences. It is important to carefully evaluate the potential benefits and risks of AI in agriculture and ensure that appropriate safety measures are in place. In conclusion, AI has the potential to transform agriculture by improving efficiency, reducing costs, and increasing crop yields. By leveraging AI technologies, farmers can make more informed decisions about planting, harvesting, and pest control, while minimizing the impact on the environment. However, it is important to carefully evaluate the potential risks and benefits associated with AI in agriculture and ensure that appropriate safety measures are in place.

Our Conference Memory



About the Conference Chairman



CONFERENCE CHAIRMAN

Dr. S.P. Singh, born in Village Jevri, Post Rajbun, District Meerut (U.P.), in 1970 and Graduated in Agriculture with Honors from G.M.V., Rampur Maniharan, Saharanpur (U.P.). He did his Post Graduation in Agricultural Botany, Institute of Advance Studies, Meerut University Campus, Meerut and Doctorate in the same discipline (Ag. Bot.) from C.S.J.M. University, Kanpur. Presently, he is working as Scientist (Plant Breeding) at C.S.A. University of Agriculture and Technology, Zonal Agriculture Research Station, Kalai, Aligarh (U.P.). Dr. Singh is a fellow of SRDA, and member of many other professional Societies, having 21 years of experience in Research and Extension Education Works. He authored many books such as Plant Breeding, Agriculture at a Glance, Hand Book of Agriculture (Hindi), Crop Physiology (Hindi & English), College Botany, Environmental Science & Agroecology, Concepts of Ecology etc. He is well recognized Scientist and having more than 300 publications in reputed National and International Journals. Dr. S.P. Singh is also Editor-in-Chief, Progressive Research-An International Journal & Frontiers in Crop Improvement (both Journals are NAAS recognized), Secretary, Society for Scientific Development in Agriculture & Technology and also Chief Managing Director, Astha Foundation, Meerut, working in the field of Science & Education.

He has been awarded as Best Editor and Writer Award-2006, Young Scientist Award-2007, Dr. M.S. Swaminathan Young Scientist Award-2009, Distinguished Scientist Award-2014, Scientific Initiator Award-2014 from Directorate of Rice Research, Hyderabad, Science Leader Award-2015 From RVSKVV, Gwalior, Outstanding Scientist in Agriculture Award-2016, Outstanding Achievement Award-2016, Excellence in Research Award-2017, Innovative Scientist of the Year Award-2017 Outstanding Scientist in Agriculture Award-2018 Before this International conference, Dr. S.P. Singh has already organized five conference at different corner of country, first conference was National symposium on "Achieving Millennium Development Goal : Problems & Prospects" at Bundelkhand University, Jhansi (UP) during October 25-26, 2009 under the umbrella of SSDAT, Meerut, Dr. Singh has been acted as an Organizing Secretary. The second was National conference on Emerging Problems and Recent Advances in Applied Sciences : Basic to molecular Approaches (EPRAAS-2014) during February 08-09, 2014 at Ch. Charan Singh University, Meerut (UP) again by SSDAT, Meerut in which Dr. S.P. Singh has played his role as an Organizing Chairman. The Third, Conference was Organized by SSDAT, Meerut and Astha Foundation, Meerut at Directorate of Rice Research, Hyderabad on Emerging Challenges and opportunities in Biotic and Abiotic Stress Management (ECOBASM-2014) during December 13-14, 2014. Fourth Conference organized by Astha Foundation, Meerut & SSDAT, Meerut at RVSKVV, Gwalior on Global Research Initiatives for Sustainable Agriculture & Allied Sciences (GRISAAS-2015). Fifth Conference was jointly organized by SSDAT, Meerut & Astha Foundation, Meerut at PJTSAU, Rajendranagar, Hyderabad, Telangana State on Innovative and Current Advances in Agriculture & Allied Sciences (ICAAAS-2016) during December 10-11, 2016. Sixth Conference organized by Astha Foundation, Meerut in collaboration with SSDAT, Meerut, MPUAT, Udaipur; CSAUT, Kanpur; UAS, Raichur at MPUAT, Udaipur, Rajasthan on Global Research Initiatives for Sustainable Agriculture & Allied Sciences (GRISAAS-2017). Seventh Conference organized by Astha Foundation, Meerut in collaboration with SSDAT, Meerut, CSAUT, Kanpur; IGKV, Raipur; BAU, Sabour; MPKV, Rahuri; RARI, Durgapura, Jaipur; Global Research Initiatives for Sustainable Agriculture & Allied Sciences (GRISAAS-2018). Eight Conference organized by Astha Foundation, Meerut in collaboration with SSDAT, Meerut, CSAUT, Kanpur; IGKV, Raipur; BAU, Sabour; MPKV, Rahuri; UAHS, Shivamogga, Global Research Initiatives for Sustainable Agriculture & Allied Sciences (GRISAAS-2019). Ninth Conference organized by SSDAT, Meerut in collaboration with Astha Foundation, Meerut, Innovative and Current Advances in Agriculture & Allied Sciences (ICAAAS-2020) at Bangkok, Thailand. Tenth International Web Conference organized by Astha Foundation, Meerut in collaboration with SSDAT, Meerut, CSAUT, Kanpur; IGKV, Raipur; BAU, Sabour; MPKV, Rahuri; BAU Ranchi and UAHS, Shivamogga on Global Research Initiatives for Sustainable Agriculture & Allied Sciences (GRISAAS-2020). Eleventh International Web Conference organized by SSDAT, Meerut in collaboration with Astha Foundation, Meerut, CSAUT, Kanpur; IGKV, Raipur; MPKV, Rahuri; BAU Ranchi and UAHS, Shivamogga on Innovative and Current Advances in Agriculture & Allied Sciences (ICAAAS-2021). Twelfth International Web Conference organized by Astha Foundation, Meerut in collaboration with SSDAT, Meerut, CSAUT, Kanpur; IGKV, Raipur; BAU, Sabour; MPKV, Rahuri; BAU Ranchi and UAHS, Shivamogga on Global Research Initiatives for Sustainable Agriculture & Allied Sciences (GRISAAS-2021). Thirteen International Conference in Hybrid Mode organized by SSDAT, Meerut in collaboration with Astha Foundation, Meerut, CSAUT, Kanpur; HPU, Shimla; BAU Ranchi, HFRI, Shimla and HNBGU, Srinagar on Innovative and Current Advances in Agriculture & Allied Sciences (ICAAAS-2022).

Glimpse of SSDAT & Astha Foundation's Conferences



Published By :

**Astha Foundation
Meerut (U.P.) INDIA**

**Suman Villa, 85, Phool Bagh Colony, Main Road,
Meerut-250002 Mob. : 08273775051, 09450068438**



ISBN No. : 978-81-958010-1-5