VI[th] International Conference in Hybrid Mode on

INNOVATIVE AND CURRENT ADVANCES IN AGRICULTURE AND ALLIED SCIENCES

15 - 20 July, 2024

Souvenir & Conference Book

ICAAAS-2024

Chief Editor : **Dr. S.P. Singh**

Organized By

Society for Scientific Development in Agriculture and Technology
MEERUT (U.P.) INDIA

In Collaboration with

Astha Foundation, Meerut, UP, INDIA
CSAUAT, Kanpur UP, INDIA
HPU, Shimla HP, INDIA
UAS, Raichur Karnataka, INDIA
ICAR-CIFE Mumbai Maharashtra, INDIA
AFU, Rampur Chitwan, NEPAL
KSNUAHS, Shi amoga Karnataka, INDIA
RK (PG) College Shamli, U.P., INDIA

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(ICAAAS-2024)

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Society for Scientific Development in Agriculture & Technology
Meerut, U.P., India

In Collaboration with

University of Agricultural Sciences, Raichur, Karnataka, India

C.S.A. University of Agriculture & Technology, Kanpur, U.P., India

Agriculture & Forestry University, Rampur-Chitwan, Nepal

Himachal Pradesh University, Summer Hill, Shimla, H.P., India

K.S.N. University of Agriculture & Horticulture Sciences, Shivamogga, Karnataka

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

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6th International Conference in Hybrid Mode on

INNOVATIVE AND CURRENT ADVANCES IN AGRICULTURE AND ALLIED SCIENCES

(ICAAAS-2024)

SOUVENIR & CONFERENCE BOOK

Chief Editor

Dr. S.P. Singh

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

EDITORS

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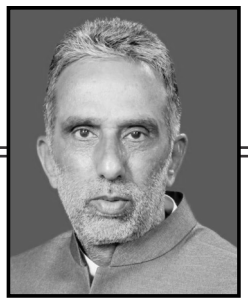
Published By : ASTHA FOUNDATION, MEERUT

कृष्ण पाल गुर्जर
Krishan Pal Gurjar



सत्यमेव जयते

सहकारिता एवं बिजली राज्य मंत्री
भारत सरकार
MINISTER OF STATE FOR COOPERATION & ENERGY GOVERNMENT OF INDIA

MESSAGE

It is a great to welcome you all to the 6th International Conference in Hybrid Mode on **"Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2024)"** which is being held during 15-20 July 2024 at Cong Doan Vietnam Hotel, Hanoi, Vietnam, C14 Tran Binh Trong Street, Hoan Kiem District, Hoan Kiem, Hanoi, Vietnam organized by Society for **Scientific Development in Agriculture and Technology, Meerut (U.P.) India** in collaboration with CSAUAT Kanpur U.P., UAS Raichur Karnataka, KSNUAHS Shivamogga Karnataka, HPU Shimla H.P., ICAR-CIFE Mumbai Maharashtra, AFU Rampur Chitwan Nepal, RK (PG) College Shamli U.P. and Astha Foundation Meerut (UP) India.

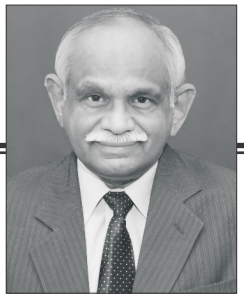
India has undergone a series of ups and down in agriculture production and food security playing havoc in the year of abnormality. Food Security in India can be achieved by playing higher attention to such as climate change, integrated water management, use the advanced agricultural techniques and pricing 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 and Allied Sciences.

Krishan Pal Gurjar

National Academy of Agricultural Sciences

Prof. Anil Kumar Singh
Prof. Anil Kumar Singh
Vice-President



MESSAGE

It is a matter of great pleasure to know that **Society for Scientific Development in Agriculture and Technology, Meerut (U.P.) India** in collaboration with CSAUAT Kanpur U.P., UAS Raichur Karnataka, KSNUAHS Shivamogga Karnataka, HPU Shimla H.P., ICAR-CIFE Mumbai Maharashtra, AFU Rampur Chitwan Nepal, RK (PG) College Shamli U.P. and Astha Foundation Meerut (UP) India are organizing a seven days 6th International Conference in Hybrid Mode on **"Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2024)''** during 15-20 July 2024 at Cong Doan Vietnam Hotel, Hanoi, Vietnam, C14 Tran Binh Trong Street, Hoan Kiem District, Hoan Kiem, Hanoi, Vietnam.

Agriculture is no longer an activity for substenance 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 burring 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)

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UNIVERSITY OF AGRICULTURAL SCIENCES, RAICHUR

[ICAR, NAAC accredited and UGC u/s 12(B) & 2(f) approved]

Dr. M. HANUMANTHAPPA
M.Sc.(Agri.), Ph.D., PGDAEM
Vice-Chancellor

Message

It is a matter of great pleasure to know that **Society for Scientific Development in Agriculture and Technology, Meerut** in collaboration with CSAUAT, Kanpur, U.P.; UAS, Raichur, Karnataka; HPU, Shimla, H.P.; ICAR-CIFE, Mumbai, Maharashtra; KSNUAHS, Sivamogga, Karnataka; AFU, Rampur Chitwan, Nepal and Astha Foundation, Meerut, U.P., India are organizing a Seven days 6th International Conference in hybrid mode on **"Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2024)"** during 15–20 July, 2024 at Cong Doan Vietnam Hotel, Hanoi, Vietnam, C14 Tran Binh Trong Street, Hoan Kiem District, Hoan Kiem, Hanoi, Vietnam.

We are the country with more than 50 percent of our population still dependent on agriculture. It is a challenging fact that even after one decade of twenty-first century. 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 of technology and services will take strong steps towards second green revolution. I am extremely confident that the discussion among professionals, exchange of ideas, issue and 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 issues before scientific community working towards food security of India and abroad.

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

[M. Hanumanthappa]
Vice chancellor

बिरसा कृषि विश्वविद्यालय
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डॉ. ओंकार नाथ सिंह
Dr. Onkar Nath Singh
कुलपति
Former 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 seven days 6th International Conference in Hybrid Mode on **"Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2024)"** organized by Society for **Scientific Development in Agriculture and Technology, Meerut (U.P.) India** in collaboration with CSAUAT Kanpur U.P., UAS Raichur Karnataka, KSNUAHS Shivamogga Karnataka, HPU Shimla H.P., ICAR-CIFE Mumbai Maharashtra, AFU Rampur Chitwan Nepal, RK (PG) College Shamli U.P. and Astha Foundation Meerut (UP) India, during 15-20 July 2024 at Cong Doan Vietnam Hotel, Hanoi, Vietnam, C14 Tran Binh Trong Street, Hoan Kiem District, Hoan Kiem, Hanoi, Vietnam.

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 seven days International Conference.

(O.N. Singh)

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भारतीय कृषि अनुसंधान परिषद
भा.कृ.अनु.प.-केन्द्रीय मात्स्यिकी शिक्षा संस्थान, मुंबई
(वि.अ.आ. अधिनियम धारा-३ के अंतर्गत विशविद्यालय)
ICAR - CENTRAL INSTITUTE OF FISHERIES EDUCATION
(University under Sec.3 of UGC Act)
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

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Ravishankar C. N.

डा. रविशंकर सी.एन./ Dr. Ravishankar C.N.
निदेशक / कुलपति / Director / Vice Chancellor
भा. कृ. अनु. प.-केन्द्रीय मत्सिकी शिक्षा संस्थान
ICAR-Central Institute of Fisheries Education
यारी रोड, वरसोवा, मुंबई / Versova, Mumbai-400 061.

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विश्वविद्यालय

Nilamber-Pitamber
University

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Former Vice-Chancellor

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MESSAGE

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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.

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

(Ram Lakhan Singh)

Astha Foundation®

Suman Villa, 85, Phool Bagh Colony, Main Road, Meerut (U.P.) INDIA
Email : dr.sp.singh24@gmail.in
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Dr. S.P. Singh
President

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 vi ., 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 and SSDAT,** Meerut, UP, India 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.

6th International Conference in Hybrid Mode on **''Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS-2024)** during 15-20 July 2024. 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
Organi ing Chairman
ICAAAS-2023

ABOUT ICAAAS

Innovative and Current Advances in Agriculture and Allied Sciences (ICAAAS) is a brain child of **Society for Scientific Development in Agriculture and Technology** 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. The five different themes of sessions were planned for the ICAAAS and these themes itself explains the vision of ICAAAS. These themes of sessions are :

1. Innovation in Crop Improvement, Biotechnology, Genetic Engineering, Precision Horticulture, Agroforestry and Impact of Climate Change on Biodiversity and Food Security.
2. Advances in Disease and Pest Management, Livelihood and Sustainable Management Practices, Post-Harvest Technology, Food Processing and Value Addition for Augmenting Farmer's Income.
3. Key Factor for Crop Productivity: Cropping System, Agronomic and Soil Health Management Practices, Farm Mechanization, Indigenous Technical Knowledge and IPR Issues.
4. Recent Advances in Animal Health, Animal Nutrition & Husbandry, Dairy, Poultry and Fisheries Technology.
5. New Frontiers in Physical, Chemical, Mathematical, Biological, Social Sciences, Remote Sensing, Smart Agriculture, Information Technology, Digital Library and Huminities.

The **first ICAAAS** conference was organized in collaboration with Professor Jayashankar Telangana State Agriculture University, Rajendranagar, Hyderabad (Telangana); Society for Scientific Development in Agriculture and Technology (SSDAT), Meerut (U.P.) and Astha Foundation, Meerut. It held during 10-11th December, 2016 at Professor Jayashankar Telangana State Agriculture University, Rajendranagar, Hyderabad (Telangana). During the conference, 29 lead papers were presented along with 630 oral and poster presentation in eleven different themes. It received overwhelming response with the registration of more than 700 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 ICAAAS** International Conference was organized during 27 January to 01 February, 2020. It was organized by Society for Scientific Development in Agriculture and Technology (SSDAT), Meerut (U.P.) and Astha Foundation, Meerut at Hotel Ramada D'Ma, 1091/388 New Petchburi Road 33, Bangkok 10400 Thailand. This conference was bestowed with 09 lead papers and 90 oral and poster presentations in eleven themes with more than 500 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 ICAAAS** International Conference is being organized during 19-21st July, 2021 from the headquarter of Society for Scientific Development in Agriculture and Technology (SSDAT). Considering the post pandemic effect and travel restrictions, it is being organized in collaboration with Astha foundation, Meerut (U.P.); Chandra Shekhar Azad University of Agriculture

& Technology, Kanpur (U.P.); 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 450 oral and posters during three days conference, As usual 11 themes will have lead cum invited papers of experts of national and International reputes 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 **fourth ICAAAS** International Conference is being organized in hybrid mode at the campus of Himachal Pradesh University (HPU), Shimla during 12-14th June, 2022 in collaboration of Astha Foundation, Meerut Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (U.P.); Bihar Agricultural University, Ranchi, Jharkhand; Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan; Hemvati Nandan Bahuguna University, Srinagar, (UKD); HASD, Mandi (HP) and HFRI, Shimla. This time more than 1000 registrations with 200 offline participation is expected including some foreign experts from Srilanka, Bangladesh and Nepal. It is carrying all 11 themes with some modifications. In spite of corona pandemic it has received overwhelming response with more than 1000 registrations and presentation of more than 415 oral and posters during three days conference, As usual 11 themes will have lead cum invited papers of experts of national and International reputes 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 **fifth ICAAAS** International Conference was organized during 10-16 July 2022. It was organized by Society for Scientific Development in Agriculture and Technology (SSDAT), Meerut (U.P.) and Astha Foundation, Meerut at Hotel Howard Johnson by Wyndham Bur Duabi Khalid Bin Al Waleed Rd-Al Raffa, Dubai, UAE. This conference was bestowed with 08 lead papers and 108 oral presentations in five themes with more than 500 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.

In the continuation of fifth ICAAAS International Conference, 6th one is being organized in hybrid mode at July 15–20, 2024 at Cong Doan Vietnam Hotel, Hanoi, Vietnam, C14 Tran Binh Trong Street, Hoan Kiem District, Hoan Kiem, Hanoi, Vietnam during 15-20 July, 2024 in collaboration of Astha Foundation, Meerut Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (U.P.); University of Agricultural Sciences, Raichur, Karnataka; Himachal Pradesh University, Shimla, H.P.; KSNUASH, Shivamogga, Karnataka; ICAR-CIFE, Mumbai, Maharashtra; NPU, Palamu, Jharkhand; AFU, Rampur Chitwan, Nepal and RKPG College, Shamli, U.P.

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Lead Papers/ Invited Papers

INNOVATIVE AND CURRENT ADVANCES IN AGRICULTURE AND ALLIED SCIENCES (ICAAAS)

S.P. Singh[1], Binay Kr. Chakraborty[2], Dilip Kumar Jha[3], Mahendra Singh[4], Gururaj Sunkad[5], B.V. Tembhurne[5], Y.K. Singh[1], P.B. Singh[6], Netrapal Malik[1], Rohit Rana[7], Harish Pal Bhati[8], Hiranmayee Nayak[9] and Princi[10]

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[2]*Mud Eel, Mud Crab, Aquaculture and Mang. Centre & Deptt. of Fisheries, Bangladesh & Bangladesh Agric. University*
[3]*Department of Aquatic Resources, Agriculture and Forestry University, Rampur, Chitwan, Nepal*
[4]*Department of Biosciences, Himachal Pradesh University, Summer Hill, Shimla, India*
[5]*University of Agricultural Sciences, Raichur, Karnataka, India*
[6]*Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India*
[7]*Rashtrya Kishan Post Graduate College, Shamli (U.P.) India*
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Agriculture plays a pivotal role in the Indian economy with over 58 per cent of rural households depending on agriculture as their prime means of livelihood. We are the country with more than 50 per cent of our population still dependent on agriculture. Human population of India has increased to 1210.2 million at a growth rate of 1.76 per cent in 2011 over 2001 (1028.7 million) and is estimated to increase further to 1530 million by 2030 (Census of India, 2011). On the other hand, our national food grain production for past 3-4 years is hovering around 234 million tonnes. This means, per capita food grain production is only about 193 kg per year. India is facing the challenge to achieve sustainable food security with shrinking land resources by producing an additional 50 million tonnes of food to meet the requirement of the prognosticated population of 1,000 million in the country.

Present and anticipated global food demands necessitate a significant increase in crop productivity in marginal farmlands. Biotic and abiotic stresses are major limiting factors for plant growth, development and crop productivity. Although every plant has some degree of innate tolerance and/or resistance to such stresses but for a successful crop there is need to improve the resistance levels of these crop plants to keep pace with the future food demands. Before the introduction of fertilizer responsive high yielding varieties (HYVs) in mid sixties, indigenous varieties of wheat, rice and maize were grown as rainfed or partially irrigated and generally with little fertilizer input. The low level of yields resulted in persistent food shortages in the country. Intensive agriculture, which implies harnessing of soil and water resources, genetic potential of plant and other inputs in a large measures, that has taken firm roots in the irrigated areas of India has no doubt succeeded in getting the country out of the "food trap". A 'ship to mouth' existence of the early fifties has been transformed into one of "farm to ship" reality. The country is now boasting of an enviable buffer stock of 50 million tonnes food grains and quantum jumps in productivity and production of wheat and rice. The input intensive modern agriculture, which has succeeded in ushering in an era of self-sufficiency in food grain production, has also brought in several environmental problems.

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 of technology and services will take strong steps towards second green revolution. Global climate change with predicted 1.5-3.8°C increases in temperature by 2100 has to cause heat stress to create threats to agricultural production through high temperature and other abiotic stresses are clearly limiting factors for crops cultivated on marginal lands, crop productivity far and wide is often at the mercy of random environmental fluctuation. The unfavourable effects of heat stress can be mitigated by developing crop plants with improved thermo-tolerance using an assortment of genetic approaches. Acquiring thermo-tolerance is a lively progression by which considerable amount of plants resources are diverted to structural and functional maintenance to escape damaged caused by heat stress.

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 new investment to protect and enhance the efficiency of natural resource use and to reduce waste at all stages of production, processing and consumption. Fighting rural poverty has become the overriding priority in the new millennium. Our agricultural scientists and technologists have to work for doubling the productivity of the available land under cultivation. While doing so, utmost care would have to be taken for various environmental and people related aspects leading to

sustainable development. In recent years, enormous progress has been made in developing agriculture technology, cultivation and trade throughout the world. India is one of the richest countries in the world known for its biodiversity and natural resources. The green revolution helped in enhancement of crop quality and increases in production to a great extent. With the rapid industrialization and urbanization due to increase in population, the burden on natural resources is increasing apart from the environmental pollution. It is a matter of pride the scientific fraternity is taking initiatives to meet the challenges of degradation of land and water resources, loss of plant diversity due to the climatic changes and environmental pollution through continuous innovation, research and development.

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. Agriculture plays an important role to meet food and development needs of the Indian population and also as a source of increasing national economy through trade. New Technologies are anticipated to play a major role in meeting nation's food security and in achieving Sustainable Development Goals of UN7 (for example- Goal 2: End Hunger, Achieve Food Security and Improve Nutrition, and Promote Sustainable Agriculture).

Innovations led development-Innovation-decision definition

Innovations – It is an idea, which is new one supposed to be adopted by the intended clientele. It may not always hold objectivity due to lapse of time since its discovery. According to Rogers (1983, 1995) the innovation – decision process is the process through which an individual or any decision making unit passes from first knowledge of an innovation, to forming an attitude towards the innovation, to a decision to adopt or reject, to implementation and use of the new idea, and to confirmation of this decision. This process consists of a series of actions and choices over time through which an individual or an organization evaluates a new idea and decides whether or not to incorporate the new idea into the ongoing system. This behaviour consists essentially of dealing with the uncertainty that is inherently involved in deciding about a new alternative to those previously in existence. The perceived newness of an innovation, and the uncertainty associated with this newness, is a distinctive aspect of innovation-decision making, compared to other types of decision making.

Innovation – decision process conceptualized to have five stages.

1. Knowledge 2. Persuasion 3. Decision 4. Implementation 5. Confirmation

Re-invention is defined as the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation. Re-invention often is beneficial to the adopters of an innovation. Flexibility in the process of adopting an innovation may reduce mistakes and encourage customization of the innovation to fit it more appropriately to local situations or changing conditions. As a result of reinvention, an innovation may be more appropriate in matching an adopter's pre-existing problems and more responsive to new problems that arise during the innovation-decision process. Recognition of the existence of Re-invention brings into focus a different view of adoption behaviour – instead of simply accepting or rejecting an innovation as a fixed idea, potential adopters on many occasions are active participants in the adoption and diffusion process, to give their own unique meaning to the innovation as it is applied in their local context. Adoption of an innovation is thus a process of social construction.

In a very short span of time, Genome Editing (GEd) Technology has demonstrated its potential applications in a wide range of sectors covering human and animal health, food, agriculture, microbial biotechnology, bio-economy, etc. These potential applications include, but are not limited to, improved crop protection and livestock breeding, improved animal welfare, modification of animal donors for xenotransplantation, products of microbial biotechnology, gene- and cell-based therapies to control diseases and prevent the inheritance of disease traits, control of vector-borne diseases such as Malaria, Dengue, Chikungunya, etc, biofuels, pharmaceuticals, and other high-value chemicals. Like with all new technologies, GEd technologies have dual-use potential and therefore involve both safety & security issues. Biotechnology offers safe and sustainable solutions to many environmental challenges. It is, therefore, envisioned that genome editing holds many promises to improve environmental quality as well as the quality of life and related services. The genome editing technologies offer

solutions to address several issues related to Human & Animal Welfare and Protection of Environment. The Genome Editing Technology offers to increase yield and productivity of agricultural crops to meet constantly increasing demand for food and food security optimally by protecting them from various biotic and abiotic stresses and various other traits. India is a fisheries giant with a total catch of about 3 million metric tons annually placing India among the world's top 10 fishing nations. India's livestock sector is also one of the largest in the world including broad spectrum of native breeds of cattle, buffalo, goats, sheep, swine, equine, camel and poultry with merits of adaptability to climate and nutrition, and resistance to diseases and stress. The national targets for production of livestock and poultry products are 61% for milk, 76% for meat, 91% for fish, and 169% for eggs by the year 2020 over the base year 1999. The production potential in livestock is not realized fully because of constraints related to feeding, breeding, health, etc. Frequent outbreaks of diseases like FMD, BQ, PPR, Brucellosis, Swine fever, and Avian Influenza, etc. continue to reduce productivity and production.

Nutritional genomics is a new and promising science area which can broadly be defined as the application of high throughput genomics (transcriptomics, proteomics, metabolomics/metabonomics) and functional genomic technologies to the study of nutritional sciences and food technology. The combination of genomics and molecular biology has created a new way for scientists to generate plant varieties, one that offers wider functional scope and greater precision than conventional plant breeding methods.

Multiple biotic and abiotic environmental stress factors affect negatively various aspects of plant growth, development, and crop productivity. Plants, as sessile organisms, have developed, in the course of their evolution, efficient strategies of response to avoid, tolerate, or adapt to different types of stress situations. The diverse stress factors that plants have to face often activate similar cell signalling pathways and cellular responses, such as the production of stress proteins, up regulation of the antioxidant machinery, and accumulation of compatible solutes. Stress can be understood as a stimulus or influence that is outside the normal range of homeostatic control in a given organism: if a stress tolerance is exceeded, mechanisms are activated at molecular, biochemical, physiological, and morphological levels; once stress is controlled, a new physiological state is established, and homeostasis is re-established. When the stress is retired, the plant may return to the original state or to a new physiological situation.

Abiotic stresses remain the greatest constraint to crop production. Worldwide, it has been estimated that approximately 70% of yield reduction is the direct result of abiotic stresses. Transgenic approaches are one of the many tools available for modern plant improvement programs. Gene discovery and functional genomics projects have revealed multitudinous mechanisms and gene families, which confer improved productivity and adaptation to abiotic stresses. These gene families can be manipulated into novel combinations, expressed ectopically, or transferred to species in which they do not naturally occur or vary. Hence, the ability to transform the major crop species with genes from any biological source is an extremely powerful tool for molecular plant breeding. Transgenic plants can be used as sources of new cultivars and they are also extremely useful as proof-of-concept tools to dissect and characterize the activity and interplay of gene networks for abiotic stress resistance.

Swaminathan D. (1998) stated that technology, capacity building, and application for sustainable rural development could be more fruitful, if the exercise is undertaken through a partnership effort among the universities, engineering institution, rural and development labs, national institutions, agricultural research centres, NGOs, government departments and industries. The actual partnership may be determined by the local situations. The corporate sector can play an effective role in discharging its social responsibility in this partnership. This role is in addition to its industrial activity in the rural areas. Similarly, the professional and scientific expertise of the professional bodies and scientific academics could be fully utilised for the rural development activity.

This is where the mobile technology which over the year have become the integral part of business world and have multiplied the working efficiency in terms of real time communication, information and data sharing, having virtual presence and reach. The fact that with minimum infrastructure availability at the individual level mobile phones have the capability to connect any individual with the entire world on a click of button makes it a powerful tool to have access to desired information. In the 21st century, Information, Communication and Technology (ICT) are the most powerful 'enabler' to provide a variety of inputs for rapid development of rural areas. The ICT could be effective tools for rural extension by the government and non-governmental organizations to effectively disseminate Information Resource. For the development, Information Resource [IR] is the vital input as that could increase the accessibility of any other resources - like financial, human, physical, technology and etc. The sustainable rural development can make a powerful contribution to fulfil - the poverty reduction,

growth with equity, food security and effective natural resource management. There is a growing emphasis on development of rural economy for enhancing the livelihood of the rural people.

A systematic review of the factors responsible for decrease in availability of the natural resources, loss of bio diversity, increase in environmental pollution, climatic changes, decline in factor productivity and operational holdings and widening gap between rich and poor are threatening our food security and health. In recent years, enormous progress has been made in developing agriculture technologies, cultivation and trade through out the world. Making the transition from sustainable agriculture to sustainable empowerment will not be possible without significant new investment in protecting and enhancing the efficiency of production, processing and marketing personnel to embrace and share a diverse range of basic studies, techniques and experiences. In this context, deliberations in the international conference by eminent and galaxy of speakers of several innovative and current advances in agriculture and allied sciences will open new vistas in addressing all the issues.

CHALLENGES AND CONSTRAINTS OF AGRICULTURE AND AQUACULTURE IN BANGLADESH

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Abstract

Despite the impact of decreasing arable land, rising population needs for food and nutrition, climate change, the Russia-Ukraine crisis, and the Corona epidemic, agricultural, aquaculture and livestock production of Bangladesh has been able to continue, and food and nutrition security is ensured by the friendly policies and strategies of the government's. To guarantee food security, the government is putting forth great effort to develop profitable, safe, and sustainable agricultural and aquaculture systems. In light of Vision 2041, the 8th Five-Year Plan, the National Agricultural Policy 2018, the Sustainable Development Goals, Deltaplan-2100, and other planning documents, the government has been working tirelessly to promote the general growth of the agriculture sector. To address the needs of the expanding population, the government has currently adopted short, medium, and long-term action plans. These plans are based on the agricultural sector's successes in responding to numerous calamities, notably the COVID-19 pandemic. Food grains were produced in a total of 484,988 metric tons (MT) in FY 2022–2023, up from 465,83 lakh MT in FY 2021–2022. In an attempt to increase output in response to Corona's impacts, agribusiness input subsidies were extended to include seed production, fertilizer subsidies, and other agricultural activities. Additionally, agricultural inputs were made available, and the availability of agricultural loans was increased. Fish production from marine and inland water sources was 47.69 lakh MT in FY 2022–23. The sustainability of conventional agriculture and aquaculture in Bangladesh is under threat from the continuous degradation of land and water resources and from declining yields due to the indiscriminate use of agro-chemicals. Agricultural sustainability depends on productivity, environmental stability, economic profitability, and social and economic equity. Significant differences were found between the two systems (conventional and sustainable agriculture) in crop diversification, soil fertility management, pest and disease management, use of agrochemicals, and environmental issues. However, no significant variations were found in the indicators of land-use pattern, crop yield and stability, risk and uncertainties, and food security. So, sustainable agriculture and aquaculture have a tendency towards becoming environmentally, economically, and socially more sound than conventional agriculture, as it requires considerably less agro-chemicals, adds more organic matter to the soil, provides balanced food, and requires higher local inputs without markedly compromising output and financial benefits.

Key words : *Agriculture, aquaculture, production, sustainability, nutrition, diversification.*

Introduction

Bangladesh's economy depends heavily on agriculture since it creates jobs, ensures food security, and supports livelihoods. In Bangladesh, eighty percent of the population is employed in agriculture. Currently, agriculture employs over 48% of the working population and contributes 21% of the GDP. Once more, with sub-sectoral GDP contributions of 11.70%, crops lead the way, followed by forestry (1.80%), livestock (2.90%), and fisheries (4.64%) (BBS & FAO, 2011; BBS, 2021). The agriculture sub-sector contributes 56% of GDP to crops, 22% to fisheries, 13% to livestock, and 9% to forestry. Agriculture must grow by at least 4.0-4.5 percent annually in order to meet the GDP growth rate of 7% annually. This can be accomplished by increasing agricultural productivity through the use of appropriate agricultural technologies and creating a supply chain that connects farmers with consumers in both domestic and international markets.

The country currently has 17.341 million people living there, but at a growth rate of 1.24%, that number will rise to 189.85 million by 2030. The projected food requirements, which include rice and wheat in particular, are 43.6 million metric tons (mmt) and fish (5.80 mmt). Crop agriculture faces challenges in increasing productivity, profitability, sustainability, resource efficiency, conserving resources, improving product quality, post-harvest management, diversification, and commercialization. The annual reduction of agricultural land owing to urbanization, infrastructure expansion, road construction, etc., is one of the other new concerns. Insufficient advancement of institutions in terms of building infrastructure, funding, and facilities for research, as well as providing qualified labor for the development of innovative technologies to address the new issues facing the agriculture industry. Institutions are lacking in infrastructure, funding, research facilities, and qualified labor to develop innovative technologies to address new issues in the agriculture industry.

Research Methodology

The study was conducted in sixty four districts of Bangladesh. A sampling plan was run for a long time to get an accurate picture of the crop harvest 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 crop collecting center, fish landing centers, wholesaler, different market survey, directly from farmer and fishers; hatchery owner and fish farmer. Secondary data were collected mainly from the Department of Agricultural Extension, Fisheries (DoF), Livestock and internet sites. The data were statistically analyzed through one-way ANOVA using SPSS program to find out whether any significant difference existed among different data (Zar, 1984). Standard deviation in each parameter was calculated and expressed as mean ±S.D.

Results and Discussion

Projected Population

The current population of the country is about 169.54 million. As projected, the population of country in the year 2030 will be 189.85 million at the growth rate of 1.26%. (BBS, 2010; Chowdhury, M.R. 2009).

Agriculture

Projected Food Requirement (Crops) : The estimation of food crops requirement by the year 2030 is made by considering the population and minimum per head requirement. Except rice, the intake of all other food crops is far below the standard. However, the food crops requirement is prepared (Table 1) by taking into account the estimates prepared by expert groups of sub-sectoral studies.

Table-1 : Food requirement by the year 2030.

Crop	Projected requirement (million ton)	Current production (million ton)	Additional requirement (MT)
Rice	39.80	34.00	5.80
Wheat	3.85	0.84	3.01
Maize	4.00	1.50	2.50
Pulses	3.50	0.20	3.30
Oilseeds	1.70	0.66	1.04
Potato	5.25	5.26	-
Vegetables	13.98	2.90	11.08
Fruits	6.24	4.22	2.02

Source : BBS, 2009, Priority Setting Reports (BARC, 2010)

All food crops except potato will be seriously deficit as per projected requirements for the year 2030. However, horizontal expansions of crop area as well as vertical increase of crop productivity are to be explored and ensured through adoption of modern technologies. In addition, exploration of new areas especially in unfavorable ecosystems and technological interventions through reducing knowledge-gap of farmers are some of the important areas to overcome the problem.

Food Grains Production : Based on the combined estimate from the Department of Agriculture Extension (DAE), Ministry of Agriculture, and BBS (2022-23), food grains were produced in 458.96 lakh MT in FY 2021-2022, with Aus contributing 32.45 lakh MT, Aman 149.58 lakh MT, Boro 209.77 lakh MT.

Table-2 : Food Grains Production during 2015-16 to 2022-23. (In lakh MT.)

Food Grains	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23*
Aus	22.89	21.34	27.09	27.20	30.12	32.85	32.45	36.90
Amon	134.83	136.56	139.94	140.55	155.02	144.38	149.58	163.45
Boro	189.38	180.16	195.76	203.89	201.81	198.85	209.77	215.34
Total Rice	347.10	338.06	362.79	373.63	386.95	376.08	391.80	415.69
Wheat	13.48	13.12	10.99	11.48	12.46	10.85	10.86	11.60
Maize	27.59	35.78	38.93	46.99	54.02	56.63	56.30	57.68
Total	388.17	386.96	412.71	432.11	453.44	443.56	458.96	484.98

Source : Bangladesh Bureau of Statistics (BBS 2022-23), Ministry of Agriculture* target and wheat 10.86 lakh MT and maize 56.30 lakh MT (Table-2).

Fisheries

Projected fish demand and supply : Besides food item, other requirements of fish are as export item, industrial use, product development, and technical loss. Present amount of utilization of fish in these areas are very minimum. As a result, the targeted amount for 2030 requires a high growth in all the areas (Table-3).

Table-3 : Projected fish demand and supply in 2030.

Year	Population (million)	Fish demand (mmt)					Total demand	Expected Production	Total gap
		Use as food	Export	Industrial use	Product development	Technical Loss			
2020	168.70	3.45	0.410	0.050	0.150	0.050 (1.5%)	4.00	3.856	0.144 (3.60%)
2025	180.89	3.70	0.543	0.080	0.250	0.030 (0.8%)	4.45	4.321	0.129 (2.89%)
2030	189.85	4.05	0.690	0.200	0.400	0.025 (0.5%)	**5.38**	5.300	0.08 (1.49%)

Thus the projected required amount of fish as food is 4.05 million metric tons (growth 1.3%), for export is 0.69 mmt (growth 10.5%), for fish and poultry feed industry is 0.20 mmt (growth 36.5%), for product development is 0.40 mmt (growth 34.5%) and technical loss is0.025 mmt (growth -2.0%). Based on the demand estimation criteria and the projected requirement, the total demand of fish will be 5.38 million metric tons in 2030.

The government's extensive planning and development initiatives in the fisheries sector have been successfully implemented, and as a consequence, fish production in FY 2021–22 reached 47.69 lakh metric tons, 1.56 times higher than the overall production (07.54 lakh MT) in FY 1983-84 (DoF. 2022). The trajectory of fish production from FY 2015–16 to FY 2022–2023 is displayed in in the figure 1.

Management of Marine Fisheries Resources : To attain the intended growth in sustainably conserving, managing, and harvesting fish resources from the enormous waters gained through sea conquest, a short-, medium-, and long-term plan of action was developed in 2014. The "Marine Fisheries Act 2020" and "Marine Fisheries Policy 2022" have been developed to ensure proper management of fisheries resources and the growth of a green economy in Bangladesh's marine waters.

The government has also taken up a project called 'Pilot Project on Tuna and Similar Pelagic Fishing in the Deep Sea' which will open a new horizon in the ocean economy. In FY 2021-22, marine fish production was 7.06 lakh MT which is 1.5 times

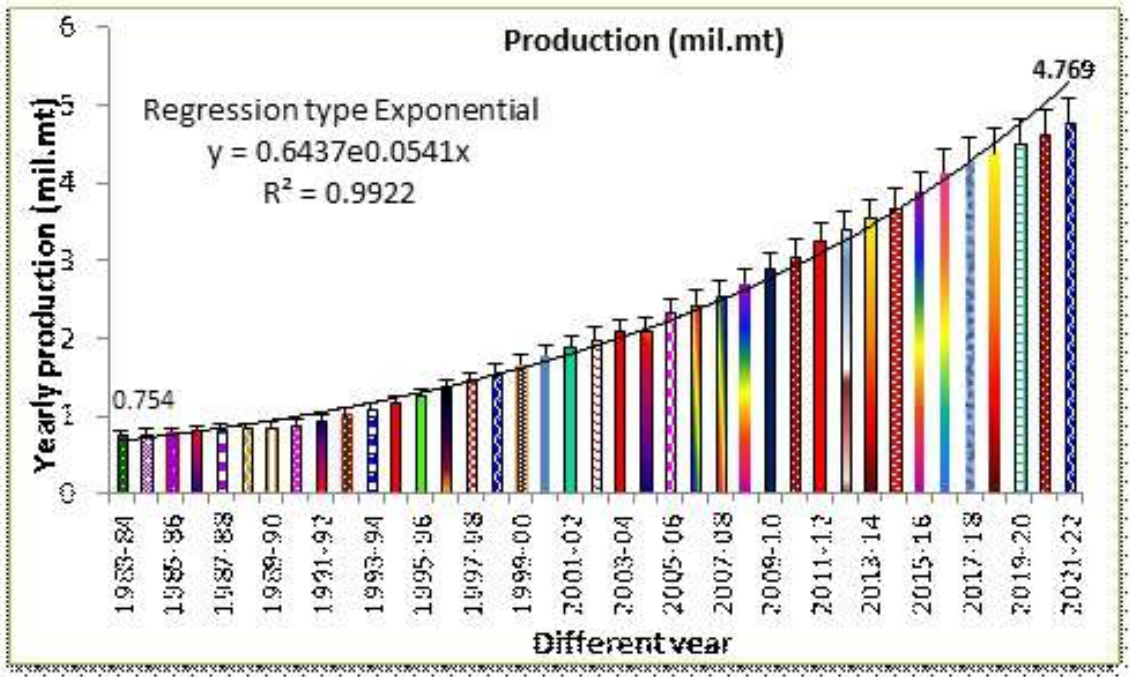

Figure-1 : Fish Production Trends in Different Resources.

higher than the total production 1.65 lakh MT in FY 1983-84 (Fig.-2). The regression type of mar ine production is Logarithmic and its equation is Y=0.2376In(x) + 0.177 (where R^2 is =0.9218).

Export of Fish and Fisheries Products : Fishing and fish products are among Bangladesh's top export industries. Bangladesh was able to export 74,042.67 MT of fish and fish products in FY 2021-22, earning Tk. 5,191.75 corer 26.96 percent increase over the previous year despite the global financial downturn. Bangladesh gained Tk. 3,226.03 crore from the export of 43,117.49 metric tons of fish and fish products in FY 2022-2023 (till January).

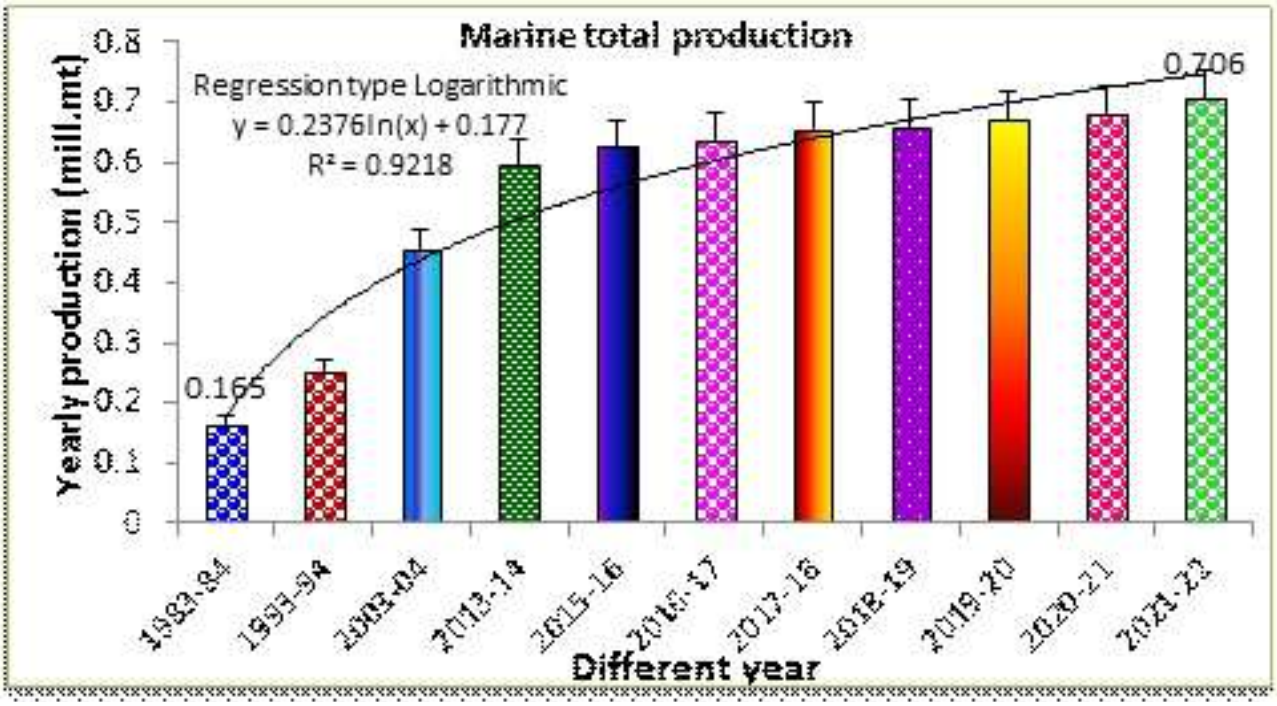

Figure-2 : Marine total production trends during 2006-07 to 2021-22.

Challenges

Agriculture : Crop agriculture faces challenges in productivity, profitability, sustainability, resource efficiency, product quality, post-harvest management, diversification, and commercialization. Climate change's sea level rise will inundate 16% of planted areas, displacement 10% of the population, and loss of 2 million tons of crop production. Cyclones and storm surges will occur more frequently, causing erosion in flood plains and char lands. Climate change will increase salinity-related damage along coasts, severely and moderately affecting cropped areas and reducing crop productivity. The agricultural sector faces emerging challenges due to inadequate institutional development in infrastructure, research funds, facilities, and skilled manpower for technology innovation.

Fisheries : Fisheries, a privileged subsector of agriculture, can boost fish output through sustainable use of resources. However, population expansion and declines due to climate change, natural resource degradation, and environmental vulnerabilities will widen the fish supply-demand gap in Bangladesh. Practical, demand-driven research is needed to meet future demand. This sector increases its contribution rate to reduce the demand-supply gap, with a steady growth rate of approximately 2.5% up to 2030. The sector is crucial for food security and poverty reduction, despite population growth and climate change challenges, including hazardous production, high input costs, and climate change-related challenges. Limitations of the sector are :

1. Vulnerability to climate change, 2. Fish biodiversity loss, 3. Environmental vulnerability, 4. Water pollution, 5. Siltation of river beds, 6. Biological depression of farming species and 7. Quality and cost of farming inputs

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 will be risen up and would be a great challenge to secure the future dietary demand of the increasing population. The sustainability in agriculture, aquaculture and fisheries, and livestock 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. A major challenge is to create policies, institutions, human resources and technologies that make the three goals more compatible. To maximize agriculture's efficiency and sustainability, public policy should seek to internalize all cost and benefits in the price of production inputs. Secure property rights and all policies offering farmers incentives for investing in resource management, as well as access to yield-increasing and resource conserving technologies are critical.

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ROLE OF ROOTSTOCK FOR THE IMPROVEMENT OF TEMPERATE FRUIT CROPS

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Rootstocks play an essential role for determining orchard performance of fruit trees. The Temperate fruit trees mainly exist in the form of a graft chimera of rootstock and scion. The rootstocks have functions of fixation and support, as well as absorption, secretion and synthesis.

Rootstocks also have important effects on the growth and development of scions, fruit yield and quality, and the resistance to biotic and abiotic stresses. Apple rootstocks mainly include seedling rootstocks (including rootstocks from wild, semi-wild, and cultivated apples and other genera), apomictic seedling rootstocks, and cloning-propagated rootstocks.

At the beginning of the 20th century, the East Malling Station in the UK screened 16 types of apple rootstocks, named from M1 to M16, from *M. pumila* var. *praecox* and *M. pumila* var. *paradisiaca*. In 1917, the East Malling Station initiated the first apple rootstock breeding and application program in the world.After that, many countries started the artificial hybrid breeding of apple rootstocks by using the M series rootstocks, and achieved numerous advancements.For example, in cooperation with Merton, the East Malling Station tried to cross M series rootstocks with Northern Spy and successfully created rootstock series MM101-115, which has resistance to woolly apple aphidsOther countries also crossed M series with their native materials and created rootstocks, such as the MAC series and CG series (USA), O3 (Canada), B series (the former Soviet Union), P series (Poland), JM series (Japan), and GM256 (China). The successful breeding of these rootstocks, especially those new dwarf rootstocks, has caused worldwide changes in the apple cultivation system.Apple rootstocks are used for apple trees and are often the deciding factor of the size of the tree that is grafted on to the root. Dwarfing, semi-dwarf, semi-standard and standard are the size benchmarks for the different sizes of roots that will be grown, with standard being the largest and dwarf being the smallest.

IARI,RS, Shimla has identified one each ideal rootstock for apple and Pear and another for temperate stone fruits from the wild population which could be utilized for the improvement of temperate fruit crops. Lateral bearing walnut also identified which is precocious, semi-vigourous and suitable for high density orcharding.The Himalayan region is rich in plant biodiversity which includes wild relatives of temperate fruit crops as well as cereal crops. Some of these have been identified as potentially useful for use as better rootstocks or for reorienting breeding programmes. *Malus baccata* collected from Shillong in the north-east deserves special mention. Likewise *Prunus cornuta, Prunus nepaulensis, Prunus* spp. Behmi,*Sorbus*spp., *Pyrus pashia* and *Pyrus pashia var. kumaonii*have been found of particular utility for stone fruits and pear. Rootstock is the underground part of the plant that comprises the root portion, on which the scion wood or bud of a desirable cultivar is placed by the method of grafting and budding. As the name suggests itself, rootstock consists of a strong root system and is hardy. Rootstocks are propagated through both seeds or by vegetative means. The stocks which are prepared from seeds are called seedling rootstocks and later are called clonal rootstocks. Based on performance, clonal rootstocks are highly preferred than the seedling rootstocks but they have short life cycles. Before selecting the rootstock, one should know all the parameters of it, as well as the area where it is going to be cultivated. For temperate fruit crops, such rootstocks should be evaluated which have a higher ability to withstand the cold temperature in winters. Different rootstocks possess diverse properties such as resistance to cold, drought, salinity, pests & diseases, etc., and impart the effects like tree vigor, precocity, and fruit size on the scion cultivars. In addition to these properties, a rootstock must be compatible with the scion varieties and for this purpose; mostly the plants of the same family are used as rootstocks. Evaluation for desired traits starts from the nursery and the plants with the appropriate characters are selected and multiplied for rootstocks. However, some wild rootstocks also consist of some major qualities like hardiness and used for grafting purposes. The temperate fruit crops, for which the rootstocks are used are apple, pear, plum, peach, apricot, cherry, walnut, etc.

Apple rootstocks: Apple rootstocks can have a variety of desirable characteristics such as resistance to crown rot oomycetes (*Phytophthora spp.*), resistance to fire blight bacteria (*Erwinia amylovora*), resistance to Woolly apple aphids, dwarfing and tree branching modifications, increased precocity (early fruitfulness), increased productivity, and tolerance to Apple Replant Disease (ARD).Among all the temperate fruit crops, apple is most important and proved as a cash crop for the temperate fruit growers. Several rootstocks have been selected and bred so far by the apple rootstock breeding program at HRI, East Malling but they are not always satisfying the needs of the modern apple growers and are not adaptable for every region (Webster, 1992). Therefore, the need for developing and identifying potential rootstocks is always there. Pramanick *et al*.(2021)

identified one indigenous rootstock for apple which is adaptable to wider soil and agro-climatic conditions,compatible with all commercial varieties grafted,easy to propagate through mound layers and hard wood cuttings through bottom heated technique.resistance to powdery mildew, moderate resistance to apple scab and tolerance to white root rot,highly resistance to woolly aphid and planting distance of 3m × 3m is ideal for high density orcharding .Quamme and Brownlee (1996) conducted three studies to identify the rootstocks with cold hardiness and observed the minimum survival temperature (MST) of the rootstocks in terms of browning of xylem and phloem. The roots of the plants were frozen with 1°C temperature/hour to check the cold resistance. In the first study, the MST of M26 (-10.0°C) was observed lower followed by MM106 (- 7.2°C) and M7 (-6.7°C) budded with Golden Delicious and Heyer12. In the second study, Summerland McIntosh variety was used as scion and the average MST of P.2 (-13.3°C) and Ottawa 3I (-13.2°C) was significantly lower followed by B9 (12.3°C), Jork 9 (-11.8°C), Alnorp 2 (-11.2°C) than the M9 (- 9.6°C) and M7 (-7.6°C). In another study, Robusta 5 exhibits great hardiness than M7, M26, and B9 on the Summerland McIntosh variety. Comparing the cold hardiness among the Malling series, (M7,9.26,104 and 106), M26 reported more tolerant against cold temperature under snow cover whereas, M7 was least tolerant (-7.6) and get killed (Wildung *et al.,* 1973). Among the Geneva series (Moran *et al.,* 2011), the cold hardiness of root tissues in Geneva 935 is reported more, whereas the G11, G30, G41 are equal hardy to M26. The selection of new dwarfing rootstocks with high tolerance to cold temperature has been made by various rootstock breeding programs in the USA (Cummins and Aldwinckle, 1983), Poland (Zagaja, 1980), Sweden (Trajkovski and Andersson, 1988), and Canada (Gragner *et al.,* 1992). Tolerance against drought condition is a desirable trait, imparted by the gene MdDREB76 which encodes a functional transcription factor. Drought tolerance in the rootstock is determined by the root dry mass (Christopher J. Atkinson *et al.,* 1998). Out of all M and MM series rootstocks, M9 was found to have higher numbers of coarse roots. Whereas, among the new selection from HRIEast Malling (AR69-7, AR295-6, AR360-19, AR486-1, and AR628-2), dwarfing rootstock AR295-6 produces the most course roots which are three times or more than that of the M9. Similarly, the large numbers of fine roots are also found in dwarfing clone AR295-6. Because of the higher root mass, the plant can absorb more water and can withstand the drought conditions. Tolerance to salt in apple is also controlled by the same gene MdDRE76. Motosugi *et al.,* (1987) compared the salt tolerance between 9 rootstocks of apple (Malusprunifolia, M4, M7, M9, M11, M16, M26, M27, and MM106), out of which M4 and M11 were severely affected by salt injury whereas, M26 was least affected. Between two In-vitro cultured rootstocks MM106 and Omara (Abdel-Hussein, 2003), MM106 was found most tolerant to salinity condition. Since wooly apple aphid infestation is a major problem in apple, all the rootstocks of Malling series of apple are susceptible to the wooly apple aphid whereas, all the MM series are resistant to it but MM 106 is very sensitive for the phytophthora infestation which causes the collar rot. Dwarfing rootstocks (Nicole L. Russo et al., 2007) Geneva® 935, G41, G11, and B.9 are resistant to fire blight and phytophthora root rot with increased yield efficiency. Similarly, rootstocks M9, EMLA, Mark, Bud 118, and Bud 9 are also reported resistant to Phytophthora cactorum.

Pear rootstocks : *Pyrus communis* and *Cydonia oblonga* are widely used rootstocks for European pear cultivars. The lack of rootstocks adapted to different soil conditions and different grafted cultivars is widely acknowledged in pear culture. *Cydonia* rootstocks (clonal) and *Pyrus* rootstocks (seedling or clonal) have their advantages and disadvantages. In each case, site-specific environmental characteristics, specific cultivar response and production objectives must be considered before choosing the best rootstock.

The effects of rootstocks on fruit yield and quality and mineral element uptake of 'Santa Maria' pear cultivar showed variations. Pear seedling and BA 29 rootstock became prominent in terms of several characteristics for 'Santa Maria' pear cultivar that is grown in highly calcareous soil in semi-arid climate conditions. The trees on seedling rootstock were found to have higher values than other rootstocks in terms of annual yield, cumulative yield and Trunk Cross Sectional Area(TCSA) value. 77.4 ton ha^{-1} yield was obtained from 10 year old 'Santa Maria' trees grafted on BA 29 rootstock at a density of 800 trees ha^{-1} . In the orchard used in the study, soil pH was significantly high. The highest N, P (although insignificant), K, Ca, Mg, Fe and Cu concentrations were determined in the trees on pear seedling and BA 29 rootstocks. The lowest leaf Fe concentrations in pear trees were determined in the trees on MA and MC rootstocks. Leaf Fe concentrations of the trees on these rootstocks began to decrease from 30 DAFB(Days After Full Bloom) and began to fall below the critical threshold after this date. According to the results obtained from this study, we recommend the seedling rootstock for normal density plantings (400 trees ha^{-1}) and BA 29 rootstock for high density plantings (800 trees ha^{-1}) at the 'Santa Maria' orchards in semi-arid conditions.

Unlike apple, rootstocks for pear have not been developed in numbers because of the less adaptability. It is still grafted on the rootstocks (Bartlett, Anjou, etc.), which are of seedling origin resulting in extreme vigor, long juvenile phase, and variable

yields. There are several other species of Pyrus which are used as rootstocks such as Pyruspyrifolia, Pyruspashia, P. betulifolia, P. calleryana, P. ussuriensis (Webster, 1997) but they impart in vigorous growth on scion variety, therefore, are not very popular. Among the seedling rootstocks, P. betulifolia is tolerant to salinity (Okubo et al., 2000) and can grow better even in the soils with a higher concentration of NaCl (50 mM). A clonal rootstock Quince (Cydonia oblonga Mill.) is the popular rootstock for pear which imparts the dwarfness and precocity but there is the problem of poor graft compatibility. To overcome this problem, some interstocks which are graft compatible (e.g. Beurrè Hardy) should be used. Also, Quince is very sensitive to cold & alkaline pH and has very poor anchorage with soil as compared to the seedling rootstocks. Various dwarfing clones of Quince rootstocks have been developed such as Quince A, Quince C (HRI, East Malling), BA29, Sydo (INRA, France), Adams 332 (Belgium), and CtS.212, (Pisa, Italy). Quince C is more dwarfing (10-20%) than Quince A. In the nurseries as well as orchards, Sedo performs better than the Quince A whereas, Adams 332 is preferred more by the nurserymen. Rootstock CtS.212 has found more tolerant of the soils with high pH (Loreti et al., 1997). A new dwarfing rootstock 193-16 selected from East Malling, in combination with scion gives rise to fruits with large size and also imparts the precocity (Browning and Watkins, 1991). The rootstocks of the OHF series are most popular (Brooks, 1984) but the problem lies with them is large tree vigor, due to which they are not preferred for high-density orcharding. However, OHF 333 and OHF 59 are less vigorous than the other clonal rootstocks of the OHF series. OHF 87 is reported high yielding and is resistant to fire blight (*Erwinia amylovora*) and tolerant to pear decline.

Peach and Nectarine Rootstocks: Traditionally, Peaches and nectarines were mostly grafted on their seedlings but these rootstocks have several problems like late bearing, variability, vigorous growth, etc. Peaches are very prone to nematode attacks and are severely affected by several soil nematodes such as *Meloidogyne* spp., P*ratylenchus* spp., *Xiphinema americanum*, and many soil-borne pathogens like *Phytophthora* spp., *Armillaria* spp., *Verticillium* spp., Agrobacterium tumefaciens, etc. So, the major focus is on producing the rootstocks which are resistant to these pests. Rootstocks such as Nemaguard, Nemared, Flordaguard, and Guardian have been reported resistant to most of the species of root-knot nematode. Similarly, the tolerant rootstocks (Alcaniz *et al.,* 1996) to lesion nematode (*Pratylenchus penetrans* and *P. vulnus*) and *Xiphinema americanum* have also been reported from different countries namely Rubira (French), Penta, Tetra (Italian), and Torinel (Spanish). Apart from sensitivity to nematodes, peaches are also non-adaptable to heavy soils with poor drainage and the calcareous soils. Therefore, the hybrid rootstocks from various places have been developed and proved tolerant of calcareous soils. These hybrid rootstocks are namely Barrier 1, Sirio (Italian), Julier, Paramount, Jasper, Cadaman (French), T 16 (Romanian), and Spanish rootstocks Montizo, Adarcias, and Adesoto 101 (Moreno et al., 1995). Hybrids between the peach and almond (*P. dulcis*) such as Monegro, Pema, Paramount, Garnem, and peach × P. davidiana namely Barrier 1, PeDa, and Cadman have been reported drought tolerant. Similarly, Everica 99, VVA-1, Kuban 86, and VSV-1 (Krymsk Fruit Research Station, Western Russia) are the 4 new rootstocks that have been found cold hardy. Besides these, Tetra, Rubira, P.S. A5, Everica, and Junior are mildly dwarfing rootstocks.

Plum rootstocks : Unlike other fruit crops, a few clonal rootstocks have been developed for plum and most of the plum varieties are grown on the seedlings of Myrobalan (P. cerasifera), whereas the clonal selections from St. Julien are most popular in UK, Scandinavia, and Holland. Plum pox virus is a serious disease in plum which results in great yield loss. Hybrid Myrobalan 29C (Almond x peach) and L2 cherry are reported resistant to plum pox virus and do not show any symptoms of virus infection (Manuel Rubio et al., 2005). Rootstock Mr. S. 2/5 has found tolerant to waterlogging condition and alkaline soils, whereas the clonal rootstock ISG 1/5 has reported tolerant to lime induced chlorosis (Cinelli and Loreti, 2002). Some new selections such as Mariana GF 8/2, Mariana8-6 (Maridon), Mariana 2624, Myrabi, Adara, Myrobalan 29C, etc. are however vigorous but show resistance against some specific soil problems. Whereas, Pixy, Maridon, and Ferlenain are dwarfing rootstocks and are suitable for HDP (Webster and Werthein, 1993).

Apricot Rootstocks : Apricot (*Prunus armeniaca* L.) is grown worldwide and grafted mostly on the seedling rootstocks. Most of the seedling rootstocks used for apricot belongs to the same species. Seedlings of peach are also used as rootstocks for apricots but are not much popular. Many apricot varieties are also grafted on Myrobalan seedling rootstock and its clones (Myrobalan B, Myrobalan 29C) throughout the apricot producing areas. Rootstocks such as Mariana GF 8-1, Greengage CD-4 and Damas1869 are reported to give higher yields in combination with scion varieties (Dimitrova, 2003). The rootstock Mariana GF 8-1 also contributes to increasing the longevity of the tree. A Spanish rootstock Pollizo prune (*Prunusinstitia* L.) has been found resistant to the flooding condition on the Mediterranean coast of Spain (Rafael Domingo *et al.,* 2002). Viruela is a serious viral disease of apricot in Spain which is caused by the Apple Chlorotic Leaf Spot Virus (ACLSV). Studies have

been reported that two rootstock selections namely GF305 peach and Real Fino apricot seedlings are resistant to ACLSV and did not show any symptom of disease on the leaves (Ibarra *et al.,* 2010).

Cherry rootstocks : There are two species of cultivated cherries i.e. sweet cherry (Prunus avium) and sour cherry (Prunus cerasus) which are grown all over the world. Sweet cherries are mostly used for fresh consumption, whereas the tart or sour cherries are utilized mainly for processing purposes. Sweet cherries are grafted on the rootstocks of their species but impart vigorous growth therefore, are not suitable for high-density planting. Two rootstocks Mazzard (wild sweet cherry) and P. mahaleb (St Lucie) are the most popular rootstocks of cherry but they also don't contribute to size control. Four clonal rootstocks Z1, PN, P3, and P7 (Lanauskas *et al.,* 2004) for sweet cherry (Vytenu rozine) were evaluated for yield and other field parameters at the Lithuanian Institute of Horticulture. Among all 4 rootstocks, P3 resulted in highest productivity, whereas the lowest was recovered from the Z1 and P7. However, PN rootstock gave average productivity but did not produce suckers, whereas the P3 showed profuse suckering. Colt is a very popular and old rootstock originated in Kent, England, and is a hybrid between P. avium F 299/2 x P. pseudocerasus L. It is semi vigorous, resistant to Phytophthora root rot, field stem pitting, and is compatible with almost all the varieties of sweet and sour cherry. Among Colt, Stockton Morello (SM), and SL-64 (Toribio *et al.,* 1997), SM is reported to give higher yield and produces small trees and the lower yield is recovered from SL-64. Semi-dwarf rootstocks of cherry (e.g. Maxma-14, Colt) induce the precocity but their branches form the blind wood very easily. A large number of dwarfing rootstocks have also been identified, including mainly the Edabriz and Weiroot series which are mostly the selections from the species of sour cherries or some closely related species. It is concluded from the above study that most of the varieties of fruit crops are grafted on the seedling rootstocks except apple which is largely propagated through the clonal rootstocks. Being the members of a singlefamily, similar rootstocks are also used for some stone fruits. Every rootstock consists of specific traits and has certain advantages and disadvantages. It has been noted that every rootstock is not adaptable to all the temperate areas because of the variability in soil. Therefore, there is further need for developing such potential rootstocks which could be adapted in almost all the temperate fruit growing belts to sustain the quality of fruits.

Walnut Rootstock : Hard walnut (Katha) seedling is used as rootstock for walnut in India. Paradox clonal rootstock is generally used to control black line disease of walnut.

Evaluation of different rootstocks (*Prunus japonica*, wild peaches, Chuli, Behmi, Bitter Almond, Paja) for different stone fruits were studied with different spacing and Prunus japonica showed dwarfness, graft compatibility and precocity in Temperate Stone Fruits and found suitable for high density orcharding.

Jyoti Bharti *Sharma et al.,(*2020) reviewed that susceptibility to biotic and abiotic factors is the major concern in the temperate fruit crops which leads to the reduction in yield, poor quality of fruits, and sometimes the unproductiveness and death of the entire tree. Therefore, using suitable rootstocks for propagation plays a key role in enhancing the longevity of the orchard and help in fetching beautiful market price. In Temperate areas, winters are more severe as compared with the summers so, the evaluation of such rootstocks which are tolerant to cold and have higher chilling requirements is the most important prospect besides other known issues. The efficacy of a fruit orchard can be enhanced by combining two different plant parts of interest using budding and grafting some desirable characters for which a rootstock is being exploited are precocity, proliferate bearing, size control, and resistance against unfavorable conditions. Also, it exhibits some other effects on the scion cultivars in terms of performance. This review has focused only on some important fruit crops and describes the selection and evaluation of important rootstocks to increase the productivity of temperate fruit crops.

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NAVIGATING SALINITY STRESS RESPONSES IN MILLETS : ADVANCES AND FUTURE DIRECTIONS WITH SPECIAL EMPHASIS ON FINGER MILLET

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With the global population steadily increasing, the demand for food is expected to rise significantly, posing a challenge for agricultural productivity. Developing crops that are resilient to various abiotic stresses, including salinity, is crucial to meet this growing demand. Salinity stress, characterized by high concentrations of soluble salts in soil and water, stands as a major hindrance to crop productivity worldwide. It disrupts water uptake in plants, induces ion toxicity, and triggers oxidative stress, collectively impairing growth and development. Salinity represents a critical abiotic stress affecting agricultural production, environmental health, and community economies, thereby threatening global food and land security (Csiszar *et al.,* 2018; Gholizadeh *et al.,* 2018; Rajkumar *et al.,* 2017). Saline soils cover approximately one billion hectares globally, constituting about 10% of the total land area, with a significant portion, 58%, found in irrigated agricultural regions (Amundson *et al.,* 2015). Soil salinization often occurs alongside waterlogging in irrigated agriculture, termed a 'dual dilemma' (Singh, 2017).

Plants have evolved intricate mechanisms to cope with salinity stress, essential for maintaining cellular ion balance and mitigating the detrimental effects of high salt concentrations. These mechanisms include ion exclusion, where plants actively regulate the uptake of toxic ions such as sodium (Na^+) and chloride (Cl^-) from the soil through selective transport mechanisms and ion channels that expel excess ions into the rhizosphere. Once inside the plant, toxic ions are sequestered into vacuoles within cells, a process known as ion compartmentalization, which helps maintain a lower cytosolic ion concentration and reduces their impact on cellular functions. To counteract water loss and maintain turgor pressure under saline conditions, plants accumulate compatible solutes like proline, glycine betaine, and sugars through osmotic adjustment, thereby enhancing cellular hydration and reducing osmotic stress (Munns and Tester, 2008). Salinity stress induces oxidative stress in plants by generating reactive oxygen species (ROS), prompting the activation of antioxidant defence mechanisms such as superoxide dismutase (SOD), catalase (CAT), and peroxidases, which detoxify ROS and protect cellular structures. Morphological adaptations, including increased root length, surface area, and density of root hairs, facilitate enhanced water and nutrient uptake from saline soils. Some plants also develop specialized structures like salt glands or salt bladders to excrete excess salts. At the genetic and molecular levels, plants respond to salinity stress by activating stress-responsive genes and transcription factors that regulate the expression of stress tolerance mechanisms. Additionally, symbiotic associations with beneficial microbes such as mycorrhizal fungi or rhizobacteria contribute to nutrient uptake and enhance salinity tolerance (Chakraborty *et al.,* 2012). These integrated responses enable plants to thrive in saline environments, bolstering their resilience and ensuring sustained agricultural productivity under challenging conditions.

Millets, renowned for their resilience to adverse conditions, present a promising avenue for developing salt-tolerant crop varieties. Important agronomic traits in millets, including tolerance to diseases, insect pests, drought, salinity, and nutrient deficiencies, are often governed by quantitative trait loci (QTL) (Ramakrishnan *et al.,* 2017; Wang *et al.,* 2017; Ramakrishnan *et al.,* 2016). Pearl millet, cultivated predominantly in marginal lands with erratic rainfall patterns and environmental stresses, exhibits natural resilience to abiotic stresses such as drought, salinity, and heat (Serba and Yadav, 2016). Sorghum, recognized for its resilience, demonstrates robust stress resistance, including tolerance to drought and salinity (Liu *et al.,* 2023). However, salt stress adversely affects the morphological and anatomical integrity of sorghum's root system, impairing its ability to absorb water and nutrients (Li *et al.,* 2015). Finger millet (*Eleusine coracana*), distinguished by its nutrient-rich composition, thrives in marginal soils and adverse climates. It ranks third in cereal production in semi-arid regions, following sorghum and pearl millet (Thilakarathna and Raizada, 2015), and is prized for its high nutritional value compared to other major cereals (Gupta *et al.,* 2017). Despite its resilience, finger millet faces challenges from abiotic stresses, particularly soil salinity, which diminishes crop quality and productivity (Hema *et al.,* 2014). Excessive accumulation of sodium (Na) and chloride (Cl) ions disrupts ion balance within plant tissues, hindering the uptake of essential elements like potassium (K), thereby reducing productivity and potentially leading to plant mortality (James *et al.,* 2011; Shah *et al.,* 2021). Salinity stress exerts significant impacts on finger millet, affecting seed germination, seedling establishment, and subsequent growth stages (Hema *et al.,* 2014). It disrupts seedling and root development, alters ion concentrations, reduces relative water content, affects photosynthetic pigments, increases proline content, and induces membrane peroxidation, thereby influencing overall plant health and productivity (Sabir *et al.,* 2011; Dugasa *et al.,* 2020; Mukami *et al.,* 2020).

The increasing prevalence of soil salinization, exacerbated by factors such as improper irrigation methods, climate change, and rising sea levels, intensifies the urgency to enhance salinity tolerance in crops. Developing effective strategies to bolster resilience against salinity stress in crops like finger millet is critical for sustaining agricultural productivity and ensuring global food security. This review aims to explore recent advancements in comprehending and managing salinity stress in millets, particularly focusing on finger millet, and to outline future research directions aimed at enhancing crop resilience.

Physiological and Biochemical Responses of Finger Millet to Salinity Stress

The physiological and biochemical responses of finger millet to salinity stress highlight essential adaptive strategies crucial for its survival and productivity in challenging environments. Previous studies, including those by Krishnamurthy *et al.,* (2014) and Mukami *et al.,* (2020), have primarily focused on screening salt-tolerant cultivars under saline conditions. Finger millet responds to high salt levels by regulating ion homeostasis through mechanisms such as ion exclusion from roots and sequestration into vacuoles, which are vital for maintaining cellular osmotic balance and minimizing ion toxicity. Osmotic adjustment mechanisms, supported by the accumulation of compatible solutes like proline and glycine betaine (Rao *et al.,* 2013; Mahadik and Kumudini, 2020), sustain water uptake and turgor pressure, ensuring cellular hydration. Biochemically, finger millet enhances the activity of antioxidant enzymes such as superoxide dismutase (SOD) and catalase (CAT) to detoxify reactive oxygen species (ROS) generated under salinity stress, thereby protecting cellular structures from oxidative damage. Morphological adaptations, such as alterations in root architecture, enhance water and nutrient uptake, further bolstering the plant's resilience. Studies like Mukami *et al.,* (2020) underscore that salt-tolerant cultivars exhibit higher germination rates, reduced root/shoot growth retardation, lower Na to K ratios in leaves and shoots, and increased levels of total soluble sugars in leaves compared to salt-sensitive plants. Chlorophyll content, a critical biochemical marker of salt tolerance, remains stable or increases in salt-tolerant finger millet varieties under salinity stress, contrasting with the typical decrease observed in salt-sensitive plants (Hema *et al.,* 2014; Ishikawa and Shabala, 2019). Understanding these complex responses is essential for developing effective strategies to enhance finger millet's tolerance to salinity stress, thereby ensuring sustainable production in salt-affected agricultural regions.

Role of Phytohormones and Secondary Metabolites in Enhancing Salt Tolerance in Plants

Phytohormones play a vital role in mediating plant responses to salinity stress, aiding in adaptation and tolerance by regulating various physiological and biochemical processes. Key phytohormones involved in salinity tolerance include abscisic acid (ABA), gibberellins (GAs), auxins, cytokinins, ethylene, jasmonic acid (JA), and salicylic acid (SA). ABA is crucial for salinity stress response, managing stomatal closure to reduce water loss, inducing stress-responsive genes, and promoting osmotic adjustment through the accumulation of osmoprotectants like proline and sugars (Hossain and Dietz, 2016). GAs influence seed germination, stem elongation, and leaf expansion, with levels typically decreasing under salinity stress to conserve energy and reduce growth. Balancing GAs and ABA is essential for an optimal stress response (Chatterjee *et al.,* 2018). Auxins are essential for root development, particularly in modifying root architecture under salinity stress, enhancing lateral root formation for better water and nutrient uptake (Sripinyowanich *et al.,* 2013). Cytokinins facilitate cell division and shoot growth, delay leaf senescence, and help maintain photosynthetic capacity under stress. Ethylene influences root growth and interacts with other hormones like ABA and JA to manage stress-induced damage (Al Hassan *et al.,* 2016). JA regulates defence-related gene expression, maintaining cellular homeostasis and protecting against oxidative damage caused by salinity stress. SA activates defence mechanisms, boosts the production of antioxidant enzymes, and mitigates oxidative stress due to salinity (Ahmad *et al.,* 2013). Exogenous gibberellin (GA) can mitigate the effects of salt stress on germination and seedling growth, improving salt tolerance in crops like sorghum.

High-throughput sequencing technology is increasingly used in studying crop resistance, aiding in the discovery of plant resistance genes and mechanisms. Cellular water homeostasis and ionic balance are essential for optimal physiological, biochemical, and molecular processes in plants. Soil salination disrupts water uptake, causing ionic imbalances, osmotic stress, and oxidative damage, which impede plant growth and development. Plants employ strategies to manage ion homeostasis, osmolyte biosynthesis, toxic ion compartmentation, and reactive oxygen species (ROS) scavenging systems, leading to changes in secondary metabolite levels. For example, salt stress increases terpene emissions in rice genotypes, with salt-sensitive genotypes emitting higher terpene volumes than tolerant ones. Enhanced proline accumulation is associated with increased salt tolerance in many plant species, and glycine betaine, a common osmoprotectant, stabilizes cellular macromolecules under stress conditions. Studies have shown that salt-tolerant genotypes accumulate more glycine betaine

than sensitive ones, correlating with improved salt tolerance. Understanding these phytohormonal and metabolic responses is crucial for developing strategies to enhance salinity tolerance in crops.

Enhancing Millet Resilience to Salinity Stress: Strategies for Improved Tolerance

Efforts to enhance millet resilience against salinity stress are pivotal for maintaining agricultural productivity in salt-affected regions. Current strategies emphasize understanding the physiological, biochemical, and genetic mechanisms underlying salt tolerance in millets. These approaches include screening and breeding for salt-tolerant varieties, investigating ion transport mechanisms to regulate ion homeostasis, and studying osmotic adjustment mechanisms through the accumulation of compatible solutes. Advances in molecular biology facilitate the identification of crucial genes and pathways involved in salt tolerance, enabling genetic engineering to develop resilient millet cultivars.

Additionally, optimizing agronomic practices and exploring symbiotic interactions with beneficial microbes offer further avenues to enhance millet's salinity tolerance. By integrating these multidisciplinary approaches, researchers aim to mitigate the detrimental effects of salinity stress on millet crops, ensuring food security and sustainable agriculture in challenging environments. Transgenic methods have proven effective in developing salt-tolerant plants with increased yield and productivity. Hema *et al.,* (2014) demonstrated that the expression of the mtlD gene in finger millet enhanced salinity tolerance, resulting in faster growth under salt stress compared to wild-type plants. Similarly, studies using GWAS across various cereal crops, such as that by Kummari *et al.,* (2021), have identified key salinity-related QTL and genes. Overexpression of PgLEA from pearl millet in transgenic tobacco plants has also shown high tolerance to salinity, drought, heat, and cold stresses (Kummari *et al.,* 2021). Additionally, Sharma *et al.,* (2014) investigated the effects of DT-QTL under salt stress conditions, further contributing to our understanding of genetic mechanisms involved in enhancing salinity tolerance in crops.

Gene Pyramiding for Enhanced Salt Tolerance

Advancements in plant genomics have been pivotal in providing essential genomic data for improving traits in crops. Gene pyramiding stands out as a breeding strategy aimed at bolstering crop salt tolerance by integrating multiple genes or alleles associated with salinity resilience into a single plant variety. This method involves crossing and selecting plants with beneficial alleles from diverse parent lines noted for their ability to withstand salt stress. By combining these genes, which govern processes like ion balance, osmotic regulation, antioxidant defence, and other stress responses, researchers aim to cultivate varieties capable of thriving in saline environments. Leveraging modern molecular techniques, gene pyramiding accelerates the breeding process and holds promise for enhancing crop yields and ensuring food security in regions affected by soil salinity. While single-gene transgenic approaches have been widely applied to enhance plant salt tolerance, they often fall short in achieving optimal expression of necessary metabolic products due to the complexity of biosynthetic pathways and the multifaceted nature of salinity stress. To address these challenges, strategies such as co-transformation of multiple genes and transgenic pyramiding through conventional hybridization have been developed to introduce complex metabolic pathways or multiple genes into plants. Research findings underscore the efficacy of gene stacking in enhancing long-term salt stress tolerance in plants. For instance, in a study by Jayasudha *et al.,* (2014), the co-expression of PgNHX1 from *Pennisetum glaucum* and AVP1 from *A. thaliana* using Agrobacterium-mediated transformation resulted in higher salt tolerance in transgenic plants compared to wild-type counterparts.

As salinity stress involves multiple genetic factors, relying on a single major gene can compromise the stability of salt-tolerant cultivars over time. Therefore, pyramiding multiple genes that confer resistance to various stresses into a single plant is crucial for maintaining sustainable and stable tolerance in crops like finger millet (Mbinda and Mukami 2021). Moving forward, genetic engineering techniques should focus on screening and pyramiding several promising salinity-tolerance genes to develop resilient finger millet cultivars capable of enduring diverse environmental challenges. While gene pyramiding holds substantial promise, challenges such as reduced gene stacking effectiveness, gene mutations, silencing, genotype-environment interactions, and the time-intensive nature of variety development remain significant considerations. Innovations like genome editing offer potential solutions to overcome these obstacles and expedite progress in enhancing crop resilience to salinity stress.

Exploring the Potential of Speed Breeding for Enhancing Salinity Tolerance in Millets

Speed breeding is an innovative technique designed to shorten the breeding cycle, showing considerable promise for enhancing salinity tolerance in millets. By manipulating factors such as light, temperature, and photoperiod, speed breeding

accelerates the growth and reproductive phases of plants, allowing them to mature and produce seeds more quickly. This rapid generation turnover can expedite the development and selection of salinity-tolerant millet varieties. Recent progress in genomics and phenomics has boosted the efficiency of speed breeding, allowing for precise identification and selection of genetic traits linked to salinity tolerance (Watson *et al.,* 2018). For example, genomic selection enables breeders to predict the salinity tolerance of progenies early in the breeding process, speeding up the creation of resilient cultivars (Hickey *et al.,* 2017). Combining speed breeding with other advanced techniques like gene editing and marker-assisted selection further enhances the development of salt-tolerant millets (Ghosh *et al.,* 2018). This integrated approach not only accelerates the breeding cycle but also ensures the inclusion of multiple traits necessary for salinity tolerance, thus contributing to food security and sustainable agriculture in salt-affected areas.

Although speed breeding protocols have been established for several major crops, they are still in the early stages of development for millets. The potential of speed breeding to improve salinity tolerance in millets is significant due to its ability to accelerate breeding cycles. By adjusting environmental conditions like light, temperature, and photoperiod, this technique can speed up plant growth and reproduction, allowing for multiple generations per year. However, specific protocols for speed breeding in millets such as finger millet and sorghum have not yet been developed (Chiurugwi *et al.,* 2018). Nonetheless, research in this area is promising. By combining speed breeding with genomic selection and marker-assisted selection, researchers can quickly identify and propagate salinity-tolerant traits (Watson *et al.,* 2018; Hickey *et al.,* 2017). As genomic resources and phenotyping tools for millets continue to evolve, the development of speed breeding protocols tailored to millets is anticipated. This will lead to more rapid and efficient breeding programs aimed at improving salinity tolerance, ultimately supporting food security and sustainable agriculture in salt-affected regions (Ghosh *et al.,* 2018).

Agronomic Strategies for Managing Salinity Stress in Crops

Agronomic management of salinity stress is vital for maintaining crop productivity and sustainability in saline environments. Effective strategies include using salt-tolerant crop varieties, appropriate irrigation techniques, and soil amendments. Developing salt-tolerant varieties through conventional breeding or genetic engineering is essential, as these varieties possess mechanisms to combat salinity's negative effects. Efficient irrigation methods, like drip irrigation, minimize salt build-up by delivering water directly to the root zone, reducing evaporation and salt deposition on the soil surface. Soil amendments such as gypsum can improve soil structure and facilitate salt leaching beyond the root zone. Adding organic matter, like compost, can enhance soil water-holding capacity and encourage beneficial microbial activity, aiding in salt stress alleviation. Crop rotation and intercropping with salt-tolerant species improve soil health and reduce overall salinity. Implementing these agronomic practices is crucial for mitigating salinity stress, enhancing crop resilience, and ensuring sustainable agricultural productivity in affected regions.

Modern integrated approaches are also being explored to enhance agricultural production and manage salinity tolerance. One such approach involves promoting saline agriculture and sustainable phyto-management by cultivating non-conventional food and bioenergy crops like Pennisetum. This method aims to recover unproductive degraded lands sustainably and profitably (Saqib *et al.,* 2019). Using salt-tolerant crops for saline agriculture and phytoremediation is a cost-effective and widely accepted strategy for soil desalination and reclamation, generating direct monetary benefits. Phytoremediation, which uses plants to reclaim degraded soils, can increase soil organic carbon, total nitrogen, available phosphorus, potassium, and exchangeable calcium and magnesium ions (Imadi *et al.,* 2016). It also enhances soil structure, porosity, water retention, hydraulic conductivity, and bulk density (Ashraf *et al.,* 2010; Imadi *et al.,* 2016). Specific agronomic methods target soil or crops directly to manage salinity stress. Increasing soil water content through frequent irrigation can lower soil salinity to levels crops can tolerate, although this may not be feasible for smallholder finger millet farmers. Finger millet, often grown in arid and semi-arid regions, faces critical salinity stress during dry periods. Applying calcium nitrate or chloride can help displace sodium ions from soil colloids, which are then leached away by rain or irrigation (Mariani and Ferrante, 2017). Magnesium applications can also improve soil structure and root environment. At the crop physiology level, chloride ions inhibit sodium channels in membranes, reducing cytosolic salt accumulation and alleviating salinity stress. Using calcium nitrates can further compete with sodium ions for accumulation in cytosol vacuoles, although this aspect requires more validation. Combining these agronomic strategies with advancements in phytoremediation and biological approaches offers a comprehensive solution for managing salinity stress in agriculture. This integrated approach accelerates the development of salt-tolerant varieties and ensures sustainable crop production in saline-affected regions, contributing to food security and environmental health.

Future Prospects

The future of managing salinity stress in agriculture holds great promise with the integration of various advanced techniques and approaches. Advancements in genetic engineering, including CRISPR/Cas9 and gene pyramiding, will enable the precise manipulation of genes associated with salinity tolerance, enhancing the resilience of orphan crops like millets. The integration of omics technologies, such as genomics, transcriptomics, proteomics, and metabolomics, will provide a comprehensive understanding of the complex networks involved in salinity stress responses, facilitating the identification of key genes, proteins, and metabolites for improving salt tolerance.

Additionally, developing speed breeding protocols for millets and other orphan crops will accelerate the breeding cycle, allowing for rapid development of salt-tolerant varieties. Enhanced agronomic practices, including precision agriculture techniques, improved irrigation systems, and the use of soil amendments, will play a crucial role in managing salinity stress effectively. Phytoremediation using non-conventional crops like *Pennisetum* offers a sustainable approach to reclaiming saline and degraded soils, improving soil health, and providing economic benefits through bioenergy crop cultivation. Understanding the roles of phytohormones and secondary metabolites in salinity tolerance will open new avenues for enhancing crop resilience, with future studies focusing on their exogenous application and synergistic effects. As climate change exacerbates salinity issues, developing crop varieties and management practices that withstand multiple stresses will be essential for ensuring food security. Supportive policies and effective extension services will be crucial for implementing these advancements and educating farmers about the latest technologies and practices. Overall, continued research and collaboration among scientists, policymakers, and farmers will be vital for realizing the full potential of these strategies, ensuring resilient and productive agricultural systems in saline-affected regions.

Conclusions

In conclusion, addressing salinity stress in agriculture is vital for maintaining crop productivity and ensuring food security, particularly in regions affected by soil salinization. This review has highlighted the multifaceted strategies for mitigating the effects of salinity stress, including the roles of phytohormones and secondary metabolites, genetic engineering, advanced agronomic practices, and phytoremediation. Phytohormones and secondary metabolites are crucial in mediating plant responses to salinity, enabling plants to adapt and endure high salinity conditions. Advances in genetic engineering and molecular breeding techniques, such as CRISPR/Cas9 and gene pyramiding, offer significant potential for developing salt-tolerant crop varieties. Integrating omics technologies will further enhance our understanding of the complex networks involved in salinity stress responses, aiding in the identification of key targets for improving salt tolerance. Developing speed breeding protocols for millets and other orphan crops will significantly shorten the breeding cycle, facilitating the rapid development of salt-tolerant varieties. Improved agronomic practices, including precision agriculture techniques, efficient irrigation systems, and soil amendments, will be vital in managing salinity stress effectively. While significant progress has been made in breeding salt-tolerant crops, more work is needed to address the polygenic nature of salinity tolerance and the simultaneous impact of other abiotic stresses. Profiling the genes, metabolites, and pathways responsible for salinity tolerance in finger millet, leveraging whole genome sequencing, will be crucial for future advancements. Collaborative efforts among scientists, policymakers, and farmers will be essential to harness the full potential of these strategies, ensuring resilient and productive agricultural systems capable of withstanding the challenges posed by salinity stress.

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GEOSPATIAL DISTRIBUTION, PREDICTION, GENETIC DIVERSITY ANALYSIS AND MANAGEMENT OF STERILITY MOSAIC DISEASE OF PIGEON PEA IN SOUTHERN AND CENTRAL INDIA UNDER CHANGING CLIMATIC SCENARIO

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Abstract

Sterility mosaic disease (SMD) is anemerging biotic riskto the cultivation of pigeon pea through out the Indian subcontinent. In the present study, we determined the spatial distribution of SMD during Kharif 2021 and 2022 and molecular variability of *PPSMV* strains and *A. cajani* vector in central and southern India. The results indicated enormous variability in the incidence levels of SMD ranging from 1.10-19.21%. Further, the phylogenetic analysis of the RNA-3 sequence of disease causing two viral agents such as *PPSMV-I* and *PPSMV-II* exhibited considerable variability among 10 different geographical strains in central and southern India. Similarly, phylogenetic analysis of the5.8S and 28S rDNA genes of *A. cajani* displayed considerable variability among 11 different geographical isolates.

Introduction

Pigeonpea is one of the most important drought-resistant grain legume in the Indian subcontinent. In India, pigeonpea is grownover an area of 5.01Mha, estimates nearly 72% of the global pigeonpea production. Sterility mosaic disease caused by *PPSMVb* is an eriophyid mite transmitted, semi-persistent, single stranded, multipartite RNA virus was the most important constraint in pigeonpea production (Mitra, 1931). Two Emaravirus strains, *PPSMV-I* and *PPSMV-II* are continuously associated with SMD of pigeonpea (Kumar *et al.,* 2000; Elbeaino *et al.,* 2015). SMD is also referred as "Green Plague" because affected plants never produce flowers and remains green at maturity. In India, SMD is an important disease predominant in almost all the pigeonpea growing regions and causing epidemic with 70-100% yield loss (Sharma *et al.,* 2015). Therefore, present investigation is carried out to determine geospatial distribution and genetic diversity analysis of *PPSMV* and its vector transmitting agent in central and southern India.

Materials and Methods

Two intensive roving surveys were carried out to understand the prevalence of SMD during Kharif 2021-22 and 2022-23 in major pigeonpea growing regions in central and southern India. The disease diagnosis in the surveyed fields was based on visual symptoms of plants andthe per cent disease incidence in each field will be determined by counting the number of infected plants from 500 randomly selected plants.

Percent disease incidence (PDI) = Number of infected plants / Total number of plants × 100

During the survey, SMD infected pigeonpea leaf samples will be collected and transported in ice packs ICRISAT, Hyderabad, snap-frozen in liquid nitrogen and stored at -80°C to study the molecular variability among the *PPSMV* isolates. 30 *PPSMV* isolates will be collected from five major pigeonpea growing states in central and southern India. Total RNA is isolated using QIAGEN RNeasy® Plant mini kit and reverse-transcriptase PCR (RT-PCR) was carried out to converted cDNA using Invitrogen superscript™ III first-strand synthesis supermix kit. The partial sequence of the RNA-3 segment (coat protein) of *PPSMV* isolated were amplified by RT-PCR as per the protocol described by Elbeaino *et al*. (2015). Further selected 10 isolates (1 *PPSMV-I* and 9 *PPSMV-II*) were cloned into TOPO 8 TA plasmid vector and Sanger's dideoxy chain-termination method was employed to observe the molecular variability among the *PPSMV* isolatesat automated DNA sequencing facility (Euro?ns, Hyderabad). Similarly, genetic diversity among *A. cajani* isolates were carried out by collecting 11 isolates from the central and southern India and Genomic DNA from pigeonpea leaf samples with 50-100 mites were extracted using Invitrogen PureLink® Plant Total DNA Purification Kit. Specific primers corresponding to the 3' end of the 5.8S and the 5' end of the 28S rDNA genes were designed using IDT PrimerQuest™ Software and PCRwas performed. The sequencing of eleven *A. cajani* isolates were caried out by following Sanger's dideoxy chain-termination (Euro?ns, Hyderabad).

Results and Discussion

The results indicated enormous variability in the incidence levels of SMD ranging from 1.10-19.21% in pigeonpea-growing

states. The agglomerative hierarchical clustering approach by means of the average linkage method for SMD incidence among the 29 administrative districts of different agroclimatic zones of India recognized two major clusters. Cluster I comprised 27 districts and cluster II comprised of 2 districts. Oligonucleotide primers corresponding to the RNA-3 segment of *PPSMV-I* and *PPSMV-II* amplified a specific product of 322 bp and 284 bp respectively. The nucleotide sequence of the RNA-3 segment of *PPSMV-I* from Tirupati along with available *PPSMV-I* RNA-3 sequences when subjected to the phylogenetic analysis, two separate clusters were formed with Tirupati isolate in single cluster and remaining isolates in another cluster. Similarly, the nucleotide sequence of the RNA-3 segment of *PPSMV-II* from nine isolates when subjected to the phylogenetic analysis, two clusters were formed. Cluster-I comprised of Podili, Tandur, Patancheru, Mahabubnagar, and Rahuri isolates, whereas cluster-II comprised of Bengaluru Rural, Coimbatore, Bidar and Krishnagiri isolates. Oligonuleotide specific primers corresponding to the 5.8S and 28S rDNA genes of *A. cajani* amplified a specific product of 480 bp. The nucleotide sequence from 11 isolates when subjected to the phylogenetic analysis, two clusters were formed. Cluster-I comprised of Bidar, Patancheru, Tirupati, Rahuri, Tandur, Badnapur, and Podili isolates, whereas cluster-II comprised of Warangal, Raichur, Bengaluru, and Coimbatore, isolates.

Conclusions

In the present study, wide variability was observed in the prevalence of SMD incidence. The phylogenetic analysis of PPSMV strains and *A. cajani* isolates reveals a distict variation is the different geographical isolates.

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NATURAL FARMING FOR IMPROVING SOIL HEALTH AND SUSTAINABLE AGRICULTURE

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Sustainable agriculture is an important factor that will shape the 21st century. Sustainability of food production systems in India linked with decline in soil health, loss of productivity, soil infertility; desertification, reduced agro-diversity, pesticide pollution and emerging pest-resistance have raised serious concerns about the future of the current chemical and input-intensive model. The Indian farmers are under stress and the modern agriculture loaded with chemicals. Productivity declined over years and has several negative consequences. The present organic carbon content ranges from 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. Farmer's indebtedness keeps increasing as they buy inputs with barrowed resources and are unable to pay it back due to changed climate vagaries. Finally consumers end up with foods with pesticide residues. So we have to transform agricultural practices to be more ecologically sustainable (https://niti.gov.in).

A resilient and sustainable agriculture system is required to face different environmental challenges. Sustainable Agriculture includes different eco-friendly farming techniques that boost crop yield and livestock production without having an adverse effect on the environment. Natural Farming offers a solution to various problems, such as food insecurity, farmer's distress, and health problems arising due to pesticide and chemical residue in food and water, global warming, climate change and natural calamities and potential to generate employment, thereby stemming the migration of rural youth (Pingali, 2012).

Natural Farming (NF) is a holistic agriculture method seeks to eliminate purchase of toxic pesticides and fertilizers, yield healthy crops, healthy living and environment friendly farming. Natural Farming releases nutrients locked up in the soil by triggering microbial activities and bring the earthworms activities back and encourage plants to fix the moisture from the air. NF is regenerative agriculture; it increases the carbon content in the soil allows us to retain more water in soil creating life in the soil with humus which increases the fertility of the soil. Natural Farming promises to end a reliance on loans, cut production costs and helps rural development. 'Natural farming' means farming *with* Nature and *without* chemicals.

The concept of natural farming lies with the diversified farming system that integrates crops, trees and livestock, allowing the optimum use of functional biodiversity. Natural Farming if done effectively enhances farmer's income while delivering many other benefits, such as restoration of soil fertility and environmental health, and mitigating and/or reducing greenhouse gas emissions. According to natural farming principles, plants get 98% of their supply of nutrients from the air, water and sunlight, remaining 2% can be fulfilled by good quality soil with plenty of friendly microorganisms (Just like in forests and natural systems). The soil is always supposed to be covered with organic mulch, which creates humus and encourages the growth of friendly microorganisms. Farm made bio-cultures named *'Jeevamrit, Beejamrit and Ghanajeevamrit* etc.' are added to the soil instead of any fertilizers to improve micro flora of soil. It holds the promise of enhancing farmers' income while delivering many other benefits, such as restoration of soil fertility and environmental health, and mitigating and/or reducing greenhouse gas emissions. In natural farming no tilting of soil and no fertilizers, is done just the way it would be in natural ecosystems. Natural farm-made pesticides like *Agni astra, Bramhaastra, Dashparni ark and Neem Astra* are used to control pests and *Shunti astra and sour butter milk* to control diseases. Weeds are considered essential and used as living or dead mulch layer. Multi-cropping is encouraged over single crop method. Concoctions are necessary to enhance the fertility of soil. Due to diverse agro climate and strength of traditional knowledge, practicing farmers there are lot of scopes for taking up natural farming in our country. Natural Farming improves soil fertility, environmental health as well as helps in the reduction of GHG's and also promises the enhancement of farmer's income. In broad terms, Natural Farming can be considered as a prominent strategy to save the planet Earth for future generations. Around 85 percent of the operational holdings in the country are small and marginal. For small holding, natural farming is better option as it provides greater opportunity for on farm management of resources.

Benefits of Natural Farming

Improve yield, ensures better health, environment conservation, increased farmer's income and minimized cost of production. Natural Farming aims to drastically cut down production costs by encouraging farmers to prepare essential biological inputs using on-farm, natural and home-grown resources. It eliminates application of synthetic chemical inputs. Rejuvenates soil

health, the most immediate impact of Natural Farming is on the biology of soil—on microbes and other living organisms such as earthworms (https://niti.gov.in).

Current Scenario of Natural Farming in India

There are several states practicing Natural Farming. Prominent among them are Andhra Pradesh, Karnataka, Chhattisgarh, Gujarat, Himachal Pradesh, Jharkhand, Odisha, Madhya Pradesh, Rajasthan, Uttar Pradesh, Kerala, and Tamil Nadu. Till now 6.5 lakh ha area is covered under natural farming in India. State governments of different states are promoting natural farming through various schemes. The Government of Andhra Pradesh turned to farming approaches that are in harmony with nature, as they build on ecological science, rather than input economics. Gujarat Atma Nirbhar package and Himachal Pradesh practices Natural Farming under the PK3: Prakritik Kheti Khushhal Kissan Yojana. The scheme aims to reduce the cost of cultivation and enhance farmers' income. The scheme seeks to promote the production of food grains, vegetables, and fruits without the use of synthetic chemicals/pesticides and fertilizers. Rajasthan state support's natural farming to reduce input costs with a view to empower farmers through remunerative agriculture – *"Kheti Mein Jaan Toh Sashakt Kisan"*. Government of Karnataka promotes natural farming through operational Research Project from 2018 and Hon'ble Chief Ministers Natural farming during 2022-2023 covering 20000 ha area.

Natural Farming for Sustainable Development Goals

Natural farming practices are socio-economic-environment- friendly farming practices will support in achieving the UN-Sustainable Development Goals by 2030. Agro ecological practices like Natural Farming being a cost-effective and ecologically compatible alternative would be an enabler in achieving the Sustainable Development Goals. By reducing input costs, they can ensure better income and financial stability, which would in turn help to alleviate poverty, bring in gender equality and ensure sustainable production and consumption patterns. This method would ensure food security and zero hunger through better yield, diversity in cropping and access to a suite of nutritional sources and income-generating crops throughout the year. The water-conserving and ecological-preservation aspects of Natural Farming contribute to the availability and sustainable management of water, reduction of CO2 emissions in various stages of agricultural value chain. The reduced use of chemical inputs in agriculture in turn would result in arrest of land degradation; reduce ocean acidification; and marine pollution from land-based activities. Natural Farming would ensure good health of farmer's consumers and can contribute to the reduction of various diseases in the community.

(https://www.ceew.in/publications/zero-budget-natural-farming-sustainable-development-goals-)

To validate the aforesaid benefits of Natural Farming, the Government of Karnataka sponsored a project on evaluation and performance of natural farming in comparison with established organic and conventional farming practices in different zones of Karnataka since 2018. Field experiments were conducted in all crops and cropping systems of zone -8 like green gram, black gram, soybean, maize and inter cropping systems like maize + soybean, red gram + soybean, red gram + maize, cotton + groundnut, red gram based millets and ground nut based millets inter cropping systems during *Kharif* season and crops like wheat, chickpea, *rabi* sorghum and chickpea + linseed during *rabi* season, sugarcane based cropping system and green gram, black gram and groundnut during summer season at zone-8, UAS, Dharwad from 2018-19 to 2022-23. Three farming practices were adopted such as, Conventional Farming Practices (CNF); Organic farming (OF) and Natural Farming (NF).

Among the different crops selected for the study under NF practice showed reduction in the yield compared to CNF. The yield reduction was less in pulses, leguminous oilseeds and millet based intercropping systems. The cost of production was saved to the extent of 10 to 36% in sole crops and 20 to 35% in intercropping systems under NF over CNF. About 20 to 55% material/input costs were saved under NF in selected crops over CNF practice. Based on results of the experiments in different crops, the crops like Green gram, Black gram, Groundnut, Soybean, Cotton+ Ground nut, Ground + Millets (Finger, Kodo and Brown top Millets) and Red gram + Millets (Barnyard, Finger and Foxtail Millet) inter cropping systems were recommended as suitable for cultivation under natural farming practices in northern transitional zone of Karnataka (Behera and Chandrashekara, 2021, Goudra and Chandrashekara, 2022, Sravani and Chandrashekara, 2022, Sushma and Chandrashekara, 2022 and Chandrashekara *et al.,* 2023). In nut shell, in all the zones recommended package of practices (CNF) recorded the higher yields over years in all crops and cropping system. Improvement in soil organic carbon, nutrient availability, soil microbial activities and reduction in cost of cultivation were noticed under natural farming practices in all the zones. In natural farming practices, soil physical, chemical and biological properties were improved over the years in all the crops and cropping

systems. The soil physical properties viz., Maximum Water Holding Capacity (MWHC) increased, Bulk density decreased and porosity increased in organic farming to the maximum extent followed by natural farming and least in Chemical farming and RPP. The soil general and beneficial micro floras as well as enzymatic activities were higher in natural farming and organic farming practices than RPP and Chemical Farming in all the crops and cropping system. So we can conclude that the natural farming will act as an alternative agricultural practices for rejuvenating soil and resilient agricultural practices.

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NOVEL POST HARVEST TECHNOLOGIES AIMING TO PROLONG SHELF LIFE OF HORTICULTURAL CROPS

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Introduction

The primary objectives in post harvest management include preservation, conservation, quality control/enhancement, processing, packaging, storage, distribution, marketing, and utilization to fulfill the food and nutritional needs of consumers. This involves all treatments or processes from the moment of harvesting until the food product reaches the end consumer.

Food quality may be defined as the combination of several physical and chemical attributes (appearance, texture, flavor, and nutritional value) which have a crucial impact on determining the degree of consumer acceptability. The quality of fruit and vegetables is mostly based on the evaluation of different external attributes (size, shape, color, gloss, firmness, texture, and taste) and internal factors (chemical, physical and microbial) dealing with nutritional traits, safety, and sustainability. To preserve the quality and extend shelf life during storage, it is essential to regulate these processes.

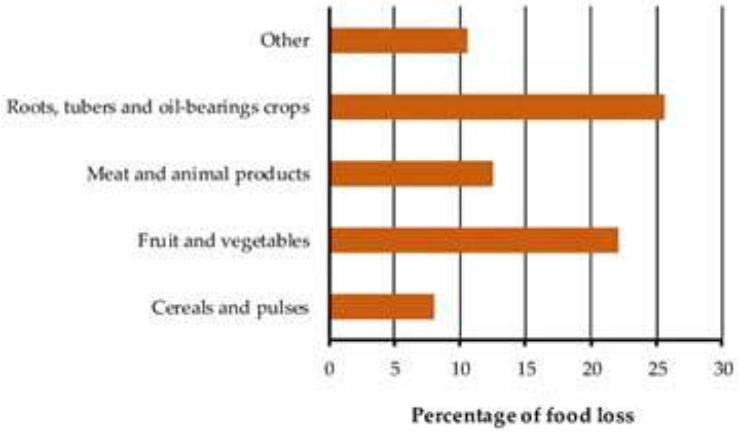
Harvested commodities are metabolically active and highly perishable. Inadequate preservation practices, besides causing important losses in nutritional and quality characteristics, can have a detrimental economic impact along the entire supply chain, from growers to consumers. The Food and Agriculture Organization (FAO) estimated that 33% of the total food produced for human consumption is lost due to postharvest spoilage). Overall, 44% of losses occur in industrialized (developed) countries and 40% occur in developing countries.

Causes of postharvest losses along the supply chain. (Bourne, M. Cornell University: Ithaca, NY, USA, 1977.)

In a recent report released by the FAO, it was reported that fruit and vegetables are the food group with the second-highest value of losses and waste (about 22%), exceeded only by roots, tubers, and oil-bearing crops at all stages in the food supply chain, due to their highly perishable nature.

Optimal postharvest handling, including storage time and temperature management, relative humidity, chemical and/or physical treatments, and packaging can slow down the biological processes caused by senescence and maturation, reduce or inhibit the development of physiological disorders, and minimize microbial growth and contamination. For example, temperature is the most important and simplest postharvest factor that can delay the decay of the product. Generally, there is a recommended storage temperature for each product, and optimum quality preservation can be achieved if the commodity is rapidly cooled to its best postharvest storage temperature as soon as possible after harvest. For these reasons, increased product shelf-life and more advanced quality control technology over longer distances have become key issues.

Recently there is much research about the effects of new postharvest physical and chemical treatments and about the biocontrol techniques used to preserve the quality, nutritional value, and safety of fresh produce, from harvest to consumer



Food losses and waste along the supply chain (percentage).

consumption. It has been widely demonstrated that these methods, whether alone or in combination with the appropriate management of storage temperature, could preserve the principal quality and nutritional traits of fruit and vegetables.

The aim of this review article is to report a detailed collection of the research works carried out in the last years about the principal application of new postharvest physical and chemical emerging technologies to preserve the quality and reduce postharvest losses and waste in fresh fruit and vegetables.

Postharvest Strategies to Extend the Shelf-Life of Fruit and Vegetables

Physical Treatments

Emerging non-thermal physical technologies have moved into the spotlight in the last few years, with the aim of replacing the traditional postharvest technologies based on thermal processing. Besides being highly water-consuming, the conventional methodologies can show deleterious effects on the fresh commodities' quality aspects. These novel technologies can reduce nutrient losses, increase consumer acceptability, promote food quality, and prolong shelf-life and freshness, guaranteeing the complete absence of chemical byproducts in the processed product, combined with a reduction in the environmental impact. However, these techniques show numerous advantages and disadvantages that have begun to be investigated to achieve a suitable quality standard by adopting cost-effective methods.

Microwave

Microwaving was applied in this context as an alternative to conventional heating, with the aim of achieving a fast and effective increase in temperature without a temperature gradient. This technique briefly treats fruits and vegetables to manage microbial growth throughout the product's minimal processing, minimizing losses of quality and simultaneously guaranteeing the smallest effect on the environment and the absence of residues in the treated product.

Pulsed Electric Field

Recently, pulsed electric field technology has become of the most interest because of its capability to obtain safe food with minimal heat production through the use of is to ms-pulses of a high electric field of high intensity. This technique has been widely used on liquid, semi-solid and solid foods, also including fresh fruit, vegetable smoothies, and juices. The PEF parameters to be optimized to obtain microbial and enzymatic inactivation in fresh products are represented by the strength of the electric fields, the treatment time, and the frequency, polarity, or shape of the pulses. Beneficial effects from PEF treatment were observed in the reduction of enzymatic activity with a consequent improvement in the quality parameters. PEF-treated products better retained their fresh flavor, textural, and functional attributes, including a longer shelf-life and greater microbiological safety..

High Hydrostatic Pressure

High hydrostatic pressure technology is mostly used for microbial inactivation or reduction and for enzyme denaturation. However, high pressure, inducing injuries on microbial cellular structures, might show similar effects on the plant cells; thus, an in-depth study into treatment optimization in various fresh systems is required. Several results show that HHP significantly

affects microbial load; however, it also influences the functionality of proteins, such as enzymes and tissue structure, specifically and differentially due to the wide variety of product types.

Cold Plasma

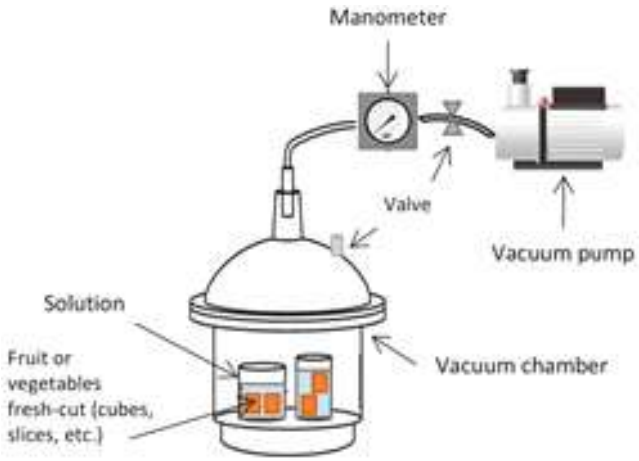
This technique allows the producer to avoid cell damage caused by direct exposure to cold plasma, representing a valuable alternative to the conventional solution of washing during fresh-cut processing for several products. To date, cold plasma and PAW washing applications have been described for strawberries kumquat fruit green leafy vegetables], blueberries fresh-cut apples ,pears cantaloupe melons, mushrooms , tomatoes, kiwifruits, and red currants.

Dipping and Vacuum Impregnation

Innovative food processing technologies, such as dipping and vacuum impregnation techniques, are being investigated and implemented to sanitize, reduce enzymatic browning, improve the texture, and use nutrients (vitamins, probiotics, minerals, organic acids, phenols, etc.) to fortify fresh-cut fruit and vegetables, in order to preserve and improve the quality and to extend the shelf-life of these products.

Dipping treatments consist of soaking the product, with or without mechanical agitation, followed by the removal of the excess solution. This method is commonly used on whole, peeled, shredded, and sliced commodities and on more perishable products, as it favors the dispersion of the solution, covering the maximum surface area of the product without any damage or stress . One of the major advantages of these dipping treatments is the removal of the cellular exudates, which can have a detrimental effect on the postharvest quality of commodities.

Food vacuum impregnation is a method that allows producers to directly introduce, dissolve, or suspend substances in the void fraction (i.e., the pores) of a food matrix in a controlled manner. VI includes two main steps: (1) the pressure is reduced in the system (under vacuum), the native gases and liquids are removed, and the product pores are expanded under the action of pressure gradients until mechanical equilibrium is achieved; (2) the atmospheric pressure is restored (relaxation period) and, with the opposite pressure gradient, the external solution fills the pores while the tissues relax, until a new equilibrium has been reached. The hydrodynamic mechanism and deformation-relaxation phenomena take place during the vacuum impregnation process, leading to the flow of external solutions into the intracellular spaces of foods.



Schematic representation of the vacuum impregnation device, the arrows point at each system element.

Edible Active Packaging, Based on Natural Compounds

Edible coatings have proven to be an effective primary packaging material in delaying the ripening process, preserving the nutritional properties and preventing quality loss by decreasing several natural processes, including gaseous exchange and the respiration and transpiration rate. Recently, it has been observed that the efficiency of edible coatings can be significantly improved by incorporating active natural components with antioxidant and/or antimicrobial properties. These packaging products are called “active” and are designed to interact with food by releasing components with biological properties. The integration of active compounds into biopolymer matrices enhances the oxidation stability of the food product and inhibits the growth of food-borne pathogens, providing additional safety features for the food products, even in the absence of cold storage.

Biocontrol Measures

Among the other approaches, biocontrol represents the key solution in the field of biological treatments. Exploiting selected microbes as control agents, biocontrol is considered one of the more sustainable postharvest approaches to increasing the shelf-life of fruit and vegetables. Bio-protection relies on the application of selected microbes that can limit the development of undesired microorganisms. The idea of having the microbiome of the fruit or vegetable as a target offers a privileged perspective in understanding the variables involved in biocontrol solutions, including the currently emerging interest in products that have been developed for pre harvest applications but that also demonstrate interest in terms of postharvest biological control.

Innovative Non-Destructive Techniques for the Quality Monitoring of Fruit and Vegetables

Image Analysis through a Computer Vision System

Computer vision systems are part of an innovative, contactless, and non-destructive technology, based on traditional imaging in the visible range of the electromagnetic spectrum, which is widely used for the in-line grading of fruit and vegetables. CVSs include novel technologies to automatically extract from an image the relevant visual information related to the visual quality of the product: they are used to classify and grade, to assess the quality, to detect defects, and to estimate the internal properties. Proper image analysis algorithms and regression or classification models can perform these tasks. The principal benefits of objective, consistent, and pervasive food control along the entire supply chain, from the producers to the final consumers, that are provided by this technology are a reduction in loss and waste, as well as increased consumer satisfaction.

E-nose

The electronic nose has become one of the most favorable sensing technologies as an alternative to conventional HS-SPME/GC-MS. From a practical point of view, it achieves the differentiation and classification of food matrices with different aroma signatures by evaluating the presence and the content of specific volatile metabolites in the headspace of the samples.

The E-nose is a sensing device supplied with a set of partial specific and broad-spectrum electronic chemical sensors that mimic human olfactory perception; it provides a digital VOC fingerprint that can be explored using suitable statistical tools. These electronic devices are generally composed of three parts: a sample-handling apparatus, a detector, and a system for data acquisition.

Near-Infrared Spectroscopy

Infrared (IR) spectroscopy is a very useful technique to recognize specific functional groups in a molecule and, thus, the chemical composition of a product by relating the vibrational properties of matter to certain internal features. Every sample has a specific IR spectrum; fruit and vegetable products with a similar spectrum also present similar bioactive compounds and nutritional value. Among the IR methodologies, near-infrared (NIR) spectroscopy, which covers the magnetic spectrum range between 780 and 2500 nm, is a rapid, non-destructive, multi-analytical technique that is widely and effectively used in several sectors, such as the food industry, agriculture, chemicals, pharmaceuticals, textiles, polymers, cosmetics, and medical applications.

The outcomes of NIR spectroscopy, combined with multivariate techniques and an image analyzer, can yield information about the solid soluble content (SSC), the firmness, the dry matter (DM), the hardness, and, in some cases, the internal injuries of harvested produce.

Conclusions

This article provides an overview of the impact of state-ofthe-art postharvest techniques (Including active packaging, dipping, vacuum impregnation, pulsed electric field, high hydrostatic pressure, and cold plasma) and biocontrol methods on preserving the high nutritional value and safety of fresh produce post-harvest. Both physical methods (Such as microwaving, pulsed electric fields, high hydrostatic pressure, and cold plasma) and a biocontrol approach have proven successful in enhancing product safety and extending shelf life.

Regarding the non-destructive techniques reported (image analysis, the E-nose, and near-infrared spectroscopy), the research in this field has made it possible to validate its effectiveness for the non-destructive evaluation of fresh and fresh-cut fruit and vegetables from “the field to the fork”, with the aim of optimizing the process phases and limiting losses.

GENERATION OF BC_2F_3 ANTHRACNOSE AND POWDERY MILDEW DISEASE RESISTANT POPULATION USING INTERSPECIFIC CROSS IN CHILLI

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Introduction

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 (*Leveiliula taurica*) are the major diseases of chilli. Chemical method of managing anthracnose and powdery mildew diseases is not sustainable and is also associated with health hazards and environmental pollution. Anthracnose causing 50 per cent yield losses and hence, major economic constraints for chilli production. The quality of fruits is affected by this disease by reducing the quantities of fruits' dry weight, capsaicin, and oleoresin (*Mistry et al*., 2010). Chemical methods of management are not sustainable and associated with health hazards and environmental pollution (Neetha *et al.,* 2016). In some countries, such as Thailand and Indonesia, fungicides are considered uneconomical and not sustainable for small-holder farmers due to their high risks to environmental safety (Setiawati *et al*., 2011). Recently Thilagam and Hemalatha (26) confirmed that application of *S. violaceoruber* fermentation broth reduced the incidence of the chilli anthracnose by promoting the seedling growth in chilli but it is not a permanent solution to control the disease. Thus, one of the most economical and significant strategies to reduce crop losses is to cultivate resistant varieties, or hybrids. Host resistance breeding is the most effective method to control anthracnose in chilli, but the non-availability of resistance sources is a major setback (Mishra *et al.,* 2018).

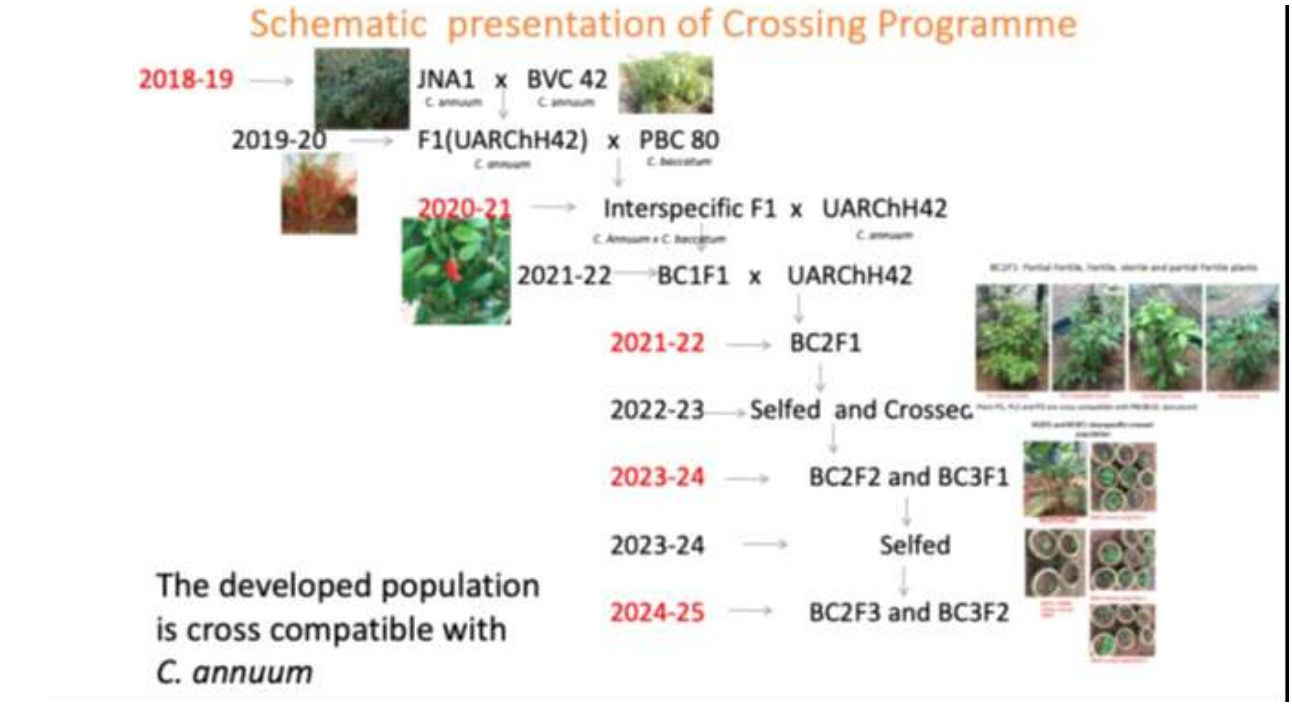
Genetics resistance is economical and eco-friendly measure to control the disease. Chilli growers shifting from red to green chilli cultivation and other crop like cotton due to severe attack of anthracnose disease during maturity and affect the quality of red chilli production which influences the export. Commercial resistant varieties were unable to be developed, due to the lack of resistance in the *Capsicum annuum* gene pool. 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 i.e. *C. annuum* and *C. baccatum*. Therefore, the crossing programme was initiated to transfer resistant gene from *C. baccutum* to *C. annuum* using conventional methods.

Methods

The large number of direct as well as reciprocal single crosses were attempted to enhance the cross compatibility between *C. annuum* and *C. baccatum*. The male sterility as well as non male sterility based hybrids belongs to C. annuum x *C. annuum* as well as large number of popular genotypes were used to make the cosses and break the coss incompatility between C. annuum and C. baccatum. However the male sterility based hybrid was found to be cross compatible with *C. baccatum* and developed the three way interspecific crossez. Embryo recue technique is also used to devepop the interspecific cross. The schematic representation of simple conventional method used to produce the interspecic cross is given below :

Results

It was found that the interspecific cross was compatible when male sterility based hybrid UARChH42 (*C. annuum* x *C. annuum*) used as female and PBC80 (*C. baccatum*) as male. The population of interspecific hybrid so produced was completely sterile as well as partial fertile. Interspecific hybrid so produced using cross compatible hybrid belongs to *C. annuum x C. annuum with C. baccatum*. The hybridity test was conducted using molecular markar which shows the banding patern as like the genotype resistant to anthracnose. Large number of back crosses (BC1F1) were attempted using newly developed partial fertile plants as female and male sterility based hybrid UARChH42 as male parent during kharif 2020-21. We could able to get single fruit having 2 normal and 2 abnormal seeds with filled embryo and 2 seeds without embryo during *kharif* 2021-22. Both the seeds filled with embryo were germinated and grown into well developed plants. Among the 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. However, sterile plant was incompatible. The crosses were attemped using other number of genotypes but it was not possible to set the fruits due to cross incompatibility. However, 36 seeds were harvested from 15 successfully



crossed BC2F1 fruits using UARchH42 as back cross parent and raised in portrays filled with cocopeat during 2022-23 and 26 seedlings were developed. The number of seedlings died due to hot season (Summer) Out of 26 seedlings we could able to survived only 4 seedlings and developed into a normal plants by using gwoth chamber. The pollen viability test was conducted using 2 per cent acetocarmine solution and found that Out of 4 plants developed in BC2F1 population, one plant was completely fertile, 2 were partial fertile and one was sterile. The crosses were attemped using all the plants immediately after flowering to study the cross compatibility. The population of interspecific cross was mated with each other and also using other important popular genotrypes of the Kalyan Karnataka region. It was found that among the 4 plants 3 plants were cross compatible with each other as well as any othger genotypes belongs to *C. annuum* as well as *C. baccatum*. We developed large number of cross combinations (BC3F1) as well as selfed progenies using completely fertile and partial fertile plants.

Resistance to anthracnose and powdery mildew was confirmed using infector fruit attached and infected plant attached methods respectively in BC2F1 generation. The population of BC2F1 generation was selfed to produced BC2F2 generation and individual plants were tested for anthracnose as well as powdery mildew disease resistant usiong molecular markers and natural epiphytic condiction respectively. We identified most of the population for powdery mildew resitant However, 36 plants were traiced out as resistant to anthracnose. The resistant to anthracnose was confirmed using molecular markers. The plants sowing resistant to powdery mildew as well as anthracnose disease of chilli were isolated and raised further for the development of homozygous inbred lines to develoip hybrids resistant to powdewry mildew as well as anthracnose in future.

Conclusions

The newly developed fertile plant was resistance to anthracnose as well as powdery mildew. The fertile plant was also self as well as cross compatible. The selfed progeny of fertile plant was produced and raised for further study and found that population so produced was fertile as well as partial fertile. Allmost all the fertile population was resistant to powdery mildew. However 36 plants were isolated after confirmation to anthracnose resistant using molecular marker. These population shall be further utilized for inbred line development programme to produce high yielding F1 hybrids. As all the selected plants are cross compatible with *capsicum annuum* species it is now possible to produce resistant high yielding hybrids/varieties for both anthracnose as well as powdery mildew diseases.

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EFFECT OF *MELIA DUBIA* (MALABAR NEEM) ON SOYBEAN AND SAFFLOWER GRAIN YIELD AT VARIOUS DENSITIES OF INTERCROPPING SYSTEM IN NORTHERN TRANSITIONAL ZONE OF KARNATAKA

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Abstract

A field experiment conducted from 2019 to 2022 at the Main Agricultural Research Station, University of Agricultural Science, Dharwad, aimed to assess the feasibility of intercropping soybean and safflower with Melia dubia at different densities. The experiment included seven treatment combinations, with soybean and safflower intercropped with Malabar neem at varying densities, alongside a control of sole soybean. Results indicated that both sole soybean and safflower achieved significantly higher grain yields. However, intercropping these crops with Melia dubia at a spacing of 4 m x 4 m resulted in the highest grain outputs. Maximum tree height and diameter at breast height were observed at spacings of 4 m x 4 m (13.03 m and 25.40 cm, respectively) and 4 m x 3.5 m (12.97 m and 24.40 cm, respectively), compared to other spacings. Basal area and volume of Melabar neem were significantly greater at a spacing of 4 m x 4 m (0.049 m^2/pl and 0.383 m^3/pl, respectively) followed by 4 m x 3.5 m (0.044 m^2/pl and 0.342 m^3/pl, respectively). Grain yields of soybean (671.30 $kgha^1$) in the Kharif season and safflower (264.88 $kgha^1$) in the Rabi season were notably higher in the initial years at a spacing of 4 m x 4 m compared to narrower spacings. However, yields gradually decreased in narrower spacings in subsequent years due to reduced light, moisture, nutrients, and increased crown shade. The positive tree-crop interaction values were 133.3%. Additionally, the benefit-cost ratio was higher with soybean and safflower intercropping systems at wider densities. Melabar neem wood can be harvested for the paper and pulp industry in just 5-7 years, while wood maturing between 9-10 years is typically used for plywood.

Key Words : Melia dubia, agroforestry system, field crop, soybean, safflower, density.

Introduction

Agroforestry systems integrate land use for bothforestry and agricultural purposes, systematically exploring plant resources in a manner that minimizes environmental impact compared to monoculture systems (Brooker *et al.,* 2014). These systems have been recognized as effective practices in mitigating conflicts arising from the expanding population and limited arable land resources. The escalating demands for energy and food due to rapid changes in the agricultural environment underscore the imperative for advancing sustainable agricultural development. *Melia dubia* is a majestic deciduous tree that grows to a height of 25 to 30 meters, with a spreading crown and a clear bole of 8 to 9 meters. The wood of Malabar neem is an excellent and highly suitable raw material for wood-based industries, such as paper and plywood, due to its natural anti-termite properties, high pulp recovery, and exceptional fiber strength compared to traditional raw materials (Parthiban *et al.,* 2009). This promising tree, highly suitable for agroforestry with a life cycle of 8 to 12 years, is gaining economic importance in both domestic and global markets (Goswami *et al.,* 2020). *M. dubia* is an alternative indigenous fast-growing multipurpose tree species suitable for agroforestry systems in India, with immense potential to benefit mankind through a wide range of products and environmental services (Kulkarni, 2017). Its commercial cultivation is becoming popular among farmers due to its characteristics, such as fast growth, straight stems with minimal branching, low shade effect, and resistance to pests and insect attacks. Additionally, these trees contribute to carbon sequestration and the mitigation of climate change impacts (Thakur and Chauhan, 2008).

The cultivation of soybean (*Glycine max*) and safflower (*Carthamus tinctorius*) in the interspaces between Malabarneem tree densities has been reported to be more economical and provide a regular income from the agroforestry system (Mutnal *et al.,* 2012). These effects may be complementary or competitive depending on the level of competition for growth resources between the woody components and the crops, as well as site conditions. Use of intercropping systems, such as those in agroforestry, emerges as an alternative for more sustainable production through land use intensification, the inclusion of marginalized areas into the production system, and the reduction of new area exploitation, thereby contributing to biome maintenance. Consequently, efforts have been made to assess the densities of Malabar neem and the productivity of arable crops under the agroforestry system.

Materials and Methods

A field experiment conducted from 2019 to 2022 at the Main Agricultural Research Station, University of Agricultural Sciences, Dharwad, Karnataka, to study the growth and productivity of *Melia dubia* under an agroforestry system. The study area is located in the Northern Transitional Zone of Karnataka, at coordinates 15º 29' 16" N latitude and 74º 58' 91" E longitude, with an altitude of 2268 feet above mean sea level. The site features medium black soil with a pH of 6.85 and available nutrients as follows: nitrogen at 245 kg/ha, phosphorus at 19.6 kg/ha, and potassium at 285 kg/ha. The mean annual rainfall is 786.2 mm, recorded over 58 rainy days. The mean maximum temperature ranges from 37.2°C to 27.1°C, and the mean minimum temperature ranges from 21.5°C to 13.0°C.

In 2010, a field experiment on *Melia dubia* was established with seven different spacing treatments (625 – 2500 plants/ha), as follows: (T1) 4 m × 1 m spacing, (T2) 4 m × 1.5 m, (T3) 4 m × 2 m, (T4) 4 m × 2.5 m, (T5) 4 m × 3 m, (T6) 4 m × 3.5 m, and (T7) 4 m × 4 m spacing. The experiment was laid out in a randomized block design with three replications. Soybean (Var: JS-335) and safflower were sown during the Kharif and Rabi seasons, respectively, between two alleys. Protective irrigation was provided in the initial years. Silvicultural practices and soil working were carried out for the *Melia dubia* trees annually. Pruning of side branches of *Melia dubia* was conducted every year. The basal area was calculated using the formula: Basal area = Đd²/4 or g²/4Đ (Chaturvedi and Khanna, 1984). The total volume was determined using the formula: Total Volume = Total height × Basal area × Form factor (Chaturvedi and Khanna, 1984) and expressed in m³. Observations on growth parameters, including height, diameter at breast height, and field crop yield, were recorded regularly, and the results were presented in tables.

Results and Discussion

The growth attributes of *Melia dubia* are summarized in Table-1. According to the results, the maximum height was observed under 4 x 4 m spacing (13.03 m) and 4 x 3.5 m spacing (12.97 m), with 4 m x 3.0 m spacing yielding slightly lower heights (12.77 m). Additionally, the diameter at breast height of *M. dubia* was significantly greater under 4 x 4 m spacing (25.40 cm) and 4 m x 3.5 m spacing (24.40 cm) compared to other spacing configurations tested. These findings are consistent with previous research by Bhaskar *et al.* (2019) on the agroforestry system of *M. dubia*. The study also revealed notable variations in growth parameters across different planting densities, as reported by Karatangi and Patil (2017).

The basal area and volume of the trees were estimated using the formula and found to be significantly higher in the 4 m x 4 m spacing (0.049 m^2/tree and 0.383 m^3/tree, respectively), followed by the 4 m x 3.5 m spacing (0.044 m^2/tree and 0.342 m^3/tree, respectively), compared to other spacings. This result can be attributed to enhanced competition for above and below-ground resources, such as sunlight and soil nutrients. These findings are consistent with those reported by Prajapati *et al.* (2020), who found higher tree volume (0.070 m^3/tree) and biomass (34.73 kg^{-1}/tree) in sole *M. dubia* plantations at 4 m × 4 m spacing. Tree productivity varies significantly based on species genotype and environmental factors. Our study highlights that varying plant densities significantly influence tree growth. Tree height decreased with increasing density, while diameter at breast height and height were inversely related to changing density. The reduced growth parameters and decreased wood volume in *M. dubia* under narrow spacing can be attributed to improved translocation of photosynthates to the cambium region (Vikrant *et al.,* 2009).

The overall variation in volume can be attributed to the density of trees planted in narrow spacing, which directly influences the total yield in field crops such as soybeans. This high lights that growth results from a combination of age and spacing (Nissen *et al.,* 2001). Higher plant density per unit area may also suggest more efficient nutrient utilization compared to lower densities, aligning with findings by Harris *et al.* (2007) on competition, growth and structure in subtropical *Eucalyptus grandis* plantations. Significant differences in the girth, height, and volume of *M. dubia* species could be attributed to competition for limiting factors such as moisture, light, nutrients, and species morphology (Thakur *et al.,* 2019).

During the Kharif season, soybean crops were sown between the alleys of *Melia dubia*. The yield of arable crops varied significantly when grown in different spacing densities within the agroforestry system (Table-2). Soybean grain yield was significantly higher when grown solely (790.8 kg/ha) compared to within agroforestry systems. In the initial years, soybean grain yield was significantly higher in the wider spacing (T7) at 671.4 kg/ha compared to narrower spacings. However, after eight years of *Melia dubia* plantation, the soybean grain yield was severely affected in the narrow spacings, particularly in T1, followed by T2 and T3. In the Rabi season, safflower yield was higher when grown as a sole crop compared to being grown with tree species. Among the tree species studied, the grain yield was higher in T7 and T6 compared to T1 and T2 (Fig. 1). A significantly higher reduction in safflower yield was observed in the narrow spacings, T1 and T2. The yield reduction in

safflower was minimal with the T5 combination, but later, the safflower yield reduction remained higher in the T1 and T2 spacing combinations.

Soybean yield decreased significantly across various densities of Malbar neem plantation throughout the investigation (Table 1). During the first two years, there were no differences in soybean yield among the different densities of the species. However, by the end of the third year, the grain yields of soybean and safflower were significantly higher in sole cropping systems compared to intercropping systems. Among the densities of species, yields of soybean and safflower were notably lower in closer spacing compared to wider spacing. As the trees aged, the reduction in soybean and safflower grain yield was highest in the T1 treatment, followed by T2 and T3 combinations. This may be attributed to the closer spacing and larger canopy of the tree species, which allowed less light to reach the field crops. Crop yields of soybean and safflower were higher in the T7 and T6 treatments compared to other tree species. This is likely due to their deep rooting systems, sparse canopies, and low moisture demands. Hence, these tree species can be cultivated in fields without significantly reducing the yield of soybean and safflower.These results are consistent with the findings of Prajapati *et al.* (2020), who observed that the growth and yield parameters of *Melia dubia* planted in various spatial configurations, whether in silvi-pasture systems or sole plantations, differed significantly due to the intercropping of sorghum sudan grass. Similarly, Bhaskar *et al.* (2019) reported that finger millet grown in association with *Melia dubia* plantation at wider spacings recorded higher grain yields. Thakur *et al.* (2019) also indicated a significant difference in *Melia dubia* tree height and diameter at breast height due to the intercropping of *Cymbopogon spp*. Research on the intercropping system of *M. dubia* has demonstrated its potential for commercial use in the plywood and timber industries. There is also a need to raise awareness among farmers about the benefits and techniques of cultivating this multipurpose tree, along with ensuring the supply of high-quality planting material.

Conclusions

Overall, the present investigation highlighted significant differences in the growth and yield attributes of both *Melia dubia* and field crops. The growth parameters of *M. dubia* were superior under the agroforestry system, indicating a detrimental impact on the intercrops of soybean and safflower grain yield due to limited light, moisture, and nutrients under plantation conditions. Therefore, it can be concluded from these results that agroforestry has a positive effect on soybean and safflower grain yields for up to three years. The highest increase in wood biomass was observed in two spatial configurations, 4 m x 4 m and 4 m x 3.5 m, under the agroforestry system, making *M. dubia* a favorable species for block plantations. Within just 3-4 years, its wood can be harvested for use in the paper and pulp industry, while wood aged 5-7 years is typically used for plywood, and wood aged 7-12 years is ideal for construction.

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EXPLORING STRATEGIES TO MITIGATE RANCIDITY IN PEARL MILLET FOR IMPROVED SHELF LIFE AND ENHANCED NUTRITIONAL VALUE

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Abstract

Pearl millet's shelf life and quality are significantly impacted by rancidity, which results in underutilization of the flour . Pearl millet flour is well-known for being gluten-free and high in nutrients. On the other hand, rancidity can negatively impact the flour's overall flavor and quality. Odors and off flavors emerge as a result of the oxidation of lipids and oils in the flour, a process known as rancidity. This may lead to a decline in customer acceptance, which in turn may have an impact on products made from pearl millet that are sold. Furthermore, as a result of rancidity, vital elements like vitamins and antioxidants may be lost, significantly reducing the nutritional value of the flour. Thus, it is essential to use appropriate handling and storage methods to reduce the risk of rancidity and increase the longevity of pearl millet products. The promise of pearl millet flour can be completely realized by resolving the rancidity issue, offering customers a high-quality and nutrient-dense substitute for conventional wheat-based flours. In light of this, the study was conducted to: i) investigate the effects of refrigerated (4-5°C) and ambient (25°C to 28°C) storage on pearl millet flour variables; ii) evaluate the variability in a panel of pearl millet germplasm with a range of backgrounds for the oxidative and hydrolytic rancidity parameters; and iii) confirm the defined roles played by target enzymes through enzymatic confirmation in a subset of lines. The rancidity profile of the pearl millet panel under study varied, according to the study. Furthermore, LOX, POX, PPO, and Lipase enzyme differences have been discovered to be significant and marked among pearl millet genotypes; however, no major variations have been found with respect to the color of the bajra grains or the deterioration of their quality.

Rancidity in pearl millet involves the degradation of its lipids, especially unsaturated fatty acids, leading to undesirable flavors, odors, and overall reduction in quality. Here's an in-depth look at the types, mechanisms, and factors influencing rancidity in pearl millet :

Types of Rancidity in Pearl Millet

1. Oxidative Rancidity

Process: Occurs when the lipids in pearl millet are exposed to oxygen.

Mechanism: Unsaturated fatty acids react with oxygen, forming hydroperoxides that break down into aldehydes, ketones, and other volatile compounds.

Contributors: High temperatures, humidity, light exposure, and metal catalysts.

Result: Produces off-flavors and odors, often described as stale or paint-like.

2. Hydrolytic Rancidity

Process: Involves the breakdown of fats by water and enzymes.

Mechanism: Lipases, enzymes present in pearl millet, hydrolyze triglycerides into free fatty acids and glycerol.

Contributors: Moisture, lipase activity, and high temperatures.

Result: Leads to a soapy or bitter taste and increases acidity.

3. Microbial Rancidity

Process: Caused by bacterial and fungal growth on pearl millet.

Mechanism: Microorganisms produce lipases that further break down fats into free fatty acids and other compounds.

Contributors: Poor storage conditions that favor microbial growth, such as high humidity and warmth.

Result: Similar to hydrolytic rancidity but can produce additional off-flavors due to microbial metabolism.

Factors Influencing Rancidity in Pearl Millet

1. Fat Content: Pearl millet has a higher fat content compared to other grains, which makes it more susceptible to rancidity.

2. Storage Conditions: High temperatures, humidity, and exposure to oxygen accelerate lipid oxidation and microbial growth.

3. Enzymatic Activity: Lipases, particularly those that hydrolyze triacylglycerols (TAGs), play a significant role in lipid degradation.

4. Genetic Variations: Genetic differences in TAG lipase genes can influence the rate of rancidity. Non-functional mutations in these genes are associated with lower levels of rancidity.

Prevention of Rancidity in Pearl Millet

Preventing rancidity in pearl millet involves strategies that minimize the factors contributing to lipid degradation. Here are detailed methods to prevent oxidative, hydrolytic, and microbial rancidity in pearl millet:

1. Proper Storage Conditions

(a) Temperature Control :

- Store pearl millet in a cool environment to slow down the rate of lipid oxidation and enzymatic activity.

- Use refrigeration if possible, especially in hot and humid climates.

(b) Humidity Control :

- Keep pearl millet in a dry place. High humidity promotes microbial growth and hydrolytic rancidity.

- Use desiccants or dehumidifiers in storage areas to control moisture levels.

(c) Oxygen Reduction :

- Store pearl millet in airtight containers to minimize exposure to oxygen.

- Vacuum-sealed packaging or modified atmosphere packaging (using nitrogen or carbon dioxide) can significantly reduce oxidative rancidity.

(d) Light Protection :

- Store pearl millet in opaque or dark containers to protect it from light, which can catalyze oxidative reactions.

- Keep storage areas dark or use UV-blocking materials.

2. Use of Antioxidants

(a) Natural Antioxidants :

- Incorporate natural antioxidants like tocopherols (Vitamin E), ascorbic acid (Vitamin C), and polyphenols from natural sources (e.g., rosemary extract) into pearl millet products.

- Use plant extracts known for their antioxidant properties.

(b) Synthetic Antioxidants:

- Utilize food-grade synthetic antioxidants such as butylated hydroxytoluene (BHT) or butylated hydroxyanisole (BHA) to prevent oxidation.

3. Pre-Milling and Post milling Approaches

(a) Acid Treatment: Acid treatment involves soaking pearl millet grains in acidic solutions like 0.1% or 0.2 N HCl to reduce anti-nutritional factors and improve iron bioavailability.

(b) Dry Heat Treatment: Dry heat treatment involves heating pearl millet grains at high temperatures (100°C) for specific periods (30 minutes, 60 minutes, 90 minutes, or 120 minutes) to reduce moisture and improve storage stability.

(c) Blanching Treatment: Blanching involves briefly heating pearl millet grains in hot water or steam to inactivate enzymes and improve color and texture.

(d) Malting Treatment: Malting involves soaking pearl millet grains in water and then drying them to activate enzymes and improve nutritional value.

(e) Pearling: Pearling involves removing the outer layers of pearl millet grains to improve nutritional value and storage stability.

(f) Heat Treatment: Heat treatment involves heating pearl millet flour at high temperatures to reduce moisture and improve storage stability.

(g) Fermentation: Fermentation involves allowing pearl millet flour to undergo microbial fermentation to improve nutritional value and storage stability.

4. Genetic and breeding approaches are crucial for developing pearl millet varieties with improved storage stability and reduced rancidity. Here are some key strategies :

Genetic Variability and Diversity- Studies have shown a wide variation for rancidity among pearl millet lines[1]. Identifying low rancid lines like 07999R, 04999B, and 08222R can be effective for improving the keeping quality of pearl millet flour[1]. High heritability coupled with high genetic advance was reported for traits like 1000 seed weight, fat content, and activity of enzymes like lipase, lipoxygenase, and peroxidase, indicating additive gene effects governing these traits[1].

Correlation Studies : Correlation studies suggest that alcoholic acidity on the 5th day of storage was positively associated with the activity of enzymes lipase and lipoxygenase[1]. This information can be utilized for identifying lines and gene effects associated with rancidity in pearl millet, providing opportunities for developing better hybrids[1].

Diversity Studies : Diversity studies using cluster analysis identified lines with low alcoholic acidity on the 5th day of storage and moderate grain yield per plant (Cluster II)[1]. These lines can be effectively utilized for improving the keeping quality of pearl millet flour.

Rancidity Matrix- : Rancidity matrix has been developed to classify pearl millet genotypes into low, medium, and high rancidity categories based on the estimation of acid value (AV) as an indicator of esterified lipid hydrolysis and the presence of free fatty acids (FFA) over time[4][5]. This matrix can be a useful tool for breeders to identify low rancid lines for further improvement.

CRISPR-based Approaches : CRISPR-based approaches to create loss-of-function of lipase genes can be explored to mitigate rancidity in elite milled pearl millet germplasm[2]. This technology can help in developing varieties with improved storage stability.

5. Future strategies for extending the shelf life of pearl millet flour and its products can leverage advancements in technology, materials science, and food processing techniques. Here are some promising strategies :

(a) Advanced Packaging Technologies

Modified Atmosphere Packaging (MAP): This involves replacing the air in the packaging with a gas mixture that can slow down spoilage. Common gases used include nitrogen and carbon dioxide. MAP can significantly extend the shelf life of flour by reducing oxidation and inhibiting the growth of aerobic microorganisms.

Active Packaging: Active packaging materials can interact with the food to enhance its shelf life. For example, packaging that releases antimicrobial agents or absorbs oxygen and moisture can help preserve the quality of pearl millet flour.

Nanotechnology: Nanomaterials can be incorporated into packaging to provide barrier properties against oxygen, moisture, and light. These materials can also have antimicrobial properties, further extending shelf life.

(b) Innovative Preservation Techniques

High-Pressure Processing (HPP): HPP uses high pressure to inactivate microorganisms and enzymes that cause spoilage. This method can preserve the nutritional and sensory qualities of the flour without the need for preservatives.

Pulsed Electric Field (PEF) Processing: PEF uses short bursts of high voltage to inactivate microbes. It's a non-thermal method that can extend shelf life while maintaining the nutritional and functional properties of the flour.

Ultraviolet (UV) Treatment: UV radiation can be used to sanitize the flour, reducing microbial load and extending shelf life without affecting the flour's quality.

(c) Biopreservation

Natural Antimicrobials: Incorporating natural antimicrobial agents such as essential oils, plant extracts, or bio-preservatives like nisin and natamycin can help inhibit microbial growth and extend shelf life.

Probiotic Cultures : Adding beneficial probiotic cultures to flour products can outcompete spoilage microorganisms and extend the shelf life of fermented products.

(d) Genetic and Agricultural Innovations

Breeding for Shelf Life: Developing pearl millet varieties with naturally higher resistance to spoilage can extend the shelf life of the flour. This could involve traditional breeding techniques or genetic engineering.

Improved Post-Harvest Handling: Advances in post-harvest handling and processing can reduce the initial microbial load and moisture content, which are critical factors in shelf life.

(e) Smart Packaging and Monitoring

Time-Temperature Indicators (TTIs): These indicators can provide real-time information about the storage conditions and potential spoilage of the flour, helping in better inventory management and reducing waste.

Sensors and IoT Integration: Integrating sensors in packaging that can monitor and relay information about the storage environment (such as temperature, humidity, and gas composition) to a central system can help in maintaining optimal storage conditions and preventing spoilage.

(f) Sustainable and Eco-Friendly Approaches

Biodegradable and Edible Coatings: Developing biodegradable or edible coatings for flour can provide a barrier to moisture and oxygen while being environmentally friendly.

Solar Drying and Dehydration: Using solar drying techniques for pearl millet can reduce moisture content effectively and sustainably, extending the shelf life of the flour.

By integrating these future strategies, it will be possible to significantly enhance the shelf life of pearl millet flour and its products, ensuring they remain safe, nutritious, and high-quality for longer periods.

ROLE OF INSECT POLLINATORS IN CONSERVATION OF HIMALAYAN BIORERSOURCES

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Pollinators are crucial to biodiversity conservation, ecosystem protection, agriculture, and climate change adaptation. Crop pollination has a global annual value of US $235–577 billion. In Morocco, insect pollinators contributed USD $1235.06 M to main crop production, accounting for 8.52% of total agricultural GDP. In response to climate change, the geographical range and phenology of insect pollinators shift, their interactions with plants and other taxa are altered, and in some cases, pollination services are reduced. As a result, a decrease in pollination activity clearly compromises adequate crop production for a growing human population. Consequently, other plant species that rely on insect pollinators for outcrossing may also face extinction, putting human health and crop production at risk. The effects of elevated temperature on flowering plants and insect pollinators may have an impact on pollinator floral resources and plant pollination success, respectively. Plant reactions to global warming, irregular rainfall, and other environmental conditions may include altered blooming, nectar, and pollen production, as well as changes in floral resource availability, distribution, visitation quality, pollinator reproductive output, and threat from insect pests and diseases. Pollinator responses, such as changes in foraging spatial scale, body size, and lifetime, may also influence pollen flow patterns and pollination efficiency. Climate change must be considered because it has the potential to have a substantial influence on pollinator populations, resulting in lower productivity and imperiling food security. Efforts should therefore be directed toward the preservation of pollinators. Thus, monitoring the status and trends of insect pollinators and assessing pollination functions and services are needed to address the potential effects of climate change and inform adaptive mnagement of ecosystems that could help ensure food security and agricultural sustainability.

Insect pollinators are arguably one of the most important components of the agro-biodiversity that maintain ecosystem services leading to sustained crop production, food security, livelihood of farmers, beside many others. Many species of honeybees, bumblebees, flower flies, butterflies, beetles, and wasps play important roles in the pollination of diverse flowers and to conserve germplasm. The Himalayan region and its watersheds is known to be rich in biodiversity of insect pollinators but it is threatened by climate change apart of many other anthropogenic pressures. This region has a poor species inventory and there is an urgent need of a rigorous investigation and assessment about the ecology and conservation status of insect pollinators to promote and maintain the sustainable ecosystem service and biodiversity maintenances (Regmi, G.R. *et al*., 2020). Recommended actions include as well doing more research to fill knowledge gaps, expanding studies to cover a wider range of pollinators, and promoting coordinated follow-up work at the local, regional, and national levels.

PROTECTED CULTIVATION OF VEGETABLES AS A LIVELIHOOD TECHNOLOGY

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Abstract

Protected cultivation of high value vegetable crops is spread all over the world especially in Asia, Europe and USA. With rapid globalization, shrinking of land and climate change, the protected cultivation of high value crops has emerged as noble technology for ensuring higher productivity, improved quality and better economic returns.

Introduction

Protected cultivation is the concept of growing potential crops in the modified natural environment for ensuring optimum growth of the crop plants without any or least stress and hence it offers a great scope to harness this potential of growing the high value crops by achieving independence of climate and weather, and to grow these crops during off -season and in marginal environments. Globally, there is urgent need to enhance productivity and quality of the produce to fulfill the demand of ever increasing quality and health conscious consumers. The use of covering techniques started with mulching followed by row covers, plastic low tunnels, walk in tunnels, high tunnels, polyhouses or greenhouses for growing tender crops under protection. All these covering devices were used to overcome various abiotic and biotic stresses since, limited areas around the world are endowed with favourable growing conditions for round the year crop production in open environments.

History and present scenario of protected cultivation

Protected cultivation on commercial scale is practised in over 50 countries across the world. In the past half century, tremendous progress has been made both in popularizing and improving greenhouse or protected cultivation technology. Before that, protected cultivation was restricted principally in botanical gardens and experimental stations. The major revolution in the adoption of protected cultivation technology has been the development of inexpensive and light weight plastics as green house cladding material and at present, it has virtually replaced the traditionally used cover of glass. Protected cultivation has rapidly expanded in many countries as early as 1960, when plastics were introduced in agriculture and subsequently during 1970's, when the rise in oil prices has resulted in the increase of energy costs. The area under protected cultivation is approaching two million hectares worldwide. In contrast to glasshouses, plastic greenhouses have been adopted in all the continents, especially Asia and USA. During last decade, there has been tremendous increase (5-10 times) in area under plastic greenhouses in different countries. The first use of polyethylene as a greenhouse covering material was in the year 1948. Globally, more than 50% area is covered with mulch especially in Mediterranean region, which is commonly used for controlling weeds, increasing temperature and retaining soil moisture. Mostly low density polyethylene (LDPE) or linear low density polyethylene (LLDPE) films are used.

India is the leading vegetable producer in the world, occupying around 11,112 thousand ha area with an annual production of 2,04,958 thousand MT in the year 2023-24, and ranks next to China. In India, the area under greenhouse cultivation of horticultural crops was more than 110,000 ha during 2020 and was mainly confined to Maharastra and Gujrat (Singh *et* al. 2020). At present, the area under greenhouses might have been doubled since the protected cultivation of high value crops has spread to many other states. India and China have tremendous potential for this technology. Israel and Turkey have significant area under greenhouse cultivation of flowers and vegetables whereas in Saudi Arabia, cucumber and tomato contribute more than 90% of total production. Egypt has also considerable area under greenhouses wherein tomato, cucumber, pepper, melons and nursery of different crops are grown. In Asia, China and Japan have considerable area under greenhouses. The Chinese use local material for frames and polythene films for cladding. Greenhouses in Japan and South Korea are used for growing vegetables and flowers and considerable demand of these is met from greenhouse production alone.

Principle of greenhouse cultivation

The greenhouse is covered with a transparent material such as plastic, PVC sheet or polycarbonate sheet or FRP (Fiber reinforced plastic) or glass.

Based upon its transparency the greenhouse cover transmits most of the sunlight.

The crop, floor and other objects inside the greenhouse absorb the sunlight admitted inside the greenhouse.

These objects in turn emit long wave thermal radiations for which the greenhouse covering material has lower transparency and as a result of this the solar energy is trapped thus leading to increased temperature inside the greenhouse.

This is known as greenhouse effect.

Objectives of protected cultivation

Protected cultivation is mainly concentrated on growing of few promising vegetables (capsicum, tomato & parthenocarpic cucumber) in which offers distinct advantages of off seasonality, high productivity, improved quality and extended availability *etc*.

The main objective of protected cultivation is to protect the plants from abiotic stress, whether physical or non-living organisms like temperature, excess/deficit water, hot and cold waves, and biotic factors such as pest and disease incidences, etc.

Efficient water use with minimal weed infestation.

Protected cultivation increases the production per unit area thereby increasing the profits.

Protected cultivation promotes the high value and quality of horticulture crops.

Protected farming propagates the healthy, uniform, and disease-free planting material, which improve germination percentages which provide better hardening.

Types of greenhouses

In general, 3 types of greenhouses are made in India viz. low cost greenhouse/polyhouse, medium cost greenhouse and high tech greenhouse/polyhouse.

(i) High tech or fully climate controlled or high cost greenhouses : High tech or fully climate controlled greenhouse is constructed to achieve higher accuracy of climate control to enhance the cultivation period of the crops. In this type of greenhouse, evaporative cooling and the heaters are used to maintain the required temperatures inside greenhouse when needed. This greenhouse consists of a sensor, a comparator and an operator. The temperature humidity and light are automatically controlled inside.

These greenhouses are generally used for cultivation of tomato and sweet pepper over a longer period of time. The greenhouses are made up of plastic except in cold places where rigid plastic or glasshouses are used.

(ii) Partial climate controlled or medium cost greenhouses : The structural frame is made up of galvanized iron pipes, like the climate controlled green house, but only the exhaust fans with evaporative cooling pads are provided to maintain the favorable temperature and humidity during summer. These types of greenhouses are suitable for vegetable cultivation in low and mid hills in North India. The basic cost of installation of these greenhouses is half to that of high tech or fully climate-controlled greenhouses.

(iii) Naturally ventilated or low cost greenhouses : These are simple greenhouses with low initial investment. The frame may be galvanized iron pipes, bamboos, wooden logs or steel pipes, or any other local material but no heating or cooling systems are provided for the structure. The top of the polyhouse is covered with the plastic and the sidewalls have the insect proof nets from ground or at 2-4' to a height of 5 to 8' with or without manually roll-able plastic cover. The initial cost of these polyhouse is less than half to that of semi climate controlled greenhouses. Modified naturally ventilated polyhouses offer great potential for commercial cultivation of high value vegetable crops.

Plastic low tunnels

Plastic low tunnels or row covers are simple and low cost structures for off-season production of vegetable crops in open field. These are flexible transparent coverings that are installed over single or multiple rows of vegetable crops during winter season to enhance plant growth as the micro-climate around the plants get the congenial warmth. The soil temperature is also raised and the plants are also protected from hail, winter cold injury, frost and strong winds etc.

Conventional versus Greenhouse Production

Conventional or traditional agricultural practices can only control the nature of root media through operations like tillage,

manuring, fertilizer application, irrigation etc. There is no control over light, temperature, air composition, humidity etc. in open field cultivation. However, greenhouse farming can be used as one of the alternative solutions for these parameters. Some of the benefits of greenhouse cultivation are :

Efficient use of agro-chemicals by minimizing emission of waste and recycling.

Efficient use of most parts of the phyto mass produced.

Efficient use of solar, wind and thermal energy.

Off season cultivation.

Protect plants from environmental hazards such as heavy rain, strong wind, excess solar radiation and extremes of temperature and humidity.

Better quality of produce.

Higher productivity.

High-income generation for small land holdings.

Site selection, orientation and parameters to be studied

If possible, locate the greenhouse where it will receive at least 6-8 hours of direct sunlight during the winter months. Site of greenhouse should be sheltered from high winds, it should be close to water and electricity, and easily accessible from your home. Avoid deep slopes, gorge areas and areas shaded by buildings or trees during the winters. The best orientation of the greenhouse construction is East-West. This will result in receiving more solar radiations during the winter. Green house is a frame structure which covered with transparent material like glass, polyethylene and poly carbonate etc. It consists of two components frame and covering material. The covering material used for a greenhouse works as a barrier to air flow and traps energy within the greenhouse, which heats both the plants and the ground inside it. This warms the air near the ground, which increases the temperature inside the greenhouse. The greenhouses can be used for growing high value vegetables, Flowers, nursery of different crops, ornamental and medicinal plants. The advantages of greenhouses are high productivity per unit area so that the genetic potentiality of the crop can be fully harnessed. In addition to this off-season vegetables and nursery can be grown which fetch high prices in the market. It is also easy to protect the crops against pests, diseases and extreme climatic conditions.

Greenhouse cultivation is a highly intensive enterprise requiring substantial labour and capital inputs. Because of this, potential growers should carefully consider all factors necessary for a successful enterprise. In many ways, Greenhouse vegetable production is a 24-hour commitment. Its maintenance, crop production and handling emergencies require constant vigilance.

The parameters which can be measured in the greenhouse can be classified into four categories :

Environmental

Temperature

Humidity

Solar Radiation

Carbon dioxide Concentration

Wind

UV Radiation

Soil

Soil moisture

Soil Temperature

pH

Nutrient status

Biological Parameters

Physical parameters and

Chemical Parameters

Plant

Photosynthesis

Leaf Area Index

Water

Water Quality

Nutrients in re-circulated water in fertigation (soilless Cultivation)

Advantages of Protected Cultivation Technology

Raising of vegetable nursery or transplants under protection.

The potential of polyhouse production technology to meet the demand of producing good nutrition and healthy foods and quality vegetables free from pesticides can be fully exploited.

Vegetable crops can be grown under adverse weather conditions round the year and off-season.

The vegetables can be produced with higher productivity and uniform quality of produce than open field cultivation.

Management and control of insect-pests, diseases and weeds is easier.

There is efficient resource management.

In the hilly terrains, the farmers generally have small land holdings and this technology provided a useful impetus to their farming livelihood by more productivity and more money from less land.

Constraints and challenges

Polyhouse culture has not become popular as yet in India as compared to western countries. High cost of inputs and non-availability of various components are the two major limiting factors in the adoption of polyhouse technology. Non-availability and scarcity of labour is another major limiting factor. Greenhouse and other structures design for different agro-climatic of the region is not standardized yet. Lack of awareness among farmers pertaining to potentials of protected vegetable production and lack of major research programme on protected vegetable farming are other limiting factors. Seed production is highly technical and labour intensive inside polyhouse. It is also difficult to maintain the pollinator inside polyhouse specially for seed production programmes.

Future needs

Polyhouse vegetable production in the country is still in infancy and for its rapid commercialization, there is urgent need to redress the following issues related to this technology :

Standardization of proper design of construction of polyhouses including cost effective and indigenously available cladding and glazing material.

Development of cost effective agro-techniques for growing of different vegetable crops in the different types of polyhouses and lowering energy costs of the green house environment management.

Major research activities on growing of vegetables under protected covers should be launched by ICAR and SAU's.

Import of planting materials, structural designs and production technologies which are not relevant under Indian conditions should be discouraged and in turn emphasis should be given to develop own F1 hybrid varieties so that seed are made available to the growers in time and at cheaper rates.

Conclusions

Protected cultivation of vegetables offers distinct advantages of quality, productivity and favourable market price to the growers. Concerted and continuous efforts are required to develop the required indigenous technology suitable for our country rather than going in for blatant aping of the western technology. Economically viable and technologically feasible production technology suitable for the Indian agroclimatic and geographical conditions is needed at the earliest. Government initiatives and efforts in popularizing the greenhouse technology among the farming community of the country needs to be strengthened. There is a need for the Government to encourage the farmers by providing timely subsidy for taking up this new technology in a big way.

GUMMOSIS PROCESS AND SUSTAINABLE TAPPING TECHNIQUES FOR HIGH GUM PRODUCTION

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Introduction

Gums and resins occupy a prime place among Non-Wood Forest Produce (NWFP/NTFP) and are known to mankind since time immemorial. Gum trees are economically important and found in tropical moist and dry deciduous forests, produce a significant quantity of gum, which are widely used as industrial, food and medicinal purposes in India. Gums are important natural biopolymers demand from biological system under stress situation i.e. disease injury to bark etc. being used as a principal components in food, pharmaceutical industries and play a key role in social and livelihood of tribal communities. Gums are metabolic by-products of plant tissues either in normal course or often as a result of disease or injury to the bark or wood of certain plants and it can not be re-entered with plant system. India is a rich center of plant biodiversity having more than 15,000 plant species including about 120 gum yielding plants and produces annually about 2,81,000 tonns of gum.

Table-1 : List of important natural gum tress and their types.

Name of Trees	Example	Type	Grade
Steruculia urens	Karaya gum	Exudate gums	I
Acacia nilotica	Acacia gum		II
Acacia catechu			II
Acacia senegal			II
Anogeissus latifolia	Ghatti gum		II
Astragalus gummifer	Tragacanth gum		II
Cyamopsis tetragonolobus	Guar gum	Plant seed gum	-
Ceratonia siliqua	Locust bean gum		-

The unscientific and brutal methods of gum tapping and over exploitation leading to the death of the tapped trees and erratic supply of these products in the market. On account of injurious and wasteful tapping and over-exploitation have been markedly declined the populations of gum producing plants. On the absence of cultivation of these trees there is a grave concern about the loss of the wild germplasm. An introduction of new tapping methods using ethephon a plant growth regulator which is non toxic, environmental friendly, inexpensive, easily available plant growth regulator induce slow release of ethelene and develops artificial stressful environment in internal tissues.

Gum Tapping Methods

1. Mechanical method : Traditionally, trees are tapped by blazing, stripping of the bark or making deep cuts in the base of the tree with axe and other tools **(Fig.-1).**

2. Chemical tapping technique : The chemical gum tapping of selected trees has initiated by using different doses of gum enhancer ethephon (2-chloro-ethyl-phosphonic acid) (trade name Ethrel) having 39%, in the tree trunk by battery operated drill machine to induce gummosis. The whole treatments are made through a syringe of 10 ml volume. The 4ml gum enhancer is injected twice during the whole period of tapping. First treatment injected in March and second in the month of May. **(Fig-2)** The chemical treatment was applied after 10 O'clock in between 10-12 am twice.


1. Two slanted hole of about 6 mm diameter with 1" deep is made on at least one meter tree girth and confined one feet above the collar of the tree with the help of battery operated drill machine.

2. After that, 4 ml (2 ml each hole) dose of ethephon. A gum enhancer is applied/injected in the hole with the help of syringe and immediately the hole is covered (patched up) by moistened clay.

3. It is observed that the tree starts exudating gum within 1-2 hrs of application of treatment. The exudates gum was picked by hand as large stalactic mass.




Table-2 : Effect of mechanical amd chemical tapping techniques on average quantity of gum exudation (g) in gum tress from April to June month.

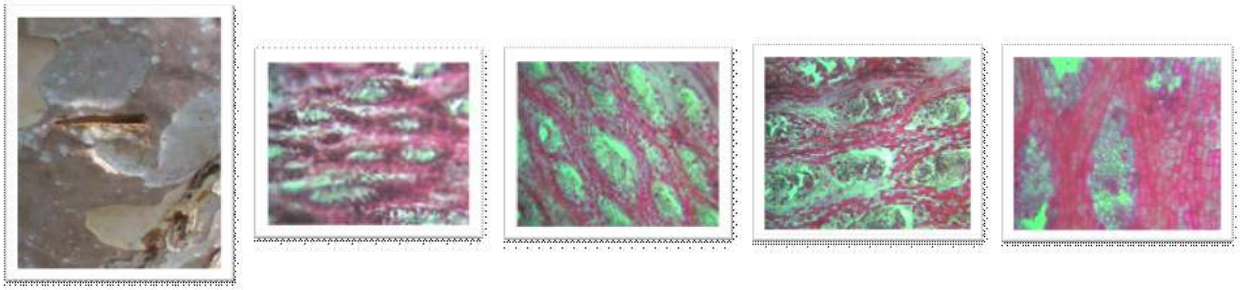
Tapping techniques	*Sterculia urens* Roxb (Elevation-286 m)	*Anogeissus latifolia* (Elevation-277m)	*Acacia nilotca* (Elevation-285 m)
Mechanical method	401.39	361.3	41.49
Chemical method Ethephon (3.9%)	801.45	705.64	112.43

Source : Kuruwanshi et al. IGKV, Raipur (Chhattisgarh)

Mechanism of Gummosis

Anatomical and histological studies are done to find out the mechanism of gummosis. The process of gummosis related to biotic and abiotic stress of tree plant plays significant role in production of biopolymers (gum/resin). An application of ethephon enhanced the process of gummosis, due to formation of gum ducts and histological changes.

The stem has normal gum ducts only in the pith and cortex. Gum ducts or cavities are normally absent in the wood. Wood is characterized by diffuse or occasionally banded parenchyma, broad multiseriate rays and thick walled fibers. Administration of ethephon into the stem induced extensive development of gum cavities in the secondary xylem. The cavities are developed from the axial parenchyma cells formed after ethephon treatment. Upon ethephon treatment, the ray cells remain intact, but only axial parenchyma cells are formed from the fusiforminitials. The cambium soon renewed its normal function and consequently a band of traumatic tissue consisting of only axial and ray parenchyma cells are formed in the outer sapwood. The axial parenchyma cells undergo active transverse divisions and the derivatives enlarge to form vertical files of isodiametric cells, the cavity initials. They are mostly thin walled, and have dense cytoplasm and large nuclei. The cavity



Control 2 hrs 4 hrs 6 hrs 8 hrs

initially develops lysigenously from a group of such cells. The lysis is triggered by the disintegration of the vertical file of cells proceeded by the darkening of cytoplasm and disappearance of nuclei. Lysis of more cells progresses in vertical and tangential directions forming a cavity. But a definite epithelium is not formed around the cavities. Tangential widening of a cavity is limited by multiseriate rays which remain mostly intact. Almost all axial parenchyma cells undergo lysis forming a system of tangentially anastomosing cavities around the intact islands of multiseriate rays. The cavity is filled with disintegrating cells and gummy substances. Nervertheless, at places of extensive cavity formation, some multiseriate rays also disintegrate. But always ray cells are the last to be affected. In radial longitudinal sections, the cavities appear as vertically elongated system interrupted by multiseriate rays.

Conclusion

The traditional method of tapping using axe resulted damaging the trees and make it susceptible to attack by insect or pathogen and lead to death of tree. The tree girth, tree inclination, direction of treatment for tapping, tree elevation, temperature and relative humidity play significant role in production of gum. The peak period of summer when temperature > 30-40 0C and RH < 40-45% significantly superior for potential production of gum.

The formation of gum duct (traumatic duct) is started quite earlier within 30-40 minutes and gum duct formation is observed within 2 hrs in Gum karaya bark section. However, in Dhawda and Babool it takes little bit more time (2-4 hrs) in gum duct formation and observed in histological analysis of bark section after ethephon treatment.

The lysigenously formed gum ducts are present in the pith and cortex of the young stem of Sterculia urens but absent in the xylem. The gum cavities are induced upon ethephon treatment. However, Anogeissus latifolia trees have no natural pre-formed gum producing tissue system in the wood but the gum cavities are induced schizo-lysigenously in the axial parenchyma of sapwood upon ethephon treatment. In Acacia nilotica, ethylene may cause gum pocket or cavity or cyst formation in plants. The loss of middle-lamellar cohesiveness and the breakdown of the primary cell walls in the phloem tissue in and around gum pockets.

Use of gum enhancer is found to be significantly effective in potential production of biopolymers (gum). The use of ethephon @3.9% in 4ml in two concomitant doses of 30-45 days interval is significantly effective for higher production of gum when it is injected by drill method.

ETIOLOGY AND MANAGEMENT OF NEW EMERGING POKKAH BOENG DISEASE IN MAIZE

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Maize (*Zea mays* L.) is the third most important cereal crop in the world and has wide adaptability to diverse agro-climatic conditions. Maize is the major source of food security and economic development in India. Climate change have been influenced the pest and disease spectrum in maize ecosystem. Pokkah boeng is an emerging disease of maize causing economical loss to the crop in India. Symptomatic maize leaves were sampled and the pathogen was identified as *Fusarium verticillioides* through molecular tools. DNA sequencing and BLAST analysis revealed 100 per cent homology with *Fusarium verticillioides* MK264336. Further, PCR amplification with *Fusarium verticillioides* specific primers VER1/VER2 confirmed the species. The fungus was designated as *Fusarium verticillioides* maize isolate SNK 01 and the sequences were deposited in GenBank with accession no ON110289. Disease symptoms observed were, leaves turned pale yellowish green with small brown spots, chlorotic appearance and these developed into stripes. Wrinkling of leaves was noticed followed by splitting and rotting. The present study forms the first report of Pokkah boeng disease of maize caused by *Fusarium verticillioides* in India. Survey relieved that disease incidence ranged from 8.64 to 38.73 per cent. The weather parameters *viz*., relative humidity of more than 85 per cent coupled with cumulative rainfall of 431.2 mm, 17 rainy days minimum temperature of 19-21°C and maximum temperature 27-29°C favoured the development of the disease. Yield losses were between 22.46 to 32.26 per cent. The disease was effectively managed by foliar application of Carbendazim 50% WP @ 1g/l, Carbendazim 12% + Mancozeb 63% WP @ 2 g/l and Hexaconazole 5% EC @ 1 ml/l. These treatments indicated 40-55 per cent disease reduction over untreated control.

Abstracts

ASSESSING GENETIC VARIABILITY, HERITABILITY, AND GENETIC ADVANCE HELPS IN SELECTING SUPERIOR GENOTYPES AND DESIGNING EFFECTIVE BREEDING STRATEGIES FOR LENTIL IMPROVEMENT

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Abstract

Lentil (*Lens culinaris* Medik.) is one of the important pulse crop of the world. The low productivity of lentils grown in Bihar is attributed to the narrow genetic base of the released cultivars which results in susceptibility to biotic and abiotic stresses. For enhancement of productivity and production, broadening of the genetic base is essentially required. The present study was carried out to get better information regarding GCV, PCV, heritability and genetic advance, pre-requisite for formulating an effective breeding programme. Thirty-nine accessions of lentil (*Lens culinaris* Medik.) including three checks viz., (Pusa Ageti Masoor, HUL-57, IPL-316) were evaluated in randomized block design (RBD)in Rabi 2021-2022 for eleven quantitative traits. Analysis of variance for agro-morphological characters showed significant differences among the studied accessions indicating the existence of wide variability. Adjusted mean values were used for the estimation of genetic variability parameters. Result: The high to medium magnitude of genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV), high heritability coupled with high genetic advance were expressed by traits viz., number of secondary branches, number of pods per plant, number of effective pods, grain yield per plant and biological yield per plant. On the basis of per se performance of thirty-nine accessions including checks it is concluded that best performing lentil genotypes viz., BRL 22-7 and BRL 25-4 from cluster IV and BRL 25-5, BRL 22-4 and BRL 33-4 from cluster V can be used as divergent parental lines for greater heterotic effects and extracting recombinants in the segregating generations for yield and associated traits.

SYNTHESIS OF PARCHMENT IMPREGNATED BARIUM MOLYBDATE MEMBRANE : AN ASSESSMENT OF EXPERIMENTAL APPROACH THROUGH ELECTROCHEMICAL PARAMETERS

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Abstract

The barium molybdate membrane is prepared by the ion-interaction method. Electrical conductivity has been measured for using different bi-univalent Electrolytes ($MgCl_2$, $CaCl_2$ or $ZnCl_2$). The effect of concentration of the electrolyte, kind of ion, and the size of the ion on the permeation rate have been studied. The permeation rate decreases with increasing the concentration of the electrolyte and the size of the ion. Membrane was characterized by using Thermogravimetry Analysis (TGA), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), and X-Ray Diffraction (XRD) analysis. The artificial membrane was tested for its antibacterial activity against gram-negative and gram-positive bacteria.

EFFECT OF NANO NITROGEN ON GROWTH, YIELD AND QUALITY OF *BT* COTTON (*GOSSYPIUM HIRSUTUM* L.)

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Abstract

A field experiment was conducted during *Kharif*, 2022 at MARS, Raichur, Karnataka to study the effect of nano nitrogen on growth, yield and quality of *Bt* cotton (*Gossypium hirsutum* L.). The experiment was laid in split plot design with three replications. The main plot consists of three different doses of nitrogen (M_1-50% RDN, M_2-75% RDN and M_3-100% RDN and sub plot consists of five different concentrations of nano nitrogen foliar spray (S_1- 0.4% nano nitrogen at flowering & boll

initiation stages, S_2- 0.4% nano nitrogen at flowering, boll initiation & boll development stages, S_3- 0.6% nano nitrogen at flowering & boll initiation stages, S_4- 0.6% nano nitrogen at flowering, boll initiation & boll development stages and S_5-Control, respectively). The RDF for hybrid is 180:90:90 kg NPK ha^{-1}. US-7067 BG-? hybrid seeds were selected for the experiment. The results revealed that, among main plots, significantly higher seed cotton yield, gross returns, net returns and BC ratio (3388 kg ha^{-1}, Rs.2,71,024 ha^{-1}, Rs.1,88,736 ha^{-1} and 3.29, respectively) were recorded by treatment received with 100 per cent RDN followed by 75 per cent RDN (3376 kg ha^{-1}, Rs.2,70,112 ha^{-1}, Rs.1,88,291 ha^{-1} and 3.30, respectively) which found *on par* with each other. Among sub plots, significantly higher seed cotton yield, gross returns, net returns and BC ratio (3485 kg ha^{-1}, Rs.2,78,784 ha^{-1}, Rs.1,95,414 ha^{-1} and 3.34, respectively) were recorded by treatment with 0.6 per cent nano nitrogen sprayed at three stages followed by 0.4 per cent nano nitrogen each at three stages (3465 kg ha^{-1}, Rs.2,77,238 ha^{-1}, Rs.1,94,768 ha^{-1} and 3.36, respectively) which found *on par* with each other. None of the interaction effects were found significant. Similar trend was noticed with respect to growth, yield parameters, uptake of N, P, K by crop and their availability in soil after harvest of the crop.

PERFORMANCE OF TRADITIONAL CROPS IN AGROFORESTRY SYSTEM UNDER TERAI CONDITIONS OF U.P, INDIA

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Abstract

A large area is available in the form of boundaries, bunds, block plantations, wastelands where this system can be adopted. Poplar and Eucalyptus are suitable and promising agro forestry tree species, which is planted cropping system. In this particular study, Economical aspects and viability of wheat and Mustard have been studied. Trees intercropped with crops attained better growth and higher litter. In the study of nutrients (N,P,K) it is revealed that all the three nutrients increase as the age of trees increases. All the nutrients increases as the tree age are increased. Nutrients in the soil are high insole plantation of trees. The yield of intercrops is low in the fields which are cultivated along with trees. The height of intercrops is higher under poplar than intercrops under Eucalyptus. This might be due to the leaf pattern and its canopy shade. No significant results were obtained for tillers per plant and effective tillers plant in wheat, however, more tillers were found in pure cropping. In Mustard primary branches per plant and seeds per siliqua were at par under Eucalyptus, Poplar, and pure cropping. Yield parameters such as secondary branches per plant, siliqua per plant, and test weight were significantly higher in pure cropping. The grain and straw/stover yields of both the crops under Eucalyptus and poplar decreased significantly as compared to open fields(crops without Eucaylptus and Poplar).

Net returns from a crop grown with Eucalyptus & Poplar and sole cropping revealed that maximum income of (Rs.82819.00/ha) was recorded in pure cropping (monoculture of wheat, whereas net returns from Mustard grown Eucalyptus. Poplar and sole cropping revealed that maximum income (Rs.67275.00/ha) and whereas negative net returns of Rs.3943.47/ha (under 4years Eucalyptus) and also negative net returns Rs.8731.00/ha (under 5 yrs Poplar) was recorded in Mustard oil.

MOLECULAR IDENTIFICATION AND ENUMERATION OF AFLATOXIGENIC *ASPERGILLUS FLAVUS* IN MAIZE-BASED DAIRY AND POULTRY FEEDS

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Abstract

Aflatoxin, the potential carcinogen produced as a secondary metabolite mainly by *Aspergillus flavus* and *A. parasiticus*, is reported as major contaminant of food and feedstuffs which ultimately affect human and animal health and it became the major constraint in export of maize and maize based feeds between countries. This study was conducted to evaluate the contamination of feedstuffs with *Aspergillus* spp., to detect the genes involved in the biosynthesis of aflatoxin and to quantify the aflatoxin. Ten *A. flavus* isolates were isolated from maize-based dairy and poultry feed samples across Karnataka, DNA of all the isolates was extracted and subjected to PCR amplification by using specific primers (*aflJ*-F and *aflJ*-R) known to bind for toxin biosynthesis gene and were characterized for the presence of the toxigenic gene. Further isolates were also subjected

to HPLC for quantification of aflatoxin. The presence of the *aflJ* gene was associated with aflatoxin production except in three isolates, which did not synthesize aflatoxin but possessed the gene in their genome. Out of 10, seven isolates of *A. flavus* produced aflatoxin B1, with concentrations ranging from 2.76 to 439.16 ppb. Based on the findings, molecular detection of the aflatoxin biosynthesis gene could be considered as quick and reliable method for the detection of aflatoxigenic *Aspergillus* and the same will be useful in designing the successful management strategies of the fungus and its toxin contamination in the feed and foodstuffs.

ARTIFICIAL INTELLIGENCE AS A REVOLUTION IN AGRICULTURE FOR ENSURING FOOD SECURITY

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Abstract

The integration of artificial intelligence (AI) in agriculture has the potential to transform food systems and help address the global food crisis. By analyzing data from various sources, AI can help farmers make data-driven decisions, optimize resource usage, and reduce environmental impact. The World Economic Forum has reported that AI integration in agriculture could bring about a 60% decrease in pesticide usage and a 50% reduction in water usage. The agricultural industry faces various challenges such as lack of effective irrigation systems, weeds, issues with plant monitoring due to crop height and extreme weather conditions. But the performance can be increased with the aid of technology and thus these problems can be solved. It can be improved with different AI driven techniques like remote sensors for soil moisture content detection and automated irrigation with the help of GPS. Artificial Intelligence in agriculture has brought an agriculture revolution. This will lead to more informed decision-making and improved crop yields, essential for addressing the global food security challenge. The modern world is all about data. Farmers can gather, and then process more data in less time with AI and analyze market demand, forecast prices as well as determine optimal times for sowing and harvesting. Application of AI in agriculture provides farmers with real-time crop insights, helping them to identify which areas need irrigation, fertilization, or pesticide treatment. Innovative farming practices such as? vertical agriculture? can also increase food production while minimizing resource usage. Challenges of AI in agriculture is Large upfront costs, Reluctance to embrace new technologies and processes, Lack of practical experience with new technologies, A lengthy technology adoption process, Technological limitations, Privacy and security issues.

Key words : Agriculture, Artificial Intelligence, Technology, Food security.

SEASONAL AND CROP DIVERSITY VARIATION SHAPE THE COMPOSITION OF BIRD COMMUNITIES IN AGRICULTURAL LANDSCAPES OF HARYANA

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Abstract

Agricultural landscapes are dynamic ecosystems where the composition and diversity of bird communities are influenced by multiple factors, including seasonal variation and crop diversity. This study examines how these factors shape bird communities in the agricultural landscapes of Haryana, a state in northern India characterized by diverse cropping systems and marked seasonal changes. Here, we disentangle the impact of seasonal variation (summer, monsoon, and winter), cropping practice (mixed crop and mono-cultural crop), crop type (Conventional and direct seeded rice, cotton, moong, pearl millet, wheat, and other crops), landscape heterogeneity, and the number of trees on the richness and abundance of farmland birds and their feeding guilds conducted within human-dominated agricultural landscapes of Haryana. The study was conducted in various agricultural fields across Haryana, covering diverse cropping systems, including rice-wheat-mustard, cotton, and Pearl Millet and Moong rotations. Haryana experiences a subtropical climate with distinct seasons: hot summers (April-June), monsoons (July-September), and mild winters (October-March). Bird surveys were conducted using point count methods across different seasons to capture temporal variations. Points were randomly selected across different crop types to ensure a representative sample. Each point was surveyed for 10 minutes, recording all bird species seen or heard within a 50-meter

radius. Surveys were conducted in the early morning hours to coincide with peak bird activity. Bird species richness and abundance were calculated for each crop type and season.

Keywords: Crop diversity, seasons, variation, avian diversity

GENETIC VARIABILITY AND G X E INTERACTION STUDIES FOR AGRO-MORPHOLOGICAL AND PHYSIO-BIOCHEMICAL TRAITS IN MUNGBEAN [*VIGNA RADIATA* (L.)WILCZEK]

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Abstract

Mungbean is an ancient pulse crop widely cultivated under different agro-ecological situations in India. It is the potential source of protein, essential minerals and vitamin-B (vitamin-C in sprouting grains). Genotype and its interaction with the prevailing environment is the basic factor determining the final yield. The genotype x environment interaction is particularly important in the expression of quantitative characters, which are controlled by polygenes and are greatly modified by environmental influences. Thus, in order to have unbiased estimates of various genetic components, it is imperative that the experiment must be repeated over different environments. The evaluation of genotype x environment interaction gives an idea of the stability or buffering ability of the population under study. Genotype x environment interaction is of common occurrence and often creates manifold difficulties in interpreting results and thus hampers the progress of breeding programme aiming at the further genetic improvement of crop plants. Hence, the knowledge of magnitude and nature of genotype x environment interaction is very useful to a breeder for proper understanding and assessment of his material. So it is necessary to screen and identify phenotypically stable genotypes which could perform more or less uniformly under different conditions. The current study aimed to identify the high potential stable genotype and appropriate sowing time for mungbean cultivation in hot arid zone of Rajasthan. A field experiment was conducted with 35 mungbean genotypes over four environments created by four different dates of sowing in RBD with three replications at SKRAU, Bikaner during summer-2019 and *Kharif*-2019 using the model of Eberhart and Russell (1966). Stability parameters revealed that genotype IC-39269 exhibited stable performance for number of seeds per pod, biological yield per plant and harvest index across the environments; whereas, IPM 02-3, MH 2-15 and RMG-344 exhibited stable performance for seed yield under favourable environment i.e. *Kharif* season; and genotype IC 103059 for stressed environment i.e. summer season.

ARTIFICIAL INTELLIGENCE : A NEW ERA OF ANIMAL HUSBANDRY

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Abstract

Artificial Intelligence (AI) uses various technologies that equip machines to sense, comprehend, act, plan and learn with human like levels of intelligence. Machine learning is a branch of artificial intelligence (AI) and computer science which revolves around the use of data and algorithms to imitate the learning process of humans. Deep learning can be called as a sub category of machine learning that arranges algorithms in layers to form associate degree “artificial neural network” that may learn and make intelligent choices on its own. AI technologies can also be used to solve the diverse application problems in the field of animal production, especially in animal breeding, which involves handling of large data. AI can assist in selection decisions at dairy farms regarding bulls at an early age through prediction of accurate estimated breeding value. Artificial Neural Network (ANN), affirm to have better performance than frequently used standard linear regression models in predicting phenotypic values. In India, few studies were conducted about ANN based prediction of first lactation milk yield and life time milk production. ANN can also be used for the prediction of mastitis and lameness, in-vitro fertilization success rates, the manure nutrient content, estrus and rumen volatile fatty acids. In addition to these, some studies were also conducted

using ANN to style and implement a morphological assessment system in beef, to predict carcass meat percentage in young pigs etc. Overall combining AI technologies and Dairy farming will revolutionarily bring changes in the dairy sector.

MEMBRANE ELECTRODIALYSIS TECHNOLOGY IN SALT WATER TREATMENT

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Abstract

Clean water is in high demand, whether it is used for human consumption, agricultural operations, or industrial applications. To address this critical issue, a small effort has been made in the current work to produce reinforced monopolar and bipolar membranes based on functionalized polysulfone and assessed for salt water electrodialysis. Commercially available monopolar and bipolar membranes were also evaluated for comparison. Electrodialysis technology can be used in operations of concentration, dilution, desalination, regeneration, and valorization to reclaim salt water and recover water and other products, e.g., heavy metal ions, salts, acids/bases, nutrients, and organics, or electrical energy.

ANTI-FREEZE PROTEINS AND THEIR APPLICATIONS IN DAIRY TECHNOLOGY

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Abstract

Anti-freeze proteins are the proteins, peptides and glycopeptides originated from different organisms to adapt the cells in frozen environmental temperatures. They can modify ice growth by stabilising the ice crystals within a temperature range and prevent ice recrystallisation (Eskandari *et al*., 2020). Antifreeze proteins are originated from fungi, nematodes, bony fishes, bacteria and diatoms. Anti-freeze glycoproteins can be classified into four categories depending on their structures and functional properties. Anti-freeze proteins are vastly used in dairy, food industries, fish and meat industries. They are used in many cryosurgeries or cryopreservation for biomedical medicines which involve gene therapy, tissue conservation and tissue engineering. Antifreeze proteins has got anti-infective properties against viruses, bacteria, fungi, and protozoa. The arthropodal anti-freeze glycoproteins bind bacteria and alter biofilm formation. They are used in organ transplantation for stabilisation. The use of chemicals may cause harmful toxic effects to organs which can be prevented by these proteins. Noodles, jelly, boiled eggs, cakes, tofu, dough, ice creams and cakes are deformed by repeated freezing and thawing procedures by the formation of crystals altering its texture. Addition of anti-freeze proteins to gels will solve the purpose. Bursting of power lines, reduction of lifetime of wings in aircraft and air circulation blockage in refrigerators are seen by the frost development can be addressed by surface coating of antifreeze proteins. (Eskandari *et al*., 2020). Although they are widely used in industrial areas, the mutagenicity, carcinogenicity and toxicity studies should be explored for safer usage to the mankind.

OPTIMIZING GROWTH CONDITIONS FOR ENHANCED PROPAGATION OF RED PULP GUAVA (*PSIDIUM GUAJAVA* L.) HYBRIDS"

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Abstract

Guava (*Psidium guajava* L.) known as the 'Apple of tropics' belongs to the family Myrtaceae. Guava is a fair source of nutrients and vitamins. Besides its high nutritional value, guava bears heavy crop every year and gives good economic returns. However, the greatest hinderance in guava plantation is indiscriminate multiplication of plants from unreliable sources by

nursery men. Hence, the study was carried out on three different propagation environmental conditions *viz.,* polyhouse, shadenet and open field considered for standardizing the propagation environmental condition for softwood grafting in different red pulp guava (*Pisidium gujava* L.) hybrids *viz.,* Arka Kiran, Punjab Pink and Punjab Bold. The present experiment was laid out in two factorial completely randomised design with nine treatments replicated thrice. The results revealed that, Arka Kiran placed under poly house condition took minimum number of days taken for first sprouting (8.34 days), and produced the maximum number of sprouts per graft (4.40), length of sprouted shoot (7.43 cm), number of leaves per graft (18.27), grafts success (94.10 %), survivability (89.92 %), total chlorophyll content (63.00 SCMR) and stomatal conductance (391.80 m mol m^2 s^{-2}) followed by Punjab Pink kept under poly house condition. These results emphasized the effectiveness of polyhouse conditions in enhancing the propagation success of red pulp guava hybrids, particularly Arka Kiran, by providing an optimal environment for sprout development and overall plant health. The study highlights the importance of controlled propagation environments in achieving consistent and high-quality guava grafts, ultimately supporting the sustainable cultivation of this valuable tropical fruit.

CHALLENGES AND CONSTRAINTS OF AGRICULTURE AND AQUACULTURE IN BANGLADESH

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Abstract

Despite the impact of decreasing arable land, rising population needs for food and nutrition, climate change, the Russia-Ukraine crisis, and the Corona epidemic, agricultural, aquaculture and livestock production of Bangladesh has been able to continue, and food and nutrition security is ensured by the friendly policies and strategies of the government's. To guarantee food security, the government is putting forth great effort to develop profitable, safe, and sustainable agricultural and aquaculture systems. In light of Vision 2041, the 8th Five-Year Plan, the National Agricultural Policy 2018, the Sustainable Development Goals, Deltaplan-2100, and other planning documents, the government has been working tirelessly to promote the general growth of the agriculture sector. To address the needs of the expanding population, the government has currently adopted short, medium, and long-term action plans. These plans are based on the agricultural sector's successes in responding to numerous calamities, notably the COVID-19 pandemic. Food grains were produced in a total of 484,988 metric tons (MT) in FY 2022–2023, up from 465,83 lakh MT in FY 2021–2022. In an attempt to increase output in response to Corona's impacts, agribusiness input subsidies were extended to include seed production, fertilizer subsidies, and other agricultural activities. Additionally, agricultural inputs were made available, and the availability of agricultural loans was increased. Fish production from marine and inland water sources was 47.69 lakh MT in FY 2022–23. The sustainability of conventional agriculture and aquaculture in Bangladesh is under threat from the continuous degradation of land and water resources and from declining yields due to the indiscriminate use of agro-chemicals. Agricultural sustainability depends on productivity, environmental stability, economic profitability, and social and economic equity. Significant differences were found between the two systems (conventional and sustainable agriculture) in crop diversification, soil fertility management, pest and disease management, use of agrochemicals, and environmental issues. However, no significant variations were found in the indicators of land-use pattern, crop yield and stability, risk and uncertainties, and food security. So, sustainable agriculture and aquaculture have a tendency towards becoming environmentally, economically, and socially more sound than conventional agriculture, as it requires considerably less agro-chemicals, adds more organic matter to the soil, provides balanced food, and requires higher local inputs without markedly compromising output and financial benefits.

PRODUCTION PERFORMANCE AND ECONOMICS OF PUNJAB DESI CROSSES CHICKEN UNDER BACKYARD FARMING SYSTEMS

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Abstract

Livestock and poultry provide a significant contribution to the economy of India. Over the last 60 years, the nation's poultry

production has increased rapidly. The indigenous chicken breeds that have been raised in backyards in free-range situations for centuries account for roughly 11% of India's total egg production. The Punjab Desi crosses chicken was developed by crossing Rhode Island Red with local backyard birds by GADVASU, Ludhiana. In order to evaluate the overall performance of Punjab Desi crosses chicken at the farmer's field under the backyard production system, 500 chicks were distributed to selected farmers in the SAS Nagar district of Punjab at a rate of 25 birds per farmer. The results of the present study revealed that the mean body weights (pooled) of Punjab Desi crosses chickens at 8, 12, 16, 20, and 40 weeks of age were 504.04±9.91, 897.79±16.26, 1255.32±16.51, 1707.29±17.39, and 2236.43±17.22g, respectively. The mean age of Punjab Desi cross chickens at the onset of egg laying and sexual maturity was found to be 152.46±1.09 and 169.30±2.10 days, respectively. The average egg production (no.) of Punjab Desi crosses chicken was found to be 67.50±2.99 and 129.95±7.32 up to 40 weeks and 52 weeks, respectively. The total gross and net income earned from the sale of eggs and birds for the rearing of Punjab Desi crosses chicken were Rs. 32435 and 24188, respectively. The benefit-cost ratio was recorded at 1: 3.94 per family, which appears to be very economical and viable for rearing under a backyard farming system. The current study suggests that Punjab Desi chicken crosses may be suitable for backyard farming systems in the Kandi zone of Punjab, given their reproductive and productive performance and adaptability.

THE GREEN REVOLUTION IN INDIA

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Abstract

India has been an agricultural country but still it cannot be considered very successful in the field of agriculture. Before 1960, farmers faced many problems. They were backward in every field, like seeds, technology, fertilizers. The weather was a different matter altogether. Famine and floods were always their enemies. Farmers were becoming poorer and poorer. Special schemes for agriculture were also made for the five-year plans, but they did not yield any significant benefit. The Intensive Agriculture District Program was started in 1960-1961. Initially, it was implemented in 7 districts whose objective was to provide loans, seeds, fertilizers, agricultural equipment etc. to the farmers to increase agricultural production. Their results were different in different areas. The Intensive Agriculture Area Program was started from 1964-1965. In this, attention was given to crops. Both the programs were related to intensive agriculture but no new variety of crops was used in them.

In 1966, high yielding seeds were used in the Kharif crop in a large area and agricultural production was increased three to four times by using chemical fertilizers and means of irrigation. There was a continuous record increase in agricultural production in the country from 1967-68. Shri Lal Bahadur Shastri was the Prime Minister at that time and M. S. Swaminathan was the father of Green Revolution in India. The Green Revolution Programme was started in the third five-year plan, 1961-66. After the Indo-China war, the Prime Minister also gave the slogan "Jai jawan Jai Kisan". The Green Revolution, also known as the Third Agricultural Revolution, was a period of technology transfer initiatives that saw great increases in crop yields and agricultural production. These changes in agriculture began in developed countries after World War II and spread globally by the late 1980s.

CRISPR/CAS9 MEDIATED GENOME EDITING FOR CROP IMPROVEMENT

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Abstract

Recent advancements in CRISPR-Cas9 mediated genome editing technology has pave the way to crop improvement. This is a multipurpose technology for crop improve that relies on the complementarity of the guideRNA (gRNA) to a specific sequence and the Cas9 endonuclease activity. This potent tool has been recommended to develop crop with desired qualities including diseases resistance. It has broadened the agricultural research area, bringing in new opportunities to develop novel plant varieties with deletion of detrimental traits or addition of significant characters. Recently, multiplex genome-editing (MGE) technologies are used for modifying genome with high precision. These genome-editing tools have greatly increased the

feasibility of introducing desired changes at multiple nucleotide levels into a target genome. This emerging tool allows researchers to perform precise genome manipulation, genetic screening, regulation, and correction to develop resistance in crop plants with fewer off-target effects. It provides a new opportunity for disease improvement and strengthens the resistant breeding programme.

EFFICACY OF THIAMETHOXAM 30% W/W FS AS SEED TREATMENT AGAINST EARLY CROP STAGE INSECT PEST IN CORN

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Abstract

An experiment was conducted to study the efficacy of thiamethoxam 30% w/w FS, as seed treatments against maize pests such as shoot fly and aphids. The experiment was laid out in Randomized Block Design with DKC 9081 variety, replicated four times, and included eight treatments. It was found that thiamethoxam 30% w/w FS at 2.4 g a.i/kg of seed provided the best protection against shoot fly and aphids, significantly reducing pest populations and enhancing seedling vigour, germination rates, and yield. No phytotoxic effects were observed at concentrations of 2.4 g a.i/kg and 4.8 g a.i/kg of seed, and the treatment was safe for beneficial insects. The study concludes that thiamethoxam 30% w/w FS at 2.4 g a.i/kg of seed is highly effective for pest management in maize, improving plant vigour and yield without adverse effects on the crop or its natural enemies, supporting its recommendation for integrated pest management.

EFFECT OF INDUSTRIALIZATION AND URBANIZATION ON AGRICULTURE

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Abstract

Industrialization and urbanization becomes a bane for the agriculture now days. With increase in industrialization and urbanization, the growth of agriculture sector decline continuously. Large area of land is covered under industry and infrastructure, which results in shortage of agriculture productive lands. The waste products of industry and urban areas are flowed in water bodies such as river, lakes and ponds which pollute them and make them unsuitable for any kind of use. The harmful effluents released from industry contaminate the air with harmful gases and suspended material. These gases and suspended particles affect the growth and development of plants and animals. The suspended particles are inhale during breathing and cause blockage in veins and arteries of animals and humans. To feed the ever increasing population of our country, the farmer put high pressure on shrinking land to get higher output. For this, farmer use modern technology and chemicals which reduce the productivity and fertility of soil. The polluted water of lakes and ponds become poisonous for the water living entities and results in death of plants and animal species. The waste effluents of urban areas and industry have high concentration of heavy metals which are very poisonous for animals and plants which survive under water and on land. The growth of plants and microbes in soil is reduced due to increase in concentration of heavy metal in soil. The effects of industries and urbanization need to be decreased to get a healthy environment for plants and animals. Special management practice needs to be developed to suppress this increasing problem to survive on earth.

COMPARATIVE EFFICACY EVALUATION OF PLANT BIO STIMULANTS AND BIO INOCULANTS ON THE FODDER MAIZE QUALITY ATTRIBUTES UNDER ORGANIC PRODUCTION SYSTEM.

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Abstract

Shifting to organic farming practices is beneficial for sustainable agriculture and organic milk production. However, there is

limited literature available on the use of plant biostimulants and farmyard manure (FYM) in the cultivation of fodder crops under organic management. Therefore, the present study was undertaken to investigate the combined effects of various plant biostimulants on the quality traits of fodder maize. A field experiment was carried out at the Research Farm, Agronomy Section, ICAR-NDRI, Karnal, Haryana in kharif season 2023 in Randomized Block Design (RBD) with six treatments replicated six times. Treatments include; T_1-Absolute control, T_2-100 RDN (Recommended Dose of Nitrogen) through FYM, T_3- PGPR+ 75% RDN through FYM+ 3 sprays of Panchagavya T_4- PGPR+75% RDN through FYM+ 3 sprays of Seaweed extract T_5-Beejamrit+75% RDN through FYM+3 sprays of Panchagavya T_6- Beejamrit + 75% RDN through FYM+ 3 sprays of Seaweed extract. The result revealed that the application of plant biostimulants significantly increases the quality parameters compared to the absolute control treatment. The highest dry matter and ether extract was recorded in T_4-(PGPR+75% RDN through FYM+ 3 sprays of Seaweed extract) and lowest under T_1-(Absolute control). T_4 contained 20% more dry matter and 23% more ether extract than which eventually indicates the highest nutrient uptake by the crop. Similarly, the lowest ADF (Acid Detergent Fibre) and NDF (Neutral Detergent Fibre) content was recorded in T_4, Compared to T_1, T_4 had 16.7% less ADF and 17.3% less NDF content, which further ensures better forage quality due to treatment with PGPR and seaweed extract. It may concluded that the combined application of PGPR and seaweed extract with FYM is quite promising for improving the growth and quality attributes of fodder maize under organic conditions for producing organic milk.

EFFECT ON VARIOUS REPRODUCTIVE INDICES FOLLOWING SPECIFIC SUPPLEMENTATION OF DIET IN INDIGENOUS COWS

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Abstract

The cow experiences a physiological shift during the transition phase, which lasts from 21 days before to 21 days after parturition. This shift is characterized by an increase in energy demand so as to express its genetic potential in terms of milk production, the period is linked with decreased feed intake consequently entering into negative energy balance (NEB), a weakened immune system, and metabolic diseases, all of which have an impact on reproductive efficiency of animal. To overcome this, the present study was designed, to fulfill the nutritional demand of advanced pregnant or early lactating animals. In the present study advanced pregnant dairy cattle were selected, which were further divided into two groups i.e., Control (n=8) and Treatment (n=8). The animal in control group was maintained on routine standard feeding schedule and those on treatment group was supplemented with experimental diet (Bypass fat @ 100gm/animal/day + Bypass protein @ 200gm/animal/day + beta-carotene @ 300mg/animal/day) along with routine standard feeding. The feeding was started 10-15 days before the expected date of calving and continued till 60th day post-partum. The post-partum reproductive efficiency was observed by monitoring different parameters such as Body Condition Score (BCS), First post-partum detectable estrus and Days to complete uterine involution. It was observed that BCS before and after treatment was improved in treatment group as compared to control group. Similarly, the first post-partum detectable estrus was recorded few days earlier in treated group as compared to the control group. Animal under treated group showed shorter involution period as compared to treated group. Thus, additional supplementation of specific nutrients in basal diet had significant impact on various reproductive indices favoring reproductive efficiency in indigenous animals.

BREEDER AGE IMPACT ON EMBRYONIC MORTALITY TRAITS IN RIR CROSSBREDS AND PUNJAB RED

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Abstract

Embryonic mortality or early deaths pose a greater threat to the breeders and prove to be a matter of concern from biological and economic point of view. The present study was conducted on RIR crossbreds (Desi cross 1 and 2) and Punjab red, categorized into five age groups with 5 weeks duration *viz.* group I (28-32 weeks), group II (33-37 weeks), group III (38-42

weeks), group IV (43-47 weeks) and group V (48-52 weeks) at Hatchery Unit, Directorate of Livestock Farms, GADVASU, Ludhiana. Hen age relationship with embryonic mortality traits was observed by dividing the total embryonic mortality (TEM) into three phases: early =7d (EEM), mid 8- 17d (MEM) and late 18-21d (LEM); on the basis of visual observation for developmental stages of embryo. The overall trend of EEM was found to range from 4.83±0.17 per cent (33-37 weeks) up to 6.61±0.45 per cent during 43-37 weeks of hen age. The MEM varied from 1.02±0.23 per cent (during early age groups of 33-37 weeks) up to 1.65±0.14 per cent during the older stages of hen age. LEM was found to be lowest during the 28-32 weeks of age group of the breeder (6.05±0.27%) and increased significantly ($p<0.05$) with the progressing age of the breeder flock (8.44±0.31%). Overall incidence of live but not hatched embryos (LNH) was found to be highest (4.55±0.26%) during later stage of the breeders' age as compared to the younger flock (2.62±0.23). The present study proves the biphasic mortality pattern of the embryos which occurs either during the early stage of incubation or after the 19th day, when the embryo shifts from the allantoic to pulmonary respiration.

FOREST POLICY OF INDIA FOR SUSTAINABILITY

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Abstract

For any country, the forest policy is an important guideline to maintain forest resources and their interaction with other land uses. India devised its first National Forest Policy (NFP) back in 1894. There has been a paradigm shift from timber production to forest conservation followed by community-based agroforestry and social forestry bringing a change in perspective towards forest resources. This change has been socio-economic, cultural, and ecological. Since the 1952 NFP, there has been advocacy and compulsory for 33% forest cover with a 60% forest cover in mountainous and hilly regions. This objective was reiterated in the NFP in 1988 and also confirmed in the National Forestry Commission report in 2006. Forest Right Act 2006 made tribals realize their contribution to safe nature is not going to be wasted but in return, they are going to take many benefits from this act as a dweller. Policies also analyze forest cover trends at the state level and assess the likelihood of meeting the prescribed policy targets under the present perspective of land use practices. Only five Indian states go ahead every year with an increase in % to meet the prescribed policy, while many more have the potential to do so if their state wasteland area is afforested. Among the rest, a few states may achieve the 33% goal provided land conversion to tree cover is not hindered, and adequate resources are available at the state level. The Planning Commission (XI Five-year Plan, 2007–12) has emphasized the inclusion of other natural ecosystems (including treeless areas and trees outside forests) to forest cover. The paper also examines the above-prescribed targets in light of the Planning Commission recommendations. It is argued that the NFP should be re-visited and revised to meet the targets, along with setting a more realistic and attainable target for Indian forest and tree cover. To support NFP, 1988 to increase forest cover under various programs like TOFs and the National Agroforestry Policy of India to improve livelihood status as well as mitigate and combat climate change.

ENHANCING CITRUS PRODUCTIVITY IN NORTHEAST INDIA: A REVIEW ON ORCHARD MANAGEMENT PRACTICES

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Abstract

Citrus is one of the most popular and widely grown fruit crops in the world belonging to rutaceae or rue family. The northeastern region of India is considered the origin centre and a hub for diversity of Citrus species, housing several wild and endangered species in their natural and undisturbed habitat. The study aims to explore the orchard management practices of citrus and impact of its adoption. The study found that orchard management is an important cultural practice for successful and sustainable cultivation of fruit crops which include all those practices performed from the initial stage of land preparation to the final stage of harvesting crops, thereby enhancing the productivity of the orchard. The reviewed papers described practices such as field preparation, use of proper planting materials and planting sites, proper soil management, regular training or

pruning, pest management, irrigation and good orchard floor with cover crops or intercrops as the major orchard management practices that is essential to boost the productivity and sustain the cultivation of citrus in a long term. However, it is found that farmers are often reluctant to invest in orchards, which resulted in decline of citrus productivity. Therefore, to increase production and commercialization of citrus it is suggested to encourage adoption of better orchard management practices.

SUSCEPTIBILITY OF ORIENTAL LEAF WORM, *SPODOPTERA LITURA* (FABRICIUS) (LEPIDOPTERA : NOCTUIDAE) TO NATIVE ENTOMOPATHOGENIC NEMATODES (STEINERNEMATIDAE AND HETERORHABDITIDAE)

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Abstract

Cabbage, *Brassica oleracea* var. *capitate* L. is the second most important cruciferous crop after cauliflower. India ranks second in production of cabbage after China. Various abiotic and biotic stresses are pivotal factors of crop losses of which, losses due to insect-pests forms key obstacle to a profitable crop production. Major constrain in cabbage production is because of Lepidopterous pests, of which diamondback moth, Oriental leaf worm and cabbage butterfly are most destructive ones. Among these insect pests, the Oriental leaf worm, *Spodoptera litura* (Noctuidae: Lepidoptera) is polyphagous pests, that feeds initially on the surface of tender leaves and at a later stage bore into the cabbage head, thereby reducing its market value. Heavy infestation may lead to failure of head formation or production of deformed head.

Bioassays results revealed that upon inoculating 400 IJs larva^{-1} to fourth-instar *S. litura* larvae with *H. indica* and *S. surkhetense*, *H. indica* caused 100% mortality whereas *S. surkhetense* caused 54% mortality. When *S. litura* pupa was inoculated with 50 IJs of *H. indica*, pupal mortality was only 10% when IJs concentration increased to 600 IJs pupa^{-1}, pupal mortality also increased to 80%. The percentage mortality in larvae and pupae of *S. litura* increased significantly with increase in the exposure time. Both nematode species were able to penetrate into the *S. litura* larvae and also completed their life cycle by producing large number of infective juveniles. Pot experiment results showed that cabbage plants sprayed with flubendiamide reduced significantly more number of larvae than plants sprayed with *H. indica* and *S. surkhetense* at a lower dose (600 IJs larva^{-1}). But at higher concentration 1200 IJs larva^{-1} performed equally well that of flubendiamide. Overall results showed that *H. indica* NBAIRH80 (genbak accession number: OR405077) can be incorporated in integrated pest management programme for *S. litura*.

RESOLUTION OF VARIABILITY AND SELECTION OF NOVEL MUTANT'S USING MGIDI IN GAMMA IRRADIATED INDIGENOUS AROMATIC RICE CULTIVAR, GOBINDABHOG

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Abstract

Indigenous aromatic rice cultivar, Gobindabhog was undertaken to improve the undesirable characters *viz.,* tall plant height, very late maturity duration and other yield constraints, through gamma rays (300 Gy) irradiation. A population of 910 M_2 plants was raised to study the variability and to screen the desirable mutants with dwarf plant height and early flowering habit. A wide range of mutations for all 14 quantitative traits under study were observed. The classification of recorded mutations revealed that the higher frequencies of mutations were observed on the complex traits like HI (39.45%), GY (38.02%) and PW (25.71%). Moderate level of mutation frequencies were observed on the PH (24.73%), BY (24.4%), GNP (22.2%), TT (17.03%), SF (16.7%) and Panicle branching habit (15.93%). The traits PL (9.45%), DF (6.04%), DM (5.05%) and TW (4.28%) recorded very lower proportion of mutations. Among the traits highly significant ($p<0.01$), positive and very strong correlations were found between CH and PH (0.98), DM and DF (0.96), GNP and PW (0.92), TT and BY (0.83). Out of 910 mutants, 727 mutants were pre-screened considering the mutations occurred at least on single trait and further they have been classified according to the number of traits mutated. Out of 727 classified mutants 554 were filtered as per atleast one desirable

mutation. Further, 288 mutants were retained, having plant height less than 130 cm and those were subjected to selection. Among the best 15 mutants screened through MGIDI based screening and manual screening 9 mutants were found common. The mutants mt-870, mt-642, mt-885, mt-866, mt-773, mt-706, mt-432 and mt-106 were remarked to be significantly dwarf as compared to the neighbouring mutant plants. The top 3 mutants mt-870, 642 and 885 possess good features for many traits compared to the parent Gobinda bhog. Data reduction followed by MGIDI based screening and further manual selection was found efficient and time saving selection approach for the selection of the best mutants for all the traits from the large diverse M_2 population.

MARKER ASSISTED BREEDING FOR BACTERIAL BLIGHT RESISTANCE AND YIELD ENHANCING GENE TO IMPROVE PRANAHITHA, A LOCAL POPULAR ELITE FINE CULTURE WITH GOOD COOKING QUALITY

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Abstract

Present investigation was conducted to study the marker assisted breeding for *Xa21* and *Gn1a* genes and their phenotypic effect along with yield and yield enhancing characteristics in 50 breeding lines of a three way cross (Pranahitha/ MTU1010//Improved Samba Mashuri (ISM)). 50 breeding lines (F_4 generation), were screened phenotypically for their resistance against bacterial blight by inoculating with BB culture, among them, twenty nine lines were found to be resistant to bacterial blight possessed with excellent grain yields equivalent to or better than Pranahitha (JGL 11727). In foreground selection, above said twenty nine lines were found homozygous positive for bacterial blight resistance gene, *Xa21* (pTA248). 50 breeding lines (F_4 generation) were subjected to fore ground selection for yield gene, *Gn1a* (Gn1a INDEL marker-3), out of these, 36 breeding lines were found to be homozygous positive for *Gn1a*. These 36 lines were shown excellent grain yields equivalent to or better than female parent, Pranahitha (JGL 11727). In genotypic evaluation (foreground selection) of both traits, BB and grain yield, 21 breeding lines were similarly identified to be homozygous positive for both the genes i.e., *Xa21* and *Gn1a*, eight lines are having only *Xa21* resistance allele and 15 lines are having only *Gn1a* resistant allele. Among these 21 breeding lines, seven lines were having significantly higher yield than the three parents *i.e.,* MTU1010 NIL, Pranahitha (JGL 11727) and Improved Samba Mashuri (ISM) with durable resistance to Bacterial Leaf Blight, could serve as donors in BB endemic areas and could be released as varieties for state and central through AICRIP after conduct of trials.

EFFECT OF IRRIGATION REGIMES AND HYDROGEL ON YIELD OF TOMATO AND SOIL PROPERTIES

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Abstract

The irrigation management in tomato is a big challenge. To address this issue, a field experiment was conducted for two consecutive years on clay loam soils at during *kharif* seasons 2022 and 2023 at Instructional Farm, College of Technology and Engineering, Maharana Pratap University of Agriculture and Technology, Udaipur (Rajasthan). The experiment consisted of 12 treatment combinations having three irrigation regimes (1.0, 0.8 and 0.6 IW/CPE) in main plots and four hydrogel levels (control, 10, 15 and 20 kg ha^{-1}) in sub plots evaluated under Split Plot Design (SPD) with three replications. The variety tested under this experiment was *USM Kareena*. The impact of irrigation regimes and application of hydrogel on plant height, fruit

yield of tomato and water use efficiency was found significant. The maximum plant height and fruit yield was found under irrigation regime I_1 (1.0 IW/CPE) followed by I_2 (0.8 IW/CPE) and I_3 (0.6 IW/CPE) whereas the higher water use efficiency was recorded under lower levels of irrigation (0.6 IW/CPE). Among the different hydrogel (Fasal Amrit) doses, FA_{20} (20 kg hydrogel per hectare) demonstrated the higher plant height, fruit yield, and water use efficiency. Most of the soil parameters were remained non-significant with irrigations regimes except moisture content but the hydrogel application reduced the soil pH and increased soil organic carbon content significantly.

INFLUENCE OF OSMOPROTECTANTS FOR ENHANCING PRODUCTIVITY IN BT COTTON UNDER RAINFED CONDITION

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Abstract

The field experiment were conducted on Cotton in Kharif 2022-2023 with nine treatments consisting of six osmoprotectants (KNO_3, Salicylic acid, Glycine betaine, Sodium nitroprusside, PPFM, Thiourea) at different concentrations was laid out in RBD at University of Agricultural Sciences, Dharwad. Among the nine treatments foliar spray of KNO_3 (2%) at 80 and 100 DAS increased the chlorophyll content (2.76 mg/g f w) as compared to control and with other treatments and there was significant increase in morpho-physiological traits viz., plant height, number of branches and total dry matters. The growth parameters and biochemical parameters like total chlorophyll content, CSI and NR activity was significantly improved due to the foliar application of osmoprotectants KNO_3 2% at 80 and 100 DAS as compared to control. The biophysical parameters like photosynthetic rate also shows significance with KNO3 2% (29.16 µmol CO_2 $m^{-2}s^{-1}$) as compared to control. The treatment of KNO_3 (2%) at 80 and 100 DAS recorded significantly higher seed cotton yield (27.58 q/ha) and number of bolls per plant as compared to control. The maximum seed cotton yield was mainly attributed to its close association with yield components viz., boll number, boll weight and harvest index (HI) and other characters such as LAI and sympodial branches. Thus, it was concluded that, foliar spray of KNO3 (2%) at 80 and 100 DAS is optimum to get higher seed cotton yield.

MEDICINAL AND NUTRITIONAL BENEFITS OF BER

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Abstract

Ber (*Zizyphus mauritiana* L) belongs to the Rhamnaceae family and is also called as jujube. It grows in arid and semi-arid regions of India and there are 125 varieties of ber in India. The cultivars Umran, Kathapal and Gola are the most promising varieties of ber in North India. Although known for its rich taste and high nutritional value, ber is an under utilised fruit and is available only for a short period of time. Value addition is a great way to increase the shelf life of the product along with adding economic value to it. It is an effective way to convert the surplus to value added products and meet the demands during scarcity. Products like jam, candy, preserve, powder, murabba, beverages, wine, pickle etc. can be prepared from ber. Apart from this ber is also used in traditional medicinal systems in India and other countries. Ber contains numerous ethnopharmaceutical compounds. These include ascorbic acid, thiamine, riboflavin, bioflavonoids, alkaloids, pectin A, glycosides (spinosins, saponins, triterpenoic acids, betulinic acid and oleanolic acid) and lipids. Ber also have neurological properties (hypnotic-sedative and anxiolytic effect and cognitive activities), hypotensive and antinephritic effect, cardiovascular activity, immunostimulant effects, antifungal, antidiabetic, antiallergic, antiulcer, antiinflammatory, antispastic, antioxidants and antibacterial activities. The secondary metabolites present in ber fruit are flavonoids, glycosides, saponins, lignins, sterols and phenols. These secondary metabolites show very effective function against pathogens. Therefore, ber fruit can be used in the treatment of liver diseases according to their function and also used in cancer treatment. In addition to fruit, different parts of plant like root, bark, leaves, flowers, seeds are used in Ayurvedic and Yunani medicines for treatment of diarrhoea, ulcer, billousness, indigestion, cough, headache, bleeding gums, asthma. It is also used as blood purifier and appetizer.

SOIL CHARACTERISTICS UNDER SOME SUB HUMID DOMINANT AGROFORESTRY SYSTEMS AT THE FOOT HILLS OF EASTERN HIMALAYAN REGION, INDIA

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Abstract

Agroforestry is a solution based system to address trade-offs between environmental conservation efforts and to increase agricultural productivity on small holder farms for better livelihood and nutritional security of the rural people. Agroforestry has helped in the rehabilitation of degraded lands on one hand and has increased farm productivity on the other. It has traditionally been a way of life and livelihood in India for centuries. The integration of trees into agricultural landscapes has the potential to generate several improvements in the soil as a habitat for soil organisms and also for crop growth. Soil improvements by trees can also occur by increased supply and availability of nutrients for crops and soil biota. Therefore, a study was carried out to examine soil physical-chemical properties under the existing agroforestry systems of AAU – HRS, Kahikuchi, Guwahati – 17 leading to higher productivity and profitability with treatments comprised of T1 – Sole Acacia mangium, T2 – Sole Jackfruit, T3 – Sole Gmelina arborea, T4 – Acacia mangium-based AF system, T5 - Jackfruit-based AF system, and T6 - Gmelina arborea-based AF system with repetition of four and RBD as the statistical design. Soil physical and chemical properties including bulk density, total porosity, micro porosity, macro porosity, CEC, mean weight diameter, moisture content, and pH from 0 – 10 cm while in the case of total organic carbon (TOC), total nitrogen (TN) and C/N ratio sampling was done from two depths viz. 0-10 cm and 10 – 20 cm by following standard protocols. Similarly, soil biological properties including microbial biomass carbon (MBC), basal respiration (BRS), metabolic quotient (q co_2), microbial quotient (q mic), total bacteria (TB), fluorescent group bacteria (FGB) and total fungi (TF) from depths 0-10 cm and 10 – 20 cm were assessed by following standard protocols. Differences between the agroforestry systems in regard to soil properties are improved mostly in AF – based systems than the sole AF systems.

RADIO AND CHEMO-SENSITIVITY OF GAMMA RAYS, ETHYL METHANE SULPHONATE (EMS) AND THEIR COMBINATION IN INDIAN MUSTARD [*BRASSICA JUNCEA* (L.) CZERN & COSS.] VAR. NRCHB-101

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Abstract

Mutation breeding harnesses natural genetic variation through induced mutations, allowing scientists to develop innovative crop varieties more rapidly. Though, higher doses induce more mutations, they can also be lethal to plants. Therefore, researchers aim to find a balance between mutation dose and plant survival. Therefore, an experiment was conducted at Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi by utilizing multiple treatment doses of mutagens to find the desirable dose among different concentration of mutagens. The uniform and healthy seeds of promising cultivar NRCHB 101 was exposed to gamma rays at varying doses, *i.e.*, 10, 20, 30, 40, and 50KR, ethyl methane sulphonate (EMS) at various concentrations *i.e.*, 0.01, 0.02, 0.03, 0.04, and 0.05M and combination treatment of gamma rays with EMS (10KR+0.02M, 20KR+0.02M, 30KR+0.02M, 40KR+0.02M, and 50KR+0.02M).

The observations for radio and chemo-sensitivity were recorded on germination, plant survival, seedling height and pollen and ovule fertility in M_1 generation. High doses of gamma rays, EMS and their combination treatment had deleterious effect on germination, seedling height and plant survival. Seed germination (61.22%) and plant survival (68.34%) as per cent of control was much affected in combination treatment (50KR+0.02M) than the individual dose of EMS and gamma rays. The higher doses of all the three treatment conditions considerably reduced the seedling height, while maximum seedling height was observed at 10KR gamma rays (4.74cm). The pollen as well as ovule fertility also showed the same response. In all cases, ovule fertility was found to be more than that of pollen fertility. The frequency of viable mutations was higher in combination treatment followed by gamma rays. In total, 33 types of macro-mutations were observed in M_2 generation. The combination treatment 20KR+0.02M and 30KR+0.02M, were most efficient in inducing macro-mutations than the individual treatment of EMS or gamma rays.

IN-SILICO ANALYSIS OF BIOACTIVE COMPOUNDS FROM MILLETS AGAINST DIABETES, HYPERTENSION, AND ATHEROSCLEROSIS USING MOLECULAR DOCKING AND SIMULATION APPROACH

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Abstract

Millets are gaining popularity as a nutritious alternative for those suffering from lifestyle problems. They provide antioxidants, fatty acids, minerals, vitamins, fiber in the diet, and polyphenols. It has been discovered that millets have antidiabetic properties, which may aid in the control of diabetes. Due to its low glycaemic index, millet may be useful in controlling blood sugar levels. Compared to many other cereal varieties, such as barley, rice, maize, and wheat, millets include alkaloids, flavonoids, terpenes, polyphenols, etc. The potential use of natural therapies for the treatment of obesity, diabetes, and associated disorders has not received much attention. As an alternative therapeutic approach, bioactive compounds may aid in the development of safe and effective anti-obesity and anti-diabetes options. The potential benefits of bioactive chemicals in the treatment of metabolic diseases such as diabetes, obesity, hypertension, and cardiovascular disease have been highlighted by recent studies. By combining a virtual screening strategy with molecular docking and dynamics simulation investigations, we were able to obtain a structural understanding of the possible binding mechanisms of secondary metabolites or bioactive compounds of millets against significant molecular targets that are crucial to the inhibition of major lifestyle diseases.

DEVELOPMENT AND VALIDATION OF AN ELISA FOR DETECTION OF CANINE PARVOVIRUS INFECTION IN DOGS

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Abstract

CPV is a highly contagious viral pathogen affecting dogs aged 6-21 weeks primarily targeting rapidly dividing cells of GIT tract which leads to hemorrhagic gastroenteritis and symptoms such as fever, vomiting, inappetence and abdominal pain. Several variants include CPV-2, CPV-2a, CPV-2b and CPV-2c. CPV can be prevented by complete vaccination and can be treated effectively if timely diagnosis is done. It can be diagnosed by effective methods such as PCR, fecal ELISA, HA and HI. The most effective being ELISA and PCR. Therefore, the present research aimed at developing, standardizing and validating a Double Antibody Sandwich ELISA for the detection of CPV by using rabbit hyperimmune sera as primary antibody and mice hyperimmune sera as secondary antibody. In the present study PCR was conducted on 100 samples and the total percent positivity was calculated to be 39%. It was observed that the maximum number of cases lied in the age group of 1- 6 months while dogs aged more than 1 year were rarely found to be positive. Males were found to be more positive than females and maximum cases were found in German shepherd, Retriever and Pomeranian. It was also found the incidence rate and the positivity rate were both high in stray animals. The developed ELISA was calculated for various parameters including sensitivity: 61%, specificity: 83.8%, Positive Predictive Value: 81.9%, Negative Predictive Value: 64.09%. ROC analysis curve was performed and the sensitivity and specificity was calculated to be 100% and 96.7% at cut off values 0.252 and 1.91. The test was therefore validated as the P/N ratio was 5.87 i.e. >2.

ETHOGRAM ANALYSIS OF TEMPERAMENT IN YOUNG CHILDREN BASED ON LABORATORY EXPERIMENT

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Abstract

Purpose : The main objective of the study was to investigate temperament in young children of 3-6 years through laboratory experiments.

Method : Five laboratory experiments were designed after a thorough review of the research literature. An ethogram was constructed and the temperament was analyzed using behaviour observational software BORIS.

Results : The results revealed that the majority of the young children assessed were happy, engaged, sociable, and focused attention. In the negative effectivity domain, nearly 50% i.e half of the respondents showed fear and disappointment. In the effortful control experiment, nearly half of the children displayed impulsivity. The study concludes that most of the children have positive temperaments, but 50% of them when subjected to eliciting conditions showed negative temperaments.

MAKING WOMEN CENTRIC DEVELOPMENTAL EFFORTS TO IMPROVE THE ECONOMY OF MID HILL AREAS OF UTTARAKHAND UNDER THE FARMERS FIRST PROGRAMME

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Abstract

Due to heavy migration of male population from the hills of Uttarakhand in search of better employment opportunities, now the women have the additional role of head of the household and major contributor in the agricultural production system. Besides, family responsibilities, rural woman play a productive role in family farming system. Based on the baseline survey of the mid-hills of the state under Farmers FIRST Programmes of GBPUA&T Pantnagar University it was found that to improve the rural livelihood it is very necessary to improve the knowledge and skills of farm women along with addressing their day to day challenges. The project initially covered three villages *viz* Dogra, Jeoli and Shiyalikhet of Bhimtal block, Nainital. Under the project, farm women of these villages were targeted and various interventions were introduced in the selected households to provide the farm women with more economic opportunities and conducted regular trainings to impart their knowledge as well as skills related to various household and farm activities. Some interventions such as backyard poultry, mushroom production, nutri-gardens, off season vegetable cultivation, fodder production and drudgery reduction tools were introduced in the selected villages of mid-hills of Uttarakhand. The present paper is an attempt to showcase the results of these interventions on the overall upliftment of the farm women of mid-hills of Uttarakhand.

PERFORMANCE OF SORGHUM BASED INTERCROPPING SYSTEM IN KALYANA KARNATAKA REGION

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Abstract

Growing of sole sorghum may not be profitable. Again, continuous sole cropping of sorghum may lead to decline in yield levels mainly because of conspicuous of nitrogen in particular and other nutrients in general. The lower productivity of *rabi* sorghum has been attributed to the fact that large area is under rainfed condition in addition to that cost of cultivation also increased due to shortage of labours, higher input prices and fluctuation of market price. In order to minimize the risk and maximize the net income for farmer, the suitable *rabi* crop selection as intercrop has to be done in sorghum based intercropping system. Keeping this in view, a field experiment entitled "Performance of sorghum based intercropping system in Kalyana Karnataka Region" was conducted at Agricultural Research Station, Hagari on medium deep black soil during *rabi* 2020-21 and situated at 14°70'36" N Latitude, 76°151' E longitude at an altitude of 458 m above mean sea level. The experiment consists of ten treatments of which five are sole cropping and five are intercropping (additive series) treatments *viz*. T_1: Normal sowing of Sorghum (45 cm X 15 cm), T_2: Paired row sowing of sorghum (30cm-60cm-30cm), T_3: T_2 + Chickpea (1:1), T_3: T_2 + Chickpea (1:1), T_4: T_2 + Safflower (1:1), T_5: T_2 + Linseed (1:1), T_6: T_2 + Coriander (1:1), T_7: Sole Chickpea, T_8: Sole Safflower, T_9: Sole Linseed and T_{10}: Sole Coriander. The experiment was laid out in randomized complete block design and replicated four times. The soil analysis revealed that the soil was non- saline (EC: 0.43 dS/m) with pH above neutral range (8.35) and was rated as medium for organic carbon (0.51%), available nitrogen (234.5 kg/ha) and medium for available phosphorus (45.1 kg/ha), potassium (347.2 kg/ha). Significantly higher sorghum grain equivalent yield, land equivalent ratio, income equivalent ratio, gross returns, net returns and benefit-cost ratio (3282.5 kg ha^{-1}, 1.34, 1.34, Rs. 99,438, Rs. 60,243 and 2.54, respectively) was recorded with paired row sowing of sorghum + chickpea (1:1) compared other

treatments. Significantly lower sorghum grain equivalent yield, land equivalent ratio, income equivalent ratio, gross returns, net returns and benefit-cost ratio (885.5 kg ha^{-1}, 1.00, 1.00, Rs. 18,205, Rs. -8,232 and 0.69, respectively) was recorded with sole sorghum.

INNOVATION IN DRAGON FRUIT IMPROVEMENT THROUGH TISSUE CULTURE

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Abstract

Pitaya or dragon fruit, which has attracted attention due to its attractive appearance, taste, and nutritional content in recent years, is located in the genus *Hylocereus* of the Cactaceae family of the Caryophyllales order. Dragon fruit plant (*Hylocereus spp.*) is generally a perennial climbing cactus species**.** The most common pitayos that being cultivated in many countries now a days are the white dragon fruit (*Hylocereus undatus*); the pink dragon fruit (*Hylocereus sp*.); the red dragon fruit (*Hylocereus polyrhizus*); the purplish-red dragon fruit (*Hylocereus costaricensis*); and the yellow dragon fruit (*Hylocereus megalanthus*). Countries of the tropical climates of the North, South and Central America are the native motherlands of Pitayos**.** The fruits of pitaya "dragon fruit" exhibit marked decorative, nutritional, health benefits, biological and therapeutic effects. Pitaya attracts attention because of its uses as a fruit color, a source of valuable minerals, powerful antioxidant properties and valuable nutritional contents. Dragon fruits contain glucose, vitamins, organic acids, soluble dietary fibers, phyto albumins and minerals. The micropropagation can be a useful tool that may replace traditional propagation to avoid limitation of starting mother plant material, to accelerate propagation cycles, to maintain the genetic fidelity and shorten the propagation periods from several months to a few weeks and to obtain disease-free plants.

TREE SPECIES COMPOSITION INFLUENCES ANNUAL LITTER FALL IN TROPICAL MOIST DECIDUOUS FORESTS OF EASTERN GHATS, ODISHA, INDIA

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Abstract

The present study investigates the influence of tree species composition on annual litter fall in tropical moist deciduous forests within Eastern Ghats, Odisha, India. For this purpose three forest communities Pure Sal Forest (PSF), Sal-dominated Moist Deciduous Forest (SDMDF) and Moist Deciduous Forest without Sal (MDFWS) located in Kandhamal district of Odisha was selected. Tree species richness, density, basal area and related diversity indices were determined through floristic inventory into 9.0 ha of forest area harboring PSF, SDMDF and MDFWS community. The above ground annual litter (AGL) fall was determined by collecting senescence leaf and other plant part at monthly intervals using litter traps of 1 m^3 size. The fine root litter production was determined through sequential soil core method. The fine root were extracted seasonally (summer, rain, winter) up to a depth of 45 cm (0-15 cm, 15-30 cm and 30-45 cm). Among the studied three forest communities the highest number of tree species was recorded in MDFWS type (51 number of tree species belonging to 41 genera and 22 families) followed by SDMDF type (39 number of tree species belonging to 36 genera and 19 families) and PSF (17 number of tree species belonging to 17 genera and 11 families). The density of trees was in the order MDFWS (746.75 trees ha^{-1}) > SDMDF (609.67 trees ha^{-1}) > PSF (545.00 trees ha^{-1}). Tree basal area was 27.15 m^{-2} ha^{-1} in MDFWS, 21.82 m^{-2} ha^{-1} in PSF and 17.83 m^{-2} ha^{-1} in SDMDF. The annual higher litter fall was observed higher in SDMDF (12.77 t ha^{-1}) followed by PSF (10.580 t ha^{-1}) and MDFWS type (8.93 t ha^{-1}). Amongst various plant parts (leaf, small branch, reproductive parts, and root) contributing to total annual litter pool of the forest, share of leaf litter was maximum and ranged 81.58% (PSF) to 84.18% (SDMDF). The

litter production was high during summer season and least during rainy season in all the forest communities. This study will be helpful in assessing nutrient turnover and fertility status of soil in various forests stands in the Eastern Ghat region.

REVOLUTIONIZING CROP NUTRITION : THE DEVELOPMENT OF SOLID AND LIQUID BIOFERTILIZERS

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Abstract

The development of bio-fertilizers, encompassing both solid and liquid formulations, represents a significant advancement in sustainable agriculture. Solid formulations involve blending the inoculums with a solid carrier, which serves as a medium to transport beneficial microbes from the laboratory to the field. These carriers, which include soils, plant waste materials, inert substances, and lyophilized microbial cultures, enhance the bioavailability of essential nutrients, protect against soil-borne pathogens, and facilitate the biodegradation of organic pollutants. Despite the extensive research on bacterial strain selection, the choice of carrier material and its impact on crop growth and yield have received limited attention. Initially, solid carriers were predominantly used, with soil being the first carrier for rhizobia. However, modern advancements have led to the categorization of carriers into four main types, with recent additions of liquid and capsule-based carriers. Conversely, liquid formulations, which can be aqueous, oil, or polymer-based, offer distinct advantages. These formulations not only contain microorganisms and their nutrients but also include cell protectors and additives that enhance cell survival during storage and application. Liquid inoculants, suitable for advanced seeding equipment, support higher cell concentrations, ease of production and sterilization, and compatibility with modern agricultural machinery. They also provide enhanced resistance to abiotic stresses such as high temperatures and desiccation, promoting the formation of resting cells for improved survivability. Overall, the innovation in bio-fertilizer formulations—both solid and liquid—presents a promising approach to boosting crop yields, enhancing soil health, and supporting sustainable agricultural practices. This abstract highlights the importance of carrier material selection and the evolving techniques that ensure the effective application and performance of bio-fertilizers in diverse agricultural settings.

EVALUATION OF ECO-FRIENDLY APPROACHES FOR THE MANAGEMENT OF GRAM POD BORER (*H. ARMIGERA*) IN CHICKPEA

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Abstract

A field experiment was conducted at Pulses Research Unit, Dr. P.D.K.V., Akola (M.S.) during 2022-23, to evaluate different biocontrol techniques against pod borer H.armigera in chickpea. The experiment was laid out in randomized block design with three replications and nine treatments viz., Bacillus thuringiensis NBAIR Bt G4 @ 20ml/L, Hear NPV NBAIR1 @ 4 ml/L (1.5x1012 OBs/ha), Metarhizium anisopliae strainNBAIR Ma4 @ 1×108 conidia /g @ 5 g /l, Heterorhabtid is indica NBAIR Hi 101 @ 12kg/ ha, BARC Bt formulation (ISPC-1 bacterium) @ 1.4g/L, Homemade neem @ 10%, Maharashtra (DOR Bt 1%) @ 4g/L, Chlorantraniliprole 18.5 SC @ 0.25 ml/L and Untreatedcontrol. Two spraying was undertaken one at 50 per cent flowering and second at podformation. The performance of each treatment was judged on the basis of larval incidence, pod damage and yield. Considering the effectiveness of various treatments; The lowest larval population of H. armigera was recorded in the treatment Chlorantraniliprole 18.5SC i.e. 0.19 larvaper plant and found at par with Hear NPV NBAIR1 and BARC Bt formulation with 0.28and 0.31 larvae per plant, respectively. The lowest per cent pod damage at harvest wasrecorded in treatment, Chlorantraniliprole 18.5 SC (0.15 %) and found found equally effective with the treatments, BARC Bt formulation NBAIR Bt G4 and Homemadeneem with 1.68, 1.70 and 2.16 per cent pod damage, respectively. Similar trend was observed in case of yield, the highest yield was recorded in treatment, Chlorantraniliprole18.5 SC (1845.76 kg/ha) followed by BARC Bt formulation (1582.22kg/ha), Homemade neem (1566.67kg/ha) and HaNPV (1524.67kg/ha).

EFFECT OF ENVIRONMENTAL EXPOSURE OF ARSENIC ON HEMATO-BIOCHEMICAL PROFILE OF CATTLE

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Abstract

To study the environmental exposure of arsenic and its effect on hematobiochemical profile in cattle (n=8), samples were collected from Nurichak, Udaypur and Kachhariadih villages (Nawada district), and Ekauna (Bhojpur district), of Bihar. The levels of arsenic were estimated using AAS (atomic absorption spectrophotometer). The levels of arsenic (µg/Liter) in the estimated drinking water samples from Nawada were below detection level whereas the same from Ekauna were 27.73±5.63. The maximum permissible limit of arsenic for drinking water is 10µgm/liter (WHO). The rectal temperature (^{0}F), respiration rate per minute, haemoglobin (g/dl), PCV(%), blood urea (mg/dl), serum creatinine (mg/dl), SGOT (IU/L), SGPT (IU/L) of cattle from the Nawada district were 101.5±0.10, 27±0.47, 8.17±0.24, 24.00±0.76, 27.57± 1.28, 0.73±0.08, 92.56±3.56, 32.24±1.68 respectively, whereas the same were 101.5± 0.12, 27.4±0.56 7.88 ±0.35, 23.37±1.03, 6.40±0.13, 33.58 ±1.75, 0.98±0.12, 134.68±4.28 and 47.64±1.37 respectively at Ekauna. In conclusion, the above data shows that there is decrease in hemoglobin and PCV while increase in the blood urea, serum creatinine, SGOT and SGPT in the area where arsenic is high showing that the animals are in higher oxidative stress condition.

EFFICACY OF DIFFERENT CHEMICAL INSECTICIDES FOR THE CONTROL OF *HELICOVERPA ARMIGERA* (HUBNER) IN CHICKPEA

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Abstract

A field experiment was conducted at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during the *Rabi* season, 2023-24. The results revealed that nine insecticides treatments evaluated against *Helicoverpa armigera* (Hubner) in chickpea. Among different nine insecticides broflanilide 20 SC 0.005% was the most effective treatments as its recorded lowest 0.34 larval population per plant and lowest 4.94 per cent pod damage. Next effective treatments were isocycloseram 10 DC 0.010% and spinetoram 11 SC 0.011% as they recorded 0.44 and 0.51 larvae per plant, respectively. The treatment of broflanilide 20 SC 0.005% recorded maximum yield (2267 kg/ha) and highest net realization over control (49337 Rs./kg), which was statistically at par with treatment of isocycloseram 10 DC 0.010%, spinetoram 11 SC 0.011%.

EFFICACY OF BOTANICALS AGAINST *A. FLAVUS* AND AFLATOXIN SYNTHESIS INHIBITION IN PEANUT

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Abstract

Peanut (*Arachis hypogea* L.) is an important oilseed as well as legume which plays an essential role in terms of income for the rural people having marginal and sub-marginal land. The oil may be extracted and used for cooking, and the residual cake is used for production of food or more commonly, in animal feeds. Peanut is frequently contaminated with aflatoxins which is the most toxic and is therefore listed as a group I carcinogen. Efficacy of botanicals were evaluated against *A. flavus* growth inhibition and aflatoxin synthesis in kernels of peanut cultivar SB-11. Methanolic extract of pomegranate fruit peel [3000 ppm concentration] was significantly found effective with minimum colony diameter of 30.67 mm without sporulation having 54.68 per cent growth inhibition of *A. flavus* over control and no aflatoxin was detected by qualitative method on PDA

medium at *in-vitro* condition. Concentration of 3000 ppm was significantly found to be effective with minimum pod colonization severity of 26.67 per cent having 72.88 per cent growth inhibition. Also, kernel colonization severity of 26.67 per cent having 70.37 per cent growth inhibition of *A. flavus* over control was observed.

EXPLORING SUSTAINABLE AGRICULTURAL SOIL MANAGEMENT: TRENDS IN BIO-CHAR BASED SLOW RELEASING FERTILIZERS

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Abstract

Sustainable agriculture is the best way to address the challenges of food security, environmental degradation, and climate change. On the other hand, conventional agricultural practices often rely heavily on synthetic fertilizers, leading to nutrient imbalances, soil degradation, and water pollution. To promote sustainable agriculture, there is a growing need for innovative and eco-friendly fertilizer management strategies. Biochar has garnered increasing attention as a soil amendment with the potential to mitigate these issues. Biochar, a carbon-rich material derived from the pyrolysis of organic matter, has emerged as a promising alternative for sustainable nutrient management in agriculture. Superficially, biocar produced in oxygen free environment at moderate temperature ranges. Commercially, biochar produced from coconut shell, wood etc., but can also economically produced from agricultural waste such as rice straw, bamboo waste, maize stalk etc. However, the production process of biochar and methods of production elucidated. Further, an attempt was made to show feasible method to synthesis of Slow release fertilizers. Specifically, the utilization of biochar for SRFs has gained prominence due to its unique properties. Critically, this chapter elucidates the synthesis, application, and potential mechanisms of biochar-based SRFs in agricultural soils. Furthermore, it addresses the prospects and challenges involved in adaption and applications of biochar-based SRFs.

MANAGEMENT OF PIGEONPEA WILT CAUSED BY FUSARIUM UDUM

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Abstract

Pigeonpea [*Cajanus cajan*] wilt disease caused by *Fusarium udum* is one of the most devasting soil-borne disease. In this experiment, eight fungicides, plant extracts and bioagents were evaluated by poisoned food technique and pot culture against *Fusarium udum*. Among different fungicides tested *in vitro* ,Carboxin 37.5% + Thiram 37.5% WS, Carbendazim 50% WP, Tebuconazole 25.9% EC, Propiconazole 25% EC, Thiophanate methyl 70% WP inhibit completely mycelial growth followed by Captan 50% WP, Mancozeb 75% WP.Whereas minimum wilt disease incidence was recorded in carbendazim 50% WP (13.33%), followed by thiophanate methyl 70% WP (17.77%), carboxin 37.5% + thiram 37.5% WS (28.88%), tebuconazole 25.9% EC (31.11%), propiconazole 25% EC (33.33%), captan 50% WP (37.77%), thiophanate methyl 45% + pyraclostrabin 5% FS (40%), mancozeb 75% WP (42.22%) at 90 DAS. Among different botanicals tested, *Azadirachta indica* was found most effective in arresting the mycelial growth of *Fusarium udum* as (73.33%) inhibition, followed by *Allium sativum*, *Eucalyptus globules*, *Milletia Pinnata*, *Allium cepa* and *Tagetes erecta* (45.55%).

EVALUATION OF PERFORMANCE OF DIFFERENT PGPR ALONG WITH RHIZOBIUM ISOLATEON GRAIN YIELD AND YIELD ATTRIBUTES OF PIGEONPEA

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Abstract

A field experiment was carried out during Kharif 2022-23 at Quality Seed Production Unit, CDF, Wanirambhapur, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.) to assess the effect of different plant growth-promoting

rhizobacteria(PGPR) along with Rhizobium isolate PKVPR-101 of Pigeonpea on grain yield and yield attributes of Pigeonpea (PKV-TARA). Six combinations of different PGPR along with the with Rhizobium isolate of Pigeonpea were investigated against without PGPR as control and Rhizobium isolate alone. Overall, seed inoculated with different PGPR along with Rhizobium isolate recorded increase trend of grain yield and ancillary parameters. The results of present study revealed that, the combined seed inoculation with Rhizobium isolate (PKVPR-101) + PGPR (PPR-46) recorded higher grain yield (1045 kg/ha) and maximum number of nodulation (24.80 nodules /plant), nodules dry weight/plant (103.52mg/plant) and plant dry weight/plant (6.28 gm/plant) among the different combination of plant growth promoting rhizobacteria.

EFFECT OF URDBEAN RHIZOBIUM ISOLATES FOR ENHANCING THE NODULATION AND GRAIN YIELD

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Abstract

The present field research was carried out during kharif 2022-23 at PulsesResearch Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.) to evaluate the performance of selected different Urdbean Rhizobium isolates on nodulation and grain yield of Urdbean (Black Gold). Urdbean Rhizobium isolates were procured from different agro climatic regions of India. The experiment was laid out in randomize block design with three replications and ten treatments including control and a treatment ofrecommended dose of chemical fertilizer with eight treatments of Rhizobium isolates. Thecarrier culture of Rhizobium isolates were inoculated @ 25 g/kg seed respectively.The results of present study revealed that the seed inoculation of Rhizobium isolate(WUR-12-1) recorded higher grain yield (792 kg/ha) and maximum number of nodulation (22.47 nodules /plant) among all the Urdbean isolates.

PDKV KANAK–WILT AND DDR DISEASE RESISTANT CHICKPEA VARIETY

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Abstract

The major goals of chickpea breeding are to increase production either by upgrading the genetic potential of cultivars or by eliminating the effect of diseases. More than 50 pathogens have been reported to affect chickpea Fusarium wilt is the major disease affecting chickpea crop in the whole country. Incorporation of disease resistant against Fusarium wilt in improved varieties hasalways been an important part of chickpea breeding programme for reduced losses due to diseases and stabilized chickpea yield. PDKV Kanak (AKG-1303) is a multiple disease resistance, high yielding and suitable for mechanical harvesting variety of chickpea (*Cicer arietinum* L.) derived through hybridization followed by pedigree selection method from a cross ofSAKI-9516 X AKG-70. It has high yielding suitable for mechanical harvesting, early and synchronous maturity with medium bold grain size (21.76 g per 100 seed). In AICRP (AVT-2 trial) seventeen entries were evaluated against wilt at 12 locations indifferent zones. Out of these, entries PDKV Kanak showed Resistant to moderately resistant for Fusarium Wilt, at 6 or more locations, and also for Dry root rot.

SEED DORMANCY STUDIES IN MUNGBEAN (*VIGNA RADIATA* L. WILCKZEK)

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Abstract

The present study entitled, “seed dormancy studies in mungbean (*Vigna radiata* L. Wilckzek)” was carried out during kharif

2021-22. The treatments were applied by the foliar application at 50 and 60 days after sowing. Field observations like number of pods per plant, pod length(cm), number of seeds per pod, seed index(g), pod yield per plant(g), pod yield per plot(kg), seed yield per plant (g), seed yield per plot (kg), seed yield (kg/ha), moisture content and laboratory observations like germination percentage (%), dormant seed (%), seedling length (cm), seedling dry weight (g), vigor index I, vigor index II and rate of germination were recorded. The results exhibited significant differences in yield and yield contributing characters due to foliar spray when compared to the control. Among the treatments, maleic hydrazide 250 ppm gave higher yield and yield contributing characters as compared to other treatments. The plot sprayed with maleic hydrazide 250 ppm recorded significantly higher no. of pods per plant (29.70), pod length (13.6), no. of seeds per pod (13.20), seed index (3.72 g), pod yield per plant (37.18 g), pod yield per plot (1.86 kg), seed yield per plant (29.27 g), seed yield per plot (1.46 kg), seed yield (13.00 kg/ha). It is important to induce dormancy by non-conventional methods i.e., foliar application of maleic hydrazide and paclobutrazol at flowering and pod initiation stages to save the produce and retain seed quality against field sprouting. The findings of the present study concluded that among all the treatments, foliar spray of maleic hydrazide 250 ppm at flowering and pod initiation stages recorded the highest seed yield as well as high no. of pods per plant, no. of seeds per pod, seed index and was also superior for inducing seed dormancy up to 35 days after storage without affecting the yield.

LIFE TABLE OF *CHRYSOPERLA ZASTROWI SILLEMI* (ESBEN-PETERSON) ON DIFFERENT HOSTS

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Abstract

Studies the life table of *C. zastrowi sillemi* was carried out at constant temperature of 25 ± 1°C on Mustard aphid [*Lipaphis erysimi* (Kaltenbach)], Maize aphid [*Rhopalosiphum maidis* (Fitch)], Cotton aphid [*Aphis gossypii* (Glover)], Cabbage aphid [*Brevicoryne brassicae* (Linnaeus)], Coriander aphid [*Hyadaphis coriandri* (Das)], Cotton mealy bug [*Phenacoccus solenopsis* (Tinsley)] and eggs of rice moth [*Corcyra cephalonica* (Stainton)] during the year 2020-21. the net reproductive rate (R_0) of *C. zastrowi sillemi* on mustard aphid, maize aphid, cotton aphid, cabbage aphid, coriander aphid, cotton mealy bug and eggs of *C. cephalonica* was 66.81, 85.27, 88.06, 74.34, 68.05, 59.73 and 77.11, respectively. The mean length of generation also differed on these hosts. It was maximum on cabbage aphid (41.51 days) and minimum on eggs of *C. cephalonica* (39.18 days). The innate capacity of increase in number (r_m) was ranged from 0.0958 to 0.1028. The finite rate of increase was worked out as 1.1069, 1.1138, 1.1145, 1.1094, 1.1102, 1.1083 and 1.1173 females per female per day on mustard aphid, maize aphid, cotton aphid cabbage aphid, coriander aphid, cotton mealy bug and eggs of *C. cephalonica*, respectively.

MORPHOLOGICAL CORRELATION STUDY OF WHEAT VARIETIES AGAINST *RHYZOPERTHA DOMINICA*

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Abstract

The ten wheat varieties were correlated based on various morphological characters of seed during storage against *Rhyzopertha dominica*. Among various varieties screened, the lower number of adults emerged in GW 513, HI 1544, GW 206, GW 1 and LOK 1 whereas, it was higher in GDW 1255, GADW 3, GW 499, GW 496 and GW 451. The weight loss due to infestation by this pest, the variety GW 513 was categorized into resistant group, whereas GW 206, HI 1544, GW 1 and LOK 1 were grouped under moderately resistant category. The varieties, GW 451, GW 496, GDW 1255 and GW 499 were considered as moderately susceptible and GADW 3 was found highly susceptible. There was positive correlation relationship between the different physical characters of seed except the seed hardness *viz.,* length of seed, width and weight of 100 seeds of different varieties with the weight loss of grain due to infestation of *R. dominica.* Seed weight (r= 0.87**) and length (r= 0.73*) were positively correlated to per cent weight loss. The seed hardness was negatively correlated with weight loss (r= -0.48), whereas it was positively and non-significantly correlated with seed width (r= 0.61).

CHARACTERIZATION OF FRENCH BEAN (*PHASEOLUS VULGARIS* L) GERMPLASM REVEALS WIDE VARIABILITY FOR RESISTANCE TO RUST DISEASE, MICRONUTRIENTS (ZINC AND IRON) IN GREEN PODS

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Abstract

French bean is a major legume vegetable and is cultivated in cool seasons across the world. Hidden hunger due to the consumption of zinc and iron-deficient diets are major concerns in modern days and rust disease is another major production constraint in French bean. To identify the germplasm having high zinc and iron contents at the green pod stage and to identify the rust-resistant germplasm, we evaluated 111 germplasm comprising 67 and 44 accessions with determinate and indeterminate growth habit respectively during *rabi,* 2022 and observed significant genetic variability for most of the traits. The days to flowering, mean pod yield per plant, and, zinc and iron contents were found significantly higher in indeterminate types as compared to determinate types. Among the determinate accessions, IIHR-228 for green pod yield per plant, IIHR-50 for zinc and IIHR-155 for iron contents at green pod stage were identified as best performing accessions. Whereas in indeterminate accessions, better-performing accessions are IIHR-214 for pod yield per plant, IIHR-274-2 for zinc and IIHR-99 for iron contents. The rust incidence was very severe during the study period and the highest PDI above 80% was observed in susceptible accessions. The mean of PDI and AUDPC showed that indeterminate types have better resistance as compared to determinate types and a total of five indeterminate type accessions didn't infect with rust disease under artificial disease screening up to 80 days after sowing. The outcome of the study is useful in further utilization of germplasm accessions with high zinc, iron&rust resistance in French bean crop improvement programmes.

STUDIES OF PARCHMENT IMPREGNATED LEAD (II) MOLYBDATE SYNTHETIC MEMBRANE: EVALUATION OF MEMBRANE SELECTIVITY FROM BI-IONIC POTENTIAL AND CONDUCTIVITY MEASUREMENT

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Abstract

The transport of ions over a parchment-impregnated Lead (II) molybdate membrane was examined. The parchment paper was treated with Lead Chloride ($PbCl_2$) and Sodium Molybdate (Na2MoO4) solution salts to incorporate Lead (II) Molybdate ($PbMoO_4$) precipitate. This reduces pore size and raises the effective fixed charge, which affects transport phenomena in membranes. SEM, TEM, and EDX were used to characterise the produced membrane. The membrane conductivity in contact with a 1:1 electrolyte was measured experimentally to assess the membrane's selectivity with preset inter-membrane mobility ratio values. The membrane's ion selectivity has been determined to be K+>Na+>Li+, indicating the weak field strength of the charged groups attached to it.

TRITROPHIC DYNAMICS : EXPLORING SYNOMONAL AND KAIROMONAL INTERACTIONS AMONG BRINJAL CULTIVARS, MEALYBUG *COCCIDOHYSTRIX INSOLITA* GREEN, AND THE NATURAL ENEMY *CHRYSOPERLA ZASTROWI SILLEMI* ESBEN-PETERSON

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Abstract

The orientation response of *Chrysoperla zastrowi sillemi* Esben-Peterson adults towards the synomonal compounds of different mealybug-infested brinjal cultivars was evaluated using a multi-armed olfactometer. Results revealed that the cultivar Udit attracted the highest number of natural enemies, while the cultivar Pusa Uttam attracted the lowest number. The

differences in compounds and their concentration in the volatile profile of the cultivars may lead to the highest preference of *C. zastrowii sillemi* for Udit and the lowest preference for Pusa Uttam. The relative response of *C. zastrowi sillemi* adults to the synomonal extracts of healthy and mealybug-infested brinjal cultivars in a Y-tube olfactometer was also assessed. The results indicated that *C. zastrowi sillemi* adults showed a greater preference towards the synomonal compounds of mealybug-infested plants compared to healthy synomonal extracts. Furthermore, the relative response of *C. zastrowi sillemi* towards the kairomonal compounds of mealybug *Coccidohystrix insolita* Green was evaluated in a Y-tube olfactometer. The results demonstrated that the highest mean number of adult lacewings were attracted to the kairomonal compounds of mealybugs compared to control n-hexane.

Overall, the present study highlights that differences in the composition of hydrocarbons in volatile blends determine the selectivity of the natural enemy, *C. zastrowii sillemi.* The findings underscore the significance of volatile blends, particularly HIPVs and kairomones, in mediating the interactions between natural enemies and their prey. Understanding the mechanisms behind natural enemy attraction to specific compounds could inform the development of more targeted and effective pest management strategies, potentially reducing reliance on chemical pesticides. Additionally, elucidating tri-trophic interations aids in predicting their behavior in agroecosystems, facilitating their integration into sustainable pest management practices.

DEVELOPMENT OF DECISION SUPPORT TOOL FOR FARMING SYSTEM USING STRUCTURED QUERY LANGUAGE TO GET OPTIMUM INCOME

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Abstract

Decision support tool (DST) for farming system has been developed Management information system on integrated farming has been developed using MySQL and dotNet following third normal for in database creation. This DST was tested with farmer's field data at Anantpur village in Nalanda district of Bihar and suitable to provide decisions in allocating land in such as a way as to get increased crop production and income to farmers of this area. This computerized system calculates total input cost, total profit/ income, net income, allocated area in different components of farming system in such a way as to get maximum income from a piece of land such as one acre and two acre area. A suitable database is created using SQL (Structured Query Language) which is a relational databases that uses tables, relations and queries. Graphical user interfaces (GUI) have been developed using dotNet software that are used to data entry, modification of data, updation of data and taking required reports. First data are entered as per requirement and this DST provides results/ decision in such a way as to get maximum income or any type of results as required by the users. This system is fully secured because it is based on user ID and Password. Only authentic user may be able use this DST. Crop, horticulture, livestock and fish are the main components of 2 acre farming system model at Ananatpur village. Farmers have initially allocated 1.2 acre in crop, 0.3 acre in horticulture, 0.08 in livestock and 0.42 acre in fish in 2 acre land and they get gross income of Rs. 348165. This DST provides decision in allocating the land among different components of farming system as 1 acre in crop, 0.4 acre in horticulture, 0.08 in livestock and 0.52 in fish and the gross income is 382060. The income of farmers is increased by 22% as the land allocation is done as directed by this DST. So this DST is very useful to farmers.

OPTIMIZATION OF PLANTING GEOMETRY AND NUTRIENT MANAGEMENT ON YIELD AND NUTRIENT UPTAKE IN TEFF

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Abstract

Teff is a minor millet cultivated and consumed as a staple food in Ethiopia. The Central Food and Technological Research Institute, Mysore introduced the teff crop to India- an effort to promote it as a "superfood". Premier areas of research are need of the hour to promote this crop at the global level so, there is need to standardize the agro techniques. Among such

techniques, planting geometry and nutrient management play a vital role in increasing yield levels of teff crop. With this view, a field experiment was conducted at GKVK, University of Agricultural Sciences, Bengaluru, Karnataka to study the "Performance of Teff under different planting geometry and nutrient management". The experiment was laid out in RCBD with Factorial concept, consisting of, two planting geometry (30 cm × 10 cm and 45 cm × 10 cm) and five nutrient levels (50 % RDF, 75 % RDF, 100 % RDF, 125 % RDF and absolute control) replicated thrice. Nitrogen, phosphorous and potassium uptake by the crop was found significantly higher under 30 cm × 10 cm spacing and among nutrient levels, uptake was significantly higher with application of 125 % RDF. Also, teff recorded significantly higher grain yield (2.37 q ha^{-1}) and straw yield (3.65 q ha^{-1}) under 30 cm × 10 cm spacing and among nutrient levels grain yield was significantly higher with application of 100% RDF. Teff is a lodging susceptible crop because of its lean stem so that yield was found to be highly correlated with lodging percentage. Lodging was significantly higher under narrow spacing and with differed nutrient levels, lodging was observed before grain filling stage under 125 per cent RDF causing severe yield reduction in teff. It may be concluded that, planting at narrow spacing of 30 cm × 10 cm with application of 100% RDF is quite promising for better performance of teff in terms of nutrient uptake and yield.

IMPACT OF ORGANIC SOURCES OF NUTRIENTS ON SOIL FERTILITY, NUTRIENT BALANCE AND PRODUCTIVITY OF RAINFED COTTON IN VERTISOLS

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Abstract

A field experiment was initiated during 2019-20 and the present study was conducted during 2023-24 at research farm of AICRP for Dryland Agriculture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra), to assess the impact of organic sources of nutrients on soil fertility, nutrient balance and productivity of rainfed cotton (Gossypium spp.) in Vertisols. The various organic sources used were FYM, vermicompost and gliricidia green leaves. The nine treatments consisting of various combinations of organic sources of nutrients along with three replications were evaluated in randomized block design. The soil of the experimental site was low in available nitrogen, medium in available phosphorus and high in available potassium. The results after 5th cycle of the study indicated that integrated application of 50% N through FYM/ vermicompost + 50% N through gliricidia resulted in improvement in soil fertility and seed cotton yield. Significantly higher organic carbon was found with the application of 50% N through FYM + 50% N through gliricidia (T_5)which was at par with application of 50% N through vermicompost + 50% N through gliricidia (T_7) and application of vermicompost 3.0 t ha^{-1} (T_4).Similarly, the nutrient balance after five years of experiment indicate that there were nutrient gains in almost all the treatments, however, the higher gain of N and K was observed with application of 50% N through FYM + 50% N through gliricidia(T_5)while higher gain of P was observed with application of 50% N through FYM + 50% N through vermicompost(T_6). Hence, it can be concluded that integrated application of 50% N through FYM/ vermicompost + 50% N through gliricidia resulted in improvement in soil fertility, nutrient balance and productivity of cotton in Vertisols.

ASSESSMENT OF GARLIC VARIETIES FOR BULB YIELD, YIELD CONTRIBUTING CHARACTERS AND ECONOMICS

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Abstract

Garlic is important spice & condiment grown in district Mohali of Punjab. It has acquired reputation in different traditions as a prophylactic and therapeutic medicinal plant. It is also an important foreign exchange earner for India. Keeping in the view the importance of garlic in crop diversification, health benefits and income generation in Punjab, Krishi Vigyan Kendra S.A.S. Nagar (Mohali) conducted an on farm trial (OFT) during 2019-20 in different villages of Mohali district of Punjab to evaluate the performance of three garlic varieties *viz*. T_1: Farmers practice, T_2: PG-17 and T_3: PG-18. The trial was conducted in randomized block design (RBD) with three replications. Yield data and economic parameters were collected from the trial plots and further cost of cultivation, net income and benefit cost ratio were computed. The selected farmers were trained

through training programmes, farmer-scientist interactions and diagnostic field visits which ensured various aspects of proper seed rate, spacing, application of balanced and optimum doses of organic manures, nutrients, proper weed management and timely management of insect-pests. The present investigation was carried out in five farmer's field during *rabi* 2019-20 to evaluate three genotypes of garlic for bulb yield and contributing characters. From the results of the on farm trial conducted, it was revealed that T_1 (Farmer's practice) gave bulb yield of 34 q/acre with B: C ratio of 3.09 whereas T_2 gave 42 q/acre with B: C ratio of 3.82 and T_3 gave 46 q/acre along with the maximum B: C ratio of 4.17. T_3 was also found to be earliest in terms of maturity (168 days), having maximum average weight of bulbs (26 g) and maximum bulb diameter (4.50). T_3 is observed to be having 35.29% increase over check while T_2 is found to having 23.53 % increase over the check. From the results of present investigation it was revealed that adoption of garlic variety PG-18 is most suitable for cultivation in Mohali district of Punjab as it gave highest yield along with highest returns per unit area as compared to the other varieties being grown by the farmers in the district. Favorable benefit cost ratio proved the economic viability of the intervention and further adoption by farmers.

INSIGHTS INTO THE WHOLE GENOME SEQUENCE OF *BACILLUS THURINGIENSIS* NBAIR BTPL, A STRAIN TOXIC TO THE MELON FRUIT FLY, *ZEUGODACUS CUCURBITAE*

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Abstract

Bacillus thuringiensis (Bt) is the most widely used biopesticide for the management of insect pests, especially those belonging to the Lepidopteran order. However, information regarding the Bt strains and toxins targeting the Melon fruit fly, *Zeugodacus cucurbitae* is very limited. Therefore, in this study, we isolated and identified five indigenous Bt strains toxic to larvae of *Z. cucurbitae*. However, out of five strains, NBAIR BtPl showed the lowest LC_{50} value (37.3 ìg/mL) whereas the Lc_{50} value for reference Bt strain var. israelensis (4Q1) was (45.41 ìg/mL). Therefore, we used the NBAIR BtPl for whole genome sequencing to identify the cry genes present in it. Homology search through the BLAST algorithm revealed that NBAIR BtPl is 99.8% similar to *B. thuringiensis* serovar *tolworthi*, and gene prediction through Prokka revealed 7406 genes, 7168 proteins, 5 rRNAs, and 66 tRNAs. BtToxin_Digger analysis of NBAIR BtPl genome revealed four *cry* gene families: *cry1*, *cry2*, *cry8Aa1,* and *cry70Aa1*. We also found that *cry70Aa1* was absent in other indigenous strains. Thus, we can predict *cry70Aa1* is the possible reason for toxicity in *Z. cucurbitae*. In this study we also identified other virulent genes encoding zwittermicin, chitinase, fengycin, and bacillibactin. Thus, the current study aids in predicting potential toxin-encoding genes responsible for toxicity to *Z. cucurbitae* and paves the development of Bt-based formulations and transgenic crops for the management of dipteran pests.

AGRI-HORTI SYSTEMS FOR SOIL HEALTH MANAGEMENT

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Abstract

To determine how agri-horticultural systems affect crop productivity and soil health, a study was carried out. Three intercrops, namely wheat, gram, and mustard, were sown in four distinct orchards—mango, guava, lime, and aonla-during the winter months. Various fruit orchards had an impact on the bulk density of the soil, which is progressively rising throughout the depth (0-45 cm). The maximum percentage of soil organic content (0.96%) was found in the upper layer (0–5 cm) of the guava orchard, while the lowest percentage (0.30%) was found in the lower layer (45–60 cm) of the lime orchard. In a guava orchard, the maximum concentrations of potassium and phosphorus (30.46 kg/ha and 612 kg/ha) were found in the upper layer of the soil. As soil depth increased, all micronutrients declined. In every orchard, the maximum soil carbon store was deposited between 5 and 15 cm down. Regardless of soil depth, guava (14.02 t/ha) and aonla orchard (15.13 t/ha) had the largest carbon stocks, respectively. In a similar vein, the assessment of carbon sequestration by different fruit crops revealed that the lime orchard sequestered 35.54 t/ha of carbon dioxide from the atmosphere, while the aonla orchard sequestered 36.46 t/ha. Mango yields ranged from 11.76 q/ha in the mango + mustard model to 12.54 q/ha in the mango + wheat model. The mango + gram model had the maximum mango equivalent yield (42.87q/ha). The guava yield in the orchard was 75.00 q/ha when using the

gram model and 66.04 q/ha when using the mustard model. The mustard model produced the lowest guava equivalent yield (93.73q/ha), whereas the guava + gram model produced the most. The yield of aonla in the orchard was 490 q/ha with the mustard model and 554 q/ha with the gram model. The aonla + gram model had the highest aonla equivalent yield (593q/ha).

EFFECT OF WATER STRESS ON CHANGES OF CHLOROPHYLL IN FRUIT CROPS

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Abstract

Water stress is a significant environmental factor affecting plant growth and development, particularly in fruit crops. Chlorophyll, the pigment responsible for photosynthesis, plays a crucial role in plant productivity and stress response. This review examines the effects of water stress on chlorophyll content and its related changes in fruit crops. We discuss the mechanisms underlying chlorophyll degradation and synthesis under water stress conditions, highlighting the regulatory pathways and molecular responses involved. Furthermore, we explore the potential strategies for mitigating the adverse effects of water stress on chlorophyll metabolism in fruit crops.

DROUGHT TOLERANCE SCREENING OF *RABI* SORGHUM GENOTYPES USING POLYETHYLENE GLYCOL-INDUCED OSMOTIC STRESS

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Abstract

This study examined the drought tolerance of *rabi* sorghum genotypes by inducing osmotic stress using Polyethylene glycol (PEG) 6000, a hydrophilic polymer that reduces water availability to seeds, thus limiting imbibition and germination. Sixty sorghum genotypes were screened in a laboratory experiment to identify potential drought-tolerant traits. The genotypes were subjected to varying levels of osmotic stress at PEG concentrations of 0%, 0.5%, and 1.0%. Data on germination percentage, vigor index, and seedling growth parameters, including shoot length, root length, and biomass accumulation, were collected. The results showed significant variation in germination rates among the genotypes under stress. Germination percentage decreased from 77% to 59% as PEG concentration increased from 0% to 1%. Seedling length and vigor index also declined progressively with higher PEG levels. Genotypes SVD-1272 and SPV-486 exhibited the highest germination percentages at 1% PEG (88% and 84%, respectively), while M148-138 and ICSV-16006 had the lowest (12% and 16%). Shoot length of the BJV-44 cultivar remained relatively stable across PEG levels (24.19 cm at control, 23.78 cm at 0.5% PEG, and 19.68 cm at 1% PEG), indicating lower sensitivity to osmotic stress. The vigor index, which combines germination percentage and seedling growth, was significantly reduced by PEG, reflecting decreased seed quality. Osmotic-sensitive genotypes had a lower vigor index, whereas tolerant ones showed less variation in germination under stress. Specifically, ICSR-15001 showed a low reduction in vigor index II, while SPV-2217 recorded the highest reduction. These findings highlight the combined effects of delayed germination and inhibited seedling growth under osmotic stress, leading to reduced seed quality and seedling performance. Identifying sorghum genotypes with better osmotic stress tolerance is crucial for improving crop productivity in arid environments.

MOLECULAR CHARACTERIZATION OF CYCLOPHILINS FROM *GLYCINE MAX.*

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Abstract

Cyclophilins are a widely distributed group of proteins that interact with cyclosporin A (CsA), a drug used for immunosuppression. Many of these proteins exhibit peptidyl-prolyl cis-trans isomerase (PPIase) activity, which facilitates the

conversion of the peptide bond preceding a proline residue between its cis and trans configurations. Recent studies indicate that cyclophilins are remarkably versatile proteins with diverse functions. They play roles in regulating numerous processes related to growth and development in plants, including hormone signaling and responses to stress. Our study aims to understand diversity amongst 62 previously reported cyclophilins in *G.max* on 300 germplasm accessions maintained at ICAR Indore. PIC value ranged from 0.39 to 0.80. On average, each locus had a PIC value of 0.546. Our study suggests GmCYP13 has putative role in YMV resistance.

STUDIES ON TRENDS FOR PRODUCTION AND REPRODUCTION TRAITS IN FRIESWAL CATTLE UNDER FIELD PROGENY TESTING

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Abstract

The goal of animal breeding is to maximize the genetic gain per unit of time. In order to assess this gain per unit time, it is essential to distinguish the environmental influences from the overall phenotypic changes. Data were collected on production and reproduction performance spread over a period of nine years (2013-2021), pertaining to Frieswal cattle maintained at Pantnagar centre of AICRP-FPT. The traits considered were age at sexual maturity (ASM), age at first calving (AFC), gestation period (GP), 305-days milk yield (305D-MY), test day peak yield (TDPY), fat percentage (FP), lactation length (LL), calving interval (CI), service period (SP), dry period (DP) and number of services per conception (NSPC). The genetic and phenotypic trends of the traits were estimated by regressing breeding values and phenotypic values of the traits on the year of calving, respectively. The environmental trend was determined by subtracting the estimated breeding values from the phenotypic values, and the regression of obtained values on year of calving was considered as environmental trend. The estimated phenotypic, genetic and environmental trends were in positive direction for ASM, AFC, TDPY, 305D-MY and DP whereas in negative direction for GP, FP, LL, CI, SP and NSPC. The results indicated that there has been improvement in the herd concerning TDPY and 305D-MY, but some deterioration in traits such as ASM, AFC, Fat %, and DP.

CORRELATION AND PATH ANALYSIS IN GROUNDNUT (*ARACHIS HYPOGAEA* L.)

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Abstract

Groundnut (*Arachis hypogaea* L.) is an important food, feed and oilseed crop. It contains 48-50% oil and 26-28% protein, and is a rich source of dietary fiber, minerals, and vitamins. It is grown in nearly 100 countries. Major groundnut producers in the world are: China, India, Nigeria, USA, Indonesia and Sudan. Groundnut is gaining importance as a food crop, on account of high digestible proteins, vitamins, minerals, phytosterols and due to increased consumer preference after value addition. Over 100 countries worldwide grow groundnut. Developing countries constitute 97% of the global area and 94% of the global production of this crop. The production of groundnut is concentrated in Asia and Africa (56% and 40% of the global area and 68% and 25% of the global production, respectively). In India, the area, production and productivity of groundnut during 2022-23 were 49.612 lakh hectares, 102.967 lakh tones and 2075 kg ha^{-1}, respectively. While in Rajasthan, the area, production and productivity of groundnut during 2022-23 were 8.048 lakh hectares, 19.318 lakh tones and 2400 kg ha^{-1}, respectively. There is a need to identify high yielding groundnut genotypes which will be useful and economic to farmers of the area. Hence, keeping in view, the field experiments were conducted during *Kharif*, 2022 and 2023 at Instructional Farm, CTAE (MPUAT), Udaipur.

Among the tested entries viz., UG 262 gave maximum mean dry pod yield (3935 Kg/ha) followed by other entries and significantly superior over all the checks viz. Pratap Mungphali-3 (3009 kg ha^{-1}), JL 501 (2894 kg ha^{-1}), TG 37 A (2836 kg ha^{-1}), and GG 7 (2778 kg ha^{-1}). Kernel yield was ranged from 1841-2941 kg ha^{-1}. The shelling out-turns of different entries ranged from 66-75%, sound mature kernels were ranged from 90-94 percent, 100-kernel weight ranged between 43-52g. The days to maturity ranged from 108-113 days.

EVALUATION OF ORGANIC MANURE AND INORGANIC FERTILIZER ON PHYSICAL PROPERTIES IN AGROFORESTRY AND RICE-WHEAT CROPPING SYSTEMS IN UTTARAKHAND

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Abstract

The investigation was conducted during the crop season, 2016-17 and 2017-18 at two different sites of G. B. Pant University of Agriculture and Technology, Pantnagar, in the first site i.e. Norman E. Borlaug Crop Research Centre, four treatments were taken in an ongoing Long Term Fertilizer Experiment (LTFE), initiated during the wet season of 1971 at experimental block of Department of Soil Science under a humid subtropical climate and the second site was Agroforestry Research Centre (AFRC), Patharchatta, GBPUA&T, Pantnagar, where two treatments were taken from Poplar and Eucalyptus based agroforestry systems and analyzed in randomized block design with four replication. The soil of the first site (LTFE) was fine loamy, mixed hyper thermic and classified taxonomically as Aquic Hapludoll and the second site (AFRC) was coarse loamy, mixed hyper thermic classified as Typic Hapludol**.** Continuous application of Farmyard manure (FYM) with 100% NPK fertilizers observed lowest bulk density and particle density at 0-15 cm and 15-30 cm layers whereas, the highest bulk density and particle density was observed in the control plot (T_1). The highest mean weight diameter of soil aggregates at surface and sub surface soil was observed in FYM along with 100% NPK fertilizer treated plot (T_3). The maximum water holding capacity in surface and sub surface soil was recorded in 100% NPK + FYM @ 15 t ha^{-1} treated plot (T_3) after *rabi* season during 2016-17 and 2017-18.

GENETIC VARIABILITY AND CHARACTER ASSOCIATION IN NIGER (*GUIZOTIA ABYSSINICA* (L.F.) CASS.)

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Abstract

The present investigation entitled “Genetic variability and character association in Niger (*Guizotia abyssinica* (L.f.) *Cass.*)” was carried out during kharif , 2022-23 to study the extent of genetic variability such as genotypic and phenotypic coefficient of variation , heritability, genetic advance , path analysis and genetic divergence for 21 quantitative and qualitative characters .The experiment was carried out in randomized block design with four replication. The analysis of variance (ANOVA) suggested that most of the characters exhibited wider variability. The range of variation of characters indicated that the upper limit of variation was higher than lower limit in different characters. High heritability was observed in the case of number plant height, C%, and C/N ratio, suggesting that these traits were controlled by additive gene action. Whereas high to moderate heritability with low genetic advances for number of branches, number of seeds/capitula, and 1000 seed weight revealed a dominant role for non- additive gene action. Character association has been examined using correlation coefficient estimates and path analysis to assess the direct and indirect effect of various yield contributing characters on seed yield per hectare among 23 Niger seed genotypes. As evident from coefficient of error variation a high experimental precision was achieved in evaluation for all the characters. Days to flowering, days to maturity, N%, P (mg/L), K(mg/L), Fe(mg/L), Zn(mg/L), C%, S%, and C/N ratio were found to be less influenced by environmental factors, as shown by a smaller difference in magnitude between GCV and PCV. Plant height, number of branches per plant, number of capitula / plant, 1000 seed weight (g), seed yield / plot (Kg), mean seed yield (Kg/ha/day), oil yield (Kg/ha), oil yield (Kg/ha/day), C%, S%, C/N ratio, C%, S%, C/N ratio were found to be significantly and positively associated with seed yield/ha. Path coefficient analysis showed that days to maturity, mean seed yield (Kg/ha/day), oil yield (Kg/ha) and C% had the direct significant effect on seed yield per hectare (Kg) followed by plant height, number of seeds per capsule and days to mature. Strong direct effect exhibited 0.786 (between oil yield Kg/ha and oil yield Kg/ ha/day) at genotypic level and 1.305 (between mean seed yield per plot) at phenotypic level.

The low direct positive effect by number of branches/plant (0.014) indicated improvement of these characters through selection of its associated characters which shows high indirect effect that i.e., mean seed yield (0.742) and days of maturity (0.371). D^2 analysis was performed to do multivariate genetic divergence analysis. Among the different characters seed yield/ ha, C% , C/N ratio were found to be major contribution towards genetic divergence. Based on 21 characters, the 23 Niger genotypes were grouped into five clusters following D^2 analysis , Tocher's method of clustering. Cluster I was the largest one comprised of 18 genotypes followed by cluster II (2 genotypes) while cluster III, IV and V consisted of 1 genotypes each. Highest cluster distance was observed in between cluster III and V. The overall clustering pattern indicated that ONS-184, ONS-175, and JNS-2017-13 were much divergent from rest of the genotypes used in the experiment.

EFFECT OF *MORINGA OLEIFERA* LEAF EXTRACT ON SCROTAL CIRCUMFERENCE, TESTICULAR WEIGHT, ENDOCRINOLOGICAL AND SEMEN QUALITY PROFILES IN ANDAMAN GOAT OF ANDAMAN AND NICOBAR ISLANDS

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Abstract

Moringa oleifera leaf extract (MOLE) supplementation on scrotal circumference (SC), testicular weight (TW), endocrinological profiles, libido and semen quality profiles in rainy and dry summer season was studied in Andaman goat (AG) bucks. Male goats (n = 12) of 3-4 years old were equally divided into control (Gr: 1) and treated (Gr: 2) groups. Treated animals received MOLE @ 200 mg/kg BW. SC and TW were measured in experimental bucks. Follicle stimulating hormone (FSH), luteinizing hormone (LH), testosterone, thyroid stimulating hormone (TSH), triiodothyronine (T3), thyroxine (T4), cortisol and prolactin, total antioxidant capacity (TAC), superoxide dismutase (SOD), catalase (CAT), glutathione (GSH) and malondialdehyde (MDA) were measured in blood. Libido profiles such as libido score (LS), mating ability score (MAS) and sex behavioural score (SBS) were estimated at semen collection. Semen samples (10 ejaculates/ buck /season) were collected and analysed. FSH, LH, and testosterone concentrations were increased (P<0.05) and TSH, T3, T4, cortisol and prolactin concentrations were decreased (P<0.05) in MOLE treated compared to control group. SC, and TW were increased (P<0.05) in MOLE treated compared to control bucks. Antioxidants were increased (P<0.05) and MDA was decreased (P<0.05) in MOLE treated compared to control group. Seminal volume, pH, sperm concentration, motility, viability, acrosomal integrity, plasma membrane integrity and nuclear integrity were increased (P<0.05) and total sperm morphological abnormalities were decreased (P<0.05) in MOLE treated compared to control group. Study concluded that MOLE treatment can be utilized effectively to improve the hormone, libido, antioxidants and SC and TW with cascading beneficial effects on semen quality profiles in Andaman goat of Andaman and Nicobar Islands.

EVALUATION OF ON VIRULENCE MONITORING OF BACTERIAL LEAF BLIGHT PATHOGEN *XANTHOMONAS ORYZAE PV ORYZAY* (*XOO*)

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Abstract

The experiment trail was conducted on virulence monitoring of bacterial leaf blight pathogen , *Xanthomonas oryzae pv oryzay* (*Xoo*) at Raipur , Chhattisgarh was conducted .The rice differentials used in this trail consisted of eleven near isogenic lines (IRBB lines) possessing different single BB in the genetic background of rice cultivar IR-24,TN1 and resistant check variety Improve Sambha Masuri (ISM) was also included in the trail .Most of the differentials possessing single bacterial resistant gene like Xa1,Xa3,Xa4,xa5,Xa7, xa8, Xa10,Xa11and Xa14were susceptible at Raipur location and most of the locations of India.BB resistant gene xa13 was susceptible at 12 locations and while Xa21was susceptible at 9 locations including Raipur . Based on the reactions of the isolates on differentials the Raipur isolate is categorized as highly virulent as compared to across the locations. This may be due the change of virulence of the *Xanthomonas oryzae pv oryzay* (*Xoo*) .The isolate from Maruteru and Raipur were quite different from other isolates and from each other and formed separate cluster . Raipur isolate is able to produced susceptible reactions on two gene, three gene and four gene pyramids. The Raipur isolate is able to produced highly

susceptible reactions on resistant checks like Improved Sambha Masuri and and local check variety Bamleswai. The susceptible check variety TN1 is also showed highly susceptible.

EFFECT OF REDUCED GLUTATHIONE ON LIQUID STORED SEMEN OF ENDANGERED TERESSA GOAT UNDER TROPICAL HUMID ISLAND ECOSYSTEM OF ANDAMAN AND NICOBAR ISLANDS, INDIA

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Abstract

Reduced glutathione in semen extender on semen quality parameters in Teressa buck was assessed. A total of 25 semen samples from six bucks were selected for the study. Spermatozoa were incubated in 2 mM, 4 mM and 6 mM of reduced glutathione as Gr II, III and IV, respectively. Liquid stored semen samples were analysed for motility, viability, total sperm abnormality, plasma membrane, acrosomal and nuclear integrities, intracellular enzymes (aspartate aminotransferase; AST, alanine aminotransferase; ALT and lactate dehydrogenase; LDH), cholesterol efflux, seminal total antioxidant capacity (TAC) and malondialdehyde (MDA) in comparison with control group (Gr I) for upto 96 h. Results revealed that reduced glutathione (4 mM) treated semen had significantly ($P<0.05$) higher motility, viability, plasma membrane, acrosomal and nuclear integrities and TAC and had significantly ($P<0.05$) lower total sperm abnormalities, AST, ALT, LDH, MDA and cholesterol efflux compared to those in other reduced glutathione treated and control groups at different hours of liquid storage. Semen quality parameters and antioxidants were showing increasing trend and total sperm abnormalities, MDA, leakage of intra-cellular enzymes and cholesterol efflux were showing decreasing trend from Gr I to Gr III and then opposite trends from Gr III to Gr IV at different hours of liquid storage. Thus, 4 mM reduced glutathione was suitable dose for liquid semen preservation in Teressa goat.

EMERGING ISSUES AND CHALLENGES FACED BY FARMERS FOR THE SUSTAINABILITY OF FARMER PRODUCERS ORGANIZATIONS (FPOS)

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Abstract

The Farmer Producer Organization (FPO) is a legal entity made up of small and marginal farmers and farm women. In other words, FPO's is primarily made up of 70-80 percent small and medium-sized farmers embraced to solve the problems faced by farmers of the organization, through collectivizing themselves as business entity related to agriculture and its allied fields. From 2002 onwards, such organizations were promoted by various development departments like NABARD, Companies Act, etc. to register themselves as Companies for sale of their goods. FPOs include farmers for activities like collection of agriculture and dairy produce, processing, branding and labelling and its marketing. It also deals in agriculture production as well as inputs like seeds, fertilizers, credit, insurance, knowledge and extension services. In India, many FPOs had been formed in the past years and working well in some of the states. Even though FPOs are doing well, still they face lot of issues and challenges for the smooth functioning and sustainability of the organization. Keeping these factors in view, the present study was done to determine the challenges that members of Farmers' Producers Organization (FPO) faced in the district S.A.S. Nagar. The data was collected through telephonic survey from 20 members of two selected FPOs of the district. The constraints faced by the FPOs in the district was found that managerial, socio-psychological, economic, infrastructural and marketing constraints were the major ones. The constraints experienced by the members of the FPO were personal like lack of trust, cooperation, unequal work delegation ineffective group leadership and delayed or minimal payments. The suggestions of the respondents for making FPOs more vibrant and sustainable were accountability of the resource institutes, capacity buildings of the stakeholders, dissemination of awareness about the functioning of FPOs among the members, timely support from the financial institutions, provision for participation in exhibitions/stalls at local, national and internation level trade fairs/ agri-expo for marketing of the products, etc. In last, mitigation strategies to be adopted by the top hierarchy of the FPOs were transparency of records, strong association with resource institutes, participatory decision making, efficient conflict management *etc*.

SHELF LIFE STUDIES ON KING OF THE FRUITS (*MANGIFERA INDICA* L.)

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Abstract

Shelf life can be a key factor in product safety, quality and value. Mango is foremost important fruit crop in Indian culture and economy. Even it is a perishable fruit, having great demand in global market and economic returns storability and shelf life are important parameters in mango farmers. A study was laid out in factorial RBD concept in Ultra High Density Planting System of Telangana orchard. Four mango varieties (*Viz*., Baneshan, Dasheri, Himayat and Kesar) were treated with growth regulators and chemicals (*Viz*., *i)* KNO_3 @ 10g/l, *ii)* KNO_3 @ 10g/l + PBZ @ 3ml/m; *iii)* KNO_3 @ 10g/l + CPPU 1ml/l; *iv)* KNO_3 @ 10g/l + K_2SO_4 @ 10g/l; *v)* KNO_3 @ 10g/l + CPPU 1ml/l + K_2SO_4 @ 10g/l; *vi)* KNO_3 @ 10g/l + PBZ @ 3ml/m + CPPU 1ml/l; *vii)* KNO_3 @ 10g/l + PBZ @ 3ml/m + K_2SO_4 @ 10g/l; *viii)* KNO_3 @ 10g/l + PBZ @ 3ml/m + CPPU @ 1ml/l + K_2SO_4 @ 10g/l) to analyze their effect on fruit shelf life (days). The results reported that treatments along with PBZ (Paclobutrazol) and CPPU (Cytokinin like synthetic growth regulator) was significantly enhanced the post-harvest storage life of mango fruit. Two Sprayings of KNO_3 @ 10g/l + PBZ @ 3ml/m + CPPU @ 1ml/l + K_2SO_4 @ 10g/l (*viz.*, one at the time of flower bud differentiation and another at fifteen days after first spraying) on four mango varieties was successfully decreased the physiological weight loss by 31.45% and titrable acidity 28% and significantly increased the fruit firmness by 10 %, TSS 6.33 %, total sugars 7.07 % and shelf life 20.92 %.

INCREASED INCOME TO FARMERS THROUGH ENTREPRENERSHIP INTERVENTIONS

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Abstract

The present study was conducted in Davanagere district of Karnataka state in India. The data was collected from 59 randomly selected farmers who could increase their income through technological interventions by ICAR-Taralabalu KVK, Davanagere during 2016 and 2021. The data collected from these farmers during 2021 in comparison with 2016 with respect to increased production and income in entrepreneurship sector. The results revealed that poultry sector found 1564.62 percent increase in income followed by other non-farm enterprises 563.11 percent, dairy sector 159.80 percent and sheep and goat rearing sector found 142.53 percent increase in income between 2016 and 2021. All sectors combined together found 656.91 percent increase in income through 59 farmers (Rs. 36,49,566.00 in 2016 to Rs. 2,76,24,221.00 in 2021). The Saturday Organic Bazaar started by Krishi Vigyan Kendra, Davanagere since 2013 wherein organically produced products are sold directly to the consumers thereby earning more profits, technological interventions including facilitating entrepreneurs in marketing through melas and exhibitions, through KVK extension activities helped in gaining more income. In the other non farm sectors fisheries sector played major role wherein introduction of fresh water fish breeds like *Amur Common Carp, Jayanti Rohu, GIFT Tilapia and pangasius* coupled with demonstration on good management practices in dairy sectors like clean milk production, balanced nutrition, proper disease management and introduction of high yielding fodder varieties like CoFS-29, CoFS-31, Lucern, DHN-6 are the major interventions contributed for increased income to the farmers. In most of the cases inputs for these entrepreneurship are from output from agriculture and horticulture sectors. This clearly indicates that technological interventions play major role in increasing income to the entrepreneurs.

EVALUATION OF THE SPATIOTEMPORAL VARIABILITY OF THE NEAR-SURFACE WIND SPEED AND RAINFALL OVER INDIA'S EASTERN COASTAL AGRO-ECOLOGICAL ZONES

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Abstract

Rainfall and near-surface wind speed were the two most important parameters for studying climate change-induced extreme events. Trend analysis of these two parameters is necessary to determine the spatiotemporal variation in such events. Therefore, the study's objective was to analyse time-series data on the variability in seasonal rainfall and near-surface wind speeds in India's six eastern coastal Agro-ecological zones (AEZs). These AEZs included AEZs 3, 7, 8, 11, 12, and 18. Climatologically, these AEZs have an experimental INMET station were selected in each AEZ. Similarly, during the period of 1920-2020, data on monthly rainfall and near-surface wind speed were collected. To check the trend of rainfall and near-surface wind speed, one used the popular statistical tests such as Mann-Kendall, Modified Mann-Kendall, Bootstrapped Mann-Kendall, Innovative Trend Analysis, and Detrended Fluctuation Analysis. All other AEZs had negative trends in the near-surface wind, which implied the influence of climate change. The rest of the trend analysis techniques, ITA discovered hidden trends. ANNUAL and trend data showed an increasing trend in rainfall in the southern AEZs and the zones adjacent to the coastline. AEZ 12 and 18 showed an increasing trend in the pre-monsoon season, while the rest of the AEZs had a decreasing trend. All zones, except AEZ 7, experienced a negative trend in the post-monsoon season. The DFA test showed mixed results, with ten of the 18 data sets showing a correlation between projected and historical 101-year rainfall trends. This study will assist researchers and government officials design a sustainable water resource management plan by taking into account the trend patterns of meteorological variables throughout agro-ecological regions.

INFLUENCE OF TERMINAL HEAT STRESS ON SEED SET, SEED YIELD AND QUALITY IN WHEAT

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Abstract

The terminal heat stress influenced on seed set, seed yield and quality in wheat (UAS 304). Three dates of sowing *viz.* Nov 15th, Dec 15th and Jan 15that an interval of 30 days and seven treatments of foliar spray *viz.*, Salicylic acid (400, 800 ppm), Ascorbic acid (10 ppm), Thiourea (400 ppm), KCl, Cycocel (*0.5*%) resulted in seeds sown during early month of November produced significantly higher seed germination (94.77 %), shoot length (14.8 cm), root length (12.4 cm), Seedling Vigour Index–I (2580), seed yield (28.47 q/ha) and B:C ratio (4.22:1) compared to late sown. Among different foliar sprays, Salicylic acid @ 800 ppm applied at 35 DAS and at second flowering stage (46 DAS) recorded highest seed germination (87.59 %), Seedling Vigour Index – I (2271), seed setting percentage (88.29 %) and seed yield (25.07 q/ha) with B:C ratio of 3.69:1 followed by foliar spray of salicylic acid @ 400 ppm (88.28 %, 2288, 86.76 %, 23.94 q/ha and 3.39:1, respectively) compared to control. So, November sown crop with foliar spray of salicylic acid @ 800 ppm applied at 35 DAS and 46 DAS can combat heat stress and can achieve increased plant growth with high seed quality parameters.

TIME SERIES MODELLING OF UNIVARIATE MODEL TO FORECAST MILLETS PRODUCTION IN INDIA

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Abstract

Millets are small-seeded crops classed as Major (Sorghum, Pearl millet, and Finger millet), Minor (Foxtail, Kodo, Banyard, Little, and Proso millets), and Pseudo (Amaranth and Buckwheat). Millets are referred to be nutri-cereals since they are highly nutritious and can greatly contribute to food and nutritional security. India is the world's largest millet grower, accounting for 41% of global production. India, Niger, China, Nigeria, and Mali produce 73% of the millet produced. India ranks 31st in the

world in terms of yield per hectare. Labeling these crops as Nutri Cereals has been promoted in order to enhance demand and allow farmers to seek higher prices. According to the government, millets have a high potential for considerably contributing to the country's food and nutritional security, and hence they are not only a nutrient powerhouse, but also climate-adaptable crops with unique nutritional features. The purpose of this study is to examine the production of different types of millets cultivated in India. The annual data were obtained from 1966–1967 to 2021–2023 from the Directorate of Economics and Statistics, Ministry of Agriculture and Farmers' Welfare, Government of India. The data was fitted using the ARIMA model in order to project future millet production in India. The univariate Box-Jenkins (1970) ARIMA approach has been used for forecasting. The model parameters were estimated using the R programming language. The fitted model's performance was evaluated using multiple measures of goodness of fit. Projections for the years 2024-2028 are calculated using the chosen model. The numerical and graphical results of millet production are displayed graphically. These estimates are especially useful for altering marketing and policy campaigns to account for future changes.

DIGITAL MEDIA USAGE BY CHILDREN AND PARENTAL STRESS

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Abstract

Digital media refers to electronic content such as images, videos, and information accessed through devices like computers and smartphones. The study aimed to assess the digital media usage by children and parental stress. The study was carried out in Dharwad taluk, Karnataka. It included 240 students (120 urban and 120 rural) in 5th, 6th, and 7th grades from private and government schools. Tools used were a self-structured questionnaire for digital media usage, Parenting Stress Index (PSI) by Abidin (1995), and the Socio-Economic Status Scale by Aggarwal. Findings revealed that 56.7 per cent of children exhibited moderate digital media usage, 32.9 per cent high usage, and 10.4 per cent low usage. Preferred devices included smart TVs (37.9%), smartphones (27.1%), tablets (19.2%), and computers (15.8%). The most-watched digital content comprised National Geographic Kids (22.1%), Disney Junior (21.7%), game apps (20.8%), social media (17.9%), and Nick Jr (17.5%). Most children used digital media for homework and school activities (25.0%), followed by entertainment (22.1%), gaming (16.3%), and communication (10%).Regarding time spent, 42.1 per ent spent 1 to 2 hours on digital media, 26.7 per cent spent 3 to 4 hours, 19.6 per cent spent less than 1 hour, and 11.7 per cent spent more than 4 hours. In terms of parental stress, 63.7 per cent of parents experienced high stress, 32.1 per cent had normal stress, and 4.2 per cent had low stress. There was a significant association ($\div^2$ = 14.72*) at 1 per cent level and a significant difference at 5 per cent level (F = 3.49*) between children's digital media usage and parental stress.

Key words: Digital media, children, parenting stress, time spent.

EFFECT OF ESTABLISHMENT METHODS AND 4HPPD INHIBITORS ON WEEDS, PRODUCTIVITY AND ECONOMICS OF *KHARIF* MAIZE IN BAEL (*AEGLE MARMELOS*) BASED AGRO-HORTI SYSTEM

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Abstract

The rainfed *kharif* maize suffers numerous complications, namely water stress, pests, diseases and soil degradation. Poor crop establishment and severe weed infestation are the major cause of low yield and reduced growth of *kharif* maize in India. Yield losses due to weeds in maize vary from 28-93% depending on the type of weed flora, intensity and duration of crop weed competition. Practice of agroforestry along with a high-value commercial crop has a far more significant impact on farmers over monoculture cropping system. To tackle this problem a field experiment was carried out during *kharif* (rainy) season of 2022 at the Agricultural Research Farm, Rajiv Gandhi South Campus, Banaras Hindu University, Barkachha, Mirzapur, Uttar Pradesh. A 13-year-old bael orchard, with each tree at a spacing of 7 m × 7 m, maize was sown as an intercrop. Factorial RBD

with two factors, i.e., establishment methods and herbicidal treatments were used. Conventional method + Atrazine 1.0 kg/ha fb Topramezone 25.2 g/ha at 25 DAS, conventional method + Atrazine 1.0 kg/ha fb Halosulfuron 67.5 g/ha at 25 DAS, conventional method + Hand weedings at 20 and 40 DAS, conventional method + Weedy check, ridge and furrow method + Atrazine 1.0 kg/ha fb Topramezone 25.2 g/ha at 25 DAS, ridge and furrow method + Atrazine 1.0 kg/ha fb Halosulfuron 67.5 g/ha at 25 DAS, ridge and furrow method + Hand weedings at 20 and 40 DAS, ridge and furrow method + Weedy check. Amongst the different combination of crop establishment and herbicide, the application of atrazine 1.0 kg/ha PE *fb* topramezone 25.2 g/ha at 25 DAS in the ridge and furrow establishment method effectively minimized the weed density, dry weight and weed index at 20,40,60 and 90 DAS. Significantly high growth and yield parameters with promising weed control efficiency and B:C (3.45) were also recorded with atrazine 1.0 kg/ha PE *fb* topramezone 25.2 g/ha.

EFFECT OF *MELIA DUBIA* (MALABAR NEEM) ON SOYBEAN AND SAFFLOWER GRAIN YIELD AT VARIOUS DENSITIES OF INTERCROPPING SYSTEM IN NORTHERN TRANSITIONAL ZONE OF KARNATAKA

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Abstract

Melia dubia is a fast-growing tree species with multipurpose benefits, suitable for plantation programs under various agro-climatic conditions. A field experiment was conducted from 2019 to 2022 during the Kharif and Rabi seasons at Main Agricultural Research Station, University of Agricultural Science, Dharwad, to assess feasibility of cultivating soybean and safflower with various densities of *Melia dubia*. The study included seven treatment combinations with soybean and safflower intercropped with Malbar neem at different densities, along with a control of sole soybean. Results showed that both sole soybean and safflower recorded significantly higher grain yields. However, soybean and safflower intercropped with *Melia dubia* at 4 m x 4 m spacing yielded higher grain outputs. The maximum tree height and diameter at breast height were recorded at 4 m x 4 m spacing (13.03 m and 25.40 cm, respectively) and the 4 m x 3.5 m spacing (12.97 m and 24.40 cm, respectively) compared to other spacings. The basal area and volume of the Malbar neem were significantly higher in 4 m x 4 m spacing (0.049 m^2/pl and 0.383 m^3/pl, respectively) followed by 4 m x 3.5 m spacing (0.044 m^2/pl and 0.342 m^3/pl, respectively). Grain yields of soybean (671.30 $kgha^{1}$) in Kharif season and safflower (264.88 $kgha^{1}$) in the Rabi season were significantly higher in the initial years at the 4 m x 4 m spacing compared to other spacings. However, yields decreased gradually in narrower spacings during later years due to reduced light, moisture, nutrients, and increased crown shade. The positive tree-crop interaction values (133.3%). The benefit-cost ratio was also higher with soybean and safflower intercropping systems at wider densities. Malbar neem wood can be harvested for the paper and pulp industry in just 5-7 years, while wood maturing between 9-10 years is typically used for plywood.

EFFECT OF PLANT GROWTH RETARDANTS ON PLANT ARCHITECTURE IN RELATION TO PRODUCTIVITY IN SORGHUM (*SORGHUM BICOLOR* L.)

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Abstract

A field experiment was conducted at Agricultural Research Station, Bheemarayanagudi, during *Rabi* 2022-23 to know the effects of plant growth retardants on morphological and yield parameters in sorghum. The experiment was laid out in randomized complete block design and replicated three times with eleven treatments including control, water spray, mepiquat chloride (@ 1000 ppm, @ 1500 ppm and @ 2000 ppm), chlormequat chloride (@ 1000 ppm, @ 1500 ppm and @ 2000 ppm), and ethephon (@ 200 ppm, @ 400 ppm and @ 600 ppm) were applied through foliar application at 35 DAS. Results revealed that nipping and all growth retardant treatments significantly reduced the plant height (cm) and increased total dry matter

production (g plant^{-1}), total leaf area (dm^2 plant^{-1}), leaf area index (LAI) and seed yield (kg ha^{-1}) compared to control. Among the treatments, foliar application of mepiquat chloride @ 2000 ppm (T_5) was recorded significantly lowest plant height (178.30 cm) and total dry matter production (195.6 g plant^{-1}), total leaf area (3212.2 cm^2 plant^{-1}), leaf area index (4.76) and seed yield (1724.9 kg ha^{-1}) compared to all other treatments. The treatment T_7 (chlormequat chloride @ 1500 ppm) was recorded second best morphological parameters and yield in pigeonpea. It was concluded that foliar application of mepiquat chloride @ 2000 ppm at 35 DAS was found best in recording better growth parameters and higher yield in sorghum.

CORRELATION AND PATH ANALYSIS IN GROUNDNUT RILS POPULATION

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Abstract

In India, groundnut is cultivated in all the seasons, but nearly 80 per cent of acreage and production comes from *Kharif* crop (June-October). Late season sowing coincide with maximum thrips population among them, *Thrips palmi* persistently transmit the virus peanut bud necrosis virus (PBNV), causing peanut bud necrosis disease (PBND) in groundnut which poses a serious threat to its production in India, resulting in complete crop loss. Incidence of PBND ranges from 5 to 80 per cent causing yield losses up to 50 per cent. This study was conducted to Identify PBND resistant sources in 260 RIL populations during *Kharif* 2022-23 at MARS, Raichur, Karnataka. Moderate to high GCV and PCV with moderate to high heritability coupled with moderate to high GAM for pod yield component traits in RILs were observed but matured pods per plant and pod yield per plant showed high magnitudes of variability, indicating that selection based on these observations yields superior genotypes. Correlation results revealed that pod yield per plant showed strong significant positive association with the number of matured pods per plant followed by hundred pod weight suggesting that improvement of yield could be achieved upon improving pods per plant and in path analysis highest direct effect on pod yield per plant was mainly contributed by number of matured pods per plant followed by hundred pod weight. Hence, due emphasis should be laid out on these yield components as selection criterion to select for high pod yield genotypes. RIL's 100 and positive check NRCGS-86 exhibited a high level of resistance for PBND and proved potent to use in breeding programs aimed at enhancing resistance in groundnut varieties.

APPRAISEMENT OF ADVANCED GENOTYPES OF PIGEONPEA AGAINST DAMAGE CAUSED BY MAJOR INSECT PESTS

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Abstract

Four AVT-1 and three AVT-2 advanced stage genotypes of pigeonpea was appraised for their reaction against pod fly (*M. obtusa*), pod bug (*C. gibbosa*) and pod borer (*H. armigera*) during *Kharif* 2017-18 at Varanasi. Among AVT-1 genotypes the pod damage due to pod fly was varied from 24.0 % to 29.67 % and grain damage was observed from 9.54 % to14.57 %. However, among AVT-2 pod damage was varied from 25.0 % to 31.0 % and grain damage was varied from 13.20 % to 17.21 %. The pod damage by pod bug in AVT-1 was observed from 14.0 % to 18.0 % while, grain damage was 3.65% to 5.11 % likewise in AVT-2 the pod damage is in range of 11.66% to 14.66 % and grain damage is 11.53% to 19.11%. Pod damage due to pod borer in AVT-1 was 4.0 % to 7.33% and grain damage was 1.28 % to 2.10 % similarly, the pod damage in AVT-2 was 4.67 % to 7.67 % and grain damage was 2.62 % to 3.70 %. Respectively.

On the basis of the above investigation it may be concluded that host plant resistance plays a very important part in governing the pest infestation level in pigeonpea. Among all three insect pests the pod fly, *Melanagromyza obtusa* (Malloch) is a cardinal insect pest on pigeonpea in Varanasi zone. None of the genotype from AVT-1 and AVT-2 was found free from damage by pod fly, pod bug and pod borer however among AVT-1 genotypes AVT-401 is found relatively less susceptible to damage cause by insect pests followed by AVT-404, AVT-403 and AVT-402 and similarly among AVT-2 genotypes AVT-501 is found relatively more tolerant followed by AVT-502 and AVT-503 in respect of damage caused by insect pests.

STUDY OF CARDIOTOXICITY IN FRESHWATER FISH *CYPRINUS CARPIO* ON EXPOSURE TO TEBUCONAZOLE

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Abstract

Tebuconazole is a broad-spectrum triazole fungicide that farmers have used to control the foliar and soil-borne diseases of many crops. Tebuconazole has toxic effects on aquatic organisms as well as long-term adverse impacts on the aquatic environment. The present study is aimed to investigate the sub-lethal toxic effects of exposure to tebuconazole on the heart of freshwater fish *Cyprinus carpio*. Carp were exposed to concentrations of 6.47 and 8.09 µl/l (median lethal concentration 32.37 µl/l) for 30 days. Exposure to tebuconazole significantly increased the reactive oxygen species and caused oxidative stress. Alterations in the MDA level and antioxidant enzymes were observed in the heart of carp. Histopathology of the heart of toxicant exposed fish revealed various changes in the cytoarchitecture as compared to normal tissue. Treated fish showed infiltration of lymphocyte, hypertrophy, vacuolation and internal hemorrhage in the cells. Various necrotic changes and degeneration in myofibres were seen with increasing duration to 30 days. The findings of our study indicate that tebuconazole induces cardiotoxicity in the fish, which further helps in assessing the health of aquatic ecosystems and associated human health risks.

IDENTIFICATION OF BRASSINOSTEROID BIOSYNTHETIC PATHWAY IN FINGER MILLET

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Abstract

Finger millet (*Eleusine coracana* L.) is known for its rich nutritional profile, impressive adaptability, long-lasting seeds life, ability to thrive in diverse climates, resistance to pests, diseases, drought, heat and salinity. The challenges of climate change have emphasized the importance of utilizing functional genomics in modern plant breeding methods to ensure global food security. Brassinosteroids (BRs) are plant steroid hormones that play a crucial role in regulating plant growth, development and stress responses. Increasing BRs level or signaling has led to a significant boost in crop yields along with providing enhanced stress tolerance. Despite the lack of information on BR biosynthesis and signaling pathways in finger millet, our recent study successfully achieved heat tolerance in BR-related seedlings compared to control one. The BR-treated seedlings displayed healthy growth and vigor whereas the control plants perished. Building on this promising result, further research is conducted to investigate the potential impact of BR in finger millet that will utilizing transcriptome analysis to uncover BR-responsive genes and pathways that drawing from the established benefits of BR in other crop species to sped up plant yield and resilience to various stresses.

DIVERSITY OF ARBUSCULAR MYCORRHIZAL FUNGI ASSOCIATED WITH NATIVE PLANTS OF BBN INDUSTRIAL BELT OF HIMACHAL PRADESH, INDIA

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Abstract

Arbuscular mycorrhizal fungi (AMF) play an essential role in plant growth and have great potential to enhance plant tolerance under polluted and toxic conditions. This study deals with a survey of five sites of the Baddi Barotiwala Nalagarh (BBN) industrial belt to investigate the diversity of AM fungi associated with native plants of polluted sites. The contamination status of polluted soil was analyzed for heavy metal content (Fe, Cu, As, Cd, Pb, Cr). According to I^{geo} (Geo-accumulation index) the concentration of Cd was in class 6 followed by Fe (class 5), and Cu, As, Pb, and Cr (class 0), indicating that the site was significantly contaminated with Cd. Results of this study revealed that Arbuscular Mycorrhizal symbiosis was established

successfully even in polluted sites which play an important role in mitigating the toxic effect of heavy metals in soil through bioremediation. A total of 29 species were identified based on morphological characteristics *i.e.* spore size, shape, colour, ornamentation, and attachment of subtending hyphae. Mycorrhizal colonization percentage in roots was also studied using the standard staining method. Among the total number of species, 14 were grouped as *Glomus*, 7 as *Acaulospora*, 5 as *Gigaspora*, 2 as *Scutellospora,* and 1 as *Entrophospora*. This study provides the first step to identifying native and putative AMF species in plants of the BBN industrial belt of Himachal Pradesh that might be cultured for further use by farmers as a sustainable organic approach in agriculture and rehabilitation forestry sectors. Even this study further strengthens the insights into biodiversity conservation and environmental management by emerging alternative technology to bioremediate heavy metal-contaminated soils.

GOVERNMENT NEEDS MORE FOCUS TO ACHIEVE THE SET TARGET OF BANK LOAN FOR DEVELOPMENT OF DAIRY AND FISHIRIES SECTORS IN THE BIHAR

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Abstract

Dairy development and Fish farming are some of the much more needed ventures for state in self-reliance in the concerned sector. The sectors help in the employment generation in one hand and economic prosperity of rural people in the state of Bihar on other. Still Bihar is very much backward in dairy and fish production and thus the requirements of these items are fully depends upon the other state like fisheries for West Bengal, Andhra Pradesh etc. However, state of Bihar is trying development of these two sectors in the state by taking many initiatives in Agriculture Road Map of the state. But, the financial situation of the rural people are not much sound so that they can adopt the new technology in their profession. It is being observed that Bank are not taking much interest in sanctioning the proposals of loans meant for dairy and fish farming by the rural people. As per the report nearly 219140 application was submitted for the development of dairy units in the state with a total loan amount of 5257 crore during the year 2023-24 but only 119634 numbers of applications get sanctioned and for this total proposed loan sanctioned amount was to the tune of Rs 745 crore. In contrary to that only a sum of Rs742 crore were released by the banks to the applicants. This amount is merely 14.17 percent of the target amount. Similarly, during the same year a loan amount was targeted to the tune of Rs. 1285 crore to 53772 applicants for fish farming but out of which only 7620 proposal get sanctioned. And in actual, an amount of Rs. 41 crore was released to the 7614 applicants which were merely 3.21 percent of the target given to them. This necessitated to the state government to give more attention and forced to the bank to sanction the more bankable proposals and needs to promote to change the minds set of banks towards farming community and for development of these sectors.

BACKYARD POULTRY FARMING: EMPOWERING RURAL COMMUNITIES WITH INCOME OPPORTUNITIES

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Abstract

In India, approximately 65 percent of the population resides in villages where staple food is either rice or wheat. Due to low protein consumption by rural population, protein malnutrition is observed that can hinder overall health. Nowadays, poultry meat is considered an affordable, good-quality source of animal protein. The poultry sector in India is mainly divided into two sub-sectors- highly organized commercial sector with about 80% of the total market share and unorganized or backyard poultry farming with about 20% of the total market share. Backyard poultry farming has gained popularity in the recent past where native breeds or improved chicken varieties are reared by households either for domestic consumption or for game

purposes. There is hardly any requirement for infrastructure setup for it and can easily be handled by women, aged people and children.

Backyard poultry farming not only can prove instrumental in socioeconomic upliftment of rural population by generating subsidiary income but also improve nutritional status by alleviating protein hunger. However, backyard poultry farming presents some significant constraints such as a high mortality rate in young chicks caused by various diseases, inadequate infrastructure, low productivity of desi birds, limited scientific knowledge, predation risks, malnutrition, climatic exposure, and feed price fluctuations. For this, there is a need to introduce improved varieties of poultry suitable for backyard farming, scientific skill development of farmers on feeding, housing, disease prevention and management. The Government of Uttarakhand has also considered importance of backyard poultry farming for hilly rural and tribal people and has promoted backyard poultry farming through various developmental schemes.

DETECTION OF PESTICIDE RESIDUES IN MARKET VEGETABLE SAMPLES

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Abstract

Vegetables are cultivated in different agro climatic zones of India. Varieties of vegetables are consumed eaten either raw or cooked and play a significant role in human food and nutrition, being naturally low in fat and carbohydrates, but rich in vitamins, minerals and dietary fiber. It helps in maintaining a healthy body and avoid constipation and other digestion problems. Vegetables are damaged by various insect pests which lowers the crop's value as well as market value. Vegetable plants offer a suitable breeding place for many kinds of insect pests. They cause direct injury to the plant by the feeding insect, which eats leaves or burrows in stems, fruit, or roots and the indirect damage is when the insect itself does slight or no harm but spreads a bacterial, viral, or fungal infection into a crop. Farmers use different types of insecticides to combat the infestation caused by the insect pests. However, farmers do not apply the recommended dose of insecticides. Farmers are not really conscious about the recommended dose, time of application and waiting period of the applied insecticides. Rationale recommendation of a pesticide needs that it must not only afford an effective pest control, but at the same time its residues on the crop must be toxicologically tolerable. Therefore, it is important to study the insecticide residues used in vegetables for establishing a safer consumption. Out of total 70 numbers of vegetable samples collected from major local markets of Manipur and 20 samples from Nagaland, 11 samples were found to detect the residues of imidacloprid (2.52, 0.38, 0.58, 0.90, 1.04, 1.85 mg/kg), carbofuran (0.17, 0.72 mg/kg), chlorantraniliprole (0.62 mg/kg) and fipronil (0.14, 0.56 mg/kg) on cabbage, cauliflower and pea collected from Manipur above Maximum Residue Limit fixed by Food Safety and Standards Authority of India. However, there was no detection of residues on the samples collected from Nagaland.

IMPACT OF DEFOLIANTS ON YIELD, ECONOMICS AND FIBRE QUALITY OF COTTON.

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Abstract

A field experiment was conducted to study the effect of chemical defoliation on growth parameters, seed cotton yield and fibre quality of cotton under high density planting during *kharif,* 2023. Defoliation with Etherel @ 3000 ppm +Sodium chlorate @0.9 % at 50 boll opening percentage resulted in higher number of bolls per square mt. and boll weight (gm.) and seed cotton yield (1375.67 kg ha^{-1}). Etherel @ 3000 ppm +Sodium chlorate @0.9 % at 50 boll opening percentage recorded significantly higher leaf defoliation (98.33 %) after 10 days after spray and was superior over other defoliants tried. In net returns (Rs./ha) was maximum in T_{10}-T_3+Diuron@400 ppm (Rs.89492) which is as par with T_3-Thidiazuron@500 ppm (Rs.86498). The application of defoliants on cotton quality parameters that the seed index recorded highest in treatment T_4. Sodium chlorate

@0.9 % (10.53) and lowest data recorded in T_{10}.T3+Diuron @400 PPM (9.07). T_2.Ethrel @3000 ppm recorded maximum lint index (6.64) and lowest was recorded in T_{10}.T3+Diuron @400 PPM (5.23).

ENHANCING RESISTANCE TO BLAST DISEASE IN FINGER MILLET (*ELEUSINE CORACANA*) USING GAMMA INDUCED MUTATION

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Abstract

Finger millet (*Eleusine coracana* (L.) Gaertn.), a nutracereals coarse crop has wide potential in resilient agriculture in changing climatic scenario. Finger millet blast disease caused by the filamentous ascomycetous fungus *Magnaporthe oryzae* is the most devastating disease affecting the growth and yield of this crop in all its growing regions. The frequent breakdown of blast resistance because of the susceptibility to rapidly evolving virulent genes of the pathogen causes yield instability in all finger millet-growing areas. We have used gamma irradiation to creat variability followed by screening against *M. oryzae*. The effect of gamma irradiation on growth, yield attributes (Plant height, No. of tillers, No. of fingers/ear, finger length) were also stud. The selected mutant lines were used for Peroxidase and Superoxide dismutase) activity. The results showed that antioxidant enzymes activity was maximum in HR followed R, MR, S and HS.

POST HARVEST TECHNOLOGY AND VALUE ADDITION IN FRUIT CROPS

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Abstract

Post-harvest processing of fruits and vegetables is a crucial step in the agricultural value chain that occurs after harvesting and before consumption or further distribution. Tropical fruits are now considered as an important item of commerce as they have gained enormous market potential. Post-harvest losses of fruits are more serious in developing countries than those in well-developed countries. The total losses from harvest to the consumer point are as high as 30-40%, which is worth thousands of crores of rupees. About 10-15% of fresh fruits and vegetables shrivel and stale, lowering their market value and consumer acceptability. Minimizing these losses can increase their supply. Post-harvest management and value-addition is integral to agricultural production for reduction in post-harvest losses, meet consumer requirements, preserve nutritional quality, optimize the utilization of by-products and create employment opportunities. A number of machines, hand tools, gadgets, structures for safe handling and processing of farm produce, process protocols for value-added products, novel products and technologies for farmers have been developed and commercialized. The current research efforts emphasize on the development of equipment, process protocols and value-added products suiting the production catchments and meeting the health requirements of various sections of the population.

THE INTERPLAY BETWEEN MATHEMATICS AND INFORMATION TECHNOLOGY

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Abstract

Mathematics and information technology (IT) are interconnected disciplines that synergistically shape modern science and technology. This abstract explores the deep-rooted relationship between these fields, highlighting how mathematics provides the theoretical framework while IT enables practical applications and advancements. Firstly, mathematics serves as the foundational language of IT. Concepts such as algorithms, encryption techniques, and data structures rely fundamentally on

mathematical principles. Algebra, calculus, discrete mathematics, and probability theory form the bedrock upon which computational methods are built. For instance, cryptography leverages number theory to create robust encryption algorithms, ensuring secure data transmission in digital communication networks. Secondly, computational mathematics exemplifies the marriage between theoretical mathematics and practical IT applications. Computational mathematics employs computers to execute complex calculations, simulations, and modeling that are essential for scientific research and technological development. High-performance computing (HPC) enables the solution of large-scale mathematical problems and facilitates innovations in diverse fields from physics simulations to weather forecasting. Thirdly, the field of data science exemplifies the fusion of statistics, mathematics, and IT. Statistics provides the theoretical framework for analyzing and interpreting data, enabling insights crucial for decision-making and predictive modeling. IT tools and programming languages empower data scientists to apply statistical methods at scale, extracting meaningful patterns and trends from vast datasets to drive business intelligence and innovation.

Moreover, information theory, pioneered by Claude Shannon, epitomizes the synergy between mathematics and IT in the realm of telecommunications and data transmission. Information theory quantifies information and establishes principles for efficient data compression, error-correction techniques, and reliable communication protocols. This theoretical framework underpins modern telecommunications infrastructure, enabling global connectivity and digital transformation. Furthermore, computational complexity theory illustrates how mathematics aids in understanding algorithmic efficiency and problem-solving capabilities. By categorizing computational problems based on their complexity, IT professionals leverage mathematical insights to optimize algorithms and streamline processes, enhancing performance across various domains, from software development to artificial intelligence. In conclusion, the symbiotic relationship between mathematics and information technology drives continuous innovation and progress in scientific research, technological development, and societal advancements. As both fields evolve, their integration becomes increasingly indispensable in tackling complex challenges and unlocking new opportunities in an interconnected world. This abstract underscores the profound impact of mathematics as the theoretical backbone and IT as the enabling force, harmonizing theory with practice to reshape the landscape of modern science and technology.

STUDY AND SCREENING OUT FOR DROUGHT RESISTANCE ON ROOT CHARACTERS ON LANDRACES OF RICE GENOTYPES FROM NAGALAND

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Abstract

Drought stress is a major constraint to rice (*Oryza sativa* L.). Root character and architecture have been primary breeding objectives for the development of stress-tolerant varieties in rice. Therefore, the study compared five root traits and six yield-attributing traits in 28 upland rice genotypes. The study revealed the presence of genetic variability among the genotypes for all the root and yield attributing traits. The highest root length and root volume were recorded for the genotype Longkhum Tsuk (SARS-2), making it best suitable for drought-like situations, among others, due to its robust root system. The genotypic coefficient of variation was observed to be highest in root shoot ratio followed by root dry weight and root length, whereas, among yield attributing characters, it was observed highest in grain yield per plant followed by number of tillers per plant and effective spikelet per panicle thus indicating more significant potential of genetic improvement of these traits by selective breeding.

Heritability in a broad sense was found to be high for root fresh weight, root dry weight androot volume, signifying these traits are highly influenced by genetic factors and thus can beused in further breeding. Genetic advance as a percentage of the mean was found to bemaximum for root dry weight, root fresh weight and root volume, indicating the scope of improvement of these characteristics through selective breeding. The correlation coefficient revealed a significant positive association between grain yield with root fresh weight, root dry weight, number of tillers per plant, effective spikelet per panicle and 1000 grain weight at both genotypic and phenotypic levels. Genotypic path analysis revealed the highest positive direct effects on grain yield were root fresh weight followed by root dry weight, root length, and 1000 grain weight.

INFLUENCE OF NUTRIENT MANAGEMENT PRACTICES IN SOIL POTASSIUM AVAILABILITY AND POTASSIUM UPTAKE OF RICE IN AN INCEPTISOL OF NORTH EAST INDIA

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Abstract

A study was conducted in winter paddy consecutively for two years at demonstration farm of Krishi Vigyan Kendra, Nagaon, Assam Agricultural University, Simaluguri in Nagaon district of Assam, North East India. Potassium (K) fractions and their contributions toward K uptake were found to be affected by various treatment combinations of the experiment. The treatments included were, T_1- Absolute control, T_2- Microbial consortia (Azospirillium + PSB + KSB) @ 4 kg/ha, T_3- RDF (60:20:40:: N: P_2O_5: K_2O), T_4- T_3 + KSB @ 4 kg/ha, T_5- ½ RDF of K as basal + ¼ at 40 DAT + ¼ at 60 DAT, T_6- Potassium nano-fertilizer @ 100 ml/1.2 L of water (10ml/100g), T_7 - T_6 + 50% RDF as top dressing at 40 DAT, T_8- ½ RDF of K as basal + Spraying 3% K solution at maximum tillering and PI stage, T_9- INM Package (50% NP + Full K + 5t/ha Enriched Compost), T_{10}- INM Package (50% NP + Full K + 5t/ha Vermicompost). In the study the concentration of water soluble K was found lowest among all four fractions of K followed by exchangeable and non exchangeable K. Highest lattice K was recorded in plot receiving 100% K fertilizer along with N & P fertilizers and INM components while lowest was recorded in control plot. Treatments where 100% K fertilizers were applied alone or in combination with INM components, observed an increase in total K highest being observed in treatment T_{10} (11015.50 mg kg^{-1}). Highly significant positive correlation values among various K forms implied the existence of dynamic equilibrium. Yield was always better in INM package. Grain yield exhibited significant positive correlation with NPK uptake (r = 0.891**, 0.946** and 0.970**), water soluble K (r = 0.785**) exchangeable K (r = 0.897**) and available K (0.867**), suggesting their availability to crop. The plot which received 50% NP + Full K + 5 t/ha Vermicompost (T_{10}) showed the highest potassium use efficiency (PUE) of 51.96% while the lowest of 40.49% in the plot receiving T_6 treatment.

EFFECT OF PLANT GROWTH REGULATORS AND BIOSTIMULANTS ON GROWTH, YIELD AND BIOCHEMICAL ANALYSIS OF ONION (*ALLIUM CEPA*)

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Abstract

A field experiment was conducted to find out the effect of plant growth regulators and biostimulants like lihocin, NAA, GA, salicylic acid, vermiwash, bio digester and cow urine on growth, yield and biochemical parameters of onion at Main Agricultural Research Station, UAS, Dharwad. The experiment was laid out in Randomised Block Design with twelve treatments replicated thrice. The maximum plant height (64.30 cm) was recorded with the spraying of GA_3 @60 ppm while, the application of lihocin @ 2500 ppm resulted in highest number of leaves (10.63), maximum leaf area (1204.49 cm2/plant), higher neck thickness (18.64 mm) and dry matter content (16.9 gm/plant). Application of lihocin @ 2500 ppm also resulted in significantly highest average bulb weight (119.60 g/bulb), total yield (54.0 t/ha) and marketable yield (51.60 t/ha) of the bulbs. The pre harvest application of lihocin @2500 ppm recorded the lowest physiological loss in weight (18.5%), higher dry matter content (15.10 %) and higher marketable bulbs (79.5%) during the course of storage. The results of chlorophyll content under different treatments found significant. The maximum chlorophyll content (1.23 mg; 2.95 mg and 2.16 mg) at 45, 60 and 90 DATP respectively was recorded with the application of lihocin @ 2500 ppm. Though application of GA3 @ 60 ppm recorded the higher % of reducing (4.98%), non reducing (2.58%) and total sugar (7.04%), it was non significant with the other treatments. Total Soluble Solids varied significantly at harvest and highest TSS was noticed in the treatment NAA @ 300 ppm (13.70). The results of ascorbic acid under different treatments showed significant difference and the maximum ascorbic acid content (11.27 mg) was observed with the treatment GA3 @40 ppm.

AN ASSESSMENT OF ECONOMICS OF CAPSICUM AND TOMATO CULTIVATION UNDER PROTECTED CULTIVATION STRUCTURES OF KALYANA-KARNATAKA REGION

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Abstract

Protected cultivation structures are the important initiative for cultivation of high value horticultural crops to the farmers for generating higher revenues in the limited areas. In this view, the study has been undertaken to know the viability of the protected cultivation structures for the cultivation of capsicum and tomato crops in the regions of Kalyana-Karnataka. The study has been conducted in the district of Koppal and Ballari in regions of Kalyana-Karnataka. The study was exclusively on the basis of primary data through personal interview method. A sample of 60 farmers were drawn as respondents from each district based on their size and composition of the structures adopted and also on the basis of crops grown under protected condition. The cost and return analysis techniques were engaged to assess the economics of capsicum and tomato crops which were being cultivated under the protected cultivation. The results showed that, the net returns of capsicum and tomato crops in protected cultivation were Rs. 2,92,768 and Rs. 2,28,289 respectively in an area of 1008 sqm and the Benefit and cost ratios were reported as 1:3.40 for capsicum and 1:2.89 for tomato. Hence, the protected cultivation structures were found to be economical and viable unit in the regions of Kalyana-Karnataka. Therefore, farmers of this region should come forward for adoption of such of these technologies for reaping higher incomes and the government supports are also very much required for enhancing the income of the farmers by encouraging the farmers to adopt protected cultivation structures.

THE ABC TRANSPORTERS AND THEIR EPIGENETIC REGULATION UNDER DROUGHT STRESS IN CHICKPEA

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Abstract

Chickpea is the most consumed pulse crop in the world which serves as a source of dietary protein for millions globally. However, the crop is prone to severe yield loss due to drought stress. The identification of genes which impart drought tolerance is therefore of immense importance. The Adenosine triphosphate (ATP)-binding cassette (ABC) transporters are an important class of proteins which play diverse roles during plant growth and development. These serve as transporters of many phytohormones like abscisic acid, which allows the plant to adapt to drought stress. In the present study, we have identified a total of 117 ABC transporters in chickpea, which were classified into eight different subfamilies. In agreement with other crops, the CaABCG family was the largest with 44 members and the CaABCE family was the smallest with only one member. The structural analysis of the proteins revealed a highly conserved domain organization with the presence of the Walker A and B motifs and the ABC signature motif in the identified proteins. The highest number of duplicated gene copies were identified for the *CaABCG* and *CaABCC* subfamilies. Based on the RNA-seq and WGBS (Whole Genome Bisulfite Sequencing) data generated from root tissues of two chickpea genotypes, which contrast for drought tolerance, we identified that DNA methylation at cytosine residues, could be a possible mechanism of regulation of these genes under drought stress. The gene, *CaABCG37,* was identified as a drought-responsive gene, which was significantly upregulated (p ? 0.05) and hypermethylated (q ? 0.01) in the DT (drought tolerant) genotype under drought stress compared to the DS (drought sensitive) genotype. The homolog of this gene in *Arabidopsis* is involved in vascular tissue development which is suggestive of its potential significance in conferring drought tolerance. This gene could therefore be utilized to develop drought tolerant cultivars in chickpea.

EVALUATING GENETIC VARIABILITY AMONG GERMPLASM ACCESSIONS OF LINSEED (*LINUM USITATISSIMUM* L.)

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Abstract

Investigations were conducted at the All India Coordinated Research Project (AICRP) on linseed at the Main Agricultural Research Station (MARS) in Raichur during the rabi season of 2022-23, utilizing germplasm lines alongside five control varieties. The findings unveiled that traits such as technical plant height, number of capsules per plant, and seed yield per plant demonstrated higher phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability, and genetic advance as a percentage of the mean (GAM), indicating their inheritance primarily through additive gene action. The extent of genetic variation was assessed based on data acquired from eight quantitative traits. The 300 genotypes and five control varieties were categorized into nine clusters using D^2 values. Clusters IV, V, VII, VIII, and IX stood as singular clusters, each comprising only one genotype. Among these, cluster VI exhibited the maximum intra-cluster distance (357.56), trailed by clusters III (248.77), II (206.56), and I (206.39). Notably, the highest inter-cluster divergence was observed between clusters VIII and IX (4866.64), succeeded by the divergence between clusters III and VIII (3447.41), and clusters V and VIII (3198.61), underscoring the diversity and significance of genotypes within these clusters for hybridization programs. Correlation and path coefficient analyses for seed yield per plant and its constituent traits unveiled significant and positive associations with the number of capsules per plant, number of seeds per capsule, and thousand seed weight. Consequently, focused selection for these traits holds promise for enhancing seed yield in linseed.

EFFECTS OF PARBOILING ON MINERAL COMPOSITION IN FERMENTED RICE WATER

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Abstract

This study examined the effects of different processing techniques and fermentation times on the mineral content of rice water fermentation, with an emphasis on the Naveen rice variety. It was carried out at the National Rice Research Institute in Cuttack, Odisha. Grain processing and rice cultivation were done according to standard agricultural techniques. Cooked rice was immersed in water for a whole night, to create fermented rice water. This study examines the influence of various cooking methods on mineral retention. A total of twenty-four treatments, comprising processing technologies, were examined in relation to brown rice (BR) and parboiled rice (PR). Iron (Fe), zinc (Zn), potassium (K), calcium (Ca), and magnesium (Mg) were among the mineral content analysed. Our findings reveal substantial differences in mineral retention based on the cooking method employed. Specifically, pressure cooking enhances potassium retention in fermented rice, while hot water boiling without parboiling exhibits higher overall mineral content retention. These results underscore the importance of cooking methods in preserving mineral composition in fermented rice. Fermented foods have gained popularity due to their distinct flavours and potential health benefits, which are acknowledged worldwide. Optimising the nutritional value of fermented rice water requires an understanding of how processing techniques affect its mineral content. This study advances the use of fermented rice water in a variety of culinary and medicinal contexts.

CONSTRAINTS FACED BY GOAT FARMERS IN THE ACCESSIBILITY OF DEVELOPED PODCAST ON GOAT FARMING

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Abstract

The present study was conceptualised to develop podcasts in the local language and study the constraints faced by goat farmers in their accessibility. It was undertaken in four steps assessment and prioritisation of information needs of the goat

farmers, development of a podcast, and evaluation of problems encountered in its accessibility. An exploratory research design was used for the present study. A total of 60 respondents were selected by purposive random sampling from the Pune and Satara districts of Maharashtra to assess the information needs of the goat farmers and to study the effectiveness, perceived utility and problems encountered in accessibility of developed podcasts. The data was collected through a structured questionnaire and was administered to the respondents through a personal interview method. The socio-economic profile of the goat farmers in the study area revealed that the majority were in the middle age group (60%), with higher secondary education (38.33%), having goat farming as their main occupation (26.67%), nuclear family type (63.67%) and medium family size (63.33%). More than half of the respondents (68%) had not received any kind of formal training in goat farming and had a marginal type of land holding (31.67%). They retained a medium flock size (46.67%) having a medium level of experience in goat farming (58.68%). They reared goats primarily for meat purpose (93.33%) and had medium annual income (55%). Based on the information needs of goat farmers, 'Dhade Shelipalanache '- a podcast was developed on feeding and health care, management and breeding practices. After the development podcast, the constraints faced by respondents were evaluated. The problems encountered such as the requisite of internet connection (36.66%), high cost of smartphones (35.00%), mandatory requirement of smartphone (21.00%), high cost of internet packages (18.00%), network connectivity problem (16.00%), no instantaneous replies for their doubts (13.00%) and difficulty in listening steps and speed of podcast (09.00%) were the major constraints faced by the goat farmers in accessing the podcast. The podcast was viewed as a useful tool by the goat farmers and many such apps can be designed in the local language to deliver information in the field of animal husbandry in the simplest manner which would prove to be beneficial for the livestock farmers.

BIOCHEMICAL AND MOLECULAR CHARACTERIZATION OF GRASS PEA GENOTYPES FOR LOW -ODAP CONTENT

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Abstract

Grass pea (*Lathyrus sativus* L.) is considered as one of the best climate resilient crop. Generally, cultivated on residual soil moisture in rice-fallow during Rabi season in India. It is also considered as an 'insurance crop' as it produces reliable yields when all other crops fail due to a harsh environment. Despite these beneficial traits, this crop is not cultivated widely due to the accumulation of a neurotoxin -N-oxalyl-L- , -diaminopropionic acid (â-ODAP) in the seeds and its association with neurolathyrism. Collection and characterization of grass pea genotypes for low â-ODAP content is the attractive approach for its improvement. In present study, fifteen grass pea genotypes were collected from different places of Bihar and seeds from each genotypes were used for Biochemical and Molecular characterization. Biochemical characterization provides valuable insights into the protein content and composition, offering a basis for selecting superior varieties with enhanced nutritional value. Little is known about the nature and the amount of genetic diversity present in existing grass pea genotypes, yet this information is pivotal for future breeding programmes, such as those striving to reduce high neurotoxin levels present in seeds. Further, Simple Sequence Repeat (SSR) Markers were used for genetic diversity analysis.

BIO-EFFICACY AND ECONOMICS OF NEW INSECTICIDE MOLECULES AGAINST INSECT PESTS AND NATURAL ENEMIES OF SUNFLOWER

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Abstract

Field experiments on bio-efficacy of new insecticide molecules against insect pests of sunflower and their natural enemies were carried out for 3 consecutive years from kharif 2021-22 to kharif 2023-24 at Zonal Agricultural Research Station, GKVK, Bangalore. Experiments were laid out with nine treatments and three replications using RCBD design. The results revealed that seed treatment with Thiamethoxam 30FS @10ml/kg; Foliar spray of Diafenthiuron 50 WP @ 600ml/ha and Emamectin benzoate 1.9 EC @ 425 ml/ha. (T6) recorded significantly lowest average population of leafhoppers (1.08 leaf

hoppers/6 leaves/plant) and thrips (0.78 thrips/6 leaves/plant) and was on par with rest of the treatments. Seed treatment with imidacloprid 48FS @ 8ml/kg; [Emamectin benzoate 5%+ Lufenuran 40% WG] @ 60g/ha (T2) recorded significantly lowest average population of *Helicoverpa. armigera* (0.20 larvae/plant). The percent reduction of *H. armigera* larvae over control was highest in T6 (84 %) followed by T2 (83%), T3 (82%), T4 (79%), T7 (74%), T1 (58%) and T8 (56%) The untreated control plot recorded significantly highest average population (0.87 coccinellids/plant) of coccinellids per plant and was on par with T4 (0.83 coccinellids/plant). Seed treatment with imidacloprid 48FS @ 8ml/kg; [Emamectin benzoate 5%+ Lufenuran 40% WG] @ 60g/ha for lepidopteran pests (T2) recorded significantly highest average seed yield (1395 kg/ha.). Seed treatment with Thiamethoxam 30FS @10ml/kg; [Flubendiamide 19.92% + thiacloprid 19.92% 480 SC] @ 200 ml/ha. (T4) recorded a maximum incremental benefit cost ratio of 13.94 followed by T3 (11.31), T8 (9.39), T2 (9.20), T5 (7.80), T6 (7.13), T7 (4.25) and T1 (3.05).

IMPROVING PHYSIOLOGY OF *BRASSICA JUNCEA* L. THROUGH EXOGENOUS APPLICATION OF MELATONIN

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Abstract

Indian mustard (*Brassica juncea* L. Czern) belongs to family Cruciferae, genus Brassica and species juncea popularly known as rai. Mustard is cultivated mostly under temperate climate. It is also cultivated in certain tropical and subtropical region as a cold weather crop. Oilseeds crops are the second most important determinant of agricultural economy, next only to cereals. Today, the demand for vegetable oils is out pacing the supply with more than half of its annual requirements being met mainly through imports. One of the major obstacles to high yield and production for Indian mustard is the lack of synchronized crop establishment due to soil conditions caused by salinity. Most of this salt influenced soil has arisen due to natural causes, as result of the accumulation of salts over a long period of time in arid and semi-arid zones. The salinity problem is increasing every year due to the use of poor quality irrigation water as well as poor drainage system. Salinity stress is a critical factor impacting plant growth, distribution, and production via influencing several intracellular processes such as photosynthesis, ion homeostasis, protein, and lipid synthesis as well as hormonal and metabolic imbalance. The experiment was carried out at the screen house of Department of Botany and Plant Physiology, CCS Haryana Agricultural University, Hisar, to investigate the impact of melatonin on the growth and physiological parameters of mustard genotype (RH- 1974) during the rabi season of 2022-23. The experiment involved four levels of salinity from control 7.5 dS/m. growth parameters such as, fresh and dry weight (g/plant) and physiological traits such as photosynthetic rate, stomatal conductance, transpiration rate, Chlorophyll Content were recorded at 7th to 10th day after foliar application of melatonin. The findings indicated a significant increase in growth and physiological parameters were observed with the foliar application of melatonin as compared to their respective controls.

THERMOSOLUTAL INSTABILITY WITH EFFECT OF WEAK MAGNETIC FIELD IN BRINKMAN'S MODEL

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Abstract

In this paper we examine the framework of linear stability analysis with the model suggested by Brinkman, the thermal instability of an incompressible viscous fluid in the presence of magnetic field confined in an anisotropic porous medium. Uniform temperature and concentration gradients are maintained along z-axis. The interesting properties associated with magnetic field have attracted a number of different results on stability by using perturbations and normal mode analysis. The particular case which holds under the physical situations of the thermal diffusivity and solute diffusivity are such that both are

equal are also considered. In present paper, the important results obtained include different conditions of stability, existence of oscillatory modes, non-oscillatory modes, discussion for stable and unstable modes, if exist in the problem.

LIFECYCLE EVALUATION OF INPUT FERTILIZERS IN IRRIGATED RICE BASED CROPPING SYSTEM OF BIHAR

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Abstract

Fertilizer specifically nitrogenous (N) fertilizer plays an important role in agricultural production systems in terms of food yield and economic returns. Rice based cropping system is one of the predominated cropping systems of Bihar. However, N application rates (NARs) are often overestimated over those cropping systems. Now -a days, the imbalance use of fertilizers in major cereal crops like rice (*Oryza sativa* L.), wheat (*Triticum aestivum* L.) Maize (*Zea Mays* L.) is one of the most prevalent cultivation challenges. This is largely because negative externalities are not entirely included when evaluating environmental impact of whole life cycle of any production system, such as only individual N losses are taken into account, or the inventory flows of reactive N have been limited solely to the farming process when evaluating environmental and economic effects of N fertilizer. To determine environmental impacts associated with production system, the use of a life cycle assessment (LCA) by estimating the total emission during entire production chain to be analyzed and quantified in a common functional unit, and evaluated in a comprehensive index, provides good insights into the behaviour of the systems. Keeping this view in mind, one field experiment was established to gain insight the life cycle analysis of rice based cropping system and economic viability on crop seasonal scale over four crop cycles (2020-21 to 2023-24) of rice based crop rotations under subtropical climatic condition. Treatments were: two predominated cropping systems viz, Transplanted Rice – Wheat - Moong (M_1) and Transplanted Rice - Maize (M_2) in main plot and seven subplot treatments (S_1: S_7) of nutrient management practices viz 100% Inorganic fertilization, 25% substitution of inorganic fertilization with organic source, 50% substitution of inorganic fertilization with organic source with the different combination of herbicides and pesticides applications besides farmers adopted practices. It was experienced that Rice-Wheat-Moong system having 8.35% reduction in Global Warming Potential, indicates environmental benign over Rice-Maize system. Moreover, environmental cost for resource consumption of input nutrients was 13.3% higher than the eutrophication cost and 26.6% higher than the acidification cost. Therefore, fertilizer management would be the major focus area to reduce system environmental burden.

STANDARDIZATION OF PROCESS TECHNOLOGY FOR NANNARI EXTRACT INSTANT POWDER (*HEMIDICUS INDICUS*)

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Abstract

Nannari (*Hemidicus Indicus*) a medicinal plant. The roots of nannari are widely used in peninsular India as health drink. Nannari juice act as a natural body coolant and hence it is consumed during summer. The present investigation was focused to standardize the process technology to produce nannari extract instant powder for explosion the possibilities of maximizing the profit level of nannari farmer. Nannari roots are generally harvested after 2-3 years of planting. After harvesting nannari roots are washed thoroughly and cut in to small pieces (5cm) and then dried under sun or solar tunnel dryer till the moisture reaches to 5-8%. Dried nannari roots were added to water in the ratio of 1:25 and subjected to microwave treatment (2.45GHz) for 15 minutes. Further the roots were boiled for 1h 45 min to get an extract then filtered by using muslin cloth. Nannari extract was extracted, filtered and added with different concentrations of maltodextrin (10, 15 and 20%). The homogenised solution was subjected to spray drier at different inlet air temperatures (150, 160 and 170^{0}C) at feed low rate of 2.5 ml. min^{-1} at 1.5-2

kg/cm^{-2}. The extract powder was analysed for its physical, proximate and reconstitutional properties. Physical properties of viz., Solubility wettability, dispersibility, loose, tapped, hunser ratio and car's index and were found to be 86.96– 97.96%, 275 – 435 sec, 76.76 -84.91, 0.33-0.47g.cc^{-1}, 0.60- 0.43g.cc^{-1}, 1.21- 1.34 and 25.53- 17.64. The shelf life of nannari extract powder retained its quality parameters for six months. The overall acceptability of reconstituted extract powder was observed to be 8.5. The production cost of spray dried extract powder was computed as Rs. 1200/- per kg. The benefit cost ratio was 1.66

EFFICACY OF NEW COMBI INSECTICIDES AGAINST MAJOR CHILLI SUCKING PESTS IN TBP COMMAND AREA OF KARNATAKA

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Abstract

Chilli (*Capsicum annum* L.) is a tropical and subtropical crop grown all over the India. The pest spectrum of chilli crop is complex with more than 293 insects and mite species debilitating the crop in the field as well as in storage. The major insect pests in Karntaka are sucking pests, thrips, *Scirtothrips dorsalis* Hood, whiteflies (Genn.) and Mite, *Polyphagotarsonemus latus*(Banks). It has become necessary to evaluate newer combi insecticides for maximum mortality of sucking insect pests with least or no ill-effects on the plant, natural enemies, consumer and environment. In the present study, evaluated a new combi insecticide methoxyfenozide 18 % + emamectin benzoate 1.8 % SC against chilli thrips and mite during *Kharif* 2020-21. The experiment was conducted at Agriculture Research Station, Gangavathi, University of Agricultural Sciences, Raichur, Karntaka and laid a randomized block design with 7 treatments replicated three times on chilli Hot Pepper hybrid-5531 (HPH 5531). Observations on the population of thrips, mites and natural enemies (Coccinellids and spiders) were recorded from 5 randomly selected plants.

The thrips and mites population was reduced after two sprays. Results revealed that methoxyfenozide 18 % + emamectin benzoate 1.8 % SC @ 112.5 + 11.25 and 90 + 9 *g a.i*/ha proved to be best treatments showing maximum reduction of thrips and mites population. The predatory populations were statistically on par with all the dosages of methoxyfenozide 18 % + emamectin benzoate 1.8 % SC as well as with the standard check treatments and were safer to natural enemies. Hence, methoxyfenozide 18 % + emamectin benzoate 1.8 % SC is a effective combi product against chilli pests and may be considered as a potential component in IPM programmes.

EVALUATION OF RESISTANT RICE CULTIVARS AGAINST MAJOR RICE INSECT PESTS IN TBP COMMAND AREA

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Abstract

Insecticides and resistant cultivars are the primary methods of insect control as part of integrated pest management. To evaluate the effectiveness of the identified multiple pest resistant rice cultures against rice pests under the protected and unprotected condition was conducted at ARS, Gangavathi, Koppal, Karnataka, India during *Kharif* 2022. Nine insect pest resistant cultures *viz*., V1-CUL M9, V2-CR 3006-8-2, V3-CR Dhan 317, V4- Akshaydhan PYL, V5-RP5587-273-1-B-B-B, V6-KMR 3, V7-Suraksha, V8-W1263, V9-RP2068-18-3-5 along with the susceptible check, TN1 were raised in 3 replications in a split plot design with main treatments being protected (pesticide application) and unprotected conditions and varieties as sub plots.

Granular application had significantly reduced the gall midge damage in the protected treatments (5.73% silver shoot) as compared to unprotected treatments (11.06% silver shoot). Stem borer incidence *i.e* white ear damage was significantly higher in unprotected treatments (8.75%) as compared to the protected (3.12 %WE) treatments. The rice cultivars CR 3006-8- 2, RP5587-273-1-B-B-B and TN1 had lower dead heart damage by yellow stem borer. The rice cultures Cul M9, RP 2068-18-3-5, W1263 had significantly lower white ear damage compared to other entries. No significant difference was observed in planthopper (226 BPH/10h and 128 WBPH /10 hills) incidence. No significanct difference was observed in natural enemies count mainly mirid bug counts (39.28/ 10 hills), dragon and damsel flies (3.01/10 hills) and spiders (4.52 /10 hills). The rice cultivar Cul M9 had higher grain yield (6727.78kg/ha) followed by RP 2068-18-3-5 (5447.72kg/ha) and RP5587-273-1- B-B-B (3784.95 kg/ha). Therefore, the study revealed a way to identify the most effective combination resistance cultivars with application of some insecticides to avoid crop loss and get better control caused by crop pests while incurring the economic cost and ecosystem resilience is maintained

AGROFORESTRY AND THE IMPACT OF CLIMATE CHANGE ON BIODIVERSITY AND HEALTH SECURITY

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Abstract

Agro forestry, the integration of trees and shrubs into agricultural landscapes, offers a multifaceted approach to addressing the challenges posed by climate change on biodiversity and health security. By combining agricultural and forestry practices, agroforestry systems enhance in biodiversity, improve soil health, and increase resilience to climate variability. These systems provide Habitats for various species, promoting biodiversity conservation and mitigating the loss of flora and fauna due to changing climatic conditions. Climate change, characterized by rising temperatures, altered precipitation patterns, and increased frequency of extreme weather events, poses significant threats to biodiversity and human health. The loss of biodiversity can disrupt ecosystems and diminish their ability to provide essential services such as pollination, water purification, and carbon sequestration. Agroforestry helps counteract these effects by maintaining and enhancing biodiversity through diverse plant species and complex habits, which support a wide range of organisms. Moreover, agroforestry contributes to health security, by enhancing food security improving nutrition, and reducing the incidence of diseases. The integration of divers crops and trees can lead to more stable and productive agricultural systems, providing a consistent supply of food even under adverse climatic conditions .Trees and plants in agroforestry systems can also improve air and water quality, reducing the prevalence of respiratory and waterborne diseases. Additionally, the increase biodiversity can regulate the spread of pests and diseases reducing the need for chemical inputs and minimizing their harmful impacts on human health and the environment. Agro forestry represents a sustainable land Management practice that addresses the dual challenges of climate change and biodiversity loss while enhancing health security .By promoting ecosystem resilience ,supporting biodiversity and improving human health outcomes, agroforestry systems offer a holistic solution to some of the most pressing environmental and health issues of our time. Investing in and scaling up agroforestry practices and sustainable agricultural landscapes in the face of climate change.

GENOMIC SELECTION : A POTENTIAL BREEDING TOOLS FOR SUGARCANE

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Abstract

Sugarcane (*Saccharum officinarum* L) is a crucial economic cash crop belongs to family Poaceae. It is being cultivated in

tropical and subtropical regions of the world as major Industrial crop. Sugarcane accounts for more than 70% of the total sugar produced globally, mostly consumed as refined sugar. Additionally, sugarcane is emerging as a source of sustainable bio-energy.

Genomic Selection (GS) is a modern breeding tool that has been very successfully applied in animal and plant breeding. It was first introduced by Haley & Visscher and is propounded by Meuwissen *et al.* 2001. It is a specialized form of MAS, in which information from genotype data on marker alleles covering the entire genome forms the basis of selection. The effects associated with all the marker loci, irrespective of whether the effects are significant or not, covering the entire genome are estimated. The marker effect estimates are used to calculate the Genomic Estimated Breeding Values (GEBVS) of different individuals/line, which form the basis of selection. GS have its potential to significantly increase the rate of genetic gain in sugarcane, mainly by (i) reducing the breeding cycle length (ii) increasing the prediction accuracy for clonal performance, and (iii) increasing the accuracy of breeding values for parent selection. GS approaches that can accurately capture non-additive genetic effects and potentially improve the accuracy of genomic estimated breeding values are particularly promising for the adoption of GS in sugarcane breeding. GS can be a promising tool for improving the rate of genetic gain for quantitative traits in sugarcane breeding. Two Strategies for the Incorporation of Genomic Selection in Sugarcane Breeding strategies like Recurrent Genomic Selection and Reciprocal Recurrent Genomic Selection hold the potential to substantially increase the rate of genetic gain in future sugarcane breeding.

A FUTURE FOCUS : SCIENCE, TECHNOLOGY AND INNOVATION IN AQUACULTURE AND FISHERIES

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Abstract

Fish plays a significant role in food and nutritional security in our country as well as the whole world. Owing to this reason, it becomes essential to increase the production of fish. But it is diminishing due to numerous diseases which can deteriorate the national economy. It is a fact that there is no single effective research work that has been done in regards to fish disease due to a lack of data and a high level of expertise. Consequently, our aim is to recognize the fish disease effectively that can help the remote farmers who need proper support for fish farming. Recognition of disease-attacked fish at an early stage can help us take necessary steps to prevent from spreading of the disease. In this work, we have performed an in-depth analysis of expert systems that can continue with an image captured with the help of smartphones and identify the disease. Two set of features is selected then a segmentation algorithm is employed to detect the disease attacked portion from the disease-free portion. Furthermore, eight prominent classification algorithms are implemented accordingly to measure the performance using performance evaluation matrices. The failures in the production of fish are occurred due to redundant and unplanned steps that can lead to various diseases. Manual identification of fish disease is not an error-free task by amateur farmers. Therefore, a computer vision-based automated approach can be a considerable solution for the reduction of disease. Fish disease recognition is divided into two problems, namely detection diseased region and classification of disease.

EFFECTS OF ARBUSCULAR MYCORRHIZAL (AMF) INOCULATION ON THE GROWTH, NUTRIENT UPTAKE AND ENZYMATIC ACTIVITIES OF *AVICENNIA MARINA* – A TRUE MANGROVE SEEDLINGS UNDER DIFFERENT LEVEL OF SOIL SALINITY: A GREENHOUSE EXPERIMENT

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Abstract

Mangroves, despite thriving at the fringes of habitat tolerance in coastal regions, stand out as the most productive ecosystems

globally. This study delves into the remarkable impact of symbiotic relationship between mangrove plant and Arbuscular mycorrhizal (AM/AMF) fungi. Specially this study assesses the interactive effects of AMF inoculation on soil nutrition, plant growth, photosynthetic pigments and enzymatic analysis of true mangrove-*Avicennia marina* under different level of soil salinity. We aimed to explore the eco physiological function of AMF in *A. marina* seedlings and to clarify the possible survival mechanism of mangrove species under saline stress with or without AMF inoculation. Remarkably, species consortia of genus *Glomus* and *Gigaspora* consistently ranked as the most prevalent effects throughout the experiment rather than single culture, indicating its strong adaptability in *A. marina* seedlings under high salinity. The inoculated AMF successfully infected *A. marina* roots, significantly promoted the height and biomass of *A. marina*, enhanced root vitality and nutrition uptake, acidic phosphatase (ACP), alkaline phosphatase (AKP), dehydrogenase, catalase and peroxidase (POD) activities comparatively higher in consortia. This research sheds light on the beneficial impact of AMF associations in mangrove ecosystems, emphasizing the significance of AMF as a key player in this symbiotic relationship. This finding contributes to our understanding of the ecological intricacies within mangrove habitats and highlight the adaptability of certain AMF genera to varying environmental conditions.

INNOVATIVE APPROACHES TO CROP PRODUCTION AND LIVELIHOOD IMPROVEMENT IN EASTERN UTTAR PRADESH

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Abstract

Eastern Uttar Pradesh, with over 158 million residents, is a densely populated region heavily reliant on agriculture. Despite this, nearly 23% of the population lives below the national poverty line. A major factor is stagnating farmer income, often attributed to fragmented landholdings (average size: 1.1 hectares), limited irrigation access (only 38% of net sown area), and overdependence on traditional crops like rice and wheat. This study explores innovative approaches to enhance crop production and improve livelihoods in the region. The proposed strategies encompass advancements in crop science, improved resource management, and market-oriented interventions. Promoting climate-resilient, high-yielding crop varieties alongside precision agriculture techniques can significantly increase productivity. Additionally, advancements in soil health management can improve long-term fertility and reduce dependence on chemical inputs. To address water scarcity, exploring micro-irrigation technologies and rainwater harvesting systems is crucial. Furthermore, strengthening farmer producer organizations (FPOs) can empower farmers for collective bargaining, reduce post-harvest losses, and enable direct marketing or value addition through processing and branding of agricultural produce. Diversification towards high-value crops, horticulture, and agro-forestry can improve income stability and resilience. Finally, robust agricultural extension services and leveraging technology for information dissemination are essential for capacity building. By implementing these innovative approaches, Eastern Uttar Pradesh can witness significant improvements in crop production, farmer income, and overall livelihood security.

EFFECT OF ULTRAVIOLET-C (UV-C) RADIATION TREATMENT ON DISINFECTION OF AFLATOXIN IN RED CHILLI AND GROUNDNUT FOR INCREASING THE EXPORT QUALITY

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Abstract

Food safety has become a major concern in society and the food industry from production to export to other countries. Although there are many technologies developed to reduce the mycotoxin in foods, the use of UV-C is one such technology, which has emerged as a possible alternative to other postharvest treatments without altering the nutritional quality of foods. In the present study, red chilli and groundnut were inoculated with *A. flavus* and exposed to UV-C for 5, 10, and 15 min at a constant distance of 10 cm. UV-C-treated samples were analyzed for *A. flavus* colonies count, aflatoxin content, changes in colour, and proximate quality parameters for a period of up to 120 days at 15 days intervals. The results of UV-C radiation

treatment for an exposure period of 15 min with a dosage of 12195 J/m^2 showed a significant reduction (99.9%) in the fungal colonies and total aflatoxin content (>90%) in both chilli and groundnut without much change in the nutritional and quality parameters.

CLIMATE RESILIENT INTEGRATED FARMING SYSTEM – A WAY FORWARD TO FOOD SECURITY

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Abstract

Climate change will affect the food productivity across the world. Making agriculture climate smart through integrated approach is an ideal solution to ensure the food security of the ever increasing global population. Climate Smart Agriculture (CSA) ensures increased productivity in sustainable way which can strengthen the farming community against the consequences of climate change. It can also mitigating the potential of climate change through carbon stocking. Integrated Farming System is a system to protect and conserve land and water resources from depletion. CSA is proposed with the aim to achieve sustainable higher productivity, ensure livelihood and food security, adapt to climate change and bring down emission of carbon. In this context, experiments were conducted at Agricultural Research Station, Tamil Nadu Agricultural University, Thanjavur during 2017-2022 with 0.80 hectare (8000 m^2) Integrated Farming System model comprising of agricultural crops (Rice based cropping system) in 5600m^2, horticultural crops (Banana and vegetables) in 1000 m^2, fodder production in 400 m^2, Azolla 100 m^2, poultry farming in 10 m^2, fishery in 800 m^2, vermicomposting in 20 m^2, dairy farming (2 cow + 1 calf) in 20 m^2 and boundary plantations in 50 m^2 to study the potential of system on food grain productivity, net income over the cost of production and employment generation among the farm families. Based on the analysis of interlinked components of the system, the results revealed that, IFS provides an opportunity to increase economic yield per unit area per unit time (Rice Grain Equivalent Yield of 28.0 tonnes / ha) by virtue of intensification of crop and allied enterprises. The system worked out with net profit Rs.2,19,000/ha. and B/C ratio 1.83. Organic supplementation through effective utilization of byproducts of linked component is done thus providing an opportunity to sustain the potentiality of production base for much longer periods.

SPRAY DRYING OF *MOMORDICA CYMBALRIA* (KARCHIKAI) JUICE POWDER AND ITS STORAGE STUDIES

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Abstract

Momordica cymbalaria is one of the species of cucurbitaceae family. The plant is a perennial climber available only during the monsoon season and is found in the south Indian states of Andhra Pradesh, Karnataka, Madhya Pradesh, Maharastra, and Tamil Nadu. India is the second largest producer of vegetables in the world after china. As per ICMR recommendation vegetable consumption is 280g/day, but the actual consumption of vegetable is only 135g/day. This gap is due to load on production of conventional foods. To overcome this challenge, it is essential to explore the available underutilized vegetables. These underutilized vegetables are far superior in nutrition and have medicinal properties along with high crop yield potential. The crop is valued for its edible fruits, and leaves as vegetable and its tubers are mainly preferred for medicinal purpose. The beta-carotene content of karchikai was 224.9 Ig/100 g and that of sponge gourd and ridge gourd was 200I.U/100 g and 55 I.U/100 g respectively. Karchikai contained a higher amount of ascorbic acid 160.77mg/100 g on a fresh weight basis. The iron and phosphorous content of karchikai was also found to be higher (130.00 mg and 5.50 mg/100 g, respectively) compared to other species. The nutrient contents of Fruits of the two vegetables *M. cymbalaria* (Karchikai) and *Momordica*

charantia (Bittergourd) are compared. The calcium content of Karchikai is three times higher than that of the Bitter gourd. The higher concentration of this nutrient in Karchikai may be exploited and used. The ascorbic acid (Vitamin C) content of Karchikai is two times higher than that of Bitter gourd. The drying of foods in the open sun is a practice being followed in many countries since ancient times, especially by individual households and small scale enterprises. Drying is a part of many conventional food preparations. It also helps to impart special taste and store food items for longer periods. Spray drying technology has given major contribution in drying of liquid products and stores it for high shelf life. The karchikai juice was made into powder by using spray dryer. Maltodextrin was added as binding agent. The proximate analysis and physiological properties was carried out of all the samples.

PERCEPTION OF FARMERS TOWARDS NATURAL FARMING IN WEST GODAVARI DISTRICT OF ANDHRA PRADESH

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Abstract

The study investigated farmers' perception of Natural Farming (NF) in the West Godavari District of Andhra Pradesh with the specific objectives of assessing overall farmers' perception, the determinants of their perception, sources of information for NF, constraints in practising NF and suggestions for sustainable NF adoption. Sixty farmers practising NF were purposively selected from six NF clusters of the west Godavari District. The data collected were analyzed using frequency counts, percentages and correlation analysis. The majority of the farmers had a medium perception of NF followed by high and low. The great majority of the farmers agreed that soil would be enriched with NF, quality production is possible with NF, NF increases microorganisms and earthworms in soil (80.00%), facilitates natural enemies population (68.33%), is complex to adopt (63.33%), weed management is difficult (55.00%) and NF is difficult to practice (53.33%). However, they have disagreed that the adoption of NF on a large scale is possible (55.00%) and purchasing and maintaining native cows is difficult (51.67%). The major sources of information were the Department of Agriculture followed by print media, practising farmers and television. Training undergone, NF experience, innovativeness, education and extension contact were the variables having a highly significant positive relation with farmers' perception at 0.01% level. The major constraints expressed by the practising NF farmers were non-availability of NF inputs (81.67%), lack of information on preparation and use of asthras (76.67%), low yields in initial years (75.00%), weed management (68.33%), preparation of asthras is difficult (63.33%) and intensive labour requirement (53.33%). The NF farmers have suggested creating awareness among farmers (78.33%), application of asthras through fertigation (71.67%), making NF inputs locally available (63.33%) providing market support for NF produce (58.33%) and giving wide publicity on the benefits of NF (51.67%) would facilitate its large scale adoption. Adoption of natural farming practices in field crops farmers got a net income of rupees 43450-51,000 in paddy, 8000-38000 in black gram and 12,250-32250 in sesamum.

STUDY ON GENETIC DIVERSITY OF LOTUS (*NELUMBO NUCIFERA* GAERTN) GENOTYPES NATURALLY GROWING IN CLIMATIC CONDITIONS OF BIHAR FOR CONSERVATION AND SUSTAINABLE UTILIZATION

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Abstract

Lotus *(Nelumbo nucifera* Gaertn) is one of the most important and beautiful perennial aquatic plants occurring naturally from Kashmir to Kanyakumari even in Himalayan lakes at altitudes up to 1400 m with huge phenotypic diversity in shape, size and colour. Besides, the ornamental beauty of its flowers and leaves, it is used as food and also for medicinal and nutraceutical

purposes worldwide. The wild form of the lotus is the source of the gene pool for the breeding of new and improved varieties. Still, due to the continued tremendous increase in human population, the natural habitat of plants is losing day by day with urbanization which is required to start systematic breeding programmes to conserve them for future breeding programmes. In view of its future potential, a study was conducted to assess the genetic diversity in lotus genotypes naturally growing in Bihar. *In-situ* morphological observation *viz.,* leaf length (cm), leaf width (cm), number of leaf venation, length of petiole (cm), diameter of leaf stalk (mm), length of flower stalk (cm), diameter of flower stalk (mm), number of petals per flower, diameter of flower bud (mm), diameter of flower (cm), weight of flower (g), petal length (cm), petal width (cm), number of stamens per flower, receptacle diameter (mm), flower colour, number of stigma per flower, number of seeds per receptacle, seed weight (g) per receptacle, rhizome length (cm), rhizome diameter (cm), and rhizome weight (g) were recorded from 33 different locations of Bihar. The result reveals the high range of diversity in flower colour, number of petals per flower, petal length, petal width and flower weight. The GCV, PCV, heritability and genetic advance were analysed for all 21 traits of 33 genotypes. The traits viz., length of flower stalk, number of petals per flower and weight of flower coupled with high heritability and genetic advance indicate their potential for developing genotypes for flower attributes.

INFLUENCE OF DIFFERENT CONCENTRATION OF IBA AND NAA IN ROOT INDUCTION AND GROWTH OF KIWIFRUIT CUTTINGS

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Abstract

Over the years, Kiwifruit (*Actinidia deliciosa*) has gained widespread popularity and is now cultivated in various parts of the world including India. The cultivation of kiwifruit requires specific climatic conditions, including, mild winters, warm summers with sufficient railfall or irrigations. In recent years kiwifruit cultivation under North Eastern region of India has gain momentum due to consumers demand for healthy and exotic fruits. This trend has prompted research and development efforts to enhance kiwifruit cultivation techniques, breeding programmes for improved varieties and its propagation for mass multiplications. Kiwifruit is usually propagated through cuttings. Thus the use of plant growth regulators has resulted in some outstanding achievements in several fruit crops with respect to growth, yield and quality. Auxin is effective in stimulating root formation on cuttings. The most widely used auxins in rooting of stem cuttings are indole-3butyric acid (IBA) and naphtaleneacetic acid (NAA). Thus, the current research has been conducted with the aim to explore the effect of varying concentrations of two plant growth regulators, IBA (Indole-3 Butyric Acid) and NAA (Naphthalene Acetic Acid) with following concentrations IBA 1000 pmm, to IBA 5000 ppm and NAA 1000 ppm to 5000 ppm. The observation were recorded for number of roots, longest root, rooting area, fresh root weight, no of shoots, no of leaf in a shoots, leaf width, leaf area and leaf ratio. This abstract highlight the result of present findings as maximum number of roots (13.667^{a}), longest root (10.533^{a} cm), Rooting area (35.333^{a} mm), fresh root weight (2.1^{a} g), no. of shoots (2.333^{a}) were observed in the cuttings treated with IBA 1000 ppm followed by cuttings treated with NAA- 5000 ppm results in terms of number of roots (12.333^{b}), longest root (10.533^{a} cm), fresh root weight (1.97^{b} g), no. of shoots (1.667^{b}), no of leaf in a shoots (6.667^{a}), leaf length (10.33^{a} cm), leaf width (9.767^{a} cm).

CULTURAL, BIOCHEMICAL AND MOLECULAR CHARACTERIZATION OF THE PATHOGEN AND EPIDEMIOLOGY OF BACTERIAL LEAF SPOT OF CHILLI

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Abstract

Chilli is an important spice crop grown in India and other parts of the world. It is a rich source of vitamin C and A & well known for its pungency. Among the various diseases infecting chilli, the bacterial leaf spot caused by *Xanthomonas vesicatoria* is most devastating disease resulting significant yield losses. Among various factors influencing the disease, weather factors such as temperature, relative humidity and rainfall play a major role in aggravating or reducing the disease intensity. Further, disease cycle depends on survival ability of the pathogen in an infected plant debris and other weed hosts.

Hence, studies were undertaken to understand the nature of the pathogen through its cultural, biochemical and molecular properties and to assess the various factors governing the disease intensity. Among the different culture media tested, luxuriant growth of the pathogen was observed in Yeast extract nutrient agar with significantly maximum number of 39 X 10^{-5} colonies followed by Yeast extract dextrose calcium carbonate agar (25 X 10^{-5}). Nutrient sucrose agar poorly supported the pathogen growth (6 X10^{-5}). In biochemical characterization, the pathogen responded positively for all the 4 tests conducted such as starch hydrolysis, gelatin liquefaction, catalase & hydrogen sulfide production. Further, molecular confirmation of the pathogen was done by amplifying 16S rDNA gene region of the bacteria & species identification was carried out using specific primers. Correlation between disease intensity & weather factors is well established which revealed that, the disease gradually progressed with age of the crop from 39th standard meteorological week & reached its peak intensity (75.20 PDI) at the end of 44th week and significant positive correlation was observed between disease development and effect of weather factors such as rainfall, rainy days, maximum &minimum relative humidity and minimum temperature. In host range studies, it is observed that, the pathogen can able to infect other solanaceous hosts such as tomato & potato. Among the weed hosts, American elm (*Ulmus americana*) and sessible joyweed (*Alternanthera sessilis*) were found infected and the pathogen survived upto 4 weeks in an infected plant debris left on soil surface.

CURRENT ADVANCES IN PCR TECHNOLOGY

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Abstract

The polymerase chain reaction (PCR) technique, initially developed by Mullis in 1983, has continued to evolve and find new applications in the field of molecular biology. PCT for which Kary Mullis in received the Nobel Prize in 1993, is one of the most notable achievements in molecular biology. Even with small quantities of biological material, PCR enables the rapid amplification of DNA fragments. PCR has undergone significant refinements and optimisations, transforming it into an indispensable tool across scientific, diagnostic, forensic, and agricultural domains. Current advances in PCR have focused on enhancing sensitivity, specificity, real-time monitoring, and multiplexing capabilities. The development of Nested PCR, on the other hand, improves specificity by utilising two rounds of amplification, enhancing target detection confidence, and reducing false positives. The capacity of real-time PCR and quantitative PCR (qPCR) to track DNA amplification in real time facilitates precise microbial load estimation and gene expression analysis. Multiplex PCR, which enables the amplification of several DNA fragments at once, by turning RNA into complementary DNA (cDNA), the reverse transcription polymerase chain reaction (RT-PCR) combines a reverse transcription step and enables the amplification of RNA molecules frequently used to assess gene expression. Digital PCR (dPCR) is a highly sensitive third-generation PCR that enables absolute quantification and accurate molecular detection of rare mutations and copy number variation. In the future, PCR technology improvements will produce specialised modifications and cutting-edge methods to meet particular requirements in a variety of fields.

EVALUATION OF BABY CORN-VEGETABLE INTERCROP MODEL FOR GROWTH AND YIELD ATTRIBUTES

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Abstract

The present investigation entitled Evaluation of Baby corn - Vegetable intercrop model for growth and yield attributes was conducted during Rabi, 2022-23 at the College Instructional Farm, Rampur Nawagon, RABL College of Agriculture and Research Station Chhuikhadan, Dist- Khairagarh-Chhuikhadan-Gandai, (C.G.). The experiment is made up of 9 treatments in random block design (RBD) with three replications of the varied intercrops. The observations were recorded from germination percentage, plant height (cm), number of leaves per plant, stem base diameter (mm), earliness (day), root length (cm), root diameter (mm), number of cob/pod per plant, cob/pod girth (cm), cob/pod length (cm), cob/pod weight (gm), fresh weight of plant (gm), dry weight of plant (gm), cob/pod yield (kg /plot), cob/pod yield (kg/ha), green fodder yield (t /ha), harvest index (%) and benefit-cost ratio.

Among all treatment combinations (T_6) baby corn + cowpea (2:2), gives the maximum germination percentage (92.25), maximum plant height (175.15 cm), maximum number of leaves per plant (10.13), maximum stem base diameter (69.71mm), lowest number of days to 50% silking (51.45), lowest days to harvest (56.4), maximum root length (26.28cm), maximum root diameter (12.30mm), highest number of cob/pod per plant (2.90), highest cob/pod girth (3.08cm), highest cob/pod length (13.17cm), highest cob/pod weight (60.22gm), highest fresh weight of plant (295.12gm), highest dry weight of plant (75.25gm), highest cob/pod yield (8.73 kg /plot), highest cob/pod yield (7274.97 kg/ha), highest green fodder yield (14.75 t /ha), highest harvest index (33.01 %) and highest B:C ratio of (2.22). which was significantly superior to sole baby corn (1.39).

EFFECT OF NATURAL AND ORGANIC FARMING PRACTICES ON GROUND NUT (*ARACHIS HYPOGAEA* L.) + FINGER MILLET (*ELEUSINE CORACANA)* INTERCROPPING SYSTEM'SPRODUCTIVITY, ECONOMICS AND SOIL HEALTH

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Abstract

In India, Groundnut is considered as the "king of oilseeds" and it contains 40% to 53% oil and Finger millet is considered as one of the most nutritious cereals. Finger millet contains about 5–8% protein, 1–2% fat, 65–75% carbohydrates, and 15–20% dietary fiber and 2.5–3.5% minerals. Both these crops are draught hardy and can be grown very well in red soil under low external in put conditions of Natural and Organic Farming practices. Hence, a field experiment was carried out in Ground nut + Finger millet intercropping system on red soil at Hanumanamatti of Haveri district from 2019-20 to 2021-22 for three years on permanent site to study the impact of natural Farming (NF), Organic Farming (OF) and conventional farming practices {(Recommended package of practices (RPP) and Chemical farming (CF)} on productivity, economics and soil health. The results showed that, RPP recorded significantly higher Ground nut yield (1413 kg ha^{-1}), Finger millet grain yield (682 kg/ha) and groundnut equivalent yield (GEY) (1787 kg/ha) than NF (1312, 586 and 1637 kg/ha, resp.,) and OF (1263, 602 and 1596 kg/ha, resp.,) . However, GEY of natural farming (1637 kg/ha) was on par with OF (1596 kg/ha) but significantly superior than chemical farming (1490). The groundnut, Finger millet and GEY were lower by 7, 14 and 8.3 per cent in NF over RPP. The pooled results showed, lower cost of cultivation under NF (Rs. 48351 ha^{-1}) and higher under RPP (Rs. 63354 ha^{-1}) and OF (Rs. 66405 ha^{-1}). About 23 and 27 per cent total costs and 34 and 39 per cent material costs were saved under NF over RPP and OF, respectively. Even without premium price, the higher net return was obtained under NF (Rs. 47980 ha^{-1}) than OF (27906 kg/ha) and RPP (Rs. 41401 ha^{-1}) due to reduced cost of cultivation. Higher organic carbon content and available P were observed in OF (0.47 % &29.73 kg/ha) than NF and CF (0.41 & 0.4 % OC and 22.83 & 23.50 kg P/ha resp.,). Similar trend was observed with respect to Fe, Zn, Ca, and B. However, soil health interns of General soil micro flora (Bacteria, fungi, *actinomycetes)*, beneficial micro organisms (N_2 fixers, PSM's) and enzymatic activities (Dehydrogenase, Phosphatase and Urease) in rhizosphere soil of both the crops were significantly higher in organic and natural farming practices than conventional farming. Hence, cultivation of Ground nut + Finger millet intercropping system under natural farming is profitable, economically viable and for improving soil health.

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT OF DRAGONFRUIT (*HYLOCEREUS POLYRHIZUS*) UNDER THE HILLY AREAS OF MIZORAM, INDIA

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Abstract

Dragon fruit (*Hylocereus undatus* L.) plant is a cactus, belonging to the family Cactaceae. Recently, dragon fruit introduced as super fruit in India, is considered to be a promising and remunerative fruit crop. The present investigation was conducted to

find out the response of integrated nutrient management of Dragonfruit (*Hylocereus polyrhizus* L.) plant on fruit yield and quality. The results clearly revealed that yield and fruit quality attributing characters were significantly influenced by integrated of organic and inorganic nutrients. The highest fruit yield per plant and fruit weight (g) was observed in 100 % NPK + poultry manure (T3).The maximum plant height (140.5 cm), number of branches per plant (8.50) and stem diameter (21.30 cm) were observed under 100 % NPK + FYM (T1) and 100 % NPK + Vermicompost (T5) respectively. Hence, treatment combination (T3) can be considered as best treatment for enhancing fruit yield and quality in Dragon fruit under Mizoram conditions.

INFLUENCE OF BIO-SYNTHESIZED NANOPARTICLES ON ROOT, PHYSIOLOGICAL AND YIELD ATTRIBUTES OF BREAD WHEAT (*TRITICUM AESTIVUM* L.)

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Abstract

Wheat (*Triticum aestivum* L.) a semi-arid cereal crop and is a staple for several countries of the world. However, enhancing wheat productivity under global climatic change is a challenging task. Productivity of wheat has been decreasing due to water stress, it negatively effects the plant growth and development. Silver and Copper NPs were able to control pest and diseases as iron and zinc NPs improves the elemental grain quality by higher accumulation of Zinc and iron content in grains. Application of nanoparticles can enhance the physiological, yield and quality traits through seed priming and foliar spray. Among different treatments T_7 (200.25, 184.75 cm) and T_3 (188.00, 162.00 cm) recorded significantly longer roots in both UAS-347 and UAS-304 respectively as compared to hydropriming (60.00, 66.50 cm) and untreated control (53.66, 54.12 cm). Similar trend is also noticed in roots for physiological and yield parameters. With seed priming, the seeds attain higher metabolic and biochemical activities necessary for better germination and it enhances the vigour of seedlings by activating the metabolic systems in the plants, which is beneficial for field emergence. Seed priming with copper (250 ppm) and silver (750 ppm) nano particles plays an important role in enhancing the water stress tolerance in wheat genotypes (UAS 347 and UAS 304).

EFFECT OF PROBIOTIC AND SYMBIOTIC SUPPLEMENTATION ON PERFORMANCE OF BUFFALO CALF

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Abstract

An on-farm trial was conducted under the banner KVK, S.A.S. Nagar (Mohali) to assess the effect of probiotic and symbiotic supplementation on the performance of buffalo calf in the farmer's field during 2023–24. Twenty-four 10- to 15 day old buffalo calves were randomly selected and distributed equally in four treatment groups, i.e., six in each group, in a completely randomised design. T1 was the farmer's practice (basal diet), T2: calves were supplemented with probiotics (Lactobacillus acidophilus) @ 1 g/calf/day besides basal diet, T3: calves were supplemented with probiotics (Lactobacillus acidophilus) @ 0.5 g/calf/day and Mannan Oligosacharide (Prebiotics) @ 2 g/calf/day besides basal diet, and T4: calves were supplemented with Jaggery @ 10 g with 1 g turmeric powder/day/calf besides basal diet. The experiment took place over a period of 90 days. The body weight of the calves was recorded at a at a fortnightly interval. The results of the study showed that the initial body weight of the calves was similar in all the treatment groups, but the final body weight (kg) was significantly higher in groups T3 (75.73±0.82), T4 (74.99±0.88), and T2 (72.74±1.48) as compared to T1 (65.03±0.59) after 90 days. Total weight gain during the 90-day period was 29.25, 37.52, 39.88, and 39.62 in treatment groups T1, T2, T3, and T4, respectively. Average daily gain (gm/day) was 325.00, 416.88, 443.11, and 440.22 in treatment groups T1, T2, T3, and T4, respectively. The incidence of diarrhoea was found to be significantly lower in the treatment group as compared to the control group. Based on the present study, it may be concluded that supplementation of probiotics, prebiotics, and jaggery with turmeric has a desirable effect in terms of a higher growth rate and a reduction in the incidence of diarrhoea in the supplemented groups as compared to the control group. Further jaggery with turmeric is natural and cost effective as compared to probiotics and prebiotics. It is suggested to farmers to use jaggery at 10 grammemes with 1 gramme of turmeric powder/day/calf for a higher growth rate and a lower incidence of diarrhoea.

SUSTAINABLE RURAL LIVELIHOOD AMONG JHUM PRACTICING FARMERS IN MIZORAM, INDIA : AN ECONOMIC ANALYSIS OF OIL PALM CULTIVATION

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Abstract

The present study was undertaken in Mizoram state of India to study the economic aspects of oil palm cultivation as a sustainable rural livelihood among jhum practicing farmers in the state. The rapid increase of land degradation due to jhumming, deforestation, loss of biodiversity and productivity, increasing flood are leading to an ecological crisis affecting livelihood options for the farmers in Mizoram. Oil palm stands as an ideal crop capable of achieving conservation of soil and moisture, repair of degraded land, provide ecological balance, food and security of rural and urban poor. The study was conducted in two districts of Mizoram namely, Kolasib and Mamit districts as the districts has considerable area of under oil palm. A survey involving a sample of 60 respondents were drawn from each district during the year 2023. The data collected were subjected to conventional tabular analysis to work out costs and returns of oil palm cultivation. The result showed that the average per hectare input cost during the entire gestation period and fruiting period was estimated to be of ?52,535.50 and ?46,639.50, respectively. The B-C ratio in oil palm plantation was worked out to be of 7.47. The benefit-cost analysis shows that the net income was higher in the oil palm planation of 11-15 years age group, indicating that the yield was at maximum in this period. At the age of 5-10 years duration when fruiting started (after five years) the net income was low being of ?2.03 lakh per hectare. After this it increased to ?4 lakh in 11 to 15 years. The settled cultivation of oil palm plantation is expected to reduce the negative impact of jhum cultivation and is also expected to provide a steady source of income for the farmers in the state.

COMPARATIVE ANALYSIS OF COMPLETE MITOCHONDRIAL GENOMES OF SEVEN DUCK GERMPLASMS FROM EASTERN INDIA

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Abstract

Native ducks are a vital economic resource that will be crucial in addressing the issue of animal protein scarcity in the future. Because they may be cultivated in a particular microclimate to meet local needs, the protection of these indigenous germplasms is crucial. The current study was carried out to generate and compare the mitochondrial genome of duck germplasm from the eastern region of India using a whole genome sequencing approach, taking into consideration the significance of mitochondrial genome as a crucial tool for species identification and monitoring the populations of conservation concern. According to our research, the size and order of the mitogenome in these duck germplasm samples are comparable to those of current populations. 400 distinct variants were found by a comparative investigation of seven mitogenomes; they need to be confirmed on a broad scale. Current findings provide important new information for the study of epidemiology, species identification, and evolutionary biology.

BIOFORTIFICATION FOR NUTRIENT-RICH MILLETS

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Abstract

Nutritional security is the key to improve the health status of the world's population as mankind is primarily dependent on plant-based diets. Plants are the major source of nutrients essential for normal growth and development. However, half of the global population, especially people from Asia and Africa suffer from nutrition deficiency as they rely on cereal crops for

food. Millets are nutritionally superior as their grains contain high number of proteins, essential amino acids, minerals, and vitamins. There are billions of persons facing the problem of micronutrient deficiency in the world, resulting to undernourishment. This results into severe consequences of health. The commercial food fortification alone will not be sufficient to combat the problem of malnutrition; however, biofortification can enhance the nutritional value of the plant-derived foods and feeds and provide a low-cost, sustainable, and long-term means of delivering micronutrients to the poor. Millets are commonly referred as "small seeded grasses" which include pearl millet, finger millet, foxtail millet, barnyard millet, kodo millet, and little millet. Among the millets, pearl millet occupies 95% of the production. The crops are favoured due to its productivity and short growing season under dry and high temperature conditions. Biofortified millets have a great potential to reduce micronutrient deficiency in the developing countries. The work done on biofortification of millets is still not much. Even after nutrient richness of millets, there is a need to work for more production with quality addition in millets to change the billions of people from nutrient insufficiency to nutrient adequacy.

ASSESSMENT OF P-SOLUBILIZERS AND N-FIXERS IN THE RHIZOSPHERE OF VEGETABLE CROPS GROWN UNDER NATURAL AND ORGANIC FARMING SYSTEMS

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Abstract

Concerned by the deterioration of soil health as a result of over use of external chemical inputs in crop production, a field investigation was conducted at three different locations (Dharwad, Devihosur and Hidkal Dam) under the University of Horticultural Sciences, Bagalkot, Karnataka consecutively for four years from 2018 to 2022 at fixed site to assess the buildup of phosphate solubilizers and nitrogen fixers population in the rhizosphere of crops grown under natural and organic farming in comparison with conventional farming practices. The treatments consisted of four different farming systems such as T_1: Package of practice, T_2: Farmers' practice, T_3: Natural farming and T_4: Organic farming and were laid out under completely randomized block design with five replications. The P-solubilizers and N-fixers population was found significantly higher in the rhizosphere of crops grown under organic farming followed by natural farming systems. The lowest population was in package of practice and farmers' practice treatments. Among the crops, higher population of P-solubilizers was found in the rhizosphere of chilli (16.4 and 13.73 × 10^4 CFU / g of soil in organic and natural farming, respectively), seed coriander (16.16 and 14.08 × 10^4 CFU / g of soil in organic and natural farming, respectively) and cabbage (13.65 and 12.56 × 10^4 CFU / g of soil in organic and natural farming, respectively). Similarly, N-fixers population was also found higher in the rhizosphere of chilli (19.98 and 17.13 × 10^4 CFU / g of soil, respectively) and seed coriander (17.88 and 15.80 × 10^4 CFU / g of soil, respectively) followed by cabbage grown under organic and natural farming. The organic and natural farming practices helped in enhancing the beneficial microbial (P-solubilizers and N-fixers) population in the rhizosphere of crops.

BIO-EFFICACY OF TRIFLOXYSTROBIN 500 G/L SC AGAINST POWDERY MILDEW DISEASE OF GRAPE

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Abstract

Grape powdery mildew is caused by the fungus *Uncinula necator.* This fungus has a narrow host range attacking only grape plants and a few related species. Powdery mildew symptoms appear on the foliage, fruit, flower parts and canes. Mildew usually appears first as whitish or greenish-white powdery patches on the undersides of basal leaves. Infected blossoms may fail to set fruit. Powdery mildew infections cause reduced berry size and reduced sugar content. Cracking of berries is so severe making fruit unsuitable for any purpose.After final spray, Trifloxystrobin 500 g/l SC@ 200 ml/100 lit of water as a foliar spray recorded the least powdery mildew severity (29.02% and 32.40%) at 5 and 10 days after spray, respectively. The next best treatments was Azoxystrobin 23% SC@ 500 ml/100 lit of water (33.19% and 36.18% PDI), followed by Trifloxystrobin 500 g/l SC@ 160 ml/100 lit of water (34.70% and 36.85% PDI) and Trifloxystrobin 500 g/l SC@ 120 ml/100 lit of water (39.37% and 41.59% PDI) at 5 and 10 days after spray, respectively amongst the different treatments. The powdery

mildew disease severity of untreated control was 71.89 per cent and 73.42 per cent at 5 and 10 days after spray, respectively. All the fungicidal treatments were superior over unsprayed control for fruit yield. However, Trifloxystrobin 500 g/l SC@ 200 ml/100 lit of water as a foliar spray recorded highest fruit yield of 29.44 t/ha. The next best treatments was Azoxystrobin 23% SC@ 500 ml/100 lit of water (29.28 t/ha), followed by Trifloxystrobin 500 g/l SC@ 160 ml/100 lit of water (28.53 t/ha) and Trifloxystrobin 500 g/l SC@ 120 ml/100 lit of water (27.57 t/ha). The fruit yield in untreated control was 17.75 t/ha.

SCREENING OF COTTON BREEDING MATERIAL FOR RESISTANCE AGAINST INSECT PESTS

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Abstract

An experiment was conducted at Cotton Research Station, Sriviliputtur during 2023-2024 to screen the breeding material against cotton insect pests. A total of fifty one entries includes the check entries (NDLH-1938 (Leaf hopper tolerant); DCH 32 (susceptible to Leaf hopper), Suraj (Susceptible to bollworms), Jadoo BGII (bollworm resistant)) were sown in two replications. The genotypes were sown in two rows. Between two genotypes, bhendi was sown as an infester crop. All the agronomic practices were followed except pesticides. The reactivity to leafhoppers was graded according to the severity of the damage symptoms for each genotype. Cotton varieties Jadoo BGII Bt and Suraj were sown as resistant and susceptible to bollworms, respectively. The injury grade index for leafhoppers was calculated and expressed as all entries are susceptible and highly susceptible. Leaf hopper population was ranged in between 1.65- 5.00 leafhoppers/3leaves in cotton entries. Minimum number of leaf hoppers were recorded in TSH 587 (1.65 leafhoppers/3leaves) while in susceptible check (DCH 32) it was 5.00 hoppers/3 leaves. Based on the hopper population and leaf damage, leaf hopper injury grade was calculated. Among 50 entries, TSH 544, TSH 423, TSH 498,TSH 387,TSH 357, MLT-SET-I-3, NDLH 1938, Jadoo are falls under moderately resistance (MR) to leaf hoppers. Maximum whitefly was recorded in Suraj (3.60) followed by NDLH 1938 (2.80),TSH 600 (2.60) and minimum in MLT-SET-I-3(0.60). Maximum thrips population was observed in Suraj (7.40) followed by DCH32 (3.40) and TSH357(3.35). Minimum thrips was recorded in TSH 492 (0.30) followed by TSH 529 (0.35). Cotton stem weevil incidence was minimum in TSH 582 (5.17%) followed by TSH490, TSH 584 (5.36%). Maximum was recorded in TSH 489 (33.64%) followed by MLT-SET-I-1(27.50%), Suraj (27.19%).

CORRELATION ANALYSIS FOR MORPHO-PHENOLOGICAL AND PRODUCTIVITY TRAITS IN F_2 POPULATION OF FIELD PEA (*PISUM SATIVUM* L.)

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Abstract

Field pea (*Pisum sativum* L. var. *arvense,* 2n=14) is amongst the most important legume crop of India, belonging to family Fabaceae with genome size of 4.45 gigabases. In changing climatic conditions, developing early genotypes suitable for late sown conditions is demanded. Keeping these points in view, the current study was designed to estimate phenotypic correlation coefficient for morpho-phenological and productivity traits in an F_2 segregating population having a population size of 378 plants. Seed yield per plant had positive significant correlation with number of seeds per plant (0.98), number of pods per plant (0.92), number of seeds per pod (0.33), number of pods per axil (0.26) and days to first flowering (0.17) while negative non-significant correlation with 100 seed weight (-0.04^{ns}) and days to maturity (-0.01^{ns}). The phenological trait, days to first flowering exhibited positive significant correlation with plant height (0.48), number of primary branches per plant (0.28), number of seeds per pod (0.18), number of pods per plant (0.19), days to maturity (0.25), seed yield per plant (0.17) and number of pods per axil (0.15). The study revealed significant positive association of seed yield per plant with yield component traits like number of seeds per plant and number of pods per plant implying the importance of these traits while formulating selection criteria. The population is intended to develop an early genotype without significant compromise for yield. Hence correlation analysis is an important method in deciding about the yield contributing traits and to formulate selection index towards breeding for high yield especially in early generation selection.

ENHANCING TUBER YIELD OF COLEUS THROUGH STCR-IPNS APPROACH IN ALFISOL

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Abstract

Coleus is an important medicinal plant used for psoriasis, eczema, skin infections, high blood pressure and asthma. Soil Test Crop Response based Integrated Plant Nutrition System (STCR-IPNS) helps to achieve the desired yield target of crops with efficient use of fertilizers. The present study was aimed at testing the validity of the following STCR-IPNS based Fertilizer Prescription Equations developed for coleus grown on red, non calcareous soil belonging to Irugur series (*Typic Haplustalf*).

$$FN = 5.28\ T - 0.30\ SN - 0.73\ ON$$

$$FP_2O_5 = 6.26\ T - 2.22\ SP - 0.91\ OP$$

$$FK_2O = 5.84\ T - 0.27\ SK - 0.58\ OK$$

where, FN, FP_2O_5 and FK_2O are fertiliser N, P_2O_5 and K_2O in kg ha^{-1} respectively;
T = Dry tuber yield target in q ha^{-1}; SN, SP and SK are soil available N, P and K in kg ha^{-1} respectively; ON, OP and OK are N, P and K supplied through FYM in kg ha^{-1}.

Six validation experiments with yield targets of 1.8, 2.0 and 2.2 t ha^{-1} were conducted at farmer's holdings in Salem district, Tamil Nadu during 2022-23. The mean results of the six validation experiments indicated that STCR-IPNS-2.2 t ha^{-1} recorded highest dry tuber yield (2173 kg ha^{-1}), response ratio (5.51 kg kg^{-1}) and BCR (2.47) and the results proved the validity of the equations. The mean yield increase in STCR-IPNS-2.2 t ha^{-1} was 31.7 per cent over blanket (RDF alone), 15.3 per cent over blanket + FYM and 46.5 per cent over farmer's practice. Therefore, STCR-IPNS based fertiliser prescription is recommended for coleus crop grown on Irugur soil series (red, non calcareous, sandy loam soil) of Tamil Nadu for getting higher dry tuber yield, response ratio and benefit cost ratio.

AGROFORESTRY IN MITIGATION SOIL EROSION AND IMPROVING SOIL HEALTH

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Abstract

Agroforestry, an integrative approach combining trees with crops and/or livestock, has emerged as a vital practice for mitigating soil erosion and enhancing soil health. This study examines the multifaceted benefits of agro forestry systems in reducing soil degradation and promoting sustainable land use. By incorporating perennial vegetation, agro forestry enhances soil structure, increases organic matter, and fosters biodiversity, leading to improved soil fertility and stability. The findings indicate that agro forestry significantly reduces surface runoff and sediment loss, thereby mitigating soil erosion. Furthermore, the presence of tree roots and litter contributes to higher microbial activity and nutrient cycling, which are crucial for maintaining long-term soil health. This paper underscores the potential of agroforestry as a sustainable land management strategy, advocating for its wider adoption to combat soil erosion and improve soil health.

STUDIES ON PROCESSING AND STORAGE STABILITY OF CARAMBOLA (*AVERRHOA CARAMBOLA* L.) READY TO SERVE DRINK FOR NUTITIONAL SECURITY

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Abstract

A trial was conducted on Carambola fruits to study the physical properties and chemical composition, to find out the suitable

recipes for preparation of ideal RTS, also storage stability of RTS prepared from suitable recipes. Physical and chemical properties revealed that average weight (g)-70.92, Juice content(%)-99.72, TSS(%)-5.68, Total tritable acidity(%)-0.84, Ascorbic acid (mg/100g)-9.98 indicated the proper maturity stage of Carambola for RTS preparation.

In this study different recipes of Carambola RTS was standardized to explore the processing potential of Carambola, a minor fruit. There were five different possibilities of recipes. The RTS prepared from the recipes 10% pulp, 13% TSS and 0.30% Acidity gave highest organoleptic quality score, grater consumer acceptabilities and retain good nutritional qualities followed by RTS prepared from 10% pulp, 10% TSS and 0.30% Acidity and the quality of the prepared RTS was maintained up to fifth months at ambient temperature.

POWER REQUIREMENT DURING CONCENTRATION OF PREHEATED BUFFALO MILK WITH SUGAR IN HORIZONTAL THIN FILM SCRAPED SURFACE HEAT EXCHANGERS

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Abstract

Currently thin film scraped surface heat exchangers (TFSSHEs) are gaining an increasing interest for thermal processing of viscous and particulate dairy and food products due to their inherent advantages in achieving idealized plug flow conditions for uniform and lesser heat induced changes during heat and mass transfer processes. Along with this, the power consumption must also be controlled due to energy crunch by modelling power number with independent variables and optimizing the operating variables. In the required experiments for power consumption in SSHEs, the formulation of working liquid for continuous production of sweetened condensed milk (SCMWL) was made by mixing buffalo milk and sugar in Fat: SNF ratio of 9:22 and required sugar at 50°C. The SCMWL ranged from 24 to 30 % was prepared and was forewarmed under pressure in LFSSHE, held in holding tube and concentrated in TFSSHEs under vacuum for concentration ranges of 42 to 88 % TS. During concentration in TFSSHEs under vacuum, the power numbers were correlated in Box Wilson Model as well as in Cobb-Douglas model. Box Wilson model reflected the significance of Condensing steam temperature at P=0.01 i.e. higher the temperature of condensing heating medium steam corresponds to higher power number and higher power consumption. With the increase of steam condensing temperature from 106.5 °C to 133.2 °C, the power number increased from 0.556 ± 0.065 to 0.809 ± 0.070. Due to increase in pseudoplasticity with increase in concentration above 50 % TS, the apparent viscosity decreased with increase in speed of rotor and shear rate, the film thickness slightly decreased and power consumption was also decreased. The linear speed of scraper rotor affects power number inversely significantly at P=0.005. With the increase in linear speed from 2.976 m/s to 5.102 m/s, the power number decreased from 1.451 ± 0.05 to 0.278 ± 0.053. From Cobb Douglas model, the significance of power number was observed by the relation having correlation coefficient as 0.7561. The blade factor, Prandtl number and Rotational number was observed to influence directly to power consumption but Re_f and $?T/T_s$ influenced inversely. The developed models for power number for Thin film scraped surface heat exchangers (TFSSHEs) used for evaporation can be utilised while designing the concentration by boliling under vacuum of viscous and concentrated dairy products from buffalo milk.

STUDIES ON PROCESSING AND STORAGE STABILITY OF JACKFRUIT NECTAR FOR NUTITIONAL SECURITY

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Abstract

A trial was conducted on Jackfruit fruits to study the physical properties and chemical composition, to find out the suitable recipes for preparation of ideal Nectar, also storage stability of Nectar prepared from suitable recipes. Physical and chemical properties revealed that average weight (g)-11500, Juice content (%)-35.70, TSS(%)-19.45, Total tritable acidity(%)-0.18, Ascorbic acid (mg/100g)-21.08 indicated the proper maturity stage of Jackfruit for Nectar preparation.

In this study different recipes of Jackfruit Nectar was standardized to explore the processing potential of Jackfruit, a minor fruit. There were five different possibilities of recipes. The Nectar prepared from the recipes 20% pulp, 16% TSS and 0.25% Acidity gave highest organoleptic quality score, grater consumer acceptabilities and retain good nutritional qualities followed by Nectar prepared from 20% pulp, 14% TSS and 0.30% Acidity and the quality of the prepared Nectar was maintained up to 6th months at ambient temperature.

IMPACT OF CALCIUM NUTRITION : POTATO STORAGE DURABILITY AND QUALITY AT 12C (CIPC)

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Abstract

This study investigated the impact of calcium treatments on three potato cultivars: Kufri Bahar, Kufri Sindhuri, and Kufri Chipsona-3. Five different treatments were applied: no calcium (control, T1), 100 kg Ca ha^{-1} as a basal application (T2), 100 kg Ca ha^{-1} in two split applications (T3), 200 kg Ca ha^{-1} as a basal application (T4), and 200 kg Ca ha^{-1} in two split applications (T5). The variety Kufri Chipsona-3 exhibited the highest specific gravity (1.093) with 200 kg Ca ha?¹, surpassing the control (1.091). Kufri Bahar reached the highest specific gravity (1.078) with 200 kg Ca ha^{-1}, followed by 1.075 at 100 kg Ca ha?¹, both significantly better than the control (1.073). A calcium level of 200 kg ha^{-1}, applied as a basal dose, consistently maintained acceptable chip color (1.2 to 3.0) in Kufri Chipsona-3 for up to 150 days at 12°C with CIPC. A similar trend, though less significant, was observed in the second year with 100 kg Ca ha?¹. The Hunter color score improved with Ca application, with Kufri Chipsona-3 achieving the highest score with 200 kg Ca ha?¹ as a basal dose in the first year, and the highest score in the second year with 200 kg Ca ha?¹ in two splits. Calcium application did not consistently affect reducing sugars during storage. The lowest phenolic compounds (mg/100g fresh tuber weight) were observed with 200 kg Ca ha?¹ in two splits in the first year, while in the second year, Ca nutrition had no effect.

OPPORTUNITIES IN FOOD PROCESSING SECTOR AND A VISION 2030–A REVIEW

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Abstract

Agriculture plays a very important role in maintaining sustainable economy of our country. The Indian economy is poised to achieve double – digit growth rate and it would become second largest economy by the year 2050. But the present worry is declining trend of share of agriculture to GDP of the country. It has declined from 35 per cent in 1990-91 to around 27 per cent in 1999-2000 and further to merely 20.3 per cent in 2020-21, to merely19.0 per cent in 2021-22 ad to merely18.3 per cent in 2022-23. Presently, agriculture contribution to GDP is in declining trend and it may be below 18 per cent in 2023-24. Growth rate of agriculture and allied sector was 5.2 % in 2005-06, 3.7% in 2006-07, and 4.7 % in 2007-08, 1.6 % in 2008-09 and –0.2 % in 2009-10; which indicated an unstable and declining growth rate. Further the growth rate of Gross value added of agriculture and allied sectors in 2020-21, 2021-22 and 2022-23 are respectively 4.1 percent, 3.5 percent and 3.3 percent (at 2011 -12 prices). However, the population growth rate is in increasing trend. Therefore, much attention should be given on increasing the growth rate and securing the quality and safety of our raw produces by following scientific management and practices and technologies in procuring, post harvesting, value addition, storage and marketing of various food products to maintain security of our country. Overall GDP of Bihar in 2023 is Rs. 8.98 lakh crore (US$110 billion) (2023–24). Multiple missions are proposed to be launched: (i) Bihar Millet Mission, (ii) Bihar Pulses and Oilseeds Development Mission, and (iii) Crop Diversification Mission. Fourth Agriculture Roadmap will be implemented with special focus on pulses and oilseeds. Infrastructure of state agricultural market yards will be modernised. A centre of excellence will be established for groundwater conservation. Requisition has been given for filling a total of 63,900 posts by Bihar Public Service Commission, Staff Selection Commission, and Technical Service Commission. The agriculture sector employs almost 80% of the state's population, which is over the national average of 58%. In India, Bihar is the eighth-largest producer of fruits and the

fourth-largest producer of vegetables. Some of the industries in the state that are expanding swiftly include food processing, dairy, sugar, manufacturing and healthcare. Hence, agriculture is the main driver of wealth in Bihar. Bihar recorded the third highest growth rate of 10.98% at constant price (2011-12) in its gross state domestic product (GSDP) during the 2021-22 FY among all the states in the country. Opportunities in Bihar in Food Processing Sectors including fruits and vegetables sector, scope in Rice Cluster, pulses cluster and Honey Clusters, scope in Maize based Industries, scope in Sugarcane and sugar factories, Opportunities in Dairy sector including Storage of Dairy and Food Products and Scope in Poultry and Abattoirs have been discussed in brief. Apart from these, vision and strategies – 2030 have been discussed with SWOT analysis.

SURVEY AND COLLECTION OF OFF-SEASON JACKFRUIT FROM JHARKHAND, INDIA

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Abstract

In Jharkhand, jackfruit is primarily grown for vegetable purposes and is often seen growing by the roadside or practically in the backyard of every household. In addition to fetching a higher price, vegetable jackfruit minimizes postharvest waste, allowing farmers to make more money. It is more expensive in the off-season and becomes the most popular alternative during India's festivities when most Hindus abstain from eating non-vegetarian cuisine. There is a global trend among people to choose vegetarian meals; in these circumstances, jackfruit is the best choice. Consequently, it has gained worldwide traction among vegetarians. Considering this a jackfruit cultivar with extended or round-the-year availability is highly sought after. It provides a consistent source of fruits that command higher prices in the off-season enabling farmers to get a premium price for their produce. Besides off-season Jackfruit, we also came across some accessions that produce fruit throughout the year. The jackfruit germplasm that bears fruit year-round can lead to insights into plant physiology, genetics, and agricultural practices, with potential benefits for crop improvement, food security, environmental conservation, and resilience to climate change, hence valuable germplasm for our field genebank.

BIOLOGY AND PREDATION POTENTIAL OF GREEN LACEWING, *CHRYSOPERLA ZASTROWI SILLEMI* (ESBEN-PETERSEN) UNDER LABORATORY CONDITIONS.

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Abstract

Biology of polyphagous predator, green lacewing (*Chrysoperla zastrowi sillemi* (Esben-Petersen)) on *Corcyra cephalonica* eggs along with its predation potential on *C. cephalonica* and *A. gossypii* was studied under laboratory conditions. Biological studies indicate that the incubation period, total larval period, pupal period, adult male and female period of *C. zastrowi sillemi* averaged at 3.00±0.06, 8.53±0.54, 8.03±0.26, 27.75±1.17 and 33.25±1.45 days, respectively. The average pre-oviposition, oviposition and post- oviposition period was reported as 4.70±0.76, 25.30±1.18 and 3.25±1.02 days respectively. All the three larval stages of *C. zastrowi sillemi* are voracious predator of insect eggs and soft bodies insects. A green lacewing grub on an average consumed 276.40±11.88 eggs of *C. cephalonica* and 349.00±21.19 nymphs and 179.80±9.32 adults of cotton aphids during its developmental period. This study explores the possibilities of ease of rearing of chrysopids for field release as well as its effectiveness in pest control.

FUNCTIONAL AND THERAPEUTIC UNDER-UTILIZED ARID FRUITS OF INDIA

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Abstract

Fruits in diet is the only solution to the hidden hunger. Fruits are rich sources of nutrients, dietary fibres, natural antioxidants includes polyphenols and flavonoids as well. Biodiversity International recommends consuming underutilized fruits to alleviate hidden hunger. Barbados cherry (1,677.6 mg/100g ascorbic acid), Aonla and Ber are rich sources of Vitamin C,

augment wound healing and treat the Scurvy. Bael, the richest source of Riboflavin (1.19 mg/100g), checks retarded growth and bad skin. Dry Karonda is the richest source of iron (39.1 per cent) to control anaemia and is a hepatoprotective, followed by date palm. Dates are rich source of Vitamin A (600IU/100g) and iron (10.4 mg per 100g). Apart from considerable amounts of vitamins A, and C (16.11, and 4.38 mg), ripe fruits of phalsa is good source of minerals, calcium 820.32 mg/100g, phosphorous 814.5 mg/100g, and iron 27.10 mg/100g). Having often the Fig, a rich source of calcium (162 mg/100 grams), is extra good for osteoporosis and excessive bleeding. Jamun is loaded with a spectrum of bioactive compounds such as alkaloids, tannins, phenols, lipids and flavonoids for pharmacological effects as antioxidant, antidiabetic, chemopreventive, anti-inflammatory. Highest calorific value ranging from 822 to 1050 K Cal/kg noticed in Custard apple as compared to 741 K cal/Kg of mango. Present study is intended to review the nutritional and healing ability of Indian arid fruits like Aonla, Custard apple, Jamun, Ber, Wood apple, Bael, Fig, Phalsa, Carissa, Barbados cherry Lasoda, Ker, Pilu Khirni, Mahua, Tamarind etc.

INFLUENCE OF BULLIED STATUS ON SELF-ESTEEM OF HIGHER PRIMARY STUDENTS

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Abstract

Bullying is usually a form of aggression in which one or more children intend to harm o another child who is perceived as being unable to defend himself or herself. Bullying represents a significant problem in schools. The aim of this study was to assess the influence of bullying on self-esteem of higher primary school students. The study sampled 240 students from 47 higher primary English medium private schools in Dharwad, and 12 higher primary English medium private school in Mudhol. 60 students from two schools studying in 5-7th class in Dharwad and Mudhol of Karnataka were selected. The tools used wereself-structured questionnaire and The Olweus bully/victim questionnaire (OBVQ) Dan A. Olweus (1996)was used to assess bullied status and Rosenberg self-esteem scale was used to assess the self-esteem. The results revealed that Majority of the students were in not and moderate bullied status (35) in Dharwad and majority of the students were in severe bullied status (36.7) among Mudhol.Majority of the students were in high self-esteem (89.1) in Dharwad and similar results was found in Mudhol (87.5). With respect to self-esteem who were having low self-esteem were in severe bullied status and students who were having high self-esteem were in not bullied status.Similar results were found among Mudhol students.The students with low self-esteem may appear less confident and more susceptible to bullying, making them more attractive targets for bullies. Students with low self-esteem may have difficulty standing up for themselves or asserting their boundaries, which can make them less effective at deterring bullies.

CLIMATE-SMART PEST MANAGEMENT : BUILDING RESILIENCE AGAINST ENVIRONMENTAL CHANGES

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Abstract

Climate-smart pest management (CSPM) is a multisectoral and interdisciplinary strategy aimed at reducing crop yield losses caused by pests, improving ecosystem services, reducing the level of greenhouse gas emissions and enhancing the resilience of agricultural systems to climate change. CSPM either avoid or resist pest coming into a region or control populations because pest responds to changing climate conditions faster than plants. The most important aspect of CSPM is to integrate the resources of the affected ecosystem into the pest control strategy, which are naturally available and to avoid further pest outbreaks. An effective CSPM practice must integrate spatial, temporal and environmental dimensions of the ecosystem. Broadly, CSPM is a process that utilizes the synchronized knowledge about the targeted pest biology and natural enemies. For several years, different management practices have been used, such as trap cropping, cover cropping, crop rotation, mulching, minimum tillage, intercropping and natural enemy refuges. For the success of CSPM, certain climate smart agricultural (CSA) activities, such as integrated soil fertility management, bio-formulations, pheromones, mechanical trapping methods, site-specific nutrient management, climate-resilient crop breeding, alternate sowing dates, suitable crop varieties or biologically-based methods for pest control are reliable which can contribute in maximizing crop yield. The CSPM pyramid

consists of three main processes which include risk assessment and forecasting, early diagnosis, and efficient interventions. Farmers can recognize and enforce specific pest prevention practices in combination with pest and climate risk forecasting information. When pest population reach economic injury level, CSPM enables farmers to make rapid decisions regarding pest control strategy. With a minimum dependency on chemical pesticides, CSPM subsequently decreases negative impacts on the agrobiodiversity and ecosystems. This makes farming systems more resilient to climate change by bringing long-term stability, enhancing plant resistance to insect pests, contributing to carbon sequestration, responsible consumption and production.

ENHANCING SEED GERMINATION WITH INNOVATIVE PRESS WHEELS IN PLANTERS

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Abstract

Soil covering and pressing devices are essential for achieving uniform sowing depth, increasing germination rates, and improving soil conditions for seeds. A study was conducted to evaluate the impact of pressing devices on soil firming, with the aim of developing an improved soil firming device that enhances germination when used in conjunction with soil covering and pressing devices. The planter with press wheel was designed and developed at department of Farm Power and Machinery, Dr. PDKV, Akola. The developed press wheel was act as soil covering, seed pressing and power transmission to seed metering device. The individual press wheel was provided for each seed box. The press wheel was 250 mm diameter to transmit power to seed metering unit and to press the seed for proper germination. The lugs type rigid press wheel was developed by using M.S. flat of thickness 5 mm. The width of wheel was 75 mm with weight of wheel was 5 kg given to press the seed for good germination. The tension type helical spring support was given to the wheel for suspension purpose and for adjusting of depth of planting. The field trial of planter with pressing device conducted with planting of soybean seed. The comparative study was carried out for planter with pressing device and planter without pressing device. The effect of planter with pressing device showed that speed of emergence increased and mean germination time decreased than planter without pressing device. For the planter with pressing device emergence period is shorter, CV (26.02 %) shows a higher rate and for planter without pressing device emergence period is longer, CV (20.45 %) shows lower rate which was an indication of emergence delay and low rate of emergence.

UNDERSTANDING THE COMPLEX REGULATORY NETWORK OF FUSARIUM WILT (*FUSARIUM OXYSPORIUM* SP *LENTIS*) RESISTANCE IN LENTIL (*LENS CULINARIS* MEDIK) USING COMPARATIVE RNA-SEQ ANALYSIS

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Abstract

Lentil is a cool season leguminous crop that pollinates self annually and has a 4 GB genome. One of the world's earliest domesticated and commonly eaten grain legumes, rich in protein, carbs, vitamins, and minerals. Fusarium wilt is a major disease that reduces yield in India and around the world, particularly in West Asia, North Africa, and East Africa, due to both biotic and abiotic stressors. Fusarium wilt can cause yield loss of up to 50% or full loss if severely impacted. The disease can emerge at either the seedling stage (early wilt) or the reproductive stage (late wilt).The pathogen, which is soil-borne, can live in the soil as chlamydospores for several years. Different management strategies are helpful for controlling wilt, but they are costly and have negative environmental consequences. As a result, it is critical to identify resistant genes, as well as understand their role and pattern of expression during the infection process, as a prerequisite for breeding resistance in lentil spp. One approach is to use transcriptome sequencing, or RNA-seq, which is an important tool for elucidating the molecular

mechanisms of wilt resistance by evaluating the gene profile and transcriptome of various plant organs, introducing candidate resistance genes, and identifying associated markers for marker assisted breeding. The comparative investigation of different genotypes will result in the discovery of specifically expressed transcripts in resistant lines that demonstrate hypersensitive responses to wilt. We discovered potential genes and pathways that regulate wilt resistance in lentils and confirmed them using quantitative expression analysis.

INSECTS AS INDICATORS OF CLIMATE CHANGE

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Abstract

Insects have strong relationship with ecology and used as bio-indicators since long time. This is an innovative approach for assessing environmental mismanagement including pollution, soil health, high input farming, inappropriate disposal of wastes, contamination, etc. which leads to climate change. The climate directly affects their survival, reproduction, distribution, abundance and development. Thus, insects are useful bio indicators of climate change. Invertebrates (class Insecta), as Bio-indicators show trends in community composition and species richness because of being small, abundant, diverse, sensitive and adaptive to different environmental conditions as well as higher level of structural and functional organization, complex morphology, physiology, developed sense organs, complex behavior and characterized by a greater diversity of species. Therefore, they are more precise, rapid and reliable to reflect disturbance of their environment. Waterstriders, antlion larvae, Chironomidae, Odonates and ants are used as bio-indicators in aquatic ecosystem as they are affected by habitat reduction and change resulting in increased drift, lowered respiration capacity and changing the efficiency of certain feeding activities. Coleopterans, Orthopterans and Collembola are used for soil and metal pollution in land ecosystem. Termites are "ecosystem engineers," for soil fertility through the determination of soil physico-chemical parameters. Lepidopterans are most efficient at determining environmental change by heavy metals and CO_2 quality. Pollinators are used to monitor environmental stress brought by introduced competitors, diseases, parasites, predators, chemical and physical factors, particularly pesticides. Furthermore, utilizing abundant species with constricted elevation ranges as bioindicators can help to monitor the effects of climate change. Due to global warming, the cold-adapted species are compelled to ascend to higher latitudes or may migrate northward. The most vulnerable species to extinction due to climate change are those found in high latitudes. Currently, bio-indicators are used and promoted by numerous conservation agencies to tackle biological monitoring, response to management, conservation prioritization and assess human impacts.

INFLAMMASOMES : NEW THERAPEUTIC HOPE IN ANIMAL HEALTH

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Abstract

The term 'inflammasome' was first coined by Dr. Jurg Tschopp in 2002. It is a multimeric protein which gets activated by microbial, damage and stress signals leading to the release of pro inflammatory cytokines and pyroptosis. The Nuclear binding domain leucine-rich repeat-containing protein 1 (NLRP1), NLRP3, NLRP6, NLRP7, NLRP12, interferon-inducible protein 16 (IFI16), NOD-like receptor family CARD domain-containing protein 4 (NLRC4), and absent in melanoma 2 (AIM2) are key inflammasomes that are being best characterised. Inflammasome complex consists of three components: (1) a pattern recognition receptor (PRR), (2) an adaptor protein, and (3) an effector protein. The PRR is meant to detect danger signals. The adaptor protein (carrying an ASC) promotes the complex assembly and establishes a connection with the effector protein (caspase enzyme). This inflammasome complex leads to the activation of caspase-1 through proximity-induced self-cleavage. Later, it induces the maturation of few proinflammatory cytokines, such as IL-1 and IL-18. This will further amplify the inflammation.

Inflammasomes are playing key role in various inflammatory diseases like multiple sclerosis, Alzheimer's disease,

Parkinson's disease atherosclerosis, type 2 diabetes, gout, psoriasis and rheumatoid arthritis. One need to understand the tissue specificity of inflammasome activation for developing novel targeted therapies. Several components have been identified as potential modulators or inhibitors of the NLRP3 inflammasome, blocking the pathways of formation of inflammasome itself and thereby disease progress. Further research and explorative studies are needed to bring concrete conclusions and therapeutic hope in human and animal health.

DEVELOPMENT OF MANAGEMENT INFORMATION SYSTEM FOR EYE HOSPITAL MANAGEMENT USING RELATIONAL PROPERTIES OF DATABASES

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Abstract

Management Information System (MIS) software has been developed for "Eye Hospital Management". The main aim of this software is to automate the existing manual system by the help of computerized equipments and full-fledged computer software fulfilling their requirements. So that their valuable data/information can be stored for a larger period with easy access and manipulation of the same. This MIS consists two parts viz. one is database and other is graphical user interface (GUI). Database is developed in MS SQL and GUI using ASP.NET for data entry, modification of data, updation of data and taking reports as per requirement. This information system is for Eye Hospital Management that is to manage the details of eye specialist, patient, medicine, and test. The project is totally built at administrative end and thus only the administrator is guaranteed the access. So this computerized system is to build an application program to reduce the manual work for managing the eye specialist, patient, doctor and medicine. It tracks all the details about the medicine, test and appointment in very user friendly manner. Any authorized person can use this MIS that makes it very useful to the user of this system.

THE EFFECT OF ELEVATIONAL GRADIENT ON MORPHO-PHYSIOLOGICAL ACTIVITY OF *POTENTILLA FRUTICOSA* AND *REINWARDTIA INDICA* IN THE JAMMU REGION

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Abstract

There is currently enormous interest in how morphological and physiological responses of herbaceous plants may be affected by changing elevational gradient. Mountain regions provide an excellent opportunity to understand how closely related species may adapt to the conditions that rapidly change with elevation. We investigated the morphological and physiological responses of two medicinal plants (*Potentilla fruticosa* and *Reinwardtia indica*) along three different altitudes of 930m, 1183m and 1843m a.s.l. We measured the variables of plant height, leaf length and leaf area. Results revealed that with increased elevation plant height, and leaf area decreased. Our results reveal that these medicinal plants undergo local adaptation by modifying their plant height and leaf area in response to the varying selection pressure associated with the elevational gradient. Thus, the findings of this research provide valuable information on how a narrow range of elevational gradient affects the morphology of the plants.

OMICS : TOOLS IN ANIMAL HEALTH, NUTRITION AND HUSBANDRY ACTIVITIES

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Abstract

The word "Omics" is originated from "ome" a Greek word means all, whole or complete. This suffix is used in biosciences to describe high throughput information to understand about the life summed up in 'omes." Several omics studies have been

taken out to analyse high throughput data of the proteins (Proteomics), genes (Genomics), mRNAs (Transcriptomics), metabolic study (Metabolomics), lipids (Lipidomics), epigenetic control expression (Epigenomics), structural analysis of glycans (Glycomics) etc in a tissue, organ at that point of time. Recently metagenomics which is the study that deals with the analysis and collection of genetic materials from all the organisms in a sample is also gaining popularity. All omics technologies are holistic as they give insight of the full set of the genes in an individual or in entire microbiome, the full set of genes get transcribed to mRNA or translated into proteins or metabolites present at a given time in a fluid, cell, organ, organisms, or population. They even identify the differences in responses to temporal, ecological and behavioural changes (Odom *et al*.,2021). As these technologies can be performed with minimal invasive procedures, they are useful as diagnostics tools. The new techniques in the sequencing and peptide analysis by mass spectrophotometer will yield better omics outputs. The deficiencies in the functional data base need to be improved. Skilled statisticians, bioinformaticians and scientists are in demand to interpret these data. With limited grants, resources for research in animal health omics data to be extrapolated to its fullest potential. Integration of all the "omics" techniques will be helpful in proper genetic selection to improve the production in dairy business (Chakraborty *et al.,* 2022).

REFINING GRAFTING SCHEDULES FOR ENHANCED SUCCESS IN RED PULP GUAVA (*PISIDIUM GUAJAVA* L.) HYBRIDS THROUGH SOFTWOOD GRAFTING TECHNIQUE

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Abstract

Guava (*Psidium guajava* L.) is one of the best-known edible fruits of tropical and subtropical climate worldwide and has commercial importance. The area under fruit cultivation is growing and there is a requirement to prepare quality guava planting material throughout the year as such a quick and successful propagation strategy is necessary. Seeds have been used to grow guava plants for a long time, however propagating by seeds results in lot of variation in the plants. Softwood grafting is a simple and effective solution to these issues and grafts may be created in less than a year, lowering the cost of raising grafts significantly. The investigation was conducted in the Main Horticulture Research and Extension Center, University of Horticultural Sciences, Bagalkot during the year 2020 to 2021 with an objective to study the best grafting month in different red pulp guava (*Pisidium gujava* L.) by softwood grafting which showed minimum number of days taken for graft take (4.58 days), maximum sprouting percentage (91.67%), highest graft success (85.83%) and survivability (96.89%) in February month. Among the varieties Arka Kiran took minimum number of days for graft take (7.04 days), more sprouting percentage (85.00%), highest graft success (67.50%) and survivability (90.13%). However, Interaction effect showed least number of days taken for graft take (4.24 days), highest graft survivability (99.50%) in Arka Kiran grafted on February month followed by March grafted plants. The findings highlight the role of selecting the optimal grafting time and guava variety to enhance grafting success and plant survivability, thereby enables efficient and cost-effective propagation for commercial guava production.

NEED FOR MICROPROPAGATION IN GERBERA JAMESONII

Bhawna Anand and Pinku Ratre

Abstract

Gerbera is one of the most important commercial flower, grown under wide range of climatic conditions, throughout the world . It has specific requirement under tropical climatic conditions and water holding capacity. According to Celts and Egyptians it symbolises innocence and purity. The plant is native to South Africa and Asiatic regions. It thrives among Himalayan regions of Kashmir to Nepal at height of 1300 to 3200 metres.Conventional methods of propagation of Gerberas (seeds, clump division and cuttings), are highly inadequate for the production of large number of propagules. This research paper aims to study the micro propagation of this plant under laboratory conditions to grow in specific regions of country. Influence of nutrient medium hormonal composition on organogenesis was studied during standardization of an improved micropropagation protocol in *Gerbera jamesonii.* Gerbera explants used for in vitro studies were shoot apices, leaf discs, floral buds, floral stalk, capitulum and seeds. Different hormones like IBA, 2, 4-D, NAA, BAP and Kn were used separately in different concentrations like 1.0, 1.5, 2.0, 2.5, and 3.0mg/l.

The effect of different combinations of growth hormones on shoot development was studied. It was found that 5.0 mg/L BAP in combination with 0.5 mg/l IAA took minimum time in shoot initiation in leaf and bud explants. As regards number of shoots per explant exhibited 4-8 shoots per explant in case of leaf and 6.5 per explant in case of bud. The length of shoots was also found maximum in both explants with 3 mg/L BAP and 1.0 mg/L NAA.The number of leaves in both explants were found greater under the influence of 3 mg/L BAP and 0.5 mg/L NAA. 2.5 mg/L of IAA and 3.0 mg/L of NAA exhibited better result on rooting system. IAA has better effect on rooting system than NAA in both explants as regards number and length of roots.

QUALITY ASSESSMENT OF FODDER OATS UNDER CO-APPLICATION OF NANO UREA AND PLANT GROWTH PROMOTING RHIZOBACTERIA WITH CONVENTIONAL FERTILIZERS IN NORTH WESTERN ZONE OF INDIA

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Abstract

Nitrogen is the major nutrient responsible for the good quality of cereal fodder crop. Excessive application of urea readily subjected to different losses results in greater environmental pollution leading to imbalanced nutrition and lower efficiency. Therefore, the present study was undertaken to assess the fodder quality under nano urea, plant growth promoting rhizobacteria (PGPR) based nutrient management in oats (Kent). The two-year field experiment was carried out at Research Farm, Agronomy Section, ICAR-National Dairy Research Institute, Karnal (Haryana) during *Rabi* season of 2021-22 and 2022-23, in Randomized Block Design with eight treatments, replicated four times. Treatment includes, T_1-control, T_2-100 % RDN (Recommended Dose of Nitrogen), T_3-100 % RDN + PGPR, T_4-75 % RDN + nano urea, T_5-75 % RDN + PGPR + nano urea, T_6-75 % RDN + conventional urea spray @ 2.5 %, T_7-50 % RDN + nano urea and T_8-50 % RDN + PGPR + nano urea. Two foliar sprays are given at 30 and 45 DAS and two sprays are given at 15 and 30 days after the first cut of fodder as per treatment. The results showed that nano urea and PGPR treatments significantly increase fodder quality parameters compared to control. Superior fodder quality parameters were recorded in T_3. Further, higher dry matter, crude protein, and ether extract were recorded in T_5 (75 % RDN + PGPR + nano urea) and lowest under T_1. T_5 obtained 11 and 10 % more DM content, and 26 and 23 % more CP than control in the I and II cut, respectively. Similarly, the lower ADF (acid detergent fibre), NDF (neutral detergent fibre) and ADL (acid detergent lignin) content was recorded in T_5 and highest in control. Which was statistically on par with superior treatment (T_3). It may concluded that application of 75% RDN+ nano urea+ PGPR is quite promising for improving the growth and quality attributes of fodder oats by saving 25% conventional fertilizers.

EFFECT OF FOLIAR APPLICATION OF MICRONUTRIENTS ON PHYSIOLOGICAL PARAMETERS, YIELD AND GRAIN QUALITY OF WHEAT (*TRITICUM AESTIVUM* L.) UNDER SODIC SOIL

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Abstract

The present investigation entitled “Effect of foliar application of micronutrients on physiological parameters, yield and grain quality of wheat (*Triticum aestivum* L.) under sodic soil” was conducted during two consecutive rabi seasons in the years of 2015-16 and 2016-17 at the Main Experiment Station, A.N.D.U.A.T. Kumarganj, Ayodhya, U.P., India. The field experiment was laid out in Randomized Block Design with eight treatments and three replications. The treatments consisted T1- Control, T_2- 6.4 kg $FeSO_4$ (1.28%), T_3- 4.0 kg $MnSO_4$ (0.8%), T_4- 2.0 kg $ZnSO_4$ (0.4%), T_5- $FeSO_4$, & $MnSO_4$, T_6- $FeSO_4$, & $ZnSO_4$, T_7- $MnSO_4$, & $ZnSO_4$ and T_8- $MnSO_4$, $ZnSO_4$ & $FeSO_4$ at the rate of spray solution in 500 litre water per hectare. The observations were recorded on parameters viz., plant height at 30, 60, 90 days and at maturity, number of tiller per hill at 60, 90, 120 days and at maturity, total dry biomass at 30, 60, 90 days and at maturity per plant (g), RGR, NAR, CGR, chlorophyll content (SPAD Value) in leaves at 30, 60 & 90 DAS (Third leaf from top), proline estimation in leaves at 30, 60 & 90 DAS, N, P, K % and Fe, Mn, Zn and Cu (mg/kg) in flag leaf at 10-15 days after heading, number of ear bearing tillers, number of grains

per ear, Ear length (cm), grain yield per plant (g), grain filing duration (days), biological yield (g) per m², test weight (g), harvest Index (%), Protein, P, K content (%) in mature grain and Fe, Mn, Zn and Cu content (mg/kg) in mature grain. Highest improvement in all growth, biochemical and yield parameters was noticed in treatment T_8- $MnSO_4$, $ZnSO_4$ & $FeSO_4$ in which first spray was done at tillering stage and second at 15 days before heading stage. The present study revealed that the foliar application of $MnSO_4$, $ZnSO_4$, & $FeSO_4$ in combination improved the growth and yield attributes in wheat through maintaining higher total soluble carbohydrate, total chlorophyll content and micronutrient content in leaf and grain significantly under sodic soil.

GENETIC VARIABILITY AND CHARACTER ASSOCIATION STUDIES IN BREAD WHEAT (*TRITICUM AESTIVUM* L. EM. THELL)

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Abstract

Fifteen diverse genotypes of wheat(*Triticum aestivum* L.em.Thell) grown in a Randomized Block Design (RBD) along with 3 replications to study genetic variability character association as well as their major yield components for 14 quantitative characters viz., days to 50% flowering, plant height, peduncle length, flag leaf area, tillers per plant, spike length, spikelets per spike, number of grains per spike, grain yield per spike, grain yield per plant, test weight, biological yield per plant, harvest index and days to maturity. Analysis of variance had shown highly significant variances among the genotypes for all the characters under study, indicated availability of wide spectrum of variability among the genotypes. The genotype AAIWL-4 (14.35) produced highest grain yield per plant followed by HD 2687 (13.62), AAIWL-3 (13.06), AAIWL-2 (12.82), AAIWL-1 (12.80), PBW373 (12.58) and HD 2967 (12.30). The PCV was greater than GCV for all characters studied. High value of heritability was recorded for number of grains per spike and lowest for grain yield per spike. Tillers per plant exhibited highest genetic advance in per cent of mean and lowest for grain yield per spike.

However, correlation analysis revealed that grain yield exhibited highly significant and correlation with harvest index followed by spikelets per spike, tillers per plant, peduncle length and number of grains per spike. Path coefficient analysis revealed that harvest index, biological yield per plant, spike length, test weight, days to maturity, flag leaf area, and days to 50% flowering have direct positive effect on grain yield, whereas negative direct effect on grain yield exerted by peduncle length, grain yield per spike, tillers per plant, spikelets per spike, number of grains per spike, plant height. The present investigation carried out for the estimates of character association among various characters and find out the direct and indirect effects of yield components on grain yield by path coefficient analysis.

APPROACHES OF CLIMATE RESILIENT PEST MANAGEMENT SYSTEM

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Abstract

Climate change has been posed a significant threat to agriculture. Impact of climate change on agriculture will be one of the major deciding factors influencing the future food security of the mankind. The importance of climate and weather events to the distribution of insects and their population dynamics has long been recognized. Several minor insect pests are likely to become more devastating with global warming and climate change. Overwintering of insect pests will increase as a result of climate change producing larger spring population as a base for a build-up in numbers in the following seasons. The climate change has also diverse effects on natural enemies of insect pests. The abundance of natural enemies can be altered in response to changes in insect pest population size induced by temperature and elevated carbon dioxide concentration effects on plants. A major portion of the cultivated areas of the world covered under rainfed. The rainfed agriculture is directly reciprocal to the climate. Therefore, detailed study of the climate change scenario on the basis of long-term historic weather data, its impact on yield and formulation of coping strategy are of paramount importance to reduce the risk of crop failure. Considerable knowledge is available on the effects of weather and climatic events on insect pests growth and development over the world.

But concerned to the impact of climate change on insect pests and their management studies are under lag phase. The potential adaptation, mitigation and natural resource management are the prominent strategies for climate resilient insect pest management. These strategies should be mostly deal with varietal improvement, production augmentation, weather forecasting application, indigenous technical knowledge and sustainable pest management. The strategies for climate resilient agriculture are the practices conducted by farmers for their farm production for minimizing the adverse effects of changing climatic conditions. This paper attempt to analyse the review of reported studies on the approaches of climate resilient pest management system for effective insect pest management.

GENETIC ANALYSIS OF BREAD WHEAT (*TRITICUM AESTIVUM* L. EM THELL) GENOTYPES FOR YIELD AND ITS COMPONENT TRAITS

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Abstract

The present study has been conducted at the Agricultural Research Farm of B.R.D.P.G. College (Campus), Deoria in a randomized block design to evaluate the extent of variability, heritability and direct and indirect effects of component traits on grain yield. The experiment was planned in the rabi 2022 with fifteen elite wheat cultivars sourced from Banaras Hindu University, Varanasi. All the recommended cultural practices were adopted to raise a good crop. The data were observed on fourteen quantitative traits of wheat. The analysis of variance showed a good amount of variability present among these cultivars of wheat as all the genotypes were significant for all the traits at given probability levels. The traits days to 50% flowering (90.7%), plant height (cm) (87%), days to maturity (91%), spike length (cm) (85%), no. of spikeletes per spike (76%), 1000grain weight(g) (86%) and biological yield per plant(g) (87%) showed very high heritability in broad sense. Most of the traits showed moderate level of genetic advance in percent of mean like flag leaf area (25.39%), spike length (26.20%), number of grains par spike (20.51%), biological yield per plant (29.14%), grain yield per spike (20.51%) and harvest index (20.69%). The genotypic (GCV) as well as phenotypic coefficient (PCV) were high for the traits flag leaf area, spike length, no. of grains per spike, biological yield per plant, grain yield per plant and harvest index. At phenotypic level the characters plant height (0.4034), ear length (0.6521), no. of spikelets per spike (0.4467), grain weight per spike (0.5265) and harvest index (0.3643) showed a strong association with grain yield per plant. The traits days to 50% flowering (0.1192), peduncle length (0.2591), ear length (0.3714) and biological yield (0.7713) exerted high amount of direct effects while biological yield *via* test weight, ear length, plant height and harvest index *via* ear length, no. of spikelets per spike, biological yield and test weight possessed high indirect effects on yield.

BIO-EFFICACY OF VARIOUS BIO-RATIONAL TREATMENTS AGAINST *HELICOVERPA ARMIGERA* (HUBNER) INFESTING CHICKPEA

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Abstract

A field experiment was conducted at Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during the *Rabi* season, 2023-24. The results revealed that seven bio-rational treatments evaluated against *Helicoverpa armigera* (Hubner) on chickpea. Among different seven bio-rationals, *Beauveria bassiana* 1.15 WP @ 0.009% was found most effective treatments as it recorded lowest 1.01 larval population and lowest 25.54 per cent pod damage of *H. armigera*. Next best effective treatment was found *i.e. Beauveria bassiana* + *Metarhizium anisopliae* 1.15 WP @ 0.005% + 0.005%. The

highest yield and highest net realization over control were recorded in the treatment *B. bassiana* 1.15 WP @ 0.009% which was followed by treatment *B. bassiana* + *M. anisopliae* 1.15 WP @ 0.005% + 0.005%.

OCCURRENCE OF CANINE SPIROCERCOSIS IN LABRADOR DOG: A NECROPSY REPORT

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Abstract

Canine Spirocercosis, caused by the the nematode *Spirocerca lupi*, is a parasitic illness in dogs. It is characterized by the formation of nodules in the oesophagus, which can lead to serious problems such as blockage, difficulty swallowing, and further infections. This illness presents a substantial health risk to dogs globally, especially in areas where there are abundant intermediate hosts such as beetles and paratenic species such as birds and reptiles. A deceased Labrador dog, aged 4 years, with a medical history of repeated vomiting, loss of appetite, and abrupt death, was submitted to the Department of Veterinary Pathology for post mortem analysis. The gross examination showed signs of dehydration and emaciation, but no substantial alterations were observed. Upon dissecting the carcass, we discovered the presence of pale mucous membrane, enlarged spleen, enlarged heart, and minute worms with a cherry red colour in the stomach and at the base of the oesophagus. Furthermore, a substantial nodule with an opening from which worms were emerging was observed at the far end of the oesophagus. Upon microscopic study of the gathered worms, it was determined that they were *Spirocerca lupi*, a type of nematode that causes oesophageal nodules in canines.

GROWTH, YIELD ATTRIBUTES, YIELD INFLUENCED BY INM IN WHEAT

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Abstract

The experiment was conducted to study "Influence of integrated nutrient management (INM) on growth and yield of wheat (*Triticum aestivum* L.)" at farmers field in Haridwar district of Uttarakhand during 2019-20 and 2020-21. The experiment consisted of eleven treatments viz. control (T1), 100 % RDF (T2), FYM @ 10 t/ha (T3), VC @ 5t/ha (T 4), 75 % RDF + FYM @ 10t/ha (T 5), 75 % RDF + VC @ 5 t/ha (T6), 50 % RDF + FYM @ 10t/ha (T 7), 50 % RDF + VC @ 5 t/ha (T 8), 50 % RDF + FYM @ 10t/ha + VC @ 5t/ha (T 9) , 75 % RDF + FYM @ 10 t/ha+ Azotobacter + PSB (T10), 75 % RDF + VC @ 5 t/ha+ Azotobacter + PSB (T11). The treatments were replicated thrice and were laid out in randomized block design (RBD). Wheat variety used for the experimentation was PBW 343. The net plot size was 5 m X 5 m and crop spacing was 20cm between rows. The results reported that wheat crop with the application of 75 % RDF + VC @ 5 t/ha+ Azotobacter + PSB (T11) performed better in terms of growth parameters and yield under field condition compared to some of the treatments. Percent increase of 5.5 % and 3.6 % was recorded during 2019-20 and 2020-21, respectively in grain 10 yield with the application of 75 % RDF + VC @ 5 t/ha+ Azotobacter + PSB (T11) over 100 % RDF (T2). These results suggest that combined application of 75 % RDF + vermicompost @ 5 t/ha+ Azospirillum + PSB or 75 % RDF + FYM @ 10 t/ha+ Azotobacter + PSB is effective to get higher yield in wheat cultivation, providing valuable insights for farmers and researchers.

NUTRITIONAL AND MEDICINAL IMPORTANCE OF PHALSA

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Abstract

Phalsa (*Grewia asiatica* L.) is a minor fruit of Indian origin. Commonly known as star apple, phalsa is a nutritious fruit of sub-tropical areas under Indian conditions. The fruit belongs to family 'Tiliaceae' and has about 41 genera and 400 species.

The profitable market of phalsa fruit mainly exits in the states namely Punjab, Haryana, Rajasthan, UP and MP. In the states like Maharashtra, Gujarat, AP, Bihar and WB phalsa fruit is grown on a very limited scale. The fruits are highly perishable in nature and it cannot be exported but its processed products are quite appreciable. Ripe fruits are consumed fresh in desserts, or processed into refreshing soft drinks like squash, RTS, sharbet etc. which are enjoyed during hot summer months in India.The fruit contain several bioactive compounds like anthocyanins, phenolics, flavonoids, tannins and antioxidant vitamins, which exhibit very high antioxidant activity. Ripe fruits of phalsa contain high amount of vitamin A, C, minerals (calcium, phosphorous and iron) and fiber however, low in calorie and fat. Unripe phalsa fruit alleviates inflammation and can be used in respiratory, cardiac, blood disorders, as well as in fever. The fruits are also beneficial for heart and liver disorders, anorexia, indigestion, thirst, toxemia, stomatitis, hiccough, asthma, spermatorrhea and diarrhea and are used for treating throat, tuberculosis and sexual debility troubles. Aqueous extracts of leaves and fruits possess anticancer property against liver and breast cancer. Thus, fruits and leaves extracts of phalsa can be utilized for the management of human cancer. The bark of root has been advised for rheumatism. For skin eruption problems, leaves can be applied on the skins.

DETECTION OF PYRETHROID RESISTANCE AGAINST *RHIPICEPHALUS MICROPLUS* AND *HYALOMMA ANATOLICUM* TICKS FROM MARATHWADA REGION OF MAHARASHTRA STATE

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Abstract

A Larval Immersion Test (LIT) was conducted to identify the presence of pyrethroid resistance in the larvae of Rhipicephalus microplus and Hyalomma anatolicum ticks. Adult ticks that were fully engorged from both species were collected from eight districts in the Marathwada region. These ticks were then reared in a laboratory, and larvae that were 14-16 days old were used for an experiment. Among the eight districts, it was found that two isolates (Parbhani & Dharashiv) of *Hyalomma anatolicum* displayed resistance to both pyrethroid pesticides (deltamethrin & cypermethrin). The larvae of *H. anatolicum* from Parbhani had estimated LC_{50} and LC_{95} values of 42.98 and 158.31 ppm, respectively, against deltamethrin. For the Dharashiv isolates, the estimated LC_{50} and LC_{95} values were 51.78 and 164.89 ppm, respectively. For cypermethrin, the LC_{50} and LC_{95} values for the Parbhani isolate were determined to be 271.15 ppm and 1105.25 ppm, respectively. The LC_{50} and LC_{95} values for Dharashiv isolates against larvae of *H. anatolicum* were determined to be 51.78 and 164.89 ppm, respectively. Nevertheless, all the examined samples of *R. microplus* ticks exhibited higher resistance to deltamethrin, with RL-IV detected in six isolates and RL-III in two isolates from the Marathwada district. The Jalna isolation had the greatest LC_{50} value of 791.83 ppm, while the Hingoli isolate had the lowest LC_{50} value of 62.07 ppm. The Lethal Concentration (LC_{50}) values obtained from the LIT analysis showed that the Dharashiv field isolates had the lowest LC_{50} value of 229.09 ppm, while the Sambhajinagar field isolates had the highest LC_{50} value of 489.78 ppm when exposed to cypermethrin. The resistance factor (RR_{50}) ranged from 1145.45 to 2448.9, whereas RR_{95} ranged from 36.04 to 78.84.

A STUDY OF BREAD WHEAT (*TRITICUM AESTIVUM* L.) GENOTYPES TO EVALUATE THE GENETIC VARIABILITY AND HERITABILITY FOR YIELD AND ITS ATTRIBUTES

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Abstract

It is one of the most important staple foods as well as the most consumed cereal amongst major cereals of the world. In wheat, grain yield is considered a complex character and is dependent on its component traits. Therefore, variability existed within each component trait must be exploited by selection to realize a maximum gain in grain yield. Keeping the facts in view the

current investigation was carried out at at the Agricultural Research Farm of B.R.D.P.G. College (Campus), Deoria in a randomized block design (RBD) in the rabi 2022 with fifteen elite wheat cultivars obtained from Department of Genetics and Plant Breeding, B.R.D. PG. College Deoria (U.P.) to evaluate the extent of variability, heritability and genetic advance for fourteen metric traits. The analysis of variance showed a good amount of variability present among these cultivars of wheat as all the genotypes were significant for all the traits at given probability levels. The magnitude of the Genotypic Coefficient of Variation (GCV) varied from 3.98 % to 24.91 %. The GCV along with phenotypic Coefficient of Variation (PCV) was recorded highest for grain yield per plant (24.91 % and 25.28%). The all of the characters had high heritability and it was recorded highest for the number of grains per spike with plant height (99.37%) followed by test weight (98.80%), biological yield per plant (98.68%), days to 50% flowering (98.33%) and flag leaf area (97.94%). The highest genetic advance was recorded for the plant height (22.85%) and number of grains per spike (20.44%). The high heritability along with high genetic advance indicates the abundance of additive gene action in the expression of these traits and selection for such traits would be rewarding.

ISOLATION, PURIFICATION IDENTIFICATION AND PATHOGENICITY TEST OF *FUSARIUM OXYSPORUM* F. SP. *CICERIS* CAUSING WILT OF CHICKPEA

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Abstract

Chickpea (*Cicer arietinum* L.) is self-pollinated, diploid (2n=2x=16) and third most important grain legume crop belongs to family Fabaceae in the world. Among Pulses Chickpea is an important pulse crop of the semi-arid tropics and the warm temperate zones, ranking first in India. The fungal diseases of chickpea, the wilt caused by *Fusarium oxysporum* Schlecht. emend Snyd. & Hans. f. sp. *ciceris* (Padwick) Snyd. & Hans. Is the most serious one. Chickpea wilt one of the most important limiting factors in successful cultivation of chickpea and is responsible for a significant reduction in yield. In India, yield losses are estimated to be of the range from 10 to 90 per cent every year in different regions and in different cultivars. The present research work was aimed to carry out comprehensive investigation on the cultural, morphological, physiological and pathogenic variation of *Fusarium oxysporum* f. sp. *ciceris.* The pathogen is facultative saprophytic and it can survive as mycelium and chlamydospores in seed, soil and also on infected crops residues, buried in the soil for up to five to six years. The fungus produced macro-conidia and micro-conidia and also chlamydospores. Fungal chlamydospores can survive in soil up to six years in the absence of the host plants. However the present study was investigated to cultural, morphological and pathogenic variability of Fusarium isolates.

PRINCIPAL COMPONENT ANALYSIS FOR IDENTIFICATION OF SUPERIOR NPT RICE GENOTYPES

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Abstract

Rice (*Oryza sativa* L.) is the most important food crop and a primary food source for more than one third of the world's population. Rice feeds more than half the world's population, and improving the productivity of this grain is necessary for food security. Rice is most important and staple food crop because more than half of the world's population (>3.5 billion) depends on it for their livelihood. The research work was conducted at Seed Breeding Farm, Department of Plant Breeding and Genetics, College of Agriculture, J.N.K.V.V, Jabalpur, Madhya Pradesh during *kharif* season (2019). The experiment was performed on 80 NPT rice genotypes. These genotypes were planted in randomized complete block design. All the given eighty rice genotypes were studied for Principal Component Analysis for identification of the superior rice genotypes. The result shown PC-1 accounted for 20.90 % of total variability, whereas, PC-2, PC-3, PC-4, PC-5, PC-6, PC-7 and PC-8 exhibited 15.01, 13.09, 10.73, 8.59, 6.21, 5.40 and 3.70 respectively. Among the genotypes under the study; JNPT-809, JNPT(S) 10-1-1B, JNPT-533, JNPT-521-1 and JNPT-526 shown their dominance in yield as well as quality attributing traits.

GENETIC VARIABILITY, CORRELATION AND PATH COEFFICIENT STUDY FOR VARIOUS YIELD AND QUALITY TRAITS IN NPT LINES OF RICE (*ORYZA SATIVA* L.)

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Abstract

This study includes eighty NPT lines of rice were evaluated for twenty-eight morphological and quality traits. The experiment was conducted during *kharif* 2019 at Seed Breeding Farm, JNKVV, Jabalpur (M.P.), India and genotypes were planted in RCBD with three replication. The values of mean square were found significant for all the characters under study. Estimates of PCV were higher than the GCV and ECV values for all the characters, suggesting that these characters were relatively much influenced by the environment. The study revealed that high heritability accompanied with high genetic advance was observed for the traits spikelet density (%), milling percentage, thousand grain weight, hulling percentage, panicle weight/plant, panicle index (%), harvest index (%), grain yield per plant, head rice recovery (%), stem length, plant height, panicle length, total spikelets/panicle and fertile spikelets/panicle. Correlation and path coefficient analysis revealed that hulling index, panicle index and panicle weight/plant showed positive correlation with grain yield per plant and at the same time exhibited high positive direct effect towards yield. Thus, they considered to be main yield contributing traits and they can be used as direct selection in improving grain yield of rice.

MORPHOLOGICAL CHARACTERIZATION OF CHILLI GENOTYPES

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Abstract

Genetic diversity analysis is deemed crucial for crop improvement, aiding in identifying suitable parental combinations and varieties. A study on the morphological characterization of chilli (*Capsicum annuum* L.) was conducted at Maharajpur Vegetable Farm, Department of Horticulture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur. Utilizing 43 genotypes from different regions of Madhya Pradesh, the study aimed to enhance crop improvement programs by understanding genetic diversity. Variability in populations is influenced by both genetic and environmental factors, essential knowledge for effective breeding operations. Aklilu et al. (2016) explored genetic variability, heritability, and genetic advance in 49 hot pepper varieties, finding significant variability in traits like leaf area index and pericarp thickness. Vaishnavi et al. (2018) studied 36 bird's eye chili genotypes, uncovering high genetic variability, heritability, and genetic advance in traits such as plant spread, fruit length, yield, and chemical contents like capsaicin and oleoresin. Yatung et al. (2014) delved into the genetic diversity of 30 chili genotypes (Capsicum annuum L.), identifying significant variability in twelve traits and grouping genotypes into six clusters through cluster analysis.

ASSESSMENT OF GENETIC DIVERSITY USING SSR MARKERS IN FENUGREEK

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Abstract

India is a leading producer and consumer of fenugreek for its culinary uses and medicinal application. Fenugreek seeds and leaves are strongly aromatic and flavorful. The seeds are bitter in taste, but lose their bitterness if lightly roasted. They are rich in vitamins such as thiamin, folic acid, riboflavin, niacin, vitamins A, B6, and C, and are a rich storehouse of many minerals such as copper, potassium, calcium, iron, selenium, zinc, manganese, and magnesium. The present investigation was carried out at 27 Fenugreek accessions, 40 random primers to evaluate genetic diversity and species relation. Total genomic DNA was extracted by CTAB method with some modification. PCR amplification was carried out by using master cycler gradient

thermal cycler. a total of 40 SSR primers were used, of which 22 markers successfully amplified DNA from the 27 Fenugreek genotypes. The PIC values ranging from 0.32 to 0.48 (with an average of 0.42) indicate substantial diversity among the Fenugreek genotypes at the specific genetic loci targeted by the SSR markers. Cluster analysis based on the presence or absence of band was performed by Jaccard's similarity coefficient, based on unweighted pair group method with arithemetic averages (UPGMA). The dendrogram revealed eight main clusters. Clusters was divided into subgroup. Cluster II and cluster VI contains maximum genotypes This investigation showed that SSR marker is a useful tool for evaluation of genetic diversity and relationship amongst different Trigonella species.

CARBOHYDRATE AND NITROGEN METABOLISM IN WHEAT (*TRITICUM AESTIVUM* L.) CROP IN RESPONSE TO SALINITY IN FIELD AND LABORATORY CONDITION

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Abstract

Salinity is a significant abiotic stress impacting wheat (*Triticum aestivum* L.) production globally. This study investigates the effects of salinity on carbohydrate and nitrogen metabolism in wheat under both field and laboratory conditions. We aimed to elucidate the biochemical and physiological responses that enable wheat to cope with saline environments. Wheat plants were subjected to varying salinity levels, and their growth, photosynthetic efficiency, and biochemical parameters were monitored. In the laboratory, controlled experiments allowed for detailed analysis of enzymatic activities and metabolite levels. Results indicated that salinity stress significantly reduced growth and biomass accumulation in wheat. Carbohydrate metabolism was notably altered, with a reduction in photosynthetic rate and chlorophyll content, leading to decreased glucose and sucrose levels. Additionally, salinity induced an increase in starch accumulation, suggesting a shift in carbon allocation. Nitrogen metabolism was also adversely affected, as evidenced by decreased nitrate reductase activity and reduced levels of amino acids such as proline, which is known to play a protective role under stress conditions. Comparative analysis between field and laboratory conditions revealed consistent trends in metabolic adjustments, although field-grown plants exhibited more pronounced stress responses. The study highlights the critical role of carbohydrate and nitrogen metabolism in salinity tolerance and suggests potential metabolic targets for enhancing wheat resilience to salinity. Understanding these mechanisms provides a foundation for developing strategies to improve wheat performance in saline environments, contributing to sustainable agricultural practices.

EFFECT OF COMBINED MELATONIN AND TRI-MODEL THERAPEUTIC METHODOLOGY (*DWEEP-GAU MAA HUMPSORE RAKSHAK*) ON HUMPSORE TREATMENT IN BOVINE SPECIES

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Abstract

Stephanofilariasis or humpsore is a chronic parasitic dermatitis and induces significantly higher stress to the bovine species in Andaman and Nicobar Islands. Various treatment regimens were attempted in the past to treat and relive stress but were found to be partially effective. Here, we claim a successful treatment regime using a FDA-approved macrocyclic lactone, a piperazine derivative and an herbal preparation. Twenty-four cattle (18 affected and 6 unaffected) were selected and divided into Gr 1: positive control (infected without treatment; $n = 6$), Gr 2: treatment group (infected with treatment with tri-model therapy including ivermectin, diethylcarbamazine citrate and an herbal ointment, $n = 6$), Gr 3: treatment group (infected with treatment with melatonin and tri-model therapy, $n = 6$), and Gr 4: negative control (non-infected animals; $n = 6$). In Gr 2 and Gr 3, treatment to the ailing animals was given for 45 days. Lesion was significantly reduced in day 15-20 of post-treatment and completely healed on day 45 of post-treatment in Gr 3. Melatonin and tri-model therapy recorded significant improvement in the surface area of the sore as compared to tri-model therapy alone. Antioxidants were increased and oxidative stress marker such as malondialdehyde (MDA) and stress hormone such as cortisol concentrations were decreased significantly ($p < 0.05$) in

Gr 3 than in untreated control group at day 14, 21 and 28. Histopathological changes in infected animals were characterized by parakeratotic hyperkeratosis along with presence of nucleated keratinocytes. There were infiltrations of polymorphonuclear cells specially eosinophils along with a few monomorphonuclear cells. Microfilarial organism was observed beneath the epidermis, which was surrounded by fibrocytes and infiltrated cells. In the melatonin and tri-model-therapeutic treated animal after recovery, the skin revived a normal architecture. Therefore, combined melatonin and tri-model therapy has the potential to relieve the stresses due to humpsore in bovine species in Andaman and Nicobar Islands.

JOB STRESS AMONG MALE AND FEMALE BUS CONDUCTORS

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Abstract

The present study was conducted in NWKRTC of Hubli-Dharwad region. The study was conducted to assess the job stress of male and female bus conductors. Self-structured questionnaire and occupational stress Index scale was used. The study revealed that less than half of male (36.5 %) and female (33.5 %) bus conductors belonged to moderate level of job stress. Whereas, 9.5 per cent of male and 15.5 per cent of female bus conductors had high stress level and 4 per cent male and 1 per cent female had low stress level. Female bus conductors had high level of stress compared to male bus conductors. Female conductors face stress due to the pressure of work and male dominance at workplace, dual work load of balancing family and work place responsibilities, over work load, shift hours of working , not allowed to avail leave, long hours of working, contact with public, misbehavior of passengers, standing during rush hours and monthly problems. However there was significant association found between job stress of male and female bus conductors. There was a significant difference between male and female bus conductors and dimensions of occupational stress like role overload, role ambiguity, responsibility for persons, intrinsic impoverishment, strenuous working condition and unprofitability . Where, in the entire dimensions female bus conductors had more stress compared to male bus conductors. The reason could be heavy work load, extra duty during Sunday, continuous vibration of the body during bus movements, constant communication with passenger for ticket collection, responsibility of daily collecting the money and depositing in office were the reasons expressed for the job stress among female bus conductors.

BANK NEEDS TO SANCTION MORE LOAN AMOUNT IN FARM MECHANIZATION AND STORAGE FOR DOUBLING FARMER INCOME IN THE BIHAR STATE

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Abstract

The Bihar state is primarily dominated by agriculture and the economy of the state depends on the rural economy. The rural economy depends on the agriculture development in the state. With the advancement of the agriculture in the state requires more amounts to adopt new technology, farm mechanizations and timely application of recommended package and practices needed for the crop. Bihar State government for development of agriculture in the state have prepared Agriculture Road Map and solving the issue of seed to market. Construction of storage structure helps to solve the seasonal glut and to get remunerative prices by the farmers. All these agricultural activities need finance. Institutional finance through bank is important. But, merely bank come forward for financing to these activities of prime importance. As per the report, 5663 crore was targeted for farm mechanization during the year 2023-24. For this 2,59,605 no. of application were approved for which a sum of Rs. 1718 crore was supposed to disbursed but only 1672 crores were released to 2,59,394 applicants. Similarly, disbursement of a loan amount of Rs. 5148 crore was target during the same year of report for storage sector. Merely, 2085 number of applications was approved and it was supposed to disburse an amount of Rs. 679 crore to these loan proposals. But,

in actual only 628 crore was released to 628 loan proposals out of these. It clearly, indicated that bank management is not providing loans to the approved applications. Less than 50 percent of targeted loan amount only is being given by bank in the state even after set target by the government. Thus. an efforts should be taken by government in this regard and disbursement of loan amount should increase in these two important sectors of farm mechanizations and storage of agricultural goods for doubling farmers income in Bihar.

PRELIMINARY PHYTOCHEMICAL SCREENING OF *BERBERIS ARISTATA*: A PROMISING HERBAL MEDICINE FROM HILLS OF UTTARAKHAND

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Abstract

Since ancient times, the indigenous medicinal system of India has included herbal plants as a traditional source of medicine as India is known as a rich repository of medicinal plants. The various reasons for shifting from the allopathic medicine towards plant material as source of medicine include side effects of different synthetic drugs, development of drug resistance strains of different microorganisms, extortionate cost of treatment, inadequate drug supply, rising population and many more. *Berberis aristata* is one such Indian medicinal plant belonging to the family Berberidaceae which is known as 'Kilmoda' in the Kumaon region of Uttarakhand and a rich heritage to the hilly areas of Uttarakhand. The present study was conducted to perform the preliminary phytochemical screening of the aqueous root extract of *Berberis aristata*. Upon qualitative analysis the plant extract showed the presence of alkaloids, glycosides, flavonoids, terpenoids and carbohydrates. The total flavonoids and phenols were quantified in the aqueous root extract. The extract also showed the presence of several micronutrients on analysis by atomic absorption spectrometry. The extract showed significant antioxidant activity upon DPPH and ABTS free radical scavenging assays. Thus, the study revealed significant antioxidant activity of the aqueous root extract of *Berberis aristata* as well as the presence of valuable phytochemicals and micronutrients which makes it a potential choice for usage as herbal medicine, although further studies will be required in animal model.

STUDY OF THE FATTY ACID DIVERSITY OF SESAME (*SESAMUM INDICUM* L.) GERMPLASM BY GAS CHROMATOGRAPHY (GC)

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Abstract

Sesame (*Sesamum indicum* L.) is an economically important oilseed crop renowned for its high-quality oil content and nutritional value. The diversity of fatty acids present in sesame seeds contributes significantly to its culinary, industrial, and medicinal applications. This study aimed to comprehensively analyze the fatty acid composition across a diverse germplasm of sesame using Gas Chromatography (GC). A total of fifty sesame accessions were selected from different geographic regions to capture the broad spectrum of genetic diversity within the species. Seeds from each accession were subjected to lipid extraction followed by fatty acid methyl ester (FAME) preparation suitable for GC analysis. GC analysis was performed using a high-resolution chromatograph equipped with a flame ionization detector (FID), which allowed for precise quantification of individual fatty acids.

The results revealed a wide range of fatty acid profiles among the sesame germplasm studied. The predominant fatty acids identified across all accessions included palmitic acid (C16:0), stearic acid (C18:0), oleic acid (C18:1), linoleic acid (C18:2), and linolenic acid (C18:3). Palmitic acid and oleic acid were found to be the major saturated and monounsaturated fatty acids, respectively, while linoleic acid and linolenic acid constituted the principal polyunsaturated fatty acids. Significant variations were observed in the relative proportions of these fatty acids among different sesame accessions. Some accessions exhibited higher levels of oleic acid, which is desirable for its stability and nutritional benefits, while others showed elevated levels of linoleic acid, known for its role in human health and disease prevention. Furthermore, certain accessions displayed unique

fatty acid profiles not commonly found in commercial varieties, suggesting potential avenues for breeding programs aimed at enhancing specific nutritional or industrial traits. The geographical origin of sesame accessions also influenced their fatty acid composition, indicating a correlation between genetic diversity and environmental adaptation. Accessions from regions with distinct climatic conditions tended to exhibit specific fatty acid profiles, reflecting adaptive responses to local environmental stresses. In conclusion, this study provides a comprehensive analysis of fatty acid diversity in sesame germplasm using GC. The findings underscore the potential of sesame as a valuable genetic resource for developing novel cultivars with tailored fatty acid profiles suited for specific culinary, industrial, and nutritional applications. Future research could explore the underlying genetic mechanisms governing fatty acid synthesis and regulation in sesame, facilitating targeted breeding efforts to enhance its agronomic and nutritional value.

IN VITRO ANALYSIS OF ANTI-UROLITHIATIC ACTIVITY OF *MORINGA OLEIFERA*

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Abstract

Urolithiasis is one of the most common pathologies of urinary system that is prevalent all around the world since many centuries. Urolithiasis is the precipitation of insoluble or less soluble salts in the urinary tract causing obstruction in the tract. Several conventional medical treatments are available for the management of urolithiasis such as allopathic medicines, surgical procedures, shockwave lithotripsy *etc*. But treating ureteric calculi remains a significant challenge in modern medicine, so there is increased interest in medicinal plants as alternative treatments for various disorders, including urolithiasis to avoid high expenditure and adverse side-effects. Several plants have been studied for their anti-urolithiatic activity and one such plant is *Moringa oleifera* commonly known as 'Drumstick' which is commonly grown tree in India belonging to Family Moringaceae. In the present study aqueous extract of leaves of *Moringa oleifera* was used at different concentrations to inhibit the formation of calcium oxalate crystals by using nucleation, aggregation, and calcium oxalate mineralization inhibition assays. The findings of the study indicated that the *Moringa* extract effectively inhibited calcium oxalate crystallization, indicating its possible application in the prevention of urinary stone formation. However, additional research, particularly using appropriate animal models, is necessary to thoroughly evaluate the anti-urolithiatic properties of *Moringa oleifera*.

FIELD SCREENING AND IDENTIFICATION OF HEAT STRESS TOLERANT LENTIL (*LENS CULINARIS* MEDIKUS SUBSP. *CULINARIS*) LINES FROM INDIGENOUS AND EXOTIC LENTIL GERMPLASM

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Abstract

Terminal Heat stress presents a significant challenge in lentil cultivation, particularly during the flowering period, ultimately limiting crop productivity. This study aimed to evaluate 158 diverse lentil genotypes to identify those exhibiting tolerance to heat stress, with the goal of enhancing stress resilience. Over two consecutive years/seasons (2022–2024), all genotypes were cultivated under both normal and late planting conditions. The analysis of variance revealed significant variations among genotypes for all studied stress indices. Notably, all genotypes exhibited a reduction in mean grain yield under stress conditions compared to non-stress conditions, highlighting the significant impact of heat stress on grain yield. Correlation analysis demonstrated a negative correlation between tolerance index and stress susceptibility percentage index with grain yield under heat stress conditions (Ys). Conversely, a highly positive correlation was observed between stress tolerance index, mean productivity, geometric mean, harmonic mean, and mean relative performance with grain yield (Yp and Ys) under both conditions, aiding in the identification of desirable genotypes. Selection based on different stress indices identified the genotype P13143, P13130 and P13135 as high-yielding under both conditions. Principal component analysis, biplot analysis, and cluster analysis confirmed that that genotypes P13143, P13130 and P13135 exhibited suitability and high yield potential under both normal and heat stress conditions. Therefore, these genotypes can be considered for cultivation in

high-temperature environments or utilized as genetic resources to introduce genetic variations aimed at improving stress tolerance in lentil genotypes.

IN VITRO EVALUATION OF NEW GENERATION FUNGICIDES TO CONTROL OF *FUSARIUM OXYSPORUM* SCHLECHT CAUSING WILT OF ISABGOL

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Abstract

The present study was carried out to investigate the efficacy of fungicides under *in vitro* condition against *Fusarium oxysporum* Schlecht causing wilt of Isabgol. Out of selected nine fungicides *viz*., Azoxystrobin 25% SC, Mancozeb-75% WP, Copper oxychloride-50% WP, Thiram-50% WP, Fosetyl-Al- 80% WP, Propineb-70% WP, Tebuconazole- 50% + Trifloxystrobin-25% WG, Azoxystrobin 11% + Tebuconazole 18.3% SC and Hexaconazole 5% EC were used at 500 and 1000 ppm against wilt pathogen *F. oxysporum* Schlecht by poison food technique. The results revealed that Tebuconazole-50% + Tebuconazole-50% + Trifloxystrobin-25% WG showed maximum inhibition percent of mycelial growth of test fungus 98.04 and 100.00 at 500 ppm and 1000 ppm, respectively followed by Hexaconacole 5% EC.

IN VITRO EVALUATION OF DIFFERENT BIO-CONTROL AGENTS (DUAL CULTURE) FOR INHIBITING THE GROWTH OF *FUSARIUM OXYSPORUM* F. SP. *GLADOLI.*

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Abstract

In vitro fungal and bacterial bio-agents were tested against *Fusarium oxysporum* by using dual culture technique. The results obtained reaveled that mycelial growth inhibition of the test pathogen ranged from 63.61-33.61 per cent. Among the four bioagent tested *T. viridae* was the mean maximum inhibition 63.61 percent followed by *T. harzianum* 53.61 percent.and then T.fluorescence that is 43.89. The minimum growth was recorded in Pseudomonas fluorescence 43.89 percent. Among all bio-agents tested fungal bio-agents were found to be effective than bacterial bio-agent in inhibiting the mycelial growth of *F.oxysporum.* The use of bio control agents for the management of soil borne diseases involve the application of these agents to soil and planting material.

A STUDY ON GROWTH AND DEVELOPMENT OF PROTECTED CULTIVATION TECHNOLOGY IN THE KALYANA-KARNATAKA REGION

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Abstract

The main purpose of protected cultivation is to provide a favourable environment for the constant growth of plant so as to obtain its maximum potential even in adverse climatic conditions.The study had been undertaken with an intension to find out the extent of growth in area under protected cultivation of horticulture crops in Karnataka state and as well as separately in the districts of Kalyana-Karnataka. For this, the secondary data required was being sourced from the Directorate of Horticulture Department, Government of Karnataka for the period from 2010-11 to 2020-21. The results were showed that, total area under poly house cultivation was increased from 24.34 ha to 47.45 ha and whereas, the area under shade net was also decreasedfrom 37.50 ha to 25.01 ha and the total area under the protected cultivation in Karnataka was increased from 61.84 ha to 72.46 ha. The government of Karnataka has initiated many programmes such as Krishi Bhagya Yojane (KBY), National Horticulture

mission (NHM) *etc*. for the benefits of the farmers which have been instrumental in changing the attitude of the farmers for the adoption of protected cultivation technologies. Similarly, the total area of polyhouse and shade net house under protected cultivation in the districts of Kalyana-Karnataka were reported as Bidar (43.75 ha.), Kalaburagi(56.56 ha.), Yadgir (6.43) Raichur, (16.62 ha.), Koppal (102.71ha.) and Ballari (59.95 ha.).The adoption of the protected cultivation depends on the factors like soil conditions, climatic conditions of the area, availability of resources with the farmers, schemes for promotion of the protected cultivation and the market for the produce . Since the above mentioned factors contribute more favourable in the districts of Koppal and Bellari making them highly suitable for cultivation of the crops under PCT. Hence more farmers have adopted the protected cultivation in these districts.

AS ASSESSMENT OF FARMERS RESPONSE FOR IMPROVING THE ADOPTION OF PROTECTED CULTIVATION TECHNOLOGIES IN THE KALYANA-KARNATAKA REGION

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Abstract

Protected cultivation is an innovative technique of raising seasonal and off-seasonal crops under a controlled environment especially for the high value horticultural crops that to limited area holding farmers like small and marginal which enables them to reap the higher revenues. With this basis, a study was undertaken to assess the farmers response for improving the adoption of protected cultivation technologiesin the Kalyana-Karnataka region. The study has been conducted in the district of Koppal and Ballari in regions of Kalyana-Karnataka. The study was exclusively on the basis of primary data through personal interview method.A sample of 60 farmers were drawn as respondents from each district based on their size and composition of the structures adopted and also on the basis of crops grown under protected condition.The Garret ranking was employed and the results revealed that, Increase the financial support for drip and sprinkler irrigation was the major suggestion given by majority (95.83%) the respondents which was ranked as I followed by Provide technical guidance about the protected cultivation (90.83) ranked as II, Increase the subsidy or loan for protected cultivation (90.00%) ranked as III, Subsidy for farm machinery in protected cultivation (84.17%) ranked as IV, Creation of cold storage facility at taluk level (75.83%) ranked as V, Supply of quality inputs at low price in right time (76.66%) ranked as VI, Regulation of marketing of protected cultivation produces (71.67%) ranked as VII, Promotion of reasonable cost purchased for farm machinery (70.00%) ranked as VIII, Creation of cold storage facility at taluk level (64.17%) ranked as IX and Supply of protected cultivation technologiesequipment's at local market (53.33%) ranked as X. The possible reasons for suggestions could be attributed to the reasons such as limited subsidy along with lack of technical guidance on the protected cultivation and higher cost in establishing the protected cultivation technologies structure might have made them give above suggestions for the improvement of Protected cultivation technology adoption.

AS ANALYSIS OF RELATIONSHIP BETWEEN PROFILE CHARACTERISTICS AND ATTITUDE OF RESPONDENTS ON THEPROTECTED CULTIVATION TECHNOLOGY IN THE KALYANA-KARNATAKA REGION

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Abstract

Relationship between personal, socio-economic and psychological characteristics of respondents and attitude of respondents towards Protected Cultivation Technologies were analysed by employing correlationtechnique. The primary data required for

the study were gathered from the120 farmers which were hailing from Koppal and Ballari in regions of Kalyana-Karnataka.Out of 13 independent variables selected for the study, eight variables viz. Social participation, extension orientation, mass media utilization, management orientation, scientific orientation, achievement orientation,age and risk orientation were found significantly related to attitude of respondents towards protected cultivation technology. The remaining five variables viz., education, family size, farmingexperience, size of land holding and annual incomewere insignificant relation with the attitude of respondents towards protected cultivation technology. The reasons attributedfor the attitude of the farmers for better adoption of Protected cultivation technology were due to more participation of the respondents in social activities (frontline line extension activities), higher utilization of mass media and actively involved in the management activities like crop planning, production of crops. Further, in order to improve the income of the farmers though adoption of Protected cultivation technology (PCT) needsmotivation which was found to be good and significant. Similarly, the age is also a very important parameters for adoption of PCT, it was found that, most of the respondentsagewere in the middle age groups and were known for their enthusiasm, risk taking ability, feeling of responsibility and strive to achieve something.

RADIATION INDUCED STERILITY : EFFECTIVE WAY OF PEST MANAGEMENT

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Abstract

The continuous and irrational use of broad-spectrum insecticides has resulted in widespread insecticide resistance, negative impact on humans, food chain and the environment has been documented. Thus, there is an urgent need for environment-friendly, species-specific, non-polluting, non-radioactive and sustainable approaches, such as the Radiation Induced sterile insect technique (SIT) for Pest Management. During several decades, the Radiation Induced SIT has been used as part of area-wide integrated pest management (AW-IPM) strategies to suppress, eradicate or prevent the invasion of insect pest populations and disease vectors worldwide. Radiation Induced Sterility is a component of Sterile insect technique by which pest population in target area is minimized. SIT consists the mass production, sterilization and release of insects into infested areas, where sterile males mate with wild females resulting in no offspring and thus reducing pest populations. Irradiation method is used for sterilization of insects using gamma and X-rays. Gamma radiation from isotopic sources is most often used, but high-energy electrons and X-rays are other practical options. Too high dose of radiation than optimum, can cause deterioration in insect quality and mating vigour. Too low radiation doses are not sufficient to ensure that treated insects are sufficiently sterile in their reproductive cells and yet able to compete for mates with wild insects. Thus, accurate dosimetry (measurement of absorbed dose) is critical. Factors such as oxygen level, insect stage during irradiation, etc influence both the absorbed dose required for sterilization and the viability of irradiated insects. Consideration of these factors in the design of irradiation protocols can help to find a balance between the sterility and competitiveness of insects produced for programmes that release sterile insects. The SIT technique will thrive as the insect control technique of the future, demanding for the cleaner food and environment.

EFFICACY OF ANTHRANILIC DIAMIDE CYANTRANILIPROLE INSECTICIDE IN MANAGEMENT OF LEPIDOPTERAN PESTS IN PADDY AND ITS IMPACT ON NATURAL ENEMIES IN KALYAN KARNATAKA REGION

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Abstract

Rice (*Oryza sativa* L.) is a monocotyledonous crop, which belongs to the family Poaceae and genus Oryza. Paddy cultivation is commonly encountered by different biotic factors including insect pests like Yellow Stem Borer (YSB), pink stem borer, green leaf hoppers, leaf folder, brown planthoppers, gall midge, grasshoppers, gundhi bugs etc.,

which adversely affect its yield. The Rice Yellow Stem Borer (YSB), *Scirpophaga incertulas* is a destructive monophagous insect pest of the order Lepidoptera and family Crambidae. Yellow Stem Borer is seen during the vegetative phase and reproductive phase, which is called "dead heart" and "white head" or "white ear," respectively. Leaf folder, *Cnaphalocrocis medinalis* (Guenee) which causes 60 to 70 per cent leaf damage to paddy crop. The chemical insecticides are still reliable method to suppress the major insect pests in the rice crop.

A field experiment was conducted at Agricultural Research Station, Gangavathi during *Summer* 2022 and *Kharif* 2022 to evaluate the efficacy of Cyantraniliprole 300 g/L OD anthranilic diamide insecticide against Yellow Stem Borer (YSB), *Scirpophaga incertules* (Walker) and leaf folder, *Cnaphalocrocis medinalis* (Guenee) infestation in rice ecosystem. Cyantraniliprole 300 g/L OD @ 75and 60 *g.a.i./*ha shows most effective with lowest dead hearts and white earheads by Yellow stem borer, Lowest leaf incidence caused by leaf folder, safe to natural enemies and higher yield. Cyantraniliprole 300 g/L OD performed better than all other treatments, suggesting that these novel insecticidal treatments have the potential to provide all-around protection against rice yellow stem borer and leaf folder in rice

STUDY ON IMPACT OF CULTIVAR AND ENVIRONMENT FACTOR INTERACTION IN EARLY MATURING SUGARCANE (*SACCHARUM OFFICINARUM* L) CROP

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Abstract

Indian Sugarcane (*Saccharum officinarum* L) agriculture has recently experienced a rapid increase in cane and sugar production. India is the world's second-largest producer of sugarcane, following Brazil, with approximately 4.79 million hectares of area, 370.5 million metric tons of production, and a productivity of 77.35 tons per hectare (Kumar, R et al. 2023). Sugar cane cultivation in these regions significantly contributes to the economy by providing a stable source of employment and income. The present study examined the impact of different cultivars and environmental conditions on various traits of early maturing sugarcane. Three different environments (E1, E2, E3) were selected for the detailed analysis. The study found significant variations in the performance of different cultivars across the environments. For instance, genotype CoP17437 exhibited the tallest stalk in E1, while CoSe17451 had the highest yield in E2, and CoP17437 performed best in E3. Similarly, variations were observed in other traits such as stalk diameter, cane yield, sucrose content, purity, fiber content, and pol percentage across different environments and cultivars.

YIELD PERFORMANCE OF LEMONGRASS (*CYMBOPOGON CITRATUS*) UNDER *GMELINA ARBOREA* SHOWED HIGHER UNDER SHADY CONDITION

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Abstract

The field experiment was conducted at farmer's field Village - Gram Para Near Bargi Dam District - Jabalpur (MP) during Rabi and kharif season of 2021 with four main treatment of pruning intensities P0, P25%, P50% and P75% and 4 subtreaments of nutrient supply T1- fertilizer, T2- vermicompost, T3- organic manure and T4- control without any application. The data should be statistically analyzed with split plot design under *Gmelina arborea* (Khamer) plantation. The result showed that the growth and yield of the lemon grass showed higher under shady condition. The P0% pruning found higher tillers per plant at 30, 60, 90, 120 days after transplanting and at harvest (10.31, 14.64, 15.65, 17.95, 20.25 cm respectively) and plant height at 30, 60 and 90 days after transplanting viz., 30.06 cm, 112.02 cm and 153.24 cm respectively. Among different pruning intensities P25 % found superior among 50 % pruning and 75% pruning. Under sub treatments T3 was superior under height

of plant and number of tillers per plant and number of effective tillers per plant among all sub treatments whereas T4 control was found lower in all growth parameter. The higher fresh leaf yield of lemon grass was found under P0 (66.95 q ha-1) among all treatments and in sub treatments T3 (48.84 q ha^{-1}) was superior among all sub treatments.

INTEGRATING SUSTAINABLE PRACTICES IN CROP IMPROVEMENT : A PATHWAY TO RESILENT AGRICULTURE

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Abstract

Integrating sustainable practices into crop improvement is essential for creating resilient agricultural systems that can withstand the challenges of climate change, soil degradation, and increasing food demand .This holistic approach combines advanced agricultural techniques with environmentally friendly methods to enhance productivity while maintaining ecological balance. One of the core elements of Sustainable crop improvement is organic farming, which minimizes the use of synthetic chemicals and relies on natural fertilization methods. This practices improves soil health by enhancing its organic matter content, increasing water retention, and promoting beneficial microbial activity. Healthier soils lead to more robust crop systems, which are better equipped to cope with adverse conditions. Conservation tillage is another sustainable practice that supports crop improvement. By reducing disturbance, conservation tillage helps preserve soil structure, prevent erosion, and maintain soil organic matter. This technique not only enhances soil fertility but also contributes to carbon sequestration, helping to mitigate climate change. Integrated pest management plays a crucial role in sustainable crop improvement by combining biological, cultural and chemical methods to manage pest populations. IPM reduces reliance on synthetic pesticides minimizes pest resistance and promotes biodiversity within agricultural ecosystems. This approach leads to healthier crops and more stable agriculture systems. Crop diversity and rotation are also vital components of Sustainable crop improvement. Diversified cropping systems improve soil health, reduce pest and disease pressures, and increase overall farm resilience. Crop rotation breaks pest and diseases cycles, reduces soil nutrient and enhances crop yields, contributing to Sustainable overall Integrating sustainable practices in crop improvement provides a comprehensive pathway to resilient agriculture. By prioritizing ecological health, reducing environmental impacts, and enhancing crop productivity, sustainable crop improvement ensures the long-term viability of agricultural systems. Promoting and investing in these practices is crucial for achieving food security and environmental sustainability in the face of global challenges. Sustainable crop improvement not only addresses current agricultural issues but also lays the foundation for a more resilient and sustainable future.

GROWTH PERFORMANCE IN GIRTH AT BREATH HEIGHT (GBH) ON DIFFERENT PRUNING INTENSITY IN *GMELINA ARBOREA* OF AGROFORESTRY SYSYTEM

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Abstract

The field experiment was conducted at farmer's field Village - Gram Para Near Bargi Dam District - Jabalpur (MP) during Rabi and kharif season of 2021-22 with four main treatment of pruning intensities P0, P25%, P50% and P75% and 4 subtreaments of nutrient supply T1- fertilizer, T2- vermicompost, T3- organic manure and T4- control without any application. The data should be statistically analyzed with split plot design under *Gmelina arborea* (Khamer) plantation. The result showed that growth performance in girth at breath height (GBH) on treatments and different pruning intensity in *Gmelina arborea* found non-significant different in the 2021-22 and 2022-23 first and second year initial to final girth at

breath height (GBH) . Whereas, highest GBH found in the P_{75} (36.85, 40.20 and 38.52 cm) in the year of 2021-22 and similarly (40.20, 43.37 and 41.79 cm) in the year of 2022-23 in initial, final and pooled mean data of first year respectively. While lowest girth at breath height (GBH) ,P_{50} found in the 2021-22 (31.43, 34.78 and 33.11 cm) and in the 2022-23 (34.78, 37.98 and 36.38 cm) estimated on initial, final and pooled mean data of second year respectively. Among The girth at breath height (GBH) Increment (cm) in pruning intensity and treatments were found non-significant effect but highest P_0 T_4, $P_{25}T_1$and P_0 T_1 in the First year, second year and pooled mean data

HEALTH PROBLEMS FACED BY OLDER ADULTS IN UTTARA KARNATAKA

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Abstract

As people age, many age related changes are common such as decline in vision and hearing, high blood pressure, muscle weakness, weakened immune system, diabetes, depression and dementia. The sample for the present study comprised of 90 rural and 90 urban elderly were purposively selected through random sampling method. Health status of elderly was assessed by using Ageing schedule Badiger and Kamat (2009) and socio-economic status by using Aggarwal *etal.* (2005) SES scale. Results revealed that majority of the elderly from urban area had common health problems to a greater extent such as poor vision (54.5%), dental problems (52.4%), depression (51%), back pain (50%), uncontrollable bladder (47.7%) and reproductive problems (45.5%).With regard rural elderly most of them had common health problems to some extent like poor vision (65.5%), poor hearing (52.2%), dental problems (50%) and uncontrollable bladder (48.8%). With regard to chronic health problems more than half of rural elderly (to some extent) and urban elderly (to greater extent) had hypertension, diabetes, arthritis and respiratory problems. The rate of overall health status was good among rural elderly as compared to urban elderly. However, majority of elderly from both areas had no common/chronic health problems like skin issues, tremors, fatigue, dementia, headache, acidity, cardiovascular and respiratory problems. There is a need for elderly to get immediate health facilities, financial assistance for medicines and services through Government and NGO's for better health status.

ROLE OF SOIL MICRO-ARTHROPODS IN SUSTAINABLE CROPPING SYSTEMS

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Abstract

Microarthropods such as Acarina, Collembola and Hymenoptera make up about 20% of the soil fauna. They play a crucial role in soil quality, carbon sequestration, nutrient cycling, and biogeochemical processes. These microarthropods convert nutrients into bioavailable forms that is absorbed by plants, thus influencing plant root-to-shoot ratio. They also regulate decomposition rates, monitor soil health and contribute to the suppression of pathogens (fungivores) and nematodes, making more resources available to bacteria. Microarthropods primarily feed on dead organic matter like leaf litter and wood, aiding in the recycling of vital nutrients. These interactions between soil-dwelling organisms and plants have an impact on plant growth, diversity and trophic groups like herbivores, parasitoids, hyperparasitoids, and pollinators. These microarthropods can directly impact soil and plant health by feeding on pest organisms or serving as prey for larger predatory arthropods. They indirectly influence plant defenses and health by feeding on specific microorganisms associated with plant roots. Microarthropods also contribute to the formation of soil aggregates through their continuous activities such as burrowing, ingestion of soil particles and decomposition which leads to changes in soil properties, increasing soil porosity and water-holding capacity. Therefore, they are key players in pedoturbation and pedogenesis. Microarthropods are highly sensitive to changes in their habitat and act as bioindicators of soil health and contamination. Collembolans react quickly to changes in their environment and can be used as cost-effective biological indicators for analyzing soil health. The abundance of microarthropods is positively associated with the application of organic soil fertility inputs, like compost or manures. No-tillage or conservational cropping systems with less disturbance and absence of pesticides promote higher microbial biomass, higher soil respiratory activity, higher CO_2 evolution and maintain crop yield. Their presence and abundance can be used as indicators of soil health, biodiversity and climate change.

EVALUATION OF *CYMBOPOGON CITRATUS* & *OCIMUM BASILICUM* PLANT EXTRACTS AGAINST *APHANOMYCES INVADANS* INFECTION IN *LABEO ROHITA* FINGERLINGS

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Abstract

The present study was conducted to evaluate the antifungul activity of *Leucas aspera* (LCE), *Cymbopogon citratus*(CCE), *Ocimum basilicum* (OBE), *Houttuniya cordata* (HCE) on *Aphanomyces invadans* and to evaluate the efficacy of these extracts against *Aphanomyces invadans* infection in *L.rohita* fingerlings. CCE & OBE has been selected as the most potent extract in the contest of yield percentage, phytochemical properties, antioxidant properties and antifungal activity of extracts. The extract of *Cymbopogon citratus* (CCE), *Ocimum basilicum* (OBE) were found to be most potent as compared to other extract and used for further experiments. The second objective was conducted to find out immune-biochemical response of *L. rohita* fingerlings, fed with CCE, OBE & CCE+ OBE (concentration: control- 0.0%, diet T1- 0.2%, diet T2- 0.2%, diet T3 - 0.2% of kg^{-1} feed). Sampling was done at 15th, 30th and 45th days of feeding. Different biochemical parameters like blood glucose, ALP, GPT, GOT^{+} and immunological parameters like NBT, anti-protease activity, plasma protein, albumin, globulin was carried out. The immunological parameters such as NBT was showed significantly higher after fed with CCE, OBE incorporated diets. The biochemical parameters blood glucose, GPT and GOT was found significantly increases. In the third experiment, the CCE-OBE diets fed group of fishes showed better resistance against *A. invadans* as compared to the control group and T1 (70.5%) diet showed highest post challenged survival percentage. From the present study, it is suggested that, CCE-OBE can be used as potent and can be used as a sustainable alternative prophylactic and therapeutic agents in aquaculture.

GENETIC DIVERSITY ANALYSIS AND CHARACTER ASSOCIATION OF RICE HYBRIDS

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Abstract

The current investigation was performed at Seed Breeding Farm, Department of Plant Breeding and Genetics, College of Agriculture, JNKVV, Jabalpur, during *Kharif* 2022. 104 rice genotypes were planted in Randomized Complete Block design with three replications. The present study was initiated to obtain the promising rice hybrids in respect of various yield and grain quality traits in rice hybrids. High GCV and PCV was observed for number of tillers/ plants, number of effective tillers/plants, panicle weight per plant, plant weight, biological yield/ plant, sterile spikelet/panicle, fertile spikelets /panicle, total no. of spikelet, spikelet density %, harvest index, panicle index, and grain yield/ plant. Grain yield per plant shared positive significant correlation with biological yield/plant and panicle weight/plant. The genotypes of cluster III and cluster VI showed higher inter cluster distance, hence the parental lines fell in these clusters may be utilized for broaden the genetic base of rice. On the basis of PCA ranking for yield attributing five genotypes viz., R 671 ×NPT 29, Kranti × JNPT 1058, Kranti × WGL -14, Shyamla x IR 64 and 29A× P3123 crosses were found superior both for yield and attributing traits.

STUDIES ON GROWTH, PHYSIOLOGICAL EFFICIENCY, AND MORPHO PHYSIOLOGICAL PARAMETERS AFFECTING PRODUCTIVITY AND YIELDS IN DIFFERENT SOYBEAN GENOTYPES

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Abstract

The research conducted at the Research Farm Adhartal, JNKVV, Jabalpur, during the *Kharif* season 2017 aimed to evaluate nineteen soybean genotypes for physiological efficiency. Employing a Randomized Completely Block Design with three

replications, the study investigated various parameters, revealing significant variability among genotypes. A consistent linear pattern of total dry matter production was observed across vegetative, flowering, and crop maturity stages. Genotypes JS 20-98, JS 20-29, and NRC 3 exhibited superior performance, accumulating maximum total dry matter throughout the crop growth stages. Leaf Area Index (LAI) demonstrated a progressive increase up to the active pod-fill stage, followed by a decline with advancing crop age. JS 20-98 and JS 20-29 maintained the highest assimilatory surface area during all growth stages. Canopy Growth Rate (CGR) and Relative Growth Rate (RGR) exhibited a similar trend, peaking at 60 days after sowing (DAS), with JS 20-98 leading during the reproductive phase. Significant variations among different genotypes were noted in air temperature, canopy temperature, photosynthetic rate, stomatal conductance, water use efficiency, mesophyll efficiency, quantum efficiency, and carboxylation efficiency. JS 20-98 emerged as the top-performing genotype, boasting the highest values for LAI, Leaf Area Duration (LAD), RGR, CGR, quantum efficiency, carboxylation efficiency, photosynthetic rate, transpiration rate, mesophyll efficiency, and chlorophyll content index. Conclusively, genotype JS 20-34 exhibited the earliest transition from the vegetative to reproductive phase, while JS 20-98 and JS 20-29 showcased superior growth and physiological attributes across all stages, making them promising candidates for soybean cultivation. These findings contribute valuable insights into soybean genotypic variations, aiding future breeding and cultivation strategies for enhanced productivity and efficiency.

ASSESSMENT OF GENETIC DIVERSITY IN LINSEED GENOTYPES USING AGRO-MORPHOLOGICAL TRAITS AND MICROSATELLITE MARKERS

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Abstract

Linseed is an important *Rabi* season oilseed crop next to rapeseed and mustard in terms of area and production. During the last two decades, flax has attracted great attention to human health mostly because of its desirable fatty acid composition. Genetic variability is crucial in the breeding or selection program of any crop. The success of any genetic program lies in exploiting genetic variability. Diversity analysis of flax is an important component for efficient management and utilization of its genetic resources, and proper handling of the seed certification programs. The present research work the linseed genotypes and understanding its diversity on both morphological and molecular levels and understanding the properties of the linseed.Based on divergence analysis, the genotypes viz., SLS 108, PKDL-167, SLS 111, JLS 67, SLS 123, SLS 118 and TL142 were identified as promising genotypes indicating vast genetic divergence regarding cluster means, intra and inter-cluster distance and per se performances. At the molecular level, twelve SSR markers were found polymorphic. The polymorphic information content (PIC) values were ranged between 0.0555 to 0.6732 with an average PIC value of 0.4020 per primer. This depicted that there is considerable genetic variability amongst the genotypes used in the molecular study and also, this was similar to the results of D^2 analysis done based on quantitative data. Unique allele was found for marker Lu-1, Lu-4, Lu-7 and Lu-8 in genotypes JLS-9, PKDL-167, SLS-16 and SLS-115 and the size was about 90 bp, 800 bp, 170 bp and 220 bp, respectively. These markers can be used for selective amplification and identification of the above specific trait/genotypes.

EXPLORATION OF PHENOPHASIC DEVELOPMENT, GROWTH PARAMETERS, AND PHYSIOLOGICAL EFFICIENCY IN DIVERSE OAT CULTIVARS

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Abstract

During the Rabi season of 2020-21, field experiment was conducted as part of the All India Coordinated Research Project (AICRP) on Fodder Research and Physiology at the College of Agriculture, JNKVV, and Jabalpur (MP) to evaluate 16 oat genotypes using a Randomized Block Design with three replications. This study examines the developmental traits and

physiological parameters of various oat genotypes, focusing on how these traits vary between genotypes. The results reveal significant differences in Phenophasic development, with IVTSC-3 displaying more extended periods for boot initiation, flower initiation, 50 per cent flowering, grain development, physiological maturity, and harvestable maturity compared to IVTSC-8, which had the shortest durations. Physiological assessments show that IVTSC-3 has the highest leaf area index, leaf area duration at 60 and 90 days, crop growth rate, and relative growth rate, while IVTSC-8 has the lowest values for all physiological observations. These findings underscore the importance of considering genotype-specific responses in oat growth dynamics, providing vital insights for oat breeding programs and agronomic practices that aim to enhance crop productivity and resilience.

EFFECT WEED MANAGEMENT PRACTICES ON GROWTH AND YIELD OF POTATO

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Abstract

The present experiment was carried out at Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during winter (*Rabi*) season of the year 2022-2023 and 2023-2024 in Kufri Bahar cultivar, which was grown with thirteen treatment different combinations of weed control in randomized block design and replicated three times. The recorded data on various parameters were influenced significantly with different weed control treatments. The results revealed that plant height at the 40, 60, 80 days after planting and at harvest was recorded in T_{12} (Weed free), which is statistically at par with T_6 (Metribuzin 70% WP (0.525 kg ha^{-1}) + Rice straw (6 t ha^{-1}) as PE). Plant emergence (%) at 30 DAP and number of stems per plant were found to have no significant difference among different weed control treatments. Yield parameters like, number of tubers per plant, average tuber weight, tuber yield per plant, total tuber yield, marketable tuber yield and yield of different grades tubers [A Grade (>75 g), B Grade (50-75 g) and C Grade (25-50g)] were maximum in T_{12} (Weed free) was found to be statistically and was at par with T_{11} which involves earthing up and T_6 (Metribuzin 70% WP (0.525 kg ha^{-1}) + Rice straw (6 t ha^{-1}) as PE).

COMPARATIVE STUDY ON NUTRITIONAL COMPOSITION OF EGG IN DIFFERENT BREEDS OF CHICKEN

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Abstract

The present experimentation was conducted at Animal farm, Department of Animal Production, Rajasthan College of Agriculture Udaipur .One hundred eighty eggs was collected from four different chicken breeds (40 week old) were used in 4 treatments with 3 replications, each consisting of 45 eggs. The treatments were (T_1) Kadaknath, (T_2) RIR, (T_3) Mewari, (T_4) Pratapdhan. In this experiment nutritional composition of egg quality traits were measured to comparison of indigenous and improved chicken breeds. Results showed that the The dry matter was higher ($P<0.05$) in Pratapdhan (26.65%) followed by Kadaknath (26.31%), Mewari (25.91%) and lowest dry matter was found in RIR (25.31%). The crude protein (%) was found to be higher in Pratapdhan (11.59), followed by RIR (11.57), Mewari (11.47) and minimum crude protein was found in Kadaknath (11.33). Maximum ether extract percent (%) was found in RIR (11.30) followed by Pratapdhan (11.28), Mewari (11.26) and lowest value was observed in Kadaknath (11.17). Highest gross energy (kcal) was found in Pratapdhan (167.53), while lowest was found in Mewari (166.82). Though the differences in crude protein, ether extract, and gross energy values among different breeds were found to be non- significant. The ash percentage (%) was higher ($P<0.05$) in Pratapdhan (1.21) and Kadaknath (1.17) as compared to RIR (1.11) and Mewari (1.08). While moisture percentage (%) was found to be higher in RIR (74.68) and Mewari (74.08) as compared to Kadaknath (73.68) and Pratapdhan (73.35). The difference in moisture per cent between RIR and Mewari as well as between Kadaknath and Pratapdhan was found non- significant. In this study it was found that improved breeds RIR and Pratapdhan was better than desi breeds in egg quality traits.

META-QTL ANALYSIS REVEALS CRUCIAL GENOMIC REGIONS FOR AGRONOMIC TRAITS AND STRESS TOLERANCE IN SORGHUM

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Abstract

Sorghum [*Sorghum bicolor* (L.) Monech] is a crucial food and fodder crop worldwide, particularly significant in the current era of climate change due to its stable C4 photosynthetic pathway. Despite its resilience, sorghum growth and production are impacted by various stresses. Numerous QTL studies have been conducted to explore the genomic regions associated with these traits in sorghum. In this study, we performed a Meta-QTL analysis by combining 235 QTLs mapped from ten previous studies, focusing on biotic stress (sorghum shoot fly, ergot disease), abiotic stress (drought and salinity), yield, and other agronomic traits. We constructed a high-density genetic map using 1,257 markers spanning 2,214.77 cM. Through this analysis, we identified a total of 26 Meta-QTLs. The average confidence interval of reported MQTLs underwent 2.56 folds refinement compared to the initial QTLs, leading to the identification of both well-known functionally characterized genes and several potential novel candidate genes for the investigated traits. These findings provide novel insights into the molecular responses to agronomic traits, biotic and abiotic stresses, significantly advancing our understanding towards enhance mapping and marker-assisted selection in sorghum.

ECONOMIC DYNAMICS OF FRUIT AND SPICE CULTIVATION IN INDIA: GROWTH AND FLUCTUATIONS

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Abstract

The export of spices holds significant importance in India's agricultural exports, with several spices such as chillies, cardamom, and cumin leading the charts. This study examines the growth patterns of cultivation area, production, yield, export quantity, and value of spices from India between 2018 and 2022. Methodologically, the study employs average annual growth rate and coefficient of variation as analytical tools. The key findings of the study indicated that pepper had the largest cultivated area among the spices considered, while chillies recorded the highest production volume. Chillies also exhibited the highest growth rate in cultivation area, whereas small cardamom showed the highest growth rates in production, yield, export quantity, and value over the past five years. Despite its strong growth in exports, small cardamom also displayed the highest variability in export volumes. Further the study suggested policies focused on incentivizing farmers to adopt modern agricultural practices and technologies to increase the cultivation area, production productivity of high-demand spices such as chillies and small cardamom. It also suggested implementation of trade policies aimed at promoting value addition and quality standards in spice production to enhance export competitiveness and ensure stable export volume.

STUDIES ON GENETIC PARAMETERS ON YIELD AND QUALITY CHARACTERS IN ADVANCED SUGARCANE CLONES (*SACCHARUM SP.* COMPLEX)

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Abstract

Sugarcane plays a crucial role in global sugar production, serving as a vital agro-industrial crop. It is a primary source of sweeteners and a crucial cash crop. Its adaptability to various climatic conditions offers farmers financial stability, making it more dependable than other agricultural commodities. Its by-products, such as ethanol, bagasse, and molasses, further enhance its value, showcasing its versatility and importance in sustainable agricultural practices. This study, conducted at

GBPUAT, Pantnagar, aimed to investigate the relationship between specific morphological and sugar quality traits and sugarcane yield. The experiment featured 11 sugarcane genotypes arranged in a Randomised Block Design with three replications. Observations were recorded for fifteen characters, covering aspects related to cane yield components such as germination percentage, number of tillers, number of millable canes, cane height, cane thickness, single cane weight and cane yield and quality parameters such as Brix content at 10 months, sucrose content at 10 months, CCS (Commercial Cane Sugar) percentage at 10 months, purity percent at 10 months, Brix content at 12 months, sucrose content at 12 months, CCS percentage at 12 months, purity percent at 12 months and CCS yield,. Analysis of variance revealed significant differences ($P < 0.01$) for most the characters studied. The Phenotypic Coefficient of Variation (PCV) values were found to be higher than that of Genotypic Coefficient of Variation (GCV) values for all the traits. High heritability (> 60%) was observed for Germination percentage, number of tillers, number of millable canes, Brix content at 10 months, cane thickness and sucrose content at 12 months. Number of tillers showed highest heritability (84.44%) and genetic advance as percent of mean (36.33%). Two trait *viz.* number of tillers, number of millable canes showed high heritability together with high genetic advance as percent of mean and it is suggesting that simple selection measures would be successful for these quantitative traits to carry out genetic advancement in the specific direction.

SYNTHETIC HERBIVORE-INDUCED PLANT VOLATILES AS FIELD ATTRACTANTS FOR BENEFICIAL INSECTS IN OKRA

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Abstract

Vegetables play a major role in agriculture by providing economic economics security to growers and food security to consumers. Okra (*Abelmoschus esculentus*) has a good potential as a foreign exchange crop and accounts major percentage in overall export of fresh vegetables from India to various parts of globe. Interestingly, around 72 insect species have been recorded on okra which causes significant economic losses to the crop. For the management of farmers rely on synthetic insecticides and these insecticides reduce the export quality of okra. It is the prime need that agriculturist must exploit the direct and indirect defense mechanisms of plants against insect herbivores. Indirect defenses act via the attraction of enemies of herbivores by emitting behavior-modifying volatile organic compounds specifically herbivore-induced plant volatiles (HIPVs). Synthetic herbivore-induced plant volatiles (HIPVs) are chemical compounds emitted by plants in response to herbivore attack. In the recent years, potential of synthetic herbivore-induced plant volatile's for the recruitment of natural enemies of insect pests in various agroecosytems have been studied. In the context of okra cultivation, using synthetic HIPVs as field attractants for beneficial insects can potentially enhance biological pest control and reduce the reliance on chemical pesticides. In conclusion, synthetic herbivore-induced plant volatiles have the potential to serve as effective field attractants for beneficial insects in okra cultivation. They offer a promising avenue for sustainable pest management, promoting natural pest control mechanisms while reducing reliance on chemical pesticides. Continued research and field trials will be crucial to fully understand and optimize their application in okra farming practices.

SEED PRIMING INFLUENCE ON GERMINATION AND SEEDLING GROWTH OF *ALBIZIA LEBBECK* (L.) BENTH

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Abstract

The experiment entitled "Seed Priming on germination and seedling growth of *Albizia lebbeck* (L.) Benth." was carried out in the nursery of College of Forestry, Odisha University of Agriculture and Technology, Bhubaneswar during the year 2021-2023.The experiment consisted 13 treatments that includeshydropriming, Osmopriming, halopriming and hormonal primingin threedifferent concentration along with control (unprimed).The experiment was carried out in completely randomized design and repeated thrice. The results of experiment showed that *A. lebbeck*seeds treated with GA_3 @ 750 mg/l

(T-6) gave the highest germination percentage (73.67%), germinationvalue (18.25%) and germination energy (44.33%). Maximum seedling growth viz. seedling length (21.10cm), collar diameter (0.423cm), no. of leaflets (29.44), leaf area (54.57 cm^2) and root length (46.27cm) were highest in T-6. In the biomass study, above ground fresh weight (7.92g), above ground dry weight (3.80g), below ground fresh weight (6.12g), below ground dry weight (2.46g) and total dry weight (6.26g) were maximumwith the treatment of GA_3 @ 750 mg/l (T-6).The seed vigour index and seedling quality index were also noted in treatment GA_3 @ 750 mg/l (T-6) at 21 days and 110 days after sowing respectively.

EFFECT OF WATER STRESS ON BIOCHEMICAL PARAMETERS OF *SORGHUM BICOLOUR* UNDER POT CONDITION

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Abstract

An experiment was conducted to evaluate the effects of water deficit on biochemical parameters on sorghum during *rabi* season (September 2009 to February 2010) in Maharashtra. The treatment combinations consisted of four moisture regimes viz. M_1, M_2, M_3 and M_4 upto harvest and six genotypes viz. Phule Yashoda, RSV-1006, Phule Chitra, Phule Vasuda, Phule Anuradha, Phule Maulee.The study revealed that, RSV-1006 and Phule Chitra genotypes had maximum total soluble sugar content. The proline content increased with a decrease in the soil moisture content in all the genotypes with predominance in Phule Maulee, Phule Chitra and Phule Anuradha which also reported positive correlation of proline accumulation. The degree of reduction in protein content as a function of water stress was less in Phlule Maulee, Phule Chitra and Phule Anuradha respectively. The genotypes Phlule Maulee, Phule Chitra and Phule Anuradha had lowest nitrate reductase activity under moisture regime M_1. The present study revealed that genotypes Phule Chitra and Phule Maulee are more suited under limited soil moisture condition. Irrespective of moisture regime Phule Yashoda and RSV-1006 found better than rest of genotypes. Therefore, these genotypes are well suited for medium soil under stress as well as non-stress conditions.

SCREENING OF BLACKGRAM GERMPLASM LINES AGAINST POWDERY MILDEW DISEASE

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Abstract

Urdbean (*Vigna mungo* (L.) Hepper, also known as blackgram, is an important pulse crop of the Indian sub-continent. Of the various abiotic and biotic factors which inflict crop at various stages, powdery mildew disease is the major biotic constraints faced by the crop. Powdery mildew disease of blackgram caused by *Erysiphe polygoni* DC is one of the economically important diseases in black gram which occurs at later stages of crop growth causing yield losses. Among the 119 germplasm lines screened, 1 germplasm line showed moderate resistant reaction with 10.1-25 per cent disease severity *i.e.*, IC 397928, 17 germplasm lines showed moderate susceptible reaction with 25.1-50 per cent disease severity, 68 germplasm lines showed susceptible reaction with 50.1-70 per cent disease severity, and 33 germplasm lines showed highly susceptible reaction with 70.1-100 per cent disease severity.

SCREENING OF GERMPLASM LINES AGAINST URDBEAN LEAF CRINKLE VIRUS INFECTING BLACKGRAM

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Abstract

Blackgram (*Vigna mungo* L.) popularly known as urdbean in India belongs to family *Leguminosae*. Blackgram is susceptible

to fungal, bacterial and viral diseases to a greater extent along with insects. Among the various constraints, Urdbean Leaf Crinkle Virus (ULCV) is the most serious disease in which the mechanical and seed transmission of ULCD is proved. It is transmitted by whitefly (*Bemisia tabaci*), aphids (*Aphis craccivora* Koch, *A. gossypii* Glov., *Acyrthosiphon pisum*, *Myzus persicae*), leaf hopper (*Circulifer tennellus*) and beetle (*Henosepilachna dodecastigma*). Characteristic symptoms of ULCD include enlargement of the leaves, crinkling, curling and rugosity. The disease affects both vegetative as well as reproductive parts, often rendering the plant completely unproductive. The results observed that among the 119 germplasm lines screened, 22 germplasm lines showed resistant reaction with 0-10 per cent infection *i.e.*, IC 519016, IC 530628, IC 527176, IC 393528, IC 253905, IC 250220, IC 45665, IC 250206, IC 600255, IC 565276, IC 590132, IC 600266, DBGV-18, DBGV-19, DBGV-32, DBGV-33, DBGV-34, DBGV-96, TRCRU-339, LBG-752 (Shining), LBG-752 (Dull) and BDU-18, 33 germplasm lines showed moderate resistant reaction with 11-30 per cent infection, 14 germplasm lines showed moderate susceptible reaction with 31-40 per cent infection, 46 germplasm lines showed susceptible reaction with 41-75 per cent infection and 4 germplasm lines showed highly susceptible reaction with 76-100 per cent infection.

COAT PROTEIN BASED CHARACTERIZATION OF YELLOW MOSAIC VIRUS INFECTING HORSE GRAM IN NORTHERN KARNATAKA

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Abstract

Horsegram (*Macrotyloma uniflorum* (Lam.) Verde.) popularly known as poor man's pulse crop, is a hardy legume known for its easily digestible quality protein. It is an indigenous plant cultivated in India, other Asian countries and Africa. Yellow Mosaic Disease (YMD) poses a significant challenge to horse gram production in India and other countries, potentially resulting in complete yield loss. Accordingly, the current investigation was carried out to characterize the coat protein gene of Yellow Mosaic Virus (YMV) infecting the horse gram at Dharwad. The total genomic DNA was extracted from yellow mosaic virus infected plant leaf tissues by utilizing modified CTAB method. Amplification of coat protein gene of the YMV infecting horse gram was carried out using specific primers, which yielded DNA fragment size of ~900 bp. The amplified product was sequenced and sequence data revealed that the CP gene of the begomovirus under study shared 98.74 per cent similarity with Horse gram yellow mosaic virus Dharward isolate (MN602423.1) and 95.75 per cent similarity with Mung bean yellow mosaic virus isolate (KY824801.1) at nucleotide level. When the deduced amino acid sequence of individual proteins of YMV infecting the horse gram at Dharwad were compared with those of other begomoviruses, the highest identity of 95.19 per cent was obtained with HgYMV Dharwad isolate (MN602423.1) and 86.61 per cent with MYMV isolate (KY824801.1).

BLUE BEETLE : A POTENTIAL DEFOLIATOR OF *CALOTROPIS PROCERA*

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Abstract

Weeds cause losses to agricultural crops, at time they serve as alternative host for insect pests. Some weeds through allelopathic effects interfere in the normal growth of plants of economic importance. It was estimated that on an average the weed control costs around INR 6000/ha (USD 92.42/ha) in rainy season crops and around INR 4000/ha (USD 61.61/ha) for winter crops, which accounts for around 33% and 22% of total cost of cultivation, respectively It was reported that globally, weeds are responsible for decreasing the production of the world's eight most important food and cash crops by 13.2% . In India, weed management costs were much higher. Weeds cost the Indian agricultural production over USD 11 billion every

year. Biological control in weed management has been reported in soybean, wheat, maize , rice , cotton , several horticultural species etc *C. procera* has allelopathic effect, while, have reported its medicinal values. In India, *C. procera* is a weed of minor importance but it is a serious problem in Minas Gerais, Brazil. Chemical control of this weed is relatively not very popular. Manual control presents problems because of the high costs and its re-establishments itself with vigour when cut. Blue beetle (*Chrysochus cobaltinus*) belonging to family Chrysomelidae was found to intensively feed on the leaves of *C. procera*. The adults were the damaging stage of the insects. The insect feeds on both mature and immature leaves by making holes on it initially. With the passage of time the entire leaf is devoured. After feeding one leaf completely, the insect moves to the next leaf on the plant. This behavior of Blue beetle was observed during 2019 to 2020 in Janjatikalyan Kendra Mahakoshal, Bargaon**.** On a single leaf there were 4 to 5 adults recorded. The feeding and mating was observed on the same leaf. Within 3-4 days of the incidence complete defoliation of the plant was seen. It usually depends on the size of the plant and numbers of blue beetles on it. The female Blue beetle appeared to be comparatively bigger in size than the male counterparts. It was also noted the female insects are voracious feeder as compared to the male. The insect was active throughout the day during July and August months. However the activity was more during morning hours till 9-10 am, thereafter the activity of the insect declined. The activity of the adult regains during the evening hours from 4-6 pm.As blue beetle is observed as an effective defoliator of *C. procera* there is a need to conserve and multiply it for mass release to large scale biological management of this weed. *C. procera* is an alternate host of aphids. Thus defoliation of *C. procera* will also help in reducing in population of aphids in the agro-ecosystem.

QUALITY CHARACTERISTICS OF VERMICELLI PREPARED FROM LITTLE MILLET FOR PREPARATION OF KHEER

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Abstract

Kheer is a semi-solid dessert with partially disintegrated cooked rice grains or vermicelli dispersed in milk solids. The process of kheer preparation is quite lengthy as it requires time to concentrate the liquid milk and therefore in this busy schedule, development of ready to cook pre mixes are required for several traditional snack foods which offers convenience for processing food products. In the present study, the ready to cook traditional millet product were prepared using little millet flour, skim milk powder, jaggery, dry fruits with combinations of rice flour, arrowroot powder, Glycerol Monostearate and xanthan gum which enhances the overall quality of the product. Different treatments were formulated viz., T1, T2, T3, T4 varying with addition of little millet flour, rice flour and arrowroot powder. Organoleptic evaluation of the kheer samples prepared from all the treatments revealed that Treatment T4, had the highest score and therefore it was considered to be the standardized product. The prepared vermicelli samples were analysed for proximate composition apart from estimating the length, width, thickness, cooking time and hardness. The standardized Vermicelli had a length of 34.7mm, width of 2.2mm and thickness of 2.7mm. The hardness of optimised sample was found to be 28.8N and cooking time was observed to be 15min.

EFFECT OF VERMICOMPOST AND HERBICIDAL WEED MANAGEMENT PRACTICES ON WEEDS, YIELD AND SOIL MICROBIAL PROPERTIES IN FENUGREEK (*TRIGONELLA FOENUM-GRAECUM* L.) UNDER SOUTHERN RAJASTHAN CONDITIONS

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Abstract

A field experiment was conducted at Instructional farm, Rajasthan College of Agriculture, MPUAT, Udaipur during *Rabi* 2016-17 and 2017-18 to study the weed flora, yield and microbial activity in fenugreek. The experiment consists of thirteen

weed management treatments in main plot consists of imazethapyr (70 g/ha and 70 g/ha *fb* hoeing at 40 DAS), imazethapyr 50 g/ha PoE at 2-4 leaf stage, imazethapyr + imazamox (RM) 50 and 60 g/ha at 2-4 leaf stage, pendimethalin 750 g/ha PE, oxyfluorfen (120, 150 g/ha and 120 g/ha PE *fb* hoeing at harvest), oxadiargyl (100 g/ha and 100 g/ha PE *fb* hoeing at 40 DAS) including weed free and weedy check and levels of vermicompost in sub plot, *viz*. control and 5 t/ha. The experiment was laid out in split plot design with three replications. The soils of experimental field was clay loam in texture, slightly alkaline in reaction, medium in organic carbon, available nitrogen, available phosphorus and high in available potassium. Fenugreek variety RMT-305 was sown with all recommended production technology. The application of herbicides was done as per treatments. Among different weed management practices application of oxadiargyl 100 g ha^{-1} PE *fb* hoeing at 40 DAS recorded the lowest weed density and weed dry matter over weedy check. The same treatment registered higher seed yield (2820 kg ha^{-1}) over rest of the weed management treatments. Maximum microbial population of bacteria (119.86 x 10^6 cfu g^{-1} soil), fungi (150.85 x 10^4 cfu g^{-1} soil) and actinomycetes (173.24 x 10^5 cfu g^{-1} soil) was recorded by application of vermicompost. Based on the results, it was concluded that application of oxadiargyl 100 g ha^{-1} PE *fb* hoeing at 40 DAS was found superior for weed control, maximum yield and microbial activity in fenugreek grown in southern Rajasthan.

BIOSYNTHESIS OF SILVER NANOPARTICLES USING GARLIC EXTRACT AND ASPERGILLUS FLAVUS: A GREEN CHEMISTRY APPROACH

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Abstract

The present study focused on the green synthesis of silver nanoparticles using a combination of garlic extract and the fungus *Aspergillus flavus*. This synergistic approach capitalized on the reducing capabilities of garlic extract and the biomolecules produced by A. flavus to efficiently convert silver ions into nanoparticles of uniform size. By optimizing parameters such as reaction temperature, pH, and incubation time, the synthesis process was tailored to yield silver nanoparticles with a size range of 30.45 to 89.56 nm. Characterization analyses, including UV-Vis spectroscopy, chemical reaction tests, and electron microscopy, confirmed the successful synthesis of silver nanoparticles with distinct morphological features. The biocompatible nature of the synthesized nanoparticles suggests their potential applications in catalysis and environmental remediation. This innovative green synthesis strategy, combining garlic extract and *Aspergillus flavus*, represents a sustainable and environmentally friendly approach to nanomaterial production, offering promising avenues for future research and development in the field of nanotechnology.

BOTANICAL CONTROL OF FUSARIUM WILT IN CHILI: A SUSTAINABLE GEO-POLITICAL, ECONOMICAL AND SOCIALLY RESPONSIBLE APPROACH

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Abstract

Fusarium wilt is a devastating disease that poses a significant threat to chili cultivation worldwide, leading to substantial yield losses and economic hardship for smallholder farmers. This study aimed to explore the potential of botanical extracts and biocontrol agents as eco-friendly and sustainable alternatives to chemical control methods for managing Fusarium wilt in chili crops. Four different botanical extracts and four Trichoderma isolates were evaluated for their ability to inhibit the growth of the causal pathogen, Fusarium solani. The results showed that neem oil and the Tr1 isolate of Trichoderma were the most effective treatments, exhibiting strong antifungal properties. Further investigations under pot culture conditions revealed that the combination of neem oil, the Tr1 Trichoderma isolate, and the organic amendment panchagavya (T7 treatment) was the most successful in reducing Fusarium wilt incidence by 69.56%. This integrated disease management (IDM) approach not only effectively controlled the disease but also enhanced plant growth parameters, such as germination rate, plant height, dry

weight, and fruit yield. The social and economic implications of this study are far-reaching. By providing smallholder chili farmers with an effective, eco-friendly, and affordable disease management strategy, the adoption of this IDM approach can lead to increased crop productivity, improved food security, and enhanced livelihoods. Furthermore, the use of locally available botanical resources and biocontrol agents aligns with the principles of sustainable agriculture, contributing to the overall environmental and political goals of promoting sustainable development and reducing the reliance on synthetic pesticides. The findings of this study highlight the potential of integrating botanical extracts and biocontrol agents as a viable and socially responsible solution to the challenge of Fusarium wilt in chili cultivation. This innovative approach holds promise for improving the economic and social well-being of smallholder farmers, while also promoting environmentally sustainable agricultural practices that align with broader political agendas for sustainable development.

ENHANCING BIOSORPTION POTENTIAL THROUGH TRAINING OF *ASPERGILLUS FLAVUS* TO ADSORB COPPER METAL IONS FROM INDUSTRIAL EFFLUENTS

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Abstract

The global mismanagement and undervaluation of water resources have led to widespread issues with inefficient and unsustainable water usage practices. Industrial effluents, containing various pollutants such as heavy metals, have been a significant contributor to the degradation of water and soil quality. Among these contaminants, heavy metals pose a particular environmental concern due to their tendency to bioaccumulate through the food chain and persist in ecosystems, potentially posing risks to human health and the broader ecosystem. The development of cost-effective and environmentally friendly treatment strategies for the removal of heavy metals from industrial wastewater is, therefore, a pressing need. This study aimed to explore the potential of utilizing soil fungi as a biosorption-based treatment strategy for the removal of heavy metals, particularly copper, from industrial effluents. The research focused on identifying fungal species with inherent resistance or tolerance to heavy metals, as these strains may exhibit higher biosorptive efficiency compared to their non-tolerant counterparts. Multiple fungal species were exposed to a range of copper concentrations (50 ppm to 2000 ppm) in a modified culture medium. The biomass of Aspergillus flavus demonstrated notable biosorption capabilities, with removal rates ranging from 46.23% to 57.15% for 50 ppm copper solutions, 31.65% to 45.19% for 100 ppm solutions, and 18.99% to 31.52% for 200 ppm solutions. Further investigations involved the use of binary and ternary metal solutions to assess the biosorption performance of the fungal biomass. Interestingly, the study found that the trained biomass (AFCuT-1000) exhibited significantly higher metal absorption compared to the untrained biomass (AFCu) ($t = 2.87; 1.46$). The findings of this study suggest that the selective breeding of fungal species for specific heavy metals could yield strains that outperform their original counterparts in both single-metal and multi-metal systems. This approach holds promise for the development of more effective biosorption-based water treatment technologies, which could contribute to the mitigation of heavy metal pollution in industrial effluents and address the pressing need for cost-effective and environmentally friendly solutions to heavy metal contamination in water resources.

SOCIO-ECONOMIC STATUS OF WESTERN UTTAR PRADESH GRASSES

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Abstract

Poaceae (grass family) are the fifth large family of angiosperms after Asteraceae, Orchidaceae, Fabaceae and Rubiaceae. It comprises of 780 genera and around 12,000 species. In India, it is represented by 278 genera and 1760 species while in Western Uttar Pradesh, 238 grasses in 46 genera are found. Western Uttar Pradesh is known as the green belt of Uttar Pradesh. This region has some demographic, economic and cultural patterns that are distinct from other parts of Uttar Pradesh, and more closely resemble those of Haryana, Punjab and Rajasthan states. It lies in the upper Indo-gangetic plain. The whole area

is sub-humid, fertile with sugarcane, wheat and rice as the principal crops of this region. As we know, Grasses play most important role in our life such as foods, medicines, cattle-fodder and many different things. Grass is widespread all over the world and has been used in various ways since ancient times. Grass has been considered sacred by our ancestors. The value of grasses has been respected by all civilizations around the world. The dependence of villagers on grasses for their livelihood in the study area has been assessed by socio-economic survey. This has been assessed in the perspective of lifestyle changes. Here grasses are used for the following purposes: Dinning Hut; Tree fencing/Plant fencing; Bamboo shop for fast food and juice; Ornamental grass; Farmers used as Rope; Scaffolding; Temple decoration etc. Sugar, jaggery, vinegar, ethanol etc. are produced from sugarcane. People of this region depend on grass for food and it is also widely used as animal fodder. In this study, villagers were individually asked about their preferences for different grasses. The present work is an effort to bring out the hidden knowledge about grasses in Western Uttar Pradesh for the welfare of mankind.

EXPLORING COMMUNICATION METHODS AMONG VEGETABLE GROWERS IN RAMGARH, JHARKHAND

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Abstract

Vegetables, as a cash crop, hold significant potential for enhancing the livelihoods of farmers, particularly small and marginal ones, in Jharkhand. Despite this potential, the productivity levels in Jharkhand, especially among resource-poor farmers, remain low. Improved production and productivity can be achieved through the adoption of new technologies, which necessitates access to high-quality information on vegetable cultivation. This study, conducted in 2021 in the Ramgarh district of Jharkhand, aimed to explore the communication sources used by vegetable growers. Out of the district's six blocks, four blocks comprise Gola, Dulmi, Chitarpur, and Patratu were purposively selected. Two villages from each block were chosen randomly, and 25 vegetable growers were selected randomly from each village, resulting in a sample of 200 growers. Data were collected through a well-structured interview schedule and analyzed using statistical tools like frequency, percentage, and mean score. The study revealed that personal locality channels were the most potent sources of information. Vegetable growers also utilized personal cosmopolite and mass media channels for information on vegetable cultivation technology. The data showed that among various information sources, progressive farmers (mean score 1.25), neighbors (1.12), radio (0.92), television (1.09), and SMS/Scientist (1.08) were the most commonly used by vegetable growers. Additionally, 40.82% of growers always used seeds from private agencies, and 48.85% consistently purchased insecticides/pesticides from authorized dealers.

DEVELOPMENT OF A NEW BLAST RESISTANT BREAD WHEAT VARIETY PHULE ANURAG FOR PENINSULAR INDIA UNDER RESTRICTED IRRIGATION CONDITION

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Abstract

NIAW 4028 (Phule Anurag), the new bread wheat variety developed by Agricultural Research Station, Niphad was identified and recommended by Varietal Identification Committee Meeting in 62nd AGM of All India Coordinated Research Project on Wheat & Barley held at MPUAT, Udaipur during August 2023. When tested in AICRP trials, it recorded a potential yield of 46.80 q ha^{-1} under restricted irrigation and showed stable performance across the zone by appearing 15 out of 24 times in the statistically superior group. A comprehensive screening of wheat genotypes was conducted in Jashore, Bangladesh, during 2020-21 and 2021-22 growing seasons to identify resistance sources against wheat blast disease. Total 350 entries were screened against blast at two different dates of sowing during 2020-21and out of that, 283 again tested at two different dates of sowing during 2021-22. Among the entries screened, NIAW 4028 exhibited notable resistance to wheat blast disease, with an average score of 5.0 compared to susceptible check, which scored 86.. Additionally, NIAW 4028 showed high level of resistance to leaf and stem rusts with ACI values of 1.6 for both rusts under artificial epiphytotic conditions The variety (IC No 650322) was released and notified by the Central Sub-Committee on Crop standards, Notification, and Release of Varieties in

India *vide* notification number S.O.1560 (E), dated 26th of March, 2024 for cultivation in Peninsular Zone of India comprising states of Maharashtra, Karnataka, Telangana & Andhra Pradesh and Tamil Nadu (except Nilgiris & Palani Hills).

INFLUENCE OF HEAT STRESS ON BIOCHEMICAL AND PHYSIOLOGICAL PARAMETERS IN WHEAT (*TRITICUM AESTIVUM* L.)

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Abstract

Wheat varieties namely Trimbak and Phule Samadhan were evaluated with two different sowing dates viz., 21st December 2017 and 16th January 2018 using seven treatments. viz., T1 - Control, T2 - Water spray, T3 - Spraying of Salicylic acid (SA) @ 50 ppm, T4 - Spraying of Salicylic acid (SA) @ 100 ppm, T5 - Spraying of potassium chloride @ 3 %, T6 - Spraying of ascorbic acid @50 ppm, T7 - Spraying of humic acid @ 3% at PGI Farm, MPKV, Rahuri during Rabi 2017-18. Field experiment was conducted with FRBD with three replications. The heat stress (16th Jan. sowing) had significant effect on physiological and biochemical parameters of wheat. The canopy temperature of 21st December sowing recorded significantly lower (23.480 C) than the 16th January sowing (34.070 C) irrespective of varieties and chemical sprays. The chlorophyll content of 21st December sowing recorded significantly higher (2.36 mg g^{-1} FW) than the 16th January sowing (1.75 mg g-1 FW) irrespective of varieties and chemical sprays. The proline content of 16th January sowing was recorded higher (1.95 moles g^{-1} FW) over 21st December sowing (1.54 moles g^{-1} FW). The lipid peroxidation rate content of 16th January sowing was recorded higher (50.94 nmol g^{-1} FW) over 21st December sowing (34.16 nmol g^{-1} FW) irrespective of varieties and chemical sprays. The lowest Canopy temperature (27.080 C) was recorded in spraying of humic acid @ 3% treatment whereas the highest (30.420 C) was found in control irrespective of sowing dates and varieties. The highest chlorophyll content (2.58 mg g^{-1} FW) was recorded in spraying of humic acid @ 3 % treatment whereas the lowest (1.65 mg g^{-1} FW) was found in control irrespective of sowing dates and varieties. The highest proline content (1.97 moles g^{-1} FW) was recorded in control whereas the lowest (1.52 ì moles g^{-1} FW) was recorded in humic acid @ 3 %. The highest lipid peroxidation rate (45.31 nmol g^{-1} FW) was recorded in control whereas the lowest (40.18 n moles g^{-1} FW) was found in humic acid @ 3 %. From the findings, it is concluded that there was reduction in physiological and biochemical parameters due to heat stress i.e. late sown (16th Jan.) conditions. The humic acid spray @ 3 % played a significant role in mitigating the effect of heat stress arisen due to late sown condition.

ASSESSMENT OF YIELD POTENTIAL OF WHEAT WITH DIFFERENT LEVELS OF VERMICOMPOST AND NITROGEN APPLICATION UNDER IRRIGATED CONDITIONS OF WESTERN MAHARASHTRA

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Abstract

Wheat, one of the world's most essential staple food crops, plays a crucial role in global food security.Wheat is the second most extensively cultivated cereal crop, suppliesnearly 28% dietary energy and 20% proteinworldwide. During 2022, India produced 107.7 million tonnes of wheat with an average productivity of 3537 Kg/ha(FAOSTAT 2022) and attained food security but nutritional security is still an important issue globally. However, In Maharashtra, wheat crop was cultivated on area of about 12.18 lakh hectare with the total production of 23.74 lakh tonnes having the average productivity of 1948 kg/ha in the year 2022-23. (krishimaharashtra.gov.in). Therefore, enhancing the production potential as well as nutritional value of wheat is of the utmost importance. To address the issue of low productivity as well as poor nutrient content of wheat integration of organic and inorganic fertilizers to meet out the demand of mineral nutrition of wheat.A field experiment was conducted atAgricultural Research Station, MPKV, Niphad to assess the performance of different levels of vermicompost and nitrogen in wheat production and its effect on growth and yield of wheat during the *rabi* season of 2022-23.The study aim to determine production potential of wheat with application of different levels of vermicompost and doses of nitrogen. Experimental results revealed that there was yield increment due to combined effect of application of vermicompost and nitrogen application to wheat.The findings suggest that for economical production ofwheat crop integrated management of nitrogen through vermicompost (3 t/ha) applied before sowingand optimum dose of nitrogen (100 % RDF).

ABOVEGROUND CARBON STOCK AND SOIL NUTRIENT STATUS OF *ACACIA MANGIUM* UNDER SILVIPASTORAL SYSTEM

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Abstract

Acacia mangium is highly valued tree species for its multiple uses and well suited to silvipastoral system under Agroforestry. A trial was conducted at Assam Agricultural University, Horticultural Research Station, Kahikuchi, Guwahati, Assam during 2017 to 2022. The experiment was laid in Randomaized Block Design where fodder hybrid napier was grown as intercrop with 13 years old tree species *Acacia mangium* planted at different spacing of 5 m x 6 m, 5 m x 5 m and 5 m x 4 m.The growth parameters of tree, tree height, diameter at breast height, canopy diameter, timber volume, above ground carbon stock were observed during the years. The maximum plant height (16.30 m), dbh (35.97 cm), timber volume (411.98 m^3ha^{-1}), tree biomass (512.55 Mg ha^{-1}) and above ground carbon stock (252.42 Mg ha^{-1}) were recorded in intercrop plot where tree spaced at 5 m x 4 m with fodder. Increase of organic matter in soil recorded maximum (37.76 %) in intercrop plot where tree spaced at 5 m x 4 m from initial. The highest increase of available N (29.10 %), available P_2O_5 (30.35 %)and available K_2O (14.71%) were observed in soil under tree + intercrop at spacing of 5 m x 4 m over the initial year of plantation. In silvipastoral system of agroforestry *Acacia mangium* would be a prominent species with fodder grass in climate change scenario.

ROLE OF ENDOPHYTIC BACTERIA IN PLANT DISEASE MANAGEMENT AND PLANT GROWTH PROMOTING TRAITS

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Abstract

The extensive use of fungicides to control diseases in crop plantations has resulted in resistant fungi, which has led to the accumulation of compounds potentially dangerous to humans, animals and the environment and as well increases in the costs of crop production. An alternative for chemicals is application of bacterial endophytes in bio-control of wide array of plant pathogens. Those bacteria that colonize the internal tissue of the plant showing no external sign of infection or negative effect on their host are defined as endophytic bacteria or endobacteria. Endophytic bacteria are found in roots, stems, leaves, seeds, fruits, tubers, ovules and also inside legume nodules. In most plants, roots have the higher numbers of endophytes compared with above-ground tissues. Plant growth promoting bacterial endophytes facilitate plant growth via direct and indirect mechanisms. In direct mechanism, promotion of plant growth occurs through the production of phytohormones like indole acetic acid (IAA), cytokines, Zinc (Zn) and Phosphorous (P) solubilization with enhancement in assimilable nitrogen availability to host through biological nitrogen fixation (BNF). In indirect mechanism, bacterial endophytes produce secondary metabolites *i.e.* siderophore, antibiotics, hydrogen cyanide (HCN) and enzyme like 1-Aminocyclopropane-1carboxylate (ACC) deaminase, cellulase and protease play an important role in conferring tolerance to biotic and abiotic stresses. In current time interest is increasing and scenario is changing for the biological control of plant disease using bacterial endophytes.

EFFECT OF TECHNIQUES OF FE APPLICATION FOR ENHANCINGFE CONTENT IN BREADWHEAT GROWN ON CALCAREOUS SOILS OF PLANE ZONE OF MAHARASHTRA

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Abstract

A field experiment was conducted on deep black soil at Agricultural Research Station, Niphad, Dist. Nashik, Maharashtra during year2020-21 to 2022-23. The experimental soil was calcareous and slightly alkaline in reaction. The soil was medium in organic carbon, low in available nitrogen, medium in available phosphorus, high in available potassium, deficient in

available micronutrients like Fe and Zn. The experiment was laid out in randomized block design and consisted of nine treatments with three replications. The treatments details were: T1 Absolute control; T2- General Recommended dose of fertilizers (120:60:40 N:P_2O_5:K_2O kg +10 t FYM ha^{-1}); T3-GRDF +Seed treatment with Fe EDTA (10 g kg^{-1} seed); T4-GRDF+Soil application of FeSO4 @ 20 kg ha^{-1}; T5- GRDF + Sprays of Fe EDTA (0.2 %) at tillering (40-45 DAS) and flowering stage (60-65 DAS); T6-GRDF + Sprays of Fe EDTA (0.2 %) at flowering stage (60-65 DAS) and milk stage (80-85 DAS); T7- GRDF + Soil application of FeSO4 @ 20 kg ha^{-1}+ sprays of Fe EDTA (0.2 %) at tillering (40-45 DAS) and flowering stage (60-65 DAS); T8- GRDF + soil application of FeSO4 @ 20 kg ha^{-1} + Sprays of Fe EDTA (0.2 %) at flowering stage (60-65 DAS) and milk stage (80-85 DAS): T9- GRDF + spray of vermiwash @ 4 per cent with FeSO4 @ 0.5 per cent (30 DAS). The three years pooled data revealed that all yield and yield parameters were significantly affected with soil and foliar application of Fealong with GRDF. The treatment, GRDF +soil application of $FeSO_4$ @ 20 kg ha^{-1} + sprays of Fe EDTA (0.2 %) at tillering stage (40-45 DAS) and flowering stage (60-65 DAS) significantly produced higher grain yield (46.17 q ha^{-1}) and straw yield (59.53 q ha^{-1}) of wheat along with increase in total Fe uptake (485.20 g ha^{-1}) and Mn uptake (303.9 g ha^{-1}) with higher grain iron concentration (58.30 mg kg^{-1}).It is concluded that application of $FeSO_4$ @ 20 kg ha^{-1} incubated in FYM (1:10 proportion) for one week along with general recommended dose of fertilizer (120:60:40 N:P_2O_5:K_2O kg ha^{-1} + 10 t FYM ha^{-1}) at the time of sowing followed by foliar sprays of Fe EDTA @ 0.2% at tillering stage (40-45 DAS) and flowering stage (60-65 DAS) to wheat crop is recommended for higher yield, iron concentration in grain and monetary returns in iron deficient soils of plain zone of Maharashtra.

ROLE OF WOMEN IN AGRICULTURE : CHALLENGES AND OPPORTUNITIES

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Abstract

Agriculture is a crucial sector for human survival, and women's contribution to it is undeniable. Women play a crucial role in agriculture, both in small and big farms, producing food for their households, communities, and beyond. However, despite their significant contribution, women often face cultural, social, and economic barriers that limit their productivity and ability to fully participate in agricultural development, including unequal access to resources, cultural and traditional barriers, and gender-based violence. It is observed that women play a significant role in agricultural development and allied activities including main crop production, live-stock production, horticulture, post-harvesting operations etc. About 70% of farm work is performed by women. Women farmers do not have equal access to productive resources and this significantly limits their potential in enhancing productivity. This explores the role of women in agriculture, focusing on their empowerment, equity, and leadership. It also examines the challenges and opportunities for women in agriculture, including access to education, training, land ownership, finance, technology, and markets. It highlights the importance of addressing gender inequality in agriculture to achieve sustainable development and food security.

STUDIES ON SENSORY PROPERTIES OF HERBAL GHEE

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Abstract

Ghee is commonly produced well and consumed all over in India. From time immemorial, ghee is an important part of Indian diet because it possess many health benefits and therapeutic properties. Ghee is a best source of fat-soluble vitamins such as A, D, E and K and it also provides all the essential fatty acids (linoleic acid and linolenic acid). Flaxseed is being consumed in different forms as a food ingredient. Flaxseed is also known as Linseed. It has high medicinal properties. Linseed has therapeutic properties in preventing diseases related to mammary and prostate gland, anticarcinogenic effect, possess laxative effect, has anti-inflammatory properties, reduces osteoporotic effects, and reduces the problems associated with menopause. It is also having antioxidative properties. Brahmi is a famous Ayurvedic medicinal herbs, which is re-emerging as a recourse to treatment of memory and other disorders. In the present study, the herbal ghee was prepared from buffalo ghee by using flaxseed oil at three different levels such as 5 percent, 10 percent and 15 percent and brahmi leaves were added at four different

levels such as 5 percent, 10 percent, 15 percent and 20 percent of the content. The treated ghee was compared with control (T0) ghee samples. The result of shown in present investigation, the most acceptable quality of buffalo ghee was prepared by using 10 percent flaxseed oil and 15 percent brahmi leaves. It revealed that the mean value of sensory characteristics such as flavour (aroma and taste) score, texture score, colour score and freedom from suspended impurities (ghee residue) score were found to be 48.00 ± 0.84, 28.00 ± 0.72, 8.00 ±0.72 and 8.50 ±0.56 respectively. Result shown than the addition of flaxseed oil and brahmi leaves additives in herbal buffalo ghee samples improved the sensory characteristics and most acceptability of the product.

CONSTRAINTS FACED BY FARMERS OF RAJASTHAN STATE IN THE ADOPTION OF IMPROVED KINNOW PRODUCTION TECHNOLOGY

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Abstract

Agriculture is the primary source of livelihood for about 58 per cent of country's population. In agriculture, fruit and vegetables are most growing sectors in India. Fruits are important part of daily human life and according to ministry sources, per capita availability of fruits is 115gm/day and the 200gm/day as a nutritional requirement. Many fruit crops are grown in India from them citrus ranks second after mango in terms of area and third in production after mango & banana. In citrus, Kinnow is a hybrid of two citrus cultivars *i.e.*, King (citrus nobilis) and Willow Leaf Mandarin (citrus deliciosa) developed by H.B. frost. Even after being the highest producer of fruit crops, kinnow growers are not satisfied with their production because of certain hurdles faced by them like improper management of kinnow orchards, heavy attack of insect, pest & diseases, infestation during peak crop growth period, fruit drop & relatively higher cost of mechanization, shortage of desired planting material and limited availability of FYM at the time of planting. The present study highlights the various barriers to the adoption of the improved kinnow production technology under National Horticulture Mission (NHM) by the farmers. Analysis of the constraints, including technical constraints, environmental constraints, financial constraints, marketing constraints and socio-personal & psychological constraints as experienced by the kinnow growers was the main objective of the investigation. Sri ganganagar district of Rajasthan state was purposely selected as the district had highest numbers of registered farmers under NHM compared to other districts in the state. Findings of the study revealed that the major constraints faced by the kinnow growers in the adoption of improved kinnow production technology under NHM were "unsuitable land for kinnow orchard", "scarcity of water for irrigation", "inadequate subsidy", "no timely sale of produce" and "traditional nature of farmers". This might be due to the lack of awareness and training on the part of the kinnow growers regarding improved practices of kinnow cultivation. So, in order to mitigate these constraints more periodical training on various aspects of improved kinnow production technology should be organized and imparted to the kinnow growers at the grass root level to acquire more knowledge about the new techniques/improved practices of kinnow cultivation.

CRISPR-CAS SYSTEMS BEYOND GENE EDITING : EXPANDING APPLICATIONS IN BIOTECHNOLOGY AND MEDICINE

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Abstract

CRISPR-Cas9 has emerged as a remarkable genome editing tool, revolutionizing genetics and science. With the help of this ground-breaking technology that consists of guide RNA and the Cas9 enzyme, it is possible to precisely alter DNA sequences in living things. Since its discovery as a bacterial defensive mechanism, CRISPR-Cas9 has quickly developed into a flexible technology with broad applications in a variety of fields. This article examines the history, mode of action, and range of uses of CRISPR-Cas9, from fundamental science to agriculture and health. In addition to its potential to heal genetic illnesses, increase crop yields, and deepen our understanding of gene function, it draws attention to the system's hitherto unmatched precision, efficiency, and flexibility in editing genes. There is discussion of CRISPR-Cas9's benefits over conventional

gene-editing techniques, as well as its present drawbacks and future work. The advantages of CRISPR-Cas9 over conventional gene-editing techniques are explored, along with the ongoing work to address its present drawbacks. The ethical issues surrounding CRISPR-Cas9 are also covered in this review, especially as they relate to human germline editing. Examining the technology's potential and obstacles as it develops further highlights the necessity of appropriate application and development. This thorough analysis highlights how CRISPR-Cas9 is at the forefront of genetic engineering and has the potential to transform many facets of society and research.

ORGANIC NUTRIENT MANAGEMENT ON PRODUCTIVITY AND PROFITABILITY OF SYSTEM OF MILLET INTENSIFICATION RAGI- *TORIA* SEQUENCE FOR SUSTAINABLE LIVELIHOOD OF TRIBAL FARMERS OF ODISHA

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Abstract

The system of millet intensification (SMI) principle have been followed in ragi which mainly emphasizes on utilizing early growth and vigor of seedlings, facilitates less competition for light and nutrients enhancing resource use efficiency (seeds, water, fertilizer and pesticide) ,and bring down over dependence on chemical fertilizers, promoting healthy root growth and increasing soil microbial activity; and thereby enhancing soil organic matter content. A field experiment entitled "Organic nutrient management on productivity and profitability of system of millet intensification ragi- *toria* sequence for sustainable livelihood of tribal farmers of Odisha" was carried out for two consecutive years (2020-2022) in the Agronomy Main Research Farm of OUAT, Bhubaneswar. The soil characteristics were sandy loam, slightly acidic in reaction (pH 4.64), low in organic carbon (4.24g kg-1 soil), medium in available nitrogen (298.1 kg ha-1) and available phosphorus (17.6 kg ha-1) and low in available potassium (95 kg ha-1). The treatments comprised of 4 organic sources of nutrient viz. N1: FYM (farm yard manure) @ 100% RDN (recommended dose of nitrogen), N2 : FYM @ 50% RDN (basal) + VC (vermicompost) @ 50% RDN (basal), N3 : FYM @ 50% RDN (basal) + VC@ 50% RDN(top dressing) and N4: FYM @ 25% RDN (basal + *toria* oil cake @ 25% RDN (basal) + VC @ 50% RDN (top dressing) applied to ragi during *kharif* and 3 organic nutrient management treatments viz. T1: residual (no nutrient), T2: FYM@ 50% RDN and T3: FYM@ 100% RDN applied to *toria* in *rabi* season. The growth parameters, yield attributing characters, seed yield (2092 kg ha-1), straw yield (2889.5 kg ha-1) and harvest index of ragi (42)were higher in N3 but statistically at par with N4.The protein yield, crude fibre content and Vitamin E content of ragi grains were maximum in N3(160.9 kg ha-1, 3.9g/100g and 0.16mg/100 g, respectively).The Ca, Mg, Fe and Zn content were higher in N3(346.7, 176.0, 4.88 and 3.98 mg/ 100 g seeds, respectively) but was at par with N4. In *toria*, the seed yield(871 kg ha-1) and stover yield(1820 kg ha-1) were higher in T3 but at par with T2.The oil yield of *toria* was highest in T3 (339.1kg ha-1).The system finger millet equivalent yield and the system production efficiency was highest in N3 but at par with N4 and in T3 but at par with T2. The energy profitability was also higher in N3 and at par with N4 and in *toria* it was highest in T3. However, the benefit cost ratio was highest in N3(1.92) in ragi and in *toria* it was highest in T2(1.83). Considering the system yield and economics it can be concluded that application of FYM @ 50% RDN (basal) + VC @ 50% RDN (top dressing) to finger millet and FYM @ 50% RDN to *toria* crop in sequence can be advocated to the farmers of Odisha.

Our Conference Memory

About the Chief Editor

Chief Editor

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 **25** years of experience in Research and Extension Education Works. **He authored many books** such as Plant Breeding, Agriculture at a Glance, Hand Book of Agricultural Sciences (Hindi & English), 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 Journal** (both Journals are NAAS recognized), **Secretary,** Society for Scientific Development in Agriculture & Technology and also **President,** 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; CSAUAT, 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, CSAUAT, 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, CSAUAT, 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, CSAUAT, Kanpur; IGKV, Raipur; BAU, Sabour; MPKV, Rahuri; BAU Rachi 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, CSAUAT, Kanpur; IGKV, Raipur; MPKV, Rahuri; BAU Rachi and UAHS, Shivamogga on Innovative and Current Advances in Agriculture & Allied Sciences **(ICAAAS-2021)**.

Glimpse of SSDAT & Astha Foundation's Conferences

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