



VIIIth International Conference in
Hybrid Mode on

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GRISAAS-2023

Global Research Initiatives for Sustainable Agriculture & Allied Sciences

18-20 DECEMBER 2023

Souvenir & Conference Book (GRISAAS-2023)

Chief Editor

Dr. S.P. Singh



Jointly Organized by :

Astha Foundation, Meerut (U.P.) India

&

University of Agricultural Sciences, Raichur, Karnataka, India



In Collaboration with :



AFU, Rampur
Chitwan, NEPAL



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Maharashtra, INDIA



RK (PG) College
Shamli, U.P., India



SSDAT
Meerut (UP) INDIA

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**VIIIth International Conference in Hybrid Mode on
GLOBAL RESEARCH INITIATIVES FOR
SUSTAINABLE AGRICULTURE & ALLIED SCIENCES
(GRISAAS-2023)**

18-20 DECEMBER 2023

Organized By

Astha Foundation, 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

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Rashtriya Kisan Post Graduate College, Shamli, U.P., India

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VIIIth International Conference in Hybrid Mode on
**GLOBAL RESEARCH INITIATIVES FOR
SUSTAINABLE AGRICULTURE & ALLIED SCIENCES
(GRISAAS-2023)**

SOUVENIR & CONFERENCE BOOK

Chief Editor

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नरेन्द्र सिंह तोमर
NARENDRA SINGH TOMAR

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

MINISTER OF AGRICULTURE & FARMERS WELFARE
RURAL DEVELOPMENT & PANCHAYATI RAJ
GOVERNMENT OF INDIA
KRISHI BHAWAN, NEW DELHI



MESSAGE

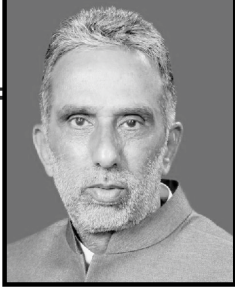
It gives me immense pleasure that the **Astha Foundation**, Meerut (U.P.) India is organizing a three days VIIIth International Conference in Hybrid Mode on “**Global Research Initiatives for Sustainable Agriculture and Allied Sciences (GRISAAS-2023)**” in Collaboration with UAS, Raichur, Karnataka; CSAUAT, Kanpur, U.P.; KSNUAHS, Shivamogga, Karnataka; HPU, Shimla, H.P.; BAU, Ranchi, Jharkhand; ICAR-CIFE, Mumbai, Maharashtra; AFU, Rampur, Chitwan, Nepal; RK (PG) College, Shamli, U.P. and Society for Scientific Development in Agriculture and Technology, Meerut (UP) India, during 18-20 December, 2023.

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

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


(Narendera Singh Tomar)

कृष्ण पाल गुर्जर
Krishan Pal Gurjar



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

MESSAGE

It is a great to welcome you all to the **VIIIth International Conference in Hybrid Mode on Global Research Initiatives for Sustainable Agriculture and Allied Sciences (GRISAAS-2023)** which is being held during 18-20 December 2023 Organized by Astha Foundation, Meerut in collaboration with UAS, Raichur, Karnataka; CSAUAT, Kanpur, U.P.; KSNUAHS, Shivamogga, Karnataka; HPU, Shimla, H.P.; BAU, Ranchi, Jharkhand; ICAR-CIFE, Mumbai, Maharashtra; AFU, Rampur, Chitwan, Nepal; RK (PG) College, Shamli, U.P. and Society for Scientific Development in Agriculture and Technology, Meerut (UP) India, during 18-20 December, 2023.

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

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

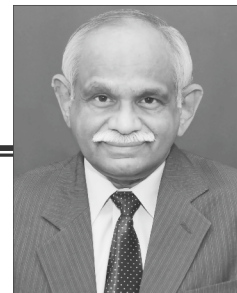


Krishan Pal Gurjar



National Academy of Agricultural Sciences

Prof. Anil Kumar Singh
Vice-President



MESSAGE

It is a matter of great pleasure to know that **Astha Foundation, Meerut** in collaboration with UAS, Raichur, Karnataka; CSAUAT, Kanpur, U.P.; KSNUAHS, Shivamogga, Karnataka; HPU, Shimla, H.P.; BAU, Ranchi, Jharkhand; ICAR-CIFE, Mumbai, Maharashtra; AFU, Rampur, Chitwan, Nepal; RK (PG) College, Shamli, U.P. and Society for Scientific Development in Agriculture and Technology, Meerut (UP) India, are organizing a three days VIIIth International Conference in Hybrid Mode on “**Global Research Initiatives for Sustainable Agriculture & Allied Sciences (GRISAAS-2023)**” during 18–20 December, 2023.

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

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


(A.K.Singh)

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

Agriculture has changed dramatically and food as well as fiber productivity soared due to new technologies, mechanization, increased chemical use, specialization and government policies that favored maximizing production. These changes allowed fewer farmers with reduced labor demands to produce the majority of the food and fiber in India. In recent years, major adverse impacts of climate change on agriculture are owing to increase in temperature, change in rainfall pattern, weather hazards, decline in soil and water quality, shifting dynamics of insects, diseases, soil flora and fauna, intrusion of sea water on land and biotic and abiotic stresses arising due to climatic extremes. There could be a few positive impacts of climate change on agriculture in some locations because of change in temperature and moisture regimes.

Greenhouse gas emissions that result from the extraction and burning of fossil fuels are major contributors to both climate change and air pollution. Many policies and individual measures, such as transport, food and energy use choices, have the potential to reduce greenhouse gas emissions and produce major health co-benefits, particularly by abating air pollution.

To address the long-term negative impacts of climate change and short and medium term impacts of climatic variability on agriculture, there is a need for sustained research on increased adaptation and mitigation, capacity building, development activities, and bringing necessary changes in policies. These actions have to be accompanied by long-term sustained actions towards generation and strengthening of strategic knowledge system in key impact sectors like water, agriculture, energy, health, etc. by building human and institutional capacity which all these are possible through sustainable agriculture.

I wish all the delegates a wonderful time, comfortable stay and innovative scientific sessions generating useful and practicable inputs for sustainable agriculture through this platform of three days international conference scheduled between 18th–20th December, 2023. I am sure deliberations of the international conference on Sustainable Agriculture will have far reaching effect for developing the futuristic strategy for the benefit of farming community on Sustainable Agriculture.

I wish for commendable success of the conference

[M. Hanumanthappa]

Vice chancellor



ಕೆಲದಿ ಶಿವಪ್ಪ ನಾಯಕ ಕೃಷಿ ವಿಶ್ವವಿದ್ಯಾಲಯ ಮತ್ತು ತೋಟಗಾರಿಕಾ ವಿಜ್ಞಾನ, ಶಿವಮೊಗ್ಗ
**KELADI SHIVAPPA NAYAKA UNIVERSITY OF AGRICULTURAL AND
HORTICULTURAL SCIENCES, SHIVAMOGGA**

Dr. R. C. Jagadeesha
M.Sc. (Agri.), Ph.D.
Vice Chancellor

Iruvakk- 577 412, Sagara Taluk
Shivamogga, District Karnataka, India

Message

It is a matter of great pleasure to know that **Astha Foundation, Meerut U.P.** and **UAS, Raichur, Karnataka** in collaboration with CSAUAT, Kanpur U.P.; HPU, Summer Hill, Shimla, H.P.; Birs Agricultural University, Ranchi, Jharkhand; ICAR-CIFE, Mumbai, Maharashtra; **KSNUAHS, Shivamogga, Karnataka**; AFU, Rampur Chitwan, Nepal and Society for Scientific Development in Agriculture and Technology, Meerut, U.P. are jointly organizing a three days VIIIth International Conference in Hybrid Mode on "Global Research Initiatives for Sustainable Agriculture and Allied Sciences (**GRISAAS-2023**)" from 18 to 20 December, 2023 in hybrid mode at University of Agricultural Sciences, Karnataka, India.

Agriculture in India is very well known since the Indus Valley Civilization. It ranks second in farm outputs worldwide and first in the world with highest net cropped area. In 2016, agriculture and allied sectors like animal husbandry, forestry and fisheries accounted 17.5% of the Gross Domestic Product (GDP) with about 41.49% of the work force in 2020. The agriculture employed > 50% of the Indian work force and contributed 17-18% to the country's GDP as per 2018. The economic contribution of agriculture of India's GDP is steadily declining with the country's broad based economic growth. In spite of this, agriculture is demographically the broadest sector and plays a significant role in the overall socio-economic fabric of India.

Agriculture is no longer an activity for sustenance 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 congratulate the organizers for their hard work and judicious planning in making this kind of academic interface possible, and wish the conference a grand success.

(R.C. Jagadeesha)



बिरसा कृषि विश्वविद्यालय BIRSA AGRICULTURAL UNIVERSITY

काँके, राँची - 834006, झारखण्ड, भारत
Kanke, Ranchi - 834006, Jharkhand (INDIA)

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



Ref. No. :

Date :

MESSAGE

Innovations can only have the answers to plateauing yield stagnation in crop productivity levels. With Challenges in several fronts as reduced land availability and increased demand for food production, crop production is being intensified through higher fertilizer inputs and cropping. The increase in production has to be achieved under conditions of declining and deteriorating land, soil and water resources and at the same time preserving the environmental quality. It will be indeed difficult to meet these daunting challenges only with the application of conventional techniques and tools, as no headway is being made through these approaches. To address the emerging challenges opportunities have to be identified to meet crop production and productivity targets so that the novel variability can be created and harnessed across the species and kingdoms. It is in this context, the three days VIIIth International Conference in Hybrid Mode on “**Global Research Initiatives for Sustainable Agriculture & Allied Sciences (GRISAAS-2023)**” organized by **Astha Foundation**, Meerut (U.P.) in collaboration with UAS, Raichur, Karnataka; CSAUAT, Kanpur, U.P.; KSNUAHS, Shivamogga, Karnataka; HPU, Shimla, H.P.; BAU, Ranchi, Jharkhand; ICAR-CIFE, Mumbai, Maharashtra; AFU, Rampur, Chitwan, Nepal; RK (PG) College, Shamli, U.P. and Society for Scientific Development in Agriculture and Technology, Meerut (UP) India, during 18–20 December, 2023.

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


(O.N. Singh)

नीलाम्बर-पीताम्बर विश्वविद्यालय



Nilamber-Pitamber University

प्रो. (डॉ.) राम लखन सिंह
पूर्व कुलपति
Prof. (Dr.) Ram Lakhan Singh
Former Vice-Chancellor



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

Date:

MESSAGE

It is a matter of great pleasure to know that **Astha Foundation, Meerut** in collaboration with UAS, Raichur, Karnataka; CSAUAT, Kanpur, U.P.; KSNUAHS, Shivamogga, Karnataka; HPU, Shimla, H.P.; BAU, Ranchi, Jharkhand; ICAR-CIFE, Mumbai, Maharashtra; AFU, Rampur, Chitwan, Nepal; RK (PG) College, Shamli, U.P. and Society for Scientific Development in Agriculture and Technology, Meerut (UP) India, are organizing a three days VIIIth International Conference on “**Global Research Initiatives for Sustainable Agriculture & Allied Sciences (GRISAAS-2023)**” during 18–20 December, 2023 in hybrid mode at UAS, Raichur, Karnataka, India.

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

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

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



भारतीय कृषि अनुसंधान परिषद

भा.कृ.अनु.प.-केन्द्रीय मात्स्यिकी शिक्षा संस्थान, मुंबई

(वि.अ.आ. अधिनियम धारा-३ के अंतर्गत विश्वविद्यालय)

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

Innovations can only have the answers to plateauing yield stagnation in crop productivity levels, with challenges in several fronts as reduced land availability and increased demand for food production, crop production is being intensified through higher fertilizer inputs and cropping. The increase in production has to be achieved under conditions of declining and deteriorating land, soil and water resources and at the same time preserving the environmental quality. It will be indeed difficult to meet these daunting challenges only with the application of conventional techniques and tools, as no headway is being made through these approaches. To address the emerging challenges opportunities have to be identified to meet crop production and productivity targets so that the novel variability can be created and harnessed across the species and kingdoms. It is in this context, the of three days VIIIth International Conference in hybrid mode on “Global Research Initiatives for Sustainable Agriculture & Allied Sciences (GRISAAS-2023)” organized by Astha Foundation, Meerut in collaboration with UAS, Raichur, Karnataka; CSAUAT, Kanpur, U.P.; KSNUAHS, Shivamogga, Karnataka; HPU, Shimla, H.P.; BAU, Ranchi, Jharkhand; ICAR-CIFE, Mumbai, Maharashtra; AFU, Rampur, Chitwan, Nepal; RK (PG) College, Shamli, U.P. and Society for Scientific Development in Agriculture and Technology, Meerut (UP) India, during 18–20 December, 2023 at UAS, Raichur, Karnataka, India.

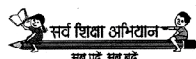
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Ravishankar C. N.

डा. रविशंकर सी.एन./ Dr. Ravishankar C.N.
निदेशक / कुलपति / Director / Vice Chancellor
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पंच मार्ग, ऑफ यारी रोड, वरसोवा, अंधेरी (प.) मुंबई - ४०० ०६१. भारत
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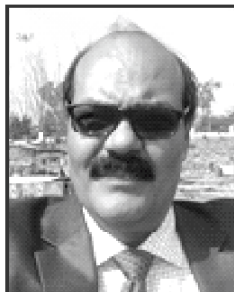


Healthy Soils for Healthy Life



Dr. Binay Kumar Chakraborty

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MESSAGE

I am extremely delighted and privileged that Astha Foundation, Meerut (U.P.) India in association with University of Agricultural Sciences, Raichur, Karnataka, India has been going to organize the 8th International Conference on "Global Research Initiatives for Sustainable Agriculture & Allied Science (GRISAAS-2023)" from 18-20 December, 2023.

The United Nations' declare seventeen Sustainable Development Goals (SDGs) to achieve decent lives for all on a healthy planet by 2030. The Aquatic resource (Aquaculture & Fisheries) has been supporting directly goal no 1. No poverty, 2. Zero hunger, 3. Good health and wellbeing, 5. Gender equality, 6. Clean water and Sanitation, 8. Decent work and economic growth, 13. Climate action and 14. Life below water. On the other hand, according to FAO 2010, the projected population of the world will be 09 billion by 2050. It should not be easy to meet the demand for food, fodder, fuel, fiber, fishery and livestock. Severe challenges of hunger, malnutrition, poor health and loss of biodiversity have to face in the coming future. These challenges are the bottle marks in the process of human development as well. The themes of the conference are very important to mitigate the dietary demand of protein and minerals for human population.

This conference will provide a platform for the research of relevant fields to contemplate and present their research papers along with the opportunity to interact with fellow researchers and academicians of their area of research. I am sure that the delegates and speakers will get a forum to exchange their ideas and come to a concrete conclusion for future Fisheries and Aquaculture developmental planning and conservation of aquatic natural resources.

I congratulate Dr. S.P. Singh, Organizing Chairman, Astha Foundation, Meerut (U.P.) India and entire team for taking up this challenging but momentous initiative. I am, therefore, confident that the three days conference would witness intense academic discourse and discussions which in turn would throw up tentative solutions to the issues in consideration.

With the warm welcome of distinguished scientists and delegates, I wish the conference a grand success in its objective and mission.

(DR. B.K. CHAKRABORTY)

डॉ रणधीर सिंह

पूर्व सहायक महानिदेशक कृषि परिसर

Dr. Randhir Singh

Former Asstt. Director General (Agricultural Extension)



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E-mail: aksicar@gmail.com



MESSAGE

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

I hope that this conference, GRISAAS-2023 will be successful in stimulating the global community to put agricultural producers at the centre of investment strategies for agriculture and allied sectors.

Warm wishes for new year and good luck

(Randhir Singh)

UNIVERSITY OF AGRICULTURAL SCIENCES, RAICHUR

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

Dr. M.G. Patil
M.Sc. (Horti.), Ph.D
Director of Education



MESSAGE

A growing movement has emerged during the past two decades to question the role of the agricultural establishment in promoting practices that contribute to social problems. Today this movement for sustainable agriculture is garnering increasing support and acceptance within mainstream agriculture. Not only does sustainable agriculture address many environmental and social concerns, but it offers innovative and economically viable opportunities for growers, laborers, consumers, policymakers and many others in the entire food system.

Widespread improvements in the quality of life of many of the world's populations have gone hand-in-hand with increased demands on natural resources. The planet is struggling to keep up, with increases in the average global temperature and the frequency of extreme weather events transforming ecosystems around the world and threatening entire species of plants and animals. Forests are drying up, there is less rainfall and more fires, and the glaciers of both the North and South Poles are shrinking. The consequences of climate change affect all of us, but in order to react and adapt to it, we must first understand it.

The threat of climate change, manifested in the increase of extreme weather conditions such as, droughts, storms or floods, has been recognized as a global priority issue. Climate change is a sustainable development challenge, with broad impacts not only on the environment but also on economic and social development. The effects of climate change will vary among regions, and between different generations, income groups and occupations as well as between women and men. Due, in part, to their lower adaptive capacities, developing countries and people living in poverty are likely to experience significant impacts.

The need of the hour is to make local bodies environment-friendly, saving water, saving energy, reducing waste, and e- wastes, adopting healthy lifestyles, adoption of natural farming, promotion of millets.

I appreciate this multi-disciplinary team for documenting overall status of programmes and policies related to sustainable agriculture in India. I am sure the International Conference on sustainable agriculture and its technical document will be useful for various stakeholders associated with this theme of adaptation in agriculture sector. In this regard, I wish the organizers, collaborators, delegates, scientific faculty, farmers and student community for the great success of the International Conference.

I wish the conference a great success.

Place : Raichur

Date : 12-12-2023


(M.G. Patil)
Director of Education
UAS, Raichur
Director of Education
UAS, Raichur

UNIVERSITY OF AGRICULTURAL SCIENCES, RAICHUR

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

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Dean (Postgraduate Studies)



MESSAGE

Stewardship of both natural and human resources is of prime importance. Stewardship of human resources includes consideration of social responsibilities such as working and living conditions of laborers, the needs of rural communities, and consumer health and safety both in the present and the future. Stewardship of land and natural resources involves maintaining or enhancing this vital resource base for the long term. In sustainable agriculture, the system is envisioned in its broadest sense, from the individual farm, to the local ecosystem, and to communities affected by this farming system both locally and globally. An emphasis on the system allows a larger and more thorough view of the consequences of farming practices on both human communities and the environment. A systems approach gives us the tools to explore the interconnections between farming and other aspects of our environment

Climate change is the defining crisis of our time and it is happening even more quickly than we feared. But we are far from powerless in the face of this global threat. As Secretary-General António Guterres pointed out in September, "the climate emergency is a race we are losing, but it is a race we can win". No corner of the globe is immune from the devastating consequences of climate change. Rising temperatures are fuelling environmental degradation, natural disasters, weather extremes, food and water insecurity, economic disruption, conflict, and terrorism. Sea levels are rising, the Arctic is melting, coral reefs are dying, oceans are acidifying, and forests are burning. It is clear that business as usual is not good enough. As the infinite cost of climate change reaches irreversible highs, now is the time for bold collective action of sustainable agriculture and allied sciences.

8th International Conference on "Global Research Initiatives for Sustainable Agriculture and Allied Sciences" is being jointly organized by University of Agricultural Sciences, Raichur, Karnataka, India and Astha Foundation, Meerut, U.P. from December 18-20, 2023 is need of the day. I am confident that the proceedings in technical sessions of the conference will be of great use to the well acclaimed scientists, researchers, students, policy makers, farmers, entrepreneurs and stake holders engaged in the area of sustainable agriculture.

I wish the conference great success.

Place : Raichur

Date : 12-12-2023


Dean(PGS)
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University Agricultural Sciences
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Agriculture and Forestry University
Faculty of Animal Science, Veterinary Science and Fisheries
Department of Aquaculture
Rampur, Chitwan, Nepal

Dr. Dilip Kumar Jha



Dated : 04-12-2023

MESSAGE

It is a matter of great pleasure to know that **Astha Foundation, Meerut U.P.** and **UAS, Raichur, Karnataka** in collaboration with CSAUAT, Kanpur U.P.; HPU, Summer Hill, Shimla, H.P.; Birsa Agricultural University, Ranchi, Jharkhand; ICAR-CIFE, Mumbai, Maharashtra; KSNUAHS, Shivamogga, Karnataka; **AFU, Rampur Chitwan, Nepal** and Society for Scientific Development in Agriculture and Technology, Meerut, U.P. are jointly organizing a three days VIIIth International Conference in Hybrid Mode on “Global Research Initiatives for Sustainable Agriculture and Allied Sciences (**GRISAAS-2023**)” during 18 to 20 December, 2023.

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.

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

Dilip Kumar Jha, PhD.
Professor and Head
Department of Aquaculture
Former Director
Curriculum Development Center



Dr. S.P. Singh
President

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MESSAGE

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

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

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

VIIIth International Conference in Hybrid Mode on “**Global Research Initiatives for Sustainable Agriculture and Allied Sciences**” (GRISAAS-2023) during 18-20 December 2023. The thematic areas chosen for the conference will be very useful for the researchers, development agencies and farmers of the country to understand the practical problems in the agricultural development of our country. Scientists have been at the forefront of our agricultural development in past. They are required to play still more critical role in ensuring sustainable agriculture development. I am sure that conference will address various aspects related to increasing productivity and food & nutritional security. Technologies have helped wipe out malnutrition and hunger and reinvigorating the innovations will spearhead path. I am sure that the outcome of this conference would be very meaningful and will be of immense use for scientists, extension workers and farmers.

S.P. SINGH

Organizing Chairman
GRISAAS-2023

ABOUT GRISAAS

Global research initiatives for sustainable agriculture and allied sciences (GRISAAS), a brain child of **Astha Foundation** to bring scientists, researchers, academicians and all stake holders from throughout the globe for the betterment of humanity with the involvement of all the branches of sciences and related field. The five different themes of sessions were planned for the GRISAAS and these themes itself explains the vision of GRISAAS. 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 Humanities.

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

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

The **third GRISAAS** International Conference was organized during 28-30th October, 2018 in collaboration of S.K.N. Agriculture University, Jobner (Rajasthan); Society for Scientific Development in Agriculture and Technology (SSDAT),

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

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

The **fifth GRISAAS** International Conference is being organized during 28-30th December, 2020 from the headquarter of Astha foundation, Meerut (U.P.). Considering the post pandemic effect and travel restrictions, it is being organized in collaboration with Society for Scientific Development in Agriculture and Technology (SSDAT), Meerut (U.P.); Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (U.P.); Bihar Agricultural University, Sabour, Bhagalpur (Bihar); Indira Gandhi Krishi Vishwavidhyalay, Raipur (Chattisgarh); University of Agriculture and Horticulture, Shivamoga (Karnataka), Bihar Agricultural University, Ranchi, Jharkhand and Swami Keshwanand Rajasthan Agricultural University, Bikaner, Rajasthan on online mode. In spite of corona pandemic it has received overwhelming response with more than 1000 registrations and presentation of more than 500 oral and posters during three days conference, As usual 11 themes will have

lead cum invited papers of experts of national and International repute in respective themes during the conference. All the lead cum invited papers and abstracts of oral and poster presentations have been compiled in souvenir and conference book and being published with ISBN number. This time it will be also available on online mode at society website www.asthafoundation.in. This conference is going to address the current scenario on farmers bills and doubts of farming community on these bills. Many of the experts including some foreign experts are expected to deliver invited papers in different themes of conference. The presence of stalwarts from the different part of country is going to have excellent deliberations and outcomes to be recommended to responsible agencies for the betterment of farmers and dairy sectors.

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

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

The **earth GRISAAS** International Conference is scheduled in hybrid mode during 18-20th December, 2023 at the University of Agricultural Sciences, Raichur, Karnataka in collaboration of Astha foundation, Meerut (U.P.). This international conference has the partner organization like the Society for Scientific Development in Agriculture and Technology (SSDAT), Meerut (U.P.); Chandra Shekhar Azad University of Agriculture & Technology, Kanpur (U.P.); Bihar Agricultural University, Ranchi, Jharkhand, KSNUAHS, Shivamogga, Karnataka; HPU, Shimla, H.P.; ICAR-CIFE, Mumbai, Maharashtra; Agriculture and Forestry University, Chitwan, Nepal and RK (PG) College, Shamli, Uttar Pradesh. Like the previous events,

GRISAAS-2023 also has the overwhelming response with more than 600 registration in the conference till date and more likely to registered 18 December in both off and on line mode. It has again proven the linkage and faith of scientific community in the Astha Foundation and SSDAT. Like seventh GRISAAS, 5 themes are in the schedule. All the lead cum invited papers and abstracts of oral and poster presentations have been compiled in souvenir and conference book and will be shortly published with ISBN number. It will also be available on online mode at Astha Foundation website www.asthafoundation.in. This conference is going to address the current scenario on farmers, agriculture, animal health care and effect of climate change on both animal and agriculture practices. Many of the experts including some foreign experts from USA, Phillipines, Nepal and Bangladesh will deliver key note address and oral presentation. The presence of stalwarts, scientists, students and extension workers in the conference and sharing their work, thoughts and visions will be useful for students, emerging scientists and for farming community. The recommendation of the three days conference have been submitted to all the major stake holders for their attention and perusal on the current issues affecting Indian rural economy.



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Lead Papers/ Invited Papers



GLOBAL RESEARCH INITIATIVES FOR SUSTAINABLE AGRICULTURE (GRISAAS)

S.P. Singh¹, Gururaj Sunkad², B.V. Tembhurme², Vijay Kr. Kurnalika², Mahender Singh³, P.B. Singh⁴,
Y.K. Singh¹, Rohit Rana⁵, Harish Pal Bhati⁶, Anil Kumar⁷, Princi⁸ and H. Nayak⁹

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⁸Jamia Humdard University, New Delhi

⁹Odisha University of Agriculture & Technology, Bhubneshwar Odisha

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

Global Agriculture Research institutes

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

Research priorities decided by CGIAR

According to Nelson and Mensbrugghe (2013) CGIAR decided public sector agricultural research priorities for sustainable food security and agricultural strategies to support food security in climate change. The focus is on the vulnerable small holder agricultural households that do not consistently and fully meet household nutritional needs. Climate change poses great risks



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

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

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

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

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

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

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



in providing technical and financial assistance for those interested in pursuing natural resource conservation and production agriculture as compatible goals.

Initiatives by United Nations for sustainable development

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

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

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

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

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

Proposed 17 Sustainable Development Goals (SDGs)?

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

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



The Global Research Alliance (GRA) : It is an international network of nine applied research organizations that works to promote application of science and technology to solve large scale issues facing developing countries. The alliance was formed in 2000 in Pretoria, South Africa. Today, the GRA has access to over 60,000 people across its membership. Vision is for a world where the application of innovative science and technology, through collaboration and co-creation, delivers access equality, improves lives, and solves global development challenges. The GRA uses the best science and technology to solve some of the biggest problems in the developing world. These global issues span borders, cultures and religions and require a cross-boundary response. They address these problems by :

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

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

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

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

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

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

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

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

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

IWRM is a process which promotes the coordinated development and management of water, land and related resources in



order to maximize economic and social welfare without compromising the sustainability of ecosystems and the environment. The network is open to all organizations involved in water resources management: developed and developing country government institutions, agencies of the United Nations, bi- and multi-lateral development banks, professional associations, research institutions, non-governmental organizations, and the private sector. In the “Our Approach” section one can read about GWP’s global strategy - Towards 2020 - how GWP are currently pursuing vision of water security. Dealing with water issues requires commitment at the highest political level. Water security will only be reached when political leaders take the lead, make the tough decisions about the different uses of water and follow through with financing and implementation. GWP sees its role as having the technical expertise and convening power to bring together diverse stakeholders who can contribute to the social and political change processes that help bring the vision of a water secure world closer to reality. GWP regularly reports on outcomes at the national, regional, and global level. GWP is implementing its strategy and up-to-date information on activities across the globe.

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

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

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

Responses to soils today :

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

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

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

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

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

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



the IPCC on a voluntary basis. Review is an essential part of the IPCC process, to ensure an objective and complete assessment of current information. IPCC aims to reflect a range of views and expertise. The Secretariat coordinates all the IPCC work and liaises with Governments. It is established by WMO and UNEP and located at WMO headquarters in Geneva. Because of its scientific and intergovernmental nature, the IPCC embodies a unique opportunity to provide rigorous and balanced scientific information to decision makers. By endorsing the IPCC reports, governments acknowledge.

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

Functions of ITPS :

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

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

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

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

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

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

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

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

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

Sustainable development in Indian Agriculture

Agriculture is the main occupation in India as large population is living in the rural areas and having agriculture as their livelihood. Sustainable development in the agriculture sector aims to increase the productivity, efficiency and level of



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

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

For promoting sustainable agriculture, following components can be considered :

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

Water-use efficiency : India is still focusing on supply side management of water. This is leading to major investments while causing degradation of ecosystems without any major benefit to farmers. The investments have to be clearly on reducing the water per unit of production. Currently, the focus of drip irrigation is only on material supply rather than the entire process and training. Creating specific incentives for using less water while improving the productivity have not even initiated. With modern technology, it is possible to create incentives to use less water and set up mechanisms to monitor water use at farm



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level. Budget should be allocated for creating well-designed projects with institutional mechanisms to implement and monitor. The goal is to use the existing infrastructure far more efficiently—both at system level and individual farm level.

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

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

Organic agriculture: India needs to slowly move from chemical-based farming to organic farming. Phase-wise approach towards removing subsidies to chemical fertilizers and introducing incentives to organic agriculture through budget provisions is the way to go about it, by conducting the conferences like GRISAAS we will be able to address these issues efficiently.



GLOBAL STATUS OF SMALL INDIGENOUS FISHES (SIS) IN BANGLADESH

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Abstract

Small indigenous fish species (SIS) contribute significantly to the nutritional as well as livelihood security of the rural mass. SIS nutrient includes copper, zinc, selenium, iodine, calcium, phosphorus magnesium, iron, cobalt, chromium and vitamin A, D and E as well as vitamins B₁, B₂, B₃ and B₁₂ that generally consumed in inadequate quantities by poorer household, and particularly important for pregnant women and children. Once, floodplain and rivers was abundant with fish fauna. Presently, multiple anthropogenic threats to the environment place ever-greater pressure on aquatic biodiversity, negatively affecting the abundance of SIS. These stresses include flood control structures, conservation of wetlands to agriculture and aquaculture, over exploitation of fish populations, invasive exotic fish species, and climate change. According to IUCN, the status of the 142 fresh water SIS fish species was ranked as four (03%) are critically endangered (CR), eighteen (13%) are endangered (EN), thirteen (09%) are vulnerable status (VU), Seventeen (12%) are lower Risk (LR), sixty six (46%) are least concern (LC) position and only twenty four (17%) are Data deficient (DD) position, respectively. But the present status of the 142 SIS fish species are ranked as twenty one (15%) are critically endangered (CR), thirty one (21%) are endangered (EN), thirty nine (27%) are vulnerable status (VU), twenty two (15%) are lower Risk (LR) and thirty one (22%) are least concern (LC) position, respectively. Some important indigenous fish species like as *Amblypharyngodon mola*, *Puntius sophore*, *Esomus danrica*, *Rohtee cotio*, *Cholisa fasciata*, *Anabas testudineus*, *Labeo bata*, *Puntius sarana*, *Ompok pabda*, *Mystus cavasius*, *Mystus tengra*, *Heteropneustes fossilis*, *Clarias batrachus* and *Macrognathus aral* are practiced for induce breeding, nursing and grow out trials. The SIS aquaculture safeguards both nutritional as well as livelihood security of the rural population.

Key words : Small indigenous species, micronutrients, minerals, vitamins, livelihood, biodiversity status.

Introduction

The fish which grow to a size of 25 cm or 9 inches at mature or adult stage in their life cycle are known as Small Indigenous Species (Felts *et al.* 1996). However, some SIS such as *Heteropneustes fossilis* can grow more than 9 inches or 25 cm. About 260 freshwater fish species (Rahman, 1989) are available in Bangladesh of which 143 has been reported as SIS. Felts *et al.* (1996) included 45 fish species to the list of SIS including carps and minnows (18 species), catfishes (9 species), perches (9 species) and others. These fishes are important source for nutrition and livelihood of major rural area of Bangladesh. Fish alone supply a per capita fish consumption of 62.58 g/day in daily dietary requirement.

The SIS have been considered as an important source of essential macro- and micro-nutrients, which play an important role in the elimination of malnutrition in the country (Ahmed *et al.* 1977, Thilsted *et al.* 1997), whereas SIS have high nutritional value in terms of protein, vitamins and minerals (Thilsted *et al.* 1997). It has also been found that small fish with bones are calcium-rich food (Larsen *et al.* 2000). In the past, the SIS were regarded as weed fish and eradicated from the fish culture ponds. There are many homestead ponds in the rural areas that are potential for aquaculture and thus can contribute homestead nutritional uplift and livelihood improvement of the rural Bangladesh.

Important source of protein from fish for the poor

Poor households are generally characterized with limited income and food availability. The purchased some basic food items might be staple foods such as cereals or grains. The cheap non-staple foods, vegetables - for example, would be only purchased when the income and staple foods were secure (Brinkman *et al.* 2009). Low-income households would consume less fish than the wealthy; however,

the low-income households are depended on fish as a major source of animal protein (Bose and Dey 2007). The consumption gap between rich and poor in meat, eggs, milk and milk products is much widened in comparison to the case of fish

(Mazumder 1998). This is because animal foods are expensive for the poor to purchase and they refer to fish for the cheap price. The fish is an important source of protein for low-income households.

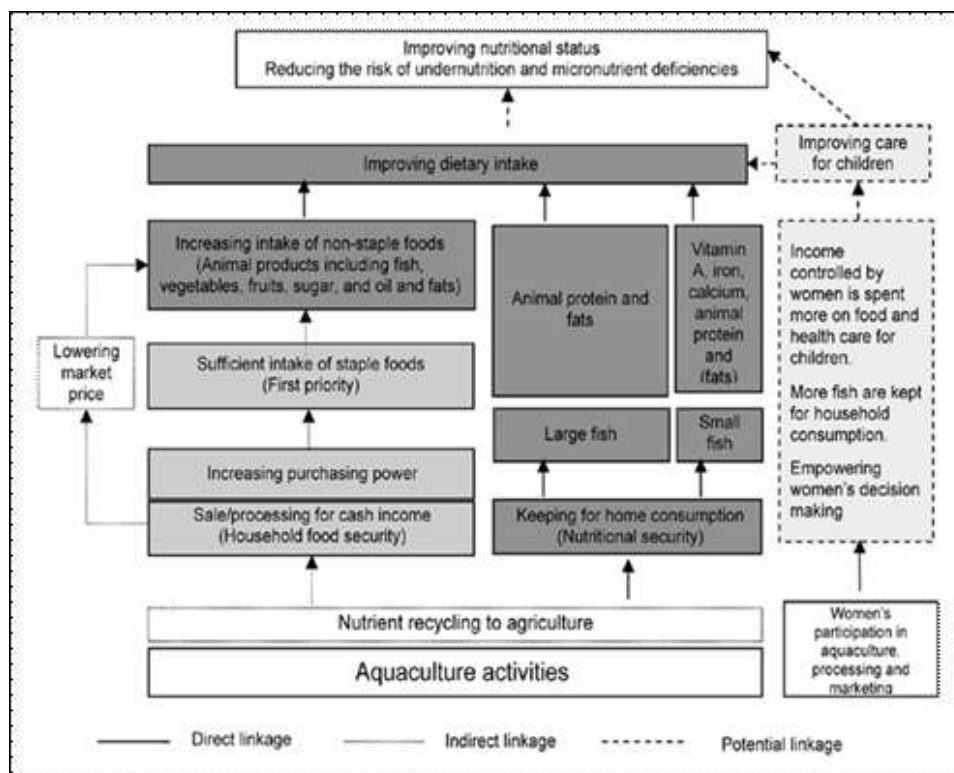


Fig-1 : The pathways through which aquaculture can improve the nutritional status adapted to (Kawarazuka 2010).

Aquaculture would improve nutritional status through exploring all types of interventions and achievement of agriculture-aquaculture integrated interventions, such as rice-fish culture, and vegetables-gardening on the dykes of fish ponds. Figure-1 demonstrates the interactions and achievements of aquaculture contribution to nutritional improvements. For aquaculture households, farmed fish becomes relatively significant because it is normally either kept for household consumption or sold for cash income. Regarding the fish for household consumption, aquaculture has also been traditionally practiced from a human nutrition perspective to improve dietary intake directly. In many developing countries, fish from small-scale aquaculture represents one, if not the principal, animal-source food for the populations, supplying both high-quality protein and essential micronutrients (Goswami and Sathiadhas 2000).

Aquaculture with Nutritional improvement and food security

A healthy diet needs to provide adequate protein, different types of essential amino acids and fatty acids (EPA/DHA) as well as vitamins and minerals. Fish can provide a rich source of these nutrients for the human population to reduce the risks of both malnutrition and non-communicable diseases (Allison *et al.* 2013). Aquaculture in a small rural farmer system provides high-quality animal protein and essential nutrients, such as pregnant women and breastfeeding, infants, and preschool children. Nearly half of all deaths worldwide have been related to malnutrition (Rajee and Mun 2017). The necessary nutrition is found mainly in fish, such as vitamin A, B₁₂, calcium, and potassium, which can protect blindness in children and death in infants (Ahmed and Garnett 2011). The consumption of the small fish as a whole including heads and bones would supplement more micronutrients, vitamins, and minerals than that of the larger one (Ahmed and Garnett 2011). The small fish species contain rich nutrients and it plays an important role in meeting the nutritional needs of the rural poor.

Methodology

A sampling catch plan was run for a long time to get a real picture of 64 districts of Bangladesh. 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 framed questionnaire. The study, being a rapid survey, gives only a broad picture of a stock of SIS that was recorded through fish harvester's,

producers, transporters and paikers, wholesaler, different market survey, directly from fishers', hatchery owner and fish farmer. Secondary data were collected mainly from the Department of Fisheries (DoF). Relevant literature was reviewed and internet sites were explored to have relevant information. The data were analyzed through one way ANOVA to find out whether any significant difference existed among different data (Zar 1984).

Results and Discussion

Beneficiaries of small-scale aquaculture

Aquaculture is provided a valuable source of high-quality food in developing countries and to be integrated into the farming systems and livelihoods of the smallholder farmers in the rural areas. Rural aquaculture refers to benefit the poor or/and the poorest in the conventional agriculture systems. Whereas the aquaculture with very low cost and very low output which was mainly consumed by aquaculture producers, the latter of Rural Aquaculture was characterized by low/medium cost, and low/medium output whereby a large share of output was sold for economic profit (Ridler and Hishamunda 2001). Small scale aquaculture increases the resilience of the rural livelihoods in developing countries in Asia (Belton 2013; Townsley 2013).

Table-1 : Chemical compositions of some SIS are shown in the following table.

Name of SIS	Water (%)	Fat (%)	Protein (%)	Ash (%)	Calcium (mg/100g)	Phosphorus (mg/100g)	Iron (mg/100g)
<i>Anabas testudineus</i>	70.0	8.80	14.8	2.00	410	390	135
<i>Channa punctatus</i>	74.0	0.60	19.4	2.60	610	530	130
<i>Glossogobius giuris</i>	79.7	0.60	14.5	2.30	370	330	104
<i>Heteropneustes fossilis</i>	68.0	0.60	22.8	1.70	670	650	226
<i>Labeo bata</i>	79.0	2.48	14.3	2.00	79.0	200	1.09
<i>Notopterus notopterus</i>	73.0	1.00	19.8	2.50	590	450	169
<i>Oxygaster bacaila</i>	77.5	4.30	14.6	2.10	590	340	1.96
<i>Puntius sarana</i>	70.2	9.50	16.5	1.53	220	120	0.54

*Source CSIR-India (1962).

Fish is considered an easily digestible food item and rich source of animal protein. SIS species contains a huge amount of Vitamin-A and Vitamin-D which are essential for human bones, teeth, skin, and eyes. SIS also supply good amount of calcium, phosphorus, iron, iodine etc. These minerals are essential for developing body resistance against disease (Table 1). Some SIS like punti (*Puntius* spp.) contains double the amount of iron another SIS, mola (*Amblypharyngodon mola*) contains three times more calcium and fifty times higher vitamin-A (Villif and Jorgensen 1993).

A. SIS Resources and their Micronutrients

Fish that can grow to 25 cm or 9 inches at the mature or adult life cycle stage are known as SIS (Roos et al. 2002). In Bangladesh out of 260 different inland fish species, Bangladesh's water bodies are home to more than 150 SIS of fish (Saha et al. 2020). Diversified water bodies (ponds, beels, haors, baors, rice fields, floodplains, etc.) are excellent breeding and rearing grounds, with an abundance of natural food, space, and appropriate environment (Mohanty et al 2013). They can spread quickly to other natural water bodies due to their ability to spawn in narrow and shallow water bodies; as the rainy season passes, their abundance rises, especially when water bodies reach their maximum levels. These water bodies do not have any naturally occurring species-specific populations. It essentially aids in obtaining the fundamental broodstock required for pond production through breeding and recruitment (Saha et al. 2020). The most common catches of SIS are Puti, Darkina, Mola, Chanda, Koi, Taki, Cheng, Tengra, Gochi, and Magur (Bogard 2015).

Different types of SIS found in natural resources such as rivers, canals, banks, ponds, low water bodies, rice fields in very varied quantities. They live in diverse and abundant ecosystems (Mohanty et al. 2015). The local people catch small fish from their local water bodies and bring them to sell in the local market. The soil topography and ecosystem sample of various rivers, channels, and rice fields of Bangladesh and eastern part of India bring diversity among small fish. The relative abundance of these species is consistent with observations made from paddy fields and associated trap ponds in the respective areas (Tacon and Metian 2013). Traditional fishing gear is usually used to collect SIS from paddy fields and attached trap ponds. Due to the structural characteristics of the equipment, fish with low biomass are more prone to such traps than fish with high biomass, resulting in species size and composition as observed of different SIS species sold on the market. Biomass and abundance

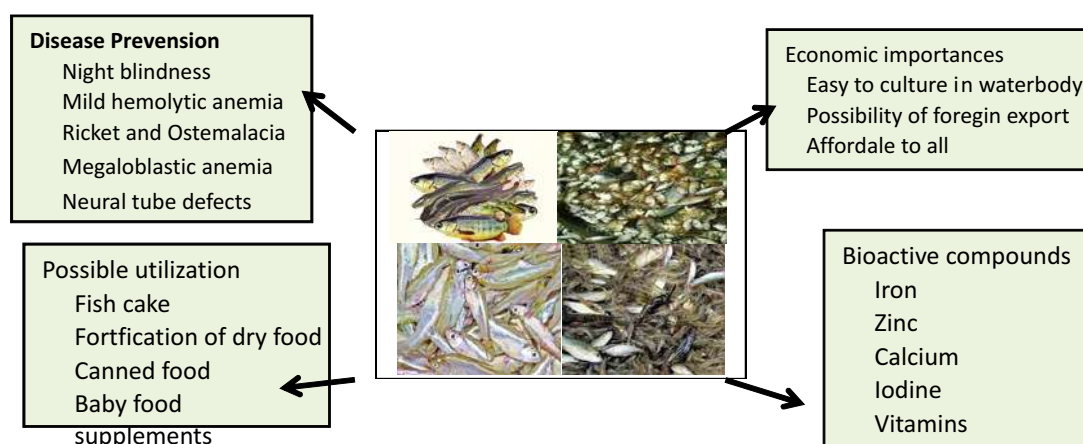


Fig.-2 : A diagram for the better utilization of SIS, their economic importance, and their impact on the human body.

characteristics of SIS are similar to those observed from the Padma River in Bangladesh (Bayen *et al.* 2016). Small fish are the only method to ensure that the next generation is talented and healthy (Fig.-2). The whole body of SIS is edible, with head, bones, eyes, and viscera, without any plate waste, making the food rich in nutrients.

B. Vitamins

Every organism needs very limited amounts of vitamins to carry out its essential tasks. Depending upon their solubility, vitamins are fat-soluble (vitamins A, D, E, K) (Thilsted *et al.*, 2016) or water-soluble (vitamin C and vitamin B complex) (Roos *et al.* 2003). The vitamins which are found in fish are discussed below.

1. Vitamin A

Vitamin A (retinol, retinoic acid) is essential for eye health, immune function, cell growth, and reproduction (Thilsted *et al.* 2016). The most common and first sign of Vitamin A deficiency is night blindness (poor vision at night or in dim light). Main sources of vitamin A are Mola and Dela fish. Mola fish has the most Vitamin A in the eyes, so one must be careful while cleaning this fish so that the head is not separated from the body and is eaten with the head, eyes, and bones.

2. Vitamin B₁₂

Vitamin B₁₂ is essential for cell division, blood formation, DNA formation, nerve function, etc. The vitamin B₁₂ content range of small fish ranged from 0.90 to 12.8 µg per 100 g, and their analytical methods varied (Roos *et al.* 2003). The highest amount was recorded in Shing fish and the lowest in Meni and Bheda fish (Roos *et al.* 2003). As the whole source of vitamin B₁₂ small fish can play a very important and increasing role in meeting its deficiency and maintaining a proper diet chart (Hossain 2010).

3. Vitamin D

Zooplankton and microalgae are considered plankton sources of vitamin D₂, and fish eat these as a part of their diet (Hossain 2010). Vitamin D helps calcium and phosphorus absorption, controls infection, reduces inflammation, prevents cancer, etc. SIS has been considered an excellent source of vitamin D (Thilsted *et al.* 2016).

4. Vitamin E

Naturally-sourced vitamin E exists in eight chemical forms: alpha-, beta-, gamma-, and delta-tocopherol, and alpha-, beta-, gamma-, and delta-tocotrienol. According to the analysis, alpha-tocopherol could not be found in 3 species (koi, chapila, baim) out of the 28 species tested. It is found to be highest (0.91 µg) in mola and lowest (0.09 µg) in kachki. Vitamin E is involved in immune function, preventing blood clogging, metabolic process, regulation of gene expression, and activity of protein kinase, and also increases the expression of two genes (Wahab *et al.* 2008).

5. Vitamin B₉ (Folate)

Maximum vitamin B₉ was obtained at 18 µg in Foli and at a minimum of m 2.9 µg in Bashpata and Kajuli. The required amount of vitamin B₉ for adults is 500–600 µg per day, but, for children, it is 80–150 µg/per day, most of which is met through the consumption of small fish in the population of Bangladesh (Roos *et al.* 2003).



C. Minerals

Minerals play a key role in managing various important physical and biological functions. Minerals are two types, micronutrients and macronutrients. Small fish usually contain a large number of macro minerals such as copper, zinc, selenium, iodine, magnesium, iron, cobalt, and chromium (Mohanty *et al.* 2013).

1. Iron

Iron's primary function in the body is to produce hemoglobin for red blood cells. About three species (chapila, darkina, and mola) can meet 25% of the RNI for PLW by having iron contents that range from 0.46 to 19 mg/100 g (Bogard *et al.* 2015). A number of locally endemic tiny fish species may considerably contribute to the consumption of iron, the most essential trace element in the diet in Bangladesh, which has a high bioavailability as foods derived from animals (Negesse and Tera 2010).

2. Zinc

Zinc involves more than 200 enzymatic reactions in catabolic processes, immune response, wound healing, and sexual maturation (Roos *et al.* 2003). The zinc concentration varies from about 0.60 to 4.7 mg/100 g in fish. Among the species, about 04 species, chela, mola, darkina, and rani, meet 25% of the RNI for PLWs, and only chela and mola meet 25% of the RNI standard for infants. Another six other SIS fish species, dhela, ekthute, kachki, mola, and tengra, fill 20 to 25 percent of RNIs, and darkina, dhela, ekthute, mola, tit punti, and rani fill 20 to 25% of RNIs for infants (Roos *et al.* 2003). SIS is rich in zinc, so they can easily be added to diet plans to meet zinc requirements.

3. Calcium

Calcium is the most abundant mineral in the body that makes up 1.5–2.0 percent of the total body weight. SIS are consumed whole with bones, calcium is treated a highly available dietary food item for humans (Burke and Segrin 2014). The importance of small fish is immense in filling calcium deficiency (Hossain 2010).

4. Iodine

The iodine content of food typically depends on its environmental conditions. The average iodine content of small freshwater fish is 43.6 µg/100 g; the highest value is 81 µg/100 g in darkina, and the lowest is 6 µg/100 g in kachki fish. Koi, shing and foli are very resourceful of iodine (Bogard *et al.* 2015). Iodine plays an essential role in regulating the biochemical functions of the human body, maintaining hormone levels, and maintaining the release of thyroxin hormone to support the body's metabolism.

5. Selenium

Selenium plays a vital part in enzymatic contrast, antioxidant and catalyst generation, cellular production, immunological function, fertility, etc. of human body. Selenium is worked to develop human skin, hair, and nails. Small fish contain selenium, which enhances thyroid function. Selenium aids in preventing cancer, cardiovascular disease, thyroid problems, oxidative damage, lowering inflammation, and preventing artery aggregation (Mohanty *et al.* 2013).

6. Other Minerals

Phosphate is essential to build block necessary for teeth and bone formation and energy production (Hossain 2010). Phosphorus ranged from 140 to 190 mg/100 g in the edible parts, including bones in small fish species, reported by FAO (Roos *et al.* 2003).

Magnesium ranged between 21 and 57 mg/100 g obtained from the whole fish body. It is essential for protein synthesis, cell replication, energy metabolism, muscle contraction, nerve conduction, and so on (Hossain 2010).

The sodium concentration of fish varied between 26 mg and 110 mg/100 g. The required amount of sodium ions is 90 g in the human body (Suo *et al.* 2021). The potassium level of fish varied from 58–350 mg/100 g. There is a link between potassium consumption and adult blood pressure decrease, which consequently affects their risk of coronary heart disease and stroke. Again digestible potassium has a preventive impact against kidney stone formation and age-related bone loss.

The manganese level of fish was 0.021–2.3 mg/100 g, which are found in small indigenous fish species. General activities of manganese on health by gluconeogenesis and the impact on cofactors of numerous enzymes are involved in carbohydrate metabolism (Hossain 2010).

The copper level of fish varied from 0.029 mg to 0.094 mg/100 g, substantially in line with other reports of small indigenous

fish. An important cofactor of the mitochondrial respiratory chain enzyme, cytochrome-C-oxidase, is involved in iron metabolism (Hossain 2010).

Nearly every species had indistinguishable levels of chromium. There is an exception of cultivated mola, which had extremely low quantities of chromium of 0.027mg/100g.

Present biodiversity status of SIS fish species in the fresh water of Bangladesh

The SIS biodiversity status (IUCN 2000) and present status of 142 freshwater SIS fish species was discussed in the figures 3 and 4. According to IUCN, the status of the 142 fresh water SIS fish species was ranked as different status. About four (03%) commercial importance species was facing as extremely higher risk of extinction (Critically endangered, CR) day-by-day. About eighteen (13%) major importance SIS fish species was facing as very high risk of extinction (Endangered, EN), thirteen (09%) SIS species was facing as high risk of extinction (Vulnerable status, VU), Seventeen (12%) SIS species were identified as Lower Risk (LR), Sixty six SIS fish species (46%) are Least concern (LC) position and only twenty four fish species (17%) are Data deficient (DD) position, respectively (Fig. 3). The present status of the 142 fresh water SIS fish species are also ranked as different status. About twenty one important SIS fish species (15%) are facing as extremely higher risk of extinction (Critically endangered, CR) day-by-day. About thirty one (21%) major commercial importance fish species was facing as very high risk of extinction (Endangered, EN), thirty nine (27%) species was facing as high risk of extinction (Vulnerable status, VU), twenty two (15%) species were identified as Lower Risk (LR) and thirty one SIS species (22%) are least concern (LC) position, respectively (Fig.-4).

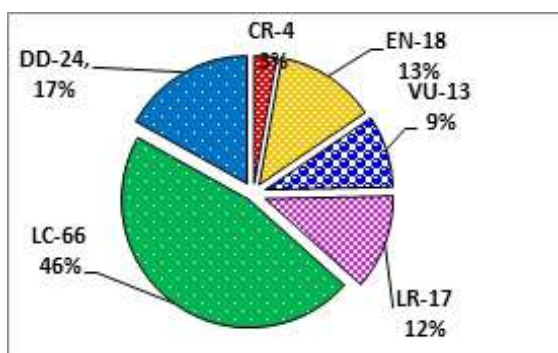


Fig.-3 : IUCN biodiversity status of fresh water SIS fishes in Bangladesh.

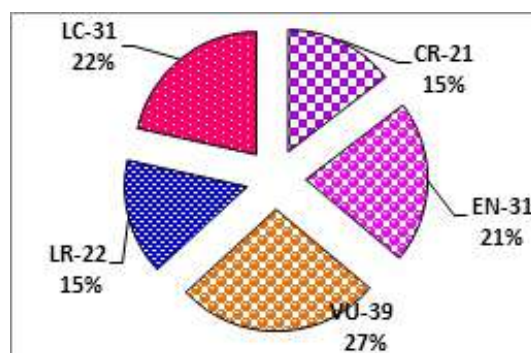


Fig.-4 : Present biodiversity status of fresh water SIS fishes in Bangladesh.

Diversify Indigenous Fish Culture

Important SIS fish species are for induced breeding to produce seed production as follows :

1. *Amblypharyngodon mola* (Hamilton 1822)

Local names of *Amblypharyngodon mola* are moa, mourala, mowka, moya (Froese and Pauly 2021). Mola is selected for induced breeding, because it's high nutritional value and good taste. Mola is rich in micronutrients (Table-3). It has high fecundity and cultivates in polyculture with other fish and currently raises good market prices (Fig.-5).



Fig-5. *Amblypharyngodon mola*

Table-3 : Nutrient composition per 100 gm of edible mola.

	Energy kj	Protein g	Fat g	Fe mg	Zn mg	Ca mg	I mg	Se mg	Vit.A µg	Vit. B µg
Natural	455	17.3	4.5	5.7	3.2	853	17	5	2503	7.98

Source : Extracted from Bogard et al. 2015.

2. *Puntius sophore* (Hamilton, 1822)

Local names of *Puntius sophore* (Fig.-6) are Phabounga, Bhadi punti, jat punti and jatputi (Froese and Pauly 2021). It is

popular for its taste and nutritious value. It is abundant in rivers, floodplains, beels and ponds. A huge amount of *P. sophore* is harvested during the dry season and conserved by drying or by fermentation. Fermentation is done by packing fish in earthen jars, and storing for at least 2 months for preparing Shidol fish. Pool barb is high in both fat and calcium as shown in Table-5.



Fig.6. *Puntius sophore*.

Table-5 : Nutrient composition per 100g of edible of pool barb.

Energy kj	Protein g	Fat g	Fe mg	Zn mg	Ca mg	I mg	Se mg	Vit. A µg	Vit. B µg
541	15.7	7.2	2.2	2.9	1042	20	9.5	54	4.01

Source : Extracted from Bogard et al. 2015.

3. Flying barb, *Esomus danricus* (Hamilton, 1822)

Local names *Esomus danricus* (Fig.-7) are darkina, darka, darikana and jhai. It has a maximum length of 13 cm, a fecundity of 392–2412 and primarily feeds on detritus and zoobenthos (Froese and Pauly 2021). Breeding was observed in June and September. Flying barb is exceptionally high in iron, zinc, iodine and vitamin B12, and vitamin A. Nutrient composition per 100 g of edible *Esomus danricus* is given in the Table-6.



Fig. 7. *Esomus danricus*.

Table-6 : Nutrient composition per 100 g of edible *Esomus danricus*.

Energy kj	Protein g	Fat g	Fe mg	Zn mg	Ca mg	I mg	Se mg	Vit.A µg	Vit. B µg
387	15.5	3.8	12	4	891	81	12	660	12.5

Source : Extracted from Bogard et al., 2015.

4. *Osteorbrama cotio* (Hamilton, 1822) Dhela

The other names of *Osteorbrama cotio* (Fig.-8) are gila khani, keti (Froese and Pauly 2021). This species is found in rivers, lakes, ponds and ditches (Rahman 1989). It has a max length of 15 cm (Menon 1999) and is an omnivorous. Dhela is high in calcium, selenium and vitamin A, as shown in Table-7.



Fig. 8. *Osteorbrama cotio*.

Table-7 : Nutrient composition per 100 g of edible dhela.

Energy kj	Protein g	Fat g	Fe mg	Zn mg	Ca mg	I mg	Se mg	Vit.A µg	Vit. B µg
387	14.7	3.8	1.8	3.7	1200	9.5	29	918	4.7

Source : Extracted from Bogard et al. 2015.

5. *Trichogaster (Colisa) fasciata* (Banded gourami)

The local names are kholiana, boro kholisha, khailsha, kholiana (Fig.-9) (Froese and Pauly 2021). It inhabits freshwater pools, ditches, ponds and marshes (Rahman 1989). Its maximum length is 12.5 cm and fecundity ranged from 1095 to 19,291 (Froese and Pauly 2021). It breeds during from April to September. Nutrient composition per 100 g of edible *Trichogaster fasciata* is given below :



Fig. 9. *Trichogaster fasciata* (Banded gourami).

Table-8 : Nutrient composition per 100 g of edible *Trichogaster fasciata*.

Energy kj	Protein g	Fat g	Fe mg	Zn mg	Ca mg	I mg	Se mg	Vit.A µg	Vit.B µg
354	15.2	2.5	4.1	2.3	1700	20	26	46	5.55

Source : Extracted from Bogard et al. 2015.

6. *Anabas testudineus* (Climbing perch)

Local names of *Anabas testudineus* (Fig.-10) are koi, Thai koi, kai, kawai. It inhabits haors, ponds, ditches, swamps and lakes. They use their tail and spiny gill covers to migrate over land into other water bodies. It is high in energy and vitamin A and has moderate amounts of selenium. According to Chanda et al. (2017), climbing perch has high PUFA content: 23.67% and 13.62% of the total fat content in small and large size fish, respectively.



Fig.-10. Climbing perch.

Table-9 : Nutrient composition per 100 g of edible climbing perch.

Energy kj	Protein g	Fat g	Fe mg	Zn mg	Ca mg	I mg	Se mg	Vit. A µg	Vit. B µg
1737	15.5	12.8	0.87	0.6	85	nd	19	295	2.38

Source : Extracted from Bogard et al. 2015.

7. Local Sarpunti, *Puntius sarana* (Hamilton)

Puntius sarana (Fig.-11) is an indigenous minor carp, locally known as ‘shar poti’. It normally breeds in streams, rivers and floodplains. This fish is omnivorous and feeds mainly on higher aquatic plants, algae, protozoan, diatoms, insects and crustaceans (Chakraborty et al. 2003). This fish is well known for its excellent taste with good market demand and nutritious value. But *P. sarana* has declined drastically in recent years due to various ecological changes. The total net production recorded 4876.07kg/ha/yr in polyculture system.



Fig.-11. Local Sarpunti, *Puntius*.

8. *Ompok pabda* (Pabda)

Ompok pabda (Fig.-12) is an endangered in Bangladesh (IUCN 2000). Body color generally silvery grey, darkest on the back and fading white on the belly. It attains 17-30 cm and it inhabits rivers, tanks and ponds (Talwar and Jhingran 1991). It is found in beels, ponds, pools, river and streams of Bangladesh. The food and feeding habit of pabda is omnivore. Body composition of pabda is 100g contains protein 19.2%, fat 2.0%, iron 0.2 g, calcium 402 mg, phosphorus 216 mg and water 79.3% (Fig.-13). It breeds during April to July (Siddique 1996). Aquaculture of this species is practicing in whole parts of Bangladesh.



Fig.-12. *Ompok pabda* (Pabda).

9. *Mystus cavasius* (Gulsa)

Mystus cavasius (Fig.-13) is a small indigenous species in Bangladesh. It is a freshwater catfish. Due to the higher market value and taste it is very popular in Bangladesh. It inhabits in rivers, floodplain and ponds. Its fecundity range is 3,314-63,135. Its conservation status is endangered. The length of this species is upto 18.0 cm. The food and feeding is carnivorous. It breeds between April and August.



Fig.-13. *Mystus cavasius*.

10. *Mystus tengra* (Tengra)

Mystus tengra (Fig.-14) is a fresh water fish. It inhabits rivers, floodplain and ponds. The Maximum length is up to 14.0 cm. Food and feeding is carnivorous. It breeds between April and August. Fecundity range number is 6770-21708. It's conservation status is endangered.



Fig.-14. *Mystus tengra*.

11. *Heteropneustes fossilis*

Heteropneustes fossilis (Fig.-15) is a small indigenous freshwater species in Bangladesh. Due to its nutritious value and test, their market value is higher. It inhabits in rivers, floodplain and ponds. Its fecundity range is 3,314-63,135 (Bhatt et al. 1977). It inhabits rivers, floodplain and ponds. They attain maximum length up to 16-30 cm. The fish is omnivore. It breeds between April and October.



Fig.-15. *Heteropneustes fossilis*.

12. *Clarias batrachus* (Magur)

Clarias batrachus (Fig.-16) is a small indigenous species. Due to its nutritious value and test, the market value is higher. It breeds between April and October. It inhabits in river, floodplain and ponds. Its fecundity range is 6,770-21,708. The length of this species is 16-35 cm. They attain maximum length upto 16-30 cm. The food and feeding habit is carnivorous.



Fig.-16. *Clarias batrachus*.

13. *Labeo bata*

Labeo bata, (Fig.-17) is an indigenous cyprinid of Bangladesh which is locally known as bata or bhangon bata. It is recognized for its excellent taste, nutritious and market value. It breeds in streams, rivers and floodplains. Indiscriminate destructive practices have caused havoc to aquatic bio-diversity (Chakraborty and Mirza 2007).



Fig.-17. Bata, *Labeo bata*

14. *Macrognathus ara* (Bloch & Schneider, 1801)

The *Macrognathus aral* (Fig.-18) one-stripe spiny eel which inhabits slow and shallow water of plains and estuaries and also found in canals, streams, beels, ponds and inundated fields (Talwar and Jhingran 1991). The species is popularly known as peacock eel in the international market also having an excellent ornamental value. The fecundity was found to range from 866 to 2074 and gonad weight from 3.56 to 5.06 g (Chakraborty 2008).



Fig.-18. *Macrognathus ara*.

Conclusions

Presently, freshwater abundance during the monsoon makes clean to a large extent. Some years, this process has been seriously hampered because the water was more or less like a stagnant pool without the strong current due to the issue of global climate change. The freshwater small scale aquaculture production is very complex and diverse in terms of production scale, integrated degree, and commercial levels which are all designed to be an alternative livelihood to produce fish and fish products to improve household food security, increase household income, and generate more employment for local villages. Small-scale aquaculture (SSA) can serve as an entry to commercial aquaculture production. As considered to be small and less risky, small-scale aquaculture can be adopted easily by resource-poor farmers. It is necessary to consider the farmer hopes and aspirations, developmental options as well as aquaculture technology for systematizing the various characterizations of small-scale aquaculture.

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RECENT ADVANCES IN KIWI FRUIT PRODUCTION

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INTRODUCTION

The Kiwi fruit (*Actinidia deliciosa* also known as Chinese Gooseberry) is native to China and centre of origin is in the mountain ranges of South Western China where it occurs naturally as a deciduous fruiting vine. Interestingly some seeds of Chinese gooseberry i.e. Kiwi fruit were introduced in New Zealand in the beginning of 20th Century from China. New Zealand nurserymen realizing its potential as a new crop, developed cultivars and standardized its cultural practices. In 1940 about 400 ha of Kiwi were under commercial cultivation which produced about 2100 tonnes of fruit in New Zealand. Since then, there has been a steady increase in plantation and production and at present Kiwi fruit industry is best developed in New Zealand. Kiwifruit (often shortened to kiwi outside Australia and New Zealand), or Chinese gooseberry, is the edible berry of several species of woody vines in the genus *Actinidia* (Lucas, 2003 and Stirk, 2005).

Kiwi is among the very few recent introductions which have surpassed in popularity due to its tremendous commercial potential in the Sub Himalayan region of India. In fact, no other fruit has attracted so much attention in such a short period in history of commercial fruit production since 1960s. In India, Kiwi was first planted in the Lal Bagh Garden (1960) at Bangalore as an ornamental tree where bud bursting didn't take place. Later on for cultivation purpose it was planted at IARI, Regional Station, Shimla (H.P.) in 1963 from USA (<https://slideshare.net/panchaal B/>). With extensive research and development support its commercial cultivation has been extended to the hilly areas in India where chilling hour requirement can be fulfilled.

Kiwi fruit originated in China and thus is often referred to as Chinese Gooseberry. The fruit has grown in significant demand in India because of its easy cultivation process, distinctive health and nutritive benefits and Lower costs and increasing profit potential.

Kiwifruit is native to central and eastern China. The first recorded description of the kiwifruit dates to 12th century China during the Song dynasty (Ward, 2013). As it was usually collected from the wild and consumed for medicinal purposes, the plant was rarely cultivated or bred. Cultivation of kiwifruit spread from China in the early 20th century to New Zealand, where the first commercial plantings occurred (Morton, 2011). The fruit became popular with British and American servicemen stationed in New Zealand during W 2011. In New Zealand during the 1940s and 1950s, the fruit became an agricultural commodity through the development of commercially viable cultivars, agricultural practices, shipping, storage, and marketing (Mike, 2017).

Kiwi or Chinese gooseberry is grown widely in New Zealand, Italy, USA, China, Japan, Australia, France, Chile, and Spain. The kiwi fruit has high nutritive and medicinal value. In India, Kiwi is mostly grown in the mid hills of Himachal Pradesh, Uttarakhand, J & K, Sikkim, Meghalaya, Arunachal Pradesh, Nilgiri hills and hills of Kerala having area of 4 thousand hectare with production 12 metric tonnes (<https://wikipedia.org/wiki/kiwi>).

In 2017, global production of kiwifruit was 4.04 million tonnes, led by China with 50% of the world's total production. Italy, New Zealand, Iran, and Chile were other major producers. An ideal condition with proper training and pruning, yield goes up to 25 tonnes/ha and more (<https://slideshare.net/panchaal B/>).

Importance and Uses

It has a thin, hair-like, fibrous, sour-but-edible light brown skin and light green or golden flesh with rows of tiny, black, edible seeds. The fruit has a soft texture with a sweet and unique flavor. Kiwis are small fruits that pack a lot of flavor and plenty of health benefits. It is a rich source of vitamin B & C and minerals like phosphorus, potassium & calcium. Kiwi Fruits are consumed fresh or combined with other fruits in salads and desserts. It is also used for the preparation of squash and wine

Raw kiwifruit contains actinidain (also spelled actinidin) which is commercially useful as a meat tenderizer (Beutel, (1990) and possibly as a digestive aid (Boland, 2013). Actinidain also makes raw kiwifruit unsuitable for use in desserts containing milk or any other dairy products because the enzyme digests milk proteins. This applies to gelatin-based desserts, due to the fact that the actinidain will dissolve the proteins in gelatin, causing the dessert to either liquefy or prevent it from solidifying.

The skin is a good source of flavonoid antioxidants. The kiwifruit seed oil contains on average 62% alpha-linolenic acid, an



omega-3 fatty acid (Anonymous, 2009) which potentially reduce risk of blood clots. It also contains Vitamin E and a small amount of vitamin A & Potassium. Kiwifruit pulp contains carotenoids, such as provitamin A beta-carotene, lutein and zeaxanthin (Sommerburg, 1998). The ratio of glucose and fructose is 1:1 hence recommended for diabetic patient also. The acids available are Citric, Malic, Quinic acids. Chlorophyll and carotenoids in association with 30 other pigments, impart the shining pale green colour to the flesh. In a 100-gram amount, green kiwifruit provides 61 calories, is 83% water and 15% carbohydrates, with negligible protein and fat. It is particularly rich (20% or more of the Daily Value, DV) in vitamin C (112% DV) and vitamin K (38% DV), has a moderate content of vitamin E (10% DV), with no other micronutrients in significant content. Gold kiwifruit has almost similar nutritional value, although only vitamin C has high content in a 100 gram amount (194% DV). Fruit is also contains a good amount of Calcium, Copper, Iron, Magnesium, Phosphorus, Potassium, Zinc.

The actinidain found in kiwifruit can be an allergen for some individuals, including children (Le TM, *et al.*, 2013). The most common symptoms are unpleasant itching and soreness of the mouth, with wheezing as the most common severe symptom; anaphylaxis may occur. It acts as allergen for those who has allergy from Papaya and Pineapple latex.

Some fruits are unpalatable, while others taste considerably better than the majority of commercial cultivars (Morton, 2011). The most commonly sold kiwifruit is derived from *A. deliciosa* (fuzzy kiwifruit). Other species that are commonly eaten include *A. chinensis* (golden kiwifruit) (Huang and Ferguson 2003). *A. coriacea* (Chinese egg gooseberry), *A. arguta* (hardy kiwifruit), *A. kolomikta* (Arctic kiwifruit), *A. melanandra* (purple kiwifruit), *A. polygama* (silver vine) and *A. purpurea* (hearty red kiwifruit).

Most kiwifruit sold belongs to a few cultivars of *A. deliciosa* (fuzzy kiwifruit): ‘Hayward’, ‘Blake’ and ‘Saanichton 12’. They have a fuzzy, dull brown skin and bright green flesh. The familiar cultivar ‘Hayward’ was developed by Hayward Wright in Avondale, New Zealand, around 1924 (Ferguson, 1999). It was initially grown in domestic gardens, but commercial planting began in the 1940s. ‘Hayward’ is the most commonly available cultivar in stores. It is a large, egg-shaped fruit with a sweet flavour. ‘Saanichton 12’, from British Columbia, is somewhat more rectangular than ‘Hayward’ and comparably sweet, but the inner core of the fruit can be tough. ‘Blake’ can self-pollinate, but it has a smaller, more oval fruit and the flavour is considered inferior (Stirk, 2005).

Kiwi berries are edible fruits the size of a large grape, similar to fuzzy kiwifruit in taste and internal appearance, but the thin, smooth green skin and lack of fuzz makes eating the entire fruit more pleasant. They are primarily produced by three species: *Actinidia arguta* (hardy kiwi), *A. kolomikta* (Arctic kiwifruit) and *A. polygama* (silver vine). They are fast-growing, climbing vines, durable over their growing season. They are referred to as kiwi berry, baby kiwi, dessert kiwi, grape kiwi, or cocktail kiwi (Anonymous, 2013).

Climate

Kiwi fruit vines are deciduous which is fairly hardy and grow in a wide range of climatic conditions, but to produce best quality Kiwi fruit they need: In summer, high temperature (>35°C) accompanied by high insulation and low humidity may cause scorching of leaves. Relative Humidity (RH) to be maintained Minimum 70% at growing period (<https://wikipedia.org/wiki/kiwi>). Kiwi is a deciduous vine which can withstand wide climatic conditions. For high yield and quality fruits, it requires 250-1000 chilling hours below 7°C depending on cultivars to break its rest period in the winter otherwise bud break may be delayed.

In India, kiwi can successfully be grown at an elevation of 800-1500 m above mean sea level (msl). A rainfall of about 1500 mm/year is sufficient. Wind is a major limiting factor in establishing a kiwi fruit farm and growing high-quality kiwi fruit. Young and flowering shoots are easily damaged, and most Kiwi orchards need protection from winds. Steep land is contoured into terraces for planting vines. The rows are to be oriented in a north-south direction to avail maximum sunlight.

Soil

Thorough preparation of the soil is essential for the successful establishment of its vineyard. Preparation of pits, a mixture of farmyard manure and filling of pits is to be completed by December.

It can be grown on a wide range of soils but deep, rich, well-drained sandy loam soils are ideal but need regular supply of nitrogen, phosphorus, and potassium once the vines begin cropping. A soil pH slightly less than 6.9 results in maximum yield but higher pH up to 7.3 affects adversely because of Mn deficiency which is a limiting factor in kiwi cultivation



(<https://wikipedia.org/wiki/kiwi>). Soil should well-drained, fertile soils, shelter from the wind, adequate moisture year-round, protection from autumn and spring frosts, protection from hail damage.

Varieties

The main kiwi varieties cultivated in India are Abbott, Allison, Bruno, Hayward, Monty, Matua and Tomuri.

Abbott: This is an early flowering and early maturing cultivar. The oblong, medium size, fruits are covered with dense hairs. They are very sweet in taste with lower ascorbic acid content and medium titratable acidity.

Allison: Fruit resembles to that of Abbott except that, it is slightly broader in proportion to its length. The petals of its flowers are overlapping and crimped along with margins. It is an early ripening, heavy bearer and sweet in taste. Ascorbic acid and titratable acidity are on the lower side. This variety is most suited for Mid and Low hills area.

Bruno: This cultivar requires comparatively less chilling period. The fruits are tapering in shape towards the stem end. They are the longest among all cultivars. The fruit is dark brown having very dense, short and bristly hair, highest in ascorbic acid. The bearing is very heavy.

Hayward: Most popular cultivar in the world so far, Hayward is comparatively shy bearer with a tendency of biennial bearing. The fruit is broad and flat, being much wider in relation to length. Largest columella (term used for central core of kiwi) among the varieties. It is superior in flavour with high sugar and low ascorbic acid content. It requires comparatively more chilling hours.

Monty: It is a late flowering cultivar but fruit maturity is not late. The fruits are oblong, resembles of Abbott and Allison. Being a prolific bearer, it needs hand thinning for obtaining good sized fruits. The fruit is somewhat wider towards blossom end with higher acidity and medium sugar content.

Pollinizer Varieties

Tomuri: It is a good pollinizer for all the cultivars specially for Hayward and Monty, the late flowering Kiwis. Flowers appear usually in groups of five. Matua is also used as pollinizer for different kiwi cultivars. Other cv, are Quinmei, Wilking super, Autari (Italy), Chico(USA)

New cultivars- Hort-16 or Golden Kiwifruit (*A.chinensis*) a smooth brown skin, Golden yellow flesh by Zspri Ltd. NZ, Marketed as Zespri Gold.

ENZA Red (Selection of Hong yang Chinese cv.) it shelves life low, however, Cv. Blake is self fertile. Cv.Top Star is Hairless smooth bud mutation of Hayward and Cv. Wilkin Super-A is famous for very large size fruit

Low chilling cultivars: Elmwood, Vincent, Summer kiwi-Hayward x Summer 4605, Mont Cap. *Actinidia arguta*-an ornamental vine and popular for small size fruit in japan.Skin can also be eaten of the varieties of this sp. Cv. Issal (self fertile). Jumbo (bold Size), Akanasnaya.

Actinidia purpurea- Red skin, Red Flesh close relative of *A.arguta*. Cv.Ken red-*A.argutavar cordifolia* x *A.melandra* 'Hort16A' is a golden kiwifruit cultivar marketed worldwide as Zespri Gold (Anonymous, 2018). This cultivar has suffered significant losses in New Zealand from late 2010 to 2013 due to the *Pseudomonas syringae actinidiae* (PSA) bacterium. A new cultivar of golden kiwifruit, Gold3, has been found to be more disease-resistant and most growers have now changed to this cultivar 'Gold3', marketed by Zespri as SunGold is not quite as sweet as the previous 'Hort16A', having a sour flavor, and lacks the usually slightly pointed tip of 'Hort16A'.

Propagation

The kiwifruit is propagated either by rooting of hardwood cuttings or by grafting cultivar scions onto seedling stocks. The cultivars available in India are all green fleshed viz., Abbott, Allison, Bruno, Hayward, and Monty.

Raising Seedlings: More than 50 kg yield is possible from a single well grown cold-hardy variety of kiwi plant. Seeds can be used for raising rootstocks. The following steps to be followed

Remove seeds from Kiwi fruit. Place kiwi seeds and water in small blender to separate gooey membrane from seeds. Wash



seeds in sink using screener. Places seeds on damp paper towel and inserts into a plastic ziplock and place in warm spot. Tear paper towel into small pieces and plants a couple of the sprouted seedlings that are stuck to it into a small pot.

Root stocks

In Italy-D1 rootstock, produced from a staminate plant by micro propagation are used as it is tolerant to calcareous soil and they give uniform growth in cropping.

TR2-Precocious fruiting for Hayward.

Bruno- Most widely used rootstock in NZ even in India also, as it is having high vigour and germination%

Hard wood cuttings: Hard wood cuttings are prepared during the dormant season (January-February) from the previous year's summer growth. Well matured dormant

shoots are used for cutting having at least three healthy bold buds from middle of the shoot. Tips of the shoots should be avoided as they give a very low rate of rooting. The cuttings of the central and basal parts are ideal. Cuttings having a greater number of spurs should not be selected. The cuttings are treated with IBA (500ppm) for 10 seconds and set deeply in moist rooting medium. To prevent the cuttings from desiccation and rotting the top portion of the cuttings are waxed. A rooting medium consisting of farmyard manure: sand: leaf compost: soil in the ratio of 1:1:1:1 result in highest rooting in open conditions. Soft wood cuttings generally root easier and quicker than hard wood cuttings but they require more attention and sophisticated propagating structure as mist chamber (Kishore and Sharma (2001).

Semi hard wood cuttings: Semi hard wood cutting with 3buds and 0.5-1.0 cm in thickness from the middle portion of the current season's growth are taken in July. A wound of about 1 cm length is made on one side of the base just below the node. Lower leaf on the basal bud are removed while two leaves are retained but reduced to 20-50% by a circular cut maintaining the natural leaf shape. The cuttings are treated with sand as the rooting media. Intermittent mist should be applied at 10 min. interval. In this method 70-75% successes can be achieved.

Grafting: Though it takes almost two years to develop a nursery plant through grafting or budding onto the seedlings but this method is easiest and most economical. The kiwi plants can be raised through grafting of kiwi seedlings during January-March depending on altitude. Whip and tongue method is ideal

Budding: Seedlings become ready for budding normally at the end of first growing season when the stem diameter is about 6-8mm. One or two buds are inserted on the main stem by T budding method at 10 cm above the ground level. Chip budding during mid-February results in bud take as high as 95%. When the bud has taken, the top or the vine is cut above the union during the following dormant season. The protection to the young growing shoot from the bud is very important because it is very brittle and easily breaks.

Planting

Before planting, Land with gentle slope to be preferred. Steep lands should be contoured into terraces. If possible, its rows should be oriented in a north direction to avail maximum sunlight. Preparation of pits, maximum of farmyard manure and filling of pits should be completed by December. Kiwi planting is usually done in the month of January. The plants are pruned hard to about 30 cm. to encourage vigorous growth. Kiwi Planting distance varies according to variety and system of training. Usually, the T-bar and pergola system is adopted for planting. In T-bar, a spacing of 4 m. from row to row and 5-6 m. from plant to plant is common whereas, in pergola system, a spacing of 6 m. from row to row should be maintained. Chinese gooseberry is a dioecious plant therefore, inter-planting of male plants is essential for fruit production. In India, only 2 male clones-Tomuri and Matua are generally inter-planted. To ensure pollination, male plants are distributed through the orchard, with male to female plant ratios around 1:9. If you have enough Space keep female vines 15 feet apart; some hardy kiwis can be planted closer together at 8 feet apart. The males do not need to be right next to the females but at least within a distance of 50 feet.

Irrigation

Kiwi plants require much water due to their vigorous vegetative growth, leaf size, vine habit and high humidity in their natural habitat. Therefore, it cannot be successfully grown in rain fed areas. Moisture stress during summer adversely affects fruit size and crop returns, therefore summer irrigation is essential to cope up with growing period of fruit. Irrigation is also needed



during September and October when the fruit is in final stage for growing and development. Irrigation at 10-15 days interval is quite satisfactory for good economic returns.

Manuring and Fertilization

A fertilizer dose of 20 kg. Farm Yard manure, 0.5 kg. NPK mixture containing 15% N is recommended for application every year. After 5 years of age, 850-900 g. N, 500-600 g. P, 800-900 g. K and farmyard manure should be applied every year. Orchards are usually fertilized in spring and early summer with 200 kilograms of nitrogen,

55 kilograms of phosphorus and 100–150 kilograms of potassium per hectare (<https://wikipedia.org/wiki/kiwi>).

Kiwi requires high Cl because its deficiency adversely affects the growth of shoot and roots. In contrast, excess levels of B and Na are harmful. The N fertilizer should be applied in two equal doses, half to two-thirds in January-February and the rest after fruit set in April-May. In young vines, the fertilizer is mixed in the soil within the periphery of the vine, and for the matured vine it is broadcast evenly over the entire soil surface.

Aftercare

In view of the danger of soil erosion in hilly areas, sod culture is more justified. The natural weed cover provides good sod and helps conserve soil and organic matter. The clover (*Trifolium* sp.) sod is most common in New Zealand. The sod or the natural weed cover should be regularly mowed and can be used as much (10 cm thick) during summers. Green manuring and intercropping with vegetables and leguminous crops can be practiced during initial 5 years of plantation.

Weeding

Frequent weeding is required to allow feeder roots to avail the nutrients and moisture without any competition. Diuron @ 3 kg ai/ha and simazine 2 kg ai/ha control all weed species except *Cyperus rotundus* Linn. Inter-cultural operations are carried out on a regular basis to remove the weeds.

Mulching with black polythene conserves moisture, controls weed population and enhances the uptake of N and K, resulting in maximum growth of the vine and yield in kiwi.

Intercropping

Inter-cropping with many vegetables and leguminous crops is beneficial during the initial five years of Kiwi Farming.

Training and pruning

Training: Training may be defined as the judicious removal of any plant part to give a proper shape. It also includes providing support, bending, tying and pinching to encourage side shoots. The ideal training system is one which facilitate different operations like pruning, culture, plant protection and harvesting. Spreads the fruits in the entire area provided for the purpose, provide good leaf exposure, avoids bigger wounds to the permanent parts of the vine and maintains the vitality of the vine over a long period. Training is required to establish and maintain a well-formed framework of main branches and fruiting arms. The supporting branches are erected even before planting the vines or thereafter as early as possible. Three types of supporting structures (fences) are constructed.

Bower System: A flat topped network or crisscross wires is prepared (2m ht) to train vines on pergola or bower system supported by pillars (concrete, stone or iron) and angle arms of iron. Holes are drilled in the angle arms at distance of 60 cm to create a criss-cross network of wires. The vine is allowed to grow single shoot till it reaches the wire network. The vine is supported by sticks/rods tied with jute string. When the vine reaches the wire, it is pinched off to facilitate production of side shoots close to the wires. Two vigorous shoots in opposite direction are selected at the wire level of training as primary arms. These are allowed to grow up to the space provided for the purpose. On each primary arm, three laterals on either side at a distance of 60 cm (along the wires) are kept as secondary arms. Thus, there will be 12 secondary arms on each vine. These secondary arms are allowed to grow and have about 8-10 tertiaries, which after maturity form fruiting canes. The vines intended to be trained on bower system are planted at 3 × 3 meters apart. The system is costly and difficult to manage but gives higher yield. Fruiting arms can be retained for longer time on pergola than T-bar

Kniffin system: In this system, two trellises of wires are strung supported by vertical posts. The vine is trained so that it has four canes, one along each wire and the bearing shoots hang freely with no typing being necessary. Several modifications have



been made in the original Kniffin system. There may be three horizontal trellises at different height. This system is not so common as bower system. It is best suited for moderately vigorous cultivars. In this system two wires are stretched horizontally at the height of 0.9 m and 0.6 m supported by iron angel poles at 4.8 m distance. Two vines spaced at 2.4 meters are accommodated between two poles. The lines are kept 3 m apart. The vines, supported kiwi by sticks/rods, grow single stem and one arm is allowed to develop horizontally along each wire on eight side. Thus, each vine will have four arms. The bearing units and the renewal wood are regaled on four permanent arms while pruning.

A single wire fence is commonly adopted though another wire is sometimes provided by some growers and then structure takes the form of Kniffin system. One 2.5 mm thick tensile wire is strung on the top of pillars which are 1.8-2.0 m high above the ground. The pillars are made of wood, concrete or iron and are erected at a distance of 6m from each other in a row. The wire tension at installation should not be over- strained otherwise wire can break at knot due to crop load.

Telephone System: In this system, the vines are allowed to grow straight up to a height of 1.5-1.6 m and then trained overhead on a canopy of usually 3 or 4 wires (45-60 cm apart) fixed to the cross-angle arms supported by poles. A cross arm (1.5 m) on the pole also carries two outrigger wires. This training is known as T-bar or overload trellis/telephone system. The laterals arising from the main branch are trained on canopy of three wires.

Pruning

The following principle should be followed in kiwi pruning: The vine should grow 2-4m every year which may become overcrowded and unmanageable if not controlled by both summer and winter pruning. The fruits develop only on current season's growth, arising from the buds developed in the previous year. Only basal 3-5 buds of the current season's growth are productive (Pramanick et al, (2015). The shoots should be developed on older wood by heading back or otherwise do not fruit normally in the first season. Good quality fruits develop on the exposed vines. A shoot dies gradually (3-4 yrs) if it is pruned just beyond the fruiting bud. This is achieved by following a 3-4-year lateral replacement system which becomes a pruning cycle.

In the beginning, a lateral arising from main rod is cut back in winter to provide enough space for 4-5 fruiting shoots in 4-5 bud intervals between two such shoots. In summer, a fruiting shoot is headed back beyond 6-8 buds from the last fruit, if there is more growth on this shoot it should be again removed in summer pruning. Thus, the summer pruning constitutes in shortening back of fruiting arms. Thinning out of crisscross and shading shoots. In dormant pruning (Winter pruning)- the fruiting lateral is cut back to two vegetative buds beyond the last fruit. In the next year, these vegetative buds produce the fruiting shoots which are pruned again.

The arms on the lateral shoot and allowed to fruit during third or fourth year. After this, the laterals are removed from the main branch and other laterals are selected and pruned accordingly so that the balance between vegetative and reproductive growth is maintained for the continuity in fruit production. Since the fruiting arm is removed after the third year it implies that about one third of the total fruiting arms are cut away from the vine each year. Dormant pruning must be completed by mid-February each year.

Pollination and Flowering

Determine if all the parts in the middle of the flower are yellow, pollen-covered anthers then these are male kiwi plants. Alternatively, notice if the centers of the flowers are filled with white stigmas, along with a few yellow anthers on the edges. These are female kiwi plants. In early summer, flowers are pollinated and thinned. Kiwifruit is not self-pollinating, so part of each orchard must be devoted to male vines unless pollen is brought in for artificial pollination. Unlike most other fruits, kiwifruit needs high

levels of pollination (about 13,000 pollen grains per stigma compared to only 12 grains for apple flowers). Growers either place numerous honey-bee hives in the orchards temporarily or artificially pollinate the flowers. Some varieties can self-pollinate, but even they produce a greater and more reliable yield when pollinated by male kiwifruit (Morton, 2011). Cross-species pollination is often (but not always) successful as long as bloom times are synchronized. In nature, the species are pollinated by birds and native bumblebees, which visit the flowers for pollen, not nectar. Each honey bee visits only a single type of flower in any foray and maybe only a few branches of a single plant. The pollen needed from a different plant (such as a male for a female kiwifruit) might never reach it were it not for the cross-pollination that principally occurs in the crowded colony. Kiwi is a dioecious plant; female flowers have stamens but pollen is not viable therefore a good yield of fruit



by planting one male vine for every five to nine female vines is required. At least, 1:9 is the common ratio to be followed. Cv. Tomuri (Sync with late var.) and Matua –sync with early and mid-season cv. Moshan no-4 (China), Pollichina syn. Chinese Belle (France), Meteor Sparkle (for zespri gold).

Fruit Growth and Development

Growth period takes about 30 weeks (7-8 months). Anthesis in India generally takes place in last week of April to 2nd week of May. Harvesting started during the month of October to 3rd week of November. Growth is very rapid in first phase about 7 week (2 months) after fertilization and become slow in next 5 week (one to one and half month) but again accelerate from 13th week onwards upto the 30th week and there is a late shrinkage on the vine before harvest. It arguably follows double or triple sigmoid growth curve. It covers almost entire growing season on temperate climate. Being a prolific bearer, 20% thinning by hand is recommended. Retaining 5-6 fruit/flowering shoot produce better, A grade, exportable fruits.

Use of Bio-regulator

For parthenocarpic fruit, 8 times NAA:BA:GA₃=> 100:50:50 ppm recommended. Yield increased by increasing fruit weight 55-60gm. Inadequate chilling can be countered by HCN (Dormex, Hi-Cane, GR,SKW Trostberg). Dormex @-2-5%, 40-50 days before bud break gives best result. CPPU (N-2- Chloro-4-pyridyl-N-phenyl urea)/Sitofix is a urea derivative, cytokinin like activity commercially used for increase fruit size, yield, sweetness and advance harvest maturity and reduce keeping quality when applied @5-20 ppm 2-3 week after full bloom/@ 10ppm dipping for 10 seconds 10 days after anthesis (Huang and Ferguson (2001).

Maturity, Harvest and Yield

Kiwi vine starts bearing at the age of 4-5 years while the commercial production starts at the age of 7-8 years. The harvesting period varies from area to area. The fruits mature earlier at a lower altitude and later at high altitudes because of variation in temperature. Under Solan, H.P. conditions, the fruits can be harvested from mid of September to third week of October depending upon cultivars, whereas under Shimla, H.P. condition, the fruits are harvested from last week of October to Last week of November. In Arunachal Pradesh, December to January is the peak.

After harvesting, the fruits are rubbed with a coarse cloth to remove stiff hairs found on their surface. Hard fruits are transported to the market. Subsequently, they lose their firmness in two weeks and become edible. On an average, kiwi yield varies from 50 to 100 kg fruits/vine. Vines on trellis produce about 25 tons/ha after seven years.

Fruit is borne on one-year-old and older canes, but production declines as each cane ages. Canes should be pruned off and replaced after their third year. In the northern hemisphere the fruit ripens in November, while in the southern it ripens in May. Four-year-old plants can produce up to 7,000 kg per acre while eight-year-old plants can produce 9,000 kg per acre. The plants produce their maximum at 8 to 10 years old.

Post harvest management of Kiwi

Storage of Kiwi: Kiwi fruits have an excellent keeping quality. The fruits can be kept in good condition in a cool place without refrigeration up to 8 weeks. It can be kept for 4 to 6 months in cold storage at -0.6°C to 0°C. Firm kiwifruit ripen after a few days to a week when stored at room temperature, but should not be kept in direct sunlight. Faster ripening occurs when placed in a paper bag with an apple, pear, or banana. Once a kiwifruit is ripe, however, it is preserved optimally when stored far from other fruits, as it is very sensitive to the ethylene gas they may emit, thereby tending to over-ripen even in the refrigerator. If stored appropriately, ripe kiwifruit normally keeps for about one to two weeks (Anonymous, 2013)

Packing of Kiwi fruit: There is no standard package for kiwi fruits. Cardboard boxes of 3-4 kg. capacity is generally used for packing. Polythene liners in storage cases are very effective in maintaining high humidity and can be used to maintain fruits in good condition for a longer period.

Insect pest in Kiwi

Leaf rollers: Different types of leaf rollers are reported to infest kiwi viz., omnivorous leaf roller: *Platynota stultana*, fruit tree leaf roller: *Archips argyrospila*; obliquebanded leaf roller: *Choristoneura rosaceana* and orange tortrix: *Argyrotaenia citrana*. Omnivorous leaf roller and the other leaf rolling caterpillars directly damage fruits by scarring the surface when they feed.



Post bloom treatment is often sufficient to keep leaf rollers under control for the remainder of the season. Different treatments are recommended for the management of leaf rollers. Biological control by using parasitic wasps and tachinid flies feed on eggs, larvae or pupae. *Bacillus thuringiensis* can be sprayed as an organic method for pest management. Need based insecticides can be used for the management of the leaf rollers.

Boxelder bug: Scientific name of boxelder bug is *Boisea trivittata*. This insect feed before bloom which causes bud and fruit drop or fruit malformation. Application of insecticides should be aimed at adult bugs and applied in early spring as flower buds are developing. It has been observed that deformities of the fruit are lessened if a bloom time spray is applied.

Armored scales: Different scale insect reported to attach kiwi viz., greedy scale (*Hemiberlesia rapax*), latania scale (*Hemiberlesia lataniae*) and oleander (Ivy) scale (*Aspidiotus nerii*). Scale insects feed on plant fluids and can be located on the bark or fruit of kiwi. Heavy infestations affect the vigor of the plant and result in the presence of scales on fruit, causing it to be off graded. Management of all the three-scale insect is same. Spray of recommended tree spray oil can effectively manage these pests.

Diseases

Ripe Rot: This rot is caused by fungus *Botryosphaeria dothidea*, develops on ripening kiwi fruit. It reduces shelf life of kiwi fruit, develop unpleasant odors as well as flavors and accelerate ripening of surrounding fruits because of ethylene production. Clean orchard practices such as removal of debris, fallen leaves, rotten fruit is ideal for the management of this disease. Avoiding wounds during harvesting, storage, packing and marketing is necessary to keep fruits healthy.

Botrytis Storage Rot: This rot is caused by *Botrytis cinerea*, develops on damaged, senescing or dead plant tissues such as flowers parts including petals, sepals and styles, blown-out canes, green leaves with dead brown tissue, dead leaves, and occasionally prunings and fallen fruit. Stamens and petals retained after anthesis are initially colonised by fungus and then young fruits are infected. Heavy infection can result into fruit drop. Stem end rot is the most common *Botrytis* storage rot which develops on the wounds caused due to picking or soon after harvesting (Morton, 2011). Clean orchard practices such as removal of debris, fallen leaves, rotten fruit is ideal for the management of this disease. Fumigation of kiwi fruit with SO₂ reduces *Botrytis* storage rot.

Sclerotinia Rot: This rot is caused by fungus *Sclerotinia sclerotiorum*, develops on flowers, shoots, leaves and fruits. It appeared as soft, water-soaked lesions on fruits covered with white cottony mycelium. This disease can be managed by removal of blossom tissues from the wine. At petal fall application of vigorous air blast spray can help to remove the senescent petals and stamens (Pennycook, 1985). Removal of weed and other fallen debris will help in the management of this disease, since the fungus *S. sclerotiorum* is saprophytic.

Armillaria root rot: This root rot is caused by a fungus *Armillaria mellea* which invades roots and result into their complete destruction. Peculiar symptom of this disease is presence of white mycelial mat under the bark near soil line, dark discolouration can be seen on cortical tissues. Rhizomorphs help in the spread of the disease from plant to plant. Water logging in the tree basin, heavy moisture creates favourable conditions for the disease. For the management of root rot procure healthy planting material. Site selection is also important. Select site having good drainage, free from history of this disease.

Bacterial blight: This disease is caused by bacteria *Pseudomonas* spp. which can infect petals, flower bud, leaves etc. On petals yellow brown discolouration can be seen whereas on leaves small yellow spot may appear. Bacteria in general enter inside the plant through natural opening or wounds. Avoid injury to the plant is the ideal practice to prevent this disease.

Crown gall: It is another bacterial disease infecting kiwi. Crown gall is caused by bacteria *Agrobacterium tumefaciens*. Galls of various size can be seen on roots and stem as a typical symptom of this disease. Once the bacteria enter into the plant it is not possible to manage this disease since it inserts its DNA into the host plant. Hence use of healthy rootstock and avoiding injuries to roots and tree trunk are only management practices.

Physiological Disorders

Flats : Fruits are more width than length. Likely to produce by two proximal flowering buds of shoots. Excess tipping during summer pruning. Excess use of PGR.

Funs: Fruits developed from fascinated/fused flower. Shapeless fruits hence less commercial value.



Drooped Shoulders: The fruit appears lop-sided with the shoulder of one side slopping away abnormally. In adequate pollination, bud not infestation and deformed structure of flower is the reason.

Freezing Damage: Flesh translucency starting at the stem end of the fruit and progressing toward the blossom end as the severity increases. Susceptible fruit become somewhat yellow fleshed with prolonged storage. There was no “graininess” observed in the fruit that showed these symptoms. Freezing damage can occur on early picked kiwifruit when stored in temperatures below 0°C or when subjected to an early frost in the vineyard.

Hard-Core: This disorder is induced by exposure of kiwifruit to ethylene plus carbon dioxide levels above & present. The fruit core fails to ripen when the remainder of the fruit is soft and ripe.

Internal Breakdown: These symptoms start as a slight discoloration (water soaking at the blossom end of the fruit. With time this progresses around the blossom end and ultimately encompasses a large part of the fruit. As symptoms progress “graininess” develops below the fruit surface beginning in the area around the blossom end of the fruit.

Pericarp Granulation: The occurrence of granulation is predominantly at the stylar end of the fruit, but as in the case of translucency may extend up the sides of fruit. The disorder also is more severe with prolonged storage and after ripening at 20°C.

Marketing of Kiwi

Growers can sell their Kiwi through agents in the market or for online selling.

Depending upon elevation, it ripens from October to December which is lean period for other fruits in the market of India. Hard fruit of Kiwi can be transported to long distances without using sophisticated packing. The fruit can be stored for one month at room temperature and for 4-5 months in cold storage at 0 degree which make it possible to supply for a long period to the market without creating a glut.

Estimated Kiwi Fruit Cost Per Acre	
Variables	Estimated Costs
Kiwi Fruit Plant Material	Rs. 10,000
Labour cost	Rs. 40,000
Irrigation cost	Rs. 80,000
Fertilizer cost	Rs. 8,000
Field preparation	Rs. 20,000
Plant protection costs	Rs. 8,000
Miscellaneous Costs	Rs. 5,000
Total cost	Rs. 1,71,000 in 1st year

In the next 6 years, planting materials, field preparation and miscellaneous costs will reduce year-to-year. Cost for 6 years will be Rs 7,80,000 (around 1,30,000 for each year i.e. Rs 1,30,000 × 6 years).

Kiwi Fruit Profit from per Acre Land

Net price of Kiwi fruit in India – Rs 10 to Rs 50.

1 kg kiwi price on average is between Rs 200 to 300 (depending on area & market).

A single tree, on average, can produce 30-50 Kg of Kiwi fruits or more depending on the age of the tree.

The earning potential from a tree that can produce 30-500 kg of kiwi fruits.

30 kg (average yield per tree) × Rs 200 (market price/kg) = Rs 6000

Thus, we can say one tree can help for earning of Rs 6000. Suppose there is an acre of land with 300 kiwi trees; the income would be 300 × 6000 = 18,00,000.

By removing the 1st year's cost from the total earnings.

Rs 18,00,000 – 7,80,000 = Rs 10,20,000 (Net Profit after 6th year onwards)



Conclusion

Kiwi fruit farming in India is highly advantageous because India has favourable climatic and soil conditions. In fact, a single Kiwi tree can produce 20-50 kgs of Kiwi fruits even more. And a single Kiwi fruit retails for Rs 10-50 in India. Therefore, farmers can earn huge profits if they wish to cultivate this green, ovular-shaped, nutritive fruit in India.

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HARNESSING CLIMATE-SMART AGRICULTURE FOR SUSTAINABLE FOOD SYSTEMS: MILLETS FOR A RESILIENT FUTURE

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Introduction

The Sustainable Development Goals (SDGs) have significantly influenced human livelihood policies. The initial goals focus on eradicating obstacles related to fundamental needs, specifically hunger and poverty. Zero Hunger addresses not just food access but also the affordability and availability of nutritious food. Zero Poverty is interconnected, encompassing various facets, including food affordability. Despite staples like rice, wheat, and maize, global malnutrition persists, highlighted by statistics such as the 2023 Global Hunger Index, ranking India 111th out of 125 countries (Global Hunger Index, 2023). Since the nineteenth century, the average temperature has risen by 0.9°C due to anthropogenic activity, mostly due to greenhouse gas (GHG) emissions in the atmosphere. Rising global average temperatures due to climate change adversely affect agricultural productivity on a global scale. Changes in temperature primarily influence the duration of the crop cycle, since each crop species and variety have optimal temperature ranges for its development. Temperatures outside these ranges compromise their development and can impact productivity. High temperatures, for example, lead to a shortened crop cycle, reducing the period for maturing of grains, which can compromise productivity. This impact extends to biophysical factors such as plant and animal growth, as well as the various aspects of food processing and distribution. Evaluating the repercussions of climate change and implementing innovative technologies and strategies to mitigate its effects are crucial for optimizing agricultural productivity to meet the increasing food demands of the growing population. Millets are recognized for their ability to withstand various climate conditions, exhibiting traits such as adaptability to diverse ecological settings, minimal need for irrigation, enhanced growth and productivity in low-nutrient environments, decreased dependence on synthetic fertilizers, and heightened resistance to environmental pressures (Kole *et al.*, 2015). The term “millets” is a collective term referring to small-grained cereals, encompassing pearl millet, sorghum, finger millet, and various small millets such as barnyard millet, foxtail millet, kodo millet, proso millet, brown top millet, and little millet. Additionally, millets excel in nutritional content compared to other primary cereals, boasting high levels of dietary fibers, resistant starches, vitamins, essential amino acids, storage proteins, and various bioactive compounds (Amadou *et al.*, 2013). These attributes have positioned millets as a preferred crop for cultivation in dry and semi-arid regions globally. Despite this, there has been relatively less emphasis on investigating the climate-resilient features of millets when compared to other major cereals.

In 2018, India declared it the National Year of Millets, acknowledging the nutritional benefits of these cereals. Diligent initiatives were undertaken to foster the promotion of millets, leading to a noticeable increase in millet production, productivity, and exports in the subsequent two years. Building on this momentum, India proposed and the United Nations adopted 2023 as the “International Year of Millets” in the General Assembly. The overarching objectives include enhancing the significance of millets in ensuring food and nutrition security, promoting the widespread adoption of millets by stakeholders, and attracting investments for research, development, and extension activities related to millets. India is the largest producer of millets in the world. India’s two crops of millets namely Pearl Millet (Bajra) and Sorghum (Jowar) together contribute approx 19 per cent in world production in 2020. India’s Pearl Millet production accounts for 40.51 per cent followed by Sorghum 8.09 per cent in the world production of Millets in 2020. Total millets cultivated on 13.633 mha, yielding 18.021 Mt of grain at a productivity of 1322 kg/ha during 2020-21 in India (Table 1). The major millets producing states in India are Rajasthan, Karnataka, Maharashtra, Uttar Pradesh, Haryana, Gujarat, Madhya Pradesh, Tamil Nadu, Andhra Pradesh and Uttarakhand. Multiple crops of millets are produced in India such as Pearl Millets, Sorghum, Finger Millet, Barnyard, Foxtail, Kodo, Proso, Little Millet and Pseudo Millets like Buckwheat and Amaranths. Pearl millet (Bajra), Sorghum (Jowar) and Finger Millet (Ragi) constitutes the largest share in India’s total production of millets.

Table-1 : Area, Production & Productivity of millets during 2020-21 in India.

Crop	Area (mha)	Production (M tonnes)	Productivity (Kg/ha)
Pearl millet	7.652	10.863	1420
Sorghum	4.378	4.812	1099
Finger millet	1.159	1.998	1724
Small millets	0.444	0.347	781
Total millets	13.633	18.021	1322

Source : Directorate of Millets Development, Jaipur.



Millets as Catalysts for Climate-Smart Agriculture

Millets emerge as the optimal selection among underutilized crops, offering a solution to agricultural challenges by thriving in shallow, less fertile soils with a pH range from 4.5 to 8.0 (Rathinapriya *et al.*, 2020). Serving as a substitute for wheat and rice, millets are often considered a crop accessible to economically disadvantaged communities, given their substantial contributions to the diets of resource-limited populations. This makes millets a promising option for cultivation in developing nations (Babele *et al.*, 2022). They also exhibit a briefer life cycle of 10-12 weeks, in contrast to the lengthier 20-24 weeks required by other significant crops, enabling them to better withstand stress. Their shorter stature, restricted leaf area, reinforced cell walls, and deep root system collectively contribute to stress resilience, mitigating potential long-term consequences (Bandyopadhyay *et al.*, 2017).

Major Millets

Millets excel in nutritional content compared to other major cereals, showcasing elevated levels of calcium, iron, potassium, magnesium, and zinc, along with essential components like vitamins, amino acids, and fatty acids (Muthamilarasan and Prasad, 2021). Renowned for their immune-boosting attributes, millets are rich in antioxidants such as quercetin, curcumin, ellagic acid, and beneficial catechins. Beyond their nutritional richness, millets contribute significantly to detoxification processes, eliminating harmful pollutants, free radicals, and neutralizing enzymes in organs, thereby serving as a preventive measure against health issues like cancer and heart disease. The presence of various vitamins (A, B6, B12, C, D, E, and folate) and trace minerals (zinc, copper, selenium, and iron) in millets actively supports the human immune system and reduces the risk of infections (Babele *et al.*, 2022). Millets, abundant in magnesium and potassium, function as vasodilators, reducing blood pressure and diminishing the likelihood of heart attacks and strokes, particularly in individuals with atherosclerosis. Notably, millets exhibit thermophilic and xerophilic characteristics, thriving in higher temperatures and reproducing with minimal water input. Moreover, in contrast to major cereal crops contributing to global warming, millets present a sustainable alternative that should be given precedence in addressing global food insecurity.

Pearl Millet : In India, pearl millet commands the largest acreage among millets, covering 7.652 million hectares and yielding 10.863 million tonnes of grain at a productivity of 1420 kg per hectare. The agricultural sector in the country grapples with significant challenges, with drought and heat ranking as primary constraints on production. In this context, pearl millet stands out as a resilient solution, naturally equipped to endure higher temperatures and lower rainfall, thus playing a pivotal role in addressing the escalating global food demands. Its nutritional profile includes being a rich source of carbohydrate, energy, resistant starch (RS), 63.2% starch, quality protein (8–19%), minerals (2.3 mg/100 g), vitamins A and B, and antioxidants like coumaric acids and ferulic acid (Goswami *et al.*, 2020). Additionally, it contains unsaturated fatty acids (75%), phytic acid for cholesterol reduction, and phytate for lowering cancer risks. The antioxidant properties, attributed to polyphenols, anthocyanins, phytosterols, tannins, and pinacosanol, contribute significantly to anti-aging effects. Furthermore, pearl millet is enriched with essential amino acids, except lysine and threonine, with relatively higher methionine content. Its gluten-free nature proves particularly advantageous for individuals with celiac diseases, providing an alternative to gluten-containing cereals like wheat (Kumar *et al.*, 2020). Its inherent drought resistance, attributed to robust rooting systems, water use efficiency, and leaf adaptations, positions it as a cornerstone in regions contending with erratic rainfall patterns (Shrestha *et al.*, 2023). The crop's ability to withstand abiotic stresses such as drought, salinity, and heat makes it well-suited for cultivation on marginal lands. Notably, pearl millet can thrive in soils with salinity levels as high as 11–12 dS/m, in contrast to rice, which exhibits poor growth and productivity in soils with salinity higher than 3 dS/m (Rathinapriya *et al.*, 2020). Collaborative initiatives between the National Agricultural Research System (NARS) in India and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) have been pivotal in developing improved breeding lines. The extensive germplasm collections, encompassing wild species from 50 countries, are conserved at the ICRISAT Gene bank and the National Bureau of Plant Genetic Resources (NBPGR) in New Delhi, India.

Sorghum : Sorghum, also known as great millet and guinea corn, is cultivated on 4.378 million hectares, yielding 4.812 million metric tons of grain at a productivity of 1099 kg/ha. Beyond its substantial contributions to agriculture, sorghum emerges as a nutritional powerhouse, rich in carbohydrates, fibres, and essential vitamins like B complex, A, C, and D. Its proteins, while exhibiting low digestibility, encompass various phenolic compounds, elevating sorghum's significance in cancer prevention, diabetes and obesity prevention, and its role as an antioxidant and anti-inflammatory agent (Xiong *et al.*, 2019). As a warm-season crop, sorghum showcases remarkable resistance to pests and diseases, reinforcing its robustness for



cultivation. Notably, its adaptability extends to thriving on marginal lands and demonstrating resilience to climatic variations across diverse agroecological regions. In arid and semi-arid areas, where food security is particularly vulnerable to climate variability, sorghum serves as a staple food. Additionally, it has gained popularity as feed, fodder, and bioenergy feedstock, emerging as a healthy alternative food grain due to its nutritional quality and associated health benefits. Cultivated predominantly in rainfed conditions, sorghum showcases drought tolerance through an extensive root system and adaptability to decreased water potential (Tari *et al.*, 2013). Despite its resilience, changing climate conditions, including rainfall variability and heat stress, pose a threat to sorghum yields. Studies suggest that due to climate change, post-rainy sorghum yields may decrease by 7% by 2020, 11% by 2050, and 32% by 2080 (Srivastava *et al.*, 2010). Climate change impacts are particularly pronounced during the reproductive and grain-filling stages, leading to both yield losses and potential reductions in the nutritional quality of the crop. Therefore, addressing these challenges is imperative to enhance crop yields without compromising nutritional quality.

Small Millets/Minor Millets

The term ‘small millets’ serves as a generic designation for coarse cereals, encompassing a diverse group of grains. This classification includes finger millet (*Eleusine coracana*), foxtail millet (*Setaria italica*), proso millet (*Panicum miliaceum*), barnyard millet (*Echinochloa crus-galli*), kodo millet (*Paspalum scrobiculatum*), little millet (*Panicum sumatrense*), teff (*Eragrostis tef*), fonio (*Digitaria exilis*), Job’s tears (*Coix lacryma-jobi*), guinea millet (*Brachiaria deflexa*), and brown top millet (*Urochloa ramosa*) (Goron *et al.*, 2015). Apart from their conventional importance, small millets are increasingly acknowledged for their nutritional content and ability to withstand challenging climatic conditions. The majority of these millets are devoid of gluten, allowing for the creation of low glycaemic index products. With shorter growth cycles, small millets prove well-suited for regions experiencing unpredictable rainfall patterns. Moreover, these crops exhibit a range of adaptations that contribute to their sustainability, including resilience to pests, diseases, and the ability to grow in nutrient-poor soils. The cultivation of small millets thus presents an opportunity for promoting food security and resilience in challenging agroecological contexts.

Finger Millet : Finger millet stands out with the highest productivity among various millets, cultivated on 1.159 million hectares and yielding 1.998 million metric tons of grain, achieving a productivity rate of 1724 kg/ha. Finger millet stands out as an exceptionally calcium-rich grain, surpassing rice and wheat in fibre and mineral content. Its distinctive qualities include a sulphur-rich amino acid profile, unique protein and lipid composition, contributing to various health benefits such as anti-diabetic, anti-ulcer, anti-diarrheal, anti-tumorigenic, atherosclerogenic, anti-inflammatory, antioxidant, and antimicrobial properties (Chandra *et al.*, 2016). Notably, this millet presents a low nitrogen fertilizer requirement, ranging from 20–60 kg/ha for optimal productivity, as highlighted by Li *et al.*, (2011). This combination of nutritional richness and agricultural efficiency positions finger millet as a valuable and health-promoting crop. Beyond its agronomic attributes, finger millet is nutritionally rich, serving as an excellent source of calcium, minerals, and fibre. Adapted to diverse climatic conditions, it possesses a C4 photosynthetic pathway and is predominantly cultivated in mid-hills and mountainous regions between 600-2500 m above mean sea level (Sood *et al.*, 2015). Its versatile cultivation makes it suitable for areas ranging from sea level to hilly regions. Finger millet fulfils the criteria of being a food security and subsistence crop, particularly in hills, drought-prone, and famine-prone regions. The crop’s resilience extends to storage, as its grains are seldom affected by storage pests, and its long shelf life, spanning several years, adds to its appeal as a food security crop (Rurinda *et al.*, 2014).

Barnyard millet : Barnyard millet, distinguished as the most fibrous among cereals with a crude fibre content ranging from 8.1% to 16.3%, is associated with enhanced blood glucose maintenance and a reduced glycaemic index when consumed regularly. Moreover, documented evidence confirms barnyard millet’s resilience to both drought and waterlogging conditions (Zegada-Lizarazu and Iijima, 2005). Unlike some millets that entirely evade drought, barnyard millet, with its rapid maturation cycle of eight weeks (Kumar *et al.*, 2018), can effectively navigate unpredictable late summer droughts or serve as a recovery crop if other grain crops face failure. Distinguished as the most fibrous among cereals, barnyard millet boasts a crude fibre content ranging from 8.1% to 16.3%. Regular consumption of this millet has been associated with enhanced blood glucose regulation and a lower glycaemic index.

Foxtail millet, Kodo Millet, Proso Millet and Little Millet : These millets emerge as exemplary climate-resilient crops, showcasing remarkable adaptability to adverse environmental conditions. Flourishing in arid and semi-arid regions, these millets boast a shortened growth cycle, enabling swift maturation despite erratic rainfall patterns and shorter growing seasons. Their intrinsic drought tolerance, coupled with the ability to thrive in marginal lands of lower fertility, underscores resilience



to water scarcity and soil limitations. Additionally, these millets exhibit temperature tolerance, withstanding heat stress more effectively than major cereals. The reduced input requirements, involving lower dependence on fertilizers and pesticides, not only mitigate environmental impact but also enhance economic viability for resource-limited farmers. Beyond their agronomic attributes, the cultivation of these millets contributes significantly to biodiversity, soil conservation, and cultural heritage, collectively positioning them as pivotal players in fostering resilient agricultural systems amid the challenges posed by a changing climate. Notably, *Setaria italica* (Foxtail Millet) demonstrates exceptional water use efficiency, requiring only 257 g of water to produce 1 g of dry biomass, a substantial improvement compared to maize and wheat (Nadeem *et al.*, 2020). Additionally, foxtail millet demonstrates increased biochemical activities when exposed to abiotic stresses, leading to heightened levels of antioxidants, reactive oxygen species, and stress-related proteins (Lata *et al.*, 2011). The presence of lysine in foxtail millet renders it a valuable protein supplement across various cereals. Noteworthy health attributes include its potential for cancer prevention, management of hypoglycaemia, and improvement of digestion, as outlined by Sharma and Niranjana (2018). The multifaceted benefits of foxtail millet underscore its significance as a nutritious and health-promoting dietary choice. Kodo millet outshines in heavy metal tolerance (copper and zinc) during the seedling stage, followed by proso millet (Arora and Katewa, 1999). Proso Millet, identified as a C4 plant with a low transpiration rate, shows susceptibility to drought but compensates by acting as a source of salinity tolerance (Seghatoleslami *et al.*, 2008; Sabir *et al.*, 2011). Little millet, when faced with drought conditions, demonstrates enhanced leaf tensile strength and increased root length, showcasing its adaptive characteristics in response to various environmental stresses (Balsamo *et al.*, 2006). Notably, little millet contains substantial iron content, ranging from approximately 10 to 18 mg per 100 g. This collective resilience, combined with diverse adaptive features and nutritional advantages, establishes these millets as essential contributors to sustainable and climate-resilient agricultural practices. Their ability to thrive under challenging conditions underscores their role in promoting resilient and resource-efficient farming.

Conclusions

Climate change has unquestionably affected the global environment, presenting substantial challenges for the agricultural sector. In response, advocating for the adoption of “climate-smart/resilient” agriculture becomes imperative, emphasizing various elements such as prioritizing locally produced minor (orphan) crops like millets. The aim is to elevate the production of nutritious food, fortify the human immune system through value addition, establish cost-effective farming systems with reduced reliance on water and chemicals, and align consumer demand with climate-resistant grains, ensuring economic viability for marginal farmers. Millets, classified as orphan crops, emerge as pivotal contributors to sustainable food systems amid climate change, showcasing inherent resilience and the exceptional ability to thrive in water-scarce and stressful environments. Their resilience traits are attributed to a unique evolutionary history, domestication in semi-arid regions, and continuous selection for stability over yield. Replicating such broad resilience in conventional cereals proves challenging due to the complex genetic basis of abiotic stress tolerance. Consequently, efforts should focus on enhancing yield traits in millets and strategically shifting global production toward these resilient and underutilized crops. Small millets, often termed as ‘smart foods’ or ‘nutri-cereals,’ exhibit superior adaptability to diverse environmental conditions, marking them as climate-resilient crops. Research on their nutritional profiles and climate resilience positions millets as potential staple crops in regions prone to hunger, offering opportunities for the processing sector to develop consumer-friendly, ready-to-use, and economically accessible food products. Realizing this potential necessitates focused field and lab-oriented research, dedicated R&D in millet cultivation and value chains, along with supportive policies. Policymakers and stakeholders play a pivotal role in enhancing climate-resilient millet crop production through proactive policies, addressing the urgent need for sustainable and nutritional food solutions in vulnerable regions.

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AGRONOMIC TECHNOLOGIES FOR ECOLOGICAL SUSTAINABILITY, PRODUCTIVITY AND PROFITABILITY

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Indian agriculture supports 17.6% of world human population, 15% of world animal population, 4.2% of world's water and 2.4% of world land area. Agronomical research and developments changed the agricultural scenario in India from "Ship to Mouth" situation in 1950s to Food Security in 2013. It revolutionized from shortage to surplus of food production and India exporting many agricultural commodities to the different parts of the world. Food grains, Pulses, Oilseeds, Cotton, Sugarcane, Horticulture, Milk, Fish, Egg (no. in billion) and Meat production enhanced by 6.21, 3.29, 7.31, 10.19, 7.56, 3.54, 12.35, 18.88, 63.54 and 4.77 times from 1950-51 production to 2021-22 production, respectively. Export of Agricultural and Processed Products Increased at the growth of 20% in 2021-22 over the previous year, Rice contributed maximum – 19% of total export followed by Sugar (9%), Spices (8%) and buffalo meat (7%). At present, the agricultural total factor productivity index (Base 2015 = 100) of India is higher than China and the World.

Emerging challenges

Indian agriculture are Low input use efficiency, Multiple nutrient deficiencies, Balanced food and nutritional security, Over exploitation of natural resources, Shrinking land resources, Build-up of pests and diseases, Farming under unfavorable environment, Reduced economic gain, Environmental pollution, Global climate change and Reduced interest of youth.

Climate change :

Global warming is likely to reach 1.5⁰C between 2030 and 2052 over 1850 to 1900 (pre industrial temperature) if it continues to increase at the current rate. This leads to warming greater than the global average is being experienced in many land regions and seasons including 2 to 3 times higher in the Arctic. Impact of climate change on Indian Agriculture Vis-a Vis other countries: Global warming of 1.5⁰C and 2⁰C will be exceeded during the 21st century unless deep reductions in CO₂ and other GHGs emissions occur in the coming decades (IPCC, 2021). The global warming affects the Loss of farm revenue due to extreme temperatures and rainfall shocks is estimated to be 12 per cent for monsoon (*kharif*) and 6 per cent for winter (*rabi*) crops with more impacts on rain fed systems (Economic Survey, 2018). The Global versus Indian perspective shows that the earth is warmer by 1.1⁰C since pre-industrial time (1850s). The GHG's emission is highest in china followed by USA, EU, India, Russia and Japan mainly from energy sector (73%), followed by agriculture (16%), industrial process (8%) and least from wastes (3%). In agriculture sector, the major contribution to GHG's is from enteric fermentation (54%), agriculture soils (19%), rice cultivation (18%), manure management (7%) and 2 per cent from burning of crop residues. The major crops (Maize, rice and wheat and other crops) grain yield will be reduced or get stagnated due to global warming. Agriculture is one of the major sectors affected by the climate change by 2030. Climate change imposes huge impact on decreased growth rate of field crops like maize and simultaneously there prices may also increase. Irrigated rice yield to reduce by 3.5% in 2050 (2041-2070) and 5% in 2080 (2070-2099) and rain fed rice yield to reduce by <2.5% in 2050 (2041-2070) and 2080 (2070-2099). In wheat crop a rise of 1⁰C in mean max & min Temp for vegetative and grain filling period can reduce wheat yield by 360 and 265 kg/ha, respectively. With every 1⁰C rise in temperature yield to be reduce by 6 million tonnes. Kharif maize yields reduction expected to be 18-23% by 2050 and 2080.

Achieving Sustainable Development Goals in Agriculture :

In 2015, United Nations set agenda for transforming our world. Identified 17 SDGs to end poverty, fight inequality and injustice and overcome the climate change by 2030. For India, achieving the SDGs is crucial for achieving decent living for all. Promoting Sustainable agricultural practices supporting small scale farmers and allowing equal access to land, technology and markets can contribute to SDGs.

Actions to be taken in Agriculture

Facilitate access to productive resources, finance and services. Connect small holders to market. Encourage diversification of production and income. Build producers' knowledge and develop their capacities. Enhance soil health and restore water and manage scarcity. Mainstream biodiversity conservation and protect ecosystem functions. Reduce losses, encourage reuse



and recycle, and promote sustainable consumption. Empower people and fight inequalities. Use social protection tools to enhance productivity and income. Improve nutrition and promote balanced diet. Prevent and protect against shocks: enhance resilience. Prepare for and respond to shocks. Address and adapt to climate change to strengthen ecosystem resilience.

Attaining Sustainable Development Goals through agronomic perspective:

Sustainable and profitable production systems, risk resilience to climate change, cost reduction and high net income. Up gradation of natural resources viz., land, soils and water. Enhance and maintain the food, nutritional, income and environmental security. Crop diversification and intercropping is an important option for sustainable food production. Deep rooted legume facilitates better root growth and reduces nutrient losses (N). Create ecological balance, increase quantitative and qualitative yields. Reduce pests, diseases, and weeds. It will also helps in climate change adaptation by increasing the number of species per unit area. Improves soil health, reduces soil erosion, and improves resource use efficiency. Crop diversification will meet the food and nutritional requirement of the farm families. Minimizes climate as well as market risk and stabilizes income. Reduces water and energy foot print. Challenges are lack of appropriate machineries for various field operations. Options for chemical weed control are limited and more labor requirement.

Ground water availability in India:

Rate of extraction of ground water is very high (more than 100 per cent) in the states of Delhi, Haryana, Punjab and Rajasthan, Himachal Pradesh, Tamil Nadu, Uttar Pradesh. Out of 4,272 blocks in the country 231 blocks are over exploited and 107 blocks are under dark. Majority of the exploited and over exploited blocks are in the rain fed areas, where the extent of ground water development is more than 85% (Economic survey, 2022). Efficient water management by upgradation of natural resources viz., land, soils and water is an important strategy. Conservation of water, minimizing wastage, efficient irrigation methods, reuse of water and reducing runoff will enhance agriculture water use efficiency. Government of India is focusing on programs like catch the rain, where it falls, when it falls and by growing the right crop. Challenges are water availability, increasing soil water salinity, inadequate technology for waste water management, increasing water pollution (Nitrate, Arsenic, Fluoride etc) and Water harvesting needs huge investments.

Integrated water management:

Rainwater harvesting in farm pond and efficient use of harvested water through micro-irrigation systems viz. rain-gun, drip and sprinklers. Through various important in-situ moisture conservation practices such as BBF, conservation furrow and ridge furrow are important for Maharashtra, North Karnataka, Gujarat, S. Karnataka and AP. Ridges and Furrow system is suitable for both water conservation and draining out excessive moisture during heavy rain spells. Soybean and Maize saved with ridge furrow systems in black soils of MP when more than 120 mm rainfall received in a day (Malwa region, and Maharashtra). More crop and income per drop of water: Enhancing water productivity in rain fed areas. Central and State Government schemes for promotion of Farm pond technology are Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), Government of Andhra Pradesh programme of *Panta Sanjeevini* envisaged one lakh farm ponds with an outlay of Rs 600 crores in Ananthapuram district, A.P., *Krishi Bhagya* programme of Government of Karnataka benefitting more than two lakh farmers from southern and northern Karnataka and *Sujala Project* of Government of Karnataka. Project on Climate Resilient Agriculture (PoCRA), Government of Maharashtra envisaged more than 50,000 farm ponds in 5000 villages.

Sustainable Nutrient Management:

Sustainable management of soil health is important to achieving several goals. Achieving critical Sustainable Development Goals by 2030 can be facilitated by soil restoration and sustainable management. Integrated and balanced nutrition and by recycling of farm waste and by harnessing the potential of micro biome. Nature based solutions and precision nutrient prescriptions.

Challenges: Imbalanced nutrition skewed towards nitrogen application, excess N application causes more nitrous oxide emission and nitrate leaching. Soil carbon depletion and lack of synchrony between nutrient supply and crop demand, Increasing multi-nutrient deficiency and lack of awareness about the deficiency in the soil.

Conservation agriculture:

Conservation agriculture is a proven adaptation and mitigation option associated with a potential to mitigate greenhouse gas



emissions. CA significantly minimizes the cost and enhances profitability. Greater energy and water use efficiency and enhances microbial diversity and activity. Reduces erosion and minimizes land degradation. **Challenges:** are weed management, access to machineries, residue availability under rain fed conditions, nematode and rodent, termite problems in long term CA system and iron deficiency in direct seeded rice.

Potential of Conservation Agriculture for Soil Carbon Sequestration and Climate Resilience: Various CA systems were evaluated for drought mitigation, soil carbon build up, productivity enhancement, soil biodiversity, soil health and reducing GHG emissions. To regenerate the degraded lands and to improve soil biological processes. CA will recycle the crop residues and to conserve soil and water. Mechanization in CA will improve the resource use efficiency and will increase the yields and reduce the cost of production.

Changes associated with residue under Conservation Agriculture (CA): Soil Physical, chemical and biological Properties. Conservation Agriculture improved soil aggregation and lower the Bulk density as compared to Conventional tillage. Lesser soil penetration resistance reduced soil disturbance and Increased soil organic matter in CA systems. Crop residues accumulate on soil surface, reduced nutrient loss through erosion and evaporation, increases water infiltration rates and lowers the soil temperature. Slow nutrient release from the added crop residues and reduced diffusion of nutrients to the plant roots. Multiple benefits through Conservation Agriculture in rain fed systems are increased soil organic carbon, increase in rainwater use efficiency, increased percent of water stable aggregates, SOC and higher soil moisture content. Major constraints in adoption of CA technologies under rain fed conditions are non-availability of crop residues, Lack of proper machinery for sowing and large Investment costs. The menace of termites in alfisols and rodent problem in vertisols are severe.

Minimizing GHG's emissions through alternative technologies:

Baler for making bundles to biomass based power plants as fuel, straw chopper cum shredder- zero till sowing (ZT), Paddy combine harvester with straw management system (ZT), Rotavator for incorporation of paddy straw, Reversible MB plough, Use of straw as livestock feed and bedding material and use of straw as soil mulch in orchards. Agro-forestry for enhancing landscape productivity and ecosystem restoration, Biochar a mean for reducing GHGs. Regenerative agriculture, integrated farming system, Natural Farming, precision farming, Optimizing nutrient use efficiencies, climate Smart Farm Machinery and sensor based farming

Eco-friendly agricultural systems:

Practices like organic farming, natural farming and regenerative agriculture are ecologically compatible. It reduces input costs, ensures better income and financial stability, which in turn alleviate poverty, brings in gender equality and ensure sustainable production and consumption patterns. It ensure food security and zero hunger through better yield, diversity in cropping and access to suite of nutritional sources and income-generating crops throughout the year.

Organic and Natural Farming in India:

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 in the soil 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 borrowed 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>). **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; 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.

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->).

Research experience of UAS Dharwad:

Based on results of the experiments carried out at UAS Dharwad in different crops showed that 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. 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 and Organic farming will act as an alternative agricultural practices for rejuvenating soil and resilient agricultural practices. Organic and natural Farming also extend other sets of agro-ecological benefits such as minimum energy use, water pollution, maintaining bio-diversity, better ecosystem services, employment for workers, reduced exposure to pesticides, minimum pesticide residues, reduced soil erosion, reduced nutrient loss due to erosion, more storage of water in soil, and improved nutritional quality for livestock and human population (Chandrashekara, C.P.).

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AGRICULTURAL TRANSFORMATION FOR SUSTAINABLE FOOD SYSTEMS

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Abstract

Agriculture is the primary source of food for the global population. The cultivation of crops and the rearing of livestock provide essential nutrients necessary for human survival. Sustainable and productive agricultural practices are crucial for ensuring a stable and sufficient food supply to meet the nutritional needs of a growing population. The global food security is contingent upon safeguarding our priceless ecosystem and biodiversity. The market for innovative, socially, and environmentally sustainable food production systems is currently seeing a surge in support as public awareness of the issues facing the current industrialized food system grows. This has also increased calls for changes to agricultural policies and regulations. The preservation and upkeep of ecosystems and sustainable food systems must be prioritized in the food production process, necessitating both a rational management approach that looks forward and significant adjustments to the patterns and practices of economic development, product, and production. Low environmental effect techniques are to be given top attention, and food systems ought to be reformed to guarantee good nutrition and food safety while also having a neutral and positive environmental impact. The purpose of this review paper is to evaluate sustainable food systems strategies for the management of agriculture and food production through agricultural education.

Key words : *Sustainable farming, agroecosystem, biodiversity, university involvement, capacity building, food security and safety.*

Introduction

Agriculture is the backbone of human civilization, providing sustenance, livelihoods, and raw materials for various industries. However, the global agricultural landscape is undergoing unprecedented challenges due to population growth, climate change, resource depletion, and environmental degradation. In response to these challenges, there is a pressing need for agricultural transformation to ensure the sustainability of food systems. A sustainable food production system ensures food safety and nutrition by considering the components of production, processing, distribution, and consumption of food, and makes food accessible for everyone. This system focuses on increasing the quality of life of all individuals with profitable production and food systems, protecting and improving resources, using non-renewable and on-farm resources in the most efficient way, and producing food and other agricultural products at low costs by reducing total energy use. Modern industrial agriculture has grown dramatically over time in terms of yields and food availability, but these food systems have also brought about a number of issues that have come at a staggering cost to the environment, including soil degradation and pollution, phosphorus and nitrogen pollution, loss of biodiversity and global habitat, habitat destruction, decreased resilience of agricultural landscapes, lower farm incomes and human health, and a reduction in the amount of water that can be stored and distributed. Thus the main agricultural systems are directed to an unsustainable trail. Agricultural transformation for sustainable food systems begins with the adoption of environmentally friendly and resource-efficient practices. Agroecology, organic farming, and precision agriculture are examples of approaches that prioritize sustainability. Agroecology integrates ecological principles into farming systems, emphasizing biodiversity, soil health, and ecosystem services. Organic farming avoids synthetic inputs, focusing on natural methods and minimizing environmental harm. Precision agriculture utilizes technology to optimize resource use, reducing waste and environmental impact. Universities play an important role in the well-being of crop producer especially small-scale farmers through accessing technical knowledge and also building their capacity through different levels of training. Further, Food security and safety, a fundamental aspect of human well-being, remains an elusive goal for a significant portion of the global population. The challenge of ensuring that all individuals have access to sufficient, safe, and nutritious food to meet their dietary needs is intricate and multi-faceted. Moreover, the three interconnected ideals, social justice, environmental friendliness, and economic viability if managed properly then help toward sustainability. Environmental sustainability indicators included lowering transportation-related emissions and food loss and waste, enhancing water management, and adopting more sustainable and healthful methods of producing food. Developing novel strategies for the analysis, assessment, design, and reconstruction of the agricultural system is becoming more and more crucial since it plays a significant role in maintaining high living standards.



Diversification of Agricultural Practices for sustainable food production

Sustainable food systems require a shift from monoculture to diversified farming practices. Monoculture, while efficient in terms of scale, often leads to soil degradation, increased susceptibility to pests and diseases, and a lack of biodiversity. Agroecology, organic farming, and permaculture are examples of diversified approaches that promote crop rotation, intercropping, and the integration of livestock into farming systems. These practices enhance soil fertility, reduce reliance on chemical inputs, and contribute to resilient and sustainable ecosystems. According to FAO (2015) recommendations, sustainable agriculture should be environmentally, economically, and socially responsible and contribute to the availability, access, use, and stability of food security, while sustainable development is defined as “management and conservation of the natural resource base, and the orientation of technological change in such a manner as to ensure the attainment of continued satisfaction of human needs for present and future generations”. The sustainability strategies comprise much more than not harming the environment and protecting the natural resource base. The methodological principles for “Sustainability Assessment of Food and Agriculture systems” (SAFA) recommended by FAO are relevance, holistic, rigor, simplicity, efficiency, goal orientation, continuous improvement, performance orientation, adaptability, transparency, and accessibility.

Water Management and Conservation

Water is an indispensable resource for life on Earth, and its significance in ensuring food security and nutrition cannot be overstated. As the global population continues to burgeon, the demand for food is escalating, putting pressure on agricultural systems. Utilizing water resources effectively and sustainably is imperative for meeting the world’s growing food needs and ensuring adequate nutrition for all. This essay explores the intricate relationship between water resources and food security, emphasizing the need for responsible water management practices to address the challenges of the 21st century. Water scarcity is a critical concern in many regions, necessitating effective water management strategies in agriculture. Precision irrigation systems, rainwater harvesting, and the use of drought-resistant crops are essential components of sustainable water management. Additionally, the adoption of practices like conservation tillage and cover cropping helps prevent soil erosion, improve water retention, and maintain the overall health of water ecosystems.

Climate-Smart Agriculture

Climate change poses a significant threat to agriculture through extreme weather events, altered precipitation patterns, and rising temperatures. Agricultural transformation involves the adoption of climate-smart practices that enhance resilience and mitigate environmental impact. This includes the development of climate-resilient crop varieties, sustainable land management, and the reduction of greenhouse gas emissions from agricultural activities. Climate-smart agriculture is an innovative approach to farming that seeks to address the challenges posed by climate change while ensuring sustainable food production. It is an essential strategy to safeguard global food security and build resilience in the face of a changing climate. One of the key principles of climate-smart agriculture is adaptation. Farmers are encouraged to adopt practices and technologies that make their systems more resilient to the impacts of climate change, such as droughts, floods, and extreme temperatures. This may involve the cultivation of climate-resilient crop varieties, adjusting planting and harvesting schedules, and implementing water-saving irrigation techniques. Mitigation is another crucial aspect of climate-smart agriculture. It focuses on reducing greenhouse gas emissions from agricultural activities. Practices like precision farming, agroforestry, and the use of cover crops can help sequester carbon in the soil, offsetting emissions. Additionally, improved livestock management techniques can reduce methane emissions, a potent greenhouse gas associated with livestock production. Innovation plays a central role in climate-smart agriculture, with technology providing valuable tools for farmers. Precision agriculture, for instance, employs data-driven technologies like sensors, drones, and satellite imagery to optimize resource use, enhance productivity, and reduce environmental impact. Digital weather forecasting and climate information services also enable farmers to make informed decisions based on upcoming weather patterns. Collaboration is essential for the success of climate-smart agriculture initiatives. Governments, international organizations, research institutions, and local communities must work together to develop and disseminate knowledge, provide financial support, and create policies that incentivize sustainable farming practices. This collaborative approach ensures a holistic and effective response to the challenges posed by climate change.

Promoting Sustainable Livestock Farming and Aquaculture

Livestock production plays a vital role in global agriculture, providing a source of food, income, and various by-products. The raising of livestock, including cattle, poultry, pigs, and sheep, is an integral component of the agricultural sector, contributing



significantly to the world economy and meeting the diverse needs of societies. One primary importance of livestock production is its role in supplying high-quality protein. Meat, milk, and eggs are essential sources of nutrition, contributing vital nutrients like protein, vitamins, and minerals to human diets. Livestock products play a crucial role in addressing global food security by providing a reliable source of animal-based protein for a growing population. Livestock farming also serves as a source of income and livelihood for millions of people worldwide. Small-scale and large-scale livestock farming operations create employment opportunities, particularly in rural areas. Livestock rearing provides farmers with a steady income, promoting economic stability and poverty reduction in many regions. Beyond meat and dairy products, livestock farming produces valuable by-products. Leather, wool, and hides are important materials derived from livestock, contributing to the textile and fashion industries. Additionally, livestock manure serves as a natural fertilizer, enhancing soil fertility and promoting sustainable agricultural practices.

However, livestock production comes with its challenges and controversies. Environmental concerns, such as deforestation for pastureland and the contribution to greenhouse gas emissions, have led to discussions about sustainable and eco-friendly practices within the industry. Moreover, issues related to animal welfare and ethical treatment have prompted calls for responsible and humane farming practices. In recent years, there has been a growing emphasis on improving the sustainability of livestock production. Sustainable practices include rotational grazing, agroforestry integration, and the development of alternative protein sources, such as plant-based and lab-grown meats. These approaches aim to address environmental concerns while ensuring the continued availability of high-quality protein.

Aquaculture, the farming of aquatic organisms, holds immense importance for global food security, economic development, and environmental sustainability. As the demand for seafood continues to rise, aquaculture emerges as a key solution to meet this demand while addressing challenges faced by traditional fisheries. One of the primary contributions of aquaculture is its role in providing a sustainable and efficient source of protein. Fish and other aquatic products are rich in essential nutrients, making them crucial components of a balanced diet. Aquaculture helps alleviate pressure on wild fish populations, reducing overfishing and promoting the conservation of marine ecosystems. Economically, aquaculture creates livelihoods and stimulates economic growth, particularly in coastal and rural areas. Fish farming operations generate employment opportunities, support local businesses, and contribute to the income of millions of people globally. The industry's economic impact extends beyond direct employment, encompassing processing, transportation, and retail sectors.

Furthermore, aquaculture offers a more controlled and sustainable approach to seafood production compared to traditional fishing. By carefully managing water quality, monitoring feed inputs, and minimizing environmental impact, responsible aquaculture practices help conserve biodiversity and protect sensitive aquatic ecosystems. In the context of climate change, aquaculture provides a resilient alternative to wild fisheries that may be vulnerable to shifts in ocean conditions. Fish farming can be adapted to changing environmental circumstances, contributing to the stability of the global seafood supply in the face of climate-related challenges. The adoption of innovative farming practices, such as aquaponics and hydroponics, can further optimize water use in agriculture. These techniques involve cultivating crops in water without soil, with the added benefit of integrating fish farming. By recycling water within closed systems, these methods reduce overall water consumption and enhance resource efficiency, contributing to both food security and environmental sustainability.

Universities role in capacity building

Universities play a pivotal role in capacity building and fostering sustainable food production through education, research, and community engagement. As hubs of knowledge and innovation, universities have the potential to shape the future of agriculture by equipping students, farmers, and communities with the skills, information, and technologies needed for sustainable food systems. Firstly, universities contribute to capacity building by offering specialized academic programs in agriculture, agribusiness, environmental science, and related fields. These programs provide students with a solid foundation of knowledge, technical expertise, and critical thinking skills necessary for addressing the complexities of modern agriculture. Graduates from these programs are well-equipped to contribute to sustainable farming practices, resource management, and the development of innovative solutions for food production challenges.

Research conducted by universities is instrumental in advancing sustainable agricultural practices. Faculty and students engage in cutting-edge research on crop science, soil health, water management, and agroecology. This research not only expands the scientific understanding of agriculture but also leads to the development of practical and sustainable solutions that can be implemented by farmers. Universities serve as hubs for innovation, fostering the creation of new technologies and methodologies that enhance efficiency, reduce environmental impact, and promote resilience in food production systems.



Universities also play a crucial role in disseminating knowledge and best practices to farmers and local communities. Extension services, outreach programs, and partnerships with agricultural organizations enable universities to share research findings and sustainable farming techniques with practitioners. By organizing workshops, training sessions, and demonstration projects, universities empower farmers to adopt environmentally friendly practices, optimize resource use, and enhance the overall sustainability of their operations. Moreover, universities contribute to policy development by conducting research on the socio-economic aspects of agriculture and advocating for policies that support sustainable food production. By collaborating with policymakers and stakeholders, universities influence the formulation of regulations and incentives that promote environmentally responsible farming practices, conservation of natural resources, and equitable access to agricultural opportunities.

Continued investment in research and development is crucial for driving innovation in agriculture. Governments, private sector entities, and international organizations should collaborate to fund research initiatives that focus on developing new technologies, resilient crop varieties, and sustainable farming practices. This investment can empower the universities and farmers with the knowledge and tools needed to adapt to evolving challenges and contribute to the long-term sustainability of food systems.

Conclusions

Achieving global food security requires a comprehensive and collaborative approach that addresses the interwoven challenges of population growth, climate change, resource scarcity, globalization, poverty, and conflict. Sustainable agricultural practices, technological innovations, equitable resource distribution, and international cooperation are essential components of any strategy aimed at ensuring that no one goes hungry. As we navigate the complexities of the 21st century, a concerted effort from governments, organizations, and individuals is imperative to build a resilient and inclusive food system that can withstand the challenges of an ever-changing world. Further, the effective utilization of water resources is paramount for achieving global food security and nutrition goals. Sustainable water management practices, including efficient irrigation, rainwater harvesting, wastewater recycling, and innovative farming techniques, must be embraced to address the challenges posed by climate change and population growth. Governments, communities, and individuals alike play crucial roles in fostering responsible water management to ensure a resilient and well-nourished future for the planet. By prioritizing the judicious use of water in agriculture, we can build a foundation for sustainable food production that meets the needs of present and future generations. Moreover, universities are centres to capacity building and the promotion of sustainable food production. Through education, research, and community engagement, universities foster the development of a skilled workforce, drive innovation, and empower farmers and communities to adopt practices that ensure the long-term health and resilience of food systems. The collaborative efforts of universities, students, researchers, and the broader agricultural community are essential for creating a sustainable and food-secure future.

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POTENTIAL STRATEGIES OF MULTIFUNCTIONAL AGROFORESTRY SYSTEM FOR FARMING COMMUNITY IN NORTHERN KARNATAKA

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Abstract

The study was carried out during the months of June-August 2021 in six northern districts of Karnataka viz., Dharwad, Vijayapur, Bagalkot, Gulbarga, Koppal and Raichur to find out prominent agroforestry practices. The data were collected by interview method using structured questionnaire. The bund planting was found to be most prominent agroforestry practice both in rainfed and irrigated situations in all the six districts. Nearly 89.9 per cent of the respondents followed bund planting in rainfed situation, whereas it was 76.8 per cent in irrigated situation. The other potential agroforestry practices followed were boundary planting and scattered planting in all the six districts. Estimated area under agroforestry ranged from 3.0% in Raichur district to 22.05% in Dharwad district, where tree density varied from 2.38 to 33.0 trees ha⁻¹. Besides, two major species, namely Neem, Mahagony, Pongamia and Acacia were also mapped and area under them was estimated. Total agroforestry area was estimated to be 0.47 million ha (9.21%) and CSP in all six districts estimated to be 0.11 million t C. Considering an average of 9.21% area in the state as agroforestry, projected area under agroforestry would be 1.768 million ha and state level CSP under agroforestry systems would be 0.371 MtC in Karnataka. The study revealed that the agroforestry has considerable area in Karnataka state and playing a crucial role in mitigation of atmospheric CO₂ at state level. The highest performance was for fruits, timber, NTFP and fuel wood tree species in all the six districts in rainfed (73.8%, 67.2%, 32.6% and 40.5%, respectively) and irrigated situations (64.1%, 67.8%, 24.8% and 37.9%, respectively).

Key words : Agroecosystem, block plantation, perennial components, species diversity.

Introduction

Land-use options that increase resilience and reduce vulnerability of contemporary societies are fundamental to livelihood improvement and adaptation to environmental change. Agro forestry is the intentional combination of agriculture and forestry technologies to create integrated, diverse, productive, profitable, and sustainable land-use systems. Agro forestry plantations already meet nearly 80% of round wood requirements of wood based paper and panel products industries and have the potential to lead us to self sufficiency in timber simultaneously contributing immensely to employment generation, greening of India, carbon sequestration and environmental amelioration. The potential of agro forestry in meeting the deficit of demand and supply in timber, fodder supply, bio energy sector through tree biomass and meeting the food / fruit, fodder, timber wood and firewood as well as mitigation of the impact of climate change security has been enumerated. India's forest and tree cover is 8,07,267 square kilometers which is only 24.56 % of the India's geographical area (FSI Report 2019). It aims to bring a minimum one-third of India's total geographical area under forest cover through scientific interventions and enforcing strict rules to protect the dense cover. Our country has only 2.4% of the world's geographical area and 0.5% of the world's grazing area but supports over 16% of the world's human population and 18% of world's cattle population. Agroforestry is the potential alternative choice for increasing the tree cover outside the notified forest areas to reduce the pressure on forest land (Nair 1985). Moreover, agroforestry is the only viable option to achieve the 33% tree or green cover as mentioned in the NFP (1988). Atmospheric CO₂ concentration currently is about 388ppm & predicted to increase to approximately 470–570 ppm until year 2050 [2]. Trees have important roles in reducing vulnerability, increasing resilience of farming systems and buffering households against climate related risks. The direct benefits like employment generation and indirect ones like carbon sequestration and environment restoration have been emphasized in respect of various agro forestry systems. Agroforestry has received much attention in India from researchers, policy makers and others for its perceived ability to contribute significantly to economic growth, poverty alleviation and environmental quality.

Today agroforestry is an important part of the 'Evergreen Revolution' movement in the country. Over forty years of investments in research have clearly demonstrated the potential of agroforestry in many parts of the country and some practices have been widely adopted. But the vast potential remains largely under exploited and many technologies are yet to be widely adopted. Interplay of several complex factors, the understanding of the biophysical issues related to productivity, water



resource sharing, soil fertility, plant interactions in mixed communities is insufficient, mainly because of observational nature of research. Agroforestry is an interface between agriculture and forestry as a promising and sustainable land use practice in developing countries where trees on farmland form an integral part of the farming system [3]. Some agroforestry practices received increased attention regarding their net carbon sequestration effect by their ability to capture atmospheric CO₂ and store carbon in plants biomass and soil [4]. The socio-economic processes involved in the success and failure of agroforestry have not been investigated properly. It is crucial that progressive legal and institutional policies are created to eschew the historical dichotomy between agriculture and forestry and encourage integrated land use systems. Increasing the livelihood security and reducing the vulnerability call for societal adaptation. Such adaptations are possible when combined with traditional resource management systems. Agroforestry as a local adaptation, therefore, is a promising area of interest. This study examines the impact of agroforestry technology generation and adoption in different parts of the state or country highlights the major role of smallholders as agro forestry producers of the future potential option for livelihood improvement, climate change mitigation, biodiversity conservation, yield of goods and services to the society. It is crucial that progressive legal and institutional policies are created to eschew the historical dichotomy between agriculture and forestry and encourage integrated land-use systems. Government policies hold the key to agro forestry adoption.

Materials and Methods

The study carried out in five districts viz., Dharwad, Vijayapur, Bagalkot, Gulbarga, Koppal and Raichur which come under northern Karnataka. The background information of study area on various aspects viz., rainfall, altitude, land use pattern, major crops grown etc., was collected. It lies between 14° 39' to 17° 24' N latitude and 73° 34' to 77° 04' E longitude. The area has an elevation ranging from 459 to 882 m. In general the topography is fairly level with moderate fertile soils in these districts both dryland and irrigated situations are existing. The tract is predominantly occupied by deep black soils (80%). The black soils are clayey (60%) with low infiltration rate and high pH (7.5 to 9.0). The available N and P₂O₅ are very low, K, Ca and Mg are abundant. The soils are mixed with lime nodules and susceptible for moderate to high soil erosion rate. The other soil types in the northern dry tract are red loam and salt affected soils. Major part of the northern Karnataka lies in semi-arid tract [14]. The survey was conducted in four villages of each district across the cross section representing both rainfed (5 villages) and irrigated (5 villages) situations. A proforma was developed to collect the data from 25 farmers in each village, totally 100 sample farmers were interviewed of which 50 farmers represented rainfed situations and another 50 farmers represented the irrigated situation from every district. The survey was conducted during the months of June-August 2021. The summary of sample selection process is given in the flow chart as detailed. The data collected from various aspects related to agroforestry was expressed in terms of per cent response from the respondents.

Results and Discussion

The data on prominent agroforestry practices followed by farmers in six districts are given in table 1. The bund planting was found to be most prominent agroforestry practice both in rainfed and irrigated situations in all the six districts. Nearly 89.9 per cent of the respondents followed bund planting in rainfed situation, whereas it was 76.8 per cent in irrigated situation. The other potential agroforestry practices followed were boundary planting and scattered planting across the six districts. The boundary planting was more prominent under irrigated situation (73.8%) than rainfed situation (59.5%) in all the six districts. The boundary planting under rainfed situation was highest in Dharwad district and it was highest in Vijayapur district under irrigated situation. The scattered planting in rainfed situation was highest in Dharwad and Koppal district and it was highest under irrigated situation in Bagalkot district. The other systems followed were block plantation, avenue plantation and hortisilviculture systems. The agri-silviculture and planting along irrigation canal were found only under irrigated situations except agri-silviculture which was also found in rainfed situations in Dharwad district. These findings are in conformity with that of [13] and [14] also reported bund planting as the predominant agroforestry practice.

1. Establishment and management of model : Teak stumps were planted 4 m apart in the channels formed at 8 m wide and the density remained as 325 trees/ha. As soon as the stumps were established, 3 to 4 irrigations were given to tree component during first three months to maintain better survival percentage and later no irrigation was given to the trees. Agricultural crops were grown every year with this combination.

Rotation period and yield : The girth and height of the trees increased steadily as age increased and attained a girth at breast height of 46 cm and height of 11 m at the end of fifth year. The volume produced at five years age was 50.4 m³/ha with an average productivity of 10.1 m³/ha/yr [12].

Table-1 : Agroforestry practices followed by farmers in different districts of northern Karnataka.

Sl. No.	Agroforestry practices	Percentage of respondents following the practices													
		Vijaypur		Bagalkot		Dharwad		Gulbarga		Koppal		Raichur		Average	
		R	I	R	I	R	I	R	I	R	I	R	I	R	I
1.	Bund planting	92.5	100.0	95.4	4.8	97.5	100	90.2	80.5	81.2	94.6	82.7	80.6	89.9	76.8
2.	Boundary planting	52.4	85.4	45.6	62.6	91.0	90	76.8	66.4	18.7	72.8	72.5	65.8	59.5	73.8
3.	Agri-silviculture	-	12.4	-	18.6	80.5	85.2	-	8.2	18.5	26.2	-	8.6	16.5	26.5
4.	Horti-silviculture	19.0	8.2	-	4.6	68.5	75.1	-	12.6	21.4	36.8	-	4.3	18.2	23.6
5.	Scattered planting	25.2	78.2	21.2	84.2	88.2	79.3	12.8	52.6	37.4	24.4	18.4	10.6	33.9	54.9
6.	Block plantation	5.8	4.4	6.4	9.2	71.2	70.3	4.2	7.2	12.6	26.5	4.2	8.2	17.4	21.0
7.	Avenue plantation	2.6	14.5	3.5	20.2	35.2	51.2	3.8	10.6	14.2	20.6	5.4	14.6	10.8	22.0
8.	Planting along with irrigation canal	-	5.4	-	4.6	-	-	-	3.5	-	6.8	-	3.2	-	3.9

R - Rainfed Agroecosystem, I - Irrigated Agroecosystem

Table-2 : Kinds of trees preferred by farmers in various districts of northern Karnataka.

Sl. No.	Agroforestry practices	Percentage of respondents following the practices													
		Vijaypur		Bagalkot		Dharwad		Gulbarga		Koppal		Raichur		Average	
		R	I	R	I	R	I	R	I	R	I	R	I	R	I
		R	I	R	I	R	I	R	I	R	I	R	I	R	I
1.	Fuel wood yielding species	22.4	48.2	20.5	35.6	56.2	46.3	46.4	30.8	44.8	36.3	52.4	28.6	40.5	37.6
2.	Fruit yielding species	90.4	84.6	86.4	78.5	92.5	86.5	82.4	18.5	30.5	80.2	60.8	36.2	73.8	64.1
3.	Fodder yielding species	18.4	64.2	20.4	16.4	27.5	20.1	6.4	-	8.4	-	20.4	-	16.9	16.8
4.	Timber yielding species	65.4	88.6	76.4	82.5	80.1	88.4	48.4	36.4	62.4	80.4	70.4	30.6	67.2	67.8
5.	Short duration species	16.4	26.6	32.5	18.7	40.1	75.3	20.4	14.6	30.2	26.6	42.5	30.5	30.4	32.1
6.	Non timber forest produce	34.2	24.5	35.1	29.5	39.2	30.2	29.5	21.1	28.5	21.7	29.2	21.9	32.6	24.8
7.	Other species	11.5	-	10.8	-	31.5	25.4	20.4	-	32.0	-	18.3	-	20.8	4.2

R - Rainfed Agroecosystem, I - Irrigated Agroecosystem.

Economics of the model : Total expenditure for whole model was Rs. 12,275 (inclusive of all operation from sowing to harvest) for year 2020. Income generated from Black gram was Rs.10,400 per ha per year at Rs.16 per kg.

2. Establishment and management of model : Site preparation involves leveling, marking of pits with recommended spacing, fencing and digging of pits. Digging of pits enable develop deep tap root, improve aeration, water permeability, removal of weeds, exposing insects pests and spores for sunlight. Usually site preparation activity will be done three to four months before planting. In Indian condition planting will be done in June-July, hence site preparation may be planned well in advance by March/April. Seedlings for planting should be of height greater than 1.0 foot, collar diameter more than 3 mm and 1/3rd seedling stem should be brown in colour. The seedlings should be devoid of forked branches and must be healthy and straight with a leading shoot. Pits of size 45×45×45 cm should be left for weathering for minimum of one month. Insecticide/fungicide may be applied during planting in pit to kill the harmful organisms [12]. At the time of planting 2 kg of farm yard manure may be applied in the pit to increase water holding capacity. Planning configuration in this model is 6x3 m and usually planting is done after the onset of monsoon. Irrigation is essential for first three year in an interval of 3-5 days, especially during summer. Application of suitable fungicide and insecticide in pit before planting will reduce the infestation level. Intercropping is possible for 5-6 years in this model.

Rotation period and yield: Sandalwood trees will be felled / harvested at the age of 15 years for heartwood purpose with a yield of 15 kg of heartwood. The average height of the tress will be 8-10 m and 40-50 cm girth and fetched Rs. 6000 per kg



Fig-1 : Teak-blackgram agri-silviculture model.

heartwood. The yield obtained from Horse gram was 500 kg/year/ha and for aonla was 4 ton/ha from 5th year onwards. Casuarina in block plantation yielded 500 poles in ten year.

Economics of the model: Total expenditure for whole model (inclusive of all operation from sowing to harvest) was Rs. 1.5 crores. Income from aonla was Rs.1.2 lakhs for 4 t/ha/year at Rs. 30/kg. Income generated from sandalwood at 15 years age was Rs. 3.6 crores for 6000 kg of heartwood/ha at 15 Kg/tree at Rs. 6000/kg. Income from horse gram was Rs. 20,000 for 0.5 t/ha/year at Rs 40/kg. Income from Casuarina was Rs. 50,000 for 500 poles at Rs. 100/pole. Net income generated from this model was Rs 2.00 crores.

Impact and upscaling: Sandalwood based agroforestry system having aonla and horse gram as intercrops will help farmer to gain initial income from horse gram and intermediate income from aonla. It also helps to sequester more carbon and enhances overall productivity which ensures higher net farm income by optimal usage of natural resources. This model can be upscaled through training programme to farmers, extension materials, farmer to farmer interaction and farm field visits.



Fig-2 : Sandalwood – Soybean /blackgram agri-silviculture model.

3. Rotation period and yield: Casuarina trees will be felled/harvested in the age of 4 years for pole purpose (average height 8.1 m and 34.2 cm girth, 650 poles can be harvested per ha and sold at Rs.45 per pole). Maize yield was 2.0 t per ha per year [14].



Fig-3. Casuarina-Maize agri-silviculture model.

Economics of the model : Total expenditure for whole model was Rs.6,238 (inclusive of all operation from sowing to harvest). Income generated from maize was Rs.8,000 per ha per year for Rs 4,000 per ton. Income generated from Casuarina poles was Rs.29,250 at Rs.45 per pole and Rs 1,820 from fuel wood. Net income from this model was Rs 32,832.

1. Fuel wood and fodder yield from *H. binata* : Pruned biomass (fodder) of *H. binata* was 3.99 kg in rotation crop and 3.33 kg in fixed crop per plant at 8 years age. Average total dry biomass of *H. binata* trees ranged between 4.49 to 135.85 kg per tree at 17 years age. Biomass accumulation in stem was 45.7% of total biomass. Foliage contribution of the total biomass was 23.5%. *C. tetragonoloba* crop production was highest in pure crop plot followed by lopped and then in root barrier treatment.



Fig-4 : Hardwickia binata based agroforestry model.

4. Establishment and management of model : This model is established with superior seedling stocks of *Accacia mangium* with 4x3 m spacing. Pruning, weeding and soil working were carried out in the established agroforestry plot. At the end of first year, pepper was introduced at two vines per tree. Elephant foot yam (*Amorphophallus paeoniifolius*) or tapioca (*Manihot esculenta*) was the optional inter crop during first and second year. The yield from pepper is expected to be realized from fourth year onwards of planting and can be retained as yearly harvest of pepper is continued up to 20 years period.

Rotation period and yield : At the end of third year, the girth and height of Mangium recorded was 36 cm and 15 m respectively. In turn, volume production was 79.12 m³ per ha and wood yield on fresh weight basis was 54 MT per ha. Besides better performance in terms of growth and wood yield, there exists a greater possibility of cultivation of Pepper up to 20 years. Acacia mangium pulp yield estimated is 160 MT per ha and fuel wood yield was 30 MT per ha from branches after the rotation period of 20 years. Pepper yield estimated were 14.6 MT per ha for 17 years (as yield starts from fourth year onwards).



Fig-5 : Acacia mangium-Pepper silvi-horticulture model.

Economics of the model : Total expenditure for whole model was Rs. 3,78,500 (inclusive of all operation from sowing to harvest (Year 2009). Income generated from pepper was Rs.8,76,000/- per ha for 17 years for Rs 60 per kg. Income generated from Mangium pulp wood was Rs. 3,20,000 at Rs. 2000 per MT of pulp wood and Rs 30,000 from fuel wood. Net income from the model was of Rs 8,48,000.

5. Alley Cropping / Hedgerow Intercropping: Alley cropping is an agroforestry practice where trees are planted in a row, creating an alley for horticultural crops during the early years of tree growth . It allows the farmer to effectively use available space resources and increase short-term income from annual crops. However, the major drawback of this system is components (trees and crops) compete for light, water, and nutrients where the availability of resources is limited. That's why choosing suitable crops associated with the tree is crucial to mitigating competition for natural resources [5]. Researchers found that alley cropping reduced the crop yield due to competition for natural resources. Still, its LER (land equivalent ratio) was more significant than 1.0 [6]. Although 17.4%-22.8% crop yield is reduced in alley cropping systems, 32.7% tree yield increases and shows higher LER (1.76-2.60) [19]. Therefore, cutting/coppice height and root pruning of hedgerows reduce the competition between components in alley cropping systems [8]. Hedgerow pruning interval and ally size also influence crop yield. Firoz (2011) states that delayed pruning with wider ally size showed lower fruit yield and economic return. Three meters wide ally with a one-month pruning interval was the best treatment for okra production in hill slope [1]. Pruned materials are incorporated into the soil during the cropping period so that decomposed pruned leaves can release nutrients into the ground and improve soil properties, ultimately improving associated crops' growth and development. Ahmed (2010) evaluates the productivity of winter vegetables and soil properties (different nitrogen levels) in alley cropping systems. The growth performance of *Gliricidia sepium*, *Sesbenia grandiflora*, *Leucaena leucocephala* and *Cassia siamea* after pruning at different intervals showed *Gliricidia sepium* maintained superiority [9]. The soil properties in the alleys consisting of *Gliricidia sepium* and *Leucaena leucocephala* had positively changed. Pruned materials application in alley cropping systems reduced the nitrogen requirement for wheat production by about 50% [40]. However, alley cropping improves crop yield, soil fertility, soil erosion on derelict land, and produces animal fodder [10]

6. Cropland Agroforestry : Crop land agroforestry is an important agroforestry system recently adopted in different agro-ecological regions in Karnataka. In cropland agroforestry, farmers plant trees in cropland to produce fodder, timber, fuelwood, fruits, herbal medicine, and ecological and environmental benefits. A wide variety of tree species includes *Tecktona*

grandis Azadirachta indica, *Melia dubia*, *Albizia lebback* *Artocarpus heterophyllus*, *Cocos nucifera*, *Ziziphus spp.*, *Syzygium spp.*, *Mangifera india*, *Dalbergia sissoo*, *Swietenia macrophylla*, and *Leucaena leucocephala* are commonly practiced in Northern Karnataka. Even 79% of cropland agroforestry occupied small land areas 0.12-0.80 ha. Crops and trees uptake nutrients from the same piece of land, but crops take nutrients from the topsoil layer and trees from the deeper layer of soil. To reduce nutrient competition, shorter spacing is used for timber and fuel wood species and broader spacing for fruit trees [1]. Leaf litter is the primary source of organic matter and nutrients to the horticultural crops through the physical and microbial degradation activities, which improves soil fertility [2]. The addition of nutrients varies from species to species as their decomposition capacity of the leaf, nutrients concentration in leaf and age of leaf, rate of nutrient uptake, nutrient translocation, growth, and life form and characteristics of individual nutrients. *Meliaceae azadirachta* had the highest NH₄ (4,097 ppm) and potassium (8,904 ppm) concentrations in the leaching water. Agriculture can sequester 10-12% of global greenhouse gases emissions, but IPCC recognized that agroforestry has the highest potential to sequester carbon under the climate change mitigation strategies [11]. Developing countries have been raising attention for adaptations to climate change and greenhouse gas mitigation through agroforestry.

Agri-silviculture System : Agri-silviculture system is also an essential land-use system where various crops (Soybean, Safflower, Wheat, Jowar, Maize, Horse gram and Chick pea, etc.) are grown under different trees to increase production and benefit-cost ratio over sole cropping. Subabool (*Leucaena leucocephala*), Malbar neem (*Melia dubia*), Black siris (*Albizia lebbek*), and Mahogany (*Swietenia macrophylla*), etc. are the most common multipurpose trees used on the agri-silviculture system in Karnataka [2]. The Maize based Agri-silvicultural system became popular in the northern part of Karnataka. Even though the benefit-cost ratio is highest (3.75) compared to sole cropping, it also indicates that the agri-silviculture system ensures the highest profit return to the farmers and efficient field management compared to monoculture [2].

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EMERGENCE OF NEW PLANT DISEASES AND SIGNIFICANCE OF PLANT GROWTH PROMOTING MICRO ORGANISMS FOR DISEASE MANAGEMENT UNDER CHANGING CLIMATIC SCENARIO

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Climate change is predicted to have a direct impact on the occurrence and severity of diseases in crops, which will have a serious impact on our food security. Climate change will result in rise in temperature and carbon dioxide levels and will also have a varied effect on moisture. In many cases, temperature increases are predicted to lead to the geographic expansion of pathogen and vector distributions, bringing pathogens into contact with more potential hosts and providing new opportunities for pathogen hybridization. Apart from this, many new diseases have reported and also minor diseases have become major diseases in recent years. Plant diseases are responsible for the loss of at least 10% of global food production, representing a threat to food security. The prevention of diseases mainly dependent on agro-chemicals especially from the past few decades. Despite the great effectiveness and ease of utilization of chemicals products, their use or misuse has led to hazardous effects to environment. Some microorganisms, the bio-control agents are able to colonize the soil surrounding plant roots, the rhizosphere, making them come under the influence of plant roots.

Plant Growth Promoting Microorganisms (PGPMs) generally refers to a group of soil and rhizosphere free-living bacteria and fungi colonizing roots in a competitive environment and exerting a beneficial effect on plant growth as well as disease management. PGPM play key role not only in transforming nutrients in the soil but also giving protection against plant diseases. The beneficial effect of PGPM on plant growth involves the ability to act as phyto-stimulators or biofertilizers. PGPM could enhance crop yield through nutrient uptake and plant growth regulators. PGPM could also act as bio-control agents by the production of antibiotics and triggering induced local or systemic resistance. The exact mechanism by which PGPR stimulate plant growth is not clearly established, although several hypothesis such as production of phytohormones, suppression of deleterious organisms, HCN and siderophore production, activation of phosphate solubilization, volatile compound production and promotion of the mineral nutrient uptake and plant growth promotion are usually believed to be involved.

The studies conducted on groundnut, chickpea and pigeon pea diseases indicated that PGPMs can be used for plant growth promotion and management of diseases in these crops. The indigenous PGPM isolates of *Bacillus*, *Trichoderma* and *Pseudomonas fluorescens* showed percent inhibition of pathogens. Apart from this, the isolates were positive for KOH test, catalase test, starch hydrolysis, urease test, casein hydrolysis, gelatin liquefaction, indole and H₂S test. The shelf life of was maximum in talc and least in rice bran up to 150 days. The results also indicated the the PGPMs also able to produce bio-active compounds. The GC-M S/M S analysis of ethyl acetate extract of *Trichoderma* showed the presence bioactive compounds which are reported to process antimicrobial property. The Germination per cent, shoot length, root length and seedling vigour index.

Hence, there is a lot of scope for PGPMs in agriculture in general and plant disease management in particular. Sustainable agriculture based on environmentally-friendly methods, tends to use PGPMs as tool that could as a by-product reduce the use of chemicals. There is a great need for eco-friendly management of plant diseases through bio-agents such as PGPMs in worldwide.



BOVINE TROPICAL THEILERIOSIS IN INDIA : AN UPDATE ON EPIDEMIOLOGY, DIAGNOSIS AND CONTROL STRATEGIES

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Abstract

Ticks pose a serious threat to livestock in tropical nations like India because they harm human health and serve as a vector for the spread of haemoprotozoan diseases such theileriosis, babesiosis, and anaplasmosis. The exotic and crossbred cattle (*Bos taurus*) are known to be the most susceptible breeds, but the native cattle are naturally resistant to disease. Cross-breeding programs were an effort in India to improve the genetics of the cattle, but they had a negative effect on resistance to ticks and diseases carried by ticks. Brown (1997) estimated that bovine tropical theileriosis causes an annual loss of US \$ 800 million worldwide. In India, the cost of *Theileria annulata* infection was calculated to be 384.3 million US dollars annually. Theileriosis death and productivity loss result in significant financial loss. In cases of acute theileriosis, the diagnosis is mostly based on clinical observations and microscopic analysis of stained thin blood smears. The native and treated cattle, however, turn out to be long-term carriers with just a small number of infected erythrocytes, making it challenging to show the presence of parasites in blood smears. These long-term carriers are the main cause of illness spread by ticks. *Theileria* species differentiation on blood slides is made more difficult by the lack of a distinct morphological distinction between the various *Theileria* species in the schizonts and piroplasms.

Key words : Theileriosis, epidemiology, India, prevention and control.

Introduction

Theileriosis is the most significant hemoprotozoan disease of animals and causes serious threat to the Indian dairy industry, resulting as enormous financial losses across the nation yearly. *Theileria annulata* is an apicomplexan parasite, which affects both domestic and wild bovidae worldwide. It is primarily spread by ixodid ticks of the genus *hyalomma anatolicum* and the life cycle of the protozoan parasite is complicated which involves both vertebrate and invertebrate host. Three types of theileriosis have been identified ie. acute, sub-acute and chronic in nature. The main clinical symptoms of the disease include emaciation, pyrexia, anaemia, lymphadenopathy, lacrimation and in the last depression of the affected animals. These primary clinical signs account for the majority of animals; however, other clinical signs such as cutaneous nodules, ocular bulging, corneal opacity, nervous form and pseudocarditis have also been reported. Similarly, the disease has been reported to be transmitted horizontally by Ixodid ticks in the majority of the cases, though there have also been rare reports of vertical transmission.

Etiology :

Theileriae, belonging to the phylum Apicomplexa, order Piroplasmida, family Theileriidae, and genus *Theileria*, are obligatory intracellular protozoan parasites. Small round, ovoid, irregular, or bacilliform parasites called *Theileria*. There have been cases of theileriosis with symptoms ranging from barely noticeable to quickly lethal. They are most closely related to babesia, which they vary from by infecting erythrocytes after a developmental stage in leukocytes. Throughout much of the world, this agent infects both domestic and wild bovidae and certain species even infect small ruminants. The most dangerous and economically significant *Theileria* species known to infect cattle are *Theileria parva*, which causes East Coast fever (ECF), *Theileria annulata*, which causes tropical or Mediterranean theileriosis and *Theileria orientalis* causes *Theileria*-associated bovine anemia (TABO) or Oriental theileriosis (OT).

Epidemiology :

Theileriae have intricate life cycles in both vertebrate and invertebrate hosts and are spread by ixodid ticks. Both domestic and wild Bovidae are afflicted by Theileriae. Cattle, African buffalo (*Syncerus caffer*), Indian water buffalo (*Bubalus bubalis*) and waterbuck (*Kobus spp.*) are all susceptible to *Theileria parva* infection. Only cattle and water buffalo frequently experience subclinical infections. The African buffalo and waterbuck serve as the infection's reservoirs. Cattle and yak (*Bos grunniens*) are also susceptible to *Theileria annulata* infection, while water buffalo are more commonly affected and are thought to be the



parasite's original host. The disease affects imported taurine breeds of cattle significantly more severely than native zebu cattle in endemic regions. There are various genotypes of *Theileria orientalis* (T. Orientalis / buffeli group) that can infect cattle, water buffalo (*Bubalus bubalis*), yaks (*Bos grunniens*) and sheep.

Transmission :

Ticks spread Theileria species. *Rhipicephalus appendiculatus* is the most significant vector for *Theileria parva*. Ticks of the genus *Hyalomma* transmit *Theileria annulata*. Depending on the climate, ticks can carry the disease for up to two years on the pasture. When these field vectors are absent, disease cannot persist. In the saliva of the eating tick, Theileria sporozoites are transmitted to susceptible mammals. However, if the environmental temperature is rise than infective sporozoites can develop in ticks on the ground and the infective sporozoites may enter in the host within hours of attachment. Normally, Theileria only mature and enter the saliva after the tick attaches to a host, typically, a tick must be attached for 48–72 hours before it becomes infective. There is no transovarial transfer. Theileria sporozoites have an intricate life cycle inside the host that involves the reproduction of schizonts in leukocytes and piroplasms in erythrocytes. Usually, cattle that recover from Theileria infections start spreading the disease. Haemaphysalis species or other ixodid tick genera are the primary vectors for the spread of *Theileria orientalis*. The vector in Australia, New Zealand and Japan is *Haemaphysalis longicornis*. Another potential means of transmission for *Theileria orientalis* is mechanical transfer through common husbandry procedures. The cow can become tick-infective in 10 days after being infected by a *Theileria orientalis* nymph while it is grazing on an ignorant cow.

Epidemiology :

Sub-Saharan Africa has 13 nations where *Theileria parva* (ECF) is present. Anywhere there is a yearly rainfall of more than 20 inches, from sea level to elevations of more than 8000 feet, tick vectors can be found. *Theileria annulata* (TT) can be found throughout Asia, the Middle East, North Africa and southern Europe. *Theileria annulata* and *Theileria parva* do not share any endemic regions. The distribution of ticks could, however, alter due to climatic changes. There are eleven genotypes of the blood-borne parasite *Theileria orientalis*, known as Chitose, Ikeda, buffeli, types 4 to 8 and N1 to N3. Severe disease is linked to the Chitose and Ikeda genotypes. Although *Theileria orientalis* is present throughout the world, clinical OT has been reported in Australia, New Zealand, Japan, Korea, China and Vietnam. It is believed that three weeks after being moved onto pasture containing infected vectors, cattle get affected. When naive animals are introduced into an endemic area or when infected animals are introduced to a herd where a capable vector is present but Theileria species are not present or are only present in low prevalence, disease is more frequently observed.

Clinical Signs :

The symptoms of *Theileria annulata* infection (Tropical theileriosis) include a high fever, anaemia, enlargement of the lymph nodes, weakness, lacrimation, weight loss, inappropriate hunger and depression of the affected animals. The later stages of infection are also accompanied by lateral recumbency, diarrhoea, and dysentery. The very lethal illness known as “turning sickness” can also affect cattle. Neurologic symptoms are caused by this disease's infected cells blocking central nervous system capillaries. The incubation period can last anywhere between 4 and 14 days. There are various degrees of the typical clinical signs of tropical theileriosis, including fever (>103°F), swelling of the superficial lymph nodes (acute form), anorexia, pale or congested visible mucous membranes, conjunctivitis, severe congestion of the eyes, excessive lacrimation, corneal opacity and respiratory signs ranging from serous nasal discharge to cough. Tropical theileriosis, in contrast to *Theileria parva*, which only slightly reduces the amount of circulating erythrocytes, results in mild to severe anaemia, even though the pathology caused by the schizont stage is typically the main cause of death.

When symptoms are severe, body temperature rises to 41–42 °C. The temperature will drop to a normal range (38.0-39.5 °C) from day 5 to day 10 after the clinical commencement, however, from day 10 to present, there is a downward stage marked by hypothermia (37 to 38 °C), anaemia, jaundice, and occasionally heart failure. Even with extensive care, such animals seldom make a full recovery. Common symptoms include swollen lymph nodes, episodes of bleeding from the nose, breathing difficulties, and weight loss. Other symptoms include haemorrhages in the ocular and vaginal mucous membranes, blood-tinged diarrhoea, visible bruxism (teeth grinding), circular raised patches of hair all over the body, bruxism and other clinical signs such as, ocular bulging and corneal opacity.

Differential Diagnosis :

The disease must be differentially diagnosed from Heart water, Trypanosomosis, Babesiosis, Anaplasmosis, Malignant catarrhal fever and Contagious bovine pleuropneumonia.

Diagnosis :

Microscopy : Schizonts in blood, lymph node, and spleen Geimsa stained smears are used to identify theileriosis in live animals. Lymphocytes infected by schizonts can show Koch's blue bodies. Schizonts can be discovered in the impression smears of the majority of internal organs upon necropsy. Piroplasms, particularly in cases of *Theileria annulata* infection, can also be discovered in the blood of carrier animals. Microscopy has some drawbacks, such as the inability to detect all carrier instances and a lower sensitivity than currently used molecular techniques. It is also challenging to morphologically distinguish between various *Theileria* species or to find new ones.

Serological tests : For theileriosis diagnosis, the indirect fluorescent antibody test (IFAT) superseded the complement fixation test (CFT). It is regarded by the OIE as one of the gold standard tests for parasite diagnosis and uses whole body antigen of either piroplasm or culture-derived schizont. It is helpful to identify between several *Theileria* species as well as carrier animals. The high cross-reactivity across closely related species is IFAT's major weakness. *Theileria taurotragi* and *Theileria lestoquardi* antigens cross-react with *Theileria parva* and *Theileria annulata* antigen.

Treatment :

If there is evidence of pulmonary edema, buparvaquone is frequently prescribed along with anti-inflammatory medications and diuretics. *Theileria* parasite-related disorders can only be treated with a single drug, buparvaquone. Early in the course of a clinical condition, treatment is most effective but may necessitate multiple doses ie. repeated after 48 hours. When the disease has advanced and there has been significant loss of lymphoid and hematopoietic tissues, treatment is less effective. *Theileria annulata* has also been linked to buparvaquone resistance development.

Prevention and control :

Firstly, the control of tick population is an important factor but it is not easy task. Population of tick control by three methods such as physical, chemical and biological. For the chemical method, acaricides are used to kill ticks in order to control bovine theileriosis, but this approach is not sustainable because acaricides are costly and harm the environment. Imidocarb and oxytetracyclines are medicine which in some studies, appeared to have a positive response on cattle with low parasitaemia, but a poor response in severely infected cattle. Recovery from one strain of *T. annulata* confers cross-protection against most other strains. Another way to stop tick-borne *Theileria* transmission, immunization of the susceptible animals by live attenuated vaccines (Rakshavac-T).

Conclusions

Bovine tropical theileriosis is a tick born disease of bovine causes serious threat to animal health as well as economic losses to dairy farmers such as low milk production and increased the costs of pesticides to control tick vectors. The crossbred and exotic breeds of cattle are most susceptible than other animals. The diagnosis is mostly based on clinical observations and microscopic analysis of stained thin blood smears. There is need for scientific management practices of dairy animals, screening tests of population, timely treatment and vaccination, to control and prevent the occurrence of theileria infection in India, and thus increasing the productivity of dairy animals and economy of the livestock farmers.

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CLIMATE CHANGE AND POLLINATORS DIVERSITY

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Pollination is a very important ecosystem service for reproduction of most flowering plants and pollinating animals are necessary for transmitting genes within and among populations of wild plant species. Although most scientific research has concentrated on pollination problems in wild plants but animal pollination has become increasingly important in food production in recent years. Animal pollination is required for the production of fruit, vegetables and seeds from 87% of the world's most important food crops, accounting for 35 % of worldwide food output. Roubik (1995) gave a complete list for 1330 tropical plant species, demonstrating that animal pollination improves at least one variety of tropical crops in almost 70% of cases. Losey and Vaughan (2006) also highlighted that flower visiting insects provide an important ecosystem function to worldwide agricultural production through pollination services.

Although insect pollinators are very crucial for the ecosystem maintenance, but they are negatively threatened as a result of multiple environmental pressures. Plant-pollinator interactions have been shown to be negatively affected by invasive species, pesticide use, climate change, land-use changes such as habitat fragmentation and agricultural intensification. Now a days, Global climate change also a serious threat to insect pollinators and pollination services. Climatic change will occur too quickly for populations to adjust through genetic changes. Climate change poses a threat not only to individual species, but also to the genetic diversity that exists within them. Due to this reason, many wildlife populations have been reduced to small isolated fragmented groups with lower survival capacity. Small populations are potentially at risk and the main goal to study genetic diversity is to apply the knowledge of genetics to reduce the risk of extinction. Genetic diversity helps to maintain the higher levels of biodiversity (populations, species) and it is the foundation of a species evolutionary potential to adjust to environmental changes, making it an important pillar in conservation genetics. The impact of climate change on pollinators is determined by their thermal tolerance and temperature plasticity. Some of species are better adapted to warmer climates and may thus expand into new places where they can serve as pollinators in the future climatic conditions. Due to climate change, if insect pollinators get affected and decline, definitely species which are dependent on the pollinators will also show decrease in their diversity as well as in crop pollination, because these species have strong biotic interaction between them.

Over 75% of the major world crops and 80% of all flowering plant species rely on animal pollinators (Nabhan and Buchmann, 1997). Of the hundred or so animal-pollinated crops which make up most of the world's food supply, 15% are pollinated by domestic bees, while at least 80% are pollinated by wild bee species and other wildlife (Ingram *et.al.*, 1996). Diversity among species, including agricultural crops, depends on animal pollination. Thus, pollinators are essential for diet diversity, biodiversity, and the maintenance of natural resources.

Diversity of Pollinators

BEES 73%
FLIES 19%
BATS 6.5%
WASPS 5 %
BEETLES 5%
BIRDS 4%
BUTTERFLIES & MOTHS 4%

Though bees form the most important group of pollinators, other animals, such as bats, birds, butterflies, moths, flies and beetles also play key roles in pollination. Both the diversity of wild plants and the variability of food crops depend on this diversity. Pollination is an essential ecosystem service that enables plant reproduction and food production for humans and animals. With well over 200,000 flowering plant species dependent on pollination from over 100,000 other species, pollination is critical to the overall maintenance of biodiversity. "Pollinators also play a vital role in sustaining wildlife and ecosystem health, both as part of the complex food chain and in the reproduction of plants. Evidently, measures are needed to ensure that our native and managed pollinator population is maintained and protected." Along with providing an essential service to human populations, pollinators also have a key role in maintaining other ecosystem services including ensuring



biodiversity and helping nature to adjust to external threats such as climate change. For these reasons, pollinators are known as a “keystone species” in many terrestrial habitats. Temperature and rainfall determine where each species can live and reproduce. Climate change will directly affect: The geographic range of species, The timing of species’ life cycles, The population dynamics of species, The location of natural habitats (some species will have to move with their host habitats) and The structure and composition of ecosystems (i.e. the decline and extinction of some species and the invasion of other species). Birds, bees, bats and other species that pollinate plants life are declining at alarming rate which has threatened the existence of plant life and this downward trend could damage dozens of commercially important crops. A decline in pollinator populations is one form of global change that actually has credible potential to alter the shape and structure of terrestrial ecosystems. The decline in pollinator population and diversity presents a serious threat to agricultural production and conservation and maintenance of biodiversity in many parts of the world. One indicator of the decline in natural insect pollinators is decreasing crop yields and quality despite necessary agronomic inputs. Aesthetically pleasing butterfly species showed nearly a 40% decline in species diversity in California in three decades. Moths which are important pollinators in a variety of plant communities including night-blooming cacti, desert lilies, evening primroses, and wild tobacco have considerably declined. In Britain more than two-thirds of the nation’s larger moth species have declined over the past four decades. Many other pollinators such as digger bees, sweat bees, alkali bees, squash bees, leafcutter bees, carpenter bees, mason bees and bumble bees could well be in decline. Global climate change also poses a real threat to bumble bees; anecdotal evidence has suggested that some of the bumble bee species adapted to cool temperatures are in decline, whereas warmer adapted species are expanding their ranges. There is a clear indication of decline in flower visiting flies in many parts of the world. Changing land use practices (habitat loss through mechanical destruction, fragmentation, fire, overgrazing, recreation etc.), Pesticidal poisoning of pollinators, Enemies and Diseases, Competition between species and individuals induced by man & Climate change are mains factors responsible for declining of pollinators. As climate changes, the habitats suitable for supporting pollinators may change with some areas being lost and others being newly created. When a habitat disappears, or the pollinator is unable to move to a new habitat, then local extinction can occur (Travis, 2003; Hill *et al.*, 2002). Climate change may also disrupt the synchrony between the flowering period of plants and the activity period of pollinators (Price and Waser, 1998; Wall *et al.*, 2003). Anthropogenic changes in habitats and climates have resulted in substantial reductions in biodiversity and evidence has been accumulating that insect biodiversity is at risk as well. Of particular concern is the pollinators and the plants that are linked to one another within communities, show coincident declines.

Population declines increased vulnerability of some plant species to extinction, although consequences are difficult to define in nonagricultural systems. Some plant populations that are dependent on affected pollinators for reproduction could become more vulnerable to an extinction vortex. Decrease of bee population in environment may result in less effective pollination of native plant species and also decrease of crop yields up to 30%. Climate change will have impact on native pollinators in agroecosystems, especially bumble bees and solitary bees and their decrease will be in close connection to plant species extinction. If climate change will disturb the timings of flowering and the behaviors of pollinators such as butterflies, bumblebees, flies and even mosquitoes, then the intimate relationships between plants and pollinators that have coevolved over thousands of years will be, irrevocably altered

Impact of climatic change on pollinators and agriculture

During April 2007, farmers in Taiwan reported heavy losses in bees “for no reason”, bee boxes had been emptied”. Experts say “volatile weather” may be to blame. In India, during 2007, mango trees in Andhra Pradesh flowered three months early because of the rising heat. A few years ago, bees in the Himalayas were impacted by similar erratic flowering patterns, leading to a big drop in the honey supply and pollination of almonds. Normally almond flowering occurs in Himachal & Kashmir in the third week of February but, during 2000, flowering occurred during December, when no pollinating bees were active, leading to a total loss of the crop. Weather has impacted not just birds, bees, butterflies across the country and soon mammals will be next.” the effect of climate on agriculture is related to variabilities in local climates rather than in global climate patterns. In 2002, India and the United States suffered sharp harvest reductions because of record temperatures and drought (Attri, 2001). In 2003 Europe suffered very low rainfall throughout spring and summer, and a record level of heat damaged most crops from the United Kingdom and France in the Western Europe through Ukraine in the East. Low lying areas such as Bangladesh, India and Vietnam will experience major loss of rice crop if sea levels are expected to rise by the end of the century. Weather has impacted not just birds, bees, butterflies across the country and soon mammals will be next.” the effect of climate on agriculture is related to variabilities in local climates rather than in global climate patterns.



Modern civilization has enabled us to produce energy and materials in large quantities. The flip side of this roller-coaster ride is threatening to erode the quality of our life and even imperil the future of our civilization. From the first chipped stone to the first smelted iron took nearly 3 million years; From the first iron to the hydrogen bomb took 3000 years; But from the first car to global warming took less than 100 years. It is wake-up time!

Issues and Strategies

Development of a database on pollinators in terms of diversity, distribution, abundance, efficiency of pollinators, nesting requirements etc.

Monitoring the decline of wild and domesticated pollinators and causes of their decline, and its impact on pollination services.

Competition of exotic pollinators with local/native pollinators.

Assessing the socio-economic value of pollinators of horticultural/agricultural crops at state/national level.

To identify, document, and disseminate innovations technologies and ITK practices of farmers and fruit growers for sustaining pollinator diversity.

Create awareness amongst farmers and extension workers about the harmful effects of pesticides through extension literature, audio-visual and electronic media.

Capacity building and awareness raising in terms of management plans and training manuals for farmers, fruit growers, extension workers, NGO's and policy makers.

How to overcome climate change for better pollination

A diverse assemblage of pollinators, with different traits and responses to ambient conditions, is one of the best ways of minimizing risks due to climatic change. The “insurance” provided by a diversity of pollinators ensures that there are effective pollinators not just for current conditions, but for future conditions as well. A bio-diverse agro-ecosystem, with many more facilitative interactions between crops and crop-associated biodiversity, may also contribute significantly to carbon sequestration

Sustainable agriculture mitigates climate change

Biodiversity provides the services in the form of provision of food and water, the control of climate, and pollination.

As biodiversity is being lost, there are increased losses from droughts and floods, higher damage from storm surges and less resilient livelihoods. As such, maintaining biodiversity and associated ecosystem functions is an important component of adaptation to climate change.

Biodiversity also contributes to climate change mitigation. Forest ecosystems account for as much as 80% of the total above-ground terrestrial carbon while peat land ecosystems, which only cover 3% of the world's terrestrial surface, store 30% of all global soil carbon or the equivalent of 75% of all atmospheric carbon. As such, healthy forests and wetland systems have the potential to capture a significant portion of projected emissions. Inversely, unsustainable use of biodiversity, through deforestation and degradation, can contribute to greenhouse gas emissions.

Therefore, the links between biodiversity and climate change run both ways: biodiversity is threatened by climate change, but the conservation and sustainable use of biodiversity can reduce the impacts of climate change.



BIOLOGICAL CONTROL AND BOTANICAL ALTERNATIVES FOR MANAGING CHILLI WILT : PROMISING STRATEGIES AGAINST FUSARIUM SPECIES

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Abstract

Chilli wilt, caused by *Fusarium* species like *Fusarium oxysporum* f. sp. *capsici* and *Fusarium solani*, poses a significant threat to chilli cultivation in India and other regions. However, the use of chemical fungicides for disease management is accompanied by adverse effects on the environment and human health. Consequently, there is a growing focus on biological control and botanical alternatives to address chilli wilt. Certain *Trichoderma* species, including *T. viride* and *T. harzianum*, have demonstrated potential as biological control agents against chilli wilt. These strains effectively inhibit the growth of *Fusarium* pathogens and reduce disease incidence in both laboratory and field evaluations. *Trichoderma* spp. employ various mechanisms such as antibiosis, mycoparasitism, competition for nutrients, and the induction of defense responses in plants. Moreover, botanical extracts derived from plants like *Eucalyptus citriodora*, *Azadirachta indica*, and garlic exhibit antifungal activity against *Fusarium* species associated with chilli wilt. These extracts show promise in controlling the detrimental impacts of the pathogens and stimulating the production of defense-related enzymes in chilli plants. In summary, the use of biocontrol agents such as *Trichoderma* species and the application of botanical extracts offer effective alternatives to synthetic chemicals in managing chilli wilt disease. These strategies provide sustainable and environmentally-friendly approaches to disease management in chilli cultivation. Nevertheless, further research and field trials are necessary to optimize their implementation and integration into existing disease management practices.

Introduction

Chilli wilt, which is caused by *Fusarium oxysporum* f. sp. *capsici*, is a plant disease that specifically affects chilli (*Capsicum annum* L.), a member of the Solanaceae family and *Capsicum* genus. The first documented report of this wilt disease dates back to 1919 when Leonian made the initial observation. Chillies are cultivated primarily for their green and ripe red fruits and hold significant importance as a spice vegetable crop in India. They are widely utilized in diverse cuisines to impart a fiery heat to dishes. Red chillies, in particular, are known for their high vitamin C content, while certain varieties also contain noteworthy levels of pro-vitamin A, beta-carotene, and vitamin B6. The compounds responsible for the intense flavor and spiciness of peppers are capsaicin and related compounds collectively referred to as capsaicinoids. Chilli has been an integral part of the human diet for thousands of years, with its origins dating back to Mexico around 6000 years ago. The introduction of peppers to Asia can be attributed to Portuguese traders who recognized their trade value and their similarity to the pungency of black pepper. In India, peppers were introduced by the Portuguese in the late 15th century and have since become a common ingredient in Asian cuisine.

China holds the distinction of being the largest global producer of green chillies, accounting for approximately half of the world's production. In India, chilli is a significant spice and vegetable crop, cultivated across an area of 9.15 lakh hectares, with a total production of 3.2 million tons of both green and dried chillies. India leads the world in terms of chilli production and consumption.

In India, *Fusarium oxysporum* and *F. solani* are the most prevalent species of *Fusarium* associated with chilli wilt. Typically, the pathogen is soil-borne, and the development of the disease is favored by dry weather conditions and excessive soil moisture. Among the various pathogens affecting chilli crops, wilt disease is emerging as a serious threat to chilli cultivation in India. It causes significant yield loss, particularly in popular chilli cultivars, especially in Uttar Pradesh, during both the Kharif and Rabi seasons. The disease infects the crop at the flowering stage, leading to pale yellowing, withering, and chlorosis of leaves. When the stem and roots of infected plants are cut diagonally, brown discoloration can be observed in the xylem vessels. The underground stems become dry and brown due to cortical decay, while the roots may appear soft and water-soaked. The root system undergoes significant reduction and turns black. Affected roots can be easily uprooted, and the affected plants gradually wilt and die.



While chemical fungicides are available for managing the disease, their use poses risks to the environment and human health. In the future, there will be greater emphasis on biological management of plant diseases using microflora, as chemical pesticides have adverse effects. Various biocontrol agents such as *Pseudomonas fluorescens*, *Trichoderma viride*, *T. harzianum*, and *T. koninzi* have been individually studied by researchers for their effectiveness against Fusarium wilt and other plant diseases.

In a comparative study conducted by Sastiyar *et al.* (2016), the rhizosphere and rhizoplane of diseased and healthy chilli varieties (Malwa, Patna, and Simla) were analyzed under controlled conditions at various stages, including the seedling stage, peak vegetative growth, flowering time, and harvesting time. *Fusarium oxysporum* f. sp. capsici was found to be 100% prevalent and highly abundant in the rhizosphere and rhizoplane of diseased plants from all three chilli cultivars. The infection was most severe in the Malwa variety, which also exhibited the highest percentage of disease intensity. Fungi, actinomycetes, and bacteria isolated from the rhizosphere and rhizoplane were tested for their antagonistic properties against *Fusarium oxysporum* f. sp. capsici.

Seven strains of *Trichoderma* spp. were evaluated as biological agents against chilli wilt, which is caused by *Fusarium solani*. The assessment was conducted through laboratory and pot culture experiments. Among the tested *Trichoderma* strains, *T. viride* PDBCTV I0 exhibited complete inhibition (100%) of *F. solani*'s linear growth in dual culture on potato dextrose agar. This inhibition was observed regardless of whether the *Trichoderma* strains were seeded simultaneously, one day prior, or two days prior to pathogen inoculation (Naik *et al.*, 2009).

Chilli wilt, caused by *Fusarium solani*, poses a significant threat in the black cotton soils of Karnataka, India. From 2011-12 to 2012-13, wilt incidences ranging from 19.8% to 31.5% and from 7.5% to 12.3% were recorded in major chilli-growing regions of Karnataka. *Trichoderma harzianum* isolates 1, 2, and 5, as well as *T. viride* isolate 2, completely overgrew *F. solani* and inhibited its mycelial growth by 40-50% in vitro. In field evaluations, all the isolates effectively reduced wilt incidence and increased green chilli yield compared to the control. For instance, in Haveri district, *T. viride* enhanced yield by up to 30%, while in Bellary, *T. harzianum* isolate 1 reduced wilt incidence by 39.7% (Bhat *et al.*, 2016).

Trichoderma demonstrates higher control effects on soilborne pathogens compared to synthetic fertilizers and persists in the soil for an extended period after application. The biocontrol mechanisms employed by *Trichoderma* involve antibiosis, mycoparasitism, competition for nutrients, and the induction of defense responses or systemic resistance responses in plants. *Trichoderma* spp. are known for their secretion of cell wall degrading enzymes (CWDEs), which play a crucial role in breaking down the cell walls of pathogens and contribute to the biocontrol mechanism. Biocontrol genes, which are essential for *Trichoderma* as a potent biological control agent, govern the biocontrol activity through various genes and their products (Konappa *et al.*, 2020).

Chilli wilt, caused by *Fusarium solani*, has emerged as a serious disease affecting chilli cultivation, particularly among poor farmers. Fifteen *Trichoderma* isolates tested in vitro against the pathogen exhibited more than 52% inhibition of mycelial growth compared to the control. In field evaluations, all the isolates effectively reduced wilt incidence and improved green chilli yield compared to the control (Nagendran *et al.*, 2016).

In a study by Shafique *et al.* (2015), pathogenicity tests were conducted using four strains of *Fusarium oxysporum* f.sp. capsici and ten chilli varieties. Strain B was found to be the most pathogenic, while variety Sky red was the most susceptible. Antifungal bioassays were performed using methanolic extracts of fruit, bark, and leaves of *Eucalyptus citriodora* against *F. oxysporum*. The leaf extract showed the highest suppression (up to 98%) of fungal growth, while fruit and bark extracts exhibited lower effectiveness, with only 50-60% reduction in fungal mycelial growth. The study concluded that the methanolic extract of *E. citriodora* leaves has the potential to control the harmful effects of the pathogenic fungus, providing approximately 85% disease control in chilli plants and inducing high levels of defense-related enzymes under pathogenic stress. Additionally, Gupta and Bansal (2003) tested the leaf extract of *Azadirachta indica* and reported 100% control of *F. oxysporum* spore germination, followed by *Lantana camara*.

Singh *et al.* (2017) investigated the antifungal activity of twelve botanicals, including commercial formulations of neem and garlic, at different concentrations against *Fusarium oxysporum* under in vitro conditions. The botanicals demonstrated significant reduction in mycelial growth and sporulation of the *F. oxysporum* isolate. Neem oil formulation and garlic oil exhibited the most significant effects on the test fungus, completely inhibiting mycelial growth at a concentration of 10%. Mustard oil (69.26%), Datura (46.67%), and *Withania somnifera* (34.44%) also showed notable antifungal activity, while



other leaf extracts such as *Chrysanthemum*, *Duranta erecta*, *Bougainvillea*, *Clerodendron inerme*, and *Eucalyptus globulus* exhibited lesser effects.

The *Trichoderma* species, particularly *T. viride* and *T. harzianum*, have shown promising potential as biological control agents against chilli wilt caused by *Fusarium solani*. These *Trichoderma* strains have demonstrated the ability to inhibit the growth of the pathogen and reduce disease incidence in both laboratory and field evaluations. Additionally, botanical extracts from plants like *Eucalyptus citriodora*, *Azadirachta indica*, and garlic have exhibited antifungal activity against *Fusarium oxysporum*, another pathogen associated with chilli wilt. These findings suggest that biocontrol agents and botanical extracts can serve as effective alternatives to synthetic chemicals for managing chilli wilt disease.

Conclusions

Chilli wilt caused by *Fusarium* species, particularly *Fusarium oxysporum* f. sp. *capsici* and *Fusarium solani*, poses a significant threat to chilli cultivation in India and other regions. Chemical fungicides are available for disease management, but their use has adverse effects on the environment and human health. Therefore, there is a growing emphasis on biological control and botanical alternatives for managing chilli wilt. *Trichoderma* species, such as *T. viride* and *T. harzianum*, have shown promise as biological control agents against chilli wilt. These strains inhibit the growth of *Fusarium* pathogens and reduce disease incidence in laboratory and field evaluations. *Trichoderma* spp. employ mechanisms such as antibiosis, mycoparasitism, competition for nutrients, and the induction of defense responses in plants.

Botanical extracts from plants like *Eucalyptus citriodora*, *Azadirachta indica*, and garlic have also exhibited antifungal activity against *Fusarium* species associated with chilli wilt. These plant extracts have the potential to control the harmful effects of the pathogens and induce defense-related enzymes in chilli plants.

Overall, the use of biocontrol agents, such as *Trichoderma* species, and botanical extracts can serve as effective alternatives to synthetic chemicals for managing chilli wilt disease. These strategies offer sustainable and environmentally-friendly approaches to disease management in chilli cultivation. Further research and field trials are needed to optimize their application and integration into existing disease management practices.

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QUALITY OF IRRIGATION WATERS — CRITERIA AND CLASSIFICATION

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Introduction

Irrigation of crops is an essential input for attaining high yields, but the quality of the irrigation water is also equally critical for long term achievable production goals. Poor quality water if used for a long time will make the soil less productive or even barren depending on the amount and type of salts present in it and the texture of the soil. Low or marginally saline waters sometimes appear to stimulate crop growth because of the nutrient ions present. However, excess of soluble salts in waters leads to their accumulation in the surface particularly in heavy textured or in poorly drained soils. Many areas in the country are facing a serious problem of not only scarcity of water but also of critical poor quality of irrigation water. Tube well or well waters generally pose such problems more than canal waters.

Importance of water quality in agriculture

1. Excess of amount of salts in irrigation water decreases crop yield and quality.
2. Prolonged use of irrigation water with excess of salts results in soil salinization / sodication.
3. The effect of excess of salts in irrigation water on soil depends on nature and amount of salts present.
4. Irrigation water dominated by Sodium – soil turns into sodic / alkali
5. Irrigation water dominated by Calcium – improves soil physical properties
6. Irrigation water dominated by CO_3 and HCO_3 – leads to formation of sodic soil

Therefore, it is necessary to know the quality of irrigation water before being used for crops. To know the quality and suitability of water for irrigation, it needs to be analyzed for various quality parameters.

Extent and distribution of quality of Irrigation water in India

1. Lesser rainfall and overexploitation of ground water have made it increasingly susceptible to increased load of soluble salts.
 2. The ground water quality surveys conducted by CSSRI Karnal in different states of India revealed 32-84 % of ground waters of poor quality and not suitable for irrigation.
 3. The most affected state is Rajasthan (68% poor quality waters, most arid).
 4. Even in Karnataka, more than 25 % of ground waters are of poor quality.
 5. Usually irrigation waters from surface reservoirs are of good quality while ground waters carry higher salinity load.
 6. In red soil predominant areas (younger granites), usually the groundwater will be free from salt load.
 7. In black soil areas (weathered basalt and granite gneiss), usually the groundwater will have higher salt load.
- Injudicious use of such poor quality waters result in poor crop performance apart from deteriorating soil health.

Assessment of Irrigation Water Quality

Water quality is determined according to the purpose for which it will be used. For irrigation water, the usual criteria include salinity, sodicity, and ion toxicities. Various criteria are considered in evaluating the quality of irrigation water namely:

Characteristics that Determine Irrigation Water Quality

The characteristics of irrigation water that have been the most important in determining its quality, however, depending on climatic conditions, irrigation practices, soil-water retention characteristics, crop tolerance, depth to water and agronomic practices, etc. Are the following:

(I) Salinity Hazard (Total concentration of soluble salts);

Electrical conductivity (EC).

(II) Specific Ion Toxicity Hazard : (Ionic composition):

(a) Major constituents: (Sodium, Magnesium, Chloride, Bicarbonate, Carbonate, Silica, Sulphate, Nitrate)

(b) Minor constituents: (Boron, Lithium, Fluorine and other micro-toxicants)

(III) Sodicty Hazard : (Relative proportion of sodium to other cations): Sodium Adsorption Ratio (SAR) or Sodium to Calcium Activity Ratio (SCAR), Adjusted SAR/SCAR.

(IV) Salt Index :

(V) Alkalinity Hazard : (Bicarbonate concentration as related the calcium plus magnesium), or calcium alone; Residual Sodium Carbonate (RSC) or Residual Sodium Bicarbonate (RSBC).

In addition to above individual parameters, combined evaluation of two parameters as given below is also of practical importance.

(VI) combined evaluation on the basis of SAR and RSC

(VII) Combined Evaluation on the Basis of EC and SAR

(I) Salinity Hazard

Ideally it would be inferred that EC of irrigation water should be as low as possible but the water which is completely free of the soluble salts is never best for irrigation. The waters having EC less than 0.20 dS m⁻¹ have no fertility value and are well known to create permeability problem in the soil. The irrigation water should however, have EC preferably less than 1.5 dS m⁻¹ so that the irrigated soils does not ever become saline and there is full choice to grow the crops. Unfortunately, ground waters occurring in arid and semiarid zones are highly saline. In evaluating the quality of irrigation waters only on the basis of EC, it is presumed that low salinity waters have low RSC and high salinity waters have low SAR. Therefore, it is necessary that low salinity waters are evaluated for RSC and high salinity waters for SAR. The medium salinity waters may be subjected to both. The concentration of soluble salts in irrigation water can be classified in terms of Electrical Conductivity (EC) and expressed as dS m⁻¹. There are four classes of salinity viz., C1, C2, C3 and C4. The classes C1 and C2 of water are considered suitable for irrigation purposes (no problem). C3 and C4 classes of water are not suitable for irrigation purpose (severe problems).

USDA ratings for quality of Irrigation water

EC or salinity hazard or total salt concentration

Water Class	EC (μ mhos/cm)	Remarks
Low salinity water (C1)	< 250	Can be used safely
Moderate(Fair) salinity water (C2)	250 – 750	Can be used with moderate leaching
Medium salinity water (C3)	750 – 2,250	Can be used for irrigation purposes with some management practices
High salinity water (C4)	2,250– 5000-	Cannot be used for irrigation purposes
Very high salinity water (C5)	5,000 – 10,000	
Extremely high salinity water (C6)	10,000–22,000	

The use of saline water for irrigation depends on soil characteristics, plant type, climatic parameters and management practices. Water with low salinity is suitable for heavy textured and high salinity is suitable for light textured soils. The saline waters are classified into :

1. Low salinity water (EC : 100 – 250 micromhos/cm) : Can be used for irrigation for most of the crops in most soils with little chances of development of soil salinity. Some leaching is needed. This is usually occurs in normal irrigation practices except in soils of extremely poor permeability.

2. Medium salinity water (EC : 250 – 750 micro mhos/cm) : Can be used with moderate leaching. Plants with moderate salt tolerance can be grown mostly without special practices for the control of salinity.

3. High salinity water (EC : 750 – 2,250 micro mhos/cm) : This water cannot be used on soils with restricted drainage. Special management practices are required along with adequate drainage for salinity control and plant with good salt tolerance should be grown.

4. Very high salinity water (EC : > 2, 250 micro mhos/cm) : This water not at all suitable for irrigation but may be used occasionally under very special conditions only. If this water is to be used, the soil must be permeable, drainage must be adequate, water must be added in excess to provide considerable leaching and very tolerant crops should be grown.

(II) Specific Ion Toxicity Hazard

(a) Major constituents (Sodium, Magnesium, Chloride, Bicarbonate, Carbonate, Silica, Nitrate)

Sodium : Among the soluble constituents of irrigation water, sodium is considered most hazardous. Excess of sodium ions characterizes the water as saline or alkaline depending upon its occurrence in association with chloride/ sulphate or carbonate/ bicarbonate ions. For some time in the past, the quality of irrigation water used to be evaluated with respect to sodium based on soluble sodium percentage (SSP) calculated as below.

$$SSP = \frac{\text{Soluble Sodium Concentration}}{\text{Total Cation Concentration}} \times 100$$

It has been useful in characterizing water, since a high value indicates soft water and low value hard water. When water with excess of sodium (SSP=66) is used for irrigation, part of it is adsorbed by the soil. Both, soils and plants are adversely affected by high sodium irrigation water. Sodium soils are relatively impermeable to air and water. They are hard when dry, difficult to till and plastic and sticky when wet. These adverse physical conditions prevent germination and are generally unfavourable for plant growth. Even though, sodium is not as essential as other nutrients, it is taken up freely by many plants and it may be specifically toxic to plants.

Magnesium : It is believed that one of the important qualitative criteria in judging the irrigation water is its Mg content in relation to total divalent cations, since high Mg content in relation to total divalent cations, since high Mg adsorption by soils affects their physical properties. A harmful effect on soils appears when Ca: Mg ratio decline below 50.

$$\text{Mg Adsorption Ratio} = \frac{\text{Mg}^{2+}}{\text{Ca}^{2+} + \text{Mg}^{2+}}$$

Magnesium hazard in irrigation water is expected having Mg: Ca ratio more than 1.

Chlorides : The occurrence of chloride ions in irrigation water increases with increase in EC and sodium ions. Therefore, these ions are most dominant in very high salinity water. Unlike sodium ions, the chloride ions neither affect on the physical properties of the soil, nor are adsorbed by the soil. Therefore, it has generally not been included in modern classification system. However, it is used as a factor in some regional water classification.

$$\text{Chloride Concentration (me L}^{-1}\text{)} = \frac{\text{Cl}^{-} + \text{NO}_3^{-}}{\text{CO}_3^{-} + \text{HCO}_3^{-} + \text{SO}_4^{2-} + \text{Cl}^{-} + \text{NO}_3^{-}}$$

Sulphate : Sulphate salts are less harmful when compared to chlorides.

Eaton proposed three classes for sulphate

- < 4 me l⁻¹ - Excellent water
- 4-12 me l⁻¹ - Good to injurious
- > 12 me l⁻¹ - Injurious to unsatisfactory

It can be worked out by using the formula $\text{Cl} + 1/2 \text{SO}_4^{2-}$ where ions are expressed in me l⁻¹.

Bicarbonates and Carbonates :

$$\text{RSC} = (\text{CO}_3 + \text{HCO}_3) - (\text{Ca}^{+} \text{ Mg})$$

$$\text{RSBC} = \text{HCO}_3 - \text{Ca}$$

Nitrates : Very frequently ground water contain high amount of nitrate. When such type of irrigation water is applied on soils continuously, various properties of soils are affected.

NO ₃ (me l ⁻¹)	Remarks
< 5	No problem
5-30	Intensity of problem is moderate
1> 30	Intensity of problem is severe

Application of high amount of nitrate containing irrigation water (>30 ppm) on soils affect physical properties very badly which causes poor growth of the plants.

(b) Minor constituents (Boron, Lithium, Fluorine and other micro-toxicants)

Boron : It is evident that boron is essential for the normal growth of the plant, but the amount required is very small. The occurrence of boron in toxic concentration in certain irrigation water makes it necessary to consider this element in assessing the water quality. The permissible limits of boron in irrigation water are:

Lithium : Lithium is a trace element may be found in most of saline ground water and irrigated soils. It has been found that 0.05-0.1 ppm of lithium in water produce toxic effects on growth of citrus. It has also been reported that saline soils of varying degrees found in India contain lithium upto 2.5 ppm. Fortunately, the germination of majority of crops is not affected with this level of lithium content.

In India, saline soils contain lithium upto 2.5 ppm. At this level, germination of majority of crops including rice, wheat, barley etc., are not affected.

Fluorine : Fluorides are only sparingly soluble and are in only small amounts. The concentration of fluoride ranges from traces to more than 10 mg L⁻¹ in natural water, and surface water do not exceed 0.3 mg L⁻¹ unless they are polluted.

Fluorine :

< 1 ppm = Good

> 1ppm = Problematic

(III) Sodium Hazard

High concentrations of sodium are undesirable in water because sodium adsorbs on to the soil cation exchange sites, causing soil aggregates to break down (deflocculation), sealing the pores of the soil and making it impermeable to water flow. The sodicity hazard of irrigation water is usually evaluated by :

Sodium Adsorption Ratio (SAR)

Adjusted SAR

Sodium Adsorption Ratio (SAR) : United States Salinity Laboratory (USSL) staff introduced the concept of sodium adsorption ratio (SAR) to predict the sodium hazard. It is calculated as

$$SAR = \frac{Na^+}{\sqrt{Ca^{2+} + Mg^{2+}} / 2}$$

Where all the ions expressed as me L⁻¹.

The sodium hazard of irrigation water expressed through SAR does not take into account the effect of anionic composition.

Sodicity hazard also classified as S1, S2, S3 and S4.

Water class		SAR	Remarks
S1	low sodium hazard	0-10	Little or no hazard
S2	medium sodium hazard	10-18	Appreciable hazard but can be used with appropriate management
S3	High sodium hazard	18-26	Unsatisfactory for most of the crops
S4	Very high sodium hazard	>26	Unsatisfactory for most of the crops

Adjusted SAR : The SAR indicates the tendency for the soil to become higher in exchangeable sodium. To predict sodicity hazard more correctly for those water which contain appreciable amounts of HCO_3^- but no RSC.

IV. Salt Index

It is also used for predicting sodium hazard. It is the relation between Na^+ , Ca^{2+} and CaCO_3 present in irrigation water.

$$\text{Salt index} = (\text{Total Na}) - (\text{total Ca} - \text{Ca in } \text{CaCO}_3) \quad 4.85$$

Where all ions are to be expressed in ppm. Salt index is negative for all good water and positive for those unsuitable for irrigation.

(V) Alkalinity Hazard is evaluated by

Residual Sodium Carbonate (RSC)

Residual Sodium Bicarbonate (RSBC)

Bicarbonates (HCO_3^-) occur in low salinity water and its concentration usually decreases with an increase in EC. The proportion of bicarbonate ion is higher than calcium ions are considered undesirable, because after evaporation of irrigation water bicarbonate ions tend to precipitate calcium ions. Hence, the effect of bicarbonate together with carbonates evaluated through RSC.

$$\text{RSC} = (\text{CO}_3^{2-} + \text{HCO}_3^-) - (\text{Ca}^{2+} + \text{Mg}^{2+}), \text{ all ions expressed as me L}^{-1}.$$

Residual Sodium Carbonate (RSC) or Relative sodium carbonate (RSC) or Bicarbonate hazard.

Water Class	RSC Values (me/l)	Remarks
Safe	< 1.25	Water can be used safely
Marginal	1.25 – 2.50	Water can be used with certain management
Unsafe	> 2.50	Unsuitable for irrigation purpose in the irrigated area

(VI) Combined Evaluation on the basis of SAR and RSC : Adjusted SAR

(VII) Combined Evaluation on the basis of EC and SAR

Guidelines for identifying the problem based on EC, SAR and RSC (As per CSSRI, Karnal)

Water quality	EC _{iw} (dS/m)	SAR	RSC (me/l)
A. Good	< 2	< 10	< 2.5
B. Saline			
(i) Marginally Saline	2-4	< 10	< 2.5
(ii) Saline	> 4	< 10	< 2.5
(iii) High SAR Saline	> 4	> 10	< 2.5
C. Alkali			
(i) Marginally Alkali	< 4	< 10	2.5-4.0
(ii) Alkali	< 4	< 10	> 4
(iii) High SAR Alkali	variable	> 10	> 4

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BIO-FUEL PARK, TINTHANI : A MODEL PARK FOR PROMOTING BIOFUEL ACTIVITIES IN KALYANA KARNATAKA REGION

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The global fuel crisis in the recent times has generated awareness amongst many countries of their vulnerability to oil embargoes and shortages. Considerable attention has been focused on the development of alternative fuel sources. The automobile population has also increased tremendously over the last decade in India. Environmental degradation is another outcome of growth in motor vehicle population. One of the strategies adopted to curb deteriorating environmental quality is the use of alternative fuels like ethanol and biodiesel. Bio-diesel is being looked upon as a renewable source of energy, which can partially substitute the fossil fuels.

Biofuels are considered in part, a solution to such issues as sustainable development, energy security and a reduction of greenhouse gas emissions. Biodiesel, an environmental friendly diesel fuel similar to petro-diesel in combustion properties, has received considerable attention in the recent past worldwide. Biodiesel is a methyl or ethyl ester of fatty acid made from renewable biological resources such as vegetable oils (both edible and non edible), recycled waste vegetable oil and animal fats. The use of vegetable oils as alternative fuels has been found since 1900, when the inventor of the diesel engine Rudolph Diesel first tested peanut oil in his compression ignition engine. However, due to cheap petroleum products such non-conventional fuels never took off until recently. Biodiesel derived from various biofuel crop is already being used in USA and Europe to reduce air pollution, and dependence on depleting fossil fuel localized in specific regions of the world.

By knowing the importance of Biofuel, Karnataka state government has established Karnataka state bio-energy development board at Bengaluru.

While there were several developmental efforts with regard to alternate energy in Karnataka in the past three decades, the formation of Task Force on Bio-fuel in 2008 is undoubtedly a turning point and has resulted in convergence & better coordination of efforts for bio-fuel development in Karnataka. The initial thrust of the Task Force was to quickly finalize the Karnataka Bio-fuel Policy that could have a great impact on bio-fuel development in Karnataka. As a result, the new Karnataka Bio-fuel Policy was announced in March, 2009 and has been well received.

The Task Force also took several initiatives to accelerate the production of feedstock in the state while simultaneously creating small but visible infra-structure that could induce faith amongst stakeholders in this new era of bio-fuel development. The Task force has paid good dividends as there is already a renewed interest in bio-fuel business in Karnataka. The policy and the new initiatives have also generated considerable interest in rest of India and even in other developing nations as is evidenced by the communications being received by the Task Force.

The concerted efforts of the Task Force have resulted in planting of 3 Crore saplings of TBO species since its inception. The Bio-fuel Park at Hassan has received recognition as a novel project which can be emulated. MGIRED at Jakkur near Bangalore also has played a pioneering role by its studies & pilot plant scale facilities. In addition, six demonstration units for biodiesel production have been commissioned which would act as nuclei of development of this sector. With the announcement of the formation of the Karnataka Bio-fuel Development Board, these activities can only go faster and better.

Objectives of KSBDB

To plan, promote, organize, implement, monitor and evaluate schemes, projects, activities, etc., for bio-fuel development in the State.

Achieving energy self-reliance and fuel security by progressive use of renewable energy through harnessing potential of the State in bio-fuels without affecting the food security.

Reducing the import bill of oil for the country.



To achieve 10% blending of Bio-fuel with Petrol / Diesel by the year 2017 and above 1-% beyond 2017.

Reducing of toxic emissions and reduction of green house gas emission through partial substitution of fossil fuels with bio-fuels.

Earning carbon credits and promote trading in Certified Emission Reductions.

Increasing rural income and women empowerment by generating rural employment.

Contributing to the social and economic development of rural and urban areas.

Facilitating coordination of the work of different departments, farmers, NGOs and private agencies dealing in various aspects of bio-fuels.

Synchronizing all other policies and programmes of the State as well as the Government of India and other Funding Agencies which have direct or indirect bearing on harnessing bio-fuel potential of the State.

To encourage and support research and development activities for bio-fuel development in the State.

Designing and operating bio-fuel projects under appropriate comprehensive, transparent, consultative and participatory processes that involve all relevant stakeholders.

To take-up plant propagation and distribution of various species of bio-fuel seedlings for the benefit of farmers so that farmers derive greater benefits.

To sponsor and organize workshops, seminars, exchange visits and experience sharing regarding bio-fuel development.

To publish journals, documents and other relevant literature in any manner as may be considered desirable in furtherance of the objectives.

To mobilize funds from various sources such as self-generation, State Government/Central Government and their agencies, Banks, International Funding Agencies, Private Sector, etc., as donation, grant, aid, loan, equity participation, goodwill, subsidy etc., for meeting the objectives.

To acquire, undertake or enter into any arrangement to meet the objectives.

To facilitate contract framings, by encouraging private entrepreneurs to set up processing units and the farmers with vacant land to be garnered around the enterprise.

To undertake enumeration of waste land / marginal land available in the States with Forest and Revenue Departments and notify the same at the District, Taluk and Hobli levels.

To do all such acts and things as the Society may consider necessary, conducive or incidental, directly or indirectly, to the attainment and enlargement of the aforesaid objectives or any of them.

Special interest is being shown in view of the potential of this fuel to provide energy security and environmental protection, University of Agricultural Sciences Raichur, Karnataka in collaboration with Karnataka State Bio-energy Development Board (KSBDDB), Bengaluru established Bio-Fuel Park at Tinthini, Yadagiri district of Karnataka in 2013 as Information and Demonstration centre (I&D) for Kalyana Karnataka region.

Of the identified plant species exceeding 150 yielding bio-diesel, eight important species are planted at bio-fuel park over an area of 42 acre viz *Azadiractha indica* (Neem), *Pongamia pinnata* (Honge), *Simarouba gluca* (Laxmitaru), *Apomixis polystrichia* (Amura), *Modhuca latifolia* (Hippe), *Clophyllum innophyllum* (Surahonne), *Melia dubia* (Hebbevu) and *Melia azadiractha* (Herbevu). Short duration oil yielding crops [viz., castor (*Ricinus communis*), groundnut (*Arachis hypogaeae*), pundi (*Hibiscus* sp) etc.)] were grown as intercrops during the gestation period. With its greenery, park is attracting villagers, herders, devotees of nearby deity, His Holiness Mouneshwar helping to create awareness to the farming community on the importance of bio-fuels plantation and use as eco-friendly oil. The centre is also undertaking educating college students and intermediate students through organising training, awareness programme, exposure visits, exhibition etc. So far 24,0062 individuals were exposed to bio-fuel related information. Centre is motivating farmers to collect bio-fuel yielding seeds for oil extraction at its extracting unit. Seedlings produced in the Park are being distributed to the farmers for planting in their fields. During Deepavali festival, a campaign in and around Lingsugur and Raichur taluks was organized to motivate public to light lamps using bio-fuel during the festival. Further, oilcake, the by product of the unit is used as slow release organic manure for perennial trees. Thus, efforts are on for production and use of biodiesel oil to substitute fossil fuels if not as an alternate for encouraging and enlightening people, young and old.

The details of planting activities carried out in various blocks at park.

Sl. No.	Block name	Area planted (ac)	Species planted	Spacing	Date of planting	
			Botanical name	Common name		
1	Block A1,A2,A3,A4	8	1. <i>Azadiractha indica</i>	Neem	5m × 5m	22-09-13
			2. <i>Pongamia pinnata</i>	Honge		
			3. <i>Simarouba gluca</i>	Laxmitaru		
			4. <i>Apomixis polystrichia</i>	Amura		
			5. <i>Modhuca latifolia</i>	Hippe		
			6. <i>Clophyllum innophyllum</i>	Surahonne		
			7. <i>Melia dubia</i>	Hebbevu		
			8. <i>Melia azadiractha</i>	Arabevu		
2	Block B	7	1. <i>Azadiractha indica</i>	Neem	5m × 5m	19-09-13
			2. <i>Pongamia pinnata</i>	Honge		
			3. <i>Simarouba gluca</i>	Laxmitaru		
			4. <i>Apomixis polystrichia</i>	Amura		
			5. <i>Modhuca latifolia</i>	Hippe		
			6. <i>Clophyllum innophyllum</i>	Surahonne		
3	Block C ₁	1	Clonal orchard – Pongamia (Honge) No. of clones : 25, No. of rametes : 20 Total no. 500, Design : RCBD	3m × 3m	04-10-13	
4	Block C ₂	4	1. <i>Azadiractha indica</i>	Neem	4m × 4m	28-09-13
			2. <i>Pongamia pinnata</i>	Honge		
			3. <i>Simarouba gluca</i>	Laxmitaru		
5	Block C ₃	2	1. <i>Melia azadiractha</i>	Arabevu	2m × 2m	28-09-13
6	Block D ₁ D ₂	6	2. <i>Pongamia pinnata</i>	Honge	6m × 6m	31-10-13
			3. <i>Simarouba gluca</i>	Laxmitaru		
7	Block E ₁	5	1. <i>Azadiractha indica</i>	Neem	6m × 4m	22-12-13
			2. <i>Pongamia pinnata</i>	Honge		
			3. <i>Simarouba gluca</i>	Laxmitaru		
			4. <i>Apomixis polystrichia</i>	Amura		
			5. <i>Modhuca latifolia</i>	Hippe		
			6. <i>Clophyllum innophyllum</i>	Surahonne		
			7. <i>Melia dubia</i>	Hebbevu		
			8. <i>Melia azadiractha</i>	Arabevu		
8	Block E ₄	1.5	<i>Melia dubia</i>	Hebbevu	6m × 6m	05-10-15
9	Block A4	1.0	1. <i>Melia dubia</i>	Hebbevu	High density	25-09-18



LIVESTOCK FARMING FOR SUSTAINABLE DEVELOPMENT OF FARMING COMMUNITY IN KALYAN KARNATAKA (HYDERABAD - KARNATAKA) REGION

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Introduction

Livestock production is the backbone of Indian agriculture and source of employment in rural areas since centuries, in which the entire system of rural economy has revolved around it. Since decades, livestock keeping has emerged as an integral part of Indian farming with evidence in the oldest Indian scriptures, such as the Atharvaveda, Ayurveda and Rigveda and in archaeological remains of Harappan era in the Indus civilization (about 2000 B.C.), including a coin bearing the figure of a bull and terracotta bullock carts.

Livestock has revealed multi-faceted contribution to socio-economic development of rural masses. Due to the inelastic absorptive capacity for labour in other economic sectors, livestock sector has greater scope for generating more employment opportunities, especially for the marginal and small farmers and landless labourers who own around 70 per cent of the country's livestock. On the other hand, livestock wealth was more equitably distributed than that of land. Being an important source of income and employment, the livestock also helps in alleviating poverty and smoothening of income distribution. This sector also provides income to households dependent on agriculture and for many landless households in Kalyan Karnataka (Hyderabad - Karnataka) region. The livestock also act as a source of protein in the form of milk, egg and meat. The Government is continuously trying for bring further improvements and developing this sector in this region as an industry. The present study was undertaken to analyze the economic development and growth trends in the livestock sector in Kalyan Karnataka (Hyderabad-Karnataka) region of Karnataka State.

Key words: Income, Agricultural Diversification, Economics Development, Dairy Farming

Materials and Methods

This study investigates the economic development through livestock and dairy farming sector in Kalyan Karnataka (Hyderabad-Karnataka) region. This region constitutes 07 districts of Karnataka. The secondary data pertaining to livestock population over the years were collected from various publications and reports of livestock census, DAHD, Ministry of Agriculture and Farmers Welfare, GOI, Government of Karnataka etc. were reviewed and analyzed and the inferences were drawn accordingly.

Results and discussion

According to 20th Livestock Census, Fig 1. reveals that Kalyan Karnataka region has total cattle population of 72.86 lakhs among which the highest cattle population is 21.12 lakhs in Ballari and lowest is in 59.77 lakhs in Bidar district. In case of buffaloes, the highest population is found in Ballari district while lowest buffaloes population is found in Yadgir district. With regards to sheep, highest population is found in Ballari district (12.72 lakhs) while lowest sheep population is found in Bidar district. Further, in case of goats, the highest population is found in Kalburgi district while the lowest population is found in Koppal district. Lastly, in poultry, the highest population was found in Koppal (40.09 lakhs) and lowest population was found in Yadgir district (3.27 lakhs).

The production details of milk, egg, meat and wool in Kalyan Karnataka region are represented in Table.1. The report highlights that total milk production in Kalyan Karnataka region is 1566.27 tonnes. Among six districts, Ballari bears highest milk production (407.32 tonnes) followed by Kalburgi (283.07 tonnes) while lowest milk production is found in Yadgir (120.16 tonnes) district. With regards to egg production, the highest production is found in Koppal (14626.0 lakhs), while lowest is found in Yadgir (528.08) district. In case of meat production, the highest production is 13342.8 tonnes in Ballari district while lowest is found in Bidar district of Karnataka. Lastly, in concern with wool production, the highest production is found in Koppal (77.73tonnes) while lowest is found in Bidar (11.87tonnes) district of Karnataka.

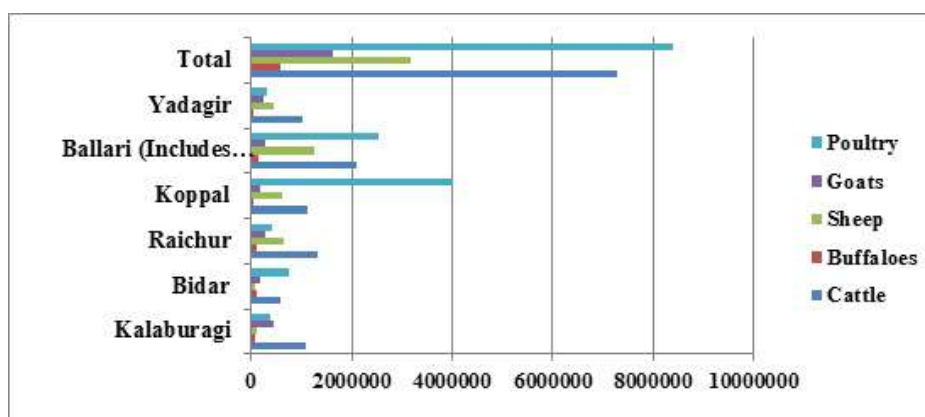


Fig.-1 : Livestock Population in Kalyan-Karnataka Region ((20th Livestock Census, 2019, GoK).

Table-1 : Production Details in Kalyan Karnataka Region (2020-21, GoK).

Districts	Milk (Tones)	Eggs (Lakhs)	Meat (Tones)	Wool (Tones)
Kalaburgi	283.076	423.486	4616.925	16.832
Bidar	211.943	919.574	1528.769	11.871
Raichur	264.778	696.356	5181.702	55.574
Koppal	278.986	14626.044	5301.380	77.736
Ballari (Includes Vijayanagar District also)	407.325	6522.830	13342.831	55.198
Yadagiri	120.162	528.088	1545.445	0.000
Total	1566.27	23716.37	31517.05	217.211

Table-2 : Revenue generations of LRIC (Deoni), Bidar (in Lakhs).

Particulars	2020-21	2021-22	2022-23
Milk	2.54	2.88	3.47
Fodder seeds/stem slips	0.90	4.29	5.34
Livestock	2.25	0.00	4.76
Grains (Jowar)	0.00	0.11	0.00
Miscellaneous (Fallen wood& scrap items)	1.39	1.26	0.00
Vermicompost, Earthworms, cow urine, FYM	0.00	0.76	1.21
Total	7.08	9.30	14.79

Livestock Research and Information Centre (Deoni), Bidar an institute under KVAFSU, Bidar is making efforts to promote economic development and to improve the living standards of farmers through livestock and dairy farming in Kalyan Karnataka (Hyderabad - Karnataka) region. As a part of Research & Extension activities, the research station is trying to build more confidence level in farmers through various scientific training and capacity building programmes. As model point of view (Table-2), the station is carrying below mentioned research and extension and other activities for the overall development.

Issues/Challenges of the Dairy sector in India

In order to achieve greater profitability, quality standards need to be improved. Following are some of the practical livestock farming challenges in India in general and Kalyan Karnataka region in specific.

- Poor scientific feed and fodder management
- Breeds and breeding system



Animal health and disease management
Lack of high yielding germplasm or low productivity
Poor hygiene conditions
Farmers' livestock product market issues
Poor education and training
High cost of livestock production
Marketing and Pricing
Poor returns
Fragmented supply chain
Poor adoption of technology by Indian livestock farmer
Inadequate veterinary facility in livestock sector
Inadequate extension services
Poor record keeping and data deficiency

Conclusions

Livestock sector has sustainable contribution in generating employment opportunities with relatively low level of risk. The productivity of this sector can be enhanced if they run their business in a scientific manner. To ensure maximum production and profits, it is essential for the farmers to adopt proper business plans and good management practices. The public and private organizations have to support the livestock farmers in the best possible ways by providing subsidies, proper prices, and market facilities in Kalyan Karnataka region to alleviate poverty and smoothen income distribution.

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BIOTECHNOLOGICAL INNOVATIONS IN AGRICULTURE : ROLE OF MULTIPLE AGENCIES IN EVALUATION AND APPROVAL OF BIOTECHNOLOGICAL PRODUCTS

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Introduction

Indian taxpayers have invested heavily in public, university, and small business developers of crops and foods improved using biotechnology. Yet the return on this investment, in terms of new, improved genetically engineered (GE) crops, is disappointingly thin. Although the Department of Agriculture, universities, and small businesses have developed dozens of GE crops with improved traits ranging from healthier and less allergenic to safer and more environmentally sustainable and carried many through safety and premarket testing, almost all have been denied commercial release mainly because of regulatory obstacles that disproportionately penalize public, academic, and smaller private breeding entities. In theory, scientifically sound regulations serve the public good by assuring a reasonable degree of product safety while not unduly stifling innovation. In a scientifically rigorous, risk-based safety assessment, the degree of regulatory scrutiny is commensurate with the degree of identified risk posed by the product in question. In reality, however, our current regulations are not based on product risk, but on spurious, undocumented risks posed by the process of genetic engineering. These regulations impose scrutiny well beyond that imposed on non-GE products posing similar risks. As well, the unnecessarily onerous and expensive regulations discourage and stifle innovation, especially in small businesses and universities. Considering various aspects of agricultural biotechnology regulation, including labelling and scientifically sound alternatives to the unnecessarily restrictive current regulatory system to allow the benefits of safe agricultural biotechnology products from small business and universities to accrue to farmers, consumers, and the environment.

Agricultural Biotechnology

Recombinant deoxyribonucleic acid (rDNA), a set of techniques also known as bioengineering, genetic engineering (GE), or genetic modification (GM), was developed in the 1970s and is now used to produce everything from pharmaceuticals to crops and foods with such traits as nutritional enhancements or disease resistance. Although public concerns regarding the GE process for medical or industrial applications have been relatively mute, agricultural applications (“agricultural biotechnology”) elicit fear from vocal segments of society, including many nongovernmental organizations. These fears can often be traced to the large knowledge gap separating the science from non-science segments of society. There is a clear consensus in the scientific and medical communities, however, that GE crops and foods are at least as safe as corresponding conventionally bred crops and foods. In the nearly half a century since its inception, not a single case of harm attributed to a GE modification has been documented.

Safety regulations governing GE processes were initiated after the scientific community itself raised concerns that the powerful new technology could potentially create unforeseen risks (Berg *et al.* 1975). Robust scientific studies conducted over the past five decades, however, have revealed that introduction of genetic variation into plants using the GE process is unlikely to generate risks beyond those inherent with conventional breeding methods (e.g., see NRC 1983, 1987; NRC/IOM 2004; OECD 1986).

Benefits of Agricultural Biotechnology

There is ample evidence that GE in plant breeding is of benefit to farmers, to consumers, and to the environment (Barfoot and Brookes 2014; Brookes and Barfoot 2017a,b; CAST 2016; Green 2012; ISAAA 2006; Klümper and Qaim 2014; Mannion and Morse 2012; NRC 2016; Qaim 2009). These documented benefits include higher yields (which result in less expensive foods); cleaner crops (less dockage for farmers and higher quality for consumers); increased incomes for farmers; less pesticide use; and substitution of more benign pesticides for older, more toxic, and environmentally damaging pesticides. Other environmental benefits include reduced topsoil loss with some GE crops facilitating no-till and reduced tillage production.

Genetically modified crops have the potential to contribute to food security through the following characteristics.

1. Increased yields, nutritional value, quality
2. Improved resistance to diseases, pests, and herbicides



3. Improved tolerance to stresses such as cold and heat, drought, and salinity
4. Reduced maturation period
5. Food products have longer shelf life.
6. Food products have considerable health benefits.
7. Reduced use of pesticides/other agricultural chemicals

The major concerns about genetically modified crops are as follows:

1. Potential impact on human health, especially due to allergens and the transfer of antibiotic resistant markers
2. Potential impact on the environment, especially due to the potential movement of genes from genetically modified plants into conventional crops or species in the wild (“outcrossing”) and the possibility of the development of resistance
3. Difficulty in labelling
4. Ethical objections to introducing animal genes in plants
5. Debate over the cost of seed issue
6. Debate over the effects on farmers’ livelihoods
7. Issues of access and intellectual property rights
8. Strong hold of multinationals over the entire process

Commercializing an Agricultural Biotechnology Product

Moving from a concept to a marketed product is a complex process regardless of the nature of the product. When the product is derived from a scientific application, the complexity goes up many-fold. Regardless of the type of crop developed, the process of commercialization requires significant effort in several areas:

1. **Scientific capability** : Is it possible to develop the crop/trait combination to yield the desired result?
2. **Intellectual property** : Does the developer have the freedom to use the transformation method, and can the developer establish and maintain intellectual property on the invention or crop?
3. **Market realities** : Is there a market for the crop?
4. **Regulations** : Can the developer afford the costs associated with the various governmental regulatory requirements and can these be achieved?

Regulatory Compliance as A Barrier to Small Companies/Academics

Barriers to the development of new GE crops are numerous, including time and cost of laboratory and field trials necessary to generate the dossiers for submission to regulatory agencies. The complexity of the regulatory process is especially daunting to navigate for small-scale businesses or academics. Even if the data could be collected to present a dossier to the regulatory agencies, the years of waiting for decisions and requests for additional data make the task even more costly.

Current Approach : Existing Regulatory Framework

The Ministry of Environment and Forests (MoEF) has notified the Rules for the Manufacture, Use, Import, Export and Storage of Hazardous Micro-organisms/ Genetically Engineered Organisms or Cells 1989 under the umbrella legislation Environment (Protection) Act, 1986.

Competent Authorities Dealing with Genetically Modified Organisms and their Functions

Most of these institutions operate under the Ministry of Science and Technology (MoST), with the notable exception of the Genetic Engineering Approval Committee (GEAC), which is housed within the MoEF (however, except for the Chair, the members of GEAC are from institutions not under the MoEF).

Regulations/guidelines

1. Recombinant DNA Advisory Committee (RDAC) under the Ministry of Science and Technology (MoST): Regulations/guidelines



Monitoring, review, and approvals

1. Institutional Biosafety Committee (IBSC) under MoST: Prepares site-specific plans
2. Review Committee on Genetic Manipulation (RCGM) under MoST: Monitors safety-related aspects of ongoing research projects
3. Monitoring-cum-Evaluation Committee (MEC) under MoST: Conducts large scale, multi-site field trials
4. Indian Council of Agricultural Research (ICAR) under the Ministry of Agriculture (MoA): Generates complete agronomic data, recommends genetically modified crops for commercial release
5. Genetic Engineering Approval Committee (GEAC) under the Ministry of Environment and Forests (MoEF): Gives approvals for release into the environment, commercial agriculture

Punitive actions

1. State Biotechnology Coordination Committee (SBCC): Addresses violations of safety and control measures
2. District Level Committee (DLC): Monitors safety regulations and takes appropriate measures

Some of the regulatory barriers that crop developers face in commercializing GE crops include the:

3. Complex regulatory framework
4. Lack of a road map that delineates how to navigate through the regulatory framework to achieve the freedom to commercialize
5. Costs associated with meeting the safety standard of “substantial equivalence”
6. Challenges and costs related to collecting extensive, relevant, and comprehensive data sets
7. Lack of standardization for data collection and analysis.

Weaknesses in the Current Approach

In light of the dual goals of rigorous safety and efficiency, the current regulatory approach has several major flaws. First, the current regulatory regime is spread across three different ministries and departments: the Ministry of Agriculture (MoA), Ministry of Environment and Forests (MoEF), and the Department of Biotechnology in the Ministry of Science and Technology (MoST). Although it can be argued that this structure ensures that the regulatory process is independent from any one Ministry, a better design would be an entirely separate and independent regulatory regime. Furthermore, as competent authorities are housed in different ministries, the procedure for the development of transgenic crops is not streamlined. Second, because the regulatory institutions are not part of a separate regulatory body, the regime lacks autonomy and credibility. In addition, the individuals themselves are not independent; rather, serving government officials are individual regulators. Third, the mandate of the regulators is not spelled out clearly. Though the regulators seem to understand their goals precisely, these should be clearly stipulated. Finally, the current regulatory approach is not harmonized with the Cartagena Protocol on Biosafety to the Convention on Biological Diversity, of which India is a signatory. In order to address these weaknesses, this policy brief outlines a number of recommendations to help ensure strong and transparent regulation.

Policy Recommendations

India's biotechnology regulatory regime should reflect several key aspects.

- Clear understanding of the regulatory process (product or process-based)
- Institutionally autonomous
- Independent and qualified regulators
- Reliable and transparent information
- Harmonization with international standards

Do New Breeding Techniques Warrant Regulatory Oversight?

In contrast to “traditional” GE, in which chimeric DNA segments from diverse sources are fused together and inserted into a host plant cell using *Agrobacterium* or other gene transfer agents/ mechanisms, new breeding techniques (NBTs)



use recently developed technologies to modify or “edit” endogenous DNA, resulting in an alteration of gene expression or function. These new “genome editing” techniques include Zinc finger, TALENs, and CRISPR-CAS9 (Abdallah *et al.* 2015).

The current GE process-based3 regulations used in most jurisdictions were initially defined in the 1980s. These regulations are triggered by the use of certain techniques or processes developed in that era—especially rDNA—to create a “transgenic” organism(s). Subsequent revisions to the definitions did not keep pace with advances in technology or with knowledge gained from studies conducted with early transgenic plants. At least some NBTs appear to be outside the scope of authority of current regulations (Camacho *et al.* 2014). Although genome editing techniques are all distinct, a common feature is that they do not require gene transfer from other species and they do not necessarily leave inserted DNA fragments in the resulting genome.

New breeding technologies can mimic changes in the DNA identical to those resulting from historical, unregulated technologies such as induced mutagenesis that are considered to pose no unreasonable risk; products from NBTs cannot be deemed inherently risky. Differential regulation of products of similar risk (e.g., induced mutagenesis vs. NBT) would violate the longstanding regulatory maxim that items of similar risk warrant the same degree of regulatory scrutiny.

Trust for Advancement of Agricultural Sciences (TAAS) : A government agency to ensure accelerated movement for harnessing agricultural sciences for the welfare of people.

The Trust for Advancement of Agricultural Sciences (TAAS) is an outcome of the 88th Session of Indian Science Congress held under the General Presidentship of Dr. R.S. Paroda at the Indian Agricultural Research Institute (IARI), New Delhi on 3-6 January, 2001. The theme of the Congress was “Food, Nutrition and Environmental Security”. TAAS acts as a neutral and vibrant Think Tank for strengthening agricultural research and innovation for development (ARI4D). It executes its programs and activities through collaboration and innovative partnerships with other national, regional and international organizations and networks. Its major strategic thrusts are; Policy advocacy, Technology transfer, Information dissemination/knowledge sharing, Human resource development/capacity building. It mobilizes all concerned stakeholders in agricultural research, production, and consumption chain to propose policies and programs for enhancing productivity, sustainability and food and nutritional security of the nation.

Conclusions

Current regulatory system is a barrier to agricultural innovation. It is a barrier depriving society of the vast benefits of its considerable investment in public entities and small company-derived GE products. Hence a revision of these regulations to center on the product, rather than the breeding process, will enable innovations from public institutions and smaller businesses to benefit society and the environment. The regulatory system needs to be adjusted, or “public, academic, and small business entities will continue to be frustrated in using these safe tools to deliver useful products.”

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GRAIN PROCESSING IN GENERAL AND RICE TECHNOLOGY IN SPECIFIC

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Abstract

Production of cereals in World is around 2813 million tonnes (MT) and India produces around 330.5 MT as on 2023. 750 MT of paddy rice is produced in World and India produces around 160 MT. From this, ~10% (16 MT) goes for the production of rice products like rice flakes, expanded rice and popped rice which are generally prepared or manufactured in small scale industries. Around 75 MT produced is used for production of raw rice and balance (75 MT) is used for the production of parboiled rice. World rice have been classified into 8 groups based on some of their physico-chemical properties like amylose content, gelatinization temp., alkali score, pasting behavior or viscographic parameters, cooking behavior etc. Importance of brown rice along with manufacturing large scale brown rice as well as nutri rice will be highlighted. Importance of Tiny rice mill will also be informed. Parboiling, a method of improving the technological and nutritive values of rice will also be highlighted. Medicinal rice Njawara, a pigmented variety, having high nutrients compared to other normal pigmented and non-pigmented rice varieties, its various physicochemical properties, protein and lipid profile in comparison with non-medicinal rice will be touched upon. Phytochemicals in rice bran will also be focused briefly. Preparation of pre-gelatinized starches will be informed. Usage of cereals, millets, legumes in the preparation of multi grain ready to cook (RTC) and ready to eat (RTE) products will also be touched upon. Making dhal from whole pulses and their technologies which are generally followed all over the world, in some parts of Asia will also be focused upon. Millet technology in brief, maize grits manufacture and products from maize, in addition manufacture of starch from tapioca, which is generally used for the manufacture of Sago will also be touched upon.

Abstracts



CHARACTERIZATION OF BRINJAL GENOTYPES FOR GROWTH, YIELD AND MORPHOLOGICAL TRAITS

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Abstract

In the present study, numerous qualitative and quantitative features were assessed in 46 brinjal genotypes in order to discover superior genotypes. Genetic diversity research is critical for the successful evaluation, preservation, and use of germplasm resources. Screening for qualitative and quantitative features is crucial for determining a plant's socioeconomic preferences. The experiment was laid out at Horticultural College and Research Institute (Women), Tamil Nadu Agricultural University, Tiruchirapalli with Forty brinjal genotypes obtained from NBPGR, New Delhi and six genotypes collected from Trichy region were evaluated for their yield, pest and disease incidence. For maintaining a healthy germplasm and improvement of any crop, a country needs to document or characterize the existing local genotypes, landraces, cultivars or farmers' variety. The passport data was recorded as per the guidelines of International Board for Plant Genetic Resources. Among the 46 accessions evaluated, TRYSM 3 recorded purple coloured, oblong non-spiny brinjal fruits with high yield and similar to the much sought locally preferred region specific Manapparai Local brinjal with similar taste and quality characters. TRYSM – 3 recorded high yield per plant (2.194 Kg) with desirable characters like earliness in flowering, early harvest with more plant height and number of branches which influences the yield indirectly. TRYSM – 3 was found to be tolerant to shoot and fruit borer infestation with 14.3 % shoot infestation and 22.9 % fruit infestation. Purification work of the promising accession TRYSM 3 is being carried out for three generations through single plant selection. Plant height differed significantly among the brinjal accessions. TRYSM 3 recorded maximum plant height of 115.5 cm with more number of branches (12) which is on par with IC 136260 (12) followed by TRYSM – 6 (11.0).

PLANT TISSUE CULTURE BASED HARDENING SKILLS DEVELOPMENT AMONG RURAL YOUTH FOR SELF EMPLOYMENT GENERATION

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Abstract

The exploration and creation of hardening facilities through skill and entrepreneurship program for employment generation in order to create a platform for self-employment generation for the rural youth of through plant tissue culture and its hardening based technology, a field survey were undertaken in Aspiration district Washim to know the present status of farmers and agricultural practices. In-vitro tissue cultures activities are more of science based and require at most care to tackle with the bacterial and fungal contaminations round the year while working. Hence, this activity can be centralized at sophisticated lab facilities with considerable high investments. But at other counterpart, once the tissue culture bottled plants get established, multiplied in sufficient quantities and also cultures are well rooted, they can be gradually transferred to outside the lab and require considerable skill as well as art. Desired skill once acquired it will leads to successful production of plants at large scale and generation of entrepreneurship on per plant commission based on hardening capacity of the unit using green house facilities. During hardening green house facilities with fan pad misting or foggers system is must to ensure for proper growth of plantlets, to maintain optimum temperature and relative humidity during initial stage of hardening known as primary step. While secondary stage is performed in low cost, simple shade net house using green nets to expose tissue culture plants to open environmental conditions. These primary and secondary hardening facilities are being explored in the rural areas of the proposed aspirational district. The educated, uneducated youths from these rural areas of Washim districts are involved the PTC based hardening process. In such a way that they will engage in proposed hardening activities based on the skills and knowledge given through this training cum demonstration program at his locality. They themselves along with other rural



youth got engaged and will act as trainer to generate other rural local people in these processes to set up their own business. In PTC based hardening process, there are many labour intensive activities and demand its timely execution. The activities involved like portrays and polythene bags fillings with soil media, seedling transplanting and caring, regular watering, monitoring of relative humidity (RH) and temperatures inside the hardening unit. Constant watch and its after caring required to check disease infection during production cycle from seedling stage like root rot, damping off of seedlings, collar rots mainly caused by fungi (*Phytophthora*, *Pythium* etc.) and to carry out its control measures. In fact, these diseases are spread through certain insect vectors and know how to manage these vectors are the key to control any viral diseases. The pest and disease are differ from the crop species under production. Hence, it is pertinent to know the exact etiology, symptom and their control measures at right time is the key for successful running of any nursery business or hardening unit. The rural youth can be effectively trained, empowered and encouraged in this business on per plant commission basis. Generally, in the present market, the commission range per plant varies from Rs 1.50 to 3.50/- per plants, if one has set the business target of 1.0 Lakh plantlets, it comes to generate income in the range from Rs. 1.50 to 3.50/- Lakh per cycle of hardening of banana. Once basic facilities created, the income generation goes high upto Rs. 10.00 per annum and rural youth are ready to take up start ups in these sector.

DSR TECHNOLOGY

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Abstract

Rice (*Oryza sativa* L.) is major crop of Buxar area of Zone III B of Bihar in Kharif season. Since last few years it has been observed that farmers' faces secure water availability in initial stage so that they are unable to grow timely nursery and delay in transplanting due to erratic rainfall and delay water supply in canal. Secondly shortage of specialized labour for transplanting due to movement of labours in urban areas as well as high labour cost. Therefore DSR is better option to overcome these issues. However, insufficient seedling stand establishment is one of the major obstacles for achieving potential yield of direct seeded rice (Mahajan *et al.* 2011). Seed priming significantly improved germination, establishment, weed suppressive ability and yield of rice, whilst unprimed control exhibited inconsistent germination, poor establishment and less weed competitiveness resulting poor yield (Anwar *et al.* 2011). Nutri-priming is a type of seed priming in which seeds are soaked in aerated solution of nutrients. Comparative yields in DSR can be obtained by adopting optimum seed rate. Higher seeding rate is one approach that helps increase crop competitiveness against weeds. High seeding rate facilitate quick canopy closure, which helps suppress weeds more effectively. The risk of yield loss from weeds in direct seeded rice is greater than transplanted rice (Rao *et al.* 2007). Herbicides based weed management has become the smartest and most viable option due to scarcity and higher wages of labour (Singh *et al.* 2006, Anwar *et al.* 2012). Continuous use of herbicides with similar mode of action might lead to development of resistance in certain weeds to the herbicides. Hence, evaluation of new herbicides molecules is imperative for the control of wide spectrum of weed flora.

RESPONSE OF MORINGA OLEIFERA TO PARTIAL ROOTZONE DRYING IRRIGATION AND REGULATED DEFICIT IRRIGATION

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Abstract

Crop production technology across the globe is facing a major constraint in the form of water availability. Increase in population would increase the pressure of existing water resources which in turn would reduce the share of agricultural water. In this scenario, it is utmost necessary to produce more crops per drop using improved irrigation techniques to achieve the goal of food security. Partial root zone drying (PRD) is the new and modified version of DI which has been in practice to improve water use efficiency (WUE) by controlled draught stress. It is simply the spatial separation of dry and wet roots which could be



maintained during entire crop season easily. An experiment was conducted in *rabi* seasons during 2019-20 to develop a suitable deficit irrigation strategy for drip-irrigated *Moringa oleifera*, at Dediapada taluka in tribal district of Narmada, Gujarat. Study aimed to assess the effect of five irrigation treatments on crop growth, yield and Irrigation water use efficiency (IWUE) of *Moringa oleifera*. Treatment T1 consists of Fixed Partial Root Zone Drying (FPRD), T2 consists of Alternate Partial Root Zone Drying (APRD) and T3 consists of Regulated Deficit Irrigation (RDI-1) where deliberate moisture stress was induced during flower bud development stage. While treatment T4 consists of Regulated Deficit Irrigation (RDI-2), in which moisture stress was induced during pod setting stage and treatment T5 was a drip irrigated control treatment. Results revealed that, lowest plant height was recorded in T3 treatment (310.3 cm). It was also revealed that significantly higher plant height was obtained in T2 treatments (in 395.0 cm) compared to all other treatments. Dry matter was found to be significantly higher in T2 treatment (5.5 kg/plant) while least was observed in T5 treatment. Treatment T2 recoded highest value for the yield (9.87 kg per tree) and least was obtained in T4 treatment (4.32 kg per tree). Various pod characteristics like length of pod, diameter of pod etc. were found to be superior in PRD treatments compared to RDI and control treatments. Maximum value of IWUE was observed in T2 treatment values of (0.0127 t ha⁻¹ mm⁻¹). While in T1 treatments the corresponding value was reported to be 0.0103 t ha⁻¹ mm⁻¹. In RDI treatments T3 treatment reported higher IWUE than T4 with the values of 0.0107 t ha⁻¹ mm⁻¹, during the experimental year. Lowest values for IWUE were reported in control treatment. It can be concluded from the study that PRD, especially APRD technique could be adopted efficiently in *Moringa oleifera* under drip irrigated system for better growth and yield.

HETEROSIS FOR YIELD AND FORAGE QUALITY PARAMETERS IN BROWN MIDRIB SORGHUM (*SORGHUM BICOLOR* (L.) MOENCH)

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Abstract

Presence of brown midrib gene in sorghum is bringing an attention to utilize this crop in manipulating forage quality due to its low lignin content. Therefore efforts were made to estimate heterosis for grain yield, fodder yield and fodder quality traits in F₁ hybrids. 30 sorghum F₁ hybrids were developed by crossing *rabi* adapted varieties and parental lines with Bmr sorghum genotypes through hand emasculation and pollination in line x tester mating design. These 30 hybrids along with their parents and two checks viz., CSH 15 R and CSV 22 R were evaluated in Randomized Block Design with three replications. Heterosis for grain yield, fodder yield and quality traits evidenced significantly highest all three types of heterosis and *per se* performance in hybrids; CSV 29R x Pbm 3, Parbhani Moti x Pbm 4, Phule Anuradha x Pbm 4 for grain yield and Parbhani Moti x Pbm 5, PMS 71 B x Pbm 5 and CSV 29 R x Pbm 5 for fodder yield per plant. For fodder quality parameters viz., in-vitro digestibility and lower lignin content hybrids; MS 104B x Pbm 2, Parbhani Moti x Pbm 5, Phule Anuradha x Pbm 3, MS 104B x Pbm 3 and PMS 71B x Pbm 5 possessed high *per se* performance and significant all three types of heterosis. In addition these crosses showed low NDF, ADF and cellulose values and higher metabolisable energy. Overall, amongst 30 crosses, six F₁ hybrids; MS 104B x Pbm 3, MS 104B x Pbm 2, PMS 71B x Pbm 3, Parbhani Moti x Pbm 5, Phule Anuradha x Pbm 3 and ICSR 196 x Pbm 3 identified as potential crosses for grain yield, fodder yield along with enriched fodder quality in terms of digestibility and crude protein. These crosses may be utilized in future breeding programme to improve the fodder digestibility along with the higher yield and protein content.

ENCAPSULATION OF ROSEMARY ESSENTIAL OIL IN CHITOSAN CARRIER: CHARACTERIZATION AND INVESTIGATION OF BIOACTIVE PROPERTIES OF OBTAINED NANOPARTICLES

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Abstract

In the present study, the essential oil extracted by steam distillation of *Rosemarinus officianalis* leaves was encapsulated in



chitosan and sodium tripolyphosphate. The formulated ROEO-CS-TPP nanoparticles were characterized by using SEM, TEM, XRD and FTIR and accessed for their encapsulation efficiency, loading capacity, release kinetics; *In vitro* evaluation of antimicrobial and antioxidant activity of nano-encapsulated essential oils was done. chitosan-tripolyphosphate nanoparticles were synthesized and encapsulation of essential oils in these formulations was carried out revealing significant affinity for the essential oils with encapsulation efficiency 60.01 ± 1.50 with loading capacity 16.48 ± 0.82 with sustained release for 48 h. Additionally, morphological analysis of nanostructures was done by SEM and TEM which revealed the spherical to oval shape of the chitosan nanoparticles with an average size of 40.66 nm. Furthermore, FTIR, XRD analysis confirmed the formation of nanoparticles. Moreover, the encapsulation of essential oils ameliorated their antioxidant and antibacterial potential which was accessed by DPPH radical scavenging and broth dilution assay. The lucrative progress in this field of synthesis and encapsulation of lipophilic compounds in different nanostructures can lead to their effective applications in different sectors and as a substitute or replacement therapy to combat multi drug resistant microbes.

SOIL ENZYME ACTIVITIES AS INFLUENCED BY ARBUSCULAR MYCORRHIZAL FUNGI UNDER VARIED SALINE CONDITIONS

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Abstract

Salinity is one of the major abiotic stress steadily increasing in arid regions, negatively affecting the crop productivity worldwide. Saline stress tolerance in crop plants is a complex phenomenon ranging from morphological, physiological, biochemical to molecular levels. Although plants could adapt a numerous strategies to alleviate saline stress effects, mycorrhizal association is emerging as one of the most efficient ways to combat stress in plants. AMF have been shown to promote plant growth and salinity tolerance by employing various mechanisms, such as up-regulation of the antioxidant system, greater accumulation of compatible osmolytes and efficient compartmentalization of excessive toxic ions. In addition, AMF can also enhance the release of soil nutrients required for plant growth in response to increased soil enzyme activity. Therefore, an experiment was conducted to assess the impact of AMF on enzyme activity of wheat rhizosphere under different salinity levels (EC ranging 4 dS m^{-1} , 6 dS m^{-1} and 8 dS m^{-1}) in green-house conditions. The results of the experiment demonstrated that salinity caused considerable decline in enzyme activities with the effect being more obvious under higher concentrations (8 EC). However, AMF inoculation significantly improved the dehydrogenase, phosphatase and urease activity in the treatments which received UASDAMF SL consortium (UASDAMF SL11 and UASDAMF SL27) and UASDAMF consortium compared to single inoculation of native AMF isolates UASDAMF SL11, UASDAMF SL27 and *G. fasciculatum* (reference strain) at all salt stress conditions. The activity of AMF and other microorganisms present in the mycorrhizosphere could be a source of soil enzymes required for biochemical reactions. The results obtained emphasize that the effect of AMF on soil enzyme activity is strongly abiotic context-dependent and coupled with beneficial effects for plant growth. Therefore soil enzyme activities has relevant implications for AMF application in salt affected soils for sustainable agriculture.

EVALUATION OF NUTRITIONAL POTENTIAL OF JELLY FISH *ACROMITUS FLAGELLATUS* (MAAS, 1903)

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Abstract

Jelly fish is considered as a menace for the fisher workers. Apart from the severe itching caused by the jelly fish, they clog nets which leads to a considerable economic loss. Hence the study aimed to evaluate the nutritional potential of commonly available jelly fish from Kerala coast to study its application. The study of proximate analysis of jellyfish found that it is rich in protein ($20.0 - 35.5 \text{ g/100 g}$) and can be utilized as a rich source of protein in food and nutraceutical industry. Amino acids, functional properties and major elements present in jellyfish were studied and analysed. Overall the obtained data suggest that



these edible bycatches can be converted into a useful nutraceutical, nutricosmetic or can be used as food and feed supplements which can significantly contribute to the indian export market as jellyfishes are a popular delicacy in foreign countries.

IMPACT OF EXOGENOUS GLOMALIN-RELATED SOIL PROTEIN (GRSP) ON THE GROWTH AND GERMINATION OF FINGER MILLET (*ELEUSINE CORACANA*) SEEDS: AN *IN VITRO* STUDY

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Abstract

The influence of Glomalin-related soil protein (GRSP), a glycoprotein secreted by arbuscular mycorrhizal fungi (AMF), on seed germination and growth remains largely unexplored. AMF form mutualistic associations with terrestrial plants, enhancing root surface area and interactions with the rhizosphere. Extracted from soil using hot citrate buffers, GRSP is recognized for its soil quality improvement and ecological restoration properties. While the functions of AMF-released glomalin are well-established, the role of exogenous glomalin, specifically Easily Extractable Glomalin-Related Soil Protein (EE-GRSP) and Total Extractable Glomalin-Related Soil Protein (T-GRSP), in plant responses is understudied. Our research aimed to assess the effects of exogenous EE-GRSP and T-GRSP at varying strengths on the growth and germination of finger millet seeds, including changes in root morphology. Over weeks, exogenous GRSP exhibited differential effects on seed growth parameters such as length, diameter and biomass. Notably, the most positive impact on plant growth was observed with exogenous EE-GRSP at half strength. In conclusion, our findings highlight the differential effects of exogenous GRSP on root growth responses, suggesting its potential as a biostimulant for seed growth *in vitro*. This study addresses a critical gap in understanding the *in vitro* responses of finger millet seeds influenced by various factors. The adaptability and nutritional value of finger millet seeds make them ideal candidates for exploring the promising role of GRSP. The implications of our findings extend to agricultural practices, especially in light of the International Year of Millets in 2023, contributing to a deeper understanding of the symbiotic relationship between AMF, GRSP, and plant growth.

ISOLATION AND CHARACTERIZATION OF DROUGHT TOLERANT PHOSPHORUS SOLUBILIZING BACTERIA FROM RHIZOSPHERE OF SORGHUM

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Abstract

Among the abiotic factors affecting the plant growth, drought is the significant one. It is known to affect the plant water relations thereby causing specific and non specific damages. Increased ethylene production caused by drought is the primary factor in early senescence of leaves and flowers in plants, which has a negative impact on productivity and yield (9–10%). Some microorganisms have the ability to produce an enzyme called 1-Aminocyclopropane-1-Carboxylate (ACC) de-aminase that has been known to cleave 1-Aminocyclopropane-1-Carboxylic acid (precursor of Ethylene) to form α -ketoglutarate. This conversion will reduce Ethylene levels in plant and its adverse effects. Some of the P- Solubilizing microorganisms are also known to produce ACC de-aminase and this study focuses on isolation of such drought tolerant ACC de-aminase producing P-solubilizers to mitigate drought stress and increase P-availability in plants. This may be the cost effective and most efficient solution for the damages caused the water stress in plants. Among the 110 strains isolated from 34 soil samples from different part of Kalaburagi district, 14 P-solubilizing isolates showed positive results for drought tolerance and ACC de-aminase production. 10 isolates have shown positive results for production of IAA. Among these isolates C4-B produced highest amount of ACC de-aminase and solubilized maximum quantity of phosphorus followed by the isolate C1-A.



SPATIAL DISTRIBUTION AND CHEMICAL CHARACTERISTICS OF WETLANDS OF THRISSUR DISTRICT IN KERALA

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Abstract

Spatial distribution and chemical characteristics of Kole land of Thrissur district were done after the flood in 2018, in order to access the fertility and productivity of the soil. A total of 25 random samples were collected from different locations of AEU 6 in Thrissur district and its mapping and chemical characterisation were done. Soils of Kole lands of Thrissur district were ultra to moderately acid in reaction (3.31 to 6.42) with an average pH of 4.98 and with medium to high organic carbon content (1.17 to 4.41 %) so also with available nitrogen which was caused by the presence of more organic matter and clay. The soils were low in available phosphorus to the extent of 40 per cent. Almost 80 per cent of soil samples showed sufficiency in potassium content. Among the secondary nutrients, calcium and sulphur were sufficient while 52 per cent of soil samples showed deficiency in available magnesium. Among micro nutrients in collected soil samples, available Fe, Mn and Zn were high and there is no Zn deficiency. Cation exchange capacity ranges from 7.57 to 22.01 cmol (+) kg⁻¹ with a mean content of 13.92 cmol (+) kg⁻¹. The present study of mapping and primary characterisation form the base for further detailed study of Kole land ecosystem of Thrissur district.

STUDY ON THE EFFECT OF HERBICIDES ON QUALITY OF CUT FLOWERS IN GLADIOLUS (*GLADIOLUS GRANDIFLORUS*)

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Abstract

The shift of farmers towards high-value floral crops and the increasing use of flowers in social and industrial contexts have made floriculture a lucrative venture. Manual weeding, a labor-intensive and costly practice for weed control, often results in crop damage. Globally, various weed control strategies, including preventive, cultural, mechanical, biological, and chemical methods, are employed in crops. Chemical control through herbicides has emerged as a recent and modern agricultural practice. The effectiveness of herbicide is decided by its specificity and mode of action under a soil conditions, its organic matter content, weather conditions and soil moisture prevailing at that particular area. Present study was conducted at college of Horticulture, Mudigere to study of herbicides on quality of cut flowers in gladiolus (*Gladiolus Grandiflorus*). Pre emergence emergence applications of herbicides improved the cut flower quality of Gladiolus plant. Pendimethalin at 1.0 kg a.i. / ha. applied as pre emergence herbicide significantly increased flower quality parameters of gladiolous cultivar summer sunshine (100.78cm).

NATURAL FARMING A WAY OF SUSTAINABILITY

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Abstract

Natural farming essentially excludes the use of many inputs associated with modern farming, most notably synthetic pesticides and fertilizers. To the maximum extent possible, natural farming systems rely upon crop rotations, crop residues, animal manures, legumes, green manures, off-farm Natural wastes, mineral-bearing rock powders and indigenous methods of pest control. These components maintain soil productivity and tilth, supply plant nutrients and help control insects, weeds and other pests. Moreover, history of Indian agriculture shows that most of its farming community relies on traditional methods and ecological agriculture such as 'Agnihotra' and 'Panchagavya' the farming systems based on ancient techniques for soil and animal management. Natural farming and Natural farming is gaining importance in 21st Century in view of sustained



agriculture and maintaining ecological balance. It lies in a simple principle of utilizing low-cost and local inputs with zero utilization of chemicals in any form like fertilizer, herbicide, pesticide, antibiotic, hormone etc. Natural Farming ensures better soil biology, improved agrobiodiversity and a more judicious usage of water with much smaller carbon and nitrogen footprints. Natural farming is indeed beneficial to farmers and that too in numerous ways. Firstly, it minimizes the cost of synthetic chemicals and fertilizers because only Naturally produced manure or bio-fertilizers are cast into the soil. Natural farming prevents the overuse of these chemicals resulting in soil degradation and reduced crop yields, ultimately becoming financially devastating for farmers. Natural farming practices are more cost-effective in the long run, as they rely on natural methods that are less expensive and help maintain soil fertility. Furthermore, Natural farming provides farmers with a stable income, as the demand for Natural produce continues to grow. Natural farming has emerged as a game changer for agriculture in India and has disrupted the continuous intrusion of chemical fertilizers in agriculture effectively. Certainly, natural farming has immense potential to transform the agricultural industry as it is well-suited to India's climate and soil conditions, further helping farmers in improving their yields while simultaneously protecting the ecosystem. Benefiting the environment, human health, and farmers and promoting healthy soil, plants, and animals, natural farming can pave the path for sustainable agriculture

SCREENING OF MUNGBEAN [*VIGNA RADIATA* (L.) WILCZEK] GENOTYPES FOR MUNGBEAN YELLOW MOSAIC VIRUS DISEASE RESISTANCE UNDER NATURAL FIELD CONDITIONS

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Abstract

Mungbean yellow mosaic disease, caused by Mungbean yellow mosaic virus (MYMV) and transmitted by insect vector-white fly (*Bemisia tabaci*), is considered to be the major destructive disease of Mungbean species. The present investigation was carried out with 36 genotypes of mungbean germplasm to screen against mungbean yellow mosaic virus disease under natural field conditions during summer. All the genotypes were exposed to natural infection by viruliferous whiteflies in the field. The maximum and minimum disease incidences (%) were observed in GP-276 (18.08%) and BRM-8-1 (0.47%) respectively at 55 DAS. The maximum and minimum disease severities (%) were observed in GP-276 (56.3%) and BRM-8-1 (0.6%) respectively at 55 DAS. The maximum and minimum AUDPC (A) values were observed in Banka Local Mung-1 (126.2) and BRM-8-1 (3.9) respectively. Among all the 36 genotypes screened, BRM-8-1 (0.6%) was observed to be resistant (R) to yellow mosaic disease (YMD). The three genotypes namely Meha, IPM-409-4, IPM-2-14 were found to be moderately resistant (MR) with disease severities of 9.3%, 6% and 6.7% respectively. The two genotypes namely GP-276 and DMG-1105-1-2 were found to be highly susceptible (HS) with disease severity percent of 56.3 and 53.3 respectively. The results indicated that BRM-8-1 can be used as donor MYMV resistant parent to develop commercial high yielding resistant varieties. GP-276 and DMG-1105-1-2 can also be used as MYMV susceptible varieties in future breeding programmes.

IN VITRO RHIZOGENESIS STUDIES IN *BAMBUSA BALCOOA* ROXB.

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Abstract

Bambusa balcooa Roxb. is a clumping evergreen bamboo that serves a variety of purposes. There are more than 1500 species of Bamboo distributed throughout the World. While, India possesses world's largest bamboo resources, next to China, with 136 species and 23 genera spread over sixteen millions hectares of land (Forest Survey of India, 2019). However, few species are considered as commercial. *B. balcooa* Roxb. is known for its commercial values and therefore it is called as commercial bamboo. This bamboo species is also known by other names such as 'Beema/ Bheema bamboo' or 'Female bamboo'. This



species is widely scattered up to an altitude of around 600m in various diverse tropical monsoon zones, such as Bangladesh, Nepal, and North-East India, as well as the tropics in Asia and Africa. It thrives in tropical lowlands with temperatures ranging from 22 to 28°C. Morphologically, this species has dull-green culms with 12-23m tall in height, with an 18-25 cm circumference. Balcooa bamboo is a thornless, fastest growing variety. It is the tropical clumping bamboo often used as a food source, scaffolding and in paper, pulp industries. This variety consists of culms on an average of 12-22 m high with 6-15 cm diameter. Nodes are thickened. Leaves are narrow and are 15-30 cm long and 25-50 mm broad. Bamboo biotechnology aims to resolve hybridization issues and producing high-quality plants in a short amount of time. Large-scale production of commercial bamboo species like *B. balcooa* can be achieved in short amount of time by in vitro culture techniques. Hence it is important to optimise procedure for large-scale and mass propagation of bamboo through micropropagation as many factors affect during *in vitro* growth. The time of year and the amount of sterilizing agent used are important factors in the development of aseptic *in vitro* shoot cultures and the nodal explants that emerge from field-grown bamboo culms. Rhizogenesis in micropropagation of bamboo is most crucial step which needs to study by different aspects. Hence, investigation entitled *In vitro* rhizogenesis studies in commercial bamboo (*Bambusa balcooa* Roxb.)” is conducted at Plant Tissue Culture Laboratory, Centre of Excellence in Plant Biotechnology, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Dist. Akola (M.S.) with the major objective to optimize in vitro parameters for root induction. It has observed that among all the treatments under study Half MS media in combination with 0.5mg/L Kinetin +0.5 mg/L BAP +0.2mg/L NAA given highest rate of root induction 86.28% followed by Half MS media in combination with 0.1mg/L Kinetin +0.5 mg/L BAP+0.2mg/L NAA with 71.74%, Half MS media in combination with 0.1mg/L Kinetin +0.1 mg/L BAP+0.2mg/L NAA with 58.45%. It was also observed that full MS media gives comparatively less rooting 29.45% following woody plant media (wpm) with 32.24% in *B. balcooa* Roxb.

DEMONSTRATION OF PROVEN TECHNOLOGIES OF BIOTECHNOLOGY IN ASPIRATIONAL DISTRICT OF VIDARBHA REGION

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Abstract

Washim district is basically agriculture oriented categorized under agro climatic zone seven and eight. The district is scattered with prominently plain surface land. Washim district lies longitude 76.7 to 77.4 deg and latitude 19.61 to 21.16 deg. Washim lies to its north, Amravati lies to its north-east, Hingoli lies to its south, Buldhana lies to its west, Yavatmal lies to its east. Washim has an area of 5150 Km². The District comprises of 03 revenue sub-division viz; Washim, Mangrulpir and Karanja and Six Talukas with total 493 Gram Panchayat. Washim District is having total geographical area of 5.13 lakh Hectare with total cultivable area is 4.12 lakh Hectare out of which area under irrigation is only 1.17 lakh hectares. Washim District has an extremity in climatic situation. To increase the crop productivity in the proposed plan the policy emphasized on the important of adoption of modern technologies, Hi-Tech plantation and cultivation, Micro-irrigation by providing subsidy to the micro irrigation equipment, dissemination of need based technologies and demonstrating the same at the gross root level so that farmers will be educated in identifying the constraints in the crop production. In the recent years plant tissue culture of Banana, citrus, papaya plantation, organic farming is gaining importance, which also finds a place in the plan which certainly helps to maintain the soil health and livelihood support. Horticulture in Washim District blessed with soil and assumed rainfall situation for cultivation of irrigated horticulture crops like Banana, Citrus, Papaya, Lime and dry land crops like Custard apple, Pomegranate but farmers are not getting better remuneration from crops due to various reasons like distress, irregular flowering, lack of quality planting material, seedlings, pest and diseases problem and decline in ground water etc. So plan emphasizes more on construction of pack house, shed net and green house for controlled cultivation, HRD, rejuvenation of old orchards and community tanks for protective irrigation coupled with area expansion of fruits including the dry land horticulture crops and medicinal and aromatic plants. Among various proven technologies and interventions developed and available in the areas of agricultural biotechnology namely plant tissue culture, hardening process of in-vitro grown seedlings along with additionally other techniques viz hydroponics, biofertilizers agent productions were also demonstrated to



beneficiaries biotechnology program for societal development, the emphasis are given to the weaker section of the society under aspirational district Washim. During the survey, randomly but potential packets of the district having higher plantation area under different fruits, vegetables cultivation were covered. When comparison were made among women beneficiaries during survey and demonstration of technologies it has noticed that among weaker sections categories, there were 46% women beneficiaries from SC categories, followed by OBC 43%, NT 7 % and least ST with 4% number of women beneficiaries.

CORRELATION AND PATH COEFFICIENT ANALYSIS IN SPONGE GOURD [*LUFFA CYLINDRICA* (L.) ROEM.]

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Abstract

The present experiment was conducted to study the correlation and path coefficient analysis in 34 sponge gourd [*Luffa cylindrica* (L.) Roem.] genotypes during the year 2020-2021 at Department of Horticulture, MARS, University of Agricultural Sciences, Dharwad, Karnataka, India. Correlation analysis showed the fruit yield per vine had significant and positive association with number of fruits per vine, number of female flowers per vine, average fruit weight and number of male flowers per vine. Negative and significant correlation was observed for days to first harvest, node at which first female flower appeared, days to first female flower appearance, node at which first male flower appeared, days to first male flower appearance and sex ratio. The path coefficient analysis revealed that number of female flowers per vine, number of fruits per vine, sex ratio and average fruit weight exerted positive direct effect on fruit yield per vine at both genotypic and phenotypic level. Based on correlation analysis and path coefficient analysis, it is concluded that simultaneous selection for number of female flowers per vine, number of fruits per vine, sex ratio and average fruit weight will be more rewarding while selecting desirable genotypes as these characters observed highly significant and positive correlation, besides high positive direct effect on fruit yield per vine among themselves.

COMPARATIVE ASSESSMENT OF SOIL AMELIORANTS IN ACID SOIL UNDER WETLAND ECOSYSTEM

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Abstract

A field experiment was conducted during the Mundakan season, 2021-22 to examine the effect of soil-applied ameliorants on the rice cultivated in the acid soil of *Kole* land in Mullasserri panchayath of Thrissur district. Different amendments were applied alone or in combination in different ratios based on calcium requirements for providing the required quantity of Ca and ameliorating acidity. Phosphogypsum @ 823.09 kg ha⁻¹, rock phosphate @ 605.68 kg ha⁻¹, lime @ 197.07 kg ha⁻¹ and dolomite @ 466.46 kg ha⁻¹ were supplied as their sole application, and combinations in different ratios along with the incorporation of vermicompost. The application of various amendments increased the soil pH and available Ca significantly whereas Fe and Al content were reduced significantly. The percentage of decrease in available Fe was the highest with the sole application of phosphogypsum to 26.47 per cent, 43.33 per cent and 58.97 per cent at 10 days after the application of amendments, at panicle initiation and harvest respectively. Similarly, the sole application of phosphogypsum (823.09 kg ha⁻¹) and the combination of phosphogypsum and dolomite in the ratio 1:3 could increase the grain yield by 22.07 per cent and 21.46 per cent respectively as compared to the control whereas the sole application of lime could enhance the grain yield only by 8.98 per cent. Hence, the sole application of phosphogypsum (823.09 kg ha⁻¹) and its combination with dolomite in 1:3 ratio (205.77 kg ha⁻¹ PG and 349.84 kg ha⁻¹ dolomite) were proven to be superior to the other amendments for enhancing crop



productivity through the management of acidity related problems and enhancing the nutrient availability. To avoid the heavy dose of phosphogypsum, the combination of PG with dolomite at 1:3 ratio can be suggested for the paddy land under a wetland ecosystem.

A HIGH GRAIN AND OIL YIELDING, FROG-EYE LEAF SPOT RESISTANT SOYBEAN VARIETY VL SOYA 99 FOR CULTIVATION IN NORTHERN HILL ZONE OF INDIA

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Abstract

A High Grain and Oil yielding, Frog-eye Leaf Spot Resistant Soybean Variety was released by “Central Variety Release Committee” and notified by “Central Sub-Committee on Crop Standards, Notification and Release of Variety” for commercial cultivation under timely sown rainfed conditions of Northern Hill Zone (Uttarakhand and Himachal Pradesh). Soybean variety VL Soya 99 (2,359 kg/ha) has shown significant yield superiority of 10.90% over the best check VL Soya 89 (2,127 kg/ha) under timely sown rainfed conditions. VL Soya 99 was found superior in oil quantity in its seed with 20.18% oil content and 484.2 kg/ha oil yield as compared to the best check VL Soya 89 (19.02% oil content and 435.3 kg/ha oil yield) and also found to possess absolute resistance to prevalent Frog-eye Leaf Spot (FLS) disease. VL Soya 99 will fulfill the requirement of soybean growers in Northern Hill Zone and pave the way for enhancing the productivity and profitability of soybean in the region.

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 has always 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 of SAKI-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 in different 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.

PROSPECTS OF PROCESSING AND VALUE ADDITION IN SUPERFOODS

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Abstract

In our global landscape, where the quest for healthier and cleaner sources of nutrients is imperative, superfoods emerge as vital players. Superfoods align closely with the principles of sustainability, encompassing economic, environmental, and social considerations, primarily in the context of meeting nutritional requirements. One such superfood is quinoa, an annual herbaceous plant, often referred to as a pseudocereal, originally cultivated in the Andes region of South America. It undergoes



a multi-step processing journey, including seed separation, washing, drying, milling, crushing, and sieving, resulting in processed seeds, quinoa flour, and semolina. This versatile ingredient has been employed in traditional South American dishes like Phiri, Chiwa, and Qusa, as well as in contemporary industrial food products such as quinoa pasta, flakes, and noodles. Teff another superfood, hails from tropical Africa finds its utilization in various food items like bread, unleavened bread, cookies, cakes, and extruded products. In Ethiopia, injera, a flatbread renowned for its pancake-like texture and softness, is a widely consumed teff-based product. Teff seeds undergo fermentation to produce traditional Ethiopian alcoholic beverages like Arake, Shamit, and Tella. Chia seeds often simply referred to as chia, originate from annual plants native to southern Mexico and Northern Guatemala. They offer numerous health benefits, for the digestive system, skin health, enhanced bone and muscle strength, as well as a reduced risk of heart disease and diabetes. Superfoods, primarily derived from plant sources, exhibit robust biological activity and possess significant nutritional potential, playing a pivotal role in the prevention of chronic diseases. Exploring the extraction of bioactive components and their integration into various food applications holds promise for the development of health-promoting foods within the food processing sector.

RESPONSE OF NUTRIENTS THROUGH SOIL AND FOLIAR APPLICATION YIELD OF FOXTAIL MILLET (*SETERIA ITALIC .L*)

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Abstract

Foxtail millet is an important minor millet crop belonging to the family Poaceae. The study was conducted during *kharif* 2018 and *kharif* 2019 at ICAR- Krishi Vigyan Kendra, Haveri to evaluate the response of foxtail millet (*Seteria italic .L*) to soil application of micronutrients and foliar application of NPK along with RDF. The experiment was laid out in RCBD comprising of nine treatments replicated thrice. Studies revealed that the growth parameters, yield attributes and grain yield of foxtail millet differed significantly due to foliar application of NPK along with RDF and soil application of micronutrients along with RDF. The results indicated that significantly higher grain yield (18.49 q ha^{-1}) and straw yield (36.14 q ha^{-1}) of foxtail millet were recorded in treatment applied with RDF + foliar spray of 19:19:19 @ 1% at flower initiation stage (pooled data of 2 years) followed by soil application of micronutrients along with RDF. The treatment RDF + foliar spray of 19:19:19 @ 1% at flower initiation stage recorded significantly higher plant height (92.50 cm), panicle length (22.27 cm) and grain weight per panicle (2.80 g). The biological yield and nutrient uptake (NPK, Zn and Fe) are also significantly higher with the same treatment. The gross returns, net returns and BC ratio were also higher with the same treatments (Rs.48284, Rs.32036 and 2.97, respectively) as compared to all other treatments and absolute control.

EFFICACY OF FUNGICIDES AGAINST *F. OXYSPORUM* F.SP. *CICERI* CAUSING WILT IN CHICKPEA UNDER *IN VITRO* CONDITION

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Abstract

Chickpea (*Cicer arietinum* L.) holds significant importance as a pulse crop cultivated throughout India. *Fusarium oxysporum* f. sp. *ciceri*, the causal agent of chickpea wilt, stands as a major affliction in northern Karnataka. This disease is transmitted via soil and seeds, with abundant pathogenic presence in the soil coupled with favourable environmental conditions leading to plant fatality and subsequent yield depreciation. An experiment was carried out to identify effective fungicides for managing chickpea wilt. Five combinations of fungicides and five systemic fungicides against *Fusarium oxysporum* f. sp. *ciceri* in laboratory conditions, employing three concentrations for each. Among the five systemic fungicides evaluated against *Fusarium oxysporum* f.sp. *ciceri* carbendazim 50% WP and tebuconazole 5.36 % w/w FS were found best with 8.61 and 82.49 per cent mean mycelial inhibition which were on par with each other and significantly superior to all other treatments. The least inhibition of mycelial growth was observed in azoxystrobin 23%SC (30.42%). Among five combiproducs evaluated, carboxin 37.5%+ thiram 37.5% WS was found to be most effective and significantly superior over control, which inhibited



93.20 cent per cent growth of *Fusarium oxysporum* f.sp. *ciceri*. This was followed by mancozeb 50% + carbendazim 25% WS with 92.55 per cent inhibition which was on par with the first best fungicide vitavax power and the least inhibition of mycelial growth (59.74%) was observed in thiophanate methyl 45% + pyraclostrobin 5% FS.

INFLUENCE OF CLIMATE CHANGE WEATHER VARIABLES (CO₂ AND TEMPERATURE) ON POWDERY MILDEW DISEASE DYNAMICS IN CHILLI

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Abstract

Chilli (*Capsicum annuum* L.) is an economically important commercial spice crop grown for its fruits which are used in green as well as ripe dried form for its pungency. Chilli production is limited by biotic stresses like fungi, bacteria, viruses, nematodes and even abiotic stresses. Among these powdery mildew caused by *Leveillula taurica* is an economically important disease and appear in severe form during winter season. The study was carried out to know the relationship of CO₂ and temperature on *L. taurica* and its disease severity during 2020. Susceptible variety of chilli (Syngenta 5531) was sown in five pots of each set and recommended package of practices were followed except for powdery mildew management in open top chambers (OTC's) constructed at Centre for Agroclimatic studies, University of Agricultural Sciences, Raichur. In the laboratory, the investigation on the effect of carbon dioxide and temperature on spore germination revealed that, highest spore germination was observed in elevated CO₂ at 550 ± 25 ppm with 2 °C rise in temperature (44.64 %) followed by elevated CO₂ at 550 ± 25 ppm with normal temperature (40.06 %) and least spore germination was recorded in lab conditions. The studies on effect of carbon dioxide and temperature on disease progress in open top chambers revealed that, in all the treatments, the disease progress was increased linearly at weekly interval. In the treatment T₂ (elevated CO₂ at 550 ± 25 ppm with 2 °C rise in temperature), the disease severity was increased from 7.65 to 60.49 PDI, which was followed by the treatment T₁ (elevated CO₂ at 550 ± 25 ppm with normal temperature), in which the disease severity was increased from 6.17 to 48.64 PDI. In the treatment T₃ (ambient CO₂ at 410 ± 25 ppm with 2 °C rise in temperature), the disease severity was increased from 5.93 to 47.65 per cent, which was followed by the treatment T₄ (ambient CO₂ at 410 ± 25 ppm with normal temperature), severity of powdery mildew was increased from 4.94 to 41.72 PDI. The least disease progress was observed in treatment T₅ (open plot), where the disease severity was increased from 4.69 to 33.82 PDI.

SUSTAINABLE PRODUCTION INTERVENTIONS IN MAIZE UNDER CHANGING CLIMATE

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Abstract

Major maize area falls under kharif season and crop may frequently expose to moisture stress which is increasing in intensity and frequency under changing climate specially during rainy season affecting maize production especially in the sub tropical climatic conditions. Therefore, a study was carried out to derive possible production interventions for sustainable maize production under changing climate particularly moisture stress by maintaining water stress condition through withholding of irrigation between 20-40, 40-60, 60-80 and 80-100 DAS. And suitability of staggered sowing at monthly interval (viz., June, July and August) and heat tolerant genotypes (viz., RCRMH 2, RCRMH 3 and RCRMH 4) were examined under moisture stress in Tunga Bhadra Project irrigation command. Results revealed that among sowing dates July sown crop performed better with significantly higher yield and economics (5610 kg ha⁻¹, Rs.50321 and 2.37 respectively for grain yield, net return and BC ratio) as it was free from moisture stress because of intermittent rains, whereas June sown crop though experienced



stress between 40-60 DAS on par with July sown may be because of use of heat tolerant genotypes, but August sown crop during 80-100DAS shown significantly lesser grain yield and economics due to delayed sowing. Among genotypes superior performance of RCRMH 3 (5511 kg ha⁻¹, Rs.48083 and 2.29 respectively for grain yield, net return and BC ratio) was noticed over RCRMH-4, and found on par with RCRMH 2 (5300 kg ha⁻¹Rs.44821 and 2.20 respectively for grain yield, net return and BC ratio) in terms of grain yield and economics and hence found ideal for stress condition. All the moisture stress treatments were found on par with each other with the use of heat tolerant genotypes indicating their ability to sustain the moisture stress.

EVALUATION OF INBRED LINES FOR MAJOR DISEASES IN PEARL MILLET (*Pennisetum glaucum* (L.) R. BR).

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Abstract

The utilization of resistant varieties is a classical approach to prevent the catastrophic losses caused by pearl millet blast and rust with reduction in the cost of production and increased yield. Therefore, a study was conducted during the *kharif* 2023 at Regional Agricultural Research Station, Vijayapura to identify resistance sources against blast and rust disease in pearl millet crop. Fifty hybrids, twenty seven parents along with three checks were screened against blast and rust diseases under field condition. None of the genotypes examined were immune. The hybrids viz., ICMA 94555 X VJP Fe & Zn-1, ICMA 94555 X VJP Fe & Zn-3, ICMA 94555 X VJP Fe & Zn-19, ICMA 94555 X VJP Fe & Zn-24 and ICMA 98222 X VJP Fe & Zn-9 were showed resistance for both rust and blast diseases.

EFFECT OF TARAMIRA (*ERUCA SATIVA*) SEED SUPPLEMENTATION AND INTRODUCTION OF POULTRY BIRDS IN ANIMALS SHED TO CONTROL TICKS INFESTATION ON BUFFALO UNDER FIELD CONDITIONS

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Abstract

Ticks are widely distributed in the tropical and sub-tropical regions worldwide and account for heavy production losses in livestock. These are haematophagous arthropod ectoparasites that infest livestock including dairy animals of all age groups and effect their health and productivity. Ticks suck large quantities of blood of their host resulting in anemia and they produce 'tick worry' which is the result of tick bites, local skin reactions, blood loss and secondary fly attacks. Ticks cause infestation and restiveness in animals. According to FAO (2004), an estimate, 80% of the world's cattle population remains infested with ticks. Tick infestation causes huge economic losses to livestock by their direct effects like sucking blood, damaging the skin and hides and spreading of blood born diseases resulting reduction in weight gain and milk yield. An on farm trial was conducted to evaluate the efficacy of feeding Taramira (*Eruca Sativa*) seed and introduction of poultry birds in animals shed to control ticks infestation on dairy animals under field conditions during July to September 2022. Forty five buffalo reared under farmer's field were randomly selected and distributed equally in to three groups i.e. T1 (control), T2 (Application of Amitraz on animal body (250 ppm) along with shed treatment with Malathion (5000ppm)) and T3 (Feeding of Taramira (*Eruca Sativa*) seed @ 70g/ day/ animal and introduction of 5-6 poultry birds in animals shed). The counting of ticks was done on neck, shoulder and Peri-anal region at fortnightly intervals. The results of the study revealed that in animals of group T2 showed a sudden decrease in the tick infestation within 15 days of intervention. However, in group T3 animals gradually reduction in the ticks' infestation from day 0 to the 60th day of the treatment was observed. The shoulder and the peri-anal region showed no tick infestation on the 60th day of the treatment in T3 group, whereas, the control showed a significant increase in the ticks' infestation in all the regions with the passing of days. Based on the study, it is concluded that the biological interventions (Feeding of Taramira (*Eruca Sativa*) seed and introduction of poultry birds in animals shed) were able to reduce the tick load by 95%. This eco-friendly technology can be recommended to the dairy farmers to put in daily use at their dairy farm, as tick control is an utmost priority for the betterment of the health, production and productivity of buffalo.



PREVALENCE OF PASTEURILLA MULTOCIDA IN THE BROILER SUPPLY CHAIN IN KARNATAKA, INDIA

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Abstract

Pasteurella multocida is the zoonotic and is the important poultry pathogen especially when they were under stress or when they are suffering from infectious diseases and causes fowl cholera in poultry and respiratory infection in humans. In the current study we analysed the prevalence and the antimicrobial resistance pattern and capsular virulence genes of *Pasteurella multocida* in broiler supply chain based on isolation and PCR by targeting *KMT1* species specific gene and 5 capsular genes. A total of 325 samples were collected from different stages of poultry supply chain like from 3 broiler breeder farms, 3 commercial broiler farms and 6 processing cum retail units from 3 different districts of Southern Karnataka. Samples were collected from different sources like bird samples (nasal samples, meat, trachea, liver, heart, lungs and intestine), human samples (worker hand swab) and environment samples (water from both farms and processing cum retail units, broiler feed, floor samples, cutting knife and cutting board samples). Out of 325 samples 4 (1.23%) *Pasteurella multocida* were isolated with 0 prevalence in breeder farms, 4.76% prevalence in commercial broiler farms and 0.54 % prevalence in processing cum retail units. Out of 3 commercial broiler farms *Pasteurella* was isolated in only one farm. Out of 3 different sources *Pasteurella* was isolated in only bird samples (3-nasal and 1-liver sample) and zero prevalence in human and environmental samples. Out of 4 isolates 3 were serotype A and one was serotype B. The isolates showed 100% resistance to amoxicillin and clavulanic acid, erythromycin, penicillin-G and ceftriaxone with MAR index of 0.6 and 0.5. The results suggesting that the high level of prevalence in only one farm may be due to history of stress factor. Indiscriminate use of antibiotic may lead to increasing antimicrobial resistance pattern.

NANO-MAGIC AGAINST CANCER: DISRUPTING POLYCOMB-MEDIATED EPIGENETIC CONTROL IN ACUTE MYELOID LEUKEMIA WITH MULTIMODAL THERAPY

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Abstract

Acute Myeloid Leukemia (AML) presents a formidable challenge with only 26% of patients surviving beyond five years post-diagnosis. This study addresses the limitations of current therapeutic agents, such as poor bioavailability and stability, by introducing a groundbreaking approach that combines a specific EZH2 inhibitor (EPZ011989) and EZH2-specific siRNA encapsulated in human serum albumin nanoparticles (HSANPs) through the desolvation method. Treatment with EPZ011989-loaded HSANPs and HSANPs-PEI@EZH2siRNA resulted in a downregulation of EZH2 in AML cells. This reduction was associated with diminished levels of the Bmi-1 protein and specific histone modifications (H3K27me3 and H2AK119ub), indicating a profound impact on the epigenetic regulation of AML. Intriguingly, the ubiquitin-mediated proteasomal degradation pathway played a crucial role in mediating the downregulation of associated proteins following exposure to the synthesized nanoparticles. Moreover, the study unveiled the downregulation of the AML-responsive transcription factor c-Myb, directly binding to the EZH2 promoter, underlining the comprehensive impact of the treatment. In an AML engrafted immunodeficient nude mouse model, systemic exposure to EPZ011989-loaded HSANPs and HSANPs-PEI@EZH2siRNA demonstrated robust EZH2 gene silencing, resulting in a notable reduction in the AML cell population in both peripheral blood and bone marrow. This research emphasizes the potential of nuclear-targeted EPZ011989-loaded HSA nanoparticles and a non-viral siRNA delivery system as a next-generation strategy for epigenetic-targeted molecular therapy in AML. The collective drug delivery and molecular targeting approach showcased in



this study pave the way for innovative anti-leukemic therapeutics with promising implications for future AML treatment paradigms.

PERFORMANCE OF WARM SEASON TURF GRASSES UNDER TREATED WASTE WATER IRRIGATION

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Abstract

This increase in population has not only escalated the demand for freshwater but has also resulted in a higher volume of wastewater produced due to the greater diversion of freshwater into non-agricultural sectors like residential, commercial, and industrial, which generate larger quantities of wastewater. Therefore, there is an immediate requirement to conserve and safeguard freshwater resources while simultaneously harnessing the generated waste water. Water scarcity poses a significant challenge in urban areas, especially in regions with limited freshwater resources or where population growth has surpassed the capacity of the available water supply. This scarcity of water creates difficulties in maintaining green spaces, including lawns and parks, which necessitate substantial amounts of water for their vitality and vibrancy. To address this issue, numerous urban areas have adopted the practice of utilizing treated wastewater for irrigating turf grasses. The present study was conducted at the Division of Floriculture and Landscaping, IARI, New Delhi, to explore the potential of using treated wastewater as a viable alternative to the often high-priced and limited fresh water supply for turf grass irrigation. Seven warm-season turf grasses were subjected to different levels of treated wastewater irrigation (Control, 100%, 75%, 50%, 25%) to assess their performance at morphological, physiological, and biochemical levels. The results demonstrated that among the different turf grasses, Seashore paspalum (*Paspalum vaginatum*) exhibited the highest shoot fresh weight, shoot dry weight, shoot density, root fresh weight, and root dry weight when irrigated with 50% treated wastewater, followed by Bermuda grass (*Cynodondactylon* var. *Tif dwarf* - 419) and Zoysia grass (*Zoysia japonica*) compared to other levels of wastewater irrigation. Regarding physiological and biochemical parameters, Bermuda grass (*Cynodondactylon* var. *Tif dwarf* - 419) displayed the highest Relative Water content, Membrane stability index, and chlorophyll content when subjected to 50% wastewater irrigation, followed by Zoysia grass (*Zoysia japonica*) and Seashore paspalum (*Paspalum vaginatum*). The accumulation of major heavy metals (Cr, Ni, Pb, Cu, Zn) in turf grasses was greatest at 100% wastewater concentration and lowest in the control. Among the heavy metals, Ni, Pb, and Cu were found to accumulate more in the root part of Bermuda grass (*Cynodon dactylon* var. *Tif dwarf* - 419), while Cr was more prevalent in the root of Zoysia grass (*Zoysia japonica*) and Zn was highly accumulated in the roots of Seashore paspalum (*Paspalum vaginatum*) at 100% wastewater concentration compared to the control.

MONITORING OF *HELICOVERPA ARMIGERA*, *SPODOPTERA LITURA* AND *PECTINOPHORA GOSSYPIELLA* THROUGH SEX PHEROMONE TRAP AND LIGHT TRAPS

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Abstract

Monitoring of *Helicoverpa armigera*, *Spodoptera litura* and *Pectinophora gossypiella* through Sex Pheromone trap and light traps were conducted at Agricultural Research Station, Raddewadgi during 2020-21 to 2022-23. In 2020 *H. armigera* pheromone trap moth catches were noticed from 17th SMW (1st week of April) and decline in the 23rd and 24th SMW (1st and 2nd week of June) and maximum moth trap catches were noticed in 40th SMW (October 1st week). Where in case of *S. litura* peak moth trap catches were noticed in 32nd (second week of August) and 38th SMW (third week of September). Again in *P. gossypiella* maximum trap catches were noticed in 49th SMW (1st week of December) and same trend were followed in light trap catches of *H. armigera*, *S. litura* and *P. gossypiella* at ARS, Raddewadgi. Similar trend was followed in 2021 and 2022 for both Sex Pheromone trap and light traps of *H. armigera*, *S. litura* and *P. gossypiella* in consecutive years.



EFFECT OF FEED ADDITIVES ON GROWTH PARAMETERS IN BROILERS

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Abstract

The study was conducted to evaluate the effects of selective feed additives on the growth performance of broilers during 0-35 days. A total of 150 day old commercial broiler chicks were randomly divided into five groups (four treatment groups and a control group). Birds were fed with broiler pre starter diet (0-10 days), starter diet (11-21 days) and finisher diet (22-35 days). The basal diet was formulated as per the ICAR specifications. The control group (Group I) was fed with only basal diet. In the group II, birds fed with curcumin and capsaicin showed numerical increase in body weight along with improvement in FCR values compared to control group at the end of experiment. In the group III, birds fed with butyric acid and valeric acid, also revealed numerical increase in body weight and improvement in FCR compared to control during fifth week of experiment. It was observed that group IV birds fed with combined feed additives with different levels of polymeric silicate, polyphenols, tannins, capsaicin, curcumin, trivalerin and allicin showed significantly higher body weight and improvement in FCR when compared to control group at the end of the experiment. In the group V, birds fed with herbal extract of vitamin E showed moderate increase in body weight along with marginal improvement in FCR compared to control group.

NANO-FERTILIZER MEDIATED PADDY SEED PRIMING FOR BETTER SEEDLING GROWTH

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Abstract

Seed priming is the process of controlled hydration of seeds to a level that permits pre-germinative metabolic activity to proceed, but prevents actual emergence of the radicle. It is one of the techniques to obtain higher yield of rice by producing quality seedlings and it is a method that might improve seed performance under stress conditions such as drought or salinity or nutrient deficiency. Nano-fertilizers are the future nutrient sources which offer reduced load of nutrients to the crop and to the soil without compromising crop productivity. In an experiment, the effect of rice seed priming with two nano-fertilizers (Nano Urea and nano DAP) and the conventional urea and DAP were analysed to derive the most effective recommendation with respect to seedling vigour. Rice seed priming with the four fertilizers in different concentrations (0.5, 1, 2 and 3%) and different periods of priming (2 hour, 4 hour and 8 hour) were done. Germination tests were done with germination paper rolls to analyse the germination percentage, seedling root length, shoot length and seedling vigour index. The germination percentage varied from 70 to 100% and seedling vigour index varied from 2132 to 3005 between the different treatments. In all treatments except the lower concentrations at lower periods of priming, nano-fertilizers performed better than the corresponding conventional fertilizers. Thus seed priming in 1% Nano DAP solution for 2 hours and seed priming in 2% nano urea solution for 8 hours could improve seedling vigour to maximum extent in paddy seedlings.

STUDIES ON ANTAGONISTIC ACTIVITY OF *TRICHODERMA* ISOLATES AGAINST *SCLEROTIUM ROLESII* SACC. CAUSING FOOT ROT ON FINGER MILLET

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Abstract

Biological control is a great renaissance of interest and research in microbiological balance to control plant pathogens, leading to the development of a better farming system. In biological control, genus *Trichoderma* serves as one of the best bioagents, which is found to be effective against a wide range of soil and foliar pathogens. *Trichoderma* is a soil-inhabiting green filamentous fungus, which belongs to the division Ascomycota and its efficacy depends mainly on the biotic character of the fungi to survive in the soil, its virulent nature and compatibility study. In the current study, the degree of virulence of four



different isolates of the *Trichoderma* was evaluated among the isolates and also against the soil-borne plant pathogen *Sclerotium rolfsii* causing the foot rot in finger millet by dual culture technique and volatility test under *in-vitro* condition and results revealed that all the isolates are capable of limiting the pathogen. However, the tr2 isolate showed the per cent inhibition in both tests. Further, in the compatibility assay, the compatibility of the *Trichoderma* with different agrochemicals (fungicides, antibiotics and weedicides) was evaluated by the poison food technique and results showed that agrochemicals such as atrazine, acrobat, chlorpyrifos are compatible with Tr2 isolate by having minimum inhibition and found safer for *Trichoderma* isolates. Meanwhile, carbendazim shows high incompatibility by showing 100% inhibition followed by azoxystrobin + difenoconazole also showed partial inhibition. These results showed that in the integration of agrochemicals with bio-control agents in the IDM modules will also play a important role in improving the efficacy of bio-control agents. Which will be much helpful in creating the sustainable and healthy environment by reducing the agrochemicals in the crop protection.

ASSESSMENT OF VARIABILITY IN INDIGENOUS AROMATIC RICE (*ORYZA SATIVA* L.) ACCESSIONS USING MORPHOLOGICAL AND QUALITY TRAITS

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Abstract

India is endowed with a great diversity of rice germplasm in its vast territorial land area with a variety of short, slender aromatic rice varieties which are popular in different traditional rice growing pockets. The aromatic land races possess immense potential of most valuable genes which can be effectively utilized in the present-day breeding programme to evolve varieties that possess not only high yield potential and quality but also resistant to biotic and abiotic stresses. Systematic study and characterization of such germplasm is not only important for utilizing the appropriate attribute based donors, but also essential in the present era for protecting the unique rice in accordance with the provision laid out in the 1992 meet on Conservation of Biological Diversity (CBD). In this context, an attempt was made to characterize sixty-four rice aromatic accessions including five checks for different morphological and quality traits to identify the desirable donors from the available variability in the collection. The present investigation was carried out at Research-cum-Instructional Farm, Department of Genetics and Plant Breeding, Indira Gandhi Agricultural University, Raipur, Chhattisgarh in Randomized Complete Block Design (RCBD) with 2 replications. Forty-four morphological traits were recorded as per the DUS guidelines of PPV and FRA, 2001 and ten quality characters were recorded as standard procedures. Among the 44 DUS characters utilized in the characterization of 64 rice genotypes, fifteen characters showed no variation. Seven characters showed the dimorphic variation. All the accessions having auricles in which 7.81% were having purple colour (B: 484, C: 604, D:130, D:143 and B: 2165) and 1.56% (B:528) were having light purple colour. Only 6.25 % (B: 214 III, L: 1250, S:665 and L: 1235) of accessions showed purple stigma. The remaining characters were polymorphic. Anthocyanin colouration in various plant parts was also varied distinctly across the genotypes. Only 3.12% (D: 668 I and D: 839 I) of accessions had leaf anthocyanin colour, whereas 53.12% of genotypes had leaf sheath anthocyanin colour. Anthocyanin colouration of keel was present in 1.56 % (B: 214 III) of accessions. Anthocyanin colouration of apex of lemma was present in 17.48% of accessions.

Rice accessions were evaluated for ten quality traits *viz.*, Grain length, Grain breadth, Decorticated grain length, Decorticated grain breadth, Length: Breadth ratio, Hulling %, Milling %, Head Rice Recovery % and Amylose content. The analysis of variance showed that there were considerable inherent genetic differences among accessions for different characters. On the basis of mean values, desirable accessions were identified for important quality traits *viz.*, C: 604 for high hulling % (89.52%); D: 1031 for high milling % (57.71%); B: 1090 for high Head Rice Recovery (57.71%) and B: 568 for high Amylose content (25.50%). Different extreme type accessions were found for the quality traits. The present investigation provided the breeding materials to the rice breeders for exploitation of aromatic landraces in future breeding programme. Some important traits like Hulling %, Milling %, Head rice recovery and amylose content, can be significantly improved by exploiting the traditional aromatic rice accessions. None of the two accessions were exactly similar phenotypically. It is concluded that characterization has confirmed the existence of distinctness, uniqueness and stability for the traits studied. This study will be useful for breeders, researchers and farmers to identify and choose the restoration and conservation of beneficial genes for crop improvement.



DETECTION OF PLASMID-MEDIATED COLISTIN RESISTANCE DETERMINANTS *MCR-1*, *MCR-2*, *MCR-3*, *MCR-4* AND *MCR-5* IN *ESCHERICHIA COLI* FROM FOODS OF ANIMAL ORIGIN IN MANIPUR

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Abstract

Polymyxin antibiotic colistin is considered the treatment of last resort for serious human infections caused by multi-drug and carbapenem-resistant gram-negative bacteria, and the occurrence and spread of colistin resistance in human and animals has been reported worldwide raising global public health concerns. From November 2019 to April 2023, a total of 678 *Escherichia coli* were isolated from foods of animal origin in Manipur (Pork meat=214, Chicken meat=173, Beef=163, and Chevon meat=128), and were screened for detection of plasmid-mediated colistin resistance determinants *mcr-1*, *mcr-2*, *mcr-3*, *mcr-4* and *mcr-5*. Plasmid-mediated colistin resistance (*mcr*) genes was detected in 1.47% of *E. coli* isolates (10/678), out of which plasmid-mediated colistin resistance determinants *mcr-1* was detected in four *E. coli* isolates (Chicken meat=2/173, 1.15 %; Beef=1/163, 0.61 %; and Pork meat=1/214, 0.46 %), *mcr-3* was detected only in one beef isolates (1/163, 0.61 %), *mcr-4* was detected in four chicken meat isolates (4/173, 2.31 %), and *mcr-5* was detected only in one beef isolates (1/163, 0.61 %). The study findings demonstrated that the *mcr* genes is prevalent in foods of animal origin in Manipur highlighting the importance of continuous monitoring and control of colistin-resistant Enterobacteriaceae to prevent them from being transmitted to humans.

EVALUATION OF DIFFERENT FUNGICIDES AGAINST ALTERNARIA LEAF BLIGHT OF LINSEED (*LINUM USITATISSIMUM* (L.))

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Abstract

Alternaria leaf blight is an important disease of linseed (*Alternaria lini* L.) that hampers its productivity and oil content. First Symptoms appear on lower leaf as black point that gradually increased in size to become circular to oval or irregular in shape. The pathogen also attack on the other foliar part of the plant. The experiment was conducted within C.R.D design *In-vitro* condition with six Fungicides namely Propiconazole, Metalaxyl, Zineb, Copper oxychloride, Sulphur and Mancozeb. The Propiconazole was most effective Fungicide which shows (13.6mm) radial growth and per cent inhibition over control (84.01%) and Metalaxyl (24.8mm) radial growth and per cent inhibition (70.84%) over control. The maximum radial growth (81.1mm) and minimum per cent inhibition over control (4.70%) was found in Mancozeb. *In vivo* condition the Propiconazole was most effective Fungicide which show the seed germination of the (95.04%) and minimum disease incidence was (6.66%) and maximum yield 7.45q/ha. in the year 2021-22. Among the tested Fungicide Mancozeb was show minimum seed germination (68.05%) and maximum disease incidence (18.33) with minimum yield 3.90q/ha in year of 2022-23.

INTEGRATED PEST MANAGEMENT (IPM) MODULE FOR MAIZE FALL ARMY WORM, *SPODOPTERA FRUGIPERDA* (J.E.SMITH)

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Abstract

A field trial was conducted to evaluate the Integrated Pest Management module and effective insecticides for the management



of maize fall army worm, *Spodoptera frugiperda* at Regional Research Station, Vridhachalam during 2021. Application of neem cake @100kg/acre at last plough, Seed treatment with cyantraniliprole 19.8% + thiamethoxim 19.8% FS@4ml/kg, Cowpea as border crop, installation of pheromone trap @5 nos/acre, Azadirachtin 1500ppm @ 5ml/lit spray on Window I late stage of 15-20 DAS, Release of *Telenomus remus* @ 50,000/acre at window II early stage of 30-35 DAS and spraying of *Metarhizium anisopliae* @ 1kg/acre are the common IPM components. Selection of insecticides, module I (Chlorantraniliprole 18.5 SC @ 0.4ml/lit during Window I (Early stage) and spraying of Emamectin benzoate 5SG @0.4g/lit at Window II (Mid stage)), module II (Flubendamide 480 SC @ 0.5ml/lit during Window I (Early stage) and spraying of Spinetor 11.7%SC @0.5ml at Window II (Mid stage)), Module III (Chlorantraniliprole 18.5 SC @ 0.4ml/lit during Window I (Early stage) and spraying of Novaluron 10EC @ 1ml/lit at Window II (Mid stage) and untreated check also maintained. Prior to the insecticides application FAW damage was ranged in between 26.92%-33.33%. Minimum of 20.35% & 18.51% FAW damage was observed in Module III on 15-20DAS, 30-35DAS respectively. Tassel damage was less in Module III (20.37%) followed by Module I (23.14%). At the time of harvest FAW damage was minimum in Module III (19.44%) and maximum (36.11%) in untreated check. Module III also recorded 3200kg yield with 1.53 BC ratio.

IMMUNOMODULATORY EFFECT OF LACTIC-YEAST FERMENTED MILK IN IN VIVO MICE MODEL

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Abstract

Fermented dairy products with the lactic-yeast fermentation of milk have not been explored much. Different combinations of fermented milk with *Lactobacillus acidophilus* NCDC 195, *L. rhamnosus* NCDC 24, *L. rhamnosus* C25, *L. rhamnosus* C6 and three yeast cultures *Kluyveromyces marxianus* 6C17, *S. cerevisiae* 364 and *S. cerevisiae* 365 at 1:1, 1:2, 1:3, 1:4, 1:5 and 2:1, 2:2, 2:3, 2:4, 2:5 ratios were made. Among those cultures, *L. acidophilus* NCDC 195, *L. rhamnosus* NCDC 24, *K. marxianus* 6C17, *S. cerevisiae* 365 were finalised for LYFM development. Better compatibility was shown between *L. acidophilus* NCDC 195, *L. rhamnosus* NCDC 24, *S. cerevisiae* 365 and *K. marxianus* 6C17, strains in spot assay. The LYFM made with 1:3 ratios of lactic: yeast cultures by normal fermentation at 37°C for 24h were selected for *in vivo* animal study. Around 1% alcohol was produced in the LYFM with a sensory score of 7.5±0.34. The initial lactic and yeast count was (10.878±0.001) and (8.228±0.333) log CFU/ml which got reduced to (8.426±0.672) and (5.341±0.333) log CFU/ml during the storage period of 28 days. The immunomodulatory properties of the LYFM *in vivo* Swiss albino mice model showed significant improvement in immune organs like the spleen and thymus. An increase in IgA (210.36±1.23), anti-inflammatory cytokine IL-10 (229.20±0.74) and a decrease in the proinflammatory cytokine TNF- α (163.99±0.80) was seen. In macrophage phagocytosis activity, a significant difference between the positive control group (24.42±4.32) and the LYFM group (56.87±3.73) was observed. Antioxidative markers like SOD (343.63±1.997), GSH (327.44±6.35), GPX (89.98±2.464), and catalase (364.32±8.13) were also improved in the LYFM group compared to other treated groups. A similar trend was obtained in histopathological results of the colon tissue that showed normal lamina propria, thickening and regeneration of epithelial cells etc. The Lactic yeast fermented milk product developed had potential immunomodulatory effects along with bio-functional properties including antimicrobial and antioxidative properties. Therefore, it may be used for enhancing immunity in cases of bacterial infection.

SEASONAL INCIDENCE OF POD BORING WEEVIL, *APION CLAVIPES* GERST (APIONIDAE: COLEOPTERA) ON PIGEONPEA, *CAJANUS CAJAN* (L.) MILLSP. UNDER WEST BENGAL CONDITION

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Abstract

Pod boring weevil, *Apion clavipes* Gerst infests Pigeonpea during vegetative, flowering, pod formation and pod maturity



stages. However, there is not much information on seasonal incidence of Pod boring weevil over different cropping season. The seasonal incidence of pod boring weevil was studied in two consecutive years during 2016-17 and 2017-18. The grub and weevil populations in shoots, flowers, pods and weather parameters were recorded during experimental period and subjected to correlation analysis. The experiment on seasonal incidence of pod boring weevil revealed that pest population started during 43rd SMW (4th week of October) and pest population attained the maximum population 45.00 grub/plant during 4th SMW (4th week of January). Pest population was observed till 11th SMW (3rd week of March). Pooled data analysed correlation co-efficient (r) values were -0.248, -0.253 and -0.141. Seasonal incidence of pod weevil negatively correlated with maximum relative humidity, minimum relative humidity and rainfall, whereas positively correlated with maximum temperature, minimum temperature and sunshine hours. The generated experimental data will be highly useful for forecasting and forewarning of pest incidence and development of Integrated Pest Management module for this particular pest.

TEXTURAL AND FUNCTIONAL QUALITY CHANGES IN EXTRUDED PRODUCT PREPARED FROM SOY FORTIFIED MAIZE-FINGER MILLET BLEND

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Abstract

Development of extruded products depends on extrusion process parameters like extruder temperature, screw configuration, screw speed, moisture content of feed, feed composition, etc. The effect of barrel temperature, feed moisture content and screw speed on textural and functional values of extruded products developed from optimized blend of maize: finger millet: defatted soy: *jimikand* the ratio of 40:30:20:10 was conducted. The RTE extruded product was developed by using co-rotating twin screw extruder. The technique of Response surface methodology (RSM) at five level three factors central composite rotatable design (CCRD) was applied for statistical analysis of data. The range of process parameters barrel temperature (100-150°C), extruder screw speed (110-350 rpm) and feed moisture content (12-20 %wb) was applied in the whole experiment. The responses studied in the present experiment were hardness (H), crispness (Cr), water absorption index (WAI) and water solubility index (WSI). The barrel temperature, screw speed and feed moisture content had significant effect on all the responses. The values of hardness, crispness, WAI and WSI of extruded products were found to be in the range of 12.43-19.04 N, 10-25 fractures, 5.76-7.25 g/g and 12.76-20.97%, respectively. The process parameters were optimized by using CCRD technique of Design Expert Software and result obtained as barrel temperature 110°C, screw speed 301 rpm and 14% feed moisture with product quality of H 12.497 N, Cr 24.90 fractures, WAI 6.42 g/g and WSI 19.85%.

PRODUCTION POTENTIAL OF KODO MILLET + GROUND NUT INTERCROPPING SYSTEM UNDER NATURAL, ORGANIC AND INTEGRATED FARMING SYSTEM

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Abstract

A field experiment was carried out in Ground nut + Kodo millet intercropping system in 4:2 row ratios at College of Agriculture, Hanumanamatti, Haveri on red soil from 2019-20 to 2021-22 on permanent site to study the impact of Natural Farming (NF), Organic Farming (OF) and Integrated crop management (ICM) practices on productivity, economics and soil health. The pooled results showed that, ICM recorded significantly higher Ground nut pod yield (1393 kg ha⁻¹), Kodo millet (499 kg ha⁻¹) and Ground nut equivalent yield (CEY) (1619 kg/ha) than NF. The reduction in Ground nut, Kodo millet and Ground nut equivalent yields (CEY) were 5.86, 12.77 and 6.86 per cent in natural farming over ICM, respectively. However, Natural Farming practices yielded 7.61 and 5.60 per cent higher Ground nut, Ground nut equivalent yield (CEY) and 6.07 per cent lower Kodo millet yield than Organic farming. The pooled results showed lower cost of cultivation under NF (Rs. 47,595 ha⁻¹) than ICM (Rs. 58,660 ha⁻¹) and OF (Rs. 58,991 ha⁻¹). About 18.86 and 19.32 per cent total costs were saved under NF over ICM and OF, respectively. Without premium prices, the higher gross return was obtained under ICM (Rs. 96,925 ha⁻¹)



than Natural and organic Farming (Rs. 86,128 and 91,315 ha⁻¹, resp.). However, the net returns were higher in natural farming (Rs. 43,720 ha⁻¹) than both ICM and Organic farming (Rs. 38,265 and 27,137 ha⁻¹, resp.). Further, with premium price, the net return was enhanced under NF (Rs. 59,361 ha⁻¹), which was 55.20 and 38.93 per cent higher than ICM and OF. Similarly, the returns obtained per rupee invested were higher with natural farming (1.93 and 2.25 with and without premium price, respectively) than other farming practices. The organic carbon content was increased slightly in organic and natural farming over 2 years. Available N is maintained. But, the available soil P, K, secondary nutrients (S, Ex. Ca and Mg) and micro nutrients (Cu, B and Mn) were declined in natural farming compared to the initial status. This envisages the nutrient mining in NF and needs personal attention to maintain and improve the available nutrients in the soil. Soil micro flora (Bacteria, fungi, actinomycetes, N₂ fixers and PSM's) and enzymatic activities (Dehydrogenase, Phosphatase and Urease) in groundnut + Kodo millet rhizosphere soil were significantly higher in organic and natural farming practices than other treatments at flowering stage. Hence, cultivation of Ground nut + Kodo millet intercropping system under natural farming practices can be recommended for getting optimum productivity, profitability and enriching soil bio-diversity.

PLANT TISSUE CULTURE BASED HARDENING SKILLS DEVELOPMENT AMONG RURAL YOUTH FOR SELF EMPLOYMENT GENERATION

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Abstract

The exploration and creation of hardening facilities through skill and entrepreneurship program for employment generation in order to create a platform for self-employment generation for the rural youth of through plant tissue culture and its hardening based technology, a field survey were undertaken in Aspiration district Washim to know the present status of farmers and agricultural practices. In-vitro tissue cultures activities are more of science based and require at most care to tackle with the bacterial and fungal contaminations round the year while working. Hence, this activity can be centralized at sophisticated lab facilities with considerable high investments. But at other counterpart, once the tissue culture bottled plants get established, multiplied in sufficient quantities and also cultures are well rooted, they can be gradually transferred to outside the lab and require considerable skill as well as art. Desired skill once acquired it will leads to successful production of plants at large scale and generation of entrepreneurship on per plant commission based on hardening capacity of the unit using green house facilities. During hardening green house facilities with fan pad misting or foggers system is must to ensure for proper growth of plantlets, to maintain optimum temperature and relative humidity during initial stage of hardening known as primary step. While secondary stage is performed in low cost, simple shade net house using green nets to expose tissue culture plants to open environmental conditions. These primary and secondary hardening facilities are being explored in the rural areas of the proposed aspirational district. The educated, uneducated youths from these rural areas of Washim districts are involved the PTC based hardening process. In such a way that they will engage in proposed hardening activities based on the skills and knowledge given through this training cum demonstration program at his locality. They themselves along with other rural youth got engaged and will act as trainer to generate other rural local people in these processes to set up their own business. In PTC based hardening process, there are many labour intensive activities and demand its timely execution. The activities involved like portrays and polythene bags fillings with soil media, seedling transplanting and caring, regular watering, monitoring of relative humidity (RH) and temperatures inside the hardening unit. Constant watch and its after caring required to check disease infection during production cycle from seedling stage like root rot, damping off of seedlings, collar rots mainly caused by fungi (*Phytophthora*, *Pythium* etc.) and to carry out its control measures. In fact, these diseases are spread through certain insect vectors and know how to manage these vectors are the key to control any viral diseases. The pest and disease are differ from the crop species under production. Hence, it is pertinent to know the exact etiology, symptom and their control measures at right time is the key for successful running of any nursery business or hardening unit. The rural youth can be effectively trained, empowered and encouraged in this business on per plant commission basis. Generally, in the present market, the commission range per plant varies from Rs 1.50 to 3.50/- per plants, if one has set the business target of 1.0 Lakh plantlets, it comes to generate income in the range from Rs. 1.50 to 3.50/- Lakh per cycle of hardening of banana. Once basic



facilities created, the income generation goes high upto Rs. 10.00 per annum and rural youth are ready to take up start ups in these sector.

MATHEMATICAL MODELING FOR OPTIMIZATION FISH FEED IN HARYANA

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Abstract

Food is the third most extreme compulsory thing for life after air and water. Due to environmental changes, depleting water bodies and land scarcity, the polyculture has been advocated in order to increase production in fisheries. Fisheries is one of the superb areas which have significant commitment in financial and social advancement of India. New water fish cultivating assumes a significant part in outside trade in various nations including India. It's known for its flexibility of giving food, nourishing, biological wellbeing and protections and work. In India, Haryana comes second in the normal yearly fish creation. In aquaculture, farming is difficult because feed represents maximum of the production cost. This study is carried out in applying the linear programming techniques for composition of fish feed mixture to minimize the cost without sacrificing the nutrients levels. The combinations lead to significantly reduced costs while raising nutrient intake, which might be quite advantageous to neighboring fish farmers.

GENETIC PURITY ASSESSMENT FOR DISCRIMINATION OF DIFFERENT ROOTSTOCKS IN CITRUS USING DNA MARKER

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Abstract

The conventional methods of citrus cultivars identification relied on morphological features. However, it is difficult to distinguish between many citrus rootstock cultivars. Recently, DNA markers have superseded many of the markers formerly used, not only because they are polymorphic with at least two alleles, but also because they are densely spread over the whole genome. Information about the genetic variations present within and between various plant populations and their structure and level can play a beneficial role in the efficient utilization of plants. A variety of techniques based on various molecular markers like RFLP, RAPD and ISSR have been used for citrus cultivar identification. It assumes that the sequence obtained after using a universal primer will show the presence of a unique sequence which helps in the identification of specific species of citrus. The use of DNA markers to obtain a genotype specific profile has distinct advantages over morphological and biochemical methods. DNA is found in plants and is unique to each individual specimen. Thus it can be mapped to reveal the genetic makeup of an organism. Molecular marker techniques have been proven powerful in the estimation of genetic diversity. Thus, PCR based multiple loci marker techniques which include random amplified polymorphic DNA (RAPD), amplified fragment length polymorphism (AFLP), Intersimple sequence repeat (ISSR) and Simple sequence repeat (SSR) or microsatellites playing important role in species identification. DNA based markers provide ideal nondestructive assays for identification of cultivars at a juvenile stage. In citrus, molecular markers such as RAPD, ISSR, and RFLP have been used for fingerprinting, genetic diversity analysis, phylogenetic studies and discrimination of cultivars. Sequence tagged microsatellite markers (STMS) are codominant, highly reproducible markers, easily automated with good analytical resolution making them the preferred choice of markers. The development of these in citrus and their utilization for discriminating species has opened avenues for genomic evaluation. In the present proposal technologies developed by National Research Centre on DNA Fingerprinting, New Delhi, Indian Institute of Horticultural Research, Bangalore and Central Citrus Research Institute, Nagpur are being used to differentiate the undesirous Galgal seedlings from the preferred rootstocks of citrus, i.e. Rangpur



lime and Rough lemon. Out of these three technologies, sample showing DNA fingerprinting pattern corresponding to Galgal by any two technologies will be confirmed as respective rootstock. Galgal is avoided as a rootstock particularly for its susceptibility to diseases. It is difficult to discriminate between Galgal, Rough lemon and Rangpur lime at seedling stage. This results in inadvertent as well as deliberate mixture of Galgal plants in the nursery. This impediment may eventually lead to great economic loss in the citrus orchards.

BIOCHEMICAL BASIS OF DEFENSE RESPONSE IN PLANT AGAINST *ALTERNARIA* LEAF BLIGHT THROUGH PLANT DEFENSE INDUCERS

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Abstract

Alternaria leaf blight of sunflower has been considered as a potentially destructive disease. Due to cons of using chemical pesticides, in this current study we are employing systemic acquired resistance (SAR) for the activation of host defense system, for the management of *Alternaria* disease. Plant defence inducers are a new class of agrochemical that does not have a direct toxic effect on the target organism but instead act by boosting plant defence. The present investigation was undertaken to know the effect of three plant defence inducers viz., salicylic acid, monopotassium phosphate and sodium propionate for the eco-friendly management of *Alternaria* leaf blight disease. Seed treatment with salicylic acid at 100 ppm followed by foliar spray of salicylic acid at 100 ppm recorded highest secondary metabolites such as flavonoids (68.71 mg/g FW) and phenols (73.53 mg/g FW) when compared to phenolics (45.07 mg/g FW) and flavonoids (51.43 mg/g FW) in control plants. Seed treatment with salicylic acid at 100 ppm followed by foliar spray of salicylic acid at 100 ppm showed increased defense enzymes such as superoxide dismutase (40.45 g/50 per cent inhibition) and peroxidase (16.86 g/min/mg protein) when compared to superoxide dismutase (54.36 g/50 per cent inhibition) and peroxidase (9.63 ig/min/mg protein) in control plants. This study demonstrated that Seed treatment followed by foliar spray with salicylic acid can be used effectively for the management of *Alternaria* blight in fields as it exhibited more defense enzyme activity and increased growth and yield parameters.

INTEGRATED MANAGEMENT OF *FUSARIUM* WILT OF GLADIOLUS

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Abstract

Pot culture experiment entitled “Integrated management of *fusarium* wilt of gladiolus” carried out in the plant pathology section college of agriculture, Nagpur during the year 2019-20. The experiment was conducted in Factorial Randomised Block Design with three main factor (neem cake, cotton cake and vermicompost) and five sub factor (T. *asperillum*, T. *harzanium*, P. *fluorescens*, B. *subtilis*, Carbendazim and uninoculated control) on Psittaneceous Hybrid variety of gladiolus. It was revealed from the result that minimum days to emergence have been recorded by application of neem cake(14.51days), with biocontrol agents .T *harzanium* (14.28days) significantly minimize the mortality 5.53, 14.16,43.26 and 51.77 per cent at 30,60,90 and 120 DAS. Similarly there was significant difference due to organic inputs and Bioagents on shoot length, number of flowers per plant, spike length, fresh weight of corms/ plant. Application of neem cake increased spike length (62.28cm/pl) shoot length7.39cm/pl, 22.76cm/pl, 25.48cm/pl and 32.26cm/pl at 30,60, 90and 120 DAS. Similar inoculation of T. *harzanium* increased spike length 68.56cm/pl, shoot length 7.39 cm/pl, 22.76cm/pl,26.28cm/pl and 32.26 cm/pl at 30, 60, 90 and 120 DAS respectively. Observations on mortality was also recorded at 30, 60, 90 and 120 DAS respectively. The interaction effect due to organic inputs and Bioagents were non significant in all the growth parameters at all interval. Thus it can be concluded that application of neem cake along with incorporation of T. *harzanium* can be used effectively for the control of Fusarium wilt of gladiolus.



POST HARVEST MANAGEMENT OF WASTE PRODUCTS OF HORTICULTURAL CROPS: AN ALTERNATIVE FOR DEVELOPING ENTREPRENEURSHIP

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Abstract

Horticultural crop waste, including peels, leaves, stems, and by-products from processing, often represents a significant challenge in terms of disposal. However, this waste can be transformed into valuable resources, presenting opportunities for entrepreneurship and sustainable economic growth. It discusses the production of organic fertilizers and soil amendments from horticultural waste, which can be utilized in agriculture, horticulture, and landscaping industries. By turning waste into high-quality organic products, entrepreneurs can contribute to sustainable agricultural practices and soil health improvement. By transforming waste into valuable resources, entrepreneurs can contribute to waste management, environmental sustainability, and rural development. However, to fully harness this potential, collaboration, innovation, and supportive policies are essential. By promoting waste-based entrepreneurship, we can unlock economic value, reduce waste generation, and pave the way for a more sustainable and circular horticultural industry.

INOCULATION EFFECT OF PGPR AND BIOPESTICIDE ON GROWTH AND YIELD OF BROCCOLI (*BRASSICA OLERACEA L. VAR. ITALICA*)

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Abstract

The present investigation was conducted to know the effect of PGPR and biopesticides on performances of Broccoli (*Brassica Oleracea L. Var. italica*). The experiment laid out in CRD comprised of 7 different treatment combinations and replicated four times. The treatments were viz., T1 (Absolute control), T2 (Application of chemical pesticides), T3 (Inoculation of PGPR), T4 (Application of *Trichoderma*), T5 (Inoculation of PGPR + Neem cake), T6 (Application of *Trichoderma* + Neem cake), T7 (Inoculation of PGP + *Trichoderma* + Neem cake). Results indicated that combined Inoculation of PGPR + *Trichoderma* + Neem cake gave significantly highest growth attributes viz. number of leaves per plant (26.75). There was no incidence of aphids, reduced number of damage leaves per plant was observed in T7- Inoculation of PGP + *Trichoderma* + Neem cake (mean value 0.41) as compared to other treatments and maximum (2.16 damaged leaves/plant) was observed in T1-control. Application of PGPR + *Trichoderma* + Neem Cake showed significantly highest fruit weight in broccoli (331.66g/fruit) as compared to other treatments. PGPR along with *Trichoderma* and Neem Cake treatment showed superior effect on broccoli which proved the best treatment combination with respect to yield and biocontrol effect.

EVALUATION OF GROWTH AND YIELD PERFORMANCE IN OKRA (*ABELMOSCHUS ESCULENTUS L. MOENCH*) HYBRIDS

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Abstract

The present investigation, designated “evaluation of growth and yield performance in okra (*Abelmoschus esculentus* L. Moench) hybrids,” was conducted from kharif 2022 to rabi 2023 at the P.G. research block at College of Horticulture, Mojerla, Wanaparthy District. During Rabi 2022-23, the experimental design was put out in Randomized Block Design with three replications, and thirteen parents selected based on per se performance and genetic investigation methods. In Rabi 2022-23,



the thirty direct crossings, ten lines, three tester parents, and two checks (Arka Anamika and PDKV Pragati) were examined for combining ability and heterosis to discover prospective F₁ hybrids with high productivity and good fruit quality for commercial exploitation. Two crossings, IC42456 Kashi Lalima and IC42456 Parbhani Kranti, out of 30 hybrids, had the biggest mean performance for yield and yield contributing variables such as number of fruits per plant, fruit yield per plant (kg), and fruit production per hectare (ton). Promising hybrids, namely IC42456 Kashi Lalima and IC42456 Parbhani Kranti, can be tested in multi-location investigations to prove their efficacy and stability in a variety of agroclimatic regions.

ANTIOXIDANT AND PHYTOCHEMICAL PROPERTIES OF *CHENOPODIUM AMBROSIODES* USING GC-MS ANALYSIS AND PRELIMINARY SCREENING

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Abstract

This study aimed to investigate the antioxidant potential and phytochemical composition of *Chenopodium ambrosioides* through Gas Chromatography-Mass Spectrometry (GC-MS) analysis and preliminary screening. Aerial parts of *Chenopodium ambrosioides* were subjected to sequential extraction using acetone and methanol solvents. The antioxidant activity was evaluated using standard assays, including DPPH radical scavenging and Reducing Power assay. GC-MS analysis was employed to identify the phytochemical constituents present in the extracts. Preliminary screening for bioactive compounds was conducted using standard chemical tests. The extracts exhibited notable antioxidant activity, with the highest radical scavenging and reducing power observed in methanol extract. GC-MS analysis identified a range of phytochemical constituents, 39 compounds in acetone and 26 in methanol extract, including piperitone oxide and terpinene as major compounds in both extracts. Preliminary screening revealed the presence of important bioactive compounds, such as alkaloids, flavonoids, and terpenoids. *Chenopodium ambrosioides* showed potent antioxidant activity, matching its diverse plant chemicals found through GC-MS analysis. The discovered active compounds need more research for possible health benefits. This study gives important information about the antioxidants and plant chemicals in *Chenopodium ambrosioides*, setting the stage for future research on its health and nutrition uses.

ENHANCING THE BIOSORPTION OF ZINC METAL IONS FROM AQUEOUS INDUSTRIAL EFFLUENTS BY TRAINED *ASPERGILLUS NIGER*

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Abstract

Water resources have been historically undervalued and mismanaged across the globe, resulting in haphazard and unplanned water usage. Industrial effluents contribute significantly to water and soil pollution, containing various pollutants such as dyes, metals, phenols, and sewage. Among these pollutants, heavy metals pose a particular concern as they tend to accumulate in the food chain and persist in the ecosystem. This study aimed to identify soil fungi with high biosorptive efficiency for zinc in both single-metal and multi-metal solutions, owing to their inherent resistance or tolerance to heavy metals. The utilization of such strains may prove beneficial in the development of biosorption-based treatment facilities for effluents containing multiple heavy metals. To evaluate the biosorptive capacity, several fungal species were exposed to increasing concentrations



of zinc (in ppm) ranging from 50 ppm to 2000 ppm in a modified culture medium. The biomass of *Aspergillus niger* exhibited biosorption ranging from 56.87% to 87.05% for 100 ppm zinc solutions, 40.67% to 55.80% for 200 ppm solutions, and 34.89% to 41.72% for 300 ppm solutions. Subsequently, biosorption assays were conducted using binary and ternary solutions. The trained biomass demonstrated significantly higher metal absorption (AFNZnT) compared to the untrained biomass (AFNZnT) ($t = 3.99$; 2.16). This observation suggests that enhancing the biosorption efficiency of a specific metal through fungal species introduction may improve the overall capacity of the system to adsorb other metals. In conclusion, selective breeding of fungal species for specific metals has the potential to yield strains that outperform their original counterparts in both single-metal and multi-metal systems.

EVALUATION OF NEW RABI SORGHUM HYBRIDS

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Abstract

Sorghum is an important cereal crop predominantly cultivated in the semi arid tropics with major production coming from the USA, Nigeria, Ethiopia, Mexico and India. As a rainfed crop, sorghum is mainly used for both human consumption and as livestock feed. In India, sorghum is cultivated over of 4.48 million ha with an annual production of 4.38 million tonnes of grains with a productivity of 1018 Kg/ha. In Karnataka, kharif and rabi sorghum are cultivated over 0.99 million hectares with an annual production of 0.914 million tons of grain. In Hyderabad Karnataka, it is mainly cultivating in Bidar, Gulbarga, Yadgir, Raichur, Koppal and Ballari districts. In these regions, varieties and local landraces are mainly cultivated in medium and deep black soils under receding moisture conditions. The three CMS lines AKMS -66A, 104 A and M31-2A were used for crossing programme with 9 lines totally 26 crosses were produced one cross seeds not germinated. The 26 hybrid combinations were evaluated at Hagari Centre during the rabi season, six Hybrid combinations viz., HHS-22-9 (grain yield of 4633 kg/ha and fodder yield of 275 q/ha), HHS-22-16 grain yield of 4875 kg/ha and fodder yield of 192 q/ha), HHS-22-18 grain yield of 4936 kg/ha and fodder yield of 181 q/ha), HHS-22-20 (grain yield of 4475 kg/ha and fodder yield of 281 q/ha) , HHS-22-23 (grain yield of 4500 kg/ha and fodder yield of 155 q/ha) and HHS-22-26 (grain yield of 4752 kg/ha and fodder yield of 277 q/ha) compared to national check CSH-16 grain yield of 3676 kg/ha and fodder yield of 133 q/ha) and Local check Pradhan (grain yield of 4285 kg/ha and fodder yield of 149 q/ha).

SHORT TERM ASSESSMENT OF INSECT POLLINATOR DIVERSITY IN THE FOREST ECOSYSTEM OF SERAJ VALLEY OF INDIAN HIMALAYAN REGION

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Abstract

The Indian Himalayan Region (IHR) is home to a diverse range of forest ecosystems that support a wide variety of insect pollinators. These pollinators are essential for the pollination and conservation of many native and cultivated plant species, providing numerous provisioning services such as food security, livelihood, and carbon sequestration. Most angiosperms are pollinated by insects, making insect pollinators crucial for the survival of these plants. The insect diversity and distribution are affected due to climatic disturbances and anthropogenic activities like habitat loss, degradation and fragmentation. Hence, there is a need for the study of insect diversity. Therefore, the present study was conducted in Seraj valley, an integral part of the North-Western Himalaya, to document the insect pollinators found in forest ecosystems at different altitudes ranging from 1000-3500 m amsl. Insects were collected using the sweeping technique and brought to the laboratory for identification. The study found that the order Lepidoptera was the most dominant among all the insect pollinators, followed by Hymenoptera and Coleoptera. Diptera and Hemiptera were the least dominant among all the insect pollinators found in the study area. The findings of this study can be used to develop conservation strategies for insect pollinators in the region, which are essential for the pollination and conservation of many native and cultivated plant species.



EXPLORING THE ENCHANTING WORLD OF TRADITIONAL PLANTS SUSTAINING TRIBAL LIVELIHOODS

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Abstract

Ethnobotany explores the fascinating relationship between people and plants by examining the diverse ways that people have used plants throughout history. It gives a general idea of how natural plants are utilised by the people living in that particular region and culture. Among Indian tribes, agriculture is the primary source of income. It is important for the country's economy, rural development, employment and occupation, food and nutritional security, growth and survival, social, economic, and cultural circumstances. The goal of the sustainable livelihood approach is to learn more about livelihoods in order to better plan and carry out initiatives to reduce unemployment. It aids in the analysis of the opportunities and limitations faced by the rural poor, fosters a deeper understanding of various viewpoints, determines the options that have the greatest potential to end unemployment. Traditional plants provide a livelihood to the local inhabitants of Kinnaur. To document the traditional knowledge and usage about traditional plants, how they are utilized by the tribal inhabitants for their livelihood, a total of 24 people of both genders belonging to different age groups were interviewed in various villages of the Kinnaur district, Himachal Pradesh. Total 10 edible plants, representing families were recorded. Of these, 7 species were represented by trees, 2 herbs and 1 shrub. The indigenous usage and customs of the local communities are rich in knowledge, but they need to be well documented in order to be preserved for a long time.

EVALUATION OF PERFORMANCE OF DIFFERENT PGPR ALONG WITH *RHIZOBIUM* ISOLATE ON 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 *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 (103.52 mg/plant) and plant dry weight/plant (6.28 gm/plant) among the different combination of plant growth promoting rhizobacteria.

GENETIC VARIABILITY AND DIVERSITY STUDIES IN FRENCH BEAN (*PHASEOLUS VULGARIS* L.) GENOTYPES

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Abstract

Field experiment was carried out with 41 genotypes of French bean (*Phaseolus vulgaris* L.) to study the genetic variability and diversity during *Rabi* 2022-23 at RARS, Vijayapur. The analysis of variance was significant for all the traits indicated higher magnitude of variability among the genotypes. High (>20%) GCV and PCV along with high heritability (>60%) coupled with genetic advance as per cent over mean (>20%) were observed for the traits viz., plant height at 25 and 50 DAS, leaf area,



number of pods per plant, green pod yield per plant and green pod yield per hectare. These results indicated the presence of additive gene effects. Thus, there is an ample scope for improving these characters with direct simple selection. Genetic diversity among the genotypes was worked out using Mahalanobis D^2 statistics. On the basis of Tocher's method, the genotypes were broadly grouped into seven clusters. Cluster I was the largest having 32 genotypes followed by cluster IV with three genotypes, cluster III with two genotypes and the rest of clusters such as cluster II, V, VI and cluster VII which had one genotype each. The maximum inter-cluster D^2 values were observed between the cluster VII and IV, indicating that the genotypes in these clusters can be used as a parents in hybridization programme to obtain transgressive segregants.

GROWTH, YIELD, QUALITY AND ECONOMICS OF SOYBEAN AS INFLUENCES BY PLANT GROWTH REGULATORS AND THEIR STAGES OF APPLICATION

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Abstract

Soybean has emerged as one of the major oilseed crop and revolutionized rural economy and lifted the socio economic status of soybean farmers. However, the increase in the productivity over the years did follow the same place, and it is not more than half of the world average, hence there is tremendous scope to increase soybean production by enhancing productivity. Plant growth regulators are known to enhance the source-sink relationship and stimulate the translocation of photo-assimilates thereby helping in effective flower formation, fruit and seed development and ultimately enhance productivity of the crops. A growth regulator can improve the physiological efficiency including photosynthetic ability and can enhance the effective partitioning of accumulates from source and sink in the field crops. Hence considering these points in view the present study was undertaken with aim to study the effect of the four bio-regulators (Salicylic acid, Ethrel, Chloromequat chloride and Nitrobenzene) and their stages of application on growth, yield and quality of soybean.

EVALUATION OF MAIZE VARIETY, RCRMH-2 UNDER FRONT LINE DEMONSTRATIONS IN FARMERS FIELDS

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Abstract

The front line demonstration on maize variety RCRMH-2 was conducted on integrated crop management (ICM) concept in comparison with farmer's practices at Kudligi and H B Halli talukas of Ballari Dist., Karnataka. Totally ten demonstrations were carried out under rain fed situation during the year 2020 with recommend package of practices like seed treatment with bio fertilizers, application of FYM @ 3 ton, NPK @ 100:50:25 kg / ha, application of zinc sulphate 2 10 kg / ha, proper hand weeding. With respect to the pest management, application of poison bait and carbaryl 4% @ 7.5 kg per hectare against insect pests and seed treatment with *Trichoderma harzianum* @ 10g per kg seeds and spraying of mancozeb 75 WP @ 2.5 g per liter against the seed born diseases and leaf spot diseases. After successful conducting of demonstrations in all the spots, the results were revealed that, the grain yield in ICM block was 22.5 quintal per acre compared to farmers practice (19.30 q/acre) with per cent increase in grain yield of 14.22. The farmer's opinion was also collected and they expressed that the demonstration plots were found superior in getting fodder yield and grain yield with the B:C ratio of 1.68.

METAGENOMIC INSIGHTS INTO THE BACTERIAL DIVERSITY OF CONTINUOUS SUGARCANE CROPPING FIELDS OF WESTERN REGION OF UTTAR PRADESH

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Abstract

Sugarcane fields in the Western region of Uttar Pradesh represent a vital agricultural landscape with significant ecological and



economic importance. This study investigates the bacterial diversity within the continuous sugarcane cropping fields of the Western region of Uttar Pradesh using metagenomic approaches. The intricate understanding of the microbial communities thriving within these fields stands as a crucial factor for ensuring sustainable crop management and bolstering productivity. Our study encompassed soil sampling from Meerut, Muzaffarnagar, and Hapur, specifically targeting areas engaged in continuous sugarcane cultivation across diverse growth stages of the crop. The findings indicated a significant reduction in both total nitrogen and available nitrogen within the rhizosphere soil due to extended periods of continuous cropping. The current study revealed a prevalence of gram-positive bacteria in the soil of continuously cropped sugarcane fields, indicating a higher abundance when compared to gram-negative bacteria.

ISOLATION AND IDENTIFICATION OF FUNGI FROM DIFFERENT INDUSTRIAL WASTE WATER

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Abstract

The release of untreated wastewater containing biotoxic substances in the form of heavy metals is one of the most crucial environmental and health challenges faced by our community. Fungi have unique bioremediation properties. The fungal community structure in different industrial effluents to provide a base for further attempts on bioremediation. Heavy metal tolerant fungi were isolated from the soil samples of industrial effluents, metal dumping sites and sludge by serial dilution method on Potato dextrose agar. These fungi were identified on the basis of morphology of mycelium (color of mycelium, texture) on media, and microscopic examination of LCB stained preparation. A total of eight fungal genera were identified from industrial effluent. *Aspergillus* was the most occurring genera in all the sample types where as *Fusarium*, *Rhizopus* and *Penicillium* were the least isolated. *Aspergillus fumigatus*, *Aspergillus niger*, *Aspergillus phoenicis*, *Aspergillus terreus*, *Fusarium camptocera*, *Rhizomucor miehei*, *Penicillium digitatum*, *Penicillium oxalicum* and *Penicillium verrucosum* are the most important addition in effluent mycoflora. These are also being used in different waste water and metal treatment all over the world.

EFFECT OF BIOFERTILIZERS AND HUMIC ACID ON GROWTH AND YIELD OF AFRICAN MARIGOLD (*TARGETES ERECTA* L.) THROUGH FIELD TRIALS IN RAICHUR DISTRICT OF KARNATAKA STATE

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Abstract

African marigold (*Tagetes erecta* L.) or African Marigold, is a frequently cultivated, tender, flowering, herbaceous annual or houseplant known for its large flowerheads. The pigments of the erect tagetes are due to the presence of carotenoids, of which the main one is lutein, which is associated with the prevention of the development of age-related eye diseases such as cataracts and macular degeneration. The essential oil of the flower contains antioxidants. It may be added to perfumes to infuse an apple scent. There is seasonal great demand for this crop during the festivals time. Marigold is also considered one of the most important flower crop with higher productivity. As the soil fertility status gradually reducing every year and farmers are not aware of the importance of nutritional requirement of the plants for the enhancement of the productivity, the quality and quantity of the produce is reducing instantly. In this context, field demonstrations were conducted by ICAR- Krishi Vigyan Kendra, Raichur, Karnataka during 2020-21 and 2021-22 in farmer's fields of different villages of Raichur district. The main objective was to enhance productivity and quality of marigold by adapting the new technologies released by UAS, Raichur. Improved cultivation practices included use of high yielding hybrid (Arka bangara), seedling treatment, weed management, irrigation, use of biofertilizers and humic acid, other nutrient management, insect pest & disease management. The findings revealed that demonstrated plots (T₁: Application of 75% of NPK + Bio fertilizers (*Azospirillum* + PSB + KMB each at 5 kg/ha) + Humic Acid @ 0.2% spray at 30 & 60 DAP) recorded an maximum plant height (77 cm & 71 cm), plant spread of (54.6 cm & 50.7 cm), diameter of the plant (4.85 cm & 4.66 cm), number of flowers per plant (74.3 & 70.9) and yield



per tone (20.0 & 17.6) during 2020-21 and 2021-22, respectively. whereas the lowest observations were recorded in T2 (100% NPK). Similarly, demonstrated plots recorded 13.63 % and 21.15 % increase in the yield during 2020-21 and 2021-22, respectively. Adoption of improved production technologies will increase the productivity of marigold and will also improve socio-economic condition of the farmers.

ENVIRONMENTAL IMPACT OF CUTTING OF TREES DUE TO ROAD EXPANSION IN BHADRAK, ODISHA

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Abstract

Akhandalamani Temple at Aradi Odisha, India, is dedicated to very famous Lord Shiva (Baba Akhandalamani), so many tourist and devotees pass through that green tunnel between Bhadrak-Kothar-Aradi road. The research entitled “Environmental impact of cutting of trees due to road expansion in Bhadrak, Odisha” was carried out in Bhadrak-Kothar-Aradi road to assess the impact of cutting of trees due to expansion on environment and the effect of cutting of trees for road expansion on local dwellers and their livelihood. Biomass estimation of cut trees was done by *Brown et al's* pan-tropical equation i.e. Aboveground Biomass = $34.47 - 8.068 (\text{Diameter}) + 0.6589 (\text{Diameter})^2$ and was found that approx. 4978.05 tons of total biomass removed from the site along with the loss of 2737.92 tons of carbon stock loss. Survey analysis was done to get the number of respondents taken was 50 and they were randomly selected, it included dwellers, shopkeepers, tourist, travellers etc. The data were collected through a structured survey questionnaire, analysed with appropriate statistical methods and were interpreted in accordance with the objectives of the study. From survey analysis it was found that 12(24%) agree with the cutting and 24(48%) people shown strongly disagree while 14(28%) people remain neutral. Road expansion have negative impact on livelihood of 16(32%) and rest 34(68%) remain unaffected. According to the respondents the more obvious environmental impact they are facing- 22(44%) increase in hotness, 16(32%) decrease in aesthetic value, 8(16%) hampers in livelihood, 4(8%) decrease in flora and faunal biodiversity. To recover this loss compensatory afforestation should be done as soon as possible and well taken care of. After the construction of road avenue plantation must be done with proper planning and by selecting correct species. People will suffer a lot during hot seasons and decreased aesthetic value of the road will definitely make the heart of regular traveler's sorrow stricken. So, change in policies of government, adoption of new technologies like translocation of whole mature tree, or diversion of road, if possible, should be done at priority basis to avoid such felling.

‘VL BARIK DHAN’-AN UPCOMING ELITE VARIETY OF RICE FOR CULTIVATION UNDER THE IRRIGATED TRANSPLANTED CONDITIONS OF NORTHERN HILLS

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Abstract

VL Barik Dhan is an early duration rice variety suitable for cultivation under the irrigated transplanted conditions of Uttarakhand, H.P. and Jammu & Kashmir. This variety has been developed by ICAR-Vivekananda Parvatiya Krishi Anusandhan Sansthan (VPKAS), Almora, Uttarakhand which is identified by the Variety Identification Committee during the 58th ARGM at Assam Agricultural University, Jorhat, 2023 held on 4th May 2023. This variety has long- slender grain (kernel length 6.90mm & LB ratio 3.28) now being preferred by the young generation in the hill region of Uttarakhand. This has been a consistent performer in medium elevated hills of Uttarakhand, Himachal Pradesh and Jammu & Kashmir during the three years of testing and found promising for these regions. On an average of three years of testing in AICRP, this variety has provided grain yield of 4,500 kg/ha in medium hills as compare to national check, VL Dhan 86 (3,896 kg/ha); regional check, Shalimar Rice 3 (2,467 kg/ha) & Local check (3,852 kg/ha) with yield advantage of 15.49, 82.41 and 16.81 per cent, respectively over these checks. This variety is developed by crossing between VL 31339 and BL 122. It matures in 115-120

days with plant height of 95-100 cm. This has semi-erect, semi-dwarf and non-lodging plant type, green basal leaf sheath colour, compact and well-exserted panicle and awless grains.

This has recorded excellent quality characteristics viz., hulling (80.7%) and milling (72.2%), head rice recovery (67.2%), intermediate ASV (5.0), amylose content (24.21%), gel consistency (22mm) and grain chalkiness is very occasionally present. It has long a slender-grain with kernel length (6.90mm), kernel breadth (2.10mm) and L/B ratio (3.28). It has shown moderate resistance against leaf blast, neck blast, brown spot, sheath blight and bacterial leaf blight. This variety has also been found responsive at both lower and normal nitrogen fertility levels. This will help in yield stabilization of hill farmers and fulfils the requirement of varietal diversification of irrigated rice growers as well as youth demand of hills for fine grain rice.

GROWTH, YIELD ATTRIBUTES AND YIELD OF AEROBIC RICE UNDER ORGANIC AND INORGANIC SOURCES NUTRIENT MANAGEMENT

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Abstract

A field study was taken up to evaluate the influence of organic sources of nutrients and fertility levels in aerobic rice during *khari*f 2017 and *khari*f 2018 at Indian Institute of Rice Research, Rajendra Nagar, Hyderabad. The experiment was laid out in split plot design with three replications. The treatment comprised of M₁: Neem leaf manure @ 6 t ha⁻¹; M₂: Vermicompost @ 2 t ha⁻¹; M₃: Goat manure @ 5 t ha⁻¹; M₄: Microbial consortia [seed treatment @ 4g kg⁻¹ + soil application @ 4 kg ha⁻¹] and four subplots with graded doses of fertilizers viz; S₁: Control; S₂: 50% RDF; S₃: 75% RDF and S₄: 100% RDF (120-60-40). It was observed that higher plant height, dry matter production and tillers m⁻² were recorded under M₂ [vermicompost 2 t ha⁻¹] followed by M₃ [goat manure 5t ha⁻¹]. Higher panicle length (25.6), panicle weight (3.4), total grains per panicle (125.7) and filled grains per panicle (116.5) was found to be high under M₂ [vermicompost 2 t ha⁻¹]. M₂ treatment [vermicompost 2t ha⁻¹] accrued higher grain yield of 4248 kg ha⁻¹ which was statistically at par with M₃ (4141 kg ha⁻¹). Lowest grain yield of 3066 kg ha⁻¹ was obtained with M₁ (neem leaf manure 6t ha⁻¹). 100% RDF (S₄) yielded 4712 kg ha⁻¹ followed by 75% RDF (S₃). The highest straw yield (5374 kg ha⁻¹) was obtained with M₂ (vermicompost 2t ha⁻¹) followed by M₃ (Goat manure 5 t ha⁻¹) (5268 kg ha⁻¹). S₄ (100%) RDF produced the highest straw yield of 5894 kg ha⁻¹ followed by S₃ (5530 kg ha⁻¹).

EFFECT OF DIFFERENT ROOTSTOCKS ON MORPHOLOGY OF SCION

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Abstract

The trial was laid out at Bihar Agricultural College, Sabour, Bhagalpur under BAU, Sabour to show the effect of different rootstocks on morphology of scion under Bihar condition. The experiment was conducted on twelve rootstocks of citrus viz. Jatti Khatti, Trifoliate orange, Carrizo citrange, Cleopatra mandarin, Citrummelo, Karna Khatti, Rangpur lime, Mosambi, Kinnow mandarin, Sour orange, Troyer citrange, Volkameriana lemon which was planted in randomized block design with three replications and maintained uniformly. Results on morphology of all twelve rootstocks showed significant variations among themselves. In respect of height at 180 days after planting in the field showed lowest in Cleopatra Mandarin i.e 9.62 cm whereas highest (17.25 cm) in Volkameriana Lemon. Stem girth was minimum in Trifoliate Orange (2.11 cm) followed by Sour Orange and Karna Khatti whereas maximum (3.06 cm) in Rangpur Lime which was at par with Troyer Citrange (3.03). This is the one year data and on that basis it can be concluded that Cleopatra Mandarin in the dwarfest rootstock under Bihar condition whereas tallest one is Volkameriana Lemon.



PICS BAG STORAGE ON POST HARVEST MANAGEMENT OF DOLICHOS BEAN [LABLAB PURPUREUS (L.) VAR TYPICUS PRAIN]

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Abstract

The present investigation entitled “PICS bag Storage on post harvest management of Dolichos Bean [*Lablab purpureus* (L.) var *Typicus Prain*]” was carried out from September, 2017 to March, 2018 in the research laboratory of College of Horticulture, Rajendranagar, Hyderabad, SKLTSHU. The experiment was laid out in by Factorial CRD with two factors: four types of bags (Factor A) i.e jute bag, polythene bag, triple layered PICS bag and jute bag treated with chloropyriphos and three storage periods (Factor B) i.e 2 months, 4 months and 6 months. Each treatment contained healthy dolichos bean seed with 10% of seed with artificial infestation of bruchid *Callosobruchus theobromae*. The treatments used were T₁: Jute bag+5kg dolichos bean seeds @10% moisture stored for 2 months; T₂: Jute bag+5kg dolichos bean seeds @10% moisture stored for 4 months; T₃: Jute bag+5kg dolichos bean seeds @10% moisture stored for 6 months; T₄: Polythene bag+5kg dolichos bean seeds @10% moisture stored for 2 months; T₅: Polythene bag+5kg dolichos bean seeds @10% moisture stored for 4 months; T₆: Polythene bag+5kg dolichos bean seeds @10% moisture stored for 6 months; T₇: Triple layer PICS bag+5kg dolichos bean seeds @10% moisture stored for 2 months; T₈: Triple layer PICS bag+5kg dolichos bean seeds @10% moisture stored for 4 months; T₉: Triple layer PICS bag+5kg dolichos bean seeds @10% moisture stored for 6 months; T₁₀: Jute bag treated with insecticide +5kg dolichos bean seed @10% moisture stored for 2 months; T₁₁: Jute bag treated with insecticide +5kg dolichos bean seeds @10% moisture stored for 4 months and T₁₂: Jute bag treated with insecticide +5kg dolichos bean seeds @10% moisture stored for 6 months. Results on Germination per cent in triple layer PICS bag (93.67, 93.33 and 93.00) at 2, 4 and 6 months storage was highest among all bag types followed by jute bag treated with insecticide (88.7). After 2, 4 and 6 months storage period, in triple layer PICS bag the protein content (%) (38.917, 38.50 and 37.76). Lowest bruchid infestation was recorded in triple layer PICS bag (13.27, 13.35 and 13.38) at 2, 4 and 6 month periods respectively. The low infestation of pest was due to hypoxia (low oxygen levels) and hypercarbia (high carbon dioxide levels) conditions created in triple layer PICS bag which caused 100% mortality of bruchid and prevent the further damage.

AGROFORESTRY : A WAY FORWARD TO CLIMATE CHANGE ADAPTATION AND MITIGATION THROUGH CARBON SEQUESTRATION

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Abstract

Agroforestry is a widespread practice in both developing and developed countries, and its visibility is increasing at the national level and in international institutions. Agroforestry is increasingly recognized as a land management system that can serve as a response option for both climate change adaptation and mitigation while addressing many of the challenges that smallholder farmers are facing. Agroforestry can generate multiple livelihood and environmental benefits, as it can help to mitigate climate change and help farmers adapt to extreme and variable weather (IPCC, 2019). Agroforestry supports tree-related ecosystem services, such as regulation of water and sediment flows, carbon and nutrient cycling in soils and it provides habitat for biodiversity. This leads to increased soil fertility, reduced soil erosion and flood and pest control. Benefits of agroforestry to smallholder farmers include increased farm productivity and reduction of external inputs such as conventional fertilizers and chemicals for pest management, leading to increased income. Climate change is happening now and urgent action is required to limit the temperature increase to 1.5 degrees (IPCC, 2019). Climate change risks (e.g. severe droughts, flooding, diseases) can have extensive impacts on agricultural systems, triggering soil erosion, crop failure, loss of biodiversity, reduced soil moisture, pest damages and economic losses. More extreme events and greater occurrence of drier



and wetter conditions are already making it difficult for farmers to plan planting and harvesting, threatening current production systems and food security as a result. Trees, forests and agriculture are key to reducing carbon. Replanting the right tree species in the right place can help farmers adapt to climatic impacts. Equally important, agroforestry can improve livelihoods in smallholder farming systems through diversified income and cash crop systems (e.g. cocoa, coffee, nuts), increased food security and improved access to nutritious food. Climate adaptation is particularly important for female farmers as they often have less access to resources compared to their male counterparts. Agroforestry practices can reduce or remove significant amounts of GHGs through increased carbon storage in biomass above-ground and below-ground and in soil organic carbon (IPCC, 2019). Integrating agroforestry into cropping and livestock-keeping systems can enhance carbon sequestration by significant amounts. Home gardening, boundary planting, fruit orchards, riverine, hedgerows, woodlots and firewood lots are major agroforestry practices that sequester CO₂.

DETECTION OF PROGESTERONE USING COMPUTATIONALLY DESIGNED MOLECULAR IMPRINTED POLYMER (MIP) BASED (QUARTZ CRYSTAL MICROBALANCE) QCM BIOSENSOR

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Abstract

Progesterone is an ovarian steroid hormone that is essential for normal breast development during puberty and in preparation for lactation and breastfeeding. Measurement of the concentration of the Progesterone, a pregnancy hormone, provides more accurate indicator of cyclic activity and the development of an easy-to-use, rapid, robust and inexpensive biosensor for progesterone analysis is the need of time. Apart from biological antibodies, which usually are being raised in animals, the use of molecularly imprinted polymers (MIPs) has received a lot of attention. In this work an artificial receptor for progesterone was synthesized using molecular imprinting technique. The composition of the MIP was optimized using computer modeling followed by experimental process. Template was removed from the imprinted polymer with the help of SPE (solid phase extraction) and characterization of MIPs was done with UV-Visible spectrophotometer and FTIR (Fourier transform infrared spectroscopy). The prepared MIPs were fabricated on the surface of quartz crystal and the detection of Progesterone was made by the shift in frequency of the crystal by a QCM biosensor. The study reveals that MIPs successfully fabricated and used as plastic antibody and as a sensing element for development of low cost and effective biosensor for progesterone detection.

GENETIC STUDIES IN BIOFORTIFIED LINES OF PEARL MILLET [*Pennisetum glaucum* (L.) R.]

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Abstract

Improving essential nutrient content in staple food crops through biofortification breeding can overcome the micronutrient malnutrition problem. Genetic improvement depends on the availability of genetic variability in the primary gene pool. This study was aimed to ascertain the magnitude of variability and diversity in a 27 biofortified lines along with three checks *Viz.*, ICTP-8203, VPMV-9 and Dhanashakti and predict pearl millet biofortification prospects for essential micronutrients. The ANOVA showed highly significant differences among the genotypes for all the characters studied, indicating the presence of sufficient variability in the experimental material. The phenotypic coefficient of variation (PCV) was slightly higher than the respective genotypic coefficient of variation (GCV) for all the characters under study indicated less influence of environment on the genotypes in expression of traits. High heritability with high genetic advance as per cent of mean for thousand seed weight, iron content and zinc content. This indicates the lesser influence of environment in the expression of the characters and may be governed by additive gene action. Hence, these traits are likely to respond to direct simple selection.



Based on the relative magnitude of D^2 values resulted through Tocher's method the genotypes were grouped in three clusters. Out of three clusters, Cluster I was the largest and included 28 genotypes while the other clusters i.e., cluster II and III consisted of single genotypes each. This suggested the existence of high degree of diversity among the genotypes. The trait thousand seed weight contributed maximum towards genetic divergence. The intra cluster distance was recorded in cluster I. The highest inter-cluster distance was observed between cluster I and III followed by the distances between cluster II and III and cluster I and cluster II indicate the substantial diversity among the genotypes in these clusters.

IN-VITRO EFFICACY OF NEW GENERATION FUNGICIDES AND ORGANIC FORMULATION FOR THEIR EFFECTIVE CONCENTRATION AGAINST *ALTERNARIA ALTERNATA* CAUSING *ALTERNARIA* BLIGHT OF TOMATO (*SOLANUM LYCOPERSICUM* L.)

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Abstract

Present investigation was undertaken for *in-vitro* efficacy of new generation fungicides and organic formulation for their effective concentration against *Alternaria alternata* causing Alternaria blight of tomato. The efficacy of new generation fungicides and organic formulations like viz., Propineb 70% WP @ (0.20%, 0.25% & 0.30%), Hexaconazole 5% EC @ (0.05%, 0.10% & 0.15%), Tebuconazole 50% + Tri-Floxystrobin 25% w/w WG {Nativo 75 WG} @ (0.05%, 0.10% & 0.15%), Mancozeb 63% + Carbendazim 12% w/w WP {SAAF 75 WP} @ (0.20%, 0.25% & 0.30%), Pyraclostrobin 5% + Metiram 55% w/w WG {Cabrio-Top 60 WG} @ (0.10%, 0.15% & 0.20%), Fresh Cow Urine @ (5%, 10% & 15%) and Azadirachtin {ECONEEM} @ (0.10%, 0.15% & 0.20%) were evaluated *in-vitro* at three different concentrations respectively against *Alternaria alternata* on PDA by poisoned food technique for estimated their effective dose to manage the Alternaria blight of tomato in the field. The data recorded from laboratory studies revealed that increase in concentration of the fungicides caused increased inhibition of mycelial growth of pathogen. Among the tested eight different new generation fungicides Tebuconazole 50%+Trifloxystrobin 25% {Nativo-75WG} was found most effective by showing minimum colony diameter 5.37, 0.00 and 0.00 mm and 94.04%, 100% and 100% per cent growth inhibition at 0.05, 0.10 and 0.15% concentrations respectively, followed by Pyraclostrobin 5% + Metiram 55% w/w WG {Cabrio-Top 60 WG} with 12.83, 4.60, 0.00 mm colony diameter and 85.74%, 94.89% and 100% per cent growth inhibition at 0.10, 0.15 and 0.20% concentrations. While, Propineb 70% WP recorded maximum colony diameter among fungicides tested 20.50, 13.30, 10.47 mm colony diameter with minimum 77.22%, 85.22% and 88.37% growth inhibition at 0.20, 0.25 and 0.30% concentrations respectively. Whereas, Fresh Cow Urine and Azadirachtin {ECONEEM} tested as organic formulation among both Azadirachtin {ECONEEM} recorded minimum colony diameter 31.50, 27.57 and 21.00 mm with maximum 65.00%, 69.37% and 76.67% per cent growth inhibition of the pathogen at 0.10, 0.15 and 0.20% concentrations. While, Fresh Cow Urine recorded 35.40, 30.37 and 25.13 mm colony diameter with 60.67%, 66.26% and 72.07% per cent growth inhibition of the pathogen at 5, 10 and 15% concentrations under *in-vitro* condition.

EXAMINING THE IMPACT OF PRECOOLING TREATMENTS ON PEAR FRUIT THROUGHOUT STORAGE

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Abstract

In this study, the impact of various precooling techniques-hydrocooling (HC), forced air cooling (FAC), and evaporative cooling (EC) - on the postharvest quality of pear fruits under cold storage conditions was investigated. Physiologically mature pears were harvested, sorted, graded, and packed in plastic crates before undergoing HC, FAC, and EC treatments to eliminate



field heat. Using a digital thermometer, the temperature of the fruit pulp was monitored until a steady temperature of 5.2°C was achieved. Subsequently, the treated fruits were packed into corrugated fiberboard boxes and stored in a cold room (0-1°C, 90-95% relative humidity) for 75-day period. After every 15-day intervals, the physico-chemical quality of pears was assessed. The findings revealed that FAC maintained superior quality, exhibiting lower physiological weight loss (3.51%), decay (3%), and higher values for firmness (13.67 lb force), organoleptic score (7.52 out of 9), TSS (12.52 °B), total sugars (8.05%), acidity (0.27%), and total phenols (39.28 mg GAE/100g) compared to the control. HC treatment was almost similar to FAC in preserving pear fruit quality, surpassing EC and the control. Notably, FAC and HC significantly prolonged the storage life of pear fruits for 60 days, in contrast to the control, which exhibited a limited storage life of only 45 days. These compelling results highlight the efficacy of FAC and HC in enhancing the storage life of pear fruits.

RESPONSE OF FOLIAR NUTRITION ON GROWTH AND YIELD OF SUMMER COWPEA IN NORTHERN DRY ZONE OF KARNATAKA

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Abstract

A field experiment was conducted to study the “Response of foliar nutrition on growth and yield of summer cowpea in Northern Dry Zone of Karnataka” in medium black soils at Krishi Vigyan Kendra (KVK) farm, Vijayapur, University of Agricultural Sciences (UAS), Dharwad during summer season of 2021. Total nine treatment combinations of organic and inorganic foliar sprays with Recommended Package of Practices (RPP) were laid out in RBD (Randomized Block Design) with three replications. Cowpea variety DC-15 was sown at a distance of 45cm x 10cm. Plant population was uniform during the course of investigation. The treatment combination RPP + 19:19:19 @ 1% + Vermiwash @ 10% at flower initiation and peak flowering stage recorded taller plants (69.86 cm), higher number of branches (33.88), total dry matter accumulation (34.23 g plant⁻¹) and leaf area index (1.746) as compare to other treatment combinations. The yield parameters like pod yield (2434 kg ha⁻¹), seed yield (1692 kg ha⁻¹) and haulm yield (3466 kg ha⁻¹) showed significantly higher effect due to the foliar application treatment of RPP + foliar spray of 19:19:19 @ 1% + Vermiwash @ 10% at flower initiation stage and peak flowering stage. The significantly lesser growth and yield parameters was recorded with absolute control.

CHARACTERIZATION OF SWEET SORGHUM GENOTYPES GENERATED THROUGH WIDE HYBRIDIZATION

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Abstract

Sweet sorghum is a carbon-neutral feedstock that can be used for bioethanol production. Stalks of sweet sorghum have sweet juice like sugarcane that is used for bioethanol production. The efficiency of bioethanol depends on the brix, total sugars, and juice extractability of a genotype. Conventional breeding methods have produced many high-performing genotypes of sweet sorghum in India. The amount of sucrose and reducing sugars are critical parameters for use as bioethanol. Tall, stout, and lodging-resistant stalks are desirable. Keeping the juice quality for one week to ten days in sweet sorghum is a critical requirement since it takes 4-7 days for the farmer to transport the harvested cane to the sugar factory, where it is processed. We introduced novel variants for sweet sorghum through de novo variation after intergeneric hybridization of sorghum with maize. High-performing genotypes are crossed with the elite sweet sorghum line. Selected 18 lines were evaluated in the field for three-years for sweet sorghum traits. Molecular analysis is performed using the genic marker system, TRAP (Target Region Amplified Polymorphism), which has primers specific to sugar-related genes such as soluble acid invertase, sucrose synthase, and SPS along with biomass-related lignin biosynthesis genes. Out of the 24 marker combinations used, 17 showed polymorphism. A cluster diagram was prepared using the marker data analysis. We present the cumulative outcome of field



evaluation and molecular analysis of wide hybridization derivatives of sweet sorghum and their relation to sucrose metabolism.

HERBIVORE FAVORED BY FUNGI : “QUADRA-TROPHIC INTERACTION” A TOOL FOR PEST MANAGEMENT

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Abstract

Fungivory or mycophagy is the process of organisms consuming fungi. Many different organisms have been recorded to gain their energy from consuming fungi, including birds, mammals, gastropods, nematodes and insects. In insects, Coleoptera, Lepidoptera, Diptera and some of the Hemiptera. Some of the Lepidoptera (Gypsy moth) and Hemipteran (aphids and thrips) insects reported to feed on plant pathogenic fungi for their benefit. Indeed, leaf-chewing herbivores and necrotrophic fungi are known to trigger plant defences through the jasmonic acid pathway, whereas, sucking insects and biotrophic fungi mainly trigger defences through the salicylic acid pathway. Early instar larvae of Gypsy moth infest on rust (*Melampsora-larici populina*) infected black poplar trees primarily feed on the sporangia, because the fungal diet provided more nutrition to the insects than leaves due to elevated level of manitol which act as cue. This led to a faster development of rust-fed caterpillars. Consequently, larvae fed on rust-infected leaves required three days less to pupate than their conspecifics on uninfected trees. Accelerated development after feeding on pathogen-infected tissue was also observed in *Ostrinia nubilis* feeding on maize. cabbage butterfly *Pieris brassica* was attacked by an endoparasitoid *Cotesia glomerata*, Parasitism was more on *Pieris* infested plants alone, whereas no or less parasitism observed on dual (*Pieris* + Powdery mildew) plants because the *Pieris*-infested mildew plants produced 40% less plant volatiles than *Pieris*-infested healthy plants. Plants infested by mildew, produced significantly less Green leaf volatiles, glucosinolate derivatives and terpenoids. *Pieris* caterpillars feeding on mildew-infected plants may escape *C. glomerata* parasitism to a certain extend. The aphids showed slower growth and lower fecundity on *Botrytis* infected leaves but increased their performance on rust infected leaves. The sequential application of pathogens showed greater inhibition of aphids and concurrent infection may reduce the cross-talk between defense pathways and thus inhibit defenses effective against aphids.

MAIZE IMPROVEMENT FOR CLIMATE CHANGE

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Abstract

In India, maize is the third most important cereal crop after rice and wheat. Maize has enormous genetic diversity that offers incredible opportunities for genetic enhancement despite the challenges offered by abiotic stresses like heat stress. Heat stress is a major factor limiting crop yield in many agricultural regions. Maize grown in tropical area is highly vulnerable to increased temperature. To circumvent the adverse effect of high temperature, there is urgent need to breed climate resilient maize genotypes due to its plasticity to produce sound yield under both optimal and stress environment.

Malnutrition especially protein deficiency remains a major problem particularly in developing countries. According to FAO estimates in ‘The state of food security and Nutrition in the world, 2019’ report 194.4 million people (14.5% of the population) are undernourished in India. Maize has great potential toward feeds and industrial raw materials and also use as human food. Normal maize is a good source of dietary requirement and contains starch (28-80%), oil (4-8 %), proteins (8-11 %) and minerals (1.5%) but lacks two essential amino acids, lysine and tryptophan thus posing the problem of nutritional deficiencies in the consumers. A wide range of deficiency symptoms like cognitive disorder, kwashiorkor disease, pellagra, reduced appetite, impaired skeleton development, delayed growth and aberrant behavior are associated with lysine and tryptophan



deficiency. QPM provides a solution as it is nutritionally superior maize with high lysine and tryptophan contents and desired kernel characteristics as compared to the normal maize. During the early stage of kernel development, heat stress is particularly detrimental to subsequent dry matter accumulation since it causes disruption of cell division, sugar metabolism, starch biosynthesis in the endosperm and reduces yield. The effects of heat stress on protein accumulation, however is less well understood. Among the abiotic factors, heat stress has been reported to cause yield losses.

SOIL MICROCLIMATE AND CROP GROWTH PERFORMANCE UNDER *GMELINA ARBOREA*-BASED AGROFORESTRY SYSTEM ON HILL SLOPES IN NE INDIA

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Abstract

Gmelina arborea, also called white teak or gamhari, is an indigenous fast-growing deciduous tree that has gained popularity in India for its diverse uses, quality wood, and quick financial returns. The rapid growth, ease of establishment, and relative pest resistance make it a suitable choice for agroforestry. In the northeast, *Gmelina arborea*-based agroforestry system could provide a sustainable substitute for jhum cultivation. A *Gmelina arborea*-based agroforestry model has been developed and assessed under high slope conditions in light of its significance. It is observed that soil moisture and temperature were higher under *Gmelina arborea* compare to monocropping of turmeric, ginger and taro. Crop growth of turmeric, ginger and taro were also recorded higher under *Gmelina arborea*.

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. Wilczek)” 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

BIO EFFICACY OF METIRAM 70% WG AGAINST EARLY AND LATE BLIGHT DISEASE OF POTATO

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Abstract

Potatoes (*Solanum tuberosum* L.) are an important food crop that are cultivated in more than one hundred countries. Two



foliar diseases, early blight (*Alternaria solani*) and late blight (*Phytophthora infestans*) threaten the crop and if not managed properly, may induce substantial yield losses. Potato plants severely affected by early blight disease had lower yields and produced smaller tubers. The pathogen causing late blight disease is highly variable and adapt to the newly breed varieties and fungicides. The field experiment was conducted at Regional Wheat Rust Research Station, Mahabaleshwar (Maharashtra) during *Rabi* season of the year 2015-16. During present investigation, various fungicides were evaluated for the management of early and late blight diseases. Considering the disease control ability and tuber yield of potato, Metiram 70% WG @ 1750 g a. i./ha was found to be superior over all other treatments. Also, none of the treatments resulted any phytotoxic symptom on potato leaves at concentration used in the experiment.

DECIPHERING GENETIC DIVERSITY FOR MORPHO-PHYSIOLOGICAL TRAITS IN CHICKPEA (*CICER ARIETINUM* L.) UNDER TWO MOISTURE REGIMES

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Abstract

Genetic diversity plays a pivotal role in any crop improvement programme. Chickpea, one of the most important pulse crops grown around the globe, suffers due to various biotic and abiotic stresses during the crop growth period resulting into reduction in the productivity. Looking into importance of breeding for drought tolerance, genetic diversity for morpho-phenological, physiological and yield attributing traits was carried out at Regional Agricultural Research Station, Vijayapur during *Rabi* 2021-22 under both well-watered (WW) and low moisture stress (LMS) conditions at flowering stage following randomized complete block design. ANOVA for nineteen traits showed significant difference among the genotypes. Days to fifty per cent flowering exhibited the mean of 45.18 (WW) and 43.46 (LMS) while maturity days were 93.49 (WW) and 90.51 (LMS). Relative water content showed a mean of 74.23 in WW and 60.86 in LMS. The SPAD at 30 DAS was 39.45 under LMS while in WW it was 40.85. Photosynthetic rate ($\text{mol m}^{-2} \text{sec}^{-1}$) was 15.85 and 11.67 respectively under WW and LMS conditions. Accumulation of proline (imole g^{-1} fresh wt) in leaves was significantly higher in LMS (11.08) as compared to WW (1.99). Based on D^2 values, thirty four genotypes were grouped into eight (WW) and five (LMS) clusters. Cluster I was the largest in WW condition with 22 genotypes while, Cluster ? in LMS with 17 genotypes. Under WW condition, hundred seed weight followed by proline content contributed maximum towards diversity whereas, proline content was the largest contributor under LMS. Under low moisture stress condition inter cluster D^2 values ranged from 946.9 to 9178.67, while it was comparatively lower and varied from 253.46 to 716.15 under well-watered condition. ICC 4958, a drought tolerant check, was grouped with the promising genotypes, ICCX-060157-11, ICCX-060157-9 and M 71 under WW while under LMS with DIBG 205, SA-1 and JG 11. The promising advanced breeding lines will be evaluated and tested for yield stability under yield trials. The insights on genetic diversity will assist in choosing the appropriate parents for hybridization programme to isolate desired transgressive segregants for drought tolerance.

FORTIFICATION OF ORGANIC AMENDMENTS WITH NUTRIENTS IMPROVES SOIL FERTILITY, MICROBIAL DYNAMICS, AND MUSTARD YIELD POTENTIAL

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Abstract

Oilseed crops like mustard are primarily cultivated in semi-arid and arid regions of Rajasthan, Haryana, Gujarat, and a portion of Punjab, where high base soil reactivity causes soils to be deficient in nutrients. The application of micronutrient enriched FYM may improve availability and their uptake to mustard results in higher productivity and quality of crop in such soils. An experiment comprising 15 treatment combination replicated thrice, was laid out in split plot design with three treatments of



FYM level (Control, @5 t ha⁻¹ and @10 t ha⁻¹) and five treatment of sources of nutrient (control, 2.5 kg Zn + 1 kg B + 5 Kg Fe + 10 kg S ha⁻¹, 5 kg Zn + 2 kg B + 10kg Fe +20 S kg ha⁻¹, 2.5 kg Zn + 1 kg B + 5 Kg Fe +10 kg S Enriched FYM @ 500 kg ha⁻¹ and 5 kg Zn + 2 kg B + 10kg Fe+20 kg S Enriched FYM @ 500 kg ha⁻¹). Nutrient enrichment with micro and secondary nutrient at the rate of 5.0 kg Zn + 2 kg B + 10 Kg Fe +20g S Enriched FYM @ 500 kg ha⁻¹ (Zn₂B₂Fe₂S₂En) significantly increased the microbial biomass carbon (56.46 % SMB-C) and SOC (17.13%) over control. Similarly, nutrient fortification significantly enhanced the activity of dehydrogenase enzyme (56.27%), alkaline phosphatase (101.44%) and aryl sulphatase (73.7%) in soil over control. Availability of S, Zn Fe and boron has increased by 17.74, 127.68, 43.41 and 52.76 percent under the treatment in which these nutrients are applied at the rate of 5.0 kg Zn + 2 kg B + 10 Kg Fe +20g S Enriched FYM @ 500 kg ha⁻¹ (Zn₂B₂Fe₂S₂En) over control (Zn₂B₂Fe₂S₂) respectively. Use of nutrient enriched FYM increased nutrient mobilization index values and highest mobilization efficiency index value was recorded under the treatment of Nutrient enrichment with micro and secondary nutrient at the rate of 5.0 kg Zn + 2 kg B + 10 Kg Fe +20g S Enriched FYM @ 500 kg ha⁻¹ (Zn₂B₂Fe₂S₂En). Enhancement in seed and stover yield might be due direct increase in nutrient availability and indirectly overall improvement in soil biochemical properties resulted to more vegetative growth and dry matter accumulation in plants.

RECENT MUTATION BREEDING STRATEGIES FOR CHILLI CROP IMPROVEMENT

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Abstract

Chilli (*Capsicum annuum* L., 2n=2x=24) is an important horticultural crop with a high economic value due its regular uses for culinary as well as medicinal purposes. Among the various available plant breeding methods, mutation breeding has also been shown to have huge potential in generating genetically stable variations to improve crop yield and quality. Chemical mutagens may successfully alter a plant's genetic makeup, although the degree of success is highly dependent on the type and quantity of the chemical, and the kind of plant used in the experiment. Since a high mutagen concentration prevents seed germination due to loss of viability, breeders must identify the proper mutagen concentration without compromising seed viability. Recently, a mutation breeding programme in chilli was conducted for introducing genetic variation in which 1.5 % Ethyl methane sulfonate (EMS) and 0.5 % sodium azide (SA) were used to induce mutations in four promising chili genotypes and found that efficiency of EMS was greater than SA and more variants were noticed in EMS-treated populations. Due to the recessive nature of the majority of induced mutations, only dominant mutations may be identified and mutant phenotypes are unlikely to appear in the M₁ generation. Therefore, it is recommended to evaluate the mutants in further generations and also confirming the induced genetic variations using the molecular markers. In a recent study, M₄ generation of EMS chilli mutant population was evaluated for the confirmation of mutation and genetic stability by using Random Amplified Polymorphic DNA (RAPD) genetic markers in addition to phenotypic markers and observed that the mutant line was superior than initial line for capsaicinoid content and various morphological traits. Moreover, the differences in RAPD profiles between mutant and initial line confirmed the existence of stable genetic variation in the mutant line at the molecular level.

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 devastating soil borne disease. In this experiment total 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% +



pyraclostrobin 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%).

STUDIES ON INFLUENCE OF BIOCONTROL AGENTS ON YIELD, QUALITY AND PEST AND DISEASE INCIDENCE, ECONOMICS OF TURMERIC (*CURCUMA LONGA* L.) VARIETIES

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Abstract

Turmeric rhizome is susceptible to many diseases caused by fungal pathogens. Among the various diseases, rhizome rot and leaf blotch are major problems in all turmeric growing areas of India. Management of the disease using fungicides has led to the development of resistant strains of pathogens. Hence this study was carried out for the eco-friendly management of diseases of turmeric using antagonistic biocontrol agents. The present investigation on “Studies on influence of biocontrol agents on yield, quality and pest and disease incidence, economics of Turmeric (*Curcuma longa* L.) varieties” was conducted at College of Horticulture, Rajendranagar, SKLTSHU, Mulugu during 2021-22. The experiment was laid out in Factorial Randomized block design (FRBD) with 3 replications and 12 treatments conferred that among different best treatments of experiments, the treatment M₃-{FYM 45 t ha⁻¹ + AMC (Arka microbial consortium) 1 l q⁻¹ manure + vertical split of mother rhizome of Salem variety} recorded maximum fresh weight of rhizomes per clump (358.23 g), dry weight of rhizomes per clump (70.79 g), fresh rhizome yield per plant (483.33 g), fresh rhizome yield per plot (24.18 kg), highest curing percentage (19.76 %), and curcumin content (6.26 %) recorded at harvest. Lowest leaf blotch incidence (22.48 %) was reported in the treatment M₃ - {FYM 45 t ha⁻¹ + AMC (Arka microbial consortium) 1 l q⁻¹ manure + vertical split of mother rhizome of Salem variety}. Among different biocontrol agents, B₁- *Trichoderma viride* (5kg ha⁻¹) + *Bacillus thuringiensis* (750 g ha⁻¹) recorded maximum fresh weight of rhizomes per clump (349.23 g), dry weight of rhizomes per clump (68.13 g), fresh rhizome yield per plant (478.40 g), fresh rhizome yield per plot (23.89 kg), highest curing percentage (19.77 %), curcumin content (5.93 %) and lowest leaf blotch incidence (23.28 %) recorded after harvest. Among the interaction, the treatment M₃B₁ - {FYM 45 t ha⁻¹ + AMC (Arka microbial consortium) 1 l q⁻¹ manure + vertical split of mother rhizome of Salem variety} + *Trichoderma viride* (5 kg ha⁻¹) + *Bacillus thuringiensis* (750 g ha⁻¹) reported maximum fresh weight of rhizomes per clump (363.50 g), dry weight of rhizomes per clump (73.55 g), fresh rhizome yield per plant (499.50 g), fresh rhizome yield per plot (24.92 kg). The highest curing percentage (20.15 %) and highest curcumin content (6.44 %) and lowest leaf blotch incidence (18.33 %) were also recorded with M₃B₁. In terms of B:C ratio, the treatment M₃B₁-{FYM 45 t ha⁻¹ + AMC (Arka microbial consortium) 1 l q⁻¹ manure + vertical split of mother rhizome of Salem variety} + *Trichoderma viride* (5 kg ha⁻¹) + *Bacillus thuringiensis* (750 g ha⁻¹) has recorded maximum benefit cost ratio (1.69). Application of best treatments of experiments and biocontrol agents increased yield and it lead to higher returns by reducing incidence of pest and diseases.

IMPORTANCE OF MILLETS IN MITIGATING FOOD SECURITY

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Abstract

There are several different types of millets, each with its own unique flavor and nutritional profile. Some of the most commonly consumed millets include: 1. Pearl Millet: Also known as bajra, this is the most widely cultivated millet in the world and is a staple food in many African and Indian communities. 2. Foxtail Millet: Also known as Italian millet, this is one of the smallest types of millet and has a mild, nutty flavor. It is often used as a grain in soups, stews, and porridges. 3. Proso Millet: Also known as common millet, this is one of the fastest-growing millets and is often used as birdseed or as a food grain in Asia. 4. Finger Millet: Also known as ragi, this is a staple food in many African and Indian communities and is highly



valued for its high calcium content. 5. Sorghum: This is one of the most widely grown millets in the world and is used as a staplefood in many African and South American communities. It is also used to make sorghum syrup and alcohol. 6. Barnyard millet: Also known as samak, is a type of millet that is grown and consumed in many parts of Asia, including India, China, and Southeast Asia. This small-seeded grain is highly valued for its fast-growing nature and drought tolerance, making it a good option for farmers in regions with limited water such as phosphorus, iron, and magnesium. In addition, kodo millet is glutenfree and can be a good alternative for people with celiac disease or gluten intolerance. 8. Little Millets: Little millets, also known as kutki in hindi are nutritious, gluten-free, non-sticky and non-acid-forming grains. Owing to the importance of Millets in human diet and to raise awareness about the important role that millets play in food security and nutrition, and to promote their cultivation and consumption globally, the year 2023 was declared as The International Year of Millets by the United Nations General Assembly. Millets have the potential to provide essential nutrients, such as protein, fiber, vitamins, and minerals, to millions of people in need. In addition to their nutritional benefits, millets are also highly resilient crops, making them suitable for cultivation in challenging environments, such as dry and arid regions, where other crops may struggle to grow. The objective of this year is to promote the use of millets as a nutritious food source, particularly in regions where people face food insecurity and malnutrition.

IMPACT OF SUBSOILING ON *IN-SITU* MOISTURE CONSERVATION IN *VERTISOLS*

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Abstract

The infiltration rate of vertical soils is too low, it needs more opportunity time for the infiltration. Thus, in situ moisture conservation measures would help to infiltration and to conserve the moisture. In addition to this, the major parts of Northern dryzone is having the *rabi* based cropping system, where enough time is available for implementing the *in-situ* moisture conservation measures effectively. Excess using of the heavy machineries like tractors and combine harvesters over the years leads to the formation of hard pan and it impairs infiltration of water. The sub soiler (the chisel plough), which cuts (punchures) upto 50 to 60 cm deep in to soil. Thus, it facilitates for the infiltration of water. Hence the experiment was conducted in chickpea crop with five treatments T₁, subsoiling @ 2m, T₂, subsoiling @ 4m, T₃, subsoiling @ 2m + FYM @ 5t/ha, T₄: subsoiling @ 4m + FYM @ 5t/ha and T₅, control. Three years of pooled revealed that the highest yield (821 kg/ha) was recorded in the sub soiler with spacing of 2m with the vermi compost and followed by the sub soiling at 2 m spacing (771 kg/ha), while in the control (655 kg/ha). Sub soiling @ 2 m + vermicompost @ 2.5 t/ha, the yield was about 25.3 percent, while in the Sub soiling @ 2 m was about 17.7 percent higher than the control. Significantly, higher yield was recorded in all the treatments over control. Further, the net returns as well as B:C ratio are higher in all the treatments over control.

IN VITRO EVALUATION OF COMPLETE DIETS BASED ON SPINELESS CACTUS (*OPUNTIA FICUS INDICA*) AND MORINGA (*MORINGA OLEIFERA*) FOR RUMINANT FEEDING

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Abstract

Spineless cactus and Moringa were analyzed for proximate principles by chemical analysis. The ME content was determined by in vitro incubation and gas production technique (RIVIGP) according to Menke *et al* (1979). On dry matter basis with 8.41 per cent DM, the total ash, crude protein, ether extract, neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) content of spineless Cactus were 11.6, 5.14, 1.79, 28.3, 17.1 and 3.06 per cent respectively and the ME content being 8.11 MJ/kg DM. The DM content in Moringa was 22.1 per cent with the crude protein and ME content of 23.3 per cent and 10.2 respectively. Based on the chemical composition and predicted ME content, five complete diets were formulated using varying proportions of Spineless Cactus and Moringa. The proportions of Spineless Cactus and Moringa were 65:35; 60:40; 55:45; 50:50 and 45:55 in diets D1, D2, D3, D4 and D5 respectively. The ME content (MJ/kg) and crude



protein (per cent) in the diets ranged from 9.12 to 9.48 and 11.5 to 15.1. Diet D3 with a combination of fifty five per cent of Spineless Cactus and forty five per cent of Moringa containing 9.32 MJ and 13.3 per cent protein per kg diet was considered to provide a balanced supply of ME and crude protein to meet the requirement for ruminants.

MOLECULAR DOCKING APPROACH FOR EVALUATING THE ANTICANCER EFFICACY OF PHYTOCONSTITUENTS FROM *ANNONA SQUAMOSA* LINN. AGAINST BREAST CANCER

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Abstract

Medicinal plants serve as valuable repositories of diverse photochemicals, offering remedies for a wide array of human ailments, including breast cancer. Their significant role extends to both modern and traditional medicine, exerting substantial physiological effects on the human body. The therapeutic potential of herbal treatments enriched with an array of bioactive photochemicals proves advantageous and reduced adverse effects compared to modern pharmaceuticals. Molecular docking has emerged as a crucial tool in drug discovery due to its cost-effectiveness and increasing popularity among researchers. The present investigation focuses on exploring the potential of Annonaceous acetogenins from *Annona squamosa* Linn. as anti-cancer agents, particularly targeting the estrogen receptor (ER α) protein (PDBID – 3ERT). The study employs ligands such as Annomuricin, Annosquacin I, Bullatacin, and Bullatalicin to interact with the ER α protein. Encouraging results are observed in terms of binding energy and inhibition constants, indicating their potential to impede the proliferation of breast cancer by targeting the ERA protein.

STATUS OF PROBLEM BEHAVIOR AMONG PRESCHOOLERS OF DHARWAD DISTRICT, KARNATAKA

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Abstract

The prevalence of problem behavior was studied on 334 preschool children (3-6 years) of both rural and urban areas of Dharwad district. A multi stage random sampling method was employed where three talukas out of five were randomly selected from Dharwad district and from these selected talukas, two villages each were selected. A total of ten anganwadi's from five villages with 213 children and from six urban anganwadi's from three cities of the selected talukas with 121 children formed the sample. The ASEBA Child Behavior Checklist was administered to the class teachers. The prevalence of problem behavior revealed that, 47.0 percent of preschoolers were in the borderline and 13.8 percent were in the clinical range while only 39.2 percent were in the normal category. On internalizing behavioral problems, 49.7 percent of children were in clinical range and 30.2 percent in borderline wherein 6.6 percent were emotionally reactive, 15.6 percent anxious/depressed, 26.6 percent with somatic complaints, 2.4 percent withdrawn symptoms. On externalizing behavioral problems, 26.0 percent were in clinical range wherein 9.1 percent had attention problems and 7.8 percent aggressive behavior. There is need to address the problem behavior among preschool children during their early years through parent counseling intervention programmes.

CLIMATE CHANGE CHALLENGES IN CULTIVATION OF PIGEONPEA

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Abstract

Pigeonpea is an important pulse crop commercially cultivated across the country. The south and central India predominates in



its cultivation. It is a drought tolerant pulse crop and is a major source of vegetarian protein for more than 80 population across South East Asia including India. North Karnataka is known as pulse Pigeonpea has been intensively cultivated across North Karnataka is popularly known as pulse bowl of the country. Karnataka and Maharashtra together produce more than half the pigeonpea produced in India. However, the total production in the country is far behind the domestic demand. The country annually imports pigeonpea to bridge the gap between the demand supply. There are many challenges hindering the pigeonpea cultivation. Ever since the effects of global warming are felt across different sectors, agriculture has been equally experiencing its ill effects. Many crops are threatened by new and emerging biotic and abiotic stresses. The climate change has become a major challenge in pigeonpea cultivation and it has become precursor to many minor diseases become major obstacles in pigeonpea production. Though diseases are major obstacles followed by pests in limiting the production potential and productivity, efforts are regularly done to overcome these diseases by host resistance and other means of management. But magnification of minor diseases in to major epidemics has threatened pigeonpea production over the past four years. Fusarium wilt and sterility mosaic were commonly known in pigeonpea but are now overtaken by Phytophthora Stem Blight (PSB), Macrophomina Stem Blight and Dry Root Rot (MSB&DRR) influenced by climate change. Over the past three years regular surveillance was done on documentation of new emerging diseases in pigeonpea at AICRP, Kalaburagi during 2020, 2021 and 2022 threatening pigeonpea production. The rainfall intensity of 680 increased by more than 160 to 230 % during these years and especially during early growing season. This succumbed pigeonpea to severe infection by Phytophthora stem blight. Further frequent dry spells add to the infection of dry root rot pathogen. Both these diseases together threatened the pigeonpea cultivation vary seriously. Often in many plots, combined infection of PSB and MSB&DRR was frequently seen in early maturing cultivars. The crop loss due to these emerging minor diseases ranged between 20 to 75 per cent in three years across North Karnataka covering 5 districts growing Pigeonpea. Early maturing cultivars affected more followed by medium and late types. In 2022 all the cultivars both under rainfed and irrigated situations succumbed to heavy incidence of PSB, MSB & DRR coupled with sporadic incidence of wilt. The climate change ill effects are visible and witnessed very much in pigeonpea and there is need to develop a strategy for management of these emerging diseases and develop resistant cultivars for commercial cultivation.

MORPHOLOGICAL AND MOLECULAR CHARACTERIZATION OF NATIVE ISOLATES OF *METARHIZIUM RILEYI* (FARL.) SAMSON FROM NORTH-EASTERN KARNATAKA

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Abstract

Morphological and molecular studies were done to confirm the native isolates of entomopathogenic fungi (EPF) *Metarhizium rileyi* (Farl.) Samson collected on lepidopteran cadavers from natural incidence of *M. rileyi* in the cropping ecosystem, across the North- Eastern Karnataka region. Among the different isolates of EPF, on *Spodoptera frugiperda* and *S. litura* was found more consistent on subculturing than the EPF collected on cabbage diamond back moth, cotton bollworm complex and groundnut leaf miner. The fungal colony colour was white during initial stage and then during sporulating stage the colour changed into malachite green colour. The conidiophores were in compact patches. Conidia were aseptate and elongate by forming chains. Conidia were hyaline and round or ovoid in shape. Conidiophores were short, which bears round to ovoid aseptate conidia in different isolates. The conidia size on its ratio found that, the highest size ratio was recorded in UASRBCMr-10 and UASRBCMr-20 2.34 and 2.19, respectively which was on par with UASRBC Mr-15 then remaining isolates which has shown less than 2.0. The radial growth found only in Mr-7, Mr-20 and Mr-22nd isolates, colony diameter ranged from 0.3 to 2.23 cm, concentric rings of colonies found in all the isolates except Mr-4, Mr-19 and Mr-20th isolates and PCR based DNA sequencing analysis using ITS1 and ITS4 primers was performed. NCBI Genebank with accession numbers viz., OK178862, OK184900, OK184898, OK184899, OK184897 and OK177835 respectively. The phylogenetic relationship was derived from comparisons of the ITS gene sequences and a Dendrogram was constructed. The homology and variations



based on amino acid sequences among the isolates showed 71 per cent (OK184897) and 51 per cent similarity with four isolates (OK184899, OK177835, OK178862 and OK184898).

EFFECT OF *RHIZOBIUM* ALONG WITH PULSE MAGIC ON GENERAL AND BENEFICIAL MICROFLORA IN COWPEA (*VIGNA UNGUICULATA* L.) ECOSYSTEM

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Abstract

Pulse crops are not only used as human diet but also for edifying soil fertility through biological nitrogen fixation and Rhizobia is well known in bolstering the yield of pulses. The study entitled as the “Effect of *Rhizobium* along with pulse magic on general and beneficial microflora in cowpea (*Vigna unguiculata* L.) Ecosystem”. The experiment was laid out in RCBD with three replications and ten treatments. The results indicated that increasing rate of application of *Rhizobium* along with pulse magic increased the population of general and beneficial soil microflora such as bacteria, fungi, actinomycetes, *Azotobacter* and PSB. The treatments that was implicated with *Rhizobium*+ Pulse magic @ 10 g/lit twice at 25 and 35 days after sowing had significantly more influence on the population of bacteria, fungal and actinomycetes than other treatments (Bacteria 74.17×10^6 cfu/g, Fungi 26.08×10^3 cfu/g, Actinomycetes 33.80×10^4 cfu/g, *Azotobacter* 18.07×10^4 cfu/g, PSB 32.13×10^4 cfu/g and *Rhizobium* 36.00×10^4 cfu/g). The lowest microbial population was recorded in control. This is due to presence of mixture of nitrogen 10 (%), phosphorus 40 (%), micro nutrients 03 (%) and PGR 20 ppm in pulse magic. Besides this, the application of *Rhizobium* would have resulted in increased secondary micronutrients in the soil, which might have helped to increase the microbial population. Application of pulse magic and biofertilizer increased the organic carbon content in the soil which served as the energy source for these beneficial microorganisms and hence higher population load was found. In conclusion, the plots treated with *Rhizobium* + Pulse magic @ 10g/lit twice improved the soil biological properties. Hence, it is better to go for Pulse magic foliar spray along with *Rhizobium* application.

EXPLORING DROUGHT RESILIENCE IN RABI SORGHUM (*SORGHUM BICOLOR* L. MOENCH) VARIETIES: UNRAVELING ADAPTIVE TRAITS FOR SUSTAINABLE CULTIVATION

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Abstract

This study aimed to assess drought tolerance among rabi sorghum genotypes through a series of experiments conducted on samples obtained from AICRP Sorghum at the College of Agriculture, Dharwad. Initial evaluations under polyethylene glycol (PEG)-induced osmotic stress highlighted a decrease in germination percentage from 77% to 59% with increasing PEG levels (0% to 1%). Notably, SPV-486 exhibited superior vigour index II values at 0.5% and 1% PEG, while SVD-1358 excelled at 0% PEG. Twenty sorghum genotypes were chosen based on their germination performance for subsequent field evaluations over two rabi seasons (2021-22 and 2022-23) under rainfed and irrigated conditions at the Main Agricultural Research Station (MARS), University of Agricultural Sciences, Dharwad. Various morpho-physiological, biochemical, and yield-related parameters were measured, revealing significant negative impacts of moisture stress across all parameters. BJV-44 and M-35-1 exhibited the least decline in grain yield per plant under rainfed conditions, showcasing higher drought tolerance compared to irrigated conditions. Conversely, M 148-138 and Tandur L showed substantial declines in yield under rainfed conditions. Overall field performance analysis identified BJV44, M-35-1, Phule annuradha, and Basavan motti as drought-tolerant genotypes, demonstrating minimal reductions in physiological and yield traits under stress, while M148-138, Tandur L, and Chitapur L showed higher reductions. Genetic diversity assessment using SSR markers revealed nine polymorphic primers, with SSR primer Xtxp145 displaying significant variation (PIC of 0.998) and Xtxp335 exhibiting low variation (PIC of 0.023). Cluster analysis categorized the genotypes into seven clusters, depicting genetic links and diversity among them based on similarity indices. This comprehensive evaluation provides crucial insights into identifying drought-tolerant sorghum genotypes, essential for developing resilient varieties in the face of challenging climatic conditions.



PRATAP MUNGPALI-5 (DGUG 244) A NEW HIGH YIELDING GENOTYPE OF GROUNDNUT

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Abstract

UG 244 a new generation high yielding and foliar disease resistant genotype derived from the cross SG 99 x TAG 24 is a spanish bunch type and medium maturing genotype of groundnut recommended for entire spanish bunch groundnut growing belt of Rajasthan, where groundnut is grown under both irrigated as well as rainfed condition. Yield trials conducted in different agro-climatic zones of Rajasthan over 8 locations UG 244 showed 22 to 39% superiority for dry pod yield over checks viz., TG 37 A, SG 99, JL 501, GG 7, GJG 9 and local check Pratap Raj Mungphali. It has average dry pod yield and kernel yield of 30 q/ha and 22 q/ha, respectively. It has 50 % oil content, medium 100-kernal weight (42 g), 87% sound mature kernels, days to maturity (106 days), 73% shelling out turn and Protein content 27%. It possesses resistance to early leaf spot (ELS) while moderately resistance to collar rot, stem rot and late leaf spot (LLS). The variety shows moderately resistance to *Spodoptera litura*, leaf miner, defoliators, *jassids*, thrips and leafhopper. Overall, this genotype will be a boon for the farmers of entire spanish bunch groundnut growing belt of Rajasthan in enhancing yield. We acknowledge ICAR-DGR, Junagadh for sharing this genotype.

LAND USE AND LAND COVER CLASSIFICATION USING ARTIFICIAL NEURAL NETWORK FOR IMPROVING ACCURACY

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Abstract

Land use and land cover classified images are required to use the available land for more crop production. The main objective of present research work was to determine if the classification of features would be done using ANN (Artificial Neural Network) provides better classification accuracy of various categories on the satellite image of the year of 2000 and 2011 of East Champaran district of Bihar. Seven land use and land covers e.g. crop land, fallow land, dense built-up, river wetland, lakes/ ponds wetland, barren land and low built-up area are taken in to consideration. Basic idea is to perform the classification procedure first in the supervised maximum likelihood classification method and then in artificial neural network. For comparative purposes, standard ML and ANN classifications were done and tested on the basis of calculating producer's accuracy, user's accuracy, overall accuracy and the value of kappa coefficients using confusion matrix. After that comparative analysis among producer's accuracy, user's accuracy, overall accuracy and value of kappa coefficients of the various categories/ classes determined from the classification of the image 2000 and 2011 for both methodologies are done. The result shows that crop land, fallow land and dense built-up area exhibit higher producer and user accuracy than river wetland, lakes/ ponds wetland, barren land and low built-up area. It is observed that ANN approach exhibits better accuracies than the conventional standard ML classification approach for different land use and land covers. So the final recommendation in this study is that ANN is the better image classification technique than the standard ML technique.

UNLOCKING THE POTENTIAL OF BROWN MIDRIB SORGHUM: A CRITICAL ANALYSIS

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Abstract

The need for sustainable and resilient crop solutions has never been more critical in today's global agricultural scenario. This comprehensive review examines the current significance of Brown Midrib Sorghum as an emerging cultivar with distinct genetic attributes and versatile applications. The abundance of genetic diversity for biomass production, as well as stem sugar



and lignin composition in sorghum, can improve both the quantity and the quality of lignocellulosic biomass. Based on an examination of lignin biosynthesis pathways, there is an obvious possibility for major alterations of monolignol synthesis at key enzymatic steps, any of which could result in reduced lignin concentration and/or altered lignin composition in sorghum, which is associated with the brown midrib phenotype. This study offers insight on the underlying processes that separate brown midrib sorghum (BMR) from normal sorghum cultivars by examining current advances in genetics, metabolic pathways, and agronomic studies. Furthermore, the analysis examines the agricultural and economic consequences of brown midrib sorghum, taking into account its increased biomass production efficiency, nutritional advantages for animal feed, and possible contributions to sustainable farming practises. The environmental footprint and soil health consequences of BMR cultivation are also investigated, offering insights into its possible role in reducing the effects of climate change. Despite its potential, the study exposes existing research problems and limitations, opening the way for further studies and breakthroughs. The summary of information presented in this analysis seeks to contribute to a thorough knowledge of the unexplored potential of Brown Midrib Sorghum and to stimulate additional research and development in the field of sustainable agriculture.

MOLECULAR CHARACTERIZATION AND IDENTIFICATION OF INSECT POLLINATORS OF *VALERIANA JATAMANSI* JONES FROM SHIMLA HILLS, WESTERN HIMALAYA

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Abstract

Valeriana jatamansi Jones a perennial medicinal herb belongs to the family Caprifoliaceae and highly pollinated by wild insect pollinators. It is on the verge of extinction due to over exploitation. In present investigation various pollinating insects of *Valeriana jatamansi* were examined by using molecular method and a total of 51 species of flower visitors were collected and reported on *Valeriana jatamansi* in Tara Devi (1,927 m), Dhalli (2,155 m), Chaura Maidan (2,100 m), Fagu (2,576 m), Matiyana (2,419 m), Kufri (2,609 m), Kharapather (2,703 m) and Kupper (2,850 m), localities Shimla Hills, Western Himalaya. Out of these 29 species of insect pollinators were molecularly characterized and identified on the basis of COI sequence by using mtDNA marker. During BLAST analysis 98 to 100% similarity were observed with the existing Genbank sequences. Nucleotide composition showed that average AT content was significantly higher by 69.8% than the GC content of 30.0%, which proved that all the sequences were AT biased. Phylogenetic analysis of 29 different species of insect pollinators of *Valeriana jatamansi* revealed two clades, one shows phylogenetic relationship between 28 species which belongs to four orders Diptera, Hymenoptera, Hemiptera and Lepidoptera and the other shows the one species which are belongs to order Coleoptera.

ELECTROSTATIC FIELD SEED TREATMENT : A NOVEL APPROACH TO ENHANCE SEED QUALITY OF MEDIUM VIGOUR CHILLI SEEDS

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Abstract

Chilli (*Capsicum annum*) being an important spice as well as vegetable crop in Indian culinary has enormous health benefits which are hidden to the world in the form of seeds. Drastic loss in seed quality is observed due to harsh post-harvest handling and storage. To overcome these losses seed enhancement techniques are being followed. Among them, physical seed treatment is given utmost importance, as it is cost effective, easy to handle and harmless to the ecosystem. Present paper deals with an experiment conducted at the Department of Seed Science and Technology, College of Agriculture, UAS, Dharwad, Karnataka during 2023. Chilli (Rudra) seeds which were satisfying minimum germination standards (60%) with medium to low vigour



status were subjected to pre-sowing electrostatic field treatment at five different power capacity and at two different exposure periods along untreated as control. The experiment results revealed a gradual increase in Seed Germination as power capacity increased reaching a highest value of 84% at power capacity of 5kV exposed to 90 seconds, where initial recorded seed germination value was just 63%. Seedling vigour indices, Mean seedling length, Seedling dry weight were all highest at 5kV for 90 seconds. All the parameters taken into consideration showed exponential increase with increase in power capacity when compared to untreated seeds. Diseased seed (%) and Abnormal seeds decreased with increasing power. Ultimately, it was observed that lower power 5kV seeds along with lesser period of 60 and 90 seconds have proved to be the best treatment range by improving seed germination by 30% making the seeds more cost effective and reliable.

METHODS TO INCREASE AGRICULTURAL PRODUCTIVITY THROUGH ORGANIC FARMING

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Abstract

The productivity of all farming methods is largely dependent on the fertility of the soil. The most widely used definition of soil fertility is the soil's capacity to provide crops with nutrients. To recycle nutrients, manures and agricultural leftovers are handled carefully. The utilisation of legumes to augment the nitrogen in the system and restricted additions of extra nutrients in acceptable forms are the two main ways that crops receive their nutrients. Good soil structure and biological activity are essential for the availability of nutrients, the health, and production of both crops and livestock. These can be achieved through managing the organic matter in the soil. The various parts of an organic farm have intricate relationships with one another, and the smooth operation of the entire system determines the amount and calibre of the finished goods. Because of this, it is particularly challenging to separate soil fertility from the system's production and environmental components. In organic systems, crop rotation serves as the primary instrument for coordinating many facets of crop production with the preservation and enhancement of soil fertility. Well-designed, varied rotations facilitate cultural weed management techniques while lowering the prevalence of pests and illnesses. Fertility management in organic farming depends on a long-term integrated approach rather than the more focused, short-term solutions typical in conventional agriculture because of the intricate interconnections between many system components.

ASSESSMENT AND DISTRIBUTION PATTERNS OF MACRO-MOTHS IN THE MIXED CONIFER FOREST OF SHIMLA

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Abstract

This study aimed to comprehensively assess the macro-moth diversity in the mixed conifer forest of Shimla, Himachal Pradesh, predominantly characterized by chir pine, deodar, kail, silver fir and spruce forests. The objectives encompassed creating a checklist, conducting surveys and collecting various macro-moth species within the forest. A meticulous examination of 112 specimens resulted in the identification of 50 macro-moth species. The analysis of family distribution unveiled the prominence of Erebidae, constituting 48% of the identified species, followed by Sphingidae (16%), Geometridae (12%), Eupterotidae (8%), Noctuidae (8%), Lasiocampidae (4%), and Saturniidae (4%). Dominance analysis highlighted Erebidae as the most dominant family, while Lasiocampidae and Saturniidae exhibited the least dominance. Notably, Sphingidae and Geometridae populations were moderate, potentially influenced by factors such as limited availability of specific host plants and preferred habitats. Highest species richness was observed in the families Noctuidae and Eupterotidae, while Erebidae demonstrated the lowest species richness. This research provides valuable insights into macro-moth diversity



in the studied mixed conifer forest of Shimla. Understanding the distribution and abundance of these species contributes to ecological knowledge and conservation efforts. Further investigations into host plant availability and habitat preferences are recommended to enhance comprehension of the factors influencing macro-moth diversity in this region. This comprehensive study lays the foundation for future research, fostering a holistic understanding of the intricate ecological dynamics within Shimla's mixed conifer forest, thereby facilitating informed conservation strategies.

TRANSGRESSIVE SEGREGATION FOR COMBINING ABILITY IN COTTON (*GOSSYPIMUM HIRSUTUM* L.)

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Abstract

Cotton is a crop of global importance as it is a source of natural fiber, which supports the economic and social status of the people. Since cotton is often cross-pollinated crop, it can be easily improved genetically by the following outcross with emasculation and pollination. In cotton, heterosis is commercially exploited in the form of the development of hybrids, which cover the maximum area globally. Heterosis mainly depends upon the genetic diversity and the extent of dominance existing at different yield-influencing loci. This explains heterosis can be enhanced either by increasing genetic distance or dominance. The genetic distance can be increased firstly by identifying heterotic groups which consist of genetically diverse genotypes, and secondly by following different population improvement schemes. There are very few attempts made in different crops to form heterotic groups and further exploit them for heterosis and combining ability as a trait by following population improvement schemes. The present study is aimed at exploring the possibility of exploiting Stay Green and RGR heterotic groups for hybrid development by evaluating derived F₁s for recombinational variability of combining ability through a method of reciprocal selection. In this study, the improvement in the combining ability of lines of segregating generation over the parental lines is measured by comparing the derived F₁s (Double cross F₄ lines with reciprocal testers) with the benchmark crosses. Here the performance of lines in hybrid combinations with different testers is considered as the measure of combining ability. Transgressive segregation was observed when segregants fall beyond the range of both parents for any character. Similarly, A line is supposed to denote as transgressive segregation for combining ability if its hybrids are found to be better than superior benchmark cross (SBMC). Similarly, A tester is supposed to denote as transgressive segregation for combining ability if its hybrids are found to be better than superior benchmark cross (SBMC). So, for every F₁ the performance was expressed as superiority over superior benchmark cross. Many of the derived F₁s out yielded the superior benchmark crosses. The formula used for calculating positive or negative transgressive segregants for seed cotton yield (SCY) is given below :

$$\text{Transgressive segregation} = \frac{\text{SCY of derived hybrid} - \text{SCY of SBMC}}{\text{SCY of SBMC}} \times 100$$

SUPERABSORBENT HYDROGELS SYNTHESIS OF AGRICULTURAL WASTE AND ITS PERFORMANCE

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Abstract

Agriculture industry generate large amount agriculture waste which contaminant land, water, and air. This problem can be solved by recycling or utilization of agro-industrial waste for developing value added products. Agricultural wastes are rich in cellulose. Nanocellulose can be extracted through chemical and/or mechanical processes to produce superabsorbent hydrogels. As soil amendments, superabsorbent hydrogels act as water and nutrient reservoirs when applied in agricultural fields. In this work, author reviews the recent advances in agricultural waste-derived nanocellulose-based superabsorbent hydrogels and discusses the possible impacts of their applications in agriculture. It is found that chemical methods are generally more cost-effective but may pose a threat to ecosystems, whereas physical methods are environmentally friendly but more complicated and expensive. The economic viability of using these novel superabsorbent hydrogels as soil amendments is



also discussed, considering their potentials to reduce irrigation, enhance nutrient retention, and improve crop production. The results in this article indicate that the development of agricultural waste-derived superabsorbent hydrogels promotes environmental sustainability and circular economy in agriculture. It can absorb and retain a huge amount of moisture under plentiful rainfall and irrigation events and release it back to the soil for mitigating crop water demand. It plays multifarious roles in agriculture including soil-water retainer, nutrient and pesticide carriers, seed coating, soil erosion reducer, and food additives. These biodegradable materials are nontoxic to the soil, crop, and environment. Hence, the addition of the hydrogel polymer will be a promising and feasible technological tool for augmenting crop productivity under moisture stressed conditions. The life cycles of new hydrogel products need to be explored in detail before optimal cellulose sources, reagents, and methods can be proposed for improvements.

EFFECT OF IAA AND GA₃ ON GROWTH, YIELD AND ECONOMICS OF LINSEED CULTIVATION UNDER RAINFED CONDITIONS

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Abstract

63% of linseed crop in India is grown under rainfed conditions where the crop is subjected to a number of biotic and abiotic stresses resulting in low productivity of the crop which stands at 604 kg ha⁻¹ against a global average of 806 kg ha⁻¹. The use of plant growth regulators (PGRs) has been reported to regulate various physiological processes for enhancing the productivity of several oilseed crops under stress conditions. A field experiment was conducted at SAS, NU, Nagaland during rabi season of 2021 to study the response of linseed to application of PGRs under rainfed conditions. The experiment was laid out in RBD design with 6 treatments viz., Control, IAA @ 1ppm, IAA @ 2ppm, GA₃ @ 200 ppm, GA₃ @ 400 ppm and IAA @ 1 ppm + GA₃ @ 200 ppm. Two foliar sprays were applied for each treatments viz., at vegetative and reproductive stages. Application of IAA @ 1.0 ppm and 2.0 ppm and GA₃ @ 200 ppm were found to be at par and recorded significantly higher plant dry weight and number of branches as compared to control whereas, all PGR treatments recorded significantly taller plants compared to control. Number of capsules was found to be significantly higher with application of GA₃ @ 200 ppm and IAA @ 2.0 ppm which were at par. IAA @ 2.0 ppm (817 kg ha⁻¹) and GA₃ @ 200 ppm (792 kg ha⁻¹) recorded significantly higher seed yields compared to the rest of the treatments except for IAA @ 1.0 ppm and GA₃ @ 400 ppm (730.05 and 706.36 kg ha⁻¹ respectively). The highest net returns of Rs. 19881 ha⁻¹ and BCR of 2.18 was recorded with application of IAA @ 2.0 ppm followed by IAA @ 1.0 ppm whereas, treatments involving GA₃ failed to record higher BCR due to high cost of cultivation.

EFFICACY OF NEWER INSECTICIDES AGAINST SPOTTED POD BORER, *MARUCA VITRATA* FABRICIUS (CRAMBIDAE : LEPIDOPTERA) ON YARDLONG BEAN

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Abstract

Yardlong bean, *Vigna unguiculata* subsp. *sesquipedalis* is highly nutritious vegetable grown all over the country belonging to the family Fabaceae. The insect-pest damage is one of the major constraints in increasing the production and productivity of this vegetable. Particularly, the pod borer complex viz., spotted pod borer, *Maruca vitrata*, gram pod borer, *Helicoverpa armigera* and blue butterfly, *Lampides boeticus* cause severe losses. Among them, *M. vitrata* is the most serious pest, as larvae webs and feeds on floral buds, flowers and pods, attributing for greater economic loss. Various insecticides are being used widely to manage of this pest, but they failed to achieve satisfactory level of control. Hence, the present investigation was carried out to evaluate the efficacy of new insecticides against *M. vitrata* on Yardlong bean under field condition during 2020-21 at AHRs, Bavikere, KSNUAHS, Shivamogga. The experiment was carried out with two sprayings at 45 days and 70 days after sowing with following insecticide treatments viz., Lambda cyhalothrin 5 EC, Flubendiamide 48 SC,



Chlorantraniliprole 18.5 SC, Indoxacarb 15.8 EC, Spinetoram 11.7 SC, Quinalphos 25 EC, Azadirachtin 5 EC along with untreated control. Later, the observations on number of larvae and damaged pods per plant were recorded on five randomly selected plants on a day before spraying and 3, 7, 10 and 14 days after spraying. Further, per cent damage and per cent reduction of infestation over control was calculated. Results showed that spinetoram was the most promising treatment in minimizing the larval population with per cent reduction of 86.75 followed by chlorantraniliprole which recorded 85.94 per cent reduction over control. These findings suggest that spinetoram can effectively manage the *M. vitrata* over other insecticides. Additionally, spinetoram being green chemistry molecule is relatively safer to non-target organisms and can be recommended to the farming community for pest management.

COMPREHENSIVE MOLECULAR AND FUNCTIONAL CHARACTERIZATION OF HAIR QUALITY ATTRIBUTE ASSOCIATED KERATIN-ASSOCIATED PROTEIN-7 (*KRTAP7*) GENE IN INDIAN DROMEDARY CAMEL

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Abstract

The hair quality is a trait of economic importance controlled by a few genes responsible for variation in diameter and medullation% of hair fibres. Hair fibres are produced in the trichocytes (the hair-producing cells) with the help of these keratins and the keratin-associated proteins such proteins also define the particular structural and chemical characteristics of the different types of hair, fur, wool and quills in various animals. The keratin-associated proteins (KRTAPs) play important role in describing the physical and mechanical properties of the fibre viz. fibre thickness and curliness to the hair fibres by acting as a matrix for cross linking the hair-keratins. There is a void of studies available for regulatory genes and proteins involved in the variation of hair quality attributes in Indian dromedary camel (*Camelus dromedarius*) breeds. In this first report, the molecular and functional characterization of the *KRTAP7* gene in three Indian camel breeds, Bikaneri, Jaisalmeri, and Mewari is described based on a comprehensive analysis of the nucleotide and amino acid sequences. The representative animals of fibre diameter and medullation % were amplified, sequenced, and analyzed using in silico platforms. The complete gene sequence (732bp) including coding sequence (CDS: 264 bp) of the *KRTAP7* gene was amplified. The *KRTAP7* gene sequences from all four breeds of camel were identical. However, a mean percent divergence of 0.00 and 4.6 was observed with the *KRTAP7* protein sequence of the dromedary camel and other Camelidae species, respectively. The complete coding sequence (CDS) of the *KRTAP7* gene translated to 87 amino acids (aa) long *KRTAP7* protein. The amino acid sequence-based analysis revealed high hydrophilicity, a high proportion of specific amino acids, absence of signal peptides and internal acetylation sites while the presence of 13 phosphorylation sites, S-S bonding patterns and glycosylation sites in the *KRTAP7* protein. The protein-protein association networks analysis of the *KRTAP7* protein by STRING server predicted direct and indirect interactions with other regulatory genes and proteins critical for hair attributes and keratin biosynthesis process. This study provides first-hand information about the *KRTAP7* gene and functional prediction of translated protein in Indian dromedary camel. Further, the epistatic interaction of the *KRTAP7* gene with other genes need to be explored for a better understanding of hair-fibre quality attributes in Indian dromedary camel.

IN SILICO ANALYSIS OF INTERACTION OF CHILLI CHLOROPLASTIC PHOTOSYSTEM II PROTEIN D1 WITH CUCUMBER MOSAIC VIRUS (CMV) COAT PROTEIN

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Abstract

Plant viruses are of significant threat to agricultural productivity worldwide, causing substantial economic losses and



impacting food security. Understanding the molecular interactions between plant viruses and their host plants is essential for developing effective strategies for virus control and crop protection. In this study, we employed homology modeling and an *in silico* approach to investigate interactions between chilli host protein, chloroplastic photosystem II protein D1 with the coat protein of cucumber mosaic virus (CMV). To identify putative host targets, we first retrieved and characterized CMV coat protein sequences from available genomic data bank. Subsequently, we utilized established protein-protein interaction prediction algorithms and resources to predict potential interactions between CMV proteins and host proteins. This *in silico* study provides a foundation for further experimental investigations, offering potential targets for the development of novel antiviral strategies and crop protection measures. From the obtained docking scores, it was presumed that CMV CP and Photosystem II protein D1 are interacting and established structural-functional relation provided a basis to propose probable host-virus interactions in terms of virus infection and symptom development.

PREVALENCE OF GROUP A ROTAVIRUS IN THE PORK SUPPLY CHAIN OF SOUTHERN KARNATAKA, INDIA

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Abstract

Group A Rotavirus, a prominent causative agent of childhood gastroenteritis in humans and various animal species worldwide, poses a significant threat to pig farms, leading to considerable morbidity, mortality, and economic losses. This research focused on assessing the prevalence of Group A Rotavirus within the pork supply chain through PCR analysis and characterizing genotypes using semi-nested RT-PCR targeting VP4 and VP7 genes. A comprehensive sampling strategy involved collecting 203 samples, including 47 faecal samples, 34 water samples, 8 feed samples, 4 scalding water samples, and 20 samples each of pig meat, liver, skin and 10 each of pig intestine, mesenteric lymph nodes, butcher's hand swab, knife swab, and cutting board swab. The study revealed a 0.98% prevalence of Group A Rotavirus in the overall pork supply chain, with pig processing plants exhibiting a 2.13% prevalence (2/94). Notably, the pig intestine samples and butcher's hands showed a prevalence of 10% (1/10) for Group A Rotavirus. The genotypic analysis identified G9 and P[8] as the prevalent G and P genotypes in the positive samples which is usually found in humans and uncommon in pigs, suggesting a potential transmission route involving pigs scavenging around human settlements. The findings underscore the risk of cross-contamination from pigs to butchers and then meat during processing, impacting the safety of the pork industry and necessitating preventive measures to mitigate this threat.

CORRELATION STUDIES OF LAI, PAR WITH YIELD OF MANGO VARIETIES UNDER ULTRA HIGH DENSITY PLANTING SYSTEM IN TELANGANA STATE.

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Abstract

The experiment was designed in simple RBD concept in Ultra High Density Planting System of Telangana orchard during 2020-2021 and 2021-22 (two seasons). The analysis of variance (ANOVA) of RBD on Seventeen mango varieties (*Viz.*,



Alphonso, Amrapali, Baneshan, Dasher, Dasher-35, Himayat, Kesar, Mahmoodavikarabad, Sindhu, Suvarnakha, Totapuri, Ratna, Swarna sindhura, Amini, Hydershab, Jalal and Royal special) for LAI (Leaf Area Index), PAR (Interception of Photosynthetically active radiation) and yield characteristics revealed significant differences. It was concluded from the pooled data that, yield has significantly strong positive correlation with leaf area (0.983**), LAI (0.993**) and PAR (0.990**).

EXTENSION TECHNIQUES FOR CROP DIVERSIFICATION IN BUNDELKHAND REGION OF CENTRAL INDIA—A CASE STUDY

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Abstract

Traditionally, in the process of evolution of agricultural systems, water harvesting through pond technology emerged with a need base. The Bundelkhand region of India has been practicing the local *haveli* system of water harvesting during kharif season since years together and it has worked satisfactorily to cater the needs of farmers' having poor socio-economic status. The rainfall distribution pattern and the kind of land use system have resulted in evolution of water harvesting techniques, such as *in situ* conservation of rainwater through mechanical conservation measures and land use combinations (e.g. Farm Pond and Percolation Tanks). Secondly, drainage of springs and streams for irrigation and domestic water supplies (Loose Boulder Check Dams etc.). In Bundelkhand region of central India, the farmers are always trying to increase their yield and income from crops. Whatever crop they might cultivate, the bottom line is to invariably get a good price from their produce. Farmers can increase their income either by intensifying the existing enterprises or can move towards diversification (by growing new crops), value addition or successful market linkages to improve their economic status. In view of this, an effort was made under DST- MRDP funded project on "Agricultural Productivity in Climate Change Scenarios: *impacts and adaption pathways*" to meet the objective for validating the adaptation options and quantify adaptation gains on farmers' fields in Bundelkhand region of central India during 2018-2021. For the purpose of study, a total of 107 demonstrations on IARI wheat varieties (HD-2967, HD-3086 and HD-3059) were laid down on selected farmers' fields in district Jhansi (UP) and Niwadi (MP) of Bundelkhand region. The results showed that the increase in wheat yields varies from 19 to 28 per cent over the local checks at different farmers' fields in 5 selected villages in the region. Further, the B:C ratio was worked out 2.88 in case of HD-3086 variety followed by 2.83, HD-2967 and 2.80, HD-3059 varieties respectively whereas, B:C ratio of local checks varies from 1.70 – 1.95 which clearly showed that the IARI wheat varieties performed better. In addition, the demonstrations of chickpea and mustard varieties of IARI were also laid down at farmers' fields. Hence, these varieties are recommended for wider coverage for enhancing the farmers' income in Bundelkhand region.

VARIABILITY AND MANAGEMENT OF STEM AND POD ROT OF GROUNDNUT CAUSED BY *SCLEROTIUM ROLFSSII* SACC.

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Abstract

Stem and pod rot of groundnut caused by *Sclerotium rolfsii* Sacc. is the major constraint to groundnut production in many countries in Asia, Africa and America. The disease is a potential threat to groundnut production in warm, humid area, especially where irrigated cultivation is expanding. Stem and pod rot inflicts 10 to 25% yield losses, but it can reach over 80% in heavily infected fields. In India, stem rot of groundnut was first recorded by Butler and Bisby (1931) and causes yield losses over 25 per cent. Infected plants becomes yellow and then wilt, and the collar roots turn brown and rots in addition *S. rolfsii* infects the groundnut pegs and pods, leading to yield losses. Genetic variability among the virulent isolates of *Sclerotium rolfsii* using molecular techniques like RAPD, ITS-PCR and RFLP. The RAPD banding pattern reflected the genetic diversity among the isolates by formation of two clusters. Genetic and phenotypic diversity of *Sclerotium rolfsii* in groundnut fields in Central Vietnam. Based on internal transcribed spacer (ITS) ribosomal DNA sequence analyses, three distinct groups were identified among a total of 103 randomly selected *S. rolfsii* field isolates, with the majority of the isolates ($n = 90$) in one ITS



group. Application of tebuconazole 2%DS @ 1g/kg seed to groundnut kernels prior to sowing was found to be highly effective in the management of stem rot of groundnut with least disease incidence (7.31%) with higher pod yield (2664 kg/ha) and benefit cost ratio (5.42). Integration of seed treatment with carboxin and thiram (Vitavax powder 3g/kg seed), application of a pre-emergence fluchloralin (Basalin @1.5 a.i. kg/ ha), furrow application of bioagent three sprayings of hexaconazole (0.005%) or mancozeb (0.2%) gave the highest yield and showed the least disease incidence. *Sclerotium rolfsii*-incited stem and pod rots continue to be major constraints to groundnut production in many groundnut growing regions, since it is a soil borne disease attention needs to be paid to developing effective field and greenhouse resistance screening techniques. It is important to understand the mechanisms of resistance to *S. rolfsii*. Efforts should be made to utilize all feasible components of disease management into an integrated approach to the problem.

EVALUATION OF IPM STRATEGIES AGAINST MAJOR PESTS OF GREEN GRAM, *VIGNA RADIATA* (L. WILCZEK) IN BUNDELKHAND REGION OF UTTAR PRADESH

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Abstract

Studies on IPM validation and promotion were carried out in green gram (*Vigna radiata* L. Wilczek) crop for two consecutive years (2020-2022) in Bundelkhand region of Uttar Pradesh. Green gram is attacked by the numbers of pests such as Anthracnose, Root rot, Powdery mildew, *Yellow vein mosaic virus*, Cercospora leaf spot, aphid, whitefly, leaf hopper, tobacco cutworm, spotted pod borer, gram pod borer and blue butterfly. Generally, farmers often resort to cocktail pesticides without achieving the desired result. So, to overcome the pesticide load in green gram crop, validation and promotion of IPM strategies were carried out against major pests at Birgua, Mavai villages, Jhansi, Uttar Pradesh. Results revealed that lowest disease severity of Anthracnose, Powdery mildew, *Yellow vein mosaic virus*, Cercospora leaf spot and Root rot disease incidence (7.57, 9.90, 13.99, 11.32 and 6.28%) recorded in IPM plots compared to (11.09, 13.15, 18.04, 14.64 and 9.06%) Farmer Practice (FP) plots respectively. Similarly, two-year pooled average population of aphids (4.25 and 6.71 no./plant), whitefly (7.50 and 14.04 no./plant), leafhopper (3.70 and 7.01 no./plant), tobacco cutworm (2.96 and 3.97 L/plant) were also recorded in IPM and FP plots. Highest average seed yield (q/ha) and B:C ratio of green gram was also recorded in IPM (7.55 & 2.10) compared to FP (5.30 & 1.65) plots. Integrated Pest Management (IPM) strategies have pivotal role in preventing pest resurgence, prevent pesticide resistance, maintain natural enemy diversity and increase economic yield of the crop.

DOUBLING OF FARMER'S INCOME BY INNOVATIVE TRI-MODEL THERAPEUTIC TECHNOLOGY (DWEED-GAU MAA HUMPSORE RAKSHAK) IN ANDAMAN AND NICOBAR ISLANDS

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Abstract

Humpsore is a chronic parasitic dermatitis and induces significantly higher stress and economic losses to the dairy farmers in Andaman and Nicobar Islands. We attempted FDA-approved drugs to mitigate humpsore and to improve the economy of the dairy farmers. Humpsore infected animals were treated with tri-model therapy including ivermectin, diethylcarbamazine citrate and an herbal ointment for 45 days. Success rate of the therapeutic technology was 93.37%. This therapeutic technology improved the milk yield in 85.07% treated animals with 20-25% higher milk yield. This therapeutic technology improved the estrus induction rate in 75.43% of treated animals with pregnancy rate of 60-70%. This therapeutic technology reduced significantly the physical and oxidative stress level and fly nuisance due to humpsore. This therapeutic technology reduced the inter-calving interval, calving to conception interval, and prolonged post-partum anestrous in dairy cows. This therapeutic technology has improved conception rate, pregnancy rate, fertility rate and growth rate in calves and heifers. This therapeutic technology improved the hygienic or clean milk production. Total cost for the whole treatment of 45 days is



Rs.753.00. But the benefit from the treatment technology is very high as higher milk production, higher nutrient utilization, shorten inter-calving interval, higher growth rate in calves and heifers, higher fertility rate and lower physical, biochemical and oxidative stress in treated animals. This technology fulfilled the dream of Hon'ble Prime Minister, Shri Narendra Modi Ji i.e. Doubling of Farmer's Income in Andaman and Nicobar Islands.

GROWTH AND SURVIVAL OF AMUR CARP FED WITH COMMERCIALY AVAILABLE PROBIOTICS

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Abstract

The study evaluated the effect of four varying levels of ProGut (gut probiotic) on growth performance of Amur carp fry, an ideal species selection is imperative to achieve the better growth that ensure to achieve higher economic return. Therefore, present study was aimed to evaluate the growth and survival of amur carp and The ProGut was incorporated into a formulated diet (protein level: 35%), at 0.5, 1.0, 1.5 and 2.0% of the diet and designated as T₁, T₂, T₃ and T₄ and the fifth group, without ProGut served as control (T₀). The diets were fed for 60 days to Amur carp fry stocked at 10 nos./tub with three replicates. Results indicate that the Amur carp fry fed with the diets containing ProGut exhibited higher growth than those fed with the control diet. The survival was 100% in all the treated groups, the average weight and length of Amur carp fry to fingerlings were maximum in 1.5% ProGut treated group. Specific growth rate, protein efficiency ratio, was also highest in the group fed on ProGut at 1.5%. The results clearly exhibit the advantage of addition of ProGut , in the diet of Amur carp growth and survival.

COMPARATIVE UNTARGETED METABOLOMIC ANALYSIS REVEALS ROOT AND LEAF SPECIFIC AMINO ACIDS AND SECONDARY METABOLITES CONFER SALINITY STRESS TOLERANCE IN BRINJAL (*SOLANUM MELONGENA* L.)

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Abstract

Among the various stresses affecting plant growth, salinity stress stands as a significant hurdle, curtailing crop productivity. The persistent rise in soil salinity levels demands the development of salt-tolerant plant varieties to meet global food requirements. Brinjal, a vital vegetable crop worldwide, typically exhibits sensitivity to salt stress. Within the diverse gene pool of brinjal, identifying tolerant strains becomes crucial. Screening 110 brinjal germplasm lines during germination, supplemented by hydroponic studies, singled out Mattu Gulla (MG) and Utkal Anushree (UA) as contrasting lines in response to salt stress. Under 8 ds/m of salt stress, UA notably exhibited pronounced reductions in key growth parameters: root and shoot lengths, biomass, and leaf development. Physiological changes, including alterations in relative water content, proline levels, and chlorophyll concentrations, portrayed MG's superior resilience to salt stress compared to UA. Examination of metabolite profiles in roots and leaves under salt stress revealed substantial variations, impacting secondary metabolites, carbohydrates, organic acids, phytohormones, and amino acids. Specifically, MG displayed heightened levels of sucrose, glucose, gamma amino butyric acid, guanine, oxalic and glyoxylic acid, salicylic acid, cysteine, methionine, tyrosine, caffeic acid, ferulic acid, and GABA, while UA experienced decreased levels of these metabolites. These contrasting metabolic patterns between UA and MG underscored their distinct strategies in combating salt stress. Furthermore, pathway analysis highlighted significant disruptions in metabolic pathways associated with secondary metabolites, amino acids, and organic



acids in both root and leaf tissues under salt stress conditions. This study offers comprehensive insights into the divergent responses of UA and MG to salt stress, emphasizing the pivotal role of metabolic adaptations in fortifying salt tolerance.

ROLE OF NUTRI-CEREALS IN IMPROVING FOOD AND NUTRITIONAL SECURITY

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Abstract

Nutri-cereals play an important role both in terms of their cultivation with low water requirement as well as providing nutritional securities to the deprived population across the world. Because of the abundance of nutrients like B-vitamins, minerals (calcium, magnesium, iron, zinc, potassium), protein, essential fatty acids, phyto-chemicals, antioxidant etc. Due to the richness of millets in polyphenols and other biological active compounds, they are also considered to impart role in lowering rate of fat absorption, slow release of sugars due to low glycaemic index and thus reducing risk of heart disease, diabetes, protein energy malnutrition, nutritional anaemia and high blood pressure. An increasing tendency towards millets' consumption has been noted as a result of growing awareness of their nutritional benefits. A significant step toward long-term sustainability is making a concerted effort to incorporate millet crops into cropping systems, particularly in areas of vulnerability. Because millets are very important plant genetic resources for agriculture sector, which increases food security for impoverished farmers with marginal, dry and poor lands, particularly in Asia and Africa. Millets as climate change compliant crops score highly over other grains like wheat and rice in terms of marginal growing conditions and high nutritional value. Thus, millets cultivation can keep dry lands productive and ensure future food and nutritional security.

ASSESSING THE SUSTAINABILITY OF MAIZE AND MILLETS FOR FOOD REVOLUTION

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Abstract

Together, the three main global staple grains - wheat, rice, maize - make up an important part of the human diet. In recent years, maize crop is widely distinguished as food, feed and fodder crop worldwide from the last three decades and providing sustenance to millions of people around the world. It is not just any ordinary cereal, in fact, it can be considered a nutriceal. A nutriceal is a food that is both a cereal grain and a good source of nutrients. Maize, also known as corn, fits this definition because it is a staple crop in many countries and provides important vitamins (Vitamin C, vitamin E, vitamin K, vitamin B₁ (thiamine), vitamin B₂ (niacin), vitamin B₃ (riboflavin), vitamin B₅ (pantothenic acid), vitamin B₆ (pyridoxine)) and minerals, fiber providing a rich source of carbohydrates and essential nutrients (Dass *et. al.*, 2012). It also contains, potassium, a major nutrient which has a good significance because an average human diet is deficient in it. Due to the nutritional value of maize, there was once a void in its promotion. It is being deficient in two amino acids lysine and tryptophan, but now with the development of biofortification in maize, a speciality maize known as Quality protein maize and provitamin A rich maize, has been developed that provides a new opportunity to use maize for food revolution. It is also referred to as the "queen of cereals" since it has the highest genetic yield potential of any grain and it plays a vital role in global food security. We have explored the various aspects of maize and nutshell it is poor man's nutriceal. Its production and consumption have significant economic and social implications for farmers and their communities.

As, also on the declaration of year 2023 as the International Year of the Millets, Government of India, aims to promote the cultivation and consumption of millets at a larger scale and bring it to the entire world. Therefore, in this contrast, field trial of biofortified varieties *viz.*, four QPM hybrids *i.e* HQPM 1, HQPM 4, HQPM 5 and HQPM 7 and three Pro vitamin A rich hybrids (Pusa HQPM 1 improved, Pusa HQPM 5 improved and Pusa HQPM 7 improved) alongwith major millets *viz.*, Brown top Millet (IIMR AK-2), Kodo Millet (JK 41), Foxtail Millet (SiA-3156), Proso Millet (TNAU 2022), Sorghum (HJ 308 and HJ 541), Barnyard Millet (VL207), Little Millet (DHLM 36-3), Pearl millet (HHB299) were demonstrated during *Kharif* 2023



on 20-07-2023 at research experimental area of CCSHAU, Regional Research Station Karnal. Nine maize hybrids and important millets were planted on the same field to share equivalent number of irrigations along with other agronomic practices and manually hand weeding. Recommended dose of fertilizer for maize and millets were applied. Results for grain yield, phonological and quality parameters revealed that all of these major millets ranged between 75 to 98 days except Kodo Millet (JK 41) (106 days) and Sorghum (HJ 541) (118 days) and Sorghum (HJ 541) (110 days). Similarly days to maturity was also ranged between 85 to 92 days. Grain yield also revealed that biofortified maize and other millets had significant variation for grain yield, ranged between 7-10 q/acre for most of the millets except pearl millet (12.2 q/acre) and sorghum (6.2 q/acre) which is quite contrasting to maize (24 q/acre). On comparison of nutritional profile of maize hybrids of CCSHAU and other millets, major conclusions were drawn. It suggested that biofortified maize over all the major crops and other millets surpassed all others in terms of both production and productivity. Secondly, nutritionally it is very rich to meet daily dietary requirements being rich in essential amino acids lysine and tryptophan and provitamin A. One of the most significant advantages of corn is that it does not contain gluten, and this is quite important for people who have celiac disease and cannot consume wheat. Since there are many types of maize like normal maize, baby corn, sweet corn and popcorn it can be used in different ways. Therefore, biofortified maize solely provides the probable solution as nutriceal in terms of nutrition, versatility, adaptability and sustainability. As due to increasing population there is more food demand, therefore maize can satisfy the food requirements as well as provide human nutrition along with number of health benefits as millets.

On the other hand, maize and millets are quite similar and popular in terms of providing nutrition, offering several health benefits and have potential to strengthen farmers by value addition and set up of small scale industries of biofortified maize and millet products. For these reasons, promoting the consumption of biofortified maize can have a positive impact on both the environment and society. Like all foods, it should be consumed in proper amounts and as part of a balanced diet. Furthermore, incorporating maize into our diets along with other millets and in the midday meal of children's can provide us with essential nutrients and improve our overall health. By supporting local farmers who grow maize, we can contribute to the development of rural communities by the set up of small scale industries of biofortified maize products. Therefore, promoting such biofortified maize and other millets not only aids in addressing the nation's malnutrition problem but also provides long-term, sustainable nutrition security for the nation. By promoting its consumption, we improve not only our own health but also contribute to a more sustainable future.

EVALUATION OF ECOFRIENDLY 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. PDKV, 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 @ 20 ml/L, Hear NPV NBAIR1 @ 4 ml/L (1.5x10¹² OBs/ha), *Metarhizium anisopliae* strain NBAIR Ma4 @ 1x10⁸ conidia /g @ 5 g /l, *Heterorhabditis indica* NBAIR Hi 101 @ 12 kg/ ha, BARC *Bt* formulation (ISPC-1 bacterium) @ 1.4g/L, Home made neem @ 10%, Mahastra (DOR *Bt* 1%) @ 4g/L, Chlorantraniliprole 18.5 SC @ 0.25 ml/L and Untreated control. Two spraying was undertaken one at 50 per cent flowering and second at pod formation. 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 larva per plant and found at par with Hear NPV NBAIR1 and BARC *Bt* formulation with 0.28 and 0.31 larvae per plant, respectively. The lowest per cent pod damage at harvest was recorded in treatment, Chlorantraniliprole 18.5 SC (0.15 %) and found found equally effective with the treatments, BARC *Bt* formulation NBAIR Bt G4 and Home made neem 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, Chlorantraniliprole 18.5 SC (1845.76 kg/ha) followed by BARC *Bt* formulation (1582.22kg/ha), Home made neem (1566.67kg/ha) and HaNPV (1524.67kg/ha).



AGROBACTERIUM BASED *IN-VITRO* SCREENING METHOD FOR IDENTIFICATION OF CHILLI LEAF CURL VIRUS RESISTANT CHILLI GENOTYPES

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Abstract

Chilli leaf curl virus (ChiLCV) is a Begomovirus widely affecting chilli production in India. To test the infectivity of ChiLCV in chilli plants, an improved protocol for inoculation of in vitro-cultured chilli plants was attempted. The present study detected the presence of Chili leaf curl virus (ChiLCV) associated with ChiLCD in Maharashtra. The ChiLCD affected chili plants were exhibiting various symptoms such as leaf curling, smaller leaves, stunted growth bearing of least flowers and fruits. Total infected samples from Vidarbha and Marathwada regions were collected and subjected to a polymerase chain reaction (PCR) using coat protein (CP), DNA-A, DNA-B, and betasatellite-specific primers. The PCR results indicated that ChiLCV from Maharashtra governs the DNA-A genome along with the beta satellite molecules. A ChiLCV isolate was cloned, sequenced, and used to construct an infectious clone. Three weeks old micro shoots of ChiLCV-susceptible chilli plants were inoculated with Agrobacterium tumefaciens harboring the infectious clone for the ChiLCV isolate. After two weeks, the ChiLCV symptoms started to appear on the in vitro inoculated plants and the symptoms became more severe and pronounced eight weeks post-inoculation. Further screening of infected plants is in progress. The reported in vitro-inoculation method can be used to screen chilli genotypes for their responses to ChiLCV under controlled conditions and it will be a useful tool for better understanding of the ChiLCV biology in chilli plants.

SPIROTERAMATE 15.31% W/W OD-A PROMISING INSECTICIDE AGAINST DIAMOND BACK MOTH, *PLUTELLA XYLOSTELLA* L. IN CABBAGE

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Abstract

Bio-efficacy of Spirotetramate 15.31% w/w OD (Movento 150 w/v OD) was evaluated against DBM infesting the cabbage crop during *kharif* season of 2018 and 2019 at Kittur Rani Channamma College of Horticulture, Arabhavi, University of Horticultural Sciences Bagalkot. The test molecule Spirotetramate 15.31% w/w OD @ 60, 75, and 90 g a. i./ha and reference chemicals (check) viz., chlorpyrifos 20 % EC @ 400 g a. i. /ha, cypermethrin 10% EC @ 60 g a. i. /ha and spinosad 2.5% SC @ 15 g a. i. /ha was evaluated against Diamond back moth. Results revealed that the test molecule Spirotetramate 15.31% w/w OD @ 75 g a. i./ha was found to be optimum dose for reducing the diamond back moth (94.12% and 96.11% reduction over control during 2018 and 2019, respectively). The test chemical Spirotetramate 15.31% w/w OD @ 90 g a. i./ha was recorded highest yield (24.63 ton/ha and 23.88 ton/ha during 2018 and 2019 respectively) as compared to the rest of the treatments including the standard checks. The untreated control recorded (17.84 tones/ha and 17.78 ton/ha during 2018 and 2019 respectively) the lowest yield among the treatments. The test product was found safe to the natural enemies. Further, Spirotetramate 15.31% w/w OD at higher dose of 90 and 180 g a. i. /ha has no phytotoxic effects on cabbage crop.

ESTIMATION OF REPEATABILITY OF BIRTH WEIGHT OF FEMALE CALVES IN DIFFERENT CLASSES OF CROSSBRED COWS

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Abstract

The purpose of this study is to determine the repeatability of the birth weight of female calves in various classes of $\frac{1}{2}$ Jersey $\times$ $\frac{1}{2}$ Red Sindhi, $\frac{1}{4}$ Jersey $\times$ $\frac{3}{4}$ Red Sindhi, $\frac{3}{8}$ Jersey $\times$ $\frac{5}{8}$ Red Sindhi, $\frac{1}{8}$ Jersey $\times$ $\frac{7}{8}$ Red Sindhi crossbred of cows. The



Department of Animal Husbandry and Dairy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India, maintains a history sheet that was used to collect the data. Birth weight of female calves from the first (L1), second (L2) and third (L3) lactations of 74 cows and 122 observations of various grades of Jersey x Red Sindhi crossbred were recorded in kilograms. The ranges of birth weight of female calves from the first (L1), second (L2) and third (L3) lactations were 14.9-21.3, 14.6-24.6, 14.9-20.70 kg of $\frac{1}{2}$ Jersey $\times$ $\frac{1}{2}$ Red Sindhi crosses, 14.51-23.58, 14.60-23.13, 13.5-21.31 Kg of $\frac{1}{4}$ Jersey $\times$ $\frac{3}{4}$ Red Sindhi crosses, 16.32-19.51, 15.0-25.4, 15.42-26.5 kg of $\frac{3}{8}$ Jersey $\times$ $\frac{5}{8}$ Red Sindhi crosses, 14.10-23.60, 14.51-21.70, 15.87-21.30 kg of $\frac{1}{8}$ Jersey $\times$ $\frac{7}{8}$ Red Sindhi crosses respectively. The overall mean of birth weight of female calves was 17.18 kg of $\frac{1}{2}$ Jersey $\times$ $\frac{1}{2}$ Red Sindhi crosses, 17.84 Kg of $\frac{1}{4}$ Jersey $\times$ $\frac{3}{4}$ Red Sindhi crosses, 19.23 kg of $\frac{3}{8}$ Jersey $\times$ $\frac{5}{8}$ Red Sindhi crosses and 18.24 kg of $\frac{1}{8}$ Jersey $\times$ $\frac{7}{8}$ Red Sindhi crosses respectively. The repeatability of birth weight of female calves for 0.19 ± 0.36 of $\frac{1}{2}$ Jersey $\times$ $\frac{1}{2}$ Red Sindhi crosses, 0.22 ± 0.02 of $\frac{1}{4}$ Jersey $\times$ $\frac{3}{4}$ Red Sindhi crosses, 0.80 ± 0.14 of $\frac{3}{8}$ Jersey $\times$ $\frac{5}{8}$ Red Sindhi crosses, 0.14 ± 0.29 of $\frac{1}{8}$ Jersey $\times$ $\frac{7}{8}$ Red Sindhi crosses. For different classes of crossbred dairy cattle, more repeatability indicates greater performance. According to the results of the current study, selecting cow female calves with greater birth weight estimations might help increase the production of herds.

INSPECTING THE INFLUENCE OF RAINFALL ON *MALDANDI* SOURCE OF MALE STERILITY BESIDES ASSESSING THEIR INHERITANCE ON FERTILITY RESTORATION IN *RABI* SORGHUM [*SORGHUM BICOLOR* (L.)MOENCH]

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Abstract

Two promising restorers (DSMR-4 and DSMR-8) were crossed with a male sterile line (M31-2A), a *maldandi* cytoplasm. The obtained two hybrids were subjected to study influence of rainfall and inheritance pattern of fertility restoration. The evaluation of hybrids was conducted in two sets of experiments, including the F_2 , BC_1F_1 and F_2 , F_3 generations. The segregation pattern was analyzed in the F_2 and BC_1F_1 generations, resulting in a 54:10 ratio of fertile to sterile plants, and a 1:1 ratio of fertile to sterile plants, respectively. This revealed the involvement of three genes, at least two of which must be in a dominant condition for restoration to occur, acting in a duplicate complementary manner. In the F_3 generation, both crosses were grown to confirm the stability of restorers, and they segregated in the ratio of 10 true-breeding families and 44 segregating families, which was consistent with the F_2 ratio. Further, two seasons F_2 data was further classified as partial restorers to inspect influence of rainfall over the seasons. The major portion of partial restorers were in the range of 31%–40% during *rabi* 2019, but in *rabi* 2020, this class was shifted to 41%–50% due to the availability of water through rainfall (27.2 mm) during the reproductive stage that up-regulated minor genes leading to increased seed set percentage. This confirmed restoration is governed by major genes and minor genes further minor genes were highly sensitive towards rainfall.

IMPACT OF CLIMATE VARIABILITY ON FOOD SECURITY IN INDIA

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Abstract

“When everyone, everywhere, has physical, social, and financial access to enough, safe, and nourishing food that satisfies their dietary needs and food preferences for an active and healthy life, there is food security.” India has one of the highest rates of food insecurity in the world. Since agriculture provides a living for almost 75% of Indian households, any further losses in food grains are expected to worsen the country’s rural poor’s already dire situation. Food availability is mostly determined by agricultural production, which is heavily influenced by climatic conditions. The previous few centuries have seen significant changes in Earth’s climate due to human activity. The availability of food grains to meet dietary needs is a major obstacle to improving food security in India. A specific relationship exists between crop yield losses and water stress. Studies have shown that the body’s capacity to properly utilise the food it consumes depends on having access to water, sanitary conditions, and healthcare services. But in India, a lot of families don’t have access to potable, clean water.



The four most traded food crops (soybeans, wheat, rice, and maize) have declining or stagnating global average yields between 24 and 39 percent. The Food and Agriculture Organisation (FAO) projects that by 2050, the world's population (9.3 billion) and socioeconomic growth will have doubled the amount of food that is currently consumed. To meet this challenge, the FAO estimates that cereal yields must increase by 40%, net irrigation water requirements must increase by 40–50%, and 100–200 million hectares of additional land may be required. Low productivity in Indian agriculture is the primary issue. Increasing productivity across the board in agriculture is vital to fulfil India's rising food demand. However, agricultural practises need to be reoriented to create improved climate resilience, given how vulnerable Indian agriculture is to climate change.

EVALUATION OF IARI RELEASED GLADIOLUS VARIETIES FOR POSTHARVEST TRAITS

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Abstract

Floriculture is a competitive industry with significant economic potential due to increasing consumer demand in many countries in the last few decades. Cut flower production is a major segment in ornamental horticulture. Apart from the quality of flower, the vase life of cut flower is one of the most important factors for consumers. The quality and longevity of cut flowers are affected by a range of pre-harvest and post-harvest factors. Gladiolus (*Gladiolus grandiflorus* L.), belonging to Iridaceae family, is a monocotyledonous ornamental crop originating from South Africa. Gladiolus is a specialty cut flower with increased commercial value ranking among the top five in the global cut flower market. It is grown across a wide range of climatic conditions, including tropical, subtropical, and temperate regions of the world. Cut flower quality and longevity are vital for marketing of gladiolus spikes that ensure better economic returns for growers via consumer acceptability. However, floral senescence is a major problem in the postharvest handling chain of gladiolus. The ornamental value of cut gladioli rapidly declines after harvest. Therefore, a study was undertaken to evaluate IARI released gladiolus varieties for postharvest traits. Six varieties of Gladiolus namely; Pusa Shubham, Pusa Kiran, Pusa Manmohak, Pusa Red Valentine, Pusa Sindoori and Bindiya were evaluated for their postharvest performance. The data was recorded for various physiological, biochemical parameters and enzyme activities. It was observed that the vase life ranged from 9-11 days. The maximum vase life (11.00 days) was recorded in cv. Pusa Kiran. Water content of plant tissues is vital in their related senescence processes. In the present study, Physiological Loss in Weight at senescence was found to be minimum in cv. Pusa Kiran which had highest vase life. Also, Pusa Relative Water Content and Membrane Stability Index was observed to be maximum in cv. Pusa Kiran. The enzyme catalase increased in all the varieties at senescence while superoxide dismutase initially increased and later decreased.

FOOD PROCESSING : A CREATIVE CAREER PATH FOR YOUNG PEOPLE

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Abstract

The food processing industry is one of the largest industries in India and ranks fifth in terms of production, consumption and exports. As per the latest data available, food processing sector is expected to reach US\$ 258 billion in FY15. According to the data provided by the Department of Industrial Policies and Promotion (DIPP), the food processing sector in India has received around US\$ 7.54 billion worth of Foreign Direct Investment (FDI) during the period April 2000-March 2017. In FY 2022-23, India exported 17.8 MT of non-basmati rice and 4.6 MT of basmati rice. Government aims to make India the Global Hub for 'Shree Anna' (Millets). The Ministry of Food Processing Industries announced a scheme for Human Resource Development (HRD) in the food processing sector. The HRD scheme is being implemented through State Governments under the National Mission on Food Processing. The scheme has the following four components: Creation of infrastructure facilities for degree/diploma courses in food processing sector, Entrepreneurship Development Programme (EDP), Food Processing Training Centres (FPTC) at recognized institutions at State/National level.

Rural youth, who are potential migrants, comprise of college dropouts and graduates without proper access to skilling



programs and job-oriented training. So, they fail to understand and appreciate scope of tremendous employment opportunities through local access for agricultural resources. Though they come from farming families, they neglect an open door to fulfill their aspirations through agriculture. Agri. entrepreneurship could transform their lives if they are trained as per industry requirements and provided necessary linkages to set up small units of processing and packaging seasonal farm produce. By creating more awareness, providing education and ensuring proper training, rural migration of youth can be controlled in a big way. Food processing venture can create new strays of employment, sustain livelihoods and show a path to prosperity for rural youth, provided they are rightly guided, facilitated and supported. This can create rural employment locally and this will reduce migration of rural youth to cities, thereby contributing to the rural development and youth empowerment.

FERTIGATION STUDIES IN BANANA

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Abstract

An experiment was conducted at Agriculture Research Station under Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Achalpur (M.S.), India during 2020-21 to 2022-23 to find out suitable fertigation levels for growth, yield and better quality of banana in a randomized block design with five treatment replicated four times comprised of 120, 100, 80 and 60 per cent RDF (RDF 200:40:200 NPK g/plant) treatment of water soluble fertilizers applied through drip and results were compared with one control treatment (soil application of RDF dose). Uptake of nutrients was increased in the fertigation treatment as compared to the control soil application. Pooled data of three years revealed that, application of 120 % RDF (240:48:240 NPK g/plant) recorded highest yield, maximum monetary returns and net profit (114.79 t/ha, Rs 795877 and Rs 463676/ha) but at par with 100 % RDF (200:40:200 NPK g/plant) (113.14 t/ha, Rs 784437 and Rs 461598/ha). Whereas maximum B:C ratio (2.43) found in 100 % RDF (200:40:200 NPK g/plant) treatment followed by 120 % RDF (240:48:240 NPK g/plant) (2.40). Considering yield, monetary returns, net profit and B:C ratio, application of 100 % RDF (200:40:200 g/plant) at fortnight interval in 16 equal splits found beneficial in terms of tissue cultured cv. Grand naine banana yield through fertigation.

SUITABILITY OF STORAGE BAGS FOR THE MANAGEMENT OF PULSE BEETLE DAMAGE TO GREENGRAM

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Abstract

Green gram is the major pulse crop having enormous economic and dietary importance in our country. Like other pulses, green gram also has serious problems of field and storage pest such as *Callasobruchus sp.* Considering the extent of storage loss by this pest in green gram, several strategies viz., chemical fumigants has been adopted on large scale but it's hazardous impact both on environment and human health urged to search safe and cost effective novel strategies. In this direction conspicuous approaches use various impermeable packaging materials were chosen in the present investigation to protect pulses. 500g of greengram seeds along with five pairs of adults were released in five different packaging materials (Gunny bag, Polyethylene bag 50 micron thickness, Polyethylene bag 100 micron thickness, Polyethylene terephthalate bag 100 micron thickness and Pro-harvest bag 100 micron thickness) and packed further stored for 2 years and observed for pulse beetles activity and seed germination at definite intervals.

Results showed that the green gram stored in gunny bags were heavily infested with in 3 months of storage. Seed quality parameters were significantly affected when stored seeds in the gunny bag. Similarly seeds stored along with pulse beetle in 50 μ thickness polyethylene bag also found pulse beetle population build-up, seed damage and reduced seed germination significantly. On the contrary the impermeable bags viz., Polyethylene bag 100 μ , Polyethylene terephthalate bag 100 μ and Pro-harvest bag 100 μ completely protected seeds from pulse beetle damage even after 24 months of storage. When the



impermeable bags containing five pairs of pulse beetle along with green gram seeds found no development of insects and damage to seeds led to maintaining all the seed quality parameters at high range and did not differ significantly and showed maximum germination percentage.

VIROME IDENTIFICATION THROUGH BIOINFORMATICS IN CARICA PAPAYA

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Abstract

Identifying the virome in *Carica papaya* (papaya) through bioinformatics involves the analysis of viral sequences present in the plant. The virome refers to the collection of viruses associated with a papaya plant. Approaches used for virome identification in *Carica papaya*. Collect plant samples (leaves, stems, or any other relevant parts) from different locations and conditions to capture the diversity of the virome. Extraction total nucleic acids (DNA and RNA) from the collected samples. This step is crucial for obtaining the genetic material of both host and associated viruses. Prepare sequencing libraries from the extracted nucleic acids. For virome analysis, it's common to use methods that capture RNA (for RNA viruses). Perform high-throughput sequencing (e.g., Illumina, PacBio, Nanopore) of the prepared libraries to generate raw sequence data. This can be done through various bioinformatics tools and databases. Validate the results through targeting specific viral sequences. Collaborate with bioinformaticians and virologists to ensure a comprehensive and accurate analysis of the virome in *Carica papaya*.

STUDIES ON DISEASE CONTROLLING POTENTIAL OF INDIGENOUS STRAIN OF *TRICHODERMA VIRIDE* / *TRICHODERMA HARZIANUM* AGAINST *ALTERNARIA PORRI*

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Abstract

An experiment was conducted under field condition for disease controlling as well as plant growth promoting activities of *Trichoderma viride* and *Trichoderma harzianum* against the pathogen, *Alternaria porri* causing purple blotch of onion. Different strains of *Trichoderma viride* / *Trichoderma harzianum* were used as soil treatment @ 25 kg/ha and as foliar application @ 10 g/l. All strains of *Trichoderma viride* / *Trichoderma harzianum* were to be effective not only in promoting plant growth but also found effective for the control of purple blotch of onion. However, strain number T18 (*Trichoderma viride*) was found to be most effective strain in controlling purple blotch of onion whereas two strains number T3, T5 *Trichoderma harzianum* were significantly more effective and producing for higher bulb yield of onion per plant.

POPULATION FLUCTUATION OF MAJOR INSECT PESTS AND THEIR CORRELATION WITH ABIOTIC FACTORS ON LONG DURATION PIGEONPEA

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Abstract

For people all throughout the world, pulses constitute an essential source of plant-based proteins and amino acids. Pulses are one of the important segments of Indian Agriculture. Pigeonpea [*Cajanus cajan* (L.) Millsp.] is a significant pulse-cum-grain legume crop among pulses, infested about 300 species of insect pests from 61 families and 8 orders at different growth phases, beginning with the seedling stage and continuing through harvest and storage. Among which gram pod borer [*Helicoverpa armigera* (Hubner)], tur pod fly [*Melanagromyza obtusa* (Malloch)], tur pod bug [*Clavigralla gibbosa* (Spinola)] and plume moth [*Exelastis atomosa* (Walsingham)] are the most damaging pests, causing the plant's reproductive organs significant harm. The present investigations entitled "Seasonal incidence of major insect pests and their correlation with abiotic factors in



long duration pigeonpea [*Cajanus cajan* (L.) Millsp.]” was carried out at Agriculture Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during Kharif 2020–21. Pest activity began with the beginning of pod development and persisted, albeit at various intensities, throughout the crop’s reproductive cycle. The first incidence of tur pod fly (*M. obtusa*) was observed in the 2nd standard week, whose maggot population highest in 11th standard week (8.07 maggots/plant). The presence of tur pod bug (*C. gibbosa*) was noticed for the first time in 2nd standard week, which reached its peak (6.13 bugs/plant) in 12th standard week. Gram pod borer (*H. armigera*) initially appeared in the 3rd standard week, with the maximum population (4.40 larvae/plant) in the 12th standard week. The plume moth (*E. atomosa*) first appeared in the 4th standard week and the maximum larval population (2.20 larvae/plant) was found in the 12th standard week. The correlation between weather factors and population of pod pest complex (*M. obtusa*, *C. gibbosa*, *H. armigera* and *E. atomosa*) in 2020-21, revealed a positive correlation with maximum temperature, minimum temperature, and sunshine hours, but a negative correlation with morning & evening relative humidity and rainfall respectively.

THE QUALITY AND PRODUCTIVITY OF LINSEED (*LINUM USITATISSIMUM* L.) ARE IMPACTED BY IRON AND ZINC NUTRITION

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Abstract

At the College of Agriculture, Vijayapura, a field experiment was carried out in rabi 2020–2021 in order to examine the effect of iron and zinc nutrition on the quality and yield of linseed given that the iron and zinc levels in the soil are below the required level. Ten treatments and three replications were used in the RCBD design of the experiment. In addition to RPP (Recommended package of practises @ 40:20:20:3000-N: P2O5:K2O: FYM kg ha⁻¹), the treatments also comprised the application of ferrous and zinc sulphates at 5, 10, and 15 kg ha⁻¹ and in various combinations. The experiment’s findings showed that applying iron and zinc together significantly increased the uptake of major nutrients and micronutrients in the linseed crop when compared to RPP alone. Among the various treatments, RPP + 15 kg FeSO₄ ha⁻¹ + 15 kg ZnSO₄ ha⁻¹ produced the highest uptake of major nutrients and micronutrients in linseed crop. Major nutrients were Nitrogen (28.50 kg ha⁻¹), Phosphorus (10.7 kg ha⁻¹), Potassium (30.8 kg ha⁻¹) and Sulphur (5.18 kg ha⁻¹). Micronutrients were Iron (126.58 g kg⁻¹), Zinc (74.37 g kg⁻¹), Manganese (60.82 g kg⁻¹) and copper (31.97 g kg⁻¹) respectively. Lower values were noted in the treatment that received RPP alone, and these results were comparable to the application of RPP + 15 kg FeSO₄ ha⁻¹ + 10 kg ZnSO₄ ha⁻¹. Using fertilisers with iron and zinc increases the uptake of major nutrients and micronutrients in the linseed crop. The results of the experiment suggest that adding these micronutrients, iron and zinc, to RPP is a desirable method for giving linseed crops a balanced nutrition and ensuring a higher output.

EVALUATION OF PUFA FROM PROCESSING DISCARDS OF *PRIACANTHUS HAMRUR* (FABRICIUS, 1775) FISH AND ITS SIGNIFICANCE IN HUMAN HEALTH

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Abstract

Fish is considered as a super food in the human diet because of its high nutritional quality. Fish are a well-known source of long-chain polyunsaturated fatty acids (PUFAs) especially omega-3 and omega-6, which can prevent atherosclerosis and thrombosis. These fatty acids have preventive effects on coronary heart diseases, autoimmune disorders, arrhythmias, lowering plasma triglyceride levels and blood pressure. Moontail bull eye (*Priacanthus hamrur*) important industrial fish in India for the production of surimi and fillets, discharged a considerable amount of waste (30-70%). These wastes include the



head, skin, frame and internal organs. In this study, the different processing discards of the Moontail bull eye, including head, skin, frame and internal organs were analysed for its biochemical and nutritional quality. The study revealed that higher protein content ($25.70 \pm 0.47\%$ wet wt basis) was found in the skin region followed by internal organs ($13.66 \pm 0.36\%$ wet wt basis). The high fat content was found in the internal organ ($9.66 \pm 0.24\%$ wet wt basis). The Fatty acids composition was carried out by using gas chromatography-mass spectroscopy (GC-MS). The fatty acid profile showed that the highest amount of omega-3 and omega-6 are fatty acids found in the skin a total of 34.01%, including -linolenic (C18:3; 2.89%), eicosatrienoic (C20:3; 0.49%), eicosapentaenoic (C20:5; 12.04%), docosahexaenoic (C22:6; 12.36%), linolelaidic (C18:2; 0.20%), linoleic (C18:2; 4.89%), α -linolenic (C18:3; 0.46%), eicosatrienoic (C20:3; 0.06%) and arachidonic (C20:4; 0.60%). From this study, it has been concluded that the moontail bull eye waste has a significant amount of PUFA which has high nutritional value and health benefits for human consumption. This will pave the way for the development of functional foods from the processing discards.

FIELD EVALUATION OF AZOTRIX (AZOXYSTROBIN 16.7% + TRICYCLAZOLE 33.3% SC) AS FOLIAR APPLICATION FOR CONTROLLING BLAST DISEASE IN PADDY

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Abstract

The experiment was conducted at three locations Belagvi, Hanagal and Mugad on blast disease of paddy during 2021 and 2022 for evaluation of Azotrix (Azoxystrobin 16.7% + Tricyclazole 33.3% SC) in Transplanted Paddy with the variety RNR (fine type). The pooled data indicated that, Azotrix (@ 750 ml/ha) (Azoxystrobin 16.7% + Tricyclazole 33.3% SC) was most effective and showed the least severity of disease (10.57 mean PDI) followed by Azotrix (@ 500 ml/ha) (Azoxystrobin 16.7% + Tricyclazole 33.3% SC 11.71 PDI). The highest blast disease severity was recorded in untreated control (37.31 mean PDI). The results also revealed that spraying of Azotrix (Azoxystrobin 16.7% + Tricyclazole 33.3% SC) @ 750 and 500ml/ha equally increased the grain yield during both the seasons (36.90qt/ha and 34.64qt/ha respectively). The minimum yield was recorded in untreated control (22.33qt/ha).

BIOFORTIFICATION OF LOCAL CUCUMBER (*CUCUMIS MELO* SUB SPECIES *AGRESTIS*) CULTIVARS THROUGH BACKCROSS BREEDING WITH MUSK MELON CULTIVAR. ARKA SIRI

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Abstract

Cucumbers are the fourth most important vegetable crop. Cucumbers belonging to *Cucumis melo* sub species *agrestis* are commercially grown in Karnataka. These are having many desirable consumer preference traits but are nutritionally poor compared to melons. Development of improved varietal lines in these local types enhances the economic value of the crop. With this objective to introduce the flesh colour and taste from musk melon to the local high yielding local cultivars (UHS CS-9) and (UHS CS-12) an investigation was conducted in University of Horticultural Sciences, Bagalkot during Kharif 2022 and Kharif 2023. UHS CS-9 and UHS CS-12 were crossed with Arka siri a musk melon variety to enhance the beta carotene content of local cucumbers. Beta carotene content in local cultivar was 0.13 mg/100 gm in UHS CS-9 and 0.12 mg/100 gm in UHS CS-12 and in Arka Siri it was 0.3 mg/100 gm. Flesh colour was creamish in local cultivar and orange in Arka Siri and local cultivars were non sweet, while Arka Siri sweet in taste. The resulting F1s were intermediate for fruit shape, flesh colour was light orange and sweet in taste. Beta carotene in F1 was 0.22 and 0.20 respectively in both hybrids. In both the F1 hybrids there was a significant increase in Individual fruit weight, and total yield per plant compared to both the parents. Fruit diameter was increased but the number of fruits reduced. BC1 population was developed using local cultivar as recurrent parent. In BC1 the progenies were segregating as 1:1 Proportion for flesh colour and fruit shape. Both local types and melons were obtained in equal proportion. Back cross progenies exhibited less value for beta carotene (0.18) compared to F1s, while individual fruit weight and number of fruits reported no significant differences in comparison with F1 hybrids.



Further selections to be attempted in BC1 F₂ and back crosses to identify the desirable progenies with enhanced beta carotene content retaining all other traits of local cultivars. Resulting lines will be nutritionally enhanced compared to the existing local types.

EFFICACY OF DIFFERENT GROUPS OF ORGANICS SUPPLIED TO MULBERRY AT VARIED LEVELS ON REARING PERFORMANCE OF COMMERCIAL SILKWORM (*BOMBYX MORI* L.) HYBRIDS

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Abstract

The data from an experiment involving different combination of organic manures tested for rearing performance of silkworm hybrids (CSR₂ X CSR₄) during 2019-20 at Agricultural Research Station, Hagari, Ballari, University of Agricultural Sciences, Raichur. It was observed that, application of castor cake (*Ricinus communis*) + urea treated group stood first for mature larval weight (3.558 g/ larva), lower larval duration (24.84 days), ERR (84.87%), disease incidence (10.47%) and cocoon yield (57.39 kg/100 dfits) compared to control. Among different groups of organics, castor cake + urea group performed better than other groups for majority of the rearing parameters.

STANDARDISATION OF TEMPERATURE INDUCTION RESPONSE TECHNIQUE IN MAIZE: A NOVEL SCREENING METHOD FOR THERMOTOLERANCE AT SEED LEVEL

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Abstract

Global agriculture is negatively impacted by climate change, especially by heat stress, which hampers plant growth and development. Maize is an important and versatile crop that is used for food, feed and fodder purposes. However, maize is highly vulnerable to heat stress, especially during the reproductive stage, which reduces the yield and quality of the crop. Developing heat-tolerant maize varieties is essential to cope with climate change. Breeding approaches require screening and evaluation of a large number of maize genotypes, which is tedious and time-consuming. The temperature induction response technique (TIR) is a reliable and efficient technique that can be used to screen a large population of genotypes. It is based on the concept of acquired thermotolerance and lethal dose 50, but it is crop-specific and needs to be standardized for each crop. The present study aimed to standardize the TIR technique for maize at the seed level. The study found that the lethal temperature for maize seeds was 50°C for three hours, and the induction or sublethal temperature was a gradual exposure of maize seeds to 32-50°C for 4.5 hours. After a recovery period of 24 hours at room temperature, the seeds were tested for germination and recovery growth, which were used as indicators of thermotolerance. The standardized TIR technique can be a useful tool for screening and evaluating maize genotypes for heat tolerance at the seed stage itself.

IMPROVED BIOMASS STOVES IN RURAL AREA-A BOON

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Abstract

Inefficient combustion of solid fuels emits high concentrations of particulate matter (PM) and other harmful emissions. A



strong association has been shown between household air pollution (HAP) and acute lower respiratory infections (ALRI) in children, and chronic obstructive lung disease (COPD) and lung cancer in adults. As a result of the magnitude of these adverse health impacts, household air pollution from burning solid fuels in primitive cook stoves is the primary environmental cause of death. Keeping this in view a study was conducted in two villages namely Timmapur Village of Dharwad district and Bhaganager village of Vijayapur district. From each village 60 households were selected randomly in total 120 households were selected for the study. Interview schedule was used to elicit the required information. Results revealed that, about 80 per cent of the women were illiterate in Timmapur and 76.70 per cent of the women were illiterate in Bhaganagar. The quantity of ash, charcoal and smoke after food preparation was significantly varied between improved biomass stove and traditional stoves in both the villages. The reduction in percentage of both carbon dioxide and carbon monoxide was found in biomass stove compared to traditional stove. The experimental research revealed that as 58 percent of the fuel wood was saved per year per 100 families when compared to traditional stove. About 10-15 kg of wood is utilized per year while cooking with biomass stove from 100 families with the karijali fuel wood about 720 kg/ month/100 families. Whereas the traditional stove consumes 1200 kg /month/100 families. By using biomass stove on an average 384 trees/ year/100 families could be saved.

STUDY ON SOCIO-ECONOMIC PROFILE OF DAIRY FARMERS OF HUVINAHADAGALI TALUKA

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Abstract

Dairy plays a very important role in providing daily income to farmers to meet basic needs. Apart from milk, the other products like cow dung cow urine has high demand due to increasing demand for organic farming. The present study was conducted in Huvinahadagali taluka of Vijayanagara District, involving the sample of 120 respondents from five villages using random sampling technique based on the data who are the members of KMF. The study revealed that 40.00 per cent of farmers were middle aged group. Nearly one third (27.50 %) of the farmers completed their high school education. Majority of farmers (63.33 %) belong to small land holding category. More than two fifth (42.50 %) of farmers were living in small family. Majority of farmers (60.83 %) had less experience in dairying. More than two third of farmers (70.83 %) had dairying + farming as their occupation. More than two fifth of farmers (47.50 %) belong to low milk yield category. Great majority of farmers (95.83 %) falling under medium herd size category. More than one third (37.50 %) of farmers belong to medium level of economic motivation. Nearly two fifth (39.17 %) of the farmers had medium innovative proneness. More than two fifth of farmers (59.17 %) possessed cows only. More than two fifth (42.50 %) of farmers had low social participation. Two fifth (40.00 %) of farmers belong to high level of extension contact. Two fifth (40.00 %) of farmers belong to low mass media exposure.

MONITORING OF LEPIDOPTERAN AND SUCKING INSECT PESTS OF GROUNDNUT USING TRAPS

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Abstract

Population of *Spodoptera litura*, *Helicoverpa armigera*, *Aproaraema modicella* male moths were recorded at weekly interval throughout the season using pheromone traps starting from 30 days after the sowing (5 traps/ha). Population of sucking insect pests were recorded at weekly interval throughout the season using yellow sticky traps starting from 7 days after sowing (5 traps/ha) at AICRP on Groundnut, MARS, UAS Dharwad, Karnataka during *Kharif & summer 2022-23*. Average number of moths and sucking insects collected in different traps were computed in standard weeks. During *Kharif*, the activity of *Spodoptera* was more i.e., 387 & 353 moths/ traps during 33rd MSW & 32nd MSW resp. Highest catch of *Helicoverpa* was on 33rd MSW (34 moths/ trap) followed by 32nd MSW (26 moths/ trap). Whereas, peak incidence of leaf miner trap catch was 4 moths/trap (30th MSW). Maximum population of both leafhoppers (88 leaf hoppers/trap/wk) and thrips (44 thrips/trap/wk) were recorded in 31st MSW resp. During summer season, the highest *Spodoptera* moth's count per trap per week was 54 (9th MSW). Whereas, in max. *Helicoverpa*, 9th MSW with 22 moths/trap/wk moths. Highest catch of



leafminer was 8th MSW (17 moths/trap/week). Max population of leafhoppers (150 leaf hoppers/trap) and thrips (44 thrips/trap) were recorded in 7th & 10th MSW. In nutshell insects were more in *Kharif* compared to *summer*.

CONTAMINATION OF MARKET VEGETABLES WITH CHEMICAL PESTICIDES

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Abstract

Vegetables are a good source of minerals, vitamins and essential amino acids which are required in large quantities for human health. India stands in second position for vegetable production next to China. With the expansion of human population and urbanisation, there is limited space for crop production and repeated cultivation in the same area leads to various ecological disturbances. Crops are attacked by various factors including insect pests and diseases, causing average yield losses to the tune of 30-40 percent, which might rise to 100% if not treated properly. Vegetable cultivation is very prone to attack by various groups of insect pests and diseases. To combat these effects, farmers use various kinds of chemical pesticides to control the pests as well as to increase yields. However, most vegetables are consumed as raw, cooked and canned products. The application of different chemical pesticides and their residues after application should safeguard the protection of the consumers where there are no residues above the maximum residue limit (MRL) for consumers. To give awareness on need-based pesticide application based on the Economic Threshold Level (ETL) of the insect pests, the study was undertaken to determine the residues of major pesticides used in vegetable production using High-Performance Liquid Chromatography. Fresh vegetables such as tomato, cabbage, cauliflower, brinjal, pea, broad beans, cowpea and french beans were randomly selected from major local markets of Manipur. Results revealed that the pesticide residues of chemical insecticides like imidacloprid, fipronil, and chlorantraniliprole above MRL (FSSAI) were detected in vegetable samples.

YIELD POTENTIAL AND CARBON STOCK OF MANGO AND PINEAPPLE AGROFORESTRY SYSTEM

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Abstract

An experiment was conducted in the Agroforestry Research Station of Odisha University of Agriculture and Technology, Bhubaneswar in the year 2021-22 for Mango and Pineapple agroforestry system. It include eight treatments and three number of replications, with two Mango varieties named Amrapalli and Dasehari, with four nutrient levels i.e. N₁-RDF (100%) + FYM (10 t/ha), N₂-RDF (75%) + FYM (10t/ha), N₃-RDF (125%) + FYM (10t/ha), N₄-RDF (0%) + FYM (10t/ha). The mango field is under Ninth (9th) year plantation. Pineapple was planted as an intercrop with a spacing of 75 cm x 50 cm in the main field as third year of plantation. The highest DBH was noted in RDF(100%) + FYM(10t/Ha) + Dashehari (T₅) 24.8 cm, with a maximum height of 32.33 mts and lowest DBH in RDF(0%) + FYM(10t/Ha) + Dashehari (T₈) 15.8 cm, with minimum height of 22.64 mts. Highest AGB was recorded in RDF(125%) + FYM(10t/Ha) + Dashehari (T₇) 81026 Kg ha⁻¹ and highest BGB for T₇ (21,067 Kg ha⁻¹), with a highest total biomass of 1,02,092 Kg ha⁻¹. A maximum crown spread was noted for T₅ (11.56 mt), while a minimum was noted for T₇ (6.72 mt). The carbon stock of the system in T₇ was found to be the highest i.e. 51,046 Kg ha⁻¹, with a net carbon dioxide assimilation of 1,87,339 Kg ha⁻¹, while, the lowest being the 17,172 Kg ha⁻¹, with a net carbon dioxide assimilation of 63, 023 Kg ha⁻¹. Similarly, Carbon credit was found to be highest in case of T₇ as \$ 3062.76 and lowest in case of T₈ as \$1030.35. The highest yield for Mango was found in RDF(100%)+FYM(10t/Ha) + Amrapalli (T₁) 5911 kg/ha, while the lowest for T₈ (4,341 kg/ha). Pineapple as an intercrop was studied under eight different treatments for various attributes like average no. of leaves per plant, length of D-leaf, and Biomass of the crop. From the experiment, T₅ have the highest number of leaves per plant i.e. 21 while RDF (75%)+FYM(10t/ha) + Amrapalli (T₂) having lowest number of leaves i.e. 18. Highest dry biomass for Pineapple was recorded for T₇ (8463.89 Kg ha⁻¹), while lowest biomass found in T₈



(5933.33 Kg ha⁻¹). The total biomass under the above experiment from the agroforestry system was found to be highest in case of T₇ as 1,10,556 Kg ha⁻¹, with a total Carbon sequestered by the system being the 55,278 Kg ha⁻¹, while the lowest total biomass recorded for T₈ (40,278 Kg ha⁻¹), with carbon sequestration of 20,139 Kg ha⁻¹. Highest yield of Pineapple in T₁ (11,095 kg ha⁻¹), and lowest in T₈ (6,102 kg ha⁻¹) was found. Finally, the study of above Agroforestry System revealed the highest net return of approx. 4.4 lakh rupees from T₁ agroforestry system, while the highest B:C ratio of 3.02 was recorded for the T₇ agroforestry system. The above study, it was concluded that the maximum yield of the system was obtained from the N₁-RDF (100%) + FYM (10 t/ha) nutrient management system, whereas, the highest biomass production was observed under N₃-RDF (125%) + FYM (10 t/ha) nutrient management system. The lowest biomass production as well as the lowest yield was obtained under N₄-RDF (0%) + FYM (10 t/ha) nutrient management system which is purely organic material.

EVALUATING THE FEASIBILITY AND BENEFITS OF *EICHHORNIA CRASSIPES* AS A DIETARY SUPPLEMENT FOR *CYPRINUS CARPIO* GROWTH AND HEALTH

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Abstract

In the aquaculture, optimizing fish diets is imperative for the sustainable growth and well-being of aquatic species. This study explores the potential of *Eichhornia crassipes* as a supplementary feed for *Cyprinus carpio*, commonly known as common carp. The research involved formulating experimental diets by incorporating varying levels of Water Hyacinth alongside conventional fish feed. The feeding trial extended over a specified period, during which parameters such as growth performance, feed utilization efficiency of *Cyprinus carpio* were meticulously monitored and analyzed. Additionally, biochemical analyses were conducted to evaluate the nutritional composition of *Eichhornia crassipes* and its potential benefits for the fish. Initial findings indicate that the supplementation of Water Hyacinth positively influenced the growth rates of *Cyprinus carpio*, resulting in increased weight gain and enhanced feed conversion ratios. Moreover, it exhibited significant effects on the overall health of the fish, as evidenced by biochemical estimations. This study illuminates the potential of Water Hyacinth as a viable supplementary feed for *Cyprinus carpio* in aquaculture practices. The research outcomes hold implications for sustainable aquaculture, providing an environmentally friendly solution to improve fish growth and health while addressing concerns related to aquatic weed management. Further investigations into the long-term effects, optimal inclusion levels, and potential applications in different aquatic species are recommended to fully grasp the benefits of Water Hyacinth in aquaculture practices. In conclusion, the incorporation of *Eichhornia crassipes* in the feed was found suitable for the growth of *Cyprinus carpio* and further conclusions will be discussed in the conference.

STUDIES ON PREPARATION OF LIME BLENDED MANDARIN MARMALADE

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Abstract

Marmalade is a product that is prepared from citrus fruits, where the peel of the fruit is suspended. Marmalade is a good source of vitamin C, dietary fibres and minerals which offers numerous health benefits. Blending is one of the best methods to improve the nutritional quality of value-added product by providing the nutrients of various fruits in single product, hence giving better quality and nutrition. Thus, keeping this objective in mind, the present investigation was done for finding the best suitable combinations of blended marmalade where we have prepared blended marmalade using mandarin and lime in different proportions and stored it for 150 days, and analyzed with respect to physicochemical and sensory parameters. The experiment was conducted at the PHT Laboratory, Department of Fruit Science, Dr. PDKV, Akola during the year 2019-20. The variety Nagpur mandarin and PDKV lime were used. It was observed that the treatment having 55% mandarin and 5% lime juicy vesicles was found to be best for the parameters TSS, total sugars, reducing sugars, acidity, ascorbic acid, pectin and sodium content and sensory attributes.



EVALUATION OF PROCHLORAZ 45% EC AGAINST BLAST DISEASE IN RICE

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Abstract

The blast disease is major constrain of rice production reported to cause extensive damage in crop production. Therefore to know the effect of Prochloraz 45% EC on blast (*Pyricularia oryzae*) disease of rice crop the experiment was laid out with 6 treatments and replicated four times in RBD design at ARS, Gangavathi. The variety BPT-5204 was sown with the spacing of 20 cm x 10 cm in plot size of 5 X 5 m² with all regular agronomic practices followed as per the standard package of practice of University of Agricultural Sciences, Raichur. The fungicide Prochloraz 45% EC was applied as foliar spray treatment in the replicated plots just after the appearance of blast disease in the main field. The observations were recorded on the basis of scoring of the diseases as per the standard disease rating scale. Among the treatments, Prochloraz 45% EC @ 1250 ml/ha and Prochloraz 45% EC @ 1000 ml/ha were found to be the best treatments as there were 6.35 PDI and 6.56 PDI of leaf blast disease in rice were recorded, respectively as compared to 38.30 PDI of leaf blast disease in untreated control during first season at terminal observation. Similarly, during second season Prochloraz 45% EC @ 1250 ml/ha recorded 6.50 PDI which was on par with Prochloraz 45% EC @ 1000 ml/ha (6.83 PDI) and found superior than rest of the treatments at terminal observation. Maximum PDI i.e. 39.03 was recorded under untreated control condition. Prochloraz 45% EC @ 1250 ml/ha and Prochloraz 45% EC @ 1000 ml/ha were again recorded its superiority during all the observation days. The highest paddy yield was obtained from the treatment with Prochloraz 45% EC @ 1250 ml/ha i.e. 48.86 q/ha and 49.60 q/ha during first and second season, respectively. Minimum paddy yield i.e. 34.41 q/ha and 35.90 q/ha were recorded on untreated control treatment during first and second season, respectively

MICROPROPAGATION STUDIES IN SPINE GOURD (*MOMORDICA DIOICAROXB.*)

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Abstract

Among various rare vegetable crop, Spine gourd (*Momordica dioica* Roxb.) is a dioecious and perennial cucurbitaceous climber distributed throughout India and few Asian countries. Due to this exceptional nutritive value, this popular vegetable crop has high demand in market. But this crop always remained underutilized and underexploited mainly due to its vegetative mode of propagation and dioecious nature. Conventional commercial propagation of spine gourd largely depends on tuberous roots followed by stem cuttings and seeds. Commercial multiplication using the tuberous roots and stem cuttings are critically limited due to inadequate availability of tuberous roots and late availability of stem cuttings in fruiting season. Tuberous roots have low multiplication rate and occupies the valuable cultivable land until next planting season, which is a major concern about its large scale cultivation. Stem cuttings containing 2–3 nodes from dark green vines of 2–3 months old plants are planted, but only 30–35% of the plants sprout and survive. Another difficulties are this crop is propagation by rhizome tubers, which bears dormancy and unpredictable sex ratio in seedling progenies. As male plants dominate natural populations of spine gourd. Sex determination of the plants is possible only when the plants start flowering. Since, fruits are the main edible portion of this species, which are harvested on female plants only; it is desirable to have commercial fields with a large proportion of female plants. Accommodating, 5–10 % male plants to act as pollinators in the field is imperative for good fruit set. As the conventional methods of spine gourd propagation impose several limitations for their large-scale propagation of sex specific plants, an efficient clonal propagation method is a must. An *in vitro* propagation system offers unlimited availability of planting material early in the planting season. Micropropagation technique is well-established for rapid and large-scale multiplication of many horticultural crops including vegetables. Similarly, an attempts have to be made for rapid *in vitro*



propagation of spine gourd (*M. dioica*), wherein shoots and plant will be regenerated from various nodal explants. In the present study, the treatment combination comprising of half MS media + 1.5 mg/L Kinetin + 0.5 mg/L shows highest 79.54% culture survival followed by half MS media + 2.5 mg/L Kinetin + 1.5 mg/L results into 68.51% culture survival, whereas half MS media + 1.5 mg/L Kinetin + 0.5 mg/L shows highest 82.15% culture initial establishments and same treatment results into high rate 81.42% shoot proliferation. These treatment combinations will be proved significant in micropropagation of spine gourd with slight modifications.

USE OF DRONES IN SOYBEAN CROPPING SYSTEM

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Abstract

To guarantee that soybean plants maximize sun radiation, bean breeders must create early-maturing, standard, and late-maturing varieties for planting at various latitudes. Thus, for the purpose of managing soybean harvesting and measuring production, prompt monitoring of soybean breeding line maturity is essential. Building algorithms and establishing correlations between spectral signatures and ground truth is costly, but once the foundational research is completed, this method is easy to utilize. Given the scarcity of technical talent and labor, especially in India, drones are becoming more and more popular in the context of smart farming. Around the world, insect pests are known to wreak havoc and sharply reduce food grain supply. The FAO has estimated that illnesses and pests will cause losses of more than 37%. In order to ensure sustainable and profitable agriculture, modern crop production and management necessitate the development of an early warning system for crop health conditions. In a similar vein, minimizing losses requires prompt action to repair unwanted damages brought on by biotic and abiotic factors. The paucity of labor and the rising cost of agricultural inputs are two other issues that require quick attention. Therefore, it is imperative that inputs be used wisely through precise application procedures. Drones, also referred to as unmanned aerial vehicles (UAVs), are a useful tool for applying crop inputs such as nutrients and plant protection. Actually, it is necessary to investigate the potential applications of any technology, including drone-assisted spraying, in various crops and agroclimatic zones. Thus, there is an urgent need for crop-specific SOPs that take into account the pertinent parameters like temperature, humidity, wind speed, terrain, crop, and other environmental parameters in order to expand the scope of drone assisted pesticide application for different crops grown under diverse climatic conditions.

TRANSGRESSIVE SEGREGATION STUDIES IN F₂ GENERATION IN MUNGBEAN (*VIGNA RADIATA* (L.) WILCZEK)

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Abstract

An experiment was conducted to identify the transgressive segregants for yield and yield contributing characters in F₂ population of three crosses in mungbean. In most of the transgressive segregants, in each of the three crosses, better parent yield was transgressed with transgression of one or several other characters. In general, the highest proportion of transgressive segregants were recorded for number of pods per plant, followed by number of pods per cluster, 100 seed weight, yield per plant, number of seeds per pod. In most of the transgressive segregants, in each of the three crosses, better parent yield was transgressed simultaneously with transgression of one or several other characters. Simultaneous transgression of grain yield per plant in association with days to 50% flowering, days to maturity, plant height, number of primary branches per plant, number of cluster per plant, number of pods per cluster, number of pods per plant and 100-seed weight was observed more



frequently. It was concluded that either grain yield per plant is dependent on this character or there may be linkage drag, so that genes responsible for these characters move together. The most promising transgressive segregants observed in F₂ generation were Plant No.104 of Cross 1, Plant No.11 of Cross 2 and Plant No. 112 of Cross 3.

MORPHOLOGICAL CHARACTERISATION OF MAIZE (*ZEA MAYS* L.) GERMPLASM GROWN IN TEMPERATE AREAS OF KASHMIR VALLEY

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Abstract

Characterisation of ten popular maize varieties/ cultivated landraces in high as well as low altitude areas was undertaken using morphological descriptors (DUS). The morphological description could categorise the varieties / cultivars into three different classes on the basis of plant height, three on the basis of tassel anther glume color, two on the basis of silk color at emergence and three on the basis of cob shape. Some of the varieties exhibited distinguishing characters which can be used for their early identification under field conditions. The possible application of morphological and bio chemical markers is envisaged for DUS testing for the grant of plant variety as well as genetic purity testing in seed production programme.

PROPERTIES OF COTTON/PALF BLENDED YARNS

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Abstract

Pineapple leaf fiber is one kind of fiber obtained from plants *Cosmosus Ananas* belonging to the Bromliaceae family which is extracted from the leaves of the pineapple plant (vegetable fiber).. The pineapple fiber from the leaves can be extracted in two ways, manual and mechanical methods. Recently, the fibre extraction machine “Raspador” has been developed. Pine Apple leaf fibres were collected from the local areas where the plants were grown for fruit purpose. The leaves were collected after the harvest of the fruits. The leaves were separated individually from the bunch of leaves and the fibres were extracted from the Raspador machine. The results revealed that the percentage extraction of fibres from the leaf was found to be 2.02 per cent. The cellulose and hemicelluloses content was found to be 68.59 and 18.28 respectively. On scouring the composition of cellulose, hemicelluloses, lignin, ash and protein decreased while the moisture content increased. It is observed that the breaking load (gf) and elongation (%) of the pine apple leaf fibre decreased after scouring while Extension at maximum load (mm) increased. The scoured fibres were further blended with cotton fibres in 70/30 and 60/40 Cotton /PALF proportions to produce blended yarns. The results revealed that the strength, elongation (%) and C.S.P of Cotton / PALF in 70/30 proportion increased when compared to 100 per cent cotton yarns and 60/70 cotton / PALF blended yarns indicating that 70/30 cotton / PALF blended yarn is more suitable for production of good strength fabrics.

DEVELOPMENT OF OSMOTICALLY DEHYDRATED NUTMEG RIND CANDY USING RSM MODELING

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Abstract

The optimization of osmotically dehydrated nutmeg rind candy was developed by response surface methodology using face centered center composite design. The processing conditions were standardized with syrup temperature between (50 -70°C), syrup concentration between (60-80°Brix) and duration of osmotic dehydration between (3-5 h) as independent variables and water loss, sugar gain, chewiness and lightness as dependent variables. A quadratic model was used to describe and predict the



response quality in terms of water loss, sugar gain, chewiness and lightness with R^2 of 0.8875, 0.9580, 0.9406 and 0.9753 respectively. The optimal conditions of osmotically dehydrated nutmeg rind candy were 59.72°C for syrup temperature, 80°Brix for syrup concentration and 5h for the duration of osmotic dehydration. The water loss, sugar gain, chewiness and lightness values of the optimized candy were found to be 61.13%, 23.22%, 18N and 23.97 respectively. The experimental values satisfied the predicted model within the acceptable range of the responses. In addition to this proximate composition and microstructure analysis of the optimized candy were carried out.

MANAGEMENT OF INVASIVE PESTS IN MAIZE AND TOMATO IN MEGHALAYA

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Abstract

Invasive pests are the major threats to biodiversity and cause immense damage to the economically important crops in India. Invasive insect species generally establish in new geographical area very rapidly due to the absence of their natural predators and parasites in the new zone. In north-eastern India, maize and tomato suffer badly due to the attack of invasive pests such as fall armyworm (FAW), *Spodoptera frugiperda* (J. E. Smith) on maize and South American tomato pinworm, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) on tomato. Therefore, the present experiments were conducted at ICAR Research Complex for NEH Region, Umiam, Meghalaya to evaluate different management practices against these invasive pests in maize and tomato, respectively. The experiments were conducted in randomized block design (RBD) with three replications for both the crops. Experimental results showed that maize sown second fortnight of April along with two soil application at 20 & 40 DAS and two spray with *Bt* @2g/l recorded minimum dead heart with highest grain yield. Among the treatments, chlorantraniliprole@0.3ml/l, emamectin benzoate @0.4g/l, *Bacillus thuringiensis* (*Bt*) @2g/l and *Metarhizium anisoplae* @5ml/l were effective against FAW with less than 5% dead heart. On the other hand, tomato transplanting during third week of January along with the application of pheromone trap of *T. absoluta* and two spraying with *Bt*@2 g/l recorded maximum yield with less pests infestation.

EFFECT OF SEED COAT COLOUR ON CHEMICAL AND BIOCHEMICAL CHANGES IN SORGHUM GENOTYPES DURING STORAGE

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Abstract

Sorghum is an important grain and forage crop of semiarid regions due to its high adaptability and suitability to rain-fed low input agriculture. The colour of seed coat is most obvious physical characteristic which varies widely with white, cream, red, black etc. Differences in seed coat colour have been associated with differences in the composition of chemical compounds in the seed coats, hence laboratory experiment was conducted to study the effect of seed coat colour on chemical and biochemical changes in sorghum genotypes using completely randomized design during 2021-2022 at the Department of Seed Science and Technology, UAS Raichur. The study consists of 20 sorghum genotypes of different seed coat colour which were stored for ten months in cloth bag under ambient conditions. Seed biochemical parameters were recorded at bimonthly interval whereas seed chemical content were measured at initial and after ten months of storage. Results revealed that, both in the beginning and after ten months of storage, black seed coat (IS25040) coloured genotype recorded significantly highest total dehydrogenase activity (0.208 OD value and 0.200 OD value), alpha amylase activity (17.40 mm and 16.00 mm), protein (13.15 % and 12.00 %), starch (64.50% and 62.80%), iron (52.88 mg kg⁻¹ and 50.19 mg kg⁻¹), zinc (32.24 mg kg⁻¹ and 29.98 mg kg⁻¹), crude fibre (2.64% and 2.58%), tannin (16.40 mg /100 g and 15.90mg/100g) and lowest moisture content (10.24 % and 9.94 %) and electrical conductivity (0.10 dSm⁻¹ and 0.24 dSm⁻¹) which was followed by dark brown colour genotype (IS37225). Whereas lowest biochemical parameters (0.179 OD value and 0.145 OD value, 14.20 mm and 10.50 mm), chemical content (11.79 % and 8.93 %, 58.30 % and 54.50%, 33.25 mg kg⁻¹ and 30.16 mg kg⁻¹, 26.12 mg kg⁻¹ and 20.79 mg kg⁻¹, 2.10 % and 1.77 %, 12.80



mg /100g and 12.40 mg/ 100g) and highest moisture content (10.58 % and 10.18 %) and electrical conductivity (0.15 dSm⁻¹ and 0.39 dSm⁻¹) were observed in white seed coat coloured genotype (DJ6514) at the beginning and at the end of storage period. Hence genotype with black seed coat colour is best in maintaining seed quality parameters and can be stored for longer period of time.

SCREENING OF POTENTIAL ADJUNCT CULTURE AND ITS EFFECT ON VARIOUS PARAMETERS OF GOAT MILK WHITE BRINED CHEESE

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Abstract

White brined cheeses are pure white coloured cheeses prepared from the milk of goat/sheep or their admixture which is dipped under brine during ripening and storage and have prominent acidic and salty taste. Goat milk due to its therapeutic potential has gained limelight since Covid-19. Value addition of goat milk is limited in the country which could benefit the goat farmers. Cheese ripening is a cost intensive process due to maintenance of ripening conditions. Acceleration of cheese ripening via adjunct cultures has always been the first choice for industrialists. *Lactobacillus* is the most dominant species of the group non-starter lactic acid bacteria used for accelerating cheese ripening. This study aimed at in-vitro screening of six *Lactobacillus* single strains (*L. acidophilus*, *L. casei*, *L. delbreukii* subsp. *bulgaricus*, *L. helveticus*, *L. plantarum* and *L. rhamnosus*) for use as adjunct culture in goat milk white brined cheese (GM-WBC). Selection of strains was done based on acidification activity, salt tolerance (3-9%), proteolytic activity, lipolytic activity and compatibility with starter culture. *Lactocaseibacillus casei* and *Lactiplantibacillus plantarum* were selected and incorporated as adjunct cultures in cheese for further investigation. Various physico-chemical characteristics along with other parameters like texture, water activity, instrumental colour, microbial count and sensory parameters were studied for a period of 60 days of ripening at every 15 days interval. Maturation indices like lipolysis and proteolysis were also evaluated via Free Fatty Acids (FFA) and water-soluble nitrogen (WSN) which showed significant ($P<0.05$) increase in GM-WBC(C) sample than others. SDS-PAGE results also showed formation of unknown bands in case of GM-WBC(C) after 15th day of ripening. Textural attributes like hardness also showed significant ($P<0.05$) decrease due to proteolysis. The study suggests that *Lactocaseibacillus casei* showed considerable potential as adjunct culture in goat milk white brined cheeses (GM-WBC) by accelerating ripening period and improving the cheese flavour.

NUTRITIONAL STATUS OF INSTITUTIONALIZED AND NON-INSTITUTIONALIZED ELDERLY: A COMPARATIVE STUDY

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Abstract

Malnutrition is a serious problem and a global issue among the elderly. A good nutritional status will provide elderly's health and reduce mortality and morbidity rate among them. In India, the number of elderly populations were increasing gradually. So, the need for extensive care on this population were also increased. Moreover, under nutrition or protein-energy malnutrition (PEM) becomes more common problems among elderly. However, there is a small information on the health, nutritional status and their social conditions. Therefore, it is an essential key information for caregivers to assess nutritional status of the elderly in order to control problem. The objective of this study was to assess level of nutritional status among institutionalized and non-institutionalized elderly. An exploratory research design was employed. The study sample comprised of 180 elderly from institutionalized and non-institutionalized settings (90 from institutionalized and 90 from non-institutionalized) and Mini Nutritional Status (MNA) scale was used to assess level of nutritional status of the elderly and self-structure questionnaire used to elicit the demographic details of the elderly. The results revealed that, in institutionalized elderly, half of them were females (55.60%) than males (44.40%) while, among non-institutionalized elderly, more than the



half of them were males (54.40%) than females (45.60%). The level of nutritional status among institutionalized and non-institutionalized elderly was found to be non-significant. Nutritional status of both the groups was alarmingly by 38.90 per cent and 25.50 per cent malnourished, 35.60 per cent and 49.00 per cent were at risk of malnutrition in both institutionalized and non-institutionalized elderly. Thus, the nutritionist is to be necessary to monitor and provide the nutritional care and provide a basic nutrition education and give awareness program about the nutritional requirements of the elderly.

FOOD PROCESSING AND VALUE ADDITION IN FRUITS

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Abstract

Food processing industry has a bright future due to demographic environment in India. The food habits, ready-To-cook and ready-To-eat and so life styles have given a new dimension to the food processing industry. This industry is in transformation mode. Food processing combined with marketing has the potential of solving the basic problems of agricultural surpluses, wastages, rural joblessness and better remuneration to the farmers. India's diverse climate ensures availability of all varieties of fresh fruits & vegetables. Usually, the shelf life of perishable fruits lower due to high moisture content and its nature, so value addition is a good answer to preserve fruits. The use of new 'advanced' processing methods being potential in retaining the nutritional as well as all other quality attributes of fruits as such and with additional health values offers interesting growth opportunities for the food industry.

PHENOTYPIC VARIATION IN SOME WALNUT (*JUGLANS REGIA*.) SELECTIONS UNDER DRY LAND CONDITIONS OF KASHMIR

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Abstract

Walnut is an important nut crop of Kashmir. Due to its narrow genetic base it needs introduction of new cultivars. Investigations were carried out on 22 walnut selections to study their nut and kernel characteristics planted at Dryland Agriculture Research Station (DARS), SKUAST-Kashmir. Maximum nut weight (26.82 g) and nut length (44.00 mm) were recorded in DARS 6, however nut breadth was maximum in DARS 6 (32.50 mm). Kernel weight was recorded highest in DARS 12 (9.90 g) with maximum kernel length (34.00 mm) in DARS 19, whereas minimum kernel breadth was registered in DARS 20 (9.66 mm). Maximum kernel ratio (67.03 %) was recorded in DARS 2. Shell hardness varies from hard to soft with color ranging from dark to light.

FRUIT DETECTION AND RECOGNITION FOR AUTOMATIC HARVESTER BASED ON DEEP LEARNING

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Abstract

India's horticulture sector has proven to be more profitable and productive than the agricultural sector and has emerged as a rapidly growing industry, India ranks second in fruits production in the world after China. The Andhra Pradesh produced the largest volume of fruits in India, accounting for 19 million metric tons in financial year 2022. Maharashtra ranked second with



over 12.4 million metric tons that year. The Fruit production is estimated to be 108.34 million tons in the year 2022-23 as compared to 107.51 million tonnes in the year 2021-22. The fruit detection and classification tasks as the determination of the class based on their specific types. In general, current fruit detection and recognition methods based on Deep learning (DL) can be divided into the following areas: methods based on YOLO, SSD, AlexNet, VGGNet, ResNet, Faster R-CNN, FCN, SegNet, and Mask R-CNN. These methods can also be classified into two categories: single-stage fruit detection and recognition methods (YOLO, SSD) based on regression, and two-stage fruit detection and recognition methods (AlexNet, VGGNet, ResNet, Faster R-CNN, FCN, SegNet, and Mask R-CNN) based on candidate regions. Most of the current research work is based on two-stage fruit detection and recognition methods. The Methods based on DL are the mainstream methods for accurate, fast, robust and relatively less affected by environment fruit detection and recognition.

DESIGN AND FABRICATION OF TRACTOR MOUNTED HYDRAULIC MOTOR OPERATED PRUNER

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Abstract

In the India, farmers encounter issues with trimming boundary bushes and unwanted vegetation that obstruct roadsides, railway tracks, and electricity poles. This overgrowth is particularly noticeable after rainfall. When it encroaches onto roadsides, it creates obstacles for machinery, bullocks, and pedestrians. Typically, manual labor is employed for bush trimming, involving hand-operated secateurs, various types of axes, bill hooks, pruning saws, and other manual tools. This manual approach is not only risky but also physically demanding, expensive, and time-consuming. The transmission of mechanical power over extended distances is inefficient and not only cumbersome but also has several disadvantages when compared to hydraulic power. Thus, the hydraulic motor operated bush-cutter/pruner was designed. If the developed machine cannot withstand the substantial forces encountered during bush cutting/pruning operations, it can become ineffective due to plastic deformation or component breakage. Therefore, it is imperative to meticulously design the developed machine to enhance its operational lifespan and reduce farming costs. A Solid Works software was used to create 3D models and simulation of the machine. The key components of the machine include circular blades, a hydraulic vane motor, hydraulic double-acting cylinders, directional control valves, high-pressure flexible hose pipes, a hydraulic pump, and a supporting frame equipped with a 3-point hitch system. The design of the hydrostatic system necessitates the careful selection of components to meet the flow and pressure requirements of the hydraulic circuit. Due to the ease and excellence of the hydraulic transmission, this research is concerned to transmit power from tractor to a hydraulic motor operated bush-cutter/pruner using a hydraulic cycle. The theoretical consideration and the previous results from different studies were used to determine a suitable of a hydraulic motor, which give a sufficient torque needed to cutting different stems. Based on the simulation results optimized design of machine was suggested.

SYNERGISTIC EFFECT OF ENDOPHYTIC BACTERIA AND AGRIUSABLE NANOPARTICLES ON THE GROWTH OF *LINUM USITATISSIMUM*

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Abstract

Today's environment is contaminated due to the excessive use of chemical fertilizers and pesticides, both of which have hazardous impact on the ecosystem. Anthropogenic activities interfered with soil microbiomes. This issue is being addressed using endophytic microbes and nanoparticles. Endophytes enhance the growth of plants and increase crop productivity. Nanoparticles are very small and range between 1 to 100 nanometres in size. Several studies indicate that nanoparticles have significant impact on the plant health. Endophytic bacteria and nanoparticles work together to improve soil and plant growth. The aim of this work was to isolate and identify bacterial endophytes from *Linum usitatissimum*, as well as to check the



endophytic bacteria and Nanozeolite effect on *Linum usitatissimum* growth. Linum plant was inoculated by isolated bacterial endophytes and nanozeolite. Different treatments were administered to the plant individually or in combination. Various plant and soil parameters were checked at different time intervals. These results revealed that both endophytic bacteria and nanozeolites showed positive impact on the Linum plant by enhancing the growth and productivity.

ASSESSMENT OF GENETIC DIVERSITY AMONG TWO STRAINS OF *ALOE VERA* USING MORPHOLOGICAL, BIOCHEMICAL AND MOLECULAR MARKERS

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Abstract

Aloe vera L. Burm. f has been naturalized almost in all parts of India. This plant has been cultivated for its thick flesh from which many medicinal and cosmetic products are prepared. Its leaves have been found to contain over 200 bioactive constituents. The main objective of this study was to assess whether there is variability among two *Aloe vera* strains cultivated in medicinal field of Department of Medicinal and Aromatic plants of Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan so that this study can provide valuable information for successful future breeding programme to introduce new plant germplasm. During morphological investigation of two strains *Aloe vera* the Mean leaf length, width, weight, thickness, spine frequency of Strain 1 were found to be 62.73 cm, 6.89 cm, 447.2 gm, 13.61 mm, 39.53 respectively, while those of Strain 2 of *Aloe vera* were 47.27cm, 4.88cm, 323.6 gm, 17.58 mm, 25.07 respectively. In biochemical analysis Strain 1 mean of total sugar, phenol, protein and aloin content (by HPLC) was 0.223 mg g⁻¹ FW, 0.081 mg g⁻¹ FW, 0.138 mg g⁻¹ FW and 0.014% respectively whereas Strain 2 showed 0.413 mg g⁻¹ FW total sugar, 0.222 mg g⁻¹ FW total phenol, 0.475 mg g⁻¹ FW total protein and 0.134% aloin content. Strain 2 showed 46.00%, 63.51%, 70.94% and 89.55% increased total sugar, phenol, protein and aloin content. Dendrogram based on RAPD data also clearly differentiated two strains by clustering in two different clusters at 0.07 similarity index value. Both the strains of *Aloe vera* showed significant differences for all the parameters. Hence two strains were found to be different and could be named as non Bitter and bitter type.

AMPELOGRAPHIC CHARACTERIZATION OF GRAPE GENOTYPES FROM HIMACHAL PRADESH

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Abstract

For the 1st time, an exhaustive survey for collection, documentation, geotagging and characterization of grape genotypes was conducted in Kinnaur and Solan districts of Himachal Pradesh. The surveys were conducted in the areas spread between 30.840908 to 31.764121 °N (latitudes); 77.062697 to 78.593155 °E (longitudes); and 1188 to 2822 msl (altitudes) to collect 163 grape genotypes. For morphological characterization, 24 OIV descriptors were used to develop an ampelographic database of collected genotypes from Himachal Pradesh. Among them 17 were qualitative descriptors and 7 were quantitative descriptors. The first five axes of the PCA plot explained 56.67% of the total morphological variation in the population. Phylogenetic analysis separated all genotypes into two major clusters A and B having 65 and 98 genotypes, respectively. Both these clusters included genotypes from Kinnaur and Solan districts indicating that, there was no association of genetic diversity with geographic distribution and there might have been exchange of planting material among farmers of these two districts. Biochemical analysis was also conducted in 53 grape genotypes for 9 biochemical parameters. Anthocyanin, phenols and tannins were observed to be more in wild genotypes followed by genotypes having coloured berry skin and flesh. Biochemical evaluations of different genotypes from different elevations indicated low to significant +ve correlations between elevation, TSS, TA, carbohydrates, reducing sugars and phenols.



FICUS RACEMOSA L. : PHYTOCHEMICAL ANALYSIS AND ANTIOXIDANT POTENTIAL

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Abstract

Ficus racemosa L. is a plant of immense medicinal importance. It belongs to family Moraceae and commonly known as Cluster fig or Gular plant. *F. racemosa* leaf and roots were investigated for antioxidant potential and phytochemical constituents. Antioxidant activity of acetone and methanol extracts of plant parts were analyzed using two methods viz., DPPH (2, 2-diphenyl-1-picrylhydrazyl) assay and Reducing Power assay. Phytochemical analysis was done by Qualitative preliminary assay and GC-MS Analysis. Results revealed that methanol extract of both leaf and roots showed better antioxidant potential than acetone extract in both the deployed methods. Qualitative preliminary phytochemical analysis showed the presence of alkaloids, flavonoids, tannins, terpenoids, carbohydrates and proteins. GC-MS chromatogram of methanol extract of leaf and root showed 39 and 37 peaks respectively and acetone extract of leaf and roots of examined plant showed 31 and 20 peaks respectively.

PERFORMANCE OF FOUR ELITE GENOTYPES OF HYBRID NAPIER GRASS IN JHARKHAND

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Abstract

In Jharkhand traditional grazing systems continue to dominate the management of ruminants and cultivation of fodder is not practiced in Jharkhand. But the region have high potential to yield good quality Bajra x Napier hybrid perennial fodder with more tillers and leaves than Napier grass as it is more vigorous and higher in fodder yield and quality suitable for different agro climatic conditions. Hence four genotypes (Kamdheni, CO1, CO5 and IGFRI-10) of Hybrid Napier were evaluated for forage yield performance from 2021 to 2023 of the Subtropical region of Jharkhand. These varieties were cultivated in a 5x10 m area with row to row spacing of 1 m and plant to plant spacing of 50 cm maintained for all varieties. Total weight of each fodder was measured after each cut. Tiller production (number per meter row length) and circumference (m) was measured on each cut of each genotypes. Significant differences ($P < 0.05$) were observed among the genotypes for yield in 2021, 2022 and 2023. The fodder cutting had a significant effect on the character during all the years. Percent increase for fodder production was maximum for IGFRI 10 i.e, 94% on second cut followed by CO1 (72%), Kamdhenu (68%) and CO5 (41%) for the year 2023. Genotypes differed significantly for tiller production and circumference between different cuts during year 2022 and 2023, with maximum tiller production observed for Kamdhenu i.e, 45 and 75 for two years respectively. However the circumference was highest for Kamdhenu for year 2023 i.e, 1.9 m followed by CO5, CO1 and IGFRI 10. Kamdhenu performed better for forage production as it had maximum mean forage yield (74 and 77 kg) for the two consecutive years. As the age progressed, among all Kamdhenu was found to be very good for forage yield production followed by CO1, CO5 and IGFRI-10. Among all genotypes, Kamdhenu showed superiority in production in all cuts. In such cases, it is suggestive that genotype Kamdhenu is adaptive and productive, in a long run would be more resilient and can be cultivated to enhance the fodder production efficiency in areas of Jharkhand.

CLASSIFICATION OF BODY CONDITION SCORES OF DAIRY COWS USING THE SSD MOBILENETV1 MODEL

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Abstract

The body condition score (BCS) is an important tool for management of cows in a dairy farm. It is used to measure the level of subcutaneous fat in dairy cattle, in a scale ranging usually from 1 to 5. Due to the drawbacks of conventional BCS evaluation



approaches, the object detection technique was used to classify the BCS of dairy cows. In recent years, deep learning has grown significantly in the field of computer vision and image classification. Single shot multibox detector (SSD) is one such object detection method based on feed forward convolution network. In this approach, dataset was divided into five categories (BCS 1, 2, 3, 4 and 5) based on BCS scores given by the experts. The cow dataset was labelled using the Labelling tool with the respective class label and it was used to train the SSD MobileNetV1 model. The accuracy of SSD model was assessed using performance measures such as mAP, average precision and average recall at different IoU, scale and number of detections. The mAP of 0.62 was obtained for $AP^{IoU=0.50:0.95}$, which was the average precision across the all images, IoU thresholds and scales. The mAP of 1.0 and 0.79 was obtained for $AP^{IoU=0.50}$ and $AP^{IoU=0.75}$, respectively. Similarly, the mAP for medium and large targets was 0.80 and 0.62, respectively. The AR value of 0.67 was achieved for $AR^{Max=1}$. Similarly, the value of 0.68 was obtained for both $AR^{Max=10}$ and $AR^{Max=100}$ across all images with utmost 10 and 100 detection. The AR of 0.80 and 0.68 was obtained for medium and large target sizes. With a smaller dataset, the SSD model performed well. However, there is further scope to improve the performance of SSD model by enlarging the image dataset.

STUDY ON INHERITANCE PATTERN OF PLANT GROWTH HABIT, FLOWER TYPE AND FLOWER COLOUR IN F₁ HYBRIDS OF CHINA ASTER (*CALLISTEPHUS CHINENSIS* (L.) NEES)

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Abstract

The inheritance pattern of plant growth habit, flower type and flower colour in F₁ hybrids of China aster was estimated from twenty seven F₁ hybrids, which were developed by involving nine lines and three testers in line × tester mating design during the year 2021-23 at Floriculture unit, Department of Horticulture, University of Agricultural Sciences, GKVK, Bengaluru. The twenty seven F₁ hybrids along with parents and standard check (Arka Kamini) were evaluated in RCBD design with two replications for inheritance of plant growth habit, flower type and flower colour. The results revealed that Powder puff flower type was dominant over semi-double type. For plant habit types, spreading type found dominant over semi-erect and erect types. Erect type was recessive among all the plant habit types studied. Inheritance of flower colour leads to a conclusion that; purple colour was dominant over all the other flower colours.

SOIL ORGANIC CARBON SEQUESTRATION TO MITIGATE CLIMATE CHANGE

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Abstract

World agriculture is facing challenges due to land use change, which affects CO₂ emission to the atmosphere and hence, global warming. SOC is the core of all terrestrial life and natural resource conservation. To mitigate global warming, it is critical to increase SOC sequestration and to reduce CO₂ emission to the atmosphere. In the short-term, the active fractions of SOC such as particulate organic carbon (POC), dissolved organic carbon (DOC), microbial biomass carbon (MBC), and permanganate oxidizable carbon (KMnO₄-C), which have 1–5 years of resident time, are the sensitive indicators of land use change and management practices. Due to rapid decomposition, they increase the rate of CO₂ emission to the atmosphere. These pools significantly affect soil functions and processes and thereby, improve soil productivity and health. The slow and passive pools of SOC are used to predict the long-term effects of land use and management practices on soil quality changes. The rate of accumulation of organic carbon in soil is site-specific and depends upon climate, soil properties and plant species. Conversion of degraded lands or barren lands into forests or perennial vegetation can sequester carbon in soil. Many of the studies showed that conservation management practices, such as no-tillage, residue incorporation, manure application, use of cover crops, and integrated nutrient management practices, increase the SOC storage and improve the sustainability of agro-ecosystems



through soil aggregation and protection of SOC from microbial attack. Identification of suitable land use and management practices is of utmost importance to mitigate climate change through increased carbon sequestration in soil.

DRONE TECHNOLOGY IN AGROFORESTRY SYSTEM

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Abstract

The increased pressure on the world natural resources which arises from population growth as well as economic pressure has resulted in unsustainable use of natural resources and environmental instability. The unstable nature of the world climate, attributed to human activities, depletion of forest cover due to increased hunger for forest and non-forest products has caused a lot of environmental problems such as, land erosion, flooding, frequent and severe storm, depletion of soil fertility, natural disaster as well as seasonal changes of world climate: These negative effect on the world ecosystem required a crucial attention. The life and soul of our planet, forest ecosystems, make up for 31% of the world's biodiversity. Being the only elemental source of air for other ecosystems, the sustainability of forests is immensely vital. Ironically, even so, the understanding of the significance and sustainability of forests is heavily impaired. Restoring the vitality of the need for forests today, Drone technology and its wondrous marvels are being employed to create a warrantable and credible environment.

As humans, we tend to incline towards the chase for novelty and change from time to time. Embarking on such a journey has found us the ingenuity and creative culture of drones. Transcending typical norms of technology and automation, drone technology is uplifting this ecosystem of trees and forest cultivation. Although in its neonatal stages, the high flame of UAV innovation is burning ever-so-brightly in the spheres of forestry and forest cultivation. Redefining the elements of forestry, drone technology entails merits towards the progress and advancement of the forest ecosystems. Drones, in this realm, push the boundaries of forest cultivation and maintenance, redeeming wildlife and vegetation, while also monitoring risks to prevent the felling of trees. With the adoption of drones, forestry can witness a high cascade of improvement and growth, like never before.

FARM SUBSIDIES AND MSP IN INDIA

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Abstract

India is an agricultural country and more than 70% of its population relies upon the agricultural sector. Also, this sector has a significant contribution to the Indian economy. Thus the growth of the agricultural sector is quite important for the Indian citizens as well as the Indian Economy. It is one main reason why Govt. of India (GOI) is trying to uplift the agricultural sector in India via direct and indirect subsidies. The intervention of the Indian government toward agricultural development aims to provide farmers with higher income and improve their standard of living. Farm subsidies do not provide a complimentary income to the farmers but also morally uplift them to increase agricultural production. Also, the indirect subsidies in the agricultural sectors create new employment opportunities. Subsidies for crops and fertilizer help farmers increase their crop quality and productivity. Coverage under MSP is given to only certain crops in India like paddy, maize, sugarcane, jowar, bajra, groundnut, and soybean. The government announced a hike of Rs. 100-150 per quintal in MSP for paddy, maize, and sugarcane for the 2022-23 marketing year. To ensure that farmers can get support prices, the government has taken necessary measures by establishing warehouses where farmers can store their produce. According to Ministry of Agriculture and Farmer Welfare, farm subsidies make up around 1.5 - 2% of India's GDP, amounting to 21% of their farmers' income. The fact that the agriculture industry, which accounts for greater than 40% of employment, only contributes 16-17% of GDP highlights the difficulties and issues that farmers must deal with. The government's goal of doubling farmer income by 2022 is therefore achieved with the aid of farm subsidies, which also aid India in achieving double-digit growth by assuring food security.



STRENGTHENING OF E-EXTENSION SERVICES THROUGH E-RESOURCES IN LIVESTOCK SECTOR

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Abstract

Considering the present global developments in Information and Communication Technology (ICT), livestock extension service delivery is fast transforming. The advancement of ICT provides farmers with new opportunities to enhance their knowledge and livelihood. The development of the electronic extension (e-extension) is a result of the use of ICT in extension programmes, information delivery to users, and on the internet network. With a focus on potential ICT applications for the livestock sector, this study was a small attempt to determine how ICT can strengthen the livestock extension services to continue the growth and sustainability of the livestock sector. The main aim of the present study was to develop the e-resources to provide information on different aspects of scientific dairy and poultry farming for timely decision by farmers to avoid economic losses. We developed a variety of e-resources on scientific dairy and poultry farming, including mobile apps, multimedia/videos, and e-literature. Android-based mobile applications are available on the Google Play store, six multimedia/videos are available on YouTube, and e-leaflets, e-folders, and e-pamphlets are available on university and college websites. All links to generated material have been shared via diverse social media platforms. Developed e-resources represent the most convenient, cheapest, and most effective way of information delivery. Developed e-resources is an e-repository on scientific dairy and poultry farming practises in the local language to boost the e-extension system. It will serve as a cradle for fostering awareness and aggregating the adoption of scientific animal husbandry practices throughout the farming community. The application and adoption of the digital repository will result in capacity building among the livestock farming community.

PROCESS TECHNOLOGY FOR PRODUCTION OF BLACK LIME

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Abstract

Black lime are dried citrus fruits, typically acid fruit lime that which are lightly fermented until they take on the appearance of blackish-brown leather and become totally dry and preserved. It has a sweet and tangy flavour with some caramelized notes and are a popular ingredient in several middle eastern culinary traditions. Dehydrated whole lime is a unique product, consumed mainly in the Middle East. However, no reports were available on systematic drying of lime fruit, nor on the changes that occur in its flavour profile so present investigated was undertaken. The acid lime fruits were dried in tray dryer at 70°C for 44 h till the fruits reach the final moisture content of 5-6% (w. b). The fruits retained desired quality and 68-70% of vitamin - C. Black limes packaged in PET pouches (50µ) could be stored up to 6 months at ambient condition without significant changes in the nutritional quality.

MORPHOLOGICAL CHANGES IN PAPAYA (*CARICA PAPAYA* L.) CV. ARKA PRABHATH THROUGH GAMMA IRRADIATION

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Abstract

Nutritionally rich Papaya cv. Arka Prabhath is an advanced generation gynodioecious cultivar developed at ICAR-IIHR,



Bengaluru. Seeds of Arka Prabhath were treated with various doses (0Gy, 50Gy, 100Gy, 150Gy, 250Gy and 500Gy) of Gamma radiation to study its influence on morphological parameters. Arka Prabhath is a gynodioecious line but sex type among mutagenic population was not shown any significant difference; they were segregated for female and hermaphrodite plants. Apart from this there were some abnormalities recorded like sterile hermaphrodite flowers and some pentandria type hermaphrodites. This might be due to mutagens might have targeted some sex related genes leading to variation in sex forms among mutant populations. The leaf type revealed narrow leaved progenies (papaya type) except few shown broad leaf (castor type), some variation with petiole color and erect growth habit. This might be due to mutations some ancestor genes might have up regulated resulting in production of broad castor type leaves. Branching was observed among mutant populations. Extent of branching was ranged from 2-5 to the main stem. Erect growth habit was also observed. Branching is phenomenon which occurs upon induction of stress. In this experiment mutation inducing might have acted like stress inducer in papaya resulting in branched plants. Extent of branching among mutant populations ranged from 2-5 branches per plant. PRSV Disease incidence was recorded by scoring technique. The data on PRSV scoring showed that the most mutant progenies have not shown any tolerance towards PRSV. Even though there were no symptoms after 6 months of planting. For most of the mutant progenies disease score was ranged from 3-5 indicating susceptibility for PRSV. There is a chance of getting resistant or tolerant mutants to PRSV, which was achieved in peppers and tomato for broad spectrum viruses.

EFFECTIVENESS OF IPM STRATEGIES AGAINST BRINJAL SHOOT AND FRUIT BORER, *LEUCINODES ORBONALIS* GUENEE (CRAMBIDAE: LEPIDOPTERA)

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Abstract

Brinjal shoot and fruit borer, *Leucinodes orbonalis* is a destructive insect-pest that causes considerable damage to brinjal crop. Severe damage is mainly caused to the developing fruits as the larvae tunnel inside the fruits. A single larva can damage nearly 4-6 fruits during its life cycle. Insecticides are predominantly used to manage this insect-pest and this sole reliance on insecticides has led to the development of insecticide resistance, residual toxicity and also increasing the cost of cultivation. So, IPM is one such strategy that helps to overcome these negative impacts. Hence, field experiments were carried out during Kharif 2021-22 at KSNUAHS, Shivamogga to evaluate the efficacy of IPM module against *L. orbonalis* in brinjal. IPM module followed scheduled based application of different treatments comprised of installation of wota-T water traps (pheromone based), cultural practices like removal and destruction of infested plant parts, scheduled based application of neem-based, *Bt* based and novel insecticide compounds. The data on per cent shoot and fruit damage by *L. orbonalis* was recorded five weeks after transplanting at weekly intervals. The observations revealed that IPM module recorded lower shoot damage by *L. orbonalis* (4.32 %) compared to bio-intensive module (7.20 %) and untreated control (9.32 %). IPM module also recorded the highest reduction in shoot infestation (54.86 %) when compared to untreated control. With respect to percent fruit damage again the lowest fruit infestation was recorded in IPM module (15.16 %) followed by bio-intensive module (20.89 %). The maximum reduction in the fruit damage over control was recorded in IPM module (46.40 %). Apart from recording lower shoot and fruit damage, IPM module recorded fruit yield of 18.08 t/ha with higher cost: benefit ratio (1: 2.43) confirming its effectiveness as a suitable management strategy.

PEG-INDUCED DROUGHT STRESS ON CHICKPEA GERMINATION AND SEEDLING GROWTH PARAMETERS

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Abstract

Chickpea (*Cicer arietinum* L.) is an important pulse crop grown in tropical, subtropical and temperate regions of the world.



Chickpea productivity is highly affected by abiotic stresses, of which drought plays the most crucial role in terms of growth inhibition and yield losses. Therefore, development of drought tolerance genotypes is most prerequisite. in-vitro screening is an important approach for selection of drought tolerance genotype where stress is created by use of osmotic solutions, among which polyethylene glycol (PEG) has proven most important role in inducing drought stress. An experiment was conducted in seed unit, UAS, Dharwad during 2021-22 to estimate the stress response among twenty seven chickpea genotypes. seeds were sown in germination paper and drought stress was induced by PEG-6000 (M.W. 6000) at different stress levels 5% (-0.05 MPa) 10 % (-0.148 MPa), 15% (-0.295 MPa), 20% (-0.491 MPa) and 25% (-0.735 MPa) along with Control (0%). Seed germination and seedling growth parameters were recorded. The results revealed that the highest germination percentage was observed in control and no germination observed in 25% PEG treatment. Highest germination percentage was recorded in DIBG 205 and germination declined with higher PEG concentration. Root length is correlated to stress tolerance and highest root length was observed at 10 % PEG treatment and decreased with increase in PEG concentration. ICCV 4958 has recorded highest root length at 10% PEG. Drought significantly affected germination as well as all other associated traits with the effects of stress being analogous to the stress level applied. Seedling vigour index is a suitable selection criterion for drought tolerance. Higher seedling vigour index was observed DIBG 205, ICCV 4958, NBeG 506, DBGV 206 showing increased drought tolerance at high stress level. Possible exploitation as valuable genetic material for breeding programs.

INVESTIGATING THE INSECTICIDAL ACTIVITY OF *DIOSCOREA BULBIFERA* LECTIN AGAINST *BACILLUS THURINGIENSIS* TOXIN-RESISTANT PINK BOLLWORMS.

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Abstract

Pink bollworm (PBW), *Pectinophora gossypiella*, is a main pest of cotton. The transgenic *Bacillus thuringiensis* (Bt) cotton was introduced to control the PBW infestation in three major cotton-growing countries, India, the United States, and China. In India, non-compliance with the refuge mandate resulted in rapid field-evolved resistance of PBW populations to Bt cotton plants. Unlike India, the United States and China have seen little or no evolution of resistance of PBW to Bt cotton plants. PBW populations have gained resistance to both Bollgard I and Bollgard II in India, hence, there is a pressing need to develop novel approaches to control Bt-resistant PBW populations. In this regard, mannose-binding lectins are gaining importance for their promising insecticidal activity towards various orders of insect species. Recently, a novel mannose-binding lectin was purified from bulbils of *Dioscorea bulbifera* (DBL) which has a high binding affinity for glycans which are present in gut epithelial cells of insects like trimannosyl pentasaccharide (G# 51), trimannosyl pentasaccharide core with terminal mannose residue at the non-reducing end (G#216) and core fucosylated structures (G#483). However, the insecticidal activity of DBL has not been explored. Therefore, we hypothesize that DBL would possess insecticidal activity against PBW and other economically important insect pests by considering its affinity for glycans expressed in the insect gut. Hence, we propose to investigate the insecticidal properties of DBL against Bt toxin-resistant pink bollworm populations. The proposed work helps in the identification of plant-based biomolecules for the management of Bt-resistant PBWs.

MANGROVE BIOACTIVE COMPONENTS AND THEIR EFFECT ON MYCOBACTERIOSIS AND VIBRIOSIS IN FISH AND SHRIMP

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Abstract

Global aquaculture sector is regularly affected by infectious diseases. For fish and shrimp, *Mycobacteria* spp. and *Vibrio* Spp. are the most pathogenic bacteria. They cause Mycobacteriosis, popularly known as “Fish Tuberculosis” and Vibriosis. This results in mass death. For prevention of such diseases, farmers have been using antibiotics rampantly. This has resulted in an emergence of multi-drug resistant *Mycobacterium* spp. and *Vibrio* spp. Multi-drug resistant bacteria are a serious threat to human beings and to the environment in general, because of the horizontal gene transfer of multi-drug resistant genes. In this



situation, searching for new safe drugs becomes increasingly important. Mangrove plants are the richest source of bioactive compounds. These are distributed in intertidal regions. They are well known for their unique habitat and vegetation. They are halophytic in nature, i.e., they can tolerate low oxygen levels. Approximately, seventy true mangrove species are present around the world. Among them thirty four species are present in the Indian Sundarbans biosphere reserve. These include plants such as *Aegiceras corniculatum*, *Avicennia* spp. *Rhizophora mucronata* and *Excoecaria agallocha*. These plants are rich in phenolic compounds like alkaloids, tannins, glycosides and some other secondary metabolites such as saponins and terpenoids. These compounds act as active phytochemicals having antibacterial effect and can inhibit multi-drug resistant *Mycobacterium* sp, *Vibrio harveyi* and *Vibrio campbelli*. This work reviews some valuable medicinal plants and their effect against *Mycobacterium* spp. and *Vibrio* spp. The rampant use of antibiotics has resulted in a rise in antimicrobial resistance (AMR) in pathogens. This hampers sustainability goals. The use of mangrove plants and their parts during the fortification of shrimp feed in the brackishwater aquaculture system, may serve as a safe, sustainable and economic alternative to the use of antibiotics.

EVALUATION OF GENETICALLY IMPROVED FARMED TILAPIA (GIFT) IN SHORT SEASONAL PONDS OF SEMI-ARID AREA

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Abstract

Good candidate species for inland aquaculture commonly called as Aquatic chicken (Nile tilapia) were released in earthen pond, stocking initial size were 3cm in length and 8-10g in weight. By giving the hostel waste as food for the experimental fish we could see the good growth rate of 800-900g. Stocking density was 1000 numbers and a survival rate is 65%. Seeds were procured from ZAHRS, Mudigere. The experiment was carried out at MARS, Raichur of UASR for a period of eight months.

EVALUATION OF BOTANICALS WITH INSECTICIDES FOR SUSTAINABLE RICE PRODUCTION IN TBP COMMAND AREA

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Abstract

Botanicals can play a significant role in pest management that is environmentally friendly and alternative to synthetic chemical pesticides. They are environmentally friendly, cost-effective, and biodegradable. Their greatest strength is their target specificity, as most botanicals are harmless and non-pathogenic to humans as well. The field experiment was conducted at ARS, Gangavathi during Kharif 2022 to evaluate the evaluate performance of various treatments having combinations of commercially available neem formulation, effective plant oils along with recommended insecticides against major insect pests of rice and consequent impact on natural enemies and grain yield. Hence, it was felt necessary to identify the effective combination and strategically integrate use of botanicals for ideal rice IPM. The trial consisting four combination treatments consisting of three insecticides Chlorantraniliprole 18.5 SC, Cartap hydrochloride 50% SC and Triflumezopyrim 20% SC, one commercial neem formulation - Neemazal and two oils - Neem and Eucalyptus oil procured from local market were compared along with untreated control (only water spray).

All botanical-insecticide treatment combinations were shown to be effective in reducing the incidence of paddy gall midge, YSB, LF, BPH, and WBPH. The combination of Neemazal, neem oil, and triflumezopyrim treatment was proven to be



effective against all pests. There was no significant difference in natural enemy (mirid bug, spider, and coccinellid) populations across treatments, indicating that the combination of insecticides and botanicals is safe for beneficial species. Among various treatments, all insecticides treatment recorded highest yield of 9600 kg/ha followed by treatment with applications of neemazal, neem oil and triflumezopyrim showing yield of 8000 kg/ha which was higher than compared to untreated control. Botanical pesticides attack only target insects, are not detrimental to beneficial natural enemies, and provide residue-free food and a safe environment. As a result, we recommend using botanical pesticides as part of an integrated insect management approach.

AN IMPROVED MODEL-BASED NORMALIZATION APPROACH FOR ADDRESSING HETEROGENEITY IN LC-MS PROTEOMICS EXPRESSION DATA

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Abstract

With the introduction of high-performance liquid chromatography coupled with mass spectrometry, the proteomics data are being generated from collected samples. However, despite the development of advance LC-MS technologies, the proteomics data obtained are susceptible to systematic biases. The heterogeneity in LC-MS proteomics data can be problematic for accurate analysis and modelling. The heterogeneity may arise due to biological and/ or technical reasons. We have to take into account the biases arising due to heterogeneity that can be resolved by normalization process. Normalization aims to make the samples more comparable and more accurate downstream analysis. We have developed an improved approach for normalization of proteomics expression data which is based on a model-based normalization method “RobNorm”. In this method, density-power-weight method has been used to down-weight outliers. One-dimensional robust fitting method has been extended to the proteomics data to robustly correct the systematic bias. However, there were certain limitations in the existing method which we have attempted to overcome. We have applied group wise normalization to preserve the biological variability in proteins across the groups. Further, we have devised an approach based on outlier detection which chooses the exponent of the weighted density for each protein. The performance of the developed normalization approach was compared with the existing methods, and it was found that the proposed method has shown some improvements over the existing methods.

MOLECULAR CHARACTERIZATION OF *PSEUDOMONAS* FLUORESCENS ISOLATED FROM TOMATO PLANT AND ITS INFLUENCE ON GROWTH AND NUTRIENT UPTAKE OF TOMATO

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Abstract

Pseudomonas fluorescens is an endophytic, Gram-negative, rod shaped, bacterium which was isolated from stem of tomato using nutrient agar medium. The genomic DNA was isolated and amplified using 16S rRNA specific primers further amplified product was sequenced by Eurofins Genomics India pvt.ltd. Phylogenetic and Blast analysis of the sequenced 16S rDNA gene homology revealed that the endophytic isolate ESK-6 belonged to the genus pseudomonas with 81.88 per cent of similarity with *Pseudomonas fluorescens* MN099290.1. The efficient endophytic bacteria of *Pseudomonas fluorescens* showed significant increase in plant height, number branches, number of leaves, shoot dry weight and root dry weight per plant as compared to uninoculated control. Inoculation of bacterial endophytes on nutrient uptake was positively influenced on all the inoculated treatments. Whereas, highest nitrogen (77.12 kg/ha), phosphorus (9.65 kg/ha) and potassium (68.13 kg/ha) was observed in the isolate ESR-6 as compared to treatment which received recommended dose of fertilizer (RDF) and uninoculated control. This study concluded that using endophytic bacterial isolates for plant growth promotion and nutrient uptake can be bio prospective, which could be an ideal technique for enhancing growth and nutrient uptake of crops.



FACTORS INFLUENCING UTILIZATION OF POSTNATAL CARE SERVICES AMONG POSTPARTUM MOTHERS OF VIJAYANAGARA DISTRICT, KARNATAKA

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Abstract

India has made tremendous progress in reducing MMR by 92 per cent since 2020, but still efforts are required to achieve the new SDG target. Vijayanagara district of Karnataka is a district of Kalyan Karnataka with poor maternal and infant health practices according to National family health survey V report. Hence the present study was conducted with the objective to assess the utilization of post-natal services (PNC) and study the factors influencing utilization of postnatal care services. A community based cross sectional study was conducted in the year 2021-23 in Vijayanagar district on a sample of 810 mothers within 3 months of delivery. Pre-tested questionnaire was used to elicit the information on utilization of postnatal care services and demographic information. SES scale by Agarwala *et al.* 2005 was used. Data was analyzed using SPSS package Version 26. Results revealed that the overall prevalence of utilization of postnatal care services was 32.46 per cent out of 810 mothers. Mothers between 29 to 32 years had utilized postnatal care services, mothers from middle SES (46.50 %) group, who had ANC attendance, who had knowledge on PNC services (36.30 %) were utilized all the recommended PNC services. Socioeconomic status, age of mother, number of ANC visits and knowledge on postnatal care services were found to be significant factors affecting postnatal care services utilization. The study revealed low level of utilization of postnatal care services among mother (32.46 %). This emphasizes the need to educate pregnant and lactating mothers regarding the importance of PNC services.

ISOLATION, CHARACTERIZATION AND IDENTIFICATION OF NATIVE BIO-AGENTS AGAINST FUSARIUM WILT OF CHICKPEA

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Abstract

The native bio-agent isolates were collected from the rhizosphere soils of pulse crops viz., chickpea, pigeonpea, greengram and cowpea in northern Karnataka. Seven fungal bio-agent and 12 bacterial bio-agent isolates were isolated from these rhizosphere soil samples by following serial dilution technique on rose bengal agar medium and nutrient agar medium respectively. Morphological characterization of fungal bio-agents revealed that the colony colour varied from light green to dark green. The conidial size varied from 1.90 to 5.10 μ m. Biochemical tests of bacterial bio-agents showed positive result for gelatin liquefaction test for all the isolates. Five isolates were positive for starch hydrolysis test and most of the isolates were gram positive bacteria. Molecular characterization of the bio-agents confirmed the presence of one *Trichoderma asperellum*, four *Trichoderma harzianum*, one *Bacillus cereus*, two *Bacillus subtilis*, one *Paenibacillus lautus* and one *Stutzerimonas stutzeri* species. *In vitro* evaluation of fungal and bacterial bio-agents against chickpea wilt, revealed that, maximum growth inhibition of *Fusarium oxysporum* f. sp. *ciceri* was observed in *Trichoderma asperellum* (Tr-4) (82.59%) and *Bacillus subtilis* (Ba-9) (77.77%).

EVALUATION OF EFFICACY OF NEWER MOLECULES AGAINST PEA POD BORER

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Abstract

Field trial were conducted during 2021-22 and 2022-23 at Regional Horticultural Research and Extension Centre, Dharwad,



Karnataka to study the bio-efficacy of a new green insecticide molecule Chlorantraniliprole 18.50 % SC @ 0.2ml/l against major pod borer pest of peas. Among the treatments, Chlorantraniliprole 18.50 % SC @ 0.2ml/l and Flubendiamide 480 SC @ 0.2ml/l were highly effective in controlling pod borer by registering lowest mean larval numbers (1.35 and 2.17, respectively) at 15 days after spray with highest per reduction in per cent pod damage over control (76.57 and 68.50, respectively). Further because of lower pest load which led to lesser pod damage and culminated in higher mean pod yield (6.85 t/ha). Overall, chemical control by Chlorantraniliprole 18.50 % SC @ 0.2ml/l was most effective against peas pod borer. The study revealed that highest cost: benefit ratio of 3.21 was obtained and was most effective in reducing pest population.

HERB DIVERSITY IN PATIA RESERVE FOREST (NORTHERN TROPICAL DECIDUOUS) OF KHURDA FOREST DIVISION, ODISHA

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Abstract

The present study was undertaken in Patia reserve forest of Khurda forest division in coastal zone of Odisha. Herbal layer vegetation diversity was studied in three seasons namely summer, rainy and winter season. For this purpose quadrat sampling of 1m² was laid out in the forest to enumerate herbal density, frequency, prove nance value and diversity index in three seasons. A total of seventeen herb species was found in the summer season. The total density was 24.2 ind.m⁻² and the maximum PV of 43.06 was found in *Desmodium heterocaron*. A total of thirty nine herb species were found in the rainy season in the study area. The total herbaceous density was 57.80 ind. m⁻² and the maximum PV of 31.36 was recorded for *Dactyloctenium aegyptiacum*. A total of twenty three herb species were found in rainy season and the density was 31.9 ind.m⁻². The maximum PV of 38.99 was recorded for *Dactyloctenium aegyptiacum*. The species diversity of herbs for summer, rainy and winter season was 2.16, 2.94 and 2.5 respectively.

ENHANCING PRODUCTIVITY OF MUSTARD THROUGH SENSOR BASED PRECISE NITROGEN MANAGEMENT

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ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur (Rajasthan)-321 303, India

Abstract

A field experiment was conducted at ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur during *rabi* season of 2021-22 with the objective: optimizing N use to achieve high fertilizer N use efficiency with sustainable crop productivity in Indian mustard (*Brassica juncea* L.). The experiment was comprised of ten treatments (different N management options) laid out in randomized block design with three replications. The results revealed that N application using GreenSeeker hand held crop sensor had maximum number of silique per plant, length of silique, SPAD-chlorophyll reading, primary and secondary branches per plant, seed/pod and test weight which attributed to higher seed yield and profitability. The percent increase in seed yield was 19.31 and 64.47% higher over RDF and control which was at par with T₁ and T₂ and benefit-cost ratio was increased by 30.15 and 86.36%, respectively. Foliar spray of N through different nitrogen sources had significant effect on growth and yield parameters. Among N foliar spray treatments, application of 2% NCU was found superior over urea and KNO₃ @ 2.0 & 1.5% each. Higher SPAD reading (42.0) was observed under treatment where, N applied based on GreenSeeker due to improved synchronization between demand and supply of N to the plant.

EFFECT OF VARIOUS MODULES ON INFESTATION OF SHOOT & FRUIT BORER (*E.VITTELLA*) AT EARLY GROWTH PERIOD IN OKRA DURING SUMMER 2014-15 AND KHARIF 2015-16

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AICRP on PHET, Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola

Abstract

The experiment was conducted on the field of Department of Chilli and Vegetable Research Unit, Dr. PDKV, Akola,



Maharashtra during the Summer and *kharif* season of 2014-15 and 2015-16. Okra or Lady's finger (*Abelmoschus esculentu* (L.) Monech) is one of the favourable vegetable crops of India. It is well known for its high nutritive value and medicinal use. The treatments consisting of eight module in which, seed treatment, soil application YST, foliar spraying started from 15 days after sowing were undertaken as per schedule so as to protect crop from sucking pests and fruit borer. The minimum infestation of shoot borer was recorded in the treatment module M6 (2.54 %), followed by M4 (2.89 %) and these two treatments were statistically at par with one another. Of these, module M6 was significantly superior over all the treatment except treatment M4. It is clear above pooled result that the treatment module M6 was found significantly superior over all other modules and statistically at par with module M4 (2.89%) in minimizing shoot borer infestation to the extent of 2.54 % . Module M6 and M4 were found most effective in reducing the shoot borer *E.vittella* infestation due to cumulative effect of seed treatment imidacloprid 48FS @9ml/Kg and soil application of neem cake @250kg/ha in module M6 and foliar application of triazophos @ 2ml/L in module M4. The highest yield (80.01 q/ha) and highest net monetary returns was obtained in module M6 (Rs.1,32,492/ha).

INTEGRATED NUTRIENT MANAGEMENT FOR BETTER ENVIRONMENT AND BIODIVERSITY: EVIDENCES FROM LONG TERM FERTILIZER EXPERIMENTS

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Abstract

The Permanent Manurial Trials- (tall and dwarf) and the All India Co-ordinated Project on Long term fertilizer experiment have been laid out at Regional Agricultural Research Station, Pattambi with the main objective of studying the effect of continuous application of plant nutrients (NPK) in organic and inorganic forms and in combinations on sustainable production in the rice-rice cropping sequence. The PMT consists of 8 treatments while the LTFE consists of 12 treatments.

In PMT, the organic nutrient management (T_1) wherein whole of the mineral N was applied as cattle manure and Integrated Nutrient Management (INM) practice(T_5) where 50 per cent N was substituted by cattle manure were equally superior in growth and productivity to other treatments. INM Treatment T_5 (45 kg N ha⁻¹ as cattle manure + N:P₂O₅:K₂O 45:45:45 kg ha⁻¹) was found to be significantly superior with respect to the soil biological properties indicating the positive role of fertilizers on improving biological attributes of the soil. The incorporation of carbon into the soil was at higher rate under INM in comparison to sole application of organic manures. In LTFE with 25 years history, the carbon sequestration pattern, different pools of carbon and metagenomic analysis indicated the positive role of fertilizers in sequestering carbon to the soil and INM in supporting higher productivity. An incubation study conducted at four different temperature regimes (15, 25, 35 and 45°C) using the soil collected from the plots of LTFE as well as PMT indicated the thermal stability of carbon formed under INM in comparison to that formed under sole application of organic manures. The results of the study fortifies INM as a stable practice for biological health of soil, sequestration of soil organic carbon and higher crop productivity in the context of rising temperature scenario.

COMBINIG ABILITY ANALYSIS IN LATHYRUS

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Abstract

The present study involved the evaluation of twenty-one F_1 crosses derived from a line x tester analysis, employing three testers and seven lines. The objective was to assess the general and specific combining abilities of the parents and crosses, respectively, while identifying superior combiner parents and crosses for subsequent generations. Multiple agronomic traits were assessed for each cross in a randomized complete block design with three replications. Analysis of variance revealed significant mean squares attributed to lines, testers, and their interactions for most traits. Both general and specific combining abilities played crucial roles across the evaluated traits. NLK-06, NLK-17 and Prateek emerged as promising general combiner parents, while crosses NLK-06 x Ratan, NLK-17 x NLK-40, and NLK-17 x Prateek exhibited notable performance



in terms of yield and pod production. Selection criteria were based on combining ability and the potential of crosses for subsequent generations, prioritizing high mean performance, substantial general combining ability, and negative specific combining effects. Notably, NLK-06 x Prateek and NLK-17 x Ratan were identified as promising crosses for further investigation, offering a pathway to explore additive genetic variance through a simplified selection approach.

PERFORMANCE AND EVALUATION OF CHILLI STALK REMOVER

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Abstract

Preliminary Study on Performance and Evaluation of Chilli Stalk Remover deals with the removing of stalk from the sun dried chillies. Different varieties of chilli like Byadgi and Guntur were selected for this purpose. Various parameters like moisture content, ash content, color was estimated by proximate analysis. Other readings of speed of drum by tachometer were noted and pulley drive through which the machine runs was observed. Finally the efficiency was calculated and time required to remove the required quantity was measured. Three trials were conducted of removing stalk from two varieties of chilli and calculated. Speed of drum by was calculated tachometer and the weight of chilli with and without stalk together with the weight of chilli seeds obtained were noted while operating the machine. This machine is usually designed in such a way that the chilli stalks should be caught in the holes on the periphery of the drum and removed by the impact action if screw conveyor present inside the drum.

IDENTIFICATION OF FERTILITY RESTORER LINES WITH GOOD COMBINING ABILITY IN NEWLY DERIVED INBRED LINES OF SUNFLOWER (*HELIANTHUS ANNUUS* L.)

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Abstract

Sunflower (*Helianthus annuus* L.) is an important oilseed crop and being a highly cross-pollinated crop ideally suited for exploitation of heterosis. The present investigation was undertaken to study and identify combining ability of restorer lines in newly developed inbred lines of sunflower. Three stable CMS lines were crossed with 43 inbred lines in L X T design and resultant 129 hybrids were evaluated for pollen fertility and sterility. Out of 43 inbred lines studied, 22 inbred lines restored the fertility in all the F1's across three CMS lines. Whereas, one inbred line *i.e.*, EC198101 exhibited complete sterility across all three CMS lines. The 22 fertility restorer lines, so identified could be directly used as male parent in heterosis breeding programme for the development of superior hybrids. Analysis of combining ability revealed that, one of the female parents CMS 38A exhibited significant gca effects for more than one characters namely seed yield/plant, oil content, head diameter, 100 seed weight, volume weight, plant height and chlorophyll content in the desirable direction and can be used for development of sunflower hybrids. Among the testers the parents PM- 36 is the best general combiners for maximum traits *viz.*, days to 50 per cent flowering, days to maturity, plant height, head diameter, test weight, seed yield/plant, oil content and chlorophyll content and having multiple heads which ensures abundant and prolonged pollen supply during seed production.

ETHNOMEDICINAL PLANTS USED BY TRADITIONAL PRACTITIONERS FOR HUMAN AILMENTS IN SIRSI AND HULEKAL FOREST RANGES OF KARNATAKA STATE

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Abstract

Uttara Kannada district is one of the rich biodiversity areas in Karnataka state and is also known for its richest treasure of



medicinal plants. Presence of rich cultural heritage and enriched indigenous medicinal knowledge among local communities made this a hub of ethnomedicinal knowledge. A documentation study to record the use of ethnomedicinal plants was conducted in Hulekal and Sirsi range (Koppa section) of Uttara Kannada district. Traditional practitioners were interviewed to document the use ethnomedicinal knowledge for the treatment of human disorders. The study documented the use of total 65 different plants species belonging to 37 families used by the practitioners for the treatment. Traditional practitioners claimed the treatment for a variety of human ailments viz., cough, diabetes, dysentery, fever, liver problems, piles, menstrual disorders, night blindness, piles, venomous insect and snakebites, and thyroid problem etc. Traditional practitioners practice it as a social service to the community and they follow religious practices and rituals during the medicinal plants collection and prescription of the drugs. These ethnomedicinal plants act as a primary source for drug development so there is a need for further detailed scientific investigation. A proper documentation of ethnomedicine is a prime requirement to preserve the ancient knowledge and further use. Continuous awareness is required on the proper usage of medicinal plants to keep up the human health at least in primary health care. Even proper rules and regulation is a prerequisite for the practice and conservation of traditional medicine.

GRAIN PROCESSING IN GENERAL AND RICE TECHNOLOGY IN SPECIFIC

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Abstract

Production of cereals in World is around 2813 million tonnes (MT) and India produces around 330.5 MT as on 2023. 750 MT of paddy rice is produced in World and India produces around 160 MT. From this, ~10% (16 MT) goes for the production of rice products like rice flakes, expanded rice and popped rice which are generally prepared or manufactured in small scale industries. Around 75 MT produced is used for production of raw rice and balance (75 MT) is used for the production of parboiled rice. World rice have been classified into 8 groups based on some of their physico-chemical properties like amylose content, gelatinization temp., alkali score, pasting behavior or viscographic parameters, cooking behavior etc. Importance of brown rice along with manufacturing large scale brown rice as well as nutri rice will be highlighted. Importance of Tiny rice mill will also be informed. Parboiling, a method of improving the technological and nutritive values of rice will also be highlighted. Medicinal rice Njawara, a pigmented variety, having high nutrients compared to other normal pigmented and non-pigmented rice varieties, its various physicochemical properties, protein and lipid profile in comparison with non-medicinal rice will be touched upon. Phytochemicals in rice bran will also be focused briefly. Preparation of pre-gelatinized starches will be informed. Usage of cereals, millets, legumes in the preparation of multi grain ready to cook (RTC) and ready to eat (RTE) products will also be touched upon. Making dhal from whole pulses and their technologies which are generally followed all over the world, in some parts of Asia will also be focused upon. Millet technology in brief, maize grits manufacture and products from maize, in addition manufacture of starch from tapioca, which is generally used for the manufacture of Sago will also be touched upon.

COMPARISON OF COST ECONOMICS IN GRANULE UREA VS NANO-UREA APPLIED IN RICE

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Abstract

A field experiment was conducted at the ICAR-National Rice Research Institute-Regional Rainfed Lowland Rice Research Station (ICAR-NRRI-RRLRRS), Gerua, Assam, located at 26.25o N Latitude and 91.56o E Longitude, aiming to establish a comparative analysis between granule urea and nano-urea during the *kharif* seasons of 2022–23 and 2023–24. The primary objective was to assess the performance of nano-urea in reducing the energy consumption and global warming potential of rice cultivation in the rainfed environment of Assam. The experimental design employed a Randomized Block Design (RBD) with seven nitrogen treatments, incorporating phosphorus and potassium applications as per state recommendations. The nitrogen



treatments (T₁ to T₇) included various combination of soil application of neem-coated urea (NCU) and foliar application of nano-urea at different growth stages {basal (NCU only), active tillering, maximum tillering, panicle initiation, heading stages}. The nano-urea spray solutions were prepared based on different doses: 2 ml/liter and 4 ml/liter. The experiment demonstrated that, for a 2 ml/liter dose, 700 ml of nano-urea in 350 liters of water was required for foliar application on rice in 1 hectare area, while a 4 ml/liter dose required 1400 ml of nano-urea in 350 liters of water for the same area in three replicates. During the *Sali* seasons of 2022–23 and 2023–24, significant differences in the production costs among the treatments were observed. T₃: 20 kg N each through NCU applied as basal and at active tillering exhibited the highest net return (INR 79567/ha), followed by two sprays of 2 ml nano-urea/liter at maximum tillering and panicle initiation. T₄, receiving 20 kg N each through NCU, applied as basal and at active tillering, followed by one spray of nano-urea/liter at 4 ml/liter at panicle initiation, closely followed with a net return of 74,924 Rs/ha. In contrast, T₁ (Control) recorded the lowest net return (INR 49,952 /ha), followed by T₅ (INR 68,519/ha). T₆ (INR 53,459/ha) and T₇ (INR 64035 /ha) had statistically similar yields, both significantly lower than T₃. The study emphasized that T₃ achieved the highest grain yield (6.32 t/ha) in rice cultivation, resulting in the highest net profit of INR 79,567 per hectare. However, for comprehensive validation, these findings warrant further evaluation under extended experimental durations and diverse seasonal and site conditions.

JASMONIC ACID MEDIATED MANAGEMENT OF NECROTROPHIC PATHOGEN ALTERNARIA LEAF SPOT IN SOYBEAN

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Dr. PDKV, Akola, Maharashtra

Abstract

The Field trial was conducted during Kharif season for two consecutive years (July–October 2020 and 2021) at three different locations namely; Amravati, Yavatmal and Katol under Dr. Panjabrao Deshmukh Krishi Vidyapeeth., Akola, Maharashtra, India. The nine treatments were designed in randomized block design replicated thrice to determine the potential use of an elicitor for Alternaria leaf spot management compared with standard fungicide. The treatments include two foliar sprays of either abiotic elicitors alone namely Salicylic acid (SA) @ 100 ppm, Benzoic acid @ 100 ppm, Humic acid @ 1%, Jasmonic acid @ 100 ppm, Potassium nitrate (KNO₃) @ 1% or biotic elicitors Trichoderma viride @ 1%, Pseudomonas fluorescens @ 1% alone or recommended fungicide Propiconazole 0.1% alone at crop flower initiation stage and at 60 days after sowing. Field trials results shows the Propiconazole 0.1% significantly superior in management of disease upto 44.72 % followed by Jasmonic acid @ 100 ppm in controlling the disease upto 40.01 % and was found at par with propiconazole 0.1% in respect to percent disease index, percent disease control and seed yield. Highest percent disease index and least percent disease control and yield recorded in control. Elicitor Jasmonic acids induce protective, therapeutic treatments reduced the severity of disease advocated suppressing necrotrophs pathogen Alternaria alternata, the eco-friendly alternatives to fungicides.

EVALUATION OF SUITABLE CROP UNDER LIMITED IRRIGATION CONDITION FOR RABI SEASON

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Abstract

A field experiment was conducted at Agriculture Research Station, Achalpur during the year 2021-22 with objective to find out suitable *rabi* crop under limited irrigation water availability under Vidharbha condition. Geographically experimental location is located at 21°18' N, 77°30' to 77°35' E with 375 meter altitude. Total 968.3 mm rainfall received in 54 rainy days, experiment was conducted in split plot design with three replications. Treatments include Main plot I₁ – No Irrigation, I₂ – One Irrigation (40-45 DAS) and I₃ – Two Irrigation (20-25 and 60-65 DAS) with sub plot, C₁ – Wheat – Cv. Phule Samadhan, C₂ – Safflower – Cv. SSF – 708, C₃ – Sorghum – Phule Suchitra and C₄ – Gram – Phule Vikram. Treatment I₃. Irrigation at 20-25 and 60-65 DAS is significantly superior over I₁ and I₂ treatment, which recorded highest grain yield plant⁻¹ (7.62 g), grain yield (16.86 q ha⁻¹) and wheat equivalent yield (29.76 q ha⁻¹), except in case of treatment I₂. Treatment C₂ – Safflower crop recorded significantly higher grain yield plant⁻¹ (8.04 g), which was at par with treatment C₃. Treatment C₁ growing of wheat recorded highest grain yield (17.85 q ha⁻¹), which was significantly superior over rest of the treatment. Treatment C₄ growing



of gram crop recorded highest wheat equivalent grain yield (36.53 q ha^{-1}), which was significantly superior over rest of the treatment. Treatment I_3 . Irrigation at 20-25 and 60-65 DAS with C_2 - safflower is significantly superior over other treatment combinations (10.02 g) with respect to grain yield plant⁻¹. However, it was at par with treatment I_2C_3 (10.02 g) and I_3C_3 (10.02 g). Treatment I_3 . Irrigation at 20-25 and 60-65 DAS with C_1 - wheat is significantly superior over other treatment combinations (25.31 q ha^{-1}) with respect to grain yield. Application of two irrigation (20-25 and 60-65 DAS) and chickpea crop recorded highest wheat equivalent grain yield 29.76 and 36.53 q ha^{-1} with benefit: cost ratio (2.98).

LITTERFALL OF MULTIPURPOSE TREES AND FOREST ECOSYSTEM

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Abstract

Litterfall is a major pathway linking the plant components to the soil in an ecosystem through organic matter decomposition cycle. It acts as input-output system and as temporary sink for nutrients. Because of this important role in nutrient fluxes, factors influencing litter formation and decomposition have important implication for long term productivity of ecosystem. Environmental factors, floristic composition, stand age, tree management and stocking levels cause variation in quality and quantity of litter. They in turn alter decay and nutrient turnover rates. Thus, the return of plant nutrients to the soil and subsequent recycling via plant uptake can be manipulated by choice of species. Multipurpose trees with varying litter quality differ widely in their nutrient uptake, storage and recycling patterns. It is, therefore, essential to have a clear understanding of the tree species impacts on various aspects of soil organic matter dynamics and nutrient cycling including the effects of litter or green manure addition on soil nutrient dynamics.

PERFORMANCE OF RICE VARIETIES UNDER ORGANIC MANAGEMENT SYSTEM IN MEGHALAYA

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Abstract

An on-farm testing was conducted in East Garo Hills District of Meghalaya during *kharif* season of the year 2020 and 2021 to study the performance of rice varieties viz., CAU-R₁, CAU-R₂, CAU-R₃ and local cultivar (Sali Gipok) with 10 beneficiaries in rainfed condition. The result revealed that significantly higher grain yield, length of panicles, numbers of panicles, numbers of tillers and benefit cost ratio were recorded in CAU-R₁ varieties than others while day to harvest and plant height were recorded significantly longer in local cultivar under organic management practices. These finding indicates that CAU-R₁ found significantly better than others in hilly and plain ecosystem and acidic soil of the district.

INTERACTION EFFECT OF VARIETIES AND PLANT GROWTH REGULATORS FOR QUALITY ATTRIBUTES OF SWEET POTATO (*IPOMOEA BATATAS* L.) UNDER AGRO-CLIMATE CONDITION OF CHHATTISGARH PLAINS

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Abstract

The present investigation entitled "Interaction effect of varieties and plant growth regulators for quality attributes of sweet



potato (*Ipomoea batatas* L.) under agro-climate condition of Chhattisgarh plains” was conducted in the Horticultural Research-cum-Instructional Farm, Department of Vegetable Science, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) in the summer season during the year 2017-18 and 2018-19. Pooled data of 2 years revealed that, the interactions among V₁-Indira Nandini X P₄ - CCC-1000 ppm gave significantly higher values of qualitative characters like dry matter percentage of tuber, and V₁- Indira Nandini X P₂ . GA₃ -500 ppm produced significantly higher value of qualitative characters like starch (%) and V₂-Indira Madhur X P₂ . GA₃ -500 ppm produced significantly higher value of qualitative characters like total soluble solids (%), starch (%), total sugar (%), reducing sugars (%), non-reducing sugars (%) during both the years (2018 and 2019) and on the basis of average data.

INTERACTION EFFECT OF VARIETIES AND PLANT GROWTH REGULATORS FOR ROOT TUBER YIELD AND YIELD PARAMETERS OF SWEET POTATO (*IPOMOEA BATATAS* L.) UNDER AGRO-CLIMATE CONDITION OF CHHATTISGARH PLAINS

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Abstract

The present investigation entitled “Interaction effect of varieties and plant growth regulators for root tuber yield and yield parameters of sweet potato (*Ipomoea batatas* L.) under agro-climate condition of Chhattisgarh plains” was conducted in the Horticultural Research-cum-Instructional Farm, Department of Vegetable Science, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) in the summer season during the year 2017-18 and 2018-19. Pooled data of 2 years revealed that, the interactions among V₁- Indira Nandini X P₄ - CCC-1000 ppm gave significantly higher yield attributing characters like no. of root tubers per plant, root tuber girth (cm), root tuber yield per plant (g), root tuber yield / plot (kg), total root tuber yield (q/ha), no. of marketable tuber per plot, no. of unmarketable tuber per plot, wt. of marketable tuber yield per plot (kg), wt. of unmarketable tuber yield per plot (kg) and dry wt. of root tuber per plant (g), than others in both years (2018 and 2019) and on the basis of average data.

EFFECTS OF CADMIUM CHLORIDE ON HAEMATOLOGICAL PROFILE OF FRESHWATER FISH *CIRRHINUS MRIGALA*

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Abstract

Blood play an important role to maintain tissue stability due to its ability to maintain the constancy of internal environment. However, fish living in heavy metal-polluted water have alterations in the values of blood parameters. The objective of this study was to evaluate the effects of sub-lethal concentration of cadmium chloride on haematological profile of freshwater fish *Cirrhinus mrigala* which includes red blood corpuscles (RBC), white blood corpuscles (WBC), Haemoglobin (Hb), packed cell volume (PCV), mean corpuscular hemoglobin (MCH), mean corpuscular volume (MCV), and mean corpuscular hemoglobin concentration (MCHC). For the proposed study, fish were procured from certified fish production farms. Prior to beginning of experiment, they were given a commercial fish feed for two weeks to allow them to acclimatize. The fish were randomly allocated into four groups, each with three replicates. Then four concentrations i.e. 0.12 mg/l, 0.16 mg/l, 0.20 mg/l and 0.24mg/l of CdCl₂ were prepared along with control. In each group, thirty fishes were exposed to each concentration of CdCl₂ for 60 days. Haematological profile of the control and treated groups were estimated after every 20 days. A significant decrease in RBC, Hb, PCV values was observed and a significant increase in WBC, MCH, MCV vales was observed as compared to control values. No significant difference was observed in MCHC values among various treated groups and control.



DEVELOPMENT OF MANAGEMENT STRATEGIES FOR SPOTTED POD BORER, *MARUCA VITRATA* GEYER IN LABLAB

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Abstract

The lablab bean, *Lablab purpureus* Linnaeus is an important pulse cum vegetable crop in India. Spotted pod borer (SPB), *Maruca vitrata* causes much damage to flowers, pods and seeds of lablab. Considering the importance of this borer, a trial was conducted to evaluate some newer insecticides in comparison with the farmer's practice to manage this insect in lab lab (variety: Ankur). Treatments were, Novaluron 10% EC 750 ml/ha in flowering – flubendiamide 39.35% m/m SC 100 ml/ha during early pod formation and emamectin benzoate 5% SG at 220 g/ha during pod maturity (T1), farmer's practice i.e., indoxacarb 14.5 SC @ 1 ml/lt. at flowering and pod formation and untreated control (T3). At pod formation and pod maturation stages, borer damage was less i.e., 3.20% and 1.00% respectively in T1. In farmer's practice (T2), SPB incidence was 6.07% and 5.00% respectively. At pod formation and pod maturation stages, less SPB larvae (0.00 and 0.30/plant) was observed in T1. In untreated control, 2.70 and 3.30 larvae/plant were recorded at pod formation and pod maturation stages respectively. Spiders and coccinellids were more in untreated control (coccinellids – 1.18 to 1.33/plant and spiders - 0.40 to 0.49/plant). In insecticide sprayed plots, spiders ranged from 0.26 to 0.31/plant and coccinellids ranged from 0.45 to 1.11/plant. Yield was more (6587 kg/ha) in newer insecticides sprayed plots with high BC ratio of 2.34.

EFFECT OF IRRIGATION WATER SALINITY ON PHYSIOLOGY OF WHEAT

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Abstract

Salinity stress is one of the most detrimental factors among the abiotic stresses which adversely affect plant growth, metabolism and productivity. In India about 6.74 m ha area is affected by soil salinity. An assured source of irrigation in the wheat growing states of Punjab, Uttar Pradesh, Haryana, Madhya Pradesh and Rajasthan is brackish by 41%, 63%, 67%, 25% and 84% in respective states. Wheat is an irrigated crop and use of saline groundwater for irrigation is the major cause of salinity stress. Saline water use induced stress brings several metabolic and physiological changes in plants. Therefore, in respect of above issues, a systematic research was conducted for two successive years from 2020-21 to 2021-22 in controlled condition lysimeters at ICAR-Central Soil Salinity Institute (ICAR-CSSRI), Karnal, Haryana experimental farm. The experiment was conducted in factorial randomized block design with six replications. It comprised of 8 treatment combinations viz. two different varieties (KRL-210 & HD-3226) and four irrigation salinity levels (EC) of 0.5 (S₁), 3 (S₂), 6 (S₃) and 9 dS m⁻¹ (S₄). Effect of different levels of saline water irrigation to wheat revealed that there was decrease in yield and yield attributes with increasing salinity levels. Among the salinity levels, highest and lowest values of chlorophyll content were obtained under S₁ and S₄ at vegetative and reproductive stages, respectively. LAI significantly decreased with the increase in salt stress at each successive levels of irrigation water salinity. By application of varying levels of salinity, Na/K ratio in leaves at vegetative and reproductive stages had varied. Amongst salinity levels, the highest and lowest Na/K ratios were obtained under S₄ and S₁ levels of salinity.

POTENTIAL OF CRISPR-CAS9 IN CROP IMPROVEMENT

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Abstract

Over the past several years, CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) with CRISPR-associated



protein Cas9 (CRISPR-Cas9) has transformed the field of genome engineering and emerges as novel system for genome editing. This technique is versatile and simple compared to other genome-editing tools such as zinc finger nucleases and transcriptional activator like effector nucleases (TALENs). CRISPR-Cas9 is economical, easy to use, highly accurate and effective even when performing multiplex genome editing. Multiplex genome editing is important because it allows multiple genes to be manipulated at several genomic locations. CRISPR-Cas9 targets specific genes and creates double-stranded breaks (DSBs) at the desired site. These DSBs are then repaired by the host's repair machinery, which performs homology directed repair (HDR) or non-homologous end joining (NHEJ) to produce genomic alterations, gene knockouts and gene insertions. In NHEJ, the repair is performed by the host without the need for donor template, whereas in HDR, a donor template is required to repair the DSB. The frequency of HDR is lower than NHEJ, making the use of HDR in plants very challenging. Rice, Banana, Cassava, Maize, Potato and wheat are some major crops where CRISPR-Cas9 is widely used for Crop Improvement.

CRISPR-Cas9 based genome-editing technologies are widely accessible and could help democratize the benefits of science. Because they are relatively inexpensive to implement, they are being used to diversify agricultural systems and improve major and minor crops, including so-called orphan crops, for which funding is scarce despite their importance for food security. But many countries are still uncertain about whether to grow and how to regulate genome-edited crop varieties. So there should be consensus on Scientific, political and social persons to take advantage and maximum benefits of this new technology.

INTEGRATED PEST MANAGEMENT OF UZI FLY *EXORISTA BOMBYCIS* (L.) MANAGEMENT IN SERICULTURE

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Abstract

Diseases and pests have a significant impact on the development of cocoons. There are numerous types of pests and diseases that affect silkworms, as well as effective ways to control them. The silkworm, *Bombyx mori* L., is not only prone to many diseases but is also attacked by a variety of pests. The indiscriminate uses of chemical on controlling over serious pests like Uzi fly could be misbalancing the nature. This chapter comprises the different methods or tools in IPM to control the serious pests not only by chemicals but also different cultural, mechanical, physical, and biological aspects. Wherever, the application of IPM strategies implemented the pest and its occurrences or population could be suppressed to get primal overcome from the pests of sericulture industries. In nature over millions of substitutes would be found the control the Uzi fly in every stage while rearing the silkworms. The elements which occur naturally to control the pest from appearances.

BIOCHEMICAL BASIS OF RESISTANCE IN BRINJAL ACCESSIONS AGAINST SHOOT AND FRUIT BORER, *LEUCINODES ORBONALIS* GUENEE

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Abstract

The biochemical basis of resistance in the brinjal accessions against shoot and fruit borer, *Leucinodes orbonalis* (Guenée) was studied. The experiment was laid out at Horticultural College and Research Institute (Women), Tamil Nadu Agricultural University, Trichy, Tamil Nadu with Forty brinjal genotypes obtained from NBPGR, New Delhi and six genotypes collected from Trichy region were evaluated for their response to shoot and fruit borer. The results of the screening revealed that, out of forty entries only six brinjal accessions viz., IC 136451, IC 136231, IC 136061, IC 136296, IC 546016, IC 089964 were identified under moderately resistant category with 11 - 20% mean fruit damage. Another twelve accessions namely IC 136249, IC 136309, IC 383099, IC 136250, IC 112341, IC 215021, IC 136302, IC 136546, IC 127023, IC 90982, IC 136299, IC 90925 were found to be tolerant with 21 - 30% damage intensity and remaining 12 accessions were identified in susceptible



category with 31 - 40% fruit damage. Nine brinjal accessions with mean per cent damage intensity greater than 41 were graded as highly susceptible category. The biochemical analysis performed for each category indicated that the protein content ranged between 26 mg/g to 84 mg/g, total sugars varied from 5.58 mg/g to 18.25 mg/g and the phenol content found between 1.26 to 5.79 mg/g (Table 8). It is obvious from the correlation studies which revealed that the total sugar ($r = 0.76$), and soluble protein ($r = 0.48$) were positively correlated whereas total phenol ($r = -0.96$) was negatively correlated with the infestation of shoot and fruit borer.

NEEM AS A WONDERFUL BIO-AGENT AGAINST PLANT DISEASES IN AGRICULTURE

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Abstract

Natural compounds that plants utilize to defend themselves from pests and disease-causing organisms have emerged as the preferred option for integrated plant disease control and pest management. These natural compounds has the ability to address global issues related to agriculture, public health, population, and the environment because they are safer and more environmentally friendly than synthetic ones. Many mineral oils, botanicals, plant essential oils, and detergents are currently used for pest and disease control worldwide. Thousands of plants have been tried for this purpose. Neem has emerged as the best choice among the several disease-controlling plants and biopesticides. Neem's azadirachtin component is thought to have biological significance. Other active components include nimbin, salannin, meliantriol, nimbidin, mahmoodin, nimbolinin, sodium nimbinat, 22,23-dihydronimocinol, gallic acid, and quercetin in addition to the azadirachtin compound. Neem's biofungicidal properties stem from these vital bioactive components. Neem has shown strong biological activity against microorganisms by preventing their growth and cell wall disintegration. pathogens, systemically treated plants exhibit growth-inhibiting, antifeedant, and oviposition-deterrent effects, among other biological characteristics. Various defense mechanisms found in plants can be triggered in response to pathogens, including bacteria, viruses, and fungi. It is not economical or environmentally safe to treat plant diseases with agrochemicals. Therefore, for sustainable agriculture production, integrated disease management systems utilizing eco-friendly and culturally appropriate bio-agents are necessary. Neem and its components selectively prevent the growth of numerous microorganisms, such as bacteria, fungus, and viruses. A portion of neem's proven antimicrobial potency in the management of plant diseases. Neem is known to contain a wide variety of bioactive compounds that give it its biological properties. For example, neem extracts have been shown to inhibit the activities of plant pathogens, including bacteria and fungi that cause widespread disease.

PAPAYA LEAF CURL DISEASE : *IN SILICO* IDENTIFICATION OF PAPAYA GENOME ENCODED MICRORNAS WITH PREDICTED POTENTIAL FOR TARGETING BEGOMOVIRUS GENES

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Abstract

Papaya leaf curl disease (PaLCuD) is a prevalent disease caused by the begomovirus genus (*Geminiviridae*), which is transmitted by the whitefly vector *Bemisia tabaci*. The RNA interference (RNAi) mechanism plays a crucial role in the innate immune response against viral infections and serves as a biological process to restrict viral genomes, thereby controlling plant diseases. The objective of the present study is to identify and analyze capa-microRNAs derived from the *Carica papaya* locus, which have the potential to target various mRNAs encoded by divergent begomovirus species. This analysis is conducted using a combination of four in silico algorithms. The primary objective of our study is to systematically identify and characterize microRNAs (miRNAs) encoded in the papaya genome that are predicted to target genes (mRNA) encoded by begomoviruses, the causative agent of PaLCuD. This study identified forty-eight predicted candidates derived from the papaya locus, belonging to twenty-three miRNA families. These candidates were further investigated for their potential to target begomovirus genes. Among the candidates, capa-miR5021 was identified as the most promising miRNA, followed by



capa-miR482, capa-miR5658, capa-miR530b, capa-miR3441.2, and capa-miR414. These papaya locus-derived capa-miRNAs were predicted to bind and target the AC1 gene of the complementary strand and the AV1 gene of the virion strand in different begomovirus isolates. The AC1 gene is associated with replication-associated proteins, while the AV1 gene is involved in encapsidation during PaLCuD. To validate the accuracy of target prediction, an integrated Circos plot was created to visualize the comprehensive host-virus interaction. The in silico-predicted papaya genome-wide miRNA-mediated begomovirus target gene regulatory network confirmed the interactions, enabling further in vivo analysis. This analysis could provide valuable evidence and biological material for the development of begomovirus-resistant papaya plants and foundation for potential applications in disease management and crop improvement strategies.

EXPLORING THE POTENTIAL OF DIFFERENT WHEAT GERMPLASM ACCESSIONS FOR ADULT PLANT RESISTANCE (APR) AGAINST STRIPE RUST AND LEAF RUST INFECTIONS

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Abstract

Stripe rust and leaf rust diseases persist as a threat to wheat, a globally cultivated crop of significant importance. The development of wheat varieties resistant to these diseases promotes a sustainable protection strategy. In view of this, a field investigation was conducted in the *Rabi* season of 2022-23 at the Norman E. Borlaug Crop Research Centre, G. B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand to assess two hundred nineteen wheat germplasm accessions to determine their resistance to leaf rust and stripe rust infestations at adult plant stage. The studies revealed that out of the examined genotypes, 21 genotypes demonstrated almost immune response, 6 resistant type response, 12 moderately susceptible reaction and 10 genotypes displayed trace type response against stripe rust. 34 genotypes were found to be moderately resistant to stripe rust, constituting approximately 15.52% of the tested genotypes. In the instance of leaf rust, 27 of these genotypes demonstrated an immune reaction, 5 showed a resistant reaction, 8 moderately susceptible response, and 11 genotypes exhibited a trace-type reaction. 32 genotypes were found to be moderately resistant to leaf rust accounting for 14.61% of the tested genotypes. These genotypes displaying resistance exhibited a coefficient of infection (CI) value ranging from 0 to 20, denoting high level of adult plant resistance. Consequently, the resistant germplasm identified in this study could be employed in forthcoming breeding strategies to develop the resistant varieties against leaf rust and stripe rust of wheat.

SIGNIFICANT ROLE OF ICT IN EDUCATION

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Abstract

Technology has disrupted all areas of our lives, and education is no different. Especially after the pandemic, more institutes are looking towards online learning as a permanent teaching method along with traditional classroom teaching. Information and communication technology (ICT) has a benevolent influence on the higher education system of any country. India is likewise one of them, and the examination intends to determine the viability of ICT in reinforce the advanced education framework in this country. There are four factors that have been properly identified from various secondary sources: availability, usage, knowledge, and cost, look over these four factors, the research is trying to explore the impact of ICT. There have been many studies conducted in various colleges and universities in India. In education system, ICT allows for more student-centered learning environments. The use of information and communication technologies (ICT) has acquired prominence not only in the field of education but in other fields as well. The main objective of this research paper is to acquire an understanding of the significance of ICT in education. In all levels of education, ICT is used to enrich the system of education. When individuals make use of ICT, they are able to carry out their job duties in a manageable manner. Furthermore, its utilization has made a significant contribution to the progression of tasks and functions. The use of ICT has radically transformed the practices and procedures of practically all forms of business and governance over the last twenty-five years. ICT is favorable platform for



them to possess adequate knowledge, skills and information. Education is a widespread social activity, and great education has always been associated with strong teachers who have a lot of one-on-one time with students. Nevertheless, with the world rapidly shifting toward digital media and information, the function of ICT in education is becoming increasingly important.

PROBLEMS FACED BY THE FARMERS DURING WASTE MANAGEMENT

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Abstract

Agriculture plays a vital role in the economies of many regions, with farm families forming the backbone of agricultural activities. Farmers face several challenges when it comes to managing farm waste. In view of this the study was conducted during the year 2021 to 2023 with a sample size of 240 farm families with an objective to know the problems faced by the farmers during waste management. Self-structured interview schedule was used to elicit the information from the farmers. Appropriate statistical tools were computed to present the data. Results revealed that, majority (40.00 %) of respondents belonged to old (>50 years) age group followed by 36.67 per cent of the respondents belonged to middle (36-50 years) age group. With respect to the landholding, about 50 to 55 per cent of the farmers were belonged to small landholding (0-5 acres). Further the data with respect to the problems, the labour problem was the first rank of preference (mean score of 68.00) while management of farm waste followed by second preference to Inadequate Transportation with mean score of 63.00 and third rank was given to Lack of Infrastructure (mean score of 67.00). On the other hand, ninth and tenth rank with a mean score of 42 and 41 were given to lack of capital and lack of insurance. Lastly irrigation related problems were given eleventh rank with mean score of 40.00. Hence the combination of education, access to appropriate technologies, financial support and community involvement would solve the problems of farmers during the waste management.

EVALUATION OF RABI SORGHUM LANDRACES (*SORGHUM BICOLOR* L. MOENCH) FOR DROUGHT TOLERANCE PARAMETERS

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Abstract

The present study was conducted to assess the performance and genetic variability parameters of 28 post rainy sorghum land races (*Sorghum bicolor* (L). Moench) for drought contributing traits and yield. These 28 genotypes along with two checks (B 35 and CSV-23) were grown at Sorghum Research Station, Vasantrao Parbhani during rabi 2020-21 in randomized block design with three replications. Agronomical and plant protection measures were followed as and when required during the period of crop growth. Observations were recorded on five randomly selected plants in each entry from each replication. On the basis of mean performance, early days to flower initiation and early days to 50 per cent flowering was observed in the genotype BRJ 40813. While, genotype RSV 1345 was early to mature. The check M-35-1 followed by genotype SLV 188 recorded highest plant height. Highest number of leaves per plant was observed in the genotype SLV 182. The genotype SLV 190 recorded higher third leaf area and leaf area index. While, the highest flag leaf area was recorded in the genotype SLV 181. The genotype RSV 1785 recorded highest leaf dry weight, total dry weight, panicle length and fodder yield per plant. While, the genotype SLV 182 recorded maximum stem dry weight. The relative water content was more in RSV 1850 and Lower transpiration index was observed in SLV 193. The highest chlorophyll content, biological yield per plant, panicle weight and grain yield per plant were observed in the genotype SLV 168. The highest harvest index was recorded in the genotype RSV 1786. The genotype RSV 1772 recorded higher stay green score at maturity. Maximum root:shoot ratio was observed in RSV 1516. While, lowest stomatal count, maximum panicle dry weight and maximum 100 seed weight were observed in the genotype SLV 181. The genotypes SLV 168 and RSV 1786 recorded maximum grain yield per plant while genotype RSV 1785 recorded maximum fodder yield per plant followed by SLV 182, SSRK 13-8, SLV 168 and RSV 1345. The genotypes BRJ-40813, RSV 1785, SLV 181, SLV 190 and SLV 168 were found superior for different yield contributing and drought tolerance parameters over other genotypes and checks. Hence, these genotypes can be advanced to next generation and can be used for drought tolerance purpose.



STUDY ON IMPACT OF WORK PERFORMANCE ON LIFE SATISFACTION OF POLICE PERSONNEL

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Abstract

This study explores the relationship between work performance and life satisfaction, focusing on the challenges faced by police personnel in a demanding profession. The study identifies key themes such as job stress, organisational support, job engagement, and psychological well-being. High stress levels are often associated with policing, and studies consistently show a negative correlation between job stress and life satisfaction. Organizational support is identified as a critical factor influencing both work performance and life satisfaction, with agencies providing adequate resources, training, and support systems tending to have police personnel with higher job satisfaction levels. Job engagement is another significant aspect, with studies showing a positive relationship between job engagement and life satisfaction. Psychological well-being is another key theme, with the prevalence of mental health issues within the law enforcement community and their impact on life satisfaction. The study also explores the role of external variables such as community relations and public perception in shaping officers' work experiences. The study concludes by offering recommendations for future research, emphasising longitudinal studies, intervention strategies, and evidence-based policies to enhance the overall work performance and life satisfaction of police personnel.

ROOT ATTRACTION ASSAY OF DIFFERENT HOSTS ALLURING *MELOIDOGYNE ENTEROLOBII*: ROOT-KNOT NEMATODE OF GUAVA

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Abstract

Root-knot nematode (RKN) of guava (*Meloidogyne enterolobii*) causing sudden decline had jeopardised the Guava orchards worldwide. Poornima and co-workers reported this disease in India for the first time in 2017. A survey was conducted in the Guava orchards of Udam Singh Nagar and Bareilly districts in 2021 and 2022. The *Meloidogyne enterolobii* was isolated from the guava roots collected from the survey. *Meloidogyne enterolobii* pure culture was maintained on the tomato plants. The nematode was tested for host range on eight different hosts (Black gram (*Vigna mungo*), Green gram (*Vigna radiata*), Clover bean (*Trifolium repens*), Sword bean (*Canavalia gladiata*), Kenaf (*Hibiscus cannabinus*), Radish (*Raphanus sativus*), Finger millet (*Eleusine coracana*) and Proso millet (*Panicum miliaceum*)) and tomato was taken as control. A root attraction assay was conducted under *in vitro* conditions. Root-knot nematodes attracted towards the root at a radius of 0.2 mm were counted after 2hr, 4hrs and 6hrs from the initiation of the experiment. Results reveal that a significantly greater number of nematodes were more attracted towards the sword bean and a smaller number of nematodes moved toward black gram. However, the guava root-knot nematode is readily attracted towards the roots of sword bean and finger millet.

ANALYSIS OF GENETIC VARIABILITY AND ASSOCIATION OF POLYGENIC TRAITS AMONG ELITE CULTIVARS OF PEA (*PISUM SATIVUM* L.)

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Abstract

The present investigation was carried out at Agricultural Research Farm of B.R.D.P.G. College, (Main Campus) Deoria to assess the genetic variability and character association among eleven biometric traits of fourteen elite cultivars of field pea. The experiment was sown during the rabi 2021-22 in Randomized Block Design with replications. Analysis of variance for



seed yield per plant and its contributing traits showed significant mean sum of square due to genotypes. This indicates that there was considerable variability for these traits in the present material. High heritability with high genetic advance as % of mean was recorded for biological yield per plant, plant height, pod Length, seed Yield Per plant, primary branches, seed per pod, harvesting index, 100 Seed weight, which indicated that such traits could be improved by simple selection methods. The high heritability with high genetic advance as per cent of mean observed for these traits might be due to additive gene effects. Hence, selection in the segregating generation would be fairly effective for them. Harvesting index and biological yield per plant emerged as major contributors towards seed yield per plant. These characters show very high direct effect on seed yield. Further these traits were significantly and positively correlated with seed yield per plant. Selection based on these traits would leads to increase yield.

ROLE OF POTENTIAL BIOAGENTS AND BOTANICALS IN ENHANCING PLANT INDUCED SYSTEMIC RESISTANCE COMPOUNDS AS DEFENSE STRATEGIES AGAINST BLIGHT OF SESAME CAUSED BY *ALTERNARIA SESAMI*

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Abstract

Sesame or Til (*Sesamum indicum* L.) belongs to family *Pedaliaceae* is oldest oilseed crop grown through out the world. However, yields can be negatively impacted by numerous factors, including disease like *Alternaria* leaf blight which create problem in production. *In vitro* bio-efficacy of bioagents and botanicals were carried out against leaf blight of sesame caused by *Alternaria sesami*. Among the bioagents, *Trichoderma harzianum* (TUREF59) was found superior, recording 80.76 per cent mycelial growth inhibition. With respect to botanicals, the highest mycelial growth inhibition was recorded by *Eucalyptus globules* (82.89 %) at 15 per cent concentration. Induction of defense enzyme (PO and PAL) activity was significantly higher in plants pre-treated with *T. harzianum* TUREF59 and similarly the highest activity of PPO and accumulation of phenol was observed in plants pre-treated with *P. fluorescens* BGREB73 along with pathogen. Thus, activation of defense-related enzymes collectively enhanced resistance against the invasion of *A. sesami* in sesame plants in addition to direct antagonism and plant growth enhancement.

MATING COMPETITIVENESS OF GAMMA IRRADIATED *PECTINOPHORA GOSSYPIELLA* (SAUNDER) MALES ALONG WITH THE NATURAL POPULATION UNDER LABORATORY CONDITION

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Abstract

The degree of competitiveness of irradiated males is of crucial importance in eradication or suppression experiments evaluating the sterile-male release method. For this study, mature PBW male pupae were exposed to 150 Gy of gamma radiation (as this dose was proven to be a standardized dose for field releases in earlier studies). Those irradiated pink bollworm males were released in to the oviposition cage at different sterile to normal ratios, i.e., 0:1:1, 1:0:1, 1:1:1, 2:1:1, 5:1:1, 10:1:1, 20:1:1 and 50:1:1 (Treated male :Normal male: Normal female). Observations were made on the fecundity, per cent egg hatch, per cent egg infertility, per cent expected egg hatch, corrected sterility and control of reproduction. The degree of competitiveness of irradiated adults increased with an increasing ratio of irradiated to unirradiated adults. Results depicted that, mating competitiveness of adult male irradiated with the sub sterilized dose of 150Gy was desirable at all the ratios which ranges from 0.82 to 1. This 0.82 to 1 value is considered to be sexually competitive though it



was generally better at the higher ratios of irradiated male. The competitiveness value of the sterile adults at the ratio 5: 1: 1 and 10:1:1 was 0.87 and 0.91 respectively. Mating competitiveness value for the 20:1:1 and 50:1:1 sterile to normal over flooding ratio was 0.97 and 1.00 respectively. If the mating competitive value is near to one or equals to one which indicates that released partially sterile adults are fully competitive. Hence, the ratio 10:1:1, 20:1:1 and 50:1:1 would be the best combination to suppress the population of pink bollworm in the field. The success of the SIT mainly depends on the degree of mating competitiveness of released moths. Hence, research on the sterile male release approach therefore includes an assessment of the mating competitiveness value of males with the desired level of sterility.

STUDIES ON THE RESPONSE OF NORMAL AND IRRADIATED PINK BOLLWORM MALES TOWARDS PHEROMONE SOURCE

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Abstract

The pink bollworm (PBW), *Pectinophora gossypiella* (Saunders) cause a major menace to cotton production, because of its resistance to cry proteins and conventional insecticides. In these circumstances, one such eco-friendly approach to tackle this is eco friendly, Sterile Insect Technique (SIT). In SIT attractiveness of released moths to their natural counterpart is most important as such this ability was examined in our study. For this, newly emerged five virgin females from each gamma doses (0, 50, 100, 150, 200 and 250 Gy) were used as a bait in delta traps separately. These females were confined inside small plastic vial (perforated for aeration) and suspended inside the traps and provided with a 10% honey solution for each dose. Traps were placed at the level of plant canopy and placed in the field in the evening. Moth catches in each trap were counted and removed daily and these observations continued up to 5 days. In a same manner irradiated males were released separately inside the field cage to know its attractiveness to virgin female. The results indicated that attraction of male moths to irradiated virgin females decreased significantly with increasing doses of radiation *i.e.*, at 200 and 250 Gy. The number of males captured per female was greatest on day 2nd due to its peak sexual activity, *i.e.*, 25.60, 23.05, 19.45, 14, 9.4 and 5.9 moths at 0, 50, 100, 150, 200, and 250 Gy, respectively. Gamma radiation also affected the irradiated males to find their natural mates at a higher dose; however, the maximum number of 5.30, 5.95 and 5.10 irradiated male moths were attracted to the natural pheromone secreted by female moths at 50, 100 and 150 Gy respectively, compared to the 6.80 moths at 0 Gy. The results on attractiveness of irradiated male moths towards virgin female-baited traps were considered a good measure of male competitiveness.

IMPACT OF CLIMATE PARAMETERS ON CROP PRODUCTIVITY AND FARMERS' INCOME - A STUDY IN NORTHERN DRY ZONE (NDZ) OF KARNATAKA

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Abstract

Karnataka state has the second largest area under rain-fed agriculture *i.e.*, 7.01 m.ha after Rajasthan. The Northern Dry Zone (NDZ) of Karnataka was purposively selected for the study as it was drought vulnerable and was affected by changing climate. The study was undertaken to examine the impact of climate parameters on productivity of major crops and Farmer's income in four districts of NDZ namely Bagalakote, Ballari, Koppal and Vijayapura districts over the period of 22 years (1997-2019). Maize crop was found replacing an area and production of other cereal crops like rice, sorghum, and bajra because it was desirable crop, suiting the climatic conditions, and has a good reasonable FHP. Similarly with chickpea crop. Farmers found growing pulses as an alternative coping strategy as they were short-duration crops and drought tolerant. FHP was also increasing over the years. Major pulses yield along with rice, maize, sugarcane, and safflower crop's yield were affected by average precipitation (PCPN) positively which was found significant. Annual average Maximum temperature (T_{max}) affects yield negatively in case of greengram, rice, wheat, horsegram and safflower crops. Annual average Minimum temperature (T_{min}) affects yield of pigeon pea, sugarcane, rice and maize crops negatively whereas positively in case of wheat and chickpea crops and was found significant. The Farm Harvest Prices (FHP) of maize and chickpea crop had a significant



CAGR value of 8.98 and 7.45 per cent respectively. Whereas in the case of the cotton crop, the CAGR value was 6.57 per cent and it was significant at ten per cent. Farmers cultivate crops whose FHP was good in the previous year. Major crops cultivating farmers' of NDZ Gross income (GI) were affected by annual average PCPN positively which was found significant. Tmin affects GI of chickpea, cotton, maize and sunflower cultivating farmers' crops positively and was found significant.

CORRELATION STUDIES FOR SHOOT FLY TOLERANCE PARAMETERS IN F₂ POPULATION OF RABI SORGHUM [*SORGHUM BICOLOR* (L.) MOENCH]

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Abstract

Shoot fly assumed the most important pest of sorghum. the losses due to this pest have been estimated to reach as high as 86 per cent of grain and 46 per cent of fodder yield. Host plant resistance is the most realistic approach to minimize grain and store yield losses due to insect pests. Hence present investigation was undertaken during *rabi*-2022 at experimental farm of Sorghum Research Station, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani to assess characters associated with shoot fly tolerance in F₂ generation of *Rabi* Sorghum [*Sorghum bicolor* (L.) Moench]. The experimental material for this study comprised of total 12 sorghum genotypes (04 F₂ populations along with 06 parents and 02 checks). Results revealed that the characters leaf glossiness (non-glossy) (0.871 & 0.849), seedling vigour (non-vigorous) (0.914 & 0.889), leaf angle (0.605 & 0.598), dead heart % at 14 DAE (0.974 & 0.959) were significant and positively correlated with shoot fly dead heart per cent at 28 DAE at both genotypic and phenotypic level. While 100 seed weight was found significantly and positively correlated at phenotypic level only. Whereas, trichome density at adaxial (-0.917 & -0.904), abaxial (-0.749 & -0.735) surface and plant height (-0.789 & -0.773) exhibited negative and significant association with dead hearts per cent 28 DAE. It can be concluded that the traits more leaf glossiness, seedling vigor, narrow leaf angle, more number of trichomes and plant height are highly reliable parameters. These parameters can effectively serve as marker traits to screen and select genotypes for resistance to the sorghum shoot fly.

GENETIC VARIABILITY FOR SHOOT FLY RESISTANCE PARAMETERS IN F₂ POPULATION OF RABI SORGHUM [*SORGHUM BICOLOR* (L.) MOENCH]

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Abstract

Present investigation was undertaken during *rabi*-2022 at experimental farm of Sorghum Research Station, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani to assess genetic variability among F₂ generation of *Rabi* Sorghum [*Sorghum bicolor* (L.) Moench] for Shoot fly Resistance Parameters. The experimental material for this study comprised of total 12 sorghum genotypes (04 F₂ populations along with 06 parents and 02 checks). The analysis of variance revealed the prevalence of significant differences among the genotypes for thirteen characters. Among all, F₂ population of cross, CSV29R x IS2205 was more vigorous, glossy, highest trichomes density (abaxial), plant height, grain yield per plant, fodder yield per plant, 100 seed weight and lowest dead heart percentage at 28 DAE. The values of Phenotypic coefficient of variation were higher than the genotypic coefficient of variation with lower magnitude of differences in parents and segregating generations. The characters seedling vigor, leaf glossiness, trichome density (adaxial and abaxial), dead heart percent at 14 DAE and 28 DAE and grain yield per plant were the characters which showed high phenotypic and genotypic coefficient of variation. High heritability coupled with high genetic advance was observed for leaf angle, trichome density (adaxial and abaxial), plant height, fodder yield per plant, grain yield per plant, dead hearts percent at 28 DAE indicating scope for genetic improvement of these traits through selection. while, the characters seedling vigour, leaf glossiness, days to 50 per cent flowering and 100 seed weight exhibited high heritability accompanied with low genetic advance indicating the traits are controlled by non additive gene action.



ECOLOGY AND AVIAN ASSEMBLAGE DURING THE DEVELOPMENT OF CONVENTIONAL RICE ECOSYSTEM IN HARYANA

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Abstract

Birds play a vital role in rice cultivation as organisms that help maintain the ecological balance and help eliminate pests very effectively. However, various pests at each phase of rice growth, and the use of pesticides may cause differences in the bird species found in conventional rice paddy. The objective of this research was to explore the species of birds found in different growth stages of conventional rice paddy in selected paddy grown regions of Haryana with special reference to the species abundance, diversity, richness, evenness and similarity indices. The bird data was collected between May and November 2021-23. A total of 87 avian species were found in the survey. Most of the birds were insectivores and belonged to Order Passeriformes. The values of Shannon Weinners' diversity index (H'), Simpson's index ($\bar{d}$), and Margalef's index (D) of avian diversity at each growth phase were also calculated. This study revealed that organic cultivation supports bird diversity and beneficial insects. However, the bird menace during maturity stage is an issue to be managed in an ecofriendly way.

ASSESSMENT OF COUNSELING AND CONSULTANCY SERVICES ON PROMOTION OF AGRI-BUSINESS ENTERPRENURSHIP IN PLANT TISSUE CULTURE HARDENING

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Abstract

The present study was carried out to assess effects of counseling and consultancy services to promote agri-business incubations in plant tissue culture based hardening profession. Among various proven technologies and interventions developed and available in the areas of agricultural biotechnology namely plant tissue culture, hardening process of in-vitro grown seedlings along with few other techniques viz., hydroponics, biofertilizers agent productions were also demonstrated to beneficiaries. As per the mandate of the project subcomponent, biotechnology program for societal development, the emphasis are given to the weaker section of the society under aspirational district Washim. During the survey, randomly but potential packets of the district having higher plantation area under different fruits, vegetables cultivation was covered. When comparison were made among women beneficiaries during survey and demonstration of technologies it has noticed that among weaker sections categories, there were 46% women beneficiaries from SC categories, followed by OBC 43%, NT 7 % and least ST with 4% number of women beneficiaries. Among these beneficiaries, most interested beneficiaries will be identified and selected for actual demonstration of technologies and creation of entrepreneurship during next year program of the project. During the studies and initial training it was noticed that among women beneficiaries have their different education qualification status. There were women beneficiaries having education up to 12th class showing highest 43%, followed by 10th class passed 32%, 17% were below 10th class 5% graduates and only 3 % were found post graduate. Under the project activities, two online trainings were conducted during the year 2021 and complete package of practices as well as basics of each of the new proven technologies of biotechnology was covered by inviting eminent expertise from relevant fields. 194 trainee participants were assessed under questioner based training program and consultancies were provided. Counseling services also rendered during training program to the participants from Washim, aspirational district under study. Among, the participants, it has observed that rural youth beneficiaries are reluctant about novel technologies in Agriculture and laggards in their adoption. The finding of actual counseling with urban youths has shown interest profound in getting higher 76.25% adoption of new technologies as compare to youths from rural area with 43.47%. Youths belongs from urban



areas were eager to bear consultancy service cost as compare to the youths of rural background. The potential benefits of novel technologies such as plant tissue culture hardening and hi tech nursery production differs with the socio-economics status of the youth. Hence, prior precautionary cares needs to be undertaken before implementation of any start-ups in aspirational districts and subsequent measures to train them based on availability of their own resources.

MULTI-STAKEHOLDERS PERSPECTIVE ON NEED ASSESSMENT OF SCIENTIFIC GOAT REARING PRACTICES IN KARNATAKA STATE, INDIA

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Abstract

Agriculture and animal husbandry complement and supplement each other significantly. Small ruminants contribute enormously towards promotion of livelihood security and as an insurance cover to cope with crop failures particularly for rural landless, small and marginal male /female farmers. An understanding of farmers' information needs is of vital importance to design and develop an appropriate information system for acquainting with relevant and authoritative information. Further, information need assessment about scientific goat farming is imperative as it plays a major role in the livelihood of landless and small farmers. The study was conducted in Bidar district of Karnataka. The data was collected from 60 farmers through interview schedule and 60 professionals (30 veterinary university staff members and 30 veterinary officers) through questionnaire. Information needs on goat farming was assessed in subareas viz., breed selection, breeding and reproduction, feeding and nutrition, etc. and the responses were collected on three point continuum i.e. 'most needed', 'needed' and 'least needed'. Further, the data was analyzed using appropriate statistical tools and inferences were drawn accordingly. The study revealed that majority of the farmers needed most information on marketing and health care management aspects followed by feeding practices of goats. Further, it was found that professionals prioritized information on selection criteria of goat breed followed by health care management and insurance of goats. Further, the farmers and professionals also expressed different constraints in getting the information about scientific goat farming practices in the study. The results would be helpful in developing need based and demand driven extension modules and also on understanding the constraints of farmers which can be addressed by various public and private extension agencies for sustainable development of livestock sector.

POLYCYSTIC OVARY SYNDROME IN YOUNG WOMEN: CLINICAL RISK FACTORS AND QUALITY OF LIFE

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Abstract

Polycystic ovary syndrome (PCOS) is a common endocrine disorder affecting a significant proportion of young women worldwide. It is influenced by various factors such as hormonal imbalances, genetic predisposition, and lifestyle choices. Clinical risk factors such as obesity, hirsutism, acne, irregular menstrual cycles, alopecia, age at menarche, and prolonged menstrual flow significantly impact the quality of life (QOL) for women with PCOS. The study investigated PCOS-related clinical risk factors and quality of life. One hundred and thirty PCOS patients, ages 16 to 26 years old, were selected purposively from Dharwad obstetrics and gynecological hospitals. Clinical risk factors were assessed using a self-structured questionnaire and secondary data from medical records, and anthropometric measures were obtained to calculate BMI. The QOL of women with PCOS was assessed using the Polycystic Ovary Syndrome Quality of Life tool (PCOSQoL-47). It was found that 50.76 percent of respondents had low QOL, 49.23 percent had medium QOL, and 7.69 percent had high QOL. According to a bivariate analysis of clinical characteristics and QOL among PCOS women, obese women had a 2.87 times



higher risk of poor QOL, hirsutism (2.98 times), acne (1.75 times), alopecia (1.75 times), irregular menstrual cycles (3.69 times), and menstrual flow lengths of 7 days increased the risk (1.77 times) of developing poor QOL. There was a significant association between nutritional status, hirsutism, acne, alopecia, regular menstrual cycle, and menstrual flow length with QOL, except in hemoglobin, blood pressure, and age at menarche. In conclusion, clinical risk factors have substantial effects on the QOL in women with PCOS, particularly obesity, hirsutism, acne, alopecia, irregular menstrual cycles, and prolonged menstruation.

ARTIFICIAL NEURAL NETWORKS FOR RICE YIELD PREDICTION IN U. S. NAGAR DISTRIC, UTTARAKHAND

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Abstract

Rice crop yield data and weather data were considered in this study, covering the past 20 years (2000-2020) in U.S. Nagar District, Uttarakhand. The data was sourced from DACNET and the Meteorological Observatory, Department of Agrometeorology, College of Agriculture, G.B. Pant University of Agriculture and Technology Pantnagar, Uttarakhand based on weather parameters during different growth stages of rice. Maximum temperature, Minimum temperature, Relative Humidity A.M, Relative Humidity P.M, Total rainfall, Sunshine hours, Wind velocity and Evapotranspiration were the weather parameters considered for the study. Soft computing technique namely Artificial Neural Network was employed in the study using R software. Out of the 20-year data, 16-year data were used for model calibration while remaining 4 years data were used for model validation. The different models developed using ANN are Artificial Neural Network model using weighted and unweighted weather indices based on weather parameters at different phenological stages (ANN- WI), Artificial Neural Network model based on weather parameters at different phenological stages (ANN-W) and Artificial Neural Network model based on deviations of observed averages of weather parameters from its optimum value during the different phenological stages of wheat (ANN-D). Yield prediction models were compared based on statistical indices and error percentage (during validation). On the basis of maximum value of R^2 (0.974) and minimum value of RMSE (73.06), ANN-WI (ANN model developed by using weather indices as predictors) model could perform better than the other two models developed using ANN i.e. ANN-W and ANN-D.

EVALUATING THE COMBINING ABILITY AND HETEROSIS OF WHITE RUST RSISTANAT LINES OF INDIAN MUSTARD (*BRASSIACA JUNCEA*)

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Abstract

Experimental material for this present study consists of seven advanced lines/varieties of Indian mustard (*Brassica juncea* L.). It comprised three lines and four testers, mated in a Line $\times$ Tester design during rabi season 2021–2022 in fields of Norman E. Borlaug C.R.C., G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand. In rabi season of 2022–2023 these parents and their 12 F_{1s} were assessed in RBD (with three replications) for 15 traits, such as seed yield per plant (g), glucosinolate content ($\mu\text{mole/g}$), oil content (%), and erucic acid content (%). With the exception of seeds per siliqua and siliqua density, analysis of variance for combining ability revealed significant differences among treatments for all the features. Tester PWR 13-8 was determined to be an effective combiner for eight different traits, including oil content and seed yield per plant. Among lines for seed yield per plant, NRCHB-101 and Kranti made good combiners. Highest significant SCA effect was shown by cross-combination Giriraj $\times$ Heera for seed yield per plant; NRCHB-101 $\times$ PWR 13-8 for glucosinolate content, Kranti $\times$ PWR 13-8 for oil content and Kranti $\times$ Donskaja for erucic acid content. For seed yield per plant, the cross combination Kranti $\times$ PWR 13-8 displayed the highest mid-parent and better-parent heterosis. The cross-combination NRCHB-101 $\times$ PWR 13-8 exhibited the highest estimates for glucosinolate content across all three heterosis studies and the highest economic heterosis for seed yield per plant. The level of heterosis calculated in this present study forms a basis and a



foundation for selecting the best parents to produce superior F₁ hybrids and producing gene pools that may be utilised in further breeding programme to assess genetic diversity.

PHYSICOCHEMICAL CHARACTERISTICS OF PROTEIN ISOLATED FROM PIGEONPEA BROKENS

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Abstract

Pulses are main source of nutrition for billions of people around the world. Large number of people in the world consumes pulses as staple food in combination with cereal for meeting their protein requirement. The FAO of the United Nations has declared 2016 as the International Year of Pulses which aims to enhance public awareness of the nutritional benefits of pulses as part of sustainable food production. Pulses contain approximately 21–25% protein, almost double than that found in cereals. A study was conducted to extract and develop a process technology for production of protein isolate from pigeonpea brokens produced during pigeonpea milling in the industries. The broken dals are sold at very low prices *i.e.*, Rs. 30-35/kg in the market and generally are not inferior in protein quality. The broken dals are not utilized equally as they got poor appearance and are not preferred by consumers for consumption. In order to add value to these broken dals a study was conducted to produce protein isolate using alkaline extraction–isoelectric precipitation process. The results revealed that the protein yield and protein content were 23.60% and 92.80%, respectively. The proximate composition of developed protein isolate are 3.25, 91.03, 0.86, 3.16, 1.13, 0.56% and 767.36 kCal/100g as its final moisture, protein, fat, ash, carbohydrates, fibre content and energy value, respectively. The physical properties of protein isolate *viz.*, loose and tapped bulk density, Carr's index and Hausner ratio were found to be 0.55 g/cm³, 0.70 g/cm³, 0.22, 1.28, respectively. The water activity and solubility of produced isolate were 0.41 and 37.66% respectively and colour values *i.e.*, *L** is 58.32, *a** is 2.96, *b** is 20.16. Hence pigeonpea proteins possessing good physicochemical and flow properties may be ideal for fortification in different food product development and assist in providing the necessary nutrition for the unprivileged and malnutrition population.

FUNCTIONAL CHARACTERIZATION AND APPLICATION OF PIGEONPEA PROTEIN ISOLATE

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Abstract

Plant-based proteins have recently attracted particular interest owing to their sustainable origins, economical costs and health benefits compared to animal-based counterparts. Animal-based proteins are used in food industry in different applications due to their desirable properties including their high yield and essential amino acids content with right balance. However, most of plant-based proteins have limited applications due to their inferior functionality, which is the consequence of poor-aqueous solubility, complexity and sensitivity to environmental stress conditions. Therefore, the modulation of plant proteins to improve their technological and industrial applications, and make them more accessible in general, is highly sought after. The modification of plant proteins by altering their physicochemical properties opting suitable extraction methods provides the possibility to improve and diversify their technofunctionality and biological activities as well as addressing their limitations. Therefore, a study was carried out to know the chemical and functional properties of protein isolate from pigeonpea to have its broad applications and usage. The results of proximate composition of the developed protein isolate are 3.25, 91.03, 0.86, 3.16, 1.13 and 0.56% as moisture, protein, fat, ash, carbohydrates and fibre content, respectively. The functional properties *viz.*, water holding capacity and oil absorption capacity, foaming capacity and foaming stability were 2.93 g/mL, 2.67 g/g, 37.33% and 85.46%, respectively. The protein solubility of the isolate was recorded as 24.46%. The emulsifying properties like emulsifying activity index and emulsion stability index were 31.93 m²/g and 34.66 min., respectively which are more preferred in bakery products. Hence proteins from pulses can be regarded as versatile ingredients in several food products development.



GENETIC VARIABILITY, HERITABILITY AND DIVERSITY ANALYSIS IN PIGEONPEA [*CAJANUS CAJAN* (L.) MILLSPAUGH]

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Abstract

Pigeonpea [*Cajanus cajan* (L.) Millspaugh], an ancient crop, is crucial for poor farmers, providing protein, fuel wood, and fodder. Its seeds are a source of iron, iodine, and 20-24% protein. Grown primarily in developing countries like India, it plays a vital role in meeting dietary needs. The present study involved the analysis of 38 pigeonpea genotypes for various traits, revealing significant differences and indicating substantial genetic variability. High phenotypic (upto 33.90%) and genotypic (upto 32.31%) coefficients of variation were observed for key traits such as the number of primary branches per plant, seed yield per plant, number of pods per plant, number of secondary branches per plant, plant height, and 100-seed weight. Traits like days to 50% flowering, plant height, number of pods per plant, pod length, number of seeds per pod, 100-seed weight, and seed yield per plant exhibited high heritability (>75%) and genetic advance, suggesting the prevalence of additive gene action and their potential for improvement through selection. Diversity analysis employing Mahalanobis D² grouped genotypes into five clusters, revealing the independence of genetic diversity from geographical origin. The traits contributing most to genetic diversity were 100-seed weight, days to 50% flowering, and seed yield per plant. Molecular diversity analysis using 45 SSR (Simple sequence repeats) markers identified 30 polymorphic markers, with the highest polymorphic information content observed for marker ASSR 23. The genetic similarity coefficient among genotypes ranged from 0.49 to 0.93, indicating sufficient diversity. Clustering patterns based on morphological and molecular diversity showed a direct relationship, suggesting common parentage or genetic influence. The study underlines the presence of significant genetic variability among pigeonpea genotypes, providing insights into potential breeding strategies for improved cultivars.

DEMONSTRATION OF PROVEN TECHNOLOGIES OF BIOTECHNOLOGY IN ASPIRATIONAL DISTRICT OF VIDARBHA REGION

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Abstract

Washim district is basically agriculture oriented categorized under agro climatic zone seven and eight. The district is scattered with prominently plain surface land. Washim district lies longitude 76.7 to 77.4 deg and latitude 19.61 to 21.16 deg. Washim lies to its north, Amravati lies to its north-east, Hingoli lies to its south, Buldhana lies to its west, Yavatmal lies to its east. Washim has an area of 5150 Km². The District comprises of 03 revenue sub-division viz; Washim, Mangrulpir and Karanja and Six Talukas with total 493 Gram Panchayat. Washim District is having total geographical area of 5.13 lakh Hectare with total cultivable area is 4.12 lakh Hectare out of which area under irrigation is only 1.17 lakh hectares. Washim District has an extremity in climatic situation. To increase the crop productivity in the proposed plan the policy emphasized on the important of adoption of modern technologies, Hi-Tech plantation and cultivation, Micro – irrigation by providing subsidy to the micro irrigation equipment, dissemination of need based technologies and demonstrating the same at the gross root level so that farmers will be educated in identifying the constraints in the crop production. In the recent years plant tissue culture of Banana, citrus, papaya plantation, organic farming is gaining importance, which also finds a place in the plan which certainly helps to maintain the soil health and livelihood support. Horticulture in Washim District blessed with soil and assumed rainfall situation for cultivation of irrigated horticulture crops like Banana, Citrus, Papaya, Lime and dry land crops like Custard apple, Pomegranate but farmers are not getting better remuneration from crops due to various reasons like distress, irregular flowering, lack of quality planting material, seedlings, pest and diseases problem and decline in ground water etc. So plan emphasizes more on construction of pack house, shed net and green house for controlled cultivation, HRD, rejuvenation of old



orchards and community tanks for protective irrigation coupled with area expansion of fruits including the dry land horticulture crops and medicinal and aromatic plants. Among various proven technologies and interventions developed and available in the areas of agricultural biotechnology namely plant tissue culture, hardening process of in-vitro grown seedlings along with additionally other techniques viz hydroponics, biofertilizers agent productions were also demonstrated to beneficiaries biotechnology program for societal development, the emphasis are given to the weaker section of the society under aspirational district Washim. During the survey, randomly but potential packets of the district having higher plantation area under different fruits, vegetables cultivation were covered. When comparison were made among women beneficiaries during survey and demonstration of technologies it has noticed that among weaker sections categories, there were 46% women beneficiaries from SC categories, followed by OBC 43%, NT 7 % and least ST with 4% number of women beneficiaries.

ORGANOLEPTIC AND NUTRITIONAL EVALUATION OF VALUE ADDED PRODUCT - HOMEMADE DRIED CHIPS PREPARED FROM APPLE FRUITS

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Abstract

A research experiment was conducted during the year 2019-20 and 2020-21 in the Fruit and Vegetable Processing Unit Laboratory, Department of Horticulture, College of Agriculture, Gwalior with the local Apple fruit varieties. It was studied about the preparation of various value added product – homemade apple chips. Observations were recorded up to storage period of three months at ambient conditions. This study is analyzed in a completely randomised design with three replications. Varieties such as Red delicious and Kashmiri apple were found superior with respect to colour and appearance, taste, aroma as well as flavour. It has been noticed that overall acceptability of processed products have been found significant with the respect to 15, 30, 45, 60 and 90 days of storage. As far as organoleptic and nutritional evaluation of different homemade apple chips was concerned, the Red delicious and Kashmiri apple varieties are found to be superior for the purpose of processing industry. The postharvest losses in apple vary from 30-40% due to its perishable nature and glut during harvesting time, which reduces the market value of fruit. Hence, value addition through processing would be the only effective tool for economic utilization of increased production of apple in future. Of the world total horticultural trade, processed fruits and vegetables account for 20 per and 17 per cent respectively.

MILLETS : A CLIMATE SMART CROP

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Abstract

Climate change has deleterious effect on both human welfare and agriculture production. Millets are smart foods of the 21st century because they are “good for human being, the farmer and the planet.” They are the last crops standing during droughts. Millets are also good for animals. Millets are the amazing crops best suited for dry land soils. These can sustain even under aberrant weather conditions (climate of twenty first century) where most of other major crops fail. Millets are the small-seeded grasses that belongs to the family, Poaceae/Graminae. There are two major millets (sorghum and bajra) and six minor millets (finger millet, foxtail millet, little millet, proso millet, kodo millet and barnyard millet). Recently few more minor types of millet have been added to this group viz., tef, fonio, quinoa and browntop millet. Since centuries, millets have been a prized crop in India and are staple diet for nearly 1/3rd of the world’s population. Millets have potentiality of contributing to increase food production, both in developing and developed countries. Millets are most commonly available in the form of pearled and dehulled rain. Millets are tasty grains that have a mildly sweet, nut-like flavour. Millets are amazing in their nutrient content and are commonly known as “nutri-cereals or nutri-millets”. These are nutritionally rich and help in overcoming malnutrition and food insecurity. Though, millets cultivation is advantageous, the research in improving the age-old cultivation practices is



still at an infant stage and this needs to be addressed in order to popularize these healthy foods. Recently introduced millets fetch higher market value (than even major cereals) and hence help in uplifting the socio-economic status of the marginal farmers under dryland conditions.

IMPACT ANALYSIS OF FRONTLINE DEMONSTRATIONS (FLDS) ON GREEN GRAM IN KVK HAVERI

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Abstract

India is the largest producer and consumer of pulses. Pulses are a good and chief source of protein for a majority of the Indian population. Pulses contribute 11% of the total intake of proteins in India. In India, frequency of pulses consumption is much higher than any other source of protein, which indicates the importance of pulses in their daily food habits. Although country has produced about 19.78 MT pulses from 25.21 Mha of land during 2020 -22 still 22 per cent of the total demand is met through imports. Pulses cultivation is known to have several advantages. Their ability to fix atmospheric nitrogen improves soil fertility. These can be grown in limited moisture conditions with low input requirement. Paddy-wheat is the predominant cropping system in Punjab. The continuous cultivation of water guzzling crops like paddy has resulted in depletion of underground water. In KVK, frontline demonstrations (FLDs) are the important extension techniques to convince the farmers about latest farm technologies. The present study was conducted to assess the impact of frontline demonstrations on *Kharif* crop conducted Haveri district of Karnataka state. Study revealed that improved cultivation practices comprised under FLDs viz recommended varieties, seed rate, timely sowing and plant protection technology resulted in average increase in yield of 12.5 per cent in *Kharif* green gram and 14.67 per cent in gram crop over the check plots. Technology gaps, extension gaps and technology indices were calculated to analyze the performance of these frontline demonstrations at farmers' fields. Lower average technology index of 9.31 per cent indicates the feasibility of green gram crop in existing farming situation in the district. The improved production technology of these pulses gave higher gross return and net return with higher benefit-cost ratio in FLD plots as compared to check plots. Even though pulses production increased significantly during the last decade but continuing the rapid growth is a challenge for researchers, extension agencies and policy makers to fulfill the domestic demand.

PATHOTYPE IDENTIFICATION OF *XANTHOMONAS ORYZAE* PV. *ORYZAE* (ISHIYAMA) SWINGS ET AL. ISOLATES ON NEAR ISOGENIC LINES (NIL) IN KARNATAKA

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Abstract

Rice (*Oryza sativa* L.) is the most important staple food all over the world. The crop is known to be economically affected by some of the major diseases like blast, false smut, sheath blight, bacterial blight and rice tungro. Bacterial leaf blight (BLB) caused by *Xanthomonas oryzae* pv. *oryzae* (*Xoo*) (Ishiyama) is one of the most destructive diseases of rice. A set of 30 rice differentials (IRBB lines) consisting of single or different combinations of BLB resistant genes were used for characterization of 21 *Xoo* isolates under glasshouse condition. The result showed that none of the isolate was able to show complete virulence on all NILs. All isolates varied with degrees of resistance and susceptibility. Isolate KXo-3 was highly virulent. Among single BB resistant genes IRBB-8 (*xa8*) and IRBB-13 (*xa13*) were found highly promising while among two gene combinations, IRBB-51 (*Xa4+xa13*), IRBB-52 (*Xa4+Xa21*) and IRBB-53 (*xa5+xa13*). Among three and four gene combination of BB resistant genes, IRBB-56 (*Xa4+xa5+xa13*), IRBB-57 (*Xa4+xa5+Xa21*), IRBB-58 (*Xa4+xa13+Xa21*), IRBB-59 (*Xa5+xa13+Xa21*), IRBB-60 (*Xa4+xa5+xa13+Xa21*), IRBB-63 (*xa5+Xa7+xa13*) and IRBB-65 (*Xa4+Xa7+xa13+Xa21*) were resistant against almost all the *Xoo* isolates. Based on disease reaction, all 21 *Xoo* isolates were grouped into 6 pathotypes as IXoPt # 1, 2, 4, 5, 17 and 22. Pathotype IXoPt-22 was highly virulent and IXoPt-1 was least virulent. Out of six pathotypes, the IXoPt-2 was widely distributed with the maximum frequency of 23.8.



EVALUATION OF SHOOT FLY RESISTANCE IN M₆ GENERATION OF RABI SORGHUM (*SORGHUM BICOLOR* (L.) MOENCH) LINES

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Abstract

The shoot fly is one of the most significant pests that reduces sorghum yield levels. In Asia, Africa and Mediterranean Europe, the shoot fly (*Atherigona soccata* Rond.) poses a major pest problem for sorghum. A maximum yield loss of 80-90 percent has been reported in grain and 68 percent in fodder. At the early stages of sorghum crop growth, shoot fly damages crops and causes a specific symptom called “dead heart”. Since shoot fly control methods are not feasible for this crop, which is cultivated by poor and marginal farmers, and the pest damage ranges from 7-30 days after germination, there is very little or no time for control measures to be adopted. More importantly, this method pollutes the soil, water, food, and fodder. Therefore, the most realistic alternative method for reducing insect losses is the use of host plant resistance in mutants. The present investigation was carried to screen 100 mutant lines against shoot fly incidence in augmented block design at Agricultural Research Station, Hagari. In sorghum production shoot fly incidence is the major biotic constraints, which attacks crop at the seedling stage and causes losses of yield and fodder. The screening results revealed that 16 mutant lines shown highly resistance reaction compared to resistant check IS-2312 (15.29), among them five mutant lines showed zero percentage of dead heart per cent. These mutant lines exhibited comparatively lower number of eggs per plant and minimum dead heart formation. 2 mutant lines shown highly resistance response to seedling vigour and 1 mutant lines shown highly resistance to glossiness score traits. In order to attain uniform shoot fly pressure under field conditions the interlard-fish meal technique was followed for present experiment. These resistant lines can be used for further confirmation and also for future resistant breeding programmes.

FERTILITY RESTORATION REACTION OF DIFFERENT RESTORERS ON DIVERSE CYTOPLASMS OF PEARL MILLET [*Pennisetum GLAUCUM* (L.) R. BR.]

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Abstract

Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is the most widely grown drought tolerant coarse grain cereal cultivated in semi-arid tropical environments of south Asia and sub-Saharan Africa. It is also consumed as feed and fodder for livestock. Though alternative sources of CMS are available and found to be highly stable, their utility is restricted due to non availability of suitable restorers. The present investigation carried out using three different cytoplasm (A₁, A₄ and A₅) as female parents. In the current study, out of twenty testers, 8 testers viz., ICMR 15455-2, ICMR 15455-3, ICMR 15024, ICMR 15037, ICMR 15038, ICMR 19631, ICMR 20405 and ICMR 20444 were considered as the strong restorers of the fertility on A₁ and 9 testers viz., BRBL 1136R, ICMR 15455-2, ICMR 15455-3, ICMR 15024, ICMR 15038, ICMR 15082, ICMR 19631, ICMR 16409 and ICMR 16410 on A₄ based male sterile lines. No testers showed strong fertility restoration on A₅ cytoplasm. Three testers ICMR 15024, ICMR 19631 and ICMR 15097 showed high restoration of fertility (?80%) on all three A₁, A₄ and A₅ based male sterile lines. Identification of restorers for diverse cytoplasmic male sterile sources opens up new avenues in pearl millet hybrid breeding. It brings out the possibility of developing successful hybrid combinations in diverse cytoplasmic background other than routinely used A₁ cytoplasm and to solve the risk of emergence of diseases.



ESTIMATION OF COMBINING ABILITY ON DIVERSE CYTOPLASM OF PEARL MILLET [*Pennisetum glaucum* (L.) R. Br.]

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Abstract

The Line × Tester analysis involving sixty hybrids, twenty three parents (three lines and twenty testers) and three checks viz., VPMH 7, VPMH 14 and Kaveri Super Boss were used to assess the information on combining ability with respect to grain and its component traits in pearl millet under rainfed conditions during *Kharif* 2023 at RARS, Vijayapura. ICMA 98222 (A₁ cytoplasm), ICMA 04777 (A₄ cytoplasm) and ICMA 01777 (A₅ cytoplasm) were the three female CMS lines used in this study. Combining ability analysis shows that the lines ICMB 98222 and ICMB 04777 (A₄ cytoplasm) are significantly better general combiner for most of the characters studied. Pollinators ICMR 15037, ICMR 16401, ICMR 15038 and ICMR 16409 proved their utility for breeding high yielding hybrids. The studies on specific combining ability (SCA) effects, Two hybrids viz., ICMA 01777 × ICMR 15026 and ICMA 98222 × ICMR 15455-1 was observed the best specific combination for the trait grain yield.

GENETIC ESTIMATION OF HETEROSIS ON A₁, A₄ AND A₅ CMS LINES IN PEARL MILLET [*Pennisetum glaucum* (L.) R. Br.]

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Abstract

Among the available sources of cytoplasmic male sterility only the A₁ source has so far been exploited for developing commercial hybrids in pearl millet [*Pennisetum glaucum* (L.) R. Br.]. In the present study, heterosis over mid parent, better parent and standard check estimated in lines belonging to A₁, A₄ and A₅ cytoplasm for eight yield attributing traits. The Line × Tester analysis involving sixty hybrids, twenty three parents (three lines and twenty testers) and three checks viz., VPMH 7, VPMH 14 and Kaveri Super Boss were used to assess the magnitude of heterosis with respect to grain and its component traits in pearl millet under rainfed conditions during *Kharif* 2023 at RARS, Vijayapura. Heterosis was observed in all sources of cytoplasm for days to 50 per cent flowering, plant height, no. of productive tillers per plant, panicle length, panicle girth, 1000 seed weight(g), grain yield (Kg ha⁻¹) and dry fodder yield (Kg ha⁻¹).

PREVALENCE OF ENTEROBACTER SPECIES IN THE BROILER SUPPLY CHAIN IN KARNATAKA, INDIA

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Abstract

Broiler supply chain is the system of organization involved in broiler production which has the major role in supplying broiler meat from farm to consumer. *Enterobacter* species is one of the emerging and important food-borne zoonotic pathogen and it is the normal commensals of the animal and human gut microbiome and also act as opportunistic pathogen in humans. The



present study was conducted to determine the prevalence of various *Enterobacter* species in the poultry supply chain based on isolation, biochemical characteristics and by conducting genus and species specific PCR analysis. A total of 325 samples from broiler breeder, commercial broiler farms and broiler processing cum retail units were collected from different sources like bird samples, human and environment samples which includes 105 broiler cloacal samples, 24 (meat, liver, heart, trachea, lung, intestine and offal), 24 water samples, 12 broiler feed samples, 12 floor swabs, 14 knife swabs, 7 cutting board swabs and 7 workers hand swabs. Out of 325 samples 30(9.23%) *Enterobacter* species were isolated which includes 12(3.69%) *Enterobacter cloacae*, 15(4.62%) *Enterobacter aerogenes* and 3(0.92%) *Enterobacter hormaechei*. Out of 3 different stages of supply chain highest prevalence of 11.92% was observed in processing cum retail units due to un-hygienic practices and cross-contaminations and lowest prevalence of 3.84% was observed in broiler breeder farms may be due to following of strict biosecurity measures and 57% of prevalence was observed in workers hand swabs from processing cum retail units which shows the un-hygienic manufacturing practices. From the present research findings we can conclude that cross-contamination between birds, environment and humans has took the major role in the increased prevalence of *Enterobacter* species. We can control this by following good hygienic and good manufacturing practices.

POTENTIAL OF CHROMATOGRAPHY IN AGRICULTURE AND ALLIED SECTORS

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Abstract

Chromatography, a flexible laboratory technique, aids in the separation, identification, and analysis of complicated mixtures into specific components by utilising differential partitioning between mobile and stationary phases. This overview covers its fundamentals, types, applications, and advances. Major types used in pharmaceuticals, environmental analysis, forensics, and biochemical investigations include gas chromatography (GC) and liquid chromatography (LC), which includes High-Performance Liquid Chromatography (HPLC) and thin-layer chromatography (TLC). Its benefits include great sensitivity, resolution, and adaptability, which are critical in scientific analysis. Sample application, separation, detection, and data analysis are all part of the process, and factors like as stationary phase selection, mobile phase composition, and sophisticated techniques all have a substantial impact on separation efficiency. Pesticide residues in crops, soil, water, and other agricultural products are detected and quantified using chromatographic techniques, particularly gas chromatography (GC) and liquid chromatography (LC). This guarantees that safety requirements and laws are met. Miniaturisation, hyphenated techniques, green chromatography, and AI integration are emerging themes that are accelerating chromatography's progress in a variety of scientific disciplines.

MANAGEMENT AND UTILIZATION OF PLANT GENETIC RESOURCES FOR SUSTAINABLE AGRICULTURE

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Abstract

Plant genetics resources are defined as the genotypes of the particular species, collected from different sources and geographical origins, for use in plant breeding to develop new cultivars, whereas the germplasm of a crop may be defined as the sum total of heredity material (i.e. all the alleles of various genes, present in a crop species and its wild relatives). The plant genetics resources are the old conservation practices to conserve the germplasm and the wild-related species of the different crops in accordance to their climatic/geographical zones of the crop with the old and traditional methods for conservation. Around 5000-10000 years ago the scientist and the historian identified the “Centre of origin”(N. I VAVILOVE) and created the germplasm base for our main sources of plant protein today, including the wheat (*Triticum* spp.) in south-western Asia, rice (*Oryza sativa*) in China, corn (*Zea mays*, maize) in Mesoamerica, potato (*Solanum tuberosum*) in the Andes and Amazonia, sorghum (*Sorghum* spp.) in the Sahel and many crops with their wild species. About 6 million accessions are being stored worldwide in a total of 1308 gene banks, in 77 countries, PGRs serve as a critical foundation for crop improvement,



breeding programs, and scientific research, and are essential for addressing global challenges such as food security, climate change adaptation, and sustainable agriculture. The conservation and sustainable use of PGRs are essential to ensure the availability of genetic diversity for future generations and to support the development of resilient and productive crop varieties.

INFLUENCE OF LOW-TEMPERATURE STRESS ON PHYSIOLOGICAL PARAMETERS AND STRESS ENZYMES AT REPRODUCTIVE STAGE OF RICE (*ORYZA SATIVA* L.) VARIETIES IN LATE-KHARIF PLANTING

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Abstract

Rice (*Oryza sativa* L.) is originated from tropical areas thus sensitive to low-temperature or temperate regions. A field experiment was conducted in ARS, Ganagavathi, UAS, Raichur, Karnataka for two consecutive years (2020 & 2021). The experiment was laid out in two factorial randomized block design (RBD) in two dates of transplanting that is *Kharif* (K-15th September) and late-*Kharif* season (LK-30th September) with four varieties i.e., GNV-10-89 and GNV-1108 (short duration) and GNV-1801 and BPT-5204 (long duration) in three replications. The temperature at reproductive stage of late-*Kharif* season was 14±1°C. The results were obtained at reproductive stage. The stress enzymes activity such as catalase (EC 1.11.1.6), peroxidase (EC 1.11.1.7), ascorbate peroxidase (EC 1.11.1.11) and super oxide dismutase (EC 1.15.1.1) was found higher in low-temperature stress condition that is LK than K and among varieties, long duration varieties showed higher stress enzyme activity than short duration varieties. Photosynthetic rate and transpiration rate was higher in K and lower in LK, short duration varieties obtained higher than long duration varieties. Grain yield per hill was higher in K than LK and short duration varieties recorded higher than long duration varieties. This study concluded that the low-temperature come across the reproductive stage of long duration varieties transplanted in LK.

TRAIT ASSOCIATION STUDIES FOR GRAIN MICRONUTRIENTS IN RICE (*ORYZA SATIVA* L.) GENOTYPES

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Abstract

Rice (*Oryza sativa* L.) is the staple food crop for more than half of the world population. Thus, rice varieties enriched with various micronutrients qualifies as a better alternative to combat micronutrient deficiency. The experiment was conducted at RPCAU Research Farm, Pusa in RCBD with 2 replications, during *Kharif* (2021-2022) to study the degree and direction of association for grain characters especially grain Zinc (Zn) content and grain Iron (Fe) content in 38 genotypes of rice. Thirteen quantitative traits were taken into consideration for the experiment. An instrument known as Energy Dispersive X-Ray Fluorescence (ED-XRF) was used for estimation of the grain Iron and Zinc content. The correlation and path analysis were done by using Windostat Version 9.2 from Indostat services software. The correlation coefficient analysis at the phenotypic and genotypic level were used to determine the association of various traits among themselves and with yield. The traits number of panicles per plant (0.413 & 0.548), panicle length (0.371 & 0.458), number of grains per panicle (0.356 & 0.423), test weight (0.336 & 0.412) and kernel breadth (0.230 & 0.412) showed significant positive correlation with grain yield per plant indicating that selection towards higher values for these traits would consequently improve the yield. The traits plant height (-0.348 & -0.482), grain Zinc content (-0.327 & -0.399) and grain Iron content (-0.314 & -0.458) showed significant



negative correlation with grain yield indicating that improvement of quality with respect to micronutrient content requires cautious efforts to improve them without much compromise with yield. However, it was also found that the traits Zn and Fe content were positively correlated with each other implying that simultaneous selection of these traits could be done for developing rice varieties biofortified with zinc and iron.

ANALYZING GENETIC VARIABILITY, HERITABILITY, AND GENETIC ADVANCE IN SUGARCANE CLONES

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Abstract

In India, the sugarcane sector holds significant agricultural importance, being one of the earliest globally cultivated crops for sugar and, more recently, bioethanol production. Sugarcane, since its commercialization, has served as a source of sugar for both domestic and industrial purposes, while also generating valuable byproducts such as molasses and bagasse. This study aimed to assess variability parameters, including genotypic and phenotypic coefficients of variation, genetic advance, and heritability estimates for both yield and quality parameters in fifteen sugarcane clones. In a field experiment, 15 sugarcane clones were planted in a randomized block design at GBPUA&T, Pantnagar to investigate various genetic parameters of variability associated with cane yield and quality attributes in the plant crop. Observations were recorded on sixteen traits encompassing factors related to cane yield and quality components. These included germination percentage, number of tillers, number of millable canes, Brix% at 10 months, sucrose% at 10 months, juice purity % at 10 months, CCS% (Commercial Cane Sugar) at 10 months, cane length, cane width, single cane weight, Brix% at 12 months, sucrose% at 12 months, juice purity % at 12 months, CCS% (Commercial Cane Sugar) at 12 months, CCS yield and cane yield at harvest. The analysis of variance revealed significant differences among genotypes for most of the traits examined. Substantial variability was observed in the number of tillers, millable cane, cane and sugar yield, as well as quality indicators like juice Brix and CCS percent. Single Cane Weight, CCS yield, and Cane yield exhibited the highest genotypic and phenotypic coefficients of variation, suggesting minimal influence of environment allowing selection of genotypes for improvement in these traits. Purity % at 12 months had the lowest genotypic coefficient of variation, while Purity % at 10 months had the lowest phenotypic coefficient of variation. All characteristics except Purity % at 10 and 12 months, CCS% at 10 and 12 months exhibited high heritability, while the high genetic advance as a percentage of the mean, was observed for CCS yield, Cane yield, Single cane weight, Cane length, Number of tillers, and Number of Millable Canes, suggesting role of additive gene effects in determination of these characters. Therefore, it can be advocated that selection should prioritize on factors contributing to yield with high phenotypic and genetic coefficient of variation, heritability and genetic advance alongwith the high mean value.

TO STUDY PREDATORY EFFICIENCY OF *NOTONECTA* SPP. AND PERCENT SURVIVABILITY OF SPAWN AND FRY OF INDIAN MAJOR CARPS

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Abstract

Aquatic insects commonly associated with fish nurseries mainly belong to three orders, viz. coleoptera, hemiptera and odonata. Notonectidae is a cosmopolitan family of aquatic insects in the order Hemiptera, commonly called backswimmers. Notonectids are predators in the pond culture of various small fishes, as well as of the larvae of various fish species living in still freshwater habitats. Experiment was conducted under two sets of different development stages that means spawn and fry of Indian major carps (Catla, Rohu and Mrigal). In observation arena, a fix number of *Notonecta* were released and each experiment was replicated three times in experimentation tanks. After fix duration of experiment, spawn and fry were harvested and observed for morphological alterations. The predatory efficiency of *Notonecta* spp. and percent survivability of



spawn and fry of IMC was calculated after completion of experiment. For assessing the impact of different doses of "Cypermethrin (10ec)" on fish seed (spawn and fry) and bioassay studies were conducted using different concentration of cypermethrin for *Notonecta* spp. A dose of 500 ml/ha meter had been found most suitable for eradication of aquatic insects, because the insect toll was 100% with this dose in 24 hours. The impact of Cypermethrin on natural fish food (zooplankton) and water quality was also analysed. In the highest dose of 800ml/hr, first sign of mortality (10%) of zooplankton was seen at 12th hrs, which increased with increasing duration and thus the highest mortality rate of 40% was noticed at 48th hrs. The values of water quality parameter remained more or less same in different concentration of cypermethrin.

RELATIONSHIP BETWEEN SPIRITUAL INTELLIGENCE AND MENTAL HEALTH AMONG NURSING STUDENTS

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Abstract

Spiritual intelligence is the adaptive use of spiritual information to facilitate everyday problem solving and goal attainment. People with a high spiritual intelligence are more flexible and have a higher consciousness of the self, capable of dealing with problems, pain and overcoming them, and are less likely to experience depression. The study was conducted to know the spiritual intelligence and mental health among nursing students. The sample comprised of 180 final year B.Sc nursing students were selected from two Nursing colleges of Hubli – Dharwad city. The tools used were Roqan spiritual intelligence test and Mental health inventory to assess spiritual intelligence and mental health of students. The results revealed that majority of nursing students had average level of spiritual intelligence average and mental health status. The factors such as gender, religion, education of mother and occupation of parents had significant influence on spiritual intelligence. With regard to mental health, factors such as father's occupation and SES had significant relationship with mental health. However there is no significant inter – relationship between spiritual intelligence and mental health of nursing students.

IN VITRO RAPID CLONAL PROPAGATION OF SPINE GOURD FOR COMMERCIAL CULTIVATION IN VIDARBHA

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Abstract

Spine gourd (*Momordica dioica* Roxb.) is a dioecious and perennial cucurbitaceous climber distributed throughout India and few Asian countries. Various plant parts are consumed in a variety of ways, viz., immature green fruits are cooked as vegetable, young leaves and flowers are also eaten. Fruits contain high amount of proteins, calcium, phosphorous, iron, and the highest amount of β -carotene (162 mg/ 100 g of edible portion). In addition, this species is valued for several medicinal and curative properties. Due to this exceptional nutritive value, this popular vegetable crop has high demand in market. But this crop always remained underutilized and underexploited mainly due to its vegetative mode of propagation and dioecious nature. Conventional commercial propagation of spine gourd largely depends on tuberous roots followed by stem cuttings and seeds. Commercial multiplication using the tuberous roots and stem cuttings are critically limited due to inadequate availability of tuberous roots and late availability of stem cuttings in fruiting season. Tuberous roots have low multiplication rate and occupies the valuable cultivable land until next planting season, which is a major concern about its large scale cultivation. Stem cuttings containing 2–3 nodes from dark green vines of 2–3 months old plants are planted, but only 30-35% of the plants sprout and survive. Another difficulty of this crop is in propagation by seeds, which bears dormancy and unpredictable sex ratio in seedling progenies. As male plants dominate natural populations of spine gourd. Sex determination of the plants is possible only when the plants start flowering. Since, fruits are the main edible portion of this species, which are harvested on female plants only; it is desirable to have commercial fields with a large proportion of female plants.



Accommodating, 5–10 % male plants to act as pollinators in the field is imperative for good fruit set. As the conventional methods of spine gourd propagation impose several limitations for their large-scale propagation of sex specific plants, an efficient clonal propagation method is a must. An *in vitro* propagation system offers unlimited availability of planting material early in the planting season. Micropropagation technique is well-established for rapid and large-scale multiplication of many horticultural crops including vegetables. Similarly, an attempts have to be made for rapid *in vitro* propagation of spine gourd (*M. dioica*), wherein shoots and plant will be regenerated from various nodal explants. Moreover, there are very few limited study available on micropropagation and specifically female and male genotypes of spine gourd. In this context, it is proposed to establish a simple and efficient method for large-scale *in vitro* propagation of spine gourd, to obtain clones of known sex-type and their characterization using nodal explants from *in vitro*-raised shoots. Therefore, this project is proposed for rapid and large scale multiplication of female seedlings to maximize the yield at commercial level through exploitation of micropropagation technique along with detailed study on medicinal properties of spine gourd.

STUDIES ON RESPONSE OF CAULIFLOWER (*BRASSICA OLERACEA* VAR. *BOTRYTIS* L.) TO NAA AND GA₃ FOR GROWTH DYNAMICS AND CURD FORMATION CHARACTERS UNDER CHHATTISGARH PLAINS

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Abstract

The present experiment was conducted during *Rabi* 2020-2021 at Precision Farming Development Centre (PFDC), Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The research was conducted in RBD with 9 treatment combinations in three replications. In this experiment the four different concentrations of NAA viz. (80, 100, 120 and 140 ppm) and four different concentrations of GA₃ (50, 100, 150 and 200 ppm) were used over control. Among all the treatments, it was concluded that for growth attributing characters T3- GA₃ 150 ppm gave maximum plant height (cm) at 30, 45 and 60 DAT (28.77, 40.67, 45.00), No. of leaves/ plant at 30, 45 and 60 DAT (10, 14, 21), canopy spread (cm²) at 30, 45 and 60 DAT (39.33, 55.50, 73.17), length of leaves (cm) at 30, 45 and 60 DAT (18.67, 30.00, 37.00), width of leaves (cm) at 30, 45 and 60 DAT (10.00, 16.33, 19.20), minimum no. of days from transplant to the start of the curd (44.00), minimum no. of days from transplant to 50% curd formation (57.00), minimum no. of days from transplant to harvesting of crop (67.00). From this experiment, it was concluded that 150 ppm of GA₃ can be recommended in cauliflower for higher growth dynamics and curd formation characters.

STUDIES ON RESPONSE OF CAULIFLOWER (*BRASSICA OLERACEA* VAR. *BOTRYTIS* L.) TO NAA AND GA₃ FOR YIELD AND YIELD ATTRIBUTING CHARACTERS UNDER CHHATTISGARH PLAINS

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Abstract

The present experiment was conducted during *Rabi* 2020-2021 at Precision Farming Development Centre (PFDC), Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The research was conducted in RBD with 9 treatment combinations in three replications. In this experiment the four different concentrations of NAA viz. (80, 100, 120 and 140 ppm) and four different concentrations of GA₃ (50, 100, 150 and 200 ppm) were used over control. Among all the treatments, it was concluded that for yield attributing characters T3- GA₃ 150 ppm gave maximum yield attributing characters such as maximum curd yield per



plant (g) (0.97), curd yield per plot (Kg) (3.88), curd yield (q/ha) (358.90), curd diameter (cm) (68.33), was recorded in T3-GA₃ 150 ppm, and the minimum was recorded under T9-control. From this experiment, it was concluded that 150 ppm of GA₃ can be recommended in cauliflower for higher yield.

TO STUDY THE EFFECT OF GA₃ AND NAA ON QUALITY PARAMETERS OF CAULIFLOWER (*BRASSICA OLERACEA* VAR. *BOTRYTIS* L.) UNDER CHHATTISGARH PLAINS

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Abstract

The present experiment was conducted during Rabi 2020-2021 at Precision Farming Development Centre (PFDC), Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.). The research was conducted in RBD with 9 treatment combinations in three replications. In this experiment the four different concentrations of NAA viz. (80, 100, 120 and 140 ppm) and four different concentrations of GA₃ (50, 100, 150 and 200 ppm) were used over control. Among all the treatments, it was concluded that for growth attributing characters T3- GA₃ 150 ppm gave maximum quality attributing characters such as maximum TSS of the curd (%) (12.57), dry weight of curd per 100g fresh weight (10.37), ascorbic acid content in curd (mg/100g) (74.43) was recorded in T3- GA₃ 150 ppm. followed by the treatments T7- NAA - 120 ppm, T2- GA₃ - 100 ppm, T4- GA₃ - 200 ppm, and T8- NAA - 140 ppm and the minimum was recorded under T9-control. From this experiment, it was concluded that 150 ppm of GA₃ can be recommended in cauliflower for higher quality attributing characters.

EVALUATION OF DIFFERENT PIGEONPEA BASED INTERCROPPING SYSTEMS IN ALFISOLS FOR HIGHER PRODUCTIVITY

Devika A.R., H.M. Atheekur Rehman and Laxman Navi

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Abstract

In rainfed and dry regions of southern Karnataka, sole cropping is not much remunerative in the current scenario of climate change in agriculture to meet the varied demands of consumers and growing population. Hence, field experiment entitled “Evaluation of different pigeonpea based intercropping systems in Alfisols for higher productivity” was conducted during Kharif, 2021 at ‘K’ Block, Zonal Agricultural Research Station, University of Agricultural Sciences, GKVK, Bengaluru to evaluate most profitable intercrop (sweet corn, baby corn, sorghum, vegetable soybean, field bean, quinoa and grain amaranth) on growth and yield of pigeonpea. The experiment was laid out in RCBD with 15 treatments each replicated thrice. The plant height, number of branches per plant and biomass were found to increase when pigeonpea intercropped with legumes compared to cereal based cropping system. Higher pigeonpea plant height, number of branches and biomass were recorded in T₁₅: pigeonpea + field bean (1:2) intercropping which was on par with T₁₂: vegetable soybean (1:2). Similar results were found in seed and stalk yield (852 and 1678 kg ha⁻¹, respectively) with highest in pigeonpea + field bean (1:2) intercropping and lowest in pigeonpea + sweet corn (1:2) (574 and 1033 kg ha⁻¹, respectively) intercropping system. The data revealed that higher seed yield was positively correlated to higher plant height, number of branches, leaf area, biomass and number of pods per plant of pigeonpea due to less competition for nutrients, water and space in pulse based cropping system compared to exhaustive cereal crops.

INFLUENCE OF NANO UREA ON GROWTH, YIELD AND QUALITY OF PIGEONPEA

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Abstract

A field experiment entitled “Influence of nano urea on growth, yield and quality of pigeonpea” was conducted during Kharif



2021 at K block, Zonal Agricultural Research Station, GKVK, Bangalore. The experiment was laid out in Randomized Complete Block Design with three replications and 15 treatments. The combined effect of normal and nano urea application along with zinc and ferrous sulphate on pigeonpea growth, yield and quality parameters were studied. The results revealed that application of RDF (Nano Urea) + foliar application of water soluble ZnSO_4 and FeSO_4 @ 0.5 per cent each has recorded significantly higher plant height (242 cm), number of branches plant⁻¹ (23.7), number of compound leaves plant⁻¹ (273), leaf area plant⁻¹ (4919 cm²), dry matter accumulation plant⁻¹ (254 g), number of pods plant⁻¹ (116.2), pod yield plant⁻¹ (52.3 g), pod bearing length (64.7 cm), stalk yield (4568 kg ha⁻¹), grain yield (1179 kg ha⁻¹), protein yield (250 kg ha⁻¹), zinc (38.1 ppm) and iron content (75.7 ppm) in pigeonpea grains. This treatment was followed by RDF (Nano Urea) + soil application of ZnSO_4 @ 25 kg ha⁻¹ + FeSO_4 @ 5 kg ha⁻¹ with stalk yield (4466 kg ha⁻¹) and grain yield (1166 kg ha⁻¹). However, higher net returns (Rs. 38581 ha⁻¹) and B: C ratio (1:1.98) were recorded with the application of RDF (Nano Urea) + soil application of ZnSO_4 @ 25 kg ha⁻¹ + FeSO_4 @ 5 kg ha⁻¹ compared to all other treatments.

INFLUENCE OF FOLIAR NUTRITION ON GROWTH, YIELD AND QUALITY OF PIGEONPEA [*CAJANUS CAJAN* (L.) MILLSP.]

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Abstract

The most significant pulse crop in Karnataka is pigeonpea. Because of the poor source-sink relationship and indeterminate growth habit, the yield of pigeonpea is quite low. It is well recognized that plant growth regulators affect the source-sink relationship and promote photo assimilate translocation, which aids in fruit and seed development, flower formation, and eventually increases crop output. With this background, a field experiment was conducted to Influence of foliar nutrition on seed yield and quality of pigeonpea [*Cajanus cajan* (L.) Millsp.] during Kharif 2022 at 'K' Block, Zonal Agricultural Research Station, University of Agricultural Sciences, GKVK, Bengaluru. The experiment consisted of foliar application of two types of nutrients (19:19:19 and Pulse magic), two growth promoters (NAA, and N - Triaccontanol) and their combinations at flowering and pod formation stages, totally there were eight treatments replicated thrice in randomized complete block design. The growth and yield attributes were varied significantly and RDF + foliar application of 1% pulse magic at flowering and pod formation stage recorded higher plant height (144.6 cm), number of branches (16.8 plant⁻¹), leaf area (3218 cm² plant⁻¹), leaf area index (2.38) and total dry matter accumulation (135.5 g plant⁻¹) as compared to control (122.2 cm, 12.9, 2421 cm² plant⁻¹ and 89.4 g plant⁻¹, respectively) at harvest. Higher seed yield (1590 kg ha⁻¹), crude protein content (21.1%), crude protein yield (335.5 kg ha⁻¹), net returns (Rs. 52570 ha⁻¹) and B:C ratio (2.33) recorded with the application of RDF + foliar application of 1% pulse magic at flowering and pod formation stage and lower seed yield, net returns and B:C ratio (1104 kg ha⁻¹, Rs. 27322 ha⁻¹ and 1.74, respectively) was recorded with control treatment.

EVALUATION OF DIFFERENT PIGEONPEA BASED INTERCROPPING SYSTEMS IN ALFISOLS FOR IMPROVED INTERCROPPING EFFICIENCY

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Abstract

A field experiment was conducted at 'K' Block, Zonal Agricultural Research Station, University of Agricultural Sciences, GKVK, Bengaluru to study the effect of different intercropping systems on pigeonpea equivalent yield entitled "Evaluation of different pigeonpea based intercropping systems in Alfisols for higher productivity" during Kharif, 2021. It was observed that pigeonpea equivalent yield was significantly affected due to different intercropping systems. The experiment was laid out in RCBD with 15 treatments each replicated thrice with different intercrops like sweet corn, baby corn, sorghum, vegetable soybean, field bean, quinoa and grain amaranth in 1:2 row proportion. Pigeonpea + sweet corn intercropping system (T₂) tended to give the highest pigeonpea seed equivalent yield (2724 kg ha⁻¹) and was on par with pigeonpea + baby corn (T₁₀) (2662 kg ha⁻¹) whereas lowest recorded in pigeonpea + grain amaranth (T₁₄) (1303 kg ha⁻¹). The data revealed that higher pigeonpea seed equivalent yield was mainly attributed to higher yields and market price of sweet corn making it economically superior than other intercropping system. Similar findings were observed in net returns and benefit: cost ratio with higher



values in pigeonpea + sweet corn intercropping (Rs. 2,96,750 ha⁻¹ and 4.91, respectively) than rest of the treatments making pigeonpea + sweet corn to be the most profitable pigeonpea based intercropping system. Whereas, higher system indices like LER (1.43) and ATER (1.19) were recorded with pigeonpea + field bean (1:2) intercropping system. Thus, the enhanced land use of 11 to 43 per cent was obtained due to intercropping in pigeonpea than respective sole crops.

EVALUATION OF TAXONOMIC CLASSIFICATION AND LAND CAPABILITY, SUITABILITY AND IRRIGABILITY CLASSES FOR GUAVA GROWING SOILS OF NORTH-EAST REGION OF HARYANA

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Abstract

The present study was carried out to classification for the soils of guava growing area in North-East region of Haryana, according to Soil Survey Manual, 2017 and evaluated land capability, suitability and irrigability classification according to Frame work of Land Evaluation (FAO, 1993). Taxonomically, the soils of the all studied pedons were placed under the three orders viz. Inceptisols, Entisols and Alfisols based on morphological and physicochemical properties. However, the soils of recent alluvial plains under order Entisols were immature, lacked pedogenic development and horizon differentiation and classified as *Typic Udorthents* and *Typic Ustorthents*. Moreover, the soils of old alluvial plains under the order Inceptisols and Alfisols formed from old alluvial parent material and great group Haplustepts having ustic moisture regime and hyperthermic soil temperature regime and classified as *Typic Haplustepts* and *Typic Natrustlf*. The soils of the study areas were placed under two land capability classes (II and III), three land suitability classes (S1, S2 & S3) and three land irrigability classes (S1, S2 & S3) due to soils, pedogenic processes and topographic limitations.

MONITORING OF INSECT PESTS AND THEIR ASSOCIATED NATURAL ENEMIES ON PIGEON PEA AT PANTNAGAR, UTTARAKHAND

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Abstract

Pigeon pea, *Cajanus cajan* (L.), is an important legume crop grown throughout the tropics and subtropics, mostly in Asia, Africa, Latin America and the Caribbean region. In Asia, though India is the largest producer of pigeon pea, contributing more than 90 per cent of the world's production, productivity has always been a concern. The low productivity of pigeon pea in the country may be attributed to many reasons, among which damage by insect pests is of paramount importance. More than 250 species of insect pests are known to infest pigeon pea crop at its various growth stages in India inferring losses that vary from 27 per cent to even 100 per cent. The insect pests and their associated natural enemies on pigeon pea crop grown in Pantnagar (Uttarakhand) have been recorded during the *Kharif* crop seasons 2021-22 and 2022-23. A total of 24 insect pests belonging to 6 orders and 22 families were recorded. The incidence of insect pests were observed during all the crop stages. Among these, 5 species were recorded as major, 13 as minor and remaining 06 as negligible pests. A total of three species of insect pests viz., *Maruca vitrata* (Fabricius), *Melanagromyza obtusa* (Malloch) and *Helicoverpa armigera* (Hübner) constituting the pod borer complex have been recorded along with Pod bug, *Clavigralla gibbosa* Spinola were found to be the most destructive key pests. Gram pod borer, *H. armigera* attained its peak during 45th MSW (10.66 larvae/plant) and 49th MSW (7.00 larvae per plant) in 2021-22 and 2022-23 respectively. Highest number of maruca webs (23.80 webs/plant) were recorded during 42th MSW and 15.47 webs/ plant recorded during 44th MSW respectively in two consecutive years. Peak population of pod fly (1.20/plant) was recorded during 48 MSW and 1.10/plant during 48th MSW in the two consecutive years respectively. A total number of 9 natural enemies belonging to 5 orders and 9 families were recorded on the insect pests associated with pigeonpea crop throughout the crop seasons. Nine natural enemies viz., *Camptoplex chloridae*, *Braconid* wasp, *Coccinella*



septempunctata, Assassin bug, *Eucanthocona* bug, Tachinid fly, Hoverfly, spiders were found to be associated with the insect pest complex, regulating the insect population under natural conditions.

STUDIES ON POPULATION DYNAMICS OF YELLOW STEM BORER, *SCIRPOPHAGA INCERTULAS* WALKER (LEPIDOPTERA : PYRALIDAE)

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Abstract

The insect, *Scirpophaga incertulas* commonly known as yellow stem borer (YSB) of rice is distributed widely, covering almost all the Asian countries. YSB usually occupied more than 90 per cent of the borer populations in the rice crop from seedling to maturity stage of the crop. The yellow stem borer is monophagous and closely associated with the crop throughout the cropping period, better understanding of its adult activity pattern studies is considerable. This study was conducted on paddy crop at Agriculture Research Station, Gangavathi during 2021-22. Ten locations monitored using pheromone traps revealed clear patterns in the flight period. Moths burst seen only during the expected times, with a clear rise, fall and an in-between peak. Each flight period occurred at exactly the time of transition between two generations and there was a distinct definiteness with the higher period. Each flight period preceded and followed by zero moth activity. Further there was a distinct occurrence of definite life stages for the period of observations. The first peak trap catches ranged from 11.33 to 121.67 moths/trap/week, the second peak trap catches ranged from 10.67 to 126.67 moths/trap/week and third peak trap catches ranged from 14 to 108.67 moths/trap/week. Negligible to no moths were recorded during 28th and 39th SMW across all the locations during the study period.

FEEDING PREFERENCE OF FALL ARMYWORM, *SPODOPTERA FRUGIPERDA* (J. E. SMITH) (LEPIDOPTERA: NOCTUIDAE) ON DIFFERENT HOST PLANTS UNDER LABORATORY CONDITIONS

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Abstract

Host plant is a key determinant factor for the establishment, growth, survival and fecundity of herbivorous insects. In India, the invasive fall armyworm, *Spodoptera frugiperda* emerged as most devastating pest that feeds on of maize. A total of 353 *S. frugiperda* larval host plants recorded belonging to 76 plant families, principally Poaceae (106), Asteraceae (31) and Fabaceae (31). In this study we assessed the feeding preference of fall armyworm, *S. frugiperda* at Department of Agricultural Entomology, UAS Raichur under laboratory condition, during 2019-20 on different host plants like maize, chickpea, cabbage, sorghum, groundnut, tomato and cotton. In this experiment the first and third instar larvae were released on different host and observation were recorded at one hour and 24 hours after release of larvae. The results of the experiment revealed that the number of first instar larvae feeding on maize was higher with 8.40 ± 0.55 larvae followed by sorghum (5.20 ± 0.45) and groundnut (4.40 ± 0.55). Least feeding preference was shown towards tomato (0.80 ± 0.45) followed by chickpea (1.00 ± 0.71), but the larvae were least attracted to cotton and cabbage with 2.20 ± 0.84 and 2.00 ± 0.00 larvae, respectively. A similar



trend was observed for third instar larvae where maize (4.60 ± 0.89) was highly preferred for feeding followed by sorghum (2.40 ± 0.55) groundnut (2.20 ± 0.42) and cabbage (1.20 ± 0.43). Least feeding preference was shown towards tomato (0.20 ± 0.45) followed by chickpea (0.60 ± 0.54). Hence, from feeding preference studies its revealed that maize was the preferred host and cotton and tomato are not suitable for the growth of the larva under laboratory.

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 Pulses Research 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 of recommended dose of chemical fertilizer with eight treatments of *Rhizobium* isolates. The carrier based 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.

STUDY ON CORRELATION AND PATH ANALYSIS IN FRENCH BEAN (*PHASEOLUS VULGARIS* L.) GENOTYPES

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Abstract

An investigation on “Correlation and path analysis studies in French bean (*Phaseolus vulgaris* L.) genotypes” was undertaken during *Rabi* 2022-23 at RARS, Vijayapur. Forty one French bean genotypes were evaluated in RBD with three replications to study the interrelationship among the yield and its contributing traits. Correlation and path analysis studies revealed that green pod yield per plant was positively and significantly ($p=0.01$) associated with the traits *viz.*, number of pods per plant, average pod weight, pod length, pod width, number of seeds per pod, dry matter content in pods, plant spread (N-S) at 50 DAS, plant spread (E-W) at 50 DAS, number of primary branches at 50 DAS, leaf area and days to first flowering. Thus, suggesting that these traits have exhibited true association with direct effect on yield per plant. The direct selection of these traits would be rewarding for improvement in the total green pod yield per plant.

CHARACTERIZATION OF DRAIN DISCHARGE FROM SUBSURFACE DRAINAGE SYSTEM WITH 40 M LATERAL SPACING IN SALINE VERTISOLS OF TUNGABHADRA COMMAND AREA

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Abstract

Characterization of drain water for irrigation over the cropping season was assessed during *rabi/summer* 2020-21 at Agricultural Research Station, Gangavati in the TBP command area. Drain water samples collected fifteen times over the



cropping season from man holes revealed that the pH and EC values of drain water varied from 7.33 to 7.00 with a mean of 7.16 and 6.64 to 5.94 dS m⁻¹ with a mean of 6.22 dS m⁻¹ respectively. The SAR and RSC values in drain discharge varied from 21.80 to 14.60 (mmol/L)^{1/2} with a mean value of 17.20 (mmol/L)^{1/2} and from 13.20 to 0.00 me L⁻¹ with a mean value of 2.69 me L⁻¹. The DCR and SSP in drain discharge varied from 0.28 to 0.17 with a mean value of 0.23 and from 83.3 to 71.8 with a mean value of 76.5 respectively. The Mg/Ca and Cl/SO₄ ratios in drain discharge varied from 12.70 to 0.29 with a mean value of 1.92 and from 0.63 to 0.31 with a mean value of 0.49 respectively. The EC, SAR, RSC, and SSP values of drain water are the major constraints as far as their irrigation feasibility is concerned.

FACTORS INFLUENCING COGNITIVE FUNCTION AMONG ELDERLY

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Abstract

As aging brings progressive changes in all parts of the body including changes in the structures and function of brain which leads to cognitive decline, physical and behavioural changes among older adults. According to 2011 census 7.7 per cent of the population were above the age of 60 years and estimated to be double (15.4%) by the year 2025. The objective of the study was to know the factors influencing cognitive function among elderly. The sample comprised of 180 elderly aged 60 years and above were selected through snowball technique. The tools used were general information schedule, Mini mental state examination and Mini nutritional assessment to assess the cognitive function and nutritional status among elderly. The results revealed that about 48 per cent of elderly had normal cognitive function, while 20 per cent had severe cognitive impairment. Factors like age, education, marital status, working status and nutritional status had significant influence of cognitive function, indicating that those who had completed PUC and above education, belong to young old group, married, currently working temporarily and nourished nutritional status had normal cognitive function than old old elderly. There is a need for counselling on nutrition, health and cognitive skills to enhance the better cognitive function and psychological well being among elderly.

STATUS OF CLIMATE CHANGE IMPACT ON RICE INSECT PESTS IN INDIA

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Abstract

The importance of climate and weather events to the distribution of insects and their population dynamics has long been recognized. The climate change and global warming have affected the rice insect pests scenario drastically. Several insect pests, that were important in the past or the minor pests are likely to become more devastating with global warming and climate change. Insect pests cause an estimated annual loss of 13.6% globally and 23.3% in India. Losses due to insect pests are likely to increase as a result of change in crop diversity and climate change. An increase of 0.4°C average surface temperature over past century in India has led to rice insect pests losses increase from 10% during the pre-green revolution period to 25% during the post-green revolution period. The plant hoppers (*Nilaparvata lugens* & *Sogatella furcifera*) in northern India have been affected crop failure on more than 33,000 ha area for rice. The changes in rice insect pests losses low to severe has been inference with impact of climate change on rice insect pests scenario under eastern Uttar Pradesh conditions. The climate change has affected the number of major insect pests of rice have increase from 3 to 15 (500 times). Meanwhile, the rice stem borers (*Scirpophaga incertulas* and *Chilo suppressalis*) and rice leaf folder (*Cnaphalocrocis medinalis*) have been maintaining the major insect pest status. 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. The adaptation, mitigation and natural resource management are basic components of remedial measures taken to combat the adverse impact of climate change on rice insect pest management. To combat the adverse impact of climate change on rice insect pests, its urgent need to adopt climate resilient strategies and initiatives for insect pest



management in India. This paper attempt to analyse the review of reported studies on the status of climate change impact on rice insect pests in India to reduce the risk of strategy for effective insect pest management.

COMMON AND CHRONIC HEALTH PROBLEMS AMONG RURAL AND URBAN ELDERLY

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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 *et al.* (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.

REVIEW OF PRESENT OPPORTUNITIES IN FOOD PROCESSING SECTOR AND A VISION 2030

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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 merely 19.0 per cent in 2021-22 and to merely 18.3 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 (Bhasin, 2010). 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) (<http://J: Press Information Bureau.html>). 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). The GDP rank is 14th and GDP growth rate is 10.98 %.(2022-23)(<https://prsindia.org/budgets/states/bihar-budget-analysis-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. Approval has been given for creation of 75,543 posts in police. Bihar is primarily an agricultural state



where farming is subsistent in nature. It is one of the nation's strongest states in terms of agriculture. 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. It has marked the return of the state's economy to the 'pre-Covid-19 years', implying that the disruptions caused to the economy by the coronavirus pandemic in 2019-20 and 2020-21 have been nearly overcome. 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.

FUNCTION OF MICRONUTRIENTS IN VEGETABLE CROPS

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Abstract

Micronutrients are involved in enzyme activation and electron transport. The 17 essential nutrients are hydrogen, oxygen, carbon, nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, chloride, iron, boron, manganese, zinc, copper, molybdenum and nickel. These elements act as catalysts and catalysts in the plant system. Vegetable crops cannot be produced successfully without proper planning. Nutrients one of the most important elements in plant growth and development is the integrated supply of micronutrients and micronutrients in the right quantity and ration. Even though they are often needed in very small amounts, micronutrients are essential for plant growth. To produce as high quality food as possible from vegetable farming. Careful use of micronutrients is necessary. Many micronutrients (MO) are essential to carry out efficient functions like plant metabolism, nutrition management, chlorophyll reproductive growth, flower retention, fruit and seed development, etc. Molybdenum, boron (B), manganese (Mn), copper (Cu), chlorine (Cl), iron (Fe), zinc (Zn) and nickel (Ni) are all essential for higher plants. Micronutrients are essential for all higher plants. While Zn, Cu, Fe, and Mn are micronutrients associated with various types of enzymatic activity, and Cl, Cu, Fe, and Mn are micronutrients associated with various types of enzymatic activity, and Cl, Cu, Fe And Mn are micronutrients. Micronutrients are nutrients that are involved in various photosynthetic processes, of which only Mo is unique to nitrate reductase. Along with photosynthesis or nematic processes, plant reproductive cycles and carbohydrate metabolism are linked to boron. The output of the review focuses on the primary role that micronutrients play in vegetable production and provides a brief summary of research findings regarding the effects of micronutrients on vegetable production. Production. This may help elucidate the role of micronutrients in the growth of vegetable plants.

NATURE OF GENETIC DIVERSITY IN GREENGRAM AND IDENTIFICATION OF RESISTANCE SOURCES TO MYMV

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Abstract

Pulses play an important role in food and nutritional security. Among the various pulses, mungbean or greengram is one of the short duration and cultivated throughout the country across the seasons. Success of mungbean improvement programme mainly relied upon the nature and variability and genetic diversity available in the germplasm. Hence the present study was carried out to assess the nature of diversity in greengram germplasm utilizing Mahalanobis's D² statistics and to identify the resistance sources for MYMV during summer-2020-21. In the present study, seventy-eight genotypes of green gram were grouped into eighteen clusters. Out of these 18 clusters, XIV and XVIII clusters had single genotype (Coll.no NR/18-37 and



Coll.no NR/18-06) revealed higher seed yield per plant, number of pods per plant and also observed to be early in maturity. Cluster XI and XIII were also had lowest number of days to flowering and days to maturity respectively could be regarded as good sources for earliness. Cluster II with twenty-three and cluster VIII with eight genotype were good source for number of seed per plant and number of cluster per plant. The genotypes from these clusters could be utilized as donors for future breeding programmes to incorporate these traits for which they have shown superiority. Hence, these accessions will be used as source of divergent parents in breeding programme. Most of the genotypes were susceptible to MYMV and the genotypes such as EC-398885, EC-398891, IPM-604-1-7, Coll.no NR/18-57, Coll.no NR/18-79, IPM-14-10 and IPM-1205, IPM-2-14 were found to be resistant for yellow vein mosaic and these identified genotypes could be utilized in MYMV resistance breeding programme.

EFFECT OF LIGHT QUALITY, INTENSITY AND PHOTOPERIOD ON FLOWER CROPS IN GREENHOUSE CONDITION

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Abstract

Light is probably the most complex and variable ambient factor that act on plants. It has a very important role to give energy for photosynthesis and to act as a stimulus for growth and development. Plants respond to light quality, intensity and periodicity. Light quality refers to the colour or wavelength reaching the plant surface. Light quality is sensed by photoreceptors. Plant responds to light using a unique set of light sensitive proteins called as photoreceptors. Light quality affects physiological, morphological and anatomical features in plants. Controlling spectral quality enables faster growth and higher yield. A good lighting system will place the proper quantity and quality of light where it is needed in a cost-effective way. Intensity refers to the total amount of light that plant receives. Rate of photosynthesis is highly dependent upon light quantity.

Depending on the culture, climate and other factors artificial light or alternatively shading materials are needed to reach the optimal light level. Artificial light can be applied in ornamental plants for two main objectives : to increase the radiance level for photosynthesis and to increase the effective day length (photoperiodism). Off-season flowers can be produced by use of photoperiod and light intensity that provide a year-round production of flowers. By optimizing light quality, intensity and photoperiod, growers can influence flowering time, stem elongation, pigmentation and other important characteristics of flower crops.

UNFOLDING THE COMPLEX REGULATORY NETWORK OF RUST (*UROMYCES VICIAE-FABAE*) RESISTANCE IN LENTIL (*LENS CULINARIS* MEDIK.) THROUGH COMPARATIVE RNA-SEQ ANALYSIS

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Abstract

Lentil (*Lens culinaris* Medik.) is a highly nutritious pulse crop, but its productivity is threatened by diseases like rust caused by *Uromyces viciae-fabae*, leading to significant yield losses. The objective of this research was to investigate and gain insights into the underlying molecular mechanisms that confer resistance in lentil against rust. Through comparative RNA-Seq analysis of rust-resistant L4147 and rust-susceptible LLS 18-109 genotypes, we identified 12,316 DEGs in response to rust infection. The functional analysis of DEGs revealed their involvement in various biological processes, molecular functions,



and cellular components, as evidenced by the enrichment of GO terms such as “metabolic processes”, “cellular processes”, “catalytic activity”, “binding”, “cell”, and “cell part” etc. Whereas, KEGG analysis revealed enrichment of metabolic pathways, biosynthesis of secondary metabolites, plant-pathogen interactions etc. Notably, several histone genes, R genes, genes associated with ionic activity and metabolic processes exhibited differential expression, potentially bolstering defence against rust. We narrowed down the DEGs to 34 key genes, encoding LRR receptor-like kinase, transcription factors such as WRKY, TIFY, AP2-EREBP, some PR proteins, R proteins and more. The protein-protein interaction analysis revealed complex networks involving cell cycle regulation, hormone signalling, MAPK signalling, suberin biosynthesis etc. and some other non-interactive genes putatively associated with defense responses. Moreover, the strong correlation observed between the qRT-PCR outcomes of 16 of these genes and the RNA-Seq data served to enhance the credibility of the RNA-Seq results.

COMBINED EFFECT OF ORGANIC MANURES AND PHOSPHORUS ON SOIL PROPERTIES UNDER RICE-BLACKGRAM CROPPING SEQUENCE

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Abstract

A field experiment entitled “Phosphorus dynamics in relation to nutrient management in rice-blackgram cropping sequence” was conducted for two consecutive years (2017-2018 and 2018-2019) at Agricultural College Farm, Bapatla. The experimental soil was clay loam in texture, slightly alkaline in reaction, low in organic carbon and available nitrogen, medium in available phosphorus and high in available potassium. However, DTPA extractable micro-nutrients (Fe, Mn, Zn and Cu) were found to be above the critical limits. Further, the results revealed that significantly the lowest pH and EC were observed due to application of 100% RDNK with the combination of *Dhaincha* @10t ha⁻¹ over RDNK alone at different growth stages of rice crop. However, the pH and EC were not significantly differed among the P levels from 0 to 120 kg P₂O₅ ha⁻¹. The Similar trend was followed at both flowering and harvest in succeeding blackgram.

MULTIVARIATE ANALYSIS FOR BIOCHEMICAL AND YIELD RELATED TRAITS IN POWDERY MILDEW RESISTANCE DERIVED F₄ AND F₅ GENERATIONS OF OAT

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Abstract

The present study was planned to evaluate the extent of genetic diversity in powdery mildew resistant derived F₄ and F₅ generation progenies of seven crosses in oat viz., PLP-1 × HJ-8, HJ-8 × JPO-46, HJ-8 × PLP-1, HJ-8 × EC528896, HJ-8 × *A. sterilis* cv. HFO-878, HJ-8 × KRR-AK-26 and PLP-1 × *A. byzantina* cv. HFO-60. Among the parents used in these crosses, PLP-1, JPO-46, KRR-AK-26, EC528896 and *A. sterilis* were resistant to powdery mildew whereas, HJ-8 is highly susceptible. PCA studies revealed that first five components accounting for more than 80% of the total variance among the progenies are important in both the generations. Four PC in F₄ and five PC in F₅ generation possess eigen values > 1. The first principal component i.e., PC1 accounted for maximum proportion of total variability in the set of all variables i.e., 36.97% and 30.29% in F₄ and F₅ generations, respectively. PC1 for dry matter per cent, crude protein yield/plant, dry matter yield/plant and fresh fodder yield/plant, and PC2 for grain yield/plant, number of tillers/plant and number of leaves/plant showed high factor loading in the both F₄ and F₅ generations. PC3 carried high loading score for days to 50% flowering in both generations, and for days to 75% maturity and crude protein content (%) in F₅ generation. PC4 showed high loading for harvest index in F₄ and for grain yield/plant in F₅ generation. 100 seed weight carried high loading in PC5 in both generations. So, these PCs were regarded as grain and fodder yield factors and these traits contributing more to the diversity were considered as important in differentiating the genotypes. Two progenies of the cross HJ-8 × JPO-46 were resistant to powdery mildew disease in F₅ generation, while 16 progenies in F₄ and 11 progenies in F₅ generations showed moderately resistant response along with superiority over better parents. These progenies can be used as parents in oat breeding programmes for developing high yielding varieties with desirable powdery mildew resistance gene combinations.



IMPACT OF GENETIC ENGINEERING IN FRUIT CROPS

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Abstract

Genetic engineering is a powerful tool that has revolutionized the field of agriculture, particularly in the development of transgenic fruit crops. The principal behind genetic engineering involves the manipulation of an organism's genetic material in order to introduce desirable traits or characteristics. This can be achieved through the insertion of specific genes from one organism into the genome of another, allowing for the expression of novel traits that may not have been naturally present. The method of genetic engineering typically involves the use of recombinant DNA technology, which allows for the precise manipulation of DNA sequences. In the context of transgenic fruit crops, genetic engineering has been utilized to enhance traits such as disease resistance, shelf life, and nutritional content. For example, the development of transgenic papaya with resistance to the papaya ring spot virus has been instrumental in protecting the crop from devastation. Additionally, the introduction of genes for increased levels of certain vitamins or antioxidants has led to the production of more nutritious fruit varieties. Overall, genetic engineering has provided a means to address many of the challenges facing fruit crop production, ultimately leading to the development of more resilient and higher quality varieties.

STUDIES ON ANTIOXIDANT AND ANTIBACTERIAL ACTIVITIES OF *HYOSCYAMUS NIGER* LEAF

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Abstract

Hyoscyamus niger (Black Henbane) belongs to Solanaceae family and used as medicinal herb since ancient time. *H. niger* used to treat psychiatric disorders, insomnia, asthma, dental caries etc. Leaves of *H. niger* was collected from Spiti Valley of Lahaul and Spiti District of Himachal Pradesh. In present work antioxidant and antibacterial activities of acetone and methanol extracts of *Hyoscyamus niger* leaf were examined. Antioxidant activity was evaluated by using DPPH free radical scavenging activity and Reducing power assay, while antibacterial activity was studied by using Disk diffusion method. Antioxidant test results in terms of IC₅₀ and EC values revealed that the plant have some extent of antioxidant potential, also plant extracts depicted inhibition of growth of selected pathogenic bacteria.

STUDIES ON GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN BITTER GOURD (*MOMORDICA CHARANTIA* L.) GERMPLASM LINES

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Abstract

A field investigation is done in which thirty-six genotypes of bitter gourd were evaluated to estimate the genetic variability, heritability and genetic advance for various traits under study. Randomized complete block design is followed and the genotypes are replicated twice. The highest phenotypic and genotypic coefficients of variability were recorded for average fruit weight (g) (27.87) followed by fruit yield per plant (kg) (26.78), number of seeds per fruit (24.47), titrable acidity (20.83) and reducing sugars (15.46). High heritability coupled with high genetic advance as percent of mean observed in number of primary branches per vine (99%), vitamin -C (87%), average fruit weight (71%), fruit yield per plant (71%), While, moderate heritability along with high genetic advance as percent of mean was observed in fruit yield per plant (71%), average fruit weight (71%), fruit length (64%,). Which indicate that above characters may be most potential for further improvement. There



by, suggesting that straight selection for these traits may bring worth while improvement in identifying superior genotypes in bitter gourd.

STUDIES ON GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN BITTER GOURD (*MOMORDICA CHARANTIA* L.) GERMPLASM LINES

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Abstract

A field investigation is done in which thirty-six genotypes of bitter gourd were evaluated to estimate the genetic variability, heritability and genetic advance for various traits under study. Randomized complete block design is followed and the genotypes are replicated twice. The highest phenotypic and genotypic coefficients of variability were recorded for average fruit weight (g) (27.87) followed by fruit yield per plant (kg) (26.78), number of seeds per fruit (24.47), titrable acidity (20.83) and reducing sugars (15.46). High heritability coupled with high genetic advance as percent of mean observed in number of primary branches per vine (99%), vitamin -C (87%), average fruit weight (71%), fruit yield per plant (71%), While, moderate heritability along with high genetic advance as percent of mean was observed in fruit yield per plant (71%), average fruit weight (71%), fruit length (64%,). Which indicate that above characters may be most potential for further improvement. There by, suggesting that straight selection for these traits may bring worth while improvement in identifying superior genotypes in bitter gourd.

AN EXAMINATION OF RESILIENCY LEVELS AMONG RURAL AND URBAN ADOLESCENTS OF DHARWAD AND RANGAREDDY DISTRICTS

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Abstract

Humans undergo an array of physiological and psychological changes across the life span, including changes in language, cognition, and psychosocial development as well as impacts from peers, family and environment. Since each stage of development has a distinct function in a person's life, adolescence is recognized as a typical and crucial stage of growth where adolescents undergo several stress and storm. However, resilient individuals were able to maintain a healthy and relatively stable psychological functioning, inspite of facing severe adversity in the developmental process. The present study aimed to explore the resiliency levels among rural and urban adolescents. A differential research design was employed in the study. By random sampling technique 383 high school students recruited for the study. The findings reveal that majority of adolescents possessed with moderate levels of resiliency in both Dharwad and Rangareddy districts. Compared to urban adolescents, rural adolescents had significant higher sense of mastery, sense of relatedness, emotional reactivity and overall resiliency in Dharwad district. Similarly, in Rangareddy districts rural adolescents had significant higher levels of sense of mastery, sense of relatedness and overall resiliency. However, a significant difference observed between adolescents from Dharwad and Rangareddy districts with respect to resiliency levels.

PRECISION FARMING IN HORTICULTURAL CROPS

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Abstract

Precision farming (PF) describes using mechatronics to control the fields' temporal and spatial variability. Numerous



elements, such as appropriate planting, weeding, interculture, irrigation, insect and pest attacks, and harvesting practices, influence the output and quality of horticultural commodities. Precision farming is a proactive method that mitigates some of the dangers associated with these typical horticultural and agricultural factors. Furthermore, it reduces environmental risks when compared to traditional systems. Precision farming converts conventional extensive production into intensive production by precisely establishing many operations, including tillage, sowing/planting, irrigation, fertilizer application, weeding operation, disease detection, pesticide spraying, harvesting, etc. based on space variable data. Different precision farming techniques, like robotic control systems for real-time weed detection and control, microcontroller-based variable rate herbicide/pesticide application systems, automated harvesting, and yield monitoring systems, not perform various operations in horticultural crops not only precisely perform various operations in horticultural crops but also economically by saving various agricultural inputs and requiring less human intervention. Other examples of these techniques include wireless sensor network (WSN) enabled crop stress monitoring systems, site-specific variable rate irrigation, and robotic seed planters or transplanters for geospatial mapping of row-crop plants and transplants. When compared to traditional methods, PF yields more or at least comparable profits, but its early costs must be covered by the government and the private sector.

GENETIC ANALYSIS FOR HETEROSIS USING BIOFORTIFIED LINES ON A₁ CMS LINES IN PEARL MILLET [*Pennisetum glaucum*(L.) R.]

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Abstract

In present investigation Line x Tester analysis was carried out to estimate heterosis (heterobeltiosis, average and standard heterosis) for identification of superior hybrids. Crosses attempted using 25 biofortified testers and two A₁ cytoplasm based male sterile lines during summer 2022-23. The resultant Fifty hybrids along with two male sterile lines, 25 testers and three checks *Viz.*, VPMH 7 (Local check), VPMH 14 (Local check) and Kaveri Super Boss (commercial private check) were planted at Regional Agricultural Research Station, Vijayapura during *kharif*, 2023 and evaluated for yield and yield components. Seven hybrids exhibited significant positive standard heterosis over check VPMH 7, one hybrid displayed substantial positive heterosis over the local check VPMH 14 and commercial private check Kaveri Super Boss for grain yield. In addition, hybrids ICMA 98222 × VJP Fe & Zn-9 and ICMA 98222 × VJP Fe & Zn-25 were found to be superior for dry fodder yield over check VPMH 7 which was found best check for dry fodder yield

PLANT'S HIDDEN FUNGUS BEYOND HERBIVORE MANAGEMENT

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Abstract

Endophytes are ubiquitous, forming associations with a diverse group of organisms throughout the plant kingdom. They are the microorganisms living in asymptomatic plant tissue for all or part of their life cycle without causing detectable damage to their host. They also provide indirect defense for plants against herbivores. It is widely known that fungal pathogens such as *Beauveria bassiana* and *Metarhizium anisopliae* can exist as endophytes in plants and protect their colonized host plants against herbivorous pests. Apart from protection from pests, other possible functions of endophytes include acting as plant yield promoters, soil nutrient distributors and drought tolerance enhancers in plants. There are also some negative effects on natural enemies. The presence of endophytic fungus, *Acremonium coenophialum* within tall fescue, *Festuca arundinacea* Schreb, indirectly protects the fall armyworm, *Spodoptera frugiperda* against their parasitoids (*Euplectrus*) in terms of reducing the pupal mass of parasitoids. The negative effect is mainly due to the specific alkaloids *viz.*, N acetyl and N formyl loline that are produced by the grass-fungus symbiotum. The seven-spotted ladybird, *Coccinella septempunctata* L. is affected by plant-fungus symbiosis. It happens when grain aphid, *Rhopalosiphum padi* L. gets infected with the fungus, *Neotyphodium lolii* while feeding on perennial ryegrass, *Lolium perenne* L.. Ladybirds feeding on aphids from infected plants showed reduced fecundity and impaired reproductive performance. These negative effects on predators indicate that mycotoxins are transmitted along the food chain, causing significant damage to key predators. In haricot bean, *Phaseolus*



vulgaris L. and switchgrass, *Panicum virgatum* L. insect derived nitrogen constituted 28% and 32%, respectively, when ¹⁵N-labeled nitrogen was injected to the waxmoth larvae, *Galleria mellonella* L. in the presence of *Metarhizium robertsii*. This showed that fungal mycelia form endophytic associations with plant roots after the *Metarhizium* infected insect dies, allowing nitrogen to be translocated to the plant.

UNMANNED AERIAL VEHICLES IN PRECISION AGRICULTURE

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Abstract

Unmanned aerial vehicle (UAV) is a pilotless aircraft that can fly autonomously. UAV has three primary applications. 1) Multi-UAV cooperation in emergency situations in buildings, target (people or object) detection, tracking and monitoring disaster situations. 2) UAV-to-VANET collaborations for traffic route guidance, data packet delivery and Roadway traffic monitoring. 3) UAV-to-Ground tasks for search and rescue of people in critical situations of terrorism, forestry fires, and tsunamis, and checking the security of vital infrastructures. Different types of UAVs are available for military, agriculture, medical applications, environment and climate, and transportation facilities. Major features of UAVs are node consent, altering system topology, node mobility, radio propagation model, frequency band, localization, power consumption and network lifetime. Routing protocols of UAVs are classified on the basis of topology, position, cluster, swarm, heterogeneous and Delay-tolerant networks (DTNs). UAV has an emerging role in precision agriculture including crop-state mapping, crop-yield prediction, disease detection, weed management, targeted spraying of herbicide and pesticide and transplantation of seedlings. UAV equipped with multi-spectral cameras and heat sensors can identify water scarcity areas and irrigate them. The market for agricultural UAVs is growing rapidly and several venture companies have emerged. According to market research by Price-Waterhouse-Coopers, the market size of agricultural UAVs is forecasted to grow to about \$32.4 billion by 2050, accounting for about 25% of the global UAV market. Major UAV companies include DJI, Parrot, Precisionhawk, AGEagle, and Trimble Navigation. Major problem with UAVs is battery and flight time limitations. To solve this, research on battery technology continues.

EFFICACY OF BIO PRODUCTS ON EGG DEVELOPMENT OF GREATER WAXMOTH, (*GALLERIA MELLONELLA*) IN *APIS MELLIFERA* COLONY

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Abstract

A lab experiment was carried out to evaluate the effect of bio products on egg development of *Galleria mellonella* in *apis mellifera* colonies by the testing of different concentration viz. Pongamia oil and Citronella oil (at 0.3, 0.4 and 0.5% concentration), NSKE, Garlic clove extract and Tobacco leaf extract (at 3, 4 and 5% concentration) and *Bacillus thuringiensis* (Biobit and Biolep; at 5, 7 and 9% concentration) each tested at 24hrs, 48hrs, 72hrs and 96hrs after treatment 80 eggs for the assess the ovicidal effect of different concentrations of bio products on eggs of greater waxmoth. The experiment conducted on egg hatching or the ovicidal effect of all bio products was depends on concentration of the pesticides, higher concentration dose caused lower egg hatching percentage in each tested time frames of experiments. For the lowest egg hatching percent was recorded at 96hrs after treatment and highest egg hatching percent was recorded at 24hrs after treatment. The entire management study shows Bt, Biobit (32,000 IU mg-I) @ 9 gm concentration (03.24%), Pongamia oil @ 0.5% concentration (04.17%) and Citronella oil @ 0.5% concentration (07.46%) can be recommended for the effect on egg hatching and egg development of *G. mellonella* in honeybee hives. Unlike other invertebrates, *G. mellonella* eggs can be incubated and treated relatively precisely at 30-35°C temperature as well as 50-60% RH, whereas the environmental condition in Chambal region is extremely warm in summer and also unfavorable in winter. The study was observed on laboratory condition.



UTILIZATION OF BUCKWHEAT IN FOOD PRODUCTS FOR NUTRITIONAL SECURITRY

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Abstract

Buck wheat varieties PRB-1, Nelagiri along with bread wheat variety as control were procured from wheat scheme, MARS, Agricultural University, Dharwad during *khari* 2018. The buckwheat grains and groats were subjected to processing to get flour, semolina and vermicelli. The highly acceptable buckwheat variety was incorporated into traditional foods like *chapathi* upma, vermicelli as well as convenience food viz., cookies in proportions of 25, 50, 75 and 100 per cent with regular control bread variety. Acceptability of food products was evaluated by semi trained judges using 9 point hedonic scale. *Chapthis* were smooth, soft and puffy up to 50 per cent buckwheat flour addition and hard texture was observed in 100 per cent buckwheat flour based *chapathi*. Semolina upma with 100 per cent bread wheat had smooth texture and separable granules, while 100 per cent buckwheat semolina upma had sticky texture and mushy. Flavor and taste scores of buckwheat incorporated vermicelli upma varied significantly at ($p>0.05$), Overall acceptability scores found to be highest in 25 per cent buckwheat incorporated vermicelli upma (7.90) followed by 50 per cent (7.70). The acceptability index of cookies found to be highest in 50 per cent buckwheat incorporated cookies (84.81). Utilization of buck wheat @ 25 per cent in *chapathi*, & vermicelli upma as well as 50 per cent in cookies had better sensory scores and acceptability. Thus, the utilization of buckwheat can be promoted in different food products for the general population as well as those with digestive disorders.

STUDIES ON PLANTING GEOMETRY OF PIGEONPEA AND SUITABLE INTERCROPS UNDER EASTERN DRY ZONE OF KARNATAKA (ZONE - V)

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Abstract

The field experiment entitled “Studies on planting geometry of pigeonpea and suitable intercrops under Eastern dry zone of Karnataka (Zone - V)” was conducted during *Khari*, 2020 at ‘K’ Block, Zonal Agricultural Research Station, University of Agricultural Sciences, Gandhi Krishi Vigyan Kendra, Bengaluru to evaluate suitable intercrop (field bean, vegetable soybean and Chia) and planting geometry (normal and paired row planting with 4’ and 5’ between pairs) and its effect on growth, yield and economics of the intercropping. The experiment had 15 treatments replicated thrice in Randomised Complete Block Design. Higher pigeonpea seed and stalk yield (1813 and 4218 kg ha⁻¹, respectively) was observed in paired row (120/60 cm x 30 cm) planting which was on par with intercropping of field bean (1:2) and vegetable soybean (1:3) under 120/60 x 30 cm paired row. The data revealed higher seed yield was mainly attributed to higher plant height, leaf area index, total dry matter production, no. of pods per plant and weight of pods per plant. In intercropping system, paired row (120/60 cm x 30 cm) planting of pigeonpea with vegetable soybean (1:3) as intercrop recorded higher pigeonpea equivalent yield (1843 kg ha⁻¹), net returns (Rs. 2,19,030 ha⁻¹) and benefit:cost ratio (6.27) than normal spacing and rest of intercrops tried. However, significantly higher system indices like LER (1.69) and ATER (1.29) were recorded with paired row (150/60 cm x 45 cm) planting of pigeonpea with vegetable soybean (1:4) as intercrop in the intercropping system.

ASSESSMENT OF PHENOTYPIC VARIATION AND VARIABILITY PARAMETERS IN IMPROVED LENTIL (*LENS CULINARIS*) GENOTYPES

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Abstract

Lentil (*Lens culinaris*) is commonly called as poor man’s meat, because of its high protein value and its fast cooking characteristics. It is one of the most important Rabi pulse crop in India. The use of diverse germplasm in breeding of lentil cultivars is still meager as only few lines have often been used in hybridization causing narrowing of genetic base. The



efficient use of genetic diversity in the varietal development program is an effective method to enhance yield gains. Therefore, the aim of the present study was to identify lentil genotypes based on agro-morphological characterization and variability parameters for their exploitation in lentil breeding programs. The thirty lentil genotypes were evaluated using DUS descriptors in accordance with PPV & FRA, 2007, and categorised based on the foliage intensity of green colour (light-9, medium-15, dark-6), stem anthocyanin (absent-18, present-12), time of flowering (early-20, medium-10), leaf pubescence (present-30), leaflet size (small-6, medium-19, large-5), growth habit (erect-29, semi-erect-1), flower colour (white-2, violet-28), plant height (short-30), pod anthocyanin (absent-30), seed size (small-1, large-7, very large-22), seed testa colour (green-8, grey-18, brown-4), seed testa mottling (absent-2, present-28), cotyledon colour (yellow-1, orange-29). Eleven quantitative traits viz., days to 50% anthesis, days to maturity, plant height (cm), first pod height (cm), branches plant⁻¹, pods plant⁻¹, seeds pod⁻¹, 100 seed weight (g), seed yield plant⁻¹(g), biological yield (g) and harvest index (%) and one nutritional trait viz., protein content (%) were recorded. The results of analysis of variance (ANOVA), showed mean sum of square was found significant at 1 percent probability for all the traits under study inferring that the panel of 30 genotypes picked for the study exhibited variability. As a result, the study material can be further utilized in hybridization programmes to improve traits.

High magnitude of GCV was noticed for seed yield plant⁻¹(24.01%) whereas high PCV was perceived for seed yield plant⁻¹(28.15%) and pods plant⁻¹(21.06%). High PCV and GCV remarking existence of variability that can be taken advantage through simple selection. PCV had high difference in magnitude with GCV in traits plant height (4.97%, 8.1%), height of first pod (8.51%, 15.04%), 100 seed weight (11.7%, 19.22%), pods plant⁻¹ (17.03%, 21.06%), seedspod⁻¹ (9.57%, 13.59%), seed output plant⁻¹ (24.01%, 28.15%) and harvest index (11.55%, 19.26%) inferring influence of extraneous factors in their phenotypic expression. High heritability along with high genetic advance as a percentage of mean is seen in traits such as days to 50% anthesis (98.88%, 20.75%), number of primary branches (85.12%, 29.52%), pods plant⁻¹ (65.37%, 28.36%), seed yield plant⁻¹ (72.74%, 42.18%), and biological weight (80.15%, 32.28%), which are controlled by additive gene action. On the basis of mean performance top-performing lentil varieties identified for increased protein content were LL769, VL 535, PL 348, RVL 20-3 and VL 536 and for yield and yield attributing traits were L 4727, RLG 318, RKL 14-37, IPL 316.

PRECISION FLORICULTURE : OPTIMIZING PRODUCTION THROUGH ADVANCED TECHNOLOGIES

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Abstract

Precision floriculture represents a paradigm shift in the floriculture industry, leveraging cutting-edge technologies to enhance the precision, efficiency, and sustainability of flower cultivation. This approach integrates data-driven decision-making, automation, and advanced monitoring systems to optimize various aspects of the production process. The key components of precision floriculture, including sensor technologies, data analytics, automation, and smart cultivation practices. Sensors embedded in the greenhouse environment collect real-time data on factors such as temperature, humidity, light intensity, and soil conditions. This data is then analyzed using advanced analytics and artificial intelligence algorithms to derive actionable insights. Automation plays a crucial role in precision floriculture, with robotic systems performing tasks such as planting, pruning, and harvesting. This not only reduces labor costs but also ensures consistent and precise execution of these activities. Additionally, smart cultivation practices involve the integration of data analytics to optimize irrigation schedules, nutrient delivery, and pest control, leading to resource efficiency and environmental sustainability.

The benefits of precision floriculture extend beyond increased productivity. The optimization of resource utilization minimizes environmental impact, making the industry more sustainable. Furthermore, the ability to precisely control cultivation parameters enhances the quality of flowers, meeting the growing demand for premium and niche products in the market. While precision floriculture holds immense promise, challenges such as initial implementation costs, technological literacy, and the need for industry-wide adoption must be addressed. Precision floriculture encourages further research and collaboration within the floriculture sector to unlock the full potential of precision technologies, fostering a more efficient, sustainable, and economically viable future for flower cultivation.



FLORAL WASTE MANAGEMENT AND ITS UTILIZATION IN VALUE ADDED PRODUCTS

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Abstract

Solid waste disposal is major problem in the world, flower waste is an integral part of this Floral waste is one of the major concerns. However, like any other natural solid waste floral waste can we technologically improvised on, converting it to value-added. Degradation otherwise is a very slow process and it causes a massive hazard to wellbeing of our surroundings primarily soil and water. Therefore, there is a need of proper and eco-friendly process for floral waste degradation. Looking into the harmful impact of the improper disposal of wastes on the environment and the slow degradation of these wastes, emphasis should be given on how we can transform this waste to wealth, by their utilization in diverse sectors, ranging from agriculture to various other industries, creating various value-added products that can help generate livelihood as well.

India is a country with lots of different religions where, worshiping is the way of living and people offer various offerings to the deities, out of which floral offerings are found in huge quantity. Therefore, temple waste has an exceptional share of flower waste in the total waste. After gratifying their purpose, flowers along with other waste, find their way into the garbage or are discarded into river, sea or oceans causing various environmental problems. The majorly offered flowers in temples are marigold, rose, jasmine, chrysanthemum, hyacinth, hibiscus, etc. This floral waste can be properly managed and utilized in various value-added form. Techniques like vermicomposting, composting, dyes extraction, extraction of essential oils, making of Holi colours, dry flower technology and bio-gas generation can be used. As most of the flower contains secondary metabolites which can be further used in essential oil extraction and food additives. Handmade paper can also made by utilizing these waste products. The presentation focuses on important application of floral wastes which, helps to cope up with energy crises and environmental pollution.

PLANTS USED AS GALACTAGOGUE (VETERINARY) BY THE LOCALS OF TEHSIL RAMSHEHAR, DISTRICT SOLAN (HIMACHAL PRADESH)

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Abstract

Milk is considered as a wholesome food for people of all ages. Augmentation of milk production is a nationwide demand of rapidly growing population. Use of herbal galactagogue for safe milk production is a necessity because indiscriminate and prolonged use of feed additives, vitamins, minerals, hormones, drugs and synthetic compounds develop adverse effects which open a detrimental platform to normal health. The present study deals with the documentation of field observations on plants used as galactagogue by the inhabitants of tehsil Ramshehar, district Solan, Himachal Pradesh in North-Western Himalaya. Many plants of local flora are used as milk enhancer. The locals eke out their livelihood through the sale of milk and milk products and still depend upon plants for enhancing milk productions in dairy animals. This study includes 10 plants with 7 herbs and 3 tree belonging to 7 families.

EFFECT OF PIGEONPEA-BASED INTERCROPPING SYSTEM ON NUTRIENT UPTAKE, AVAILABLE NUTRIENT AND YIELD OF PIGEONPEA IN EASTERN DRY ZONE OF KARNATAKA (ZONE - V)

Laxman Navi, Atheekur Rehman H.M., Devika A.R. and Dayanand Naik

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Abstract

The field experiment entitled “Studies on planting geometry of pigeonpea and suitable intercrops under Eastern dry zone of Karnataka (Zone-V)” was conducted during *Kharif*, 2020 at ‘K’ Block, Zonal Agricultural Research Station, University of



Agricultural Sciences, Gandhi Krishi Vigyan Kendra, Bengaluru and studied the effect of pigeonpea-based intercropping system on nutrient uptake, available nutrient and crop yield in pigeonpea based intercropping system. The experiment had 15 treatments which were replicated thrice in Randomised Complete Block Design. Treatments consisted of sole crops pigeonpea and companion crops (field bean, vegetable soybean and chia) as well as intercrops in different row proportions (1:2, 1:3 and 1:4). In the intercropping system intercropping increased total N, P and K uptake enhancing grain and stalk/ haulm yield of pigeonpea and intercrops. Among planting geometry highest total nutrient uptake of pigeonpea was recorded in T₅ (Paired row-120/60 cm × 30 cm sole pigeonpea, 82.48, 12.60 and 102.80 kg/ha NPK respectively) compared to rest of other treatments. Among intercropping system highest total nutrient uptake of pigeonpea was recorded in T₆ (Paired row - 120/60 cm × 30 cm pigeonpea + field bean (1:2), 76.65, 12.20 and 98.36 kg/ha NPK respectively) compared to rest of intercropping treatments. In available nutrients, among planting geometry and intercropping systems highest total available nitrogen and phosphorous was recorded in T₁₄: Sole vegetable soybean (318.62 and 107.20 kg/ha N & P respectively) and higher total available potassium was recorded in T₁₃: Sole field bean (321.40 kg/ha K respectively), compared to other treatments. The combined effect of paired-row pigeonpea with field bean at 120/60 cm × 30 cm (1:2) spacing recorded the highest seed yield (1770 kg/ha) and stalk yield (4026 kg/ha).

THE PROTEOMIC DIFFERENCES IN THE MILK FAT GLOBULE MEMBRANE (MGFM) BETWEEN HIGH AND LOW MILK YIELDING SAHIWAL COWS

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Abstract

In the present study we have studied the proteomic differences in the milk fat globule membranes of high versus low milk yielding Sahiwal cows (n=12 each). The proteins extracted from milk cream fat were subjected to trypsin digestion and peptides were labelled with Tandem Mass Tag (TMT) and identified quantitatively by LC- MS/MS. Identification using the Mascot search engine revealed 1716 proteins, out of which 439 proteins were differentially expressed (DEPs). Separated the down-regulated and up-regulated proteins based on the protein fold change data obtained from the LC- MS/MS protein analysis. We found 154 up-regulated Proteins and 285 down-regulated Proteins and further selected best 12 up-regulated proteins in low milk yielders Sahiwal cattle and 12 down-regulated proteins from high milk producing Sahiwal cattle. The DEPs were further subjected to gene ontology and pathway analysis using Cytoscape plug-in tool that showed involvement of proteins in catalytic activities, binding, enzyme regulatory activities, response to wounding and the acute inflammatory response, endopeptidase inhibitor activity and apoptosis. Proteome guided genomic selection gives accurate signature protein biomarkers for high versus low milk yielding Sahiwal cattle.

INTEGRATED MANAGEMENT OF PHYTOPHTHORA STEM BLIGHT IN PIGEONPEA

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Abstract

Pigeonpea is popularly known Tur and Arhar is a major source of vegetarian protein across the country. India stands first in the world in its area and production and Karnataka stands first within the country. Its production is hindered mainly due to pest and diseases. Phytophthora stem blight has become major obstacle in recent years influenced by climate change apart from already known Fusarium wilt and sterility mosaic disease. Heavy rains after post sowing with prolonged saturated soil moisture are favoring Phytophthora blight incidence. Incidence was seen at both seedling and vegetative stage. Efforts were



done to curb the disease multiple interventions due to its soil borne nature. Different interventions were attempted including seed dressing and foliar spray with biocontrol agent, fungicide, and use of agronomic practices. The treatment involving seed dressing with metalaxyl 4 + mancozeb 64 (68WP) @ 4g/kg seed and foliar spray twice at onset of disease with an interval of 15 days @ 3g/l and making ridges & furrows during intercultivation provided best control of the disease (13.65%) with highest grain yield (898kg/ha) followed by seed treatment with Trichoderma + Pseudomonas (mixture) 5g/kg seed and two foliar spray at an interval of 15 days and making ridges & furrows during intercultivation (18.09% & 857kg/ha). The control treatment recorded the highest mean disease incidence of 61.56 per cent and lowest yield of 486kg/ha. The results confirmed the necessity of involving more than two or three operations to curtail the disease chain and life cycle of the pathogen from continuing in the field. The seed treatment and foliar sprays helped to reduce the seed infection by the pathogen and further establishment on host. Ridges and furrows drained the excess rain water and conserved the moisture during scarcity. The outcome shall be directly recommended among pigeonpea growers for field adoption and successful cultivation of pigeonpea.

BIOCHAR SIGNIFICANCE IN SUSTAINABLE AGRICULTURE

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Abstract

Ever increasing global population requires an increased supply of food, fibre and fodder which pose a great challenge for agricultural scientist to produce more and more from limited shrinking degraded land in a sustainable manner. It has become the need of the hour to develop empirical sustainable practices for agricultural systems which are ecological feasible, economically viable and socially acceptable. Biochar has attracted a lot of interest in recent years because of its potential to increase soil fertility, reduce greenhouse gas emissions and support sustainable agriculture practices. It is a substance high in carbon, produced when organic materials such as agricultural waste, wood and manure are heated at high temperatures in an oxygen-deprived environment through a process called pyrolysis. Biochar increases the porosity and structure of the soil, increasing its ability to retain water and lowering erosion. Additionally, because biochar is porous, it serves as a home for helpful soil microbes that enhance soil fertility and encourage nutrient cycling. Its addition to carbon poor soil will help in improving organic carbon status of soil as it is high in carbon and also the other mineral elements. Moreover, biochar helps in mitigate climate change by changing the physiochemical and biological characteristics of soil and storing carbon in the soil for long periods of time. It is an important tool for attaining sustainable agricultural practices because of its capacity to increase crop output, lower greenhouse gas emissions and improve soil fertility. A more resilient and sustainable agricultural future can be achieved by carefully evaluating application rates, production techniques and long-term impacts when implementing biochar-based initiatives.

OPTIMIZING CROP PRODUCTIVITY IN HILLY TERRAIN: KEY FACTORS AND STRATEGIES FOR SUCCESS

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Abstract

This paper delves into the essential factors and effective strategies for enhancing crop productivity in hilly terrain. Hilly regions pose unique challenges to agriculture, including soil erosion, uneven topography, and limited arable land. To address these challenges and unlock the agricultural potential of such areas, a comprehensive understanding of the key factors affecting crop productivity is crucial. This study examines the significance of soil management practices, terracing techniques, crop selection, and water resource management as pivotal components in optimizing agricultural output in hilly terrain. By exploring the synergy between traditional and innovative farming methods, this paper offers insights into sustainable and resilient approaches to hilly agriculture. Furthermore, the paper discusses the importance of tailored agricultural extension services and knowledge dissemination to empower local farmers with the skills necessary to implement these strategies effectively. The combination of science-based approaches and indigenous knowledge systems plays a pivotal role in achieving



sustainable crop production in hilly areas. In conclusion, the research underscores the importance of a holistic approach that encompasses ecological, technological, and socio-economic aspects to boost crop productivity in hilly terrain. Implementing these key factors and strategies can not only increase yields but also promote food security and economic stability in these challenging landscapes.

EXPLOITATION OF BIOCONTROL POTENTIAL OF PHYLLOPLANE *BACILLUS* SPECIES AGAINST *FUSARIUM SACCHARI* CAUSING POKKAH BOENG DISEASE OF SUGARCANE UNDER *IN VITRO* CONDITION

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Abstract

Pokkah boeng, once a minor fungal disease of sugarcane is becoming a major threat to sugarcane production. Among the possible surfeit strategies available to manage the disease, biological method is one of the best eco-friendly approach and considered as a beneficial alternative to conventional pesticide usage. In this study, a total of 14 bacterial isolates were isolated from sugarcane phylloplane on HiCrome Bacillus Agar. The bacterial isolates were purified by streaking and differentiated into Gram-positive and Gram-negative bacteria using 3 % KOH and Grams' test. Fourteen Gram-positive isolates with typical morphological characters of *Bacillus* were designated as ScANKP-1 to 14 and evaluated for their antagonism against *Fusarium sacchari* through dual culture technique. Out of 14 isolates, ScANKP-9 and ScANKP-13 isolates were found to be the most effective ones, with maximum antagonistic potential by significantly restricting the growth of *F. sacchari* to 4.47 and 4.80 cm, respectively, with 50.33 and 46.67 per cent inhibition in radial growth in comparison to monocultured *F. sacchari* (9.00 cm). Molecular characterization of effective isolate using modified CTAB (cetyl-methyl-ammonium bromide) method following PCR amplification of DNA with FGPS-63 and FGPL-132-38 primers followed by NCBI-BLAST and phylogenetic analysis confirmed the isolate ScANKP-9 as *Bacillus amyloliquefaciens*.

INTEGRATED SOIL HEALTH MANAGEMENT FOR SUSTAINABLE AGRICULTURE: A COMPREHENSIVE APPROACH

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Abstract

The pursuit of sustainable agriculture necessitates a profound understanding of soil health management practices. The strategies for maintaining and enhancing soil health, emphasizing an integrated approach that harmonizes ecological, agronomic, and technological interventions. Cover cropping emerges as a pivotal technique, fostering soil structure, moisture retention, and microbial diversity. Crop rotation, a complementary practice, mitigates disease pressure, improves nutrient cycling, and enhances overall soil resilience. Agroforestry, incorporating trees into agricultural landscapes, further contributes to sustainable soil management by preventing erosion, sequestering carbon, and fostering biodiversity. Precision agriculture, underpinned by advanced technologies like sensors and data analytics, optimizes resource use. This includes precise nutrient management and irrigation, resulting in increased efficiency and reduced environmental impact. The integration of these practices not only bolsters agricultural productivity but also mitigates the ecological footprint of farming operations. Community engagement and farmer education play a pivotal role in the successful adoption of these practices. Knowledge dissemination, extension services, and policy support are crucial components that empower farmers to implement sustainable soil health management. Achieving sustainable agriculture requires an integrated approach to soil health management. The



amalgamation of traditional wisdom with cutting-edge technologies provides a robust framework to address the complex challenges of modern agriculture while ensuring environmental stewardship.

VALUE ADDITION IN FLOWERS BY TINTING

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Abstract

Among different characteristics of a flower, the colour of a flower is considered as a first priority of consumer during purchase. To develop new colours in addition to already existing colours of flowers in any variety or species through breeding and biotechnology. But this required a lot of time and effort so an alternative, cost effective and simpler method came into existence. Tinting is one of the most important value addition technologies to impart desired shades of colours to flowers. It is done in flower crops where pigments are absent or light or dull. Tinting enhances aesthetic beauty of fresh and dry flowers as single 3 colour limits the flower acceptability and reduces the market value (Chougala *et al.*, 2016). At the post harvest stage tinting is outstanding method by which we can change the colour according to our wish and desire (Sowmeya *et al.*, 2017). Inflorescence colouring with food colours intensifies the visual appearance of these flowers and enhances their economic value. White flower tinting is the best way to acquire the colour of interest for decorations where a particular colour is needed. Certified synthetic food colours add an extreme and uniform colour to the tinted flowers although less costly and dangerous. Coloring with dyes at different concentrations also make flowers vulnerable to postharvest losses. Hence, to promote the quality and extend the vase life different floral preservatives are being used that provide water and energy to the cut flowers

EVALUATION OF VARYING LEVELS OF PH, SUCROSE AND COLOUR CONCENTRATION ON TINTING

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Abstract

The present investigation entitled “Evaluation of varying level of pH, sucrose and colour concentration on tinting and vase life of Tuberose (*Polianthes tuberosa* L.) cut spike.” was performed in the Floriculture laboratory, Department of Floriculture and Landscape Architecture, College of Agriculture, IGKV, Raipur, Chhattisgarh during 2019-20 in Completely Randomized Design (CRD) with nineteen treatments and three replications. The spikes of tuberose cv Prajwal were tinted with different concentration combinations of pH, sucrose and food colour. Although there was no such significant difference on length of spike, diameter of floret and time taken for colour uptake in the different concentration combinations of pH, sucrose and food colour, however, treatment combination of pH 5 + 4 per cent sucrose + 40,000 ppm of royal blue colour (T15) showed best results in majority of other parameters like physiological weight loss, colour intensity, floret opening, vase life, and improve value addition. Therefore, tinting with pH 5 + 4 per cent sucrose + 40,000 ppm of royal blue colour (T15) in supplemented solution can add colour to tuberose spikes with no detrimental effect on post-harvest qualities. Also, coloured spikes will serve as a value added product to increase farmer’s income.

MOLECULAR ANALYSIS FOR RESISTANCE AGAINST PHYTOPHTHORA BLIGHT AND EVALUATION OF HYBRID LINES IN BELL PEPPER (*CAPSICUM ANNUUM* L.) USING SSR MARKERS

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Abstract

Cultivation of capsicum is highly affected by diseases caused by devastating pathogen *Phytophthora nicotianae* var. *nicotianae*



which causes leaf blight and fruit rot. Three varieties of capsicum ‘Solan Bharpur’ (Tolerant), ‘California Wonder’ (susceptible) and ‘DKC-8’ (resistant) were used as parental genotypes. Molecular analysis of all the three varieties was carried out using SSR primers. Out of 45 SSR primers used, reproducible polymorphism was observed with 15 SSR primers. Based on dendrogram and cluster analysis, SSR markers grouped ‘Solan Bharpur’ and ‘California Wonder’ in one group distinct from ‘DKC-8’. F₁ populations were raised from ‘Solan Bharpur’ x ‘California Wonder’ and ‘California Wonder’ x ‘DKC-8’. In each cross, a total of five F₁ hybrid individuals were genotyped using three SSR primers. Out of these, two appeared to be false hybrids which exhibited similar banding patterns to the female parent, suggesting that they could be derived from selfing of the female parent. This study showed that SSR markers could be used as a more rapid, practical and efficient tool in disease resistance and are highly efficient and reproducible for genetic purity testing of capsicum lines.

SALT TOLERANT RICE CULTIVARS: RESILIENCE FOR SUSTAINABLE AGRICULTURE DEVELOPMENT

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Abstract

One of the main abiotic factors limiting agricultural productivity globally is salinity. Plants are subject to osmotic stress and ionic toxicity as a result of salinity. The role of antioxidant and physio-biochemical reactions in rice genotypes under salt stress has been examined to determine the genotype sustainability. Thus, IR 64, CSR 56, and CSR 60 rice cultivars were used in the studies. After being transplanted into pots and subjected to varying salt levels (0, 150, and 200 mmol/L NaCl) for fifteen days, the seedlings were continuously stressed until they reached the blooming stage. Every rice genotype showed a notable decrease in growth when exposed to salt stress. In comparison to the salt-tolerant genotypes (CSR 56 & CSR 60), the genotype that was more sensitive to salt (IR 64) had a greater loss in growth. Shoot biomass was reported to have decreased very little in CSR 56. When salt concentration rose in genotypes of salt-tolerant rice, proline content increased dramatically; under salt stress, CSR 56 had the greatest proline level. As the concentration of salt increased, the activities of superoxide dismutase, catalase, peroxidase, and ascorbate peroxidase dramatically increased in the genotype that was salt-tolerant and significantly decreased in the genotype that was salt-sensitive. All rice genotypes showed a considerable drop in the K⁺/Na⁺ ratio, however tolerant genotypes were able to withstand the stress. In order to improve sustainability and adjust salinity, the salt-tolerant genotype CSR 56 preserved greater levels of osmotic contents as well as catalase and ascorbate peroxidase activities during salt stress. This suggests that salt tolerance may be the fundamental mechanism for salt tolerance.

KNOWLEDGE, ATTITUDE AND PRACTICE (KAP) AMONG URBAN HOUSEHOLD WASTE MANAGEMENT

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Abstract

The study of Knowledge, Attitude, and Practice (KAP) regarding urban household waste management is crucial for understanding behaviors and perceptions. The research aims to investigate knowledge, attitudes, and practices of urban households toward effective waste management practices. In Hubli, Karnataka, India, a community-based cross-sectional study was carried out with an urban resident. Eighty households participated in the study. Face-to-face interviews were conducted using self-structured questionnaires. According to the results, 63.75 percent of respondents had a high level of knowledge, followed by moderate (25%) and low (11.25%) levels. The average knowledge score of urban household respondents for household managing waste was 8.63, indicating a good degree of knowledge. Regarding attitude, 52.50% of respondents expressed a neutral attitude, followed by negative (30%) and positive attitudes. Regarding attitude, 52.50% of respondents had a neutral attitude, which was followed by negative (30%) and positive (17.50%) attitudes toward managing household waste. The average response from urban households about their attitude toward household waste management was 4.72, indicating a neutral level of attitude. In terms of practice, moderate practice was reported by 43.75 percent of



respondents, followed by good practice (36.25%) and poor practice (20%). Urban household respondents had a modest level of practice with household waste management, as indicated by their mean score of 5.35. In conclusion urban households showed high knowledge, neutral attitudes, and moderate practices toward waste management, indicating scope for improved attitudes and practices.

EFFICACY OF NEW MOLECULES AGAINST YELLOW MITE OF CAPSICUM UNDER PROTECTED CONDITION

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Abstract

The study was conducted to investigate the efficacy of novel compounds (vertimec, spiromesifen, and ecomite) against capsicum mites under protected conditions in College of Horticulture, University of Horticultural Sciences, Bagalkot, Karnataka. The experiment was set up in a polyhouse using a Randomized Block Design (RBD), with 10 treatments, including an untreated control, replicated thrice. Vertimec 1.9 EC at 0.5 ml per litre was shown to be successful in controlling the mite population by producing the best yield (47.76 t ha⁻¹), the highest net returns (Rs. 1849600/ha), and the highest B:C ratio (2.82). Similarly, spiromesifen 240 SC at 1.0 ml per litre recorded the highest fresh fruit yield (45.0 t ha⁻¹) with higher net returns (Rs.1685000/ha) and B:C ratio (2.66) and ecomite registered higher fresh capsicum yield (43.68 t ha⁻¹) suggesting two new molecules (vertimec 1.9 EC and spiromesifen 240 SC) and biopesticide, ecomite were more cost effective and the most feasible in suppressing yellow mite.

UNLOCKING AGRICULTURAL EXCELLENCE : EVALUATING THE IMPACT OF KRISHI VIGYAN KENDRA GWALIOR'S SUBJECT-SPECIFIC TRAINING PROGRAMS

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Abstract

This study was conducted in Krishi Vigyan Kendra, Gwalior District Madhya Pradesh, 209 KVK trainees were sampled from a pool of participants, including farmers, farm women, and rural youth, who had attended KVK Gwalior's training programs over the past three years. The primary objective was to assess the perceived utility of these training programs across various thematic areas. Using a cumulative analysis, the study found that a majority of respondents (57.42%) rated KVK training programs as having a medium extent of perceived utility. Additionally, 23.44% of respondents considered these courses to have a high extent of utility, while fewer than one-fifth (19.14%) categorized the training as having a low extent of utility. These results offer valuable insights into the effectiveness of KVK training initiatives in Gwalior District, Madhya Pradesh. The findings underscore the importance of program customization to better meet the diverse needs of trainees, highlighting the potential for enhancing the impact of agricultural training programs.

FORECASTING OF COCOA PRICE USING HYBRID LONG-MEMORY TIME SERIES MODEL

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Abstract

Price forecasting in agriculture plays a significant role in the planning and decision-making processes for farmers, agribusinesses, and policymakers. Since agriculture is inherently risky, with factors such as weather conditions, pests, and



diseases affecting crop yields. Price forecasting helps farmers anticipate market conditions, allowing them to make informed decisions about crop selection, production levels, and marketing strategies to manage their financial risk. Forecasting and time series analysis are important techniques in statistics and data science that involve predicting future values based on historical data patterns. Time series data consists of observations or measurements taken sequentially over time. But we often observe the presence of long memory properties particularly with financial time-series data related to agricultural commodities. This means that past values of the series have a significant impact on its future values. To capture this long memory characteristic, the Autoregressive Fractionally Integrated Moving Average (ARFIMA) model is commonly employed. But agricultural commodity prices are known for their high volatility. In many scenarios, highly volatile time series data often demonstrates long memory properties within the mean model. In such cases, the Generalized Autoregressive Conditional Heteroscedastic (GARCH) model might not be the most suitable choice for specifying the time-series model. To effectively capture both the volatility and long memory characteristics present in the data, an ARFIMA-GARCH model is employed. This combined model is used for modelling and forecasting weekly cocoa prices of Kerala. Upon investigation, it has been determined that the residuals of the fitted model do not exhibit any discernible systematic patterns. This finding affirms the suitability of the model. The out-of-sample forecasting formulas, in addition to the forecast error variances, for the ARFIMA-GARCH model, have been derived through the recursive application of conditional expectation principles.

EFFECT OF DIFFERENT SOURCES AND LEVELS OF BIOCHAR ON GROWTH AND YIELD KHARIF MAIZE IN A VERTISOL

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Abstract

Biochar preparation is one of the beneficial technologies for crop residue management. The production and use of biochar has many opportunities for soil improvement and agricultural productivity. A field experiment was laid out in Factorial RBD, to assess the potential effect of biochar derived from maize cob rind (MCB), coconut shell (CSB) and *Prosopis sps* (PSB) on yield, soil properties and nutrient uptake by maize grown in *Kharif* season 2022. Treatments comprised of first factor as biochar sources viz., MCB, CSB and PJB and second factor as application rates viz., (7.5, 10 and 15 t ha⁻¹) along with RDF, RPP and absolute control with three replications. The results showed varied physical characteristics and chemical composition among the different sources of biochar used. Among the different biochar sources PSB recorded significantly higher total dry matter (188.21 g plant⁻¹), grain weight per cob (174.44 g cob⁻¹), grain yield (59.60 q ha⁻¹) and Stover yield (81.22 q ha⁻¹). Among the different rates of biochar application, significantly higher total dry matter (196.00 g plant⁻¹), grain weight per cob (183.02 g cob⁻¹), grain yield (57.55 q ha⁻¹), stover yield (88.94) were recorded with biochars application of 15 t ha⁻¹. However, lower values were recorded in absolute control. Variation in soil properties was observed with increasing in application rate of different biochar. This could be attributed due to increase in enzymatic activity their by increases the nutrient availability in soil. Among the Interaction effect between the sources and rate of biochar application was found to be non-significant with yield and soil parameters. Therefore, effect of biochar on the availability of soil nutrients is associated with the nature of the biochar feedstock, the rate of application and the soil characteristics.

CONSERVATION AGRICULTURE : A NOVEL METHOD FOR SUSTAINABLE SOIL PRODUCTIVITY

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Abstract

A type of sustainable agriculture known as conservation agriculture (CA) enables the successful production of food while



simultaneously preserving and even replenishing natural resources. Conservation agriculture helps farmers by increasing yields and lowering production costs. It also benefits society overall by reducing erosion, improving water quality, increasing food security, and mitigating climate change by increasing carbon sequestration, among other benefits. Because the CA systems preserve soil moisture and maintain better penetration rates, they will help overcome seasonal dry spells. Consequently, the adaptation and resilience of agricultural systems to climate change are positively impacted by CA systems. Long-term production intensification that combines high productivity with the provision of environmental services requires CA as a key component. Consequently, the adaptation and resilience of agricultural systems to climate change are positively impacted by CA systems. Long-term production intensification that combines high productivity with the provision of environmental services requires CA as a key component. It might also be crucial for preserving SOC and the consequences that follow for the physical, chemical, and biological characteristics of the soil as well as yield. Increased soil chemistry and nutrient health indices, such as soil carbon levels and nitrogen reserves, were observed when organic additions were used in conservation agriculture. This presents both a major challenge and an opportunity to enhance soil health dynamics in crop production. Higher amounts of SOC can be achieved with CA while preserving soil health, as opposed to systems that are managed traditionally. Broadly speaking, by raising soil carbon levels, inhibiting weed growth, and lowering the risk of nitrate leaching, cover crops in crop rotations enhanced nitrogen recycling.

EFFECT OF DIFFERENT SOURCES AND LEVELS OF BIOCHAR ON MAJOR NUTRIENT STATUS OF *VERTISOL* AFTER HARVEST OF MAIZE

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Abstract

Biochar additions have positive effects on the soil health directly and indirectly. The incorporation of biochar into soil alters soil physical, chemical and biological properties. The field experiment was conducted during *Kharif*, 2021-22, to study the effect of biochar on post-harvest soil after harvest of maize in a *Vertisol*. The experiment was laid out in Randomized Block Design with twelve treatments and three replications. The treatments comprised of control, RDF, RPP and various sources (*Prosopis sps* biochar, maize cob rind biochar and coconut shell biochar) levels (7.5, 10 and 15 t ha⁻¹) of biochar along with RPP. On the basis of the results obtained, macronutrients like, available nitrogen, available phosphorus, available potassium, Exch. Ca, Exch. Mg and available sulphur in post-harvest soil after harvest of maize were significantly influenced by the application of various biochar at different levels along with inorganic fertilizers (RPP). Among the sources *Prosopis sps* biochar recorded highest nutrient status compared to other sources. Irrespective of sources, application of biochars at higher quantity (15 t ha⁻¹) recorded maximum amount of nutrients. The interaction effects of sources and levels of biochar revealed that the application of RPP + *Prosopis sps* biochar @ 15 t ha⁻¹ was best over other biochar applied treatments. These biochar treatments were significantly differed compared to non biochar treatments (control, RDF and RPP treatments). The higher the dose of biochar applied, the higher the nutrient (N, P and K) use efficiency was recorded. From the present investigation, it can be concluded that the soil application of biochar along with inorganic fertilizers favourably influenced the soil nutrient status.

NATURAL ENEMIES OF MUSTARD APHID, *LIPAPHIS ERYSIMI*: COCCINELLID AND SYRPHID FLIES

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Abstract

Mustard aphid, *Lipaphis erysimi* Kalténbach (Hemiptera: Aphididae) is one of the most destructive pest and a major limiting factor for successful cultivation of mustard crop. Cruciferous ecosystem harbour several natural enemies of aphid and many of them have potential to reduce aphids population below economic injury level. Among them the seven spotted lady bird beetle



Coccinella septempunctata Linnaeus and two syrphid flies, *Episyrphus viridaureus* (Wiedemann) and *Betasyrphus isaaci* (Bhatia), were found feeding on mustard aphid throughout the mustard cropping season. Those natural enemies of mustard aphid, *Lipaphis erysimi*, biological attributes and feeding potential were studied under laboratory conditions. The predators were multiplied on mustard aphids reared on mustard plants. *C. septempunctata*, *E. viridaureus* and *B. isaaci* completed their life cycle in 68.5 ± 6.5 days, 47 ± 2 and 41 ± 2 , respectively. *C. septempunctata* completed the larval growth with four larval instars, while both the syrphids terminated the larval growth with three instars. Final instars of all the three predators were found to have highest predatory potential than the younger instars. *C. septempunctata* was found to be the most dominant predator of mustard aphid with average lifetime consumption of 4312 ± 537.74 aphids, followed by *E. viridaureus* (416.67 ± 6.76 aphids) and *B. isaaci* (338 ± 7.89 aphids). All the three predators have the potential to reduce the mustard aphids; however, *C. septempunctata* has a maximum predatory potential with a longer life, which makes this species as an excellent bioagent of *L. erysimi* and further research on their utilization on a large scale should be undertaken.

BIOCHAR HAS THE POTENTIAL TO IMPROVE SOIL HEALTH, MITIGATE THE EFFECTS OF GREENHOUSE GASES AND INCREASE PRODUCTIVITY

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Abstract

Global food security is under threat from climate change, with India being particularly vulnerable due to its tropical monsoon climate and the low ability of small and marginal farmers to adapt. Burning crop residue increases greenhouse gas emissions, which warms the environment. There are various methods for sequestering carbon from soil, including crop rotation, conservation agriculture, biomass recycling, and the use of organic amendments. Maintaining a certain amount of organic matter in the soil is essential for long-term agricultural success. One strategy to maintain soil fertility and health is to effectively use biomass by turning it into a valuable source of soil nutrients. There are currently 500 million tonnes of biomass accessible annually, most of which are underutilised or just partially used because of several limitations. Burning residue releases harmful gases, such as greenhouse gases, and results in the loss of nutrients and valuable biomass. It is also a quick technique to clean an agricultural area. A major multifaceted opportunity exists to convert large-scale agricultural waste streams from a financial and environmental liability to a lucrative asset: biochar, a byproduct of plant biomass pyrolysis. In addition to enhancing other soil qualities like water retention and nutrient availability, biochar has a lengthy half-life in the soil and is more efficient in securing carbon. In addition to reducing greenhouse gas emissions from agricultural land, biochar has the ability to boost traditional agricultural output. Millions of tonnes of crop leftovers that aren't used as feed have a huge potential to be turned into biochar in India. One practical use for biochar is as a soil amendment in agricultural systems. Research, development, and demonstration of biochar synthesis and application, however, are crucial to promoting the use of biochar as a soil amendment and as a means of mitigating greenhouse gas emissions.

THE CHARACTERISTICS AND IDEA OF SOIL FERTILITY THROUGH ORGANIC FARMING: THE SOUL'S ENDLESS LIFE

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Abstract

The productivity of all farming methods is largely dependent on the fertility of the soil. The most widely used definition of soil



fertility is the soil's capacity to provide crops with nutrients. To recycle nutrients, manures and agricultural leftovers are handled carefully. The utilisation of legumes to augment the nitrogen in the system and restricted additions of extra nutrients in acceptable forms are the two main ways that crops receive their nutrients. Good soil structure and biological activity are essential for the availability of nutrients, the health, and production of both crops and livestock. These can be achieved through managing the organic matter in the soil. The various parts of an organic farm have intricate relationships with one another, and the smooth operation of the entire system determines the amount and calibre of the finished goods. Because of this, it is particularly challenging to separate soil fertility from the system's production and environmental components. In organic systems, crop rotation serves as the primary instrument for coordinating many facets of crop production with the preservation and enhancement of soil fertility. Well-designed, varied rotations facilitate cultural weed management techniques while lowering the prevalence of pests and illnesses. Fertility management in organic farming depends on a long-term integrated approach rather than the more focused, short-term solutions typical in conventional agriculture because of the intricate interconnections between many system components.

AGRONOMIC METHODS OF ZINC BIOFORTIFICATION FOR IMPROVING PRODUCTIVITY AND NUTRITIONAL STATUS OF CHICKPEA VARIETIES

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Abstract

A field experiment was conducted at Maharana Pratap University of Agriculture and Technology, Udaipur during 2022-23 to studying the performance of chickpea varieties under different agronomic methods of zinc biofortification. The experiment was laid out in split plot design comprised four chickpea varieties viz., Pratap Chana 1, GNG-2144, GNG-1958, RVG-203 and six agronomic zinc biofortification methods viz., Control, seed priming with ZnSO_4 @ 0.05%, soil application of ZnSO_4 @ 25 kg ha⁻¹, foliar application of ZnSO_4 @ 0.5% ZnSO_4 at flowering and pod development stage, seed priming with ZnSO_4 @ 0.05% + foliar application of ZnSO_4 @ 0.5% ZnSO_4 , soil application of ZnSO_4 @ 25 kg ha⁻¹ + foliar application of ZnSO_4 @ 0.5% ZnSO_4 . The chickpea variety GNG 2144 recorded significantly higher seed yield and biological yield over variety GNG 1958, RVG 203 and Pratap Chana 1. However, highest haulm yield was registered with variety GNG 1958 which was found at par with variety GNG 2144 and both these varieties significantly increased haulm yield over variety RVG-203 and Pratap Chana-1 during both years. Under zinc biofortification methods, soil application of ZnSO_4 @ 25 kg ha⁻¹ + foliar application of ZnSO_4 @ 0.5% ZnSO_4 produced highest seed yield, haulm yield and biological yield which was significantly higher over rest of zinc biofortification methods. The chickpea variety GNG 2144 recorded highest nitrogen and zinc content in seed which was significantly higher over rest of varieties. Amongst zinc biofortification methods, highest nitrogen and zinc content in seed was recorded with soil application of ZnSO_4 @ 25 kg ha⁻¹ + foliar application of ZnSO_4 @ 0.5% ZnSO_4 over rest of zinc biofortification methods.

QUANTIFYING GROWTH OF *METARHIZIUM ANISOPLIAE* (METCHINKOFF) SOROKIN, A GREEN MUSCARDINE FUNGUS, THROUGH COLORIMETRIC ANALYSIS

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Abstract

Metarhizium anisopliae, a fungal pathogen within the Hypocreales order and Clavicipitaceae family, plays a pivotal role in controlling agricultural pests. To harness its potential as a biocontrol agent, a comprehensive understanding of its physiology is imperative. In this study, growth curve analysis was conducted on 12 isolates of *M. anisopliae* cultivated in potato dextrose broth (PDB) at 25±2 °C. Optical density (OD) values, measured over a 15-day period using a colorimeter, unveiled distinctive phases characterizing fungal development. During the Lag Phase (Days 1-2), isolates demonstrated minimal growth (OD: 0.01



to 0.125), reflecting a gradual acclimation to the culture conditions. The subsequent Exponential (Log) Phase (Days 3-8) showcased a significant surge in OD values (0.115 to 0.406), indicative of robust growth and replication. The Stationary Phase (Days 9-12) revealed stabilized OD values (0.325 to 0.480), highlighting a balance between growth and resource depletion. Conversely, the Decline Phase (Days 13-15) witnessed a decrease in OD values (0.341 to 0.490) among some isolates, potentially attributed to nutrient depletion. Notably, variations in growth rates among isolates underscored the significance of isolate-specific characteristics in shaping the temporal dynamics of the fungal growth curve. This analysis provides critical insights into the growth behavior of *M. anisopliae* isolates, emphasizing its importance in optimizing cultivation conditions for diverse applications, such as biopesticides and biocontrol agents. The observed variations in the growth curve among isolates further highlight the need for tailored approaches in harnessing the biocontrol potential of *M. anisopliae* in pest management strategies.

DEVELOPMENT OF HETEROTIC GROUPS IN COTTON (*GOSSYPIMUM HIRSUTUM* L.)

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Abstract

Cotton is a source of sustainable natural fiber and a crop of global importance. It is prominently known as white gold and the king of fiber crops as it is an important commercial crop playing a major role in the textile industry, which contributes to the social and economic status of the world. The basic formula of heterosis ($HF_1 = \frac{1}{2}dy^2$) explains how the performance of hybrids (heterosis) depends on genetic diversity and the extent of dominance existing at different yield-influencing loci. It means heterosis can be enhanced either by increasing genetic distance or dominance. For enhancing genetic distance, it is first necessary to identify the groups of genotypes that are genetically diverse from each other. The term heterotic group refers to “a group of related or unrelated genotypes from the same or different populations, which display similar combining ability and heterotic response when crossed with genotypes from other genetically distinct germplasm groups” (Melchinger and Gumber, 1998). The heterotic group comprises a set of genotypes that perform well when crossed with genotypes from the opposite heterotic group. The process of development of such groups of diverse genotypes is itself called as the development of heterotic groups and the need for developing heterotic groups and exploiting them for improving hybrids performance is slowly being realized in different crops. The development of hybrid-oriented heterotic populations and the application of schemes for improving combining ability is an integral part of hybrid breeding in maize and other cross-pollinated crops (Hallauer and Miranda, 1981). In Dharwad continuous efforts were made to understand in general the complementation pattern of parents contributing to heterosis. It was observed that the parents representing different plant types like robust and compact when crossed revealed complementation of desirable features of two groups in the hybrid. It was also observed that complementation for physiological processes involved in the development of biomass and its partition can give rise to potential hybrids. Parents with strong expression for traits contributing to biomass, photosynthesis ability and stay green nature give rise to good hybrids when crossed to parents with high harvest index and faster-growing nature as revealed by the relative growth rate (RGR) of genotypes. Even the barbadense and hirsutum (H x B) cross combinations showed superior hybrids (Yanal, 2013; Yanal *et al.*, 2013a). In cotton different types of heterotic groups were developed like the Stay green (SG) heterotic group, Relatively high growth rate (RGR) heterotic group, Compact (COM) heterotic group and Robust (ROB) heterotic group. Later these heterotic groups were exploited through reciprocal selection for combining ability.

SEROPREVALENCE OF BRUCELLOSIS IN CAMELS IN BIKANER AND NEARBY VILLAGES IN THE INDIAN THAR DESERT OF RAJASTHAN

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Abstract

Blood samples from 177 camels (108 males and 69 females) aged 0.2 to 20 years from Bikaner and nearby villages Gadwala, Gadola and Naurangdesar were analyzed for Brucellosis by Rose Bengal Plate Test (RBPT). Fifteen camels [7 (46.66%) males



and 8 (53.33%) females] aged 3 to 18 years were positive. Prevalence in camels by RBPT was 8.47%. Sex-wise prevalence was 6.48% in males and 11.59% in females. Age-wise prevalence by RBPT was 6.25% in camels of <5 years age, 8.06% in those between 5 – 8 years, 5.55% in those aged 8 – 12 years and 13.33% in camels of more than 12 years age. Prevalence was 12.90% in Bikaner, 8.33% in Gadwala, 3.33% in Gadola and 6.12% in Naurangdesar, respectively. Out of 166 camel sera analyzed by ELISA, four were positive. The prevalence through ELISA was 2.25%. Sex – wise prevalence by ELISA was 0.92% in males and 4.34% in females, respectively. Age-wise prevalence by ELISA was 1.20% in camels between 5 – 8 years of age and 0.60% each in camels aged between 8 – 12 years, and those above 12 years of age, respectively. Location-wise prevalence was 1.61% in Bikaner and 6.12% in Naurangdesar, respectively. The study revealed that Brucellosis is prevalent in camels in Bikaner and adjoining villages in Rajasthan state of India and is of public health significance being a zoonotic disease transmissible to humans in contact with camels or consuming raw milk or handling meat.

BIOLOGICAL TREATMENT OF DYES IN CONTAMINATED WATER: A REVIEW

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Abstract

The rapid growth of industrialization has resulted in a significant surge in the worldwide demand for textile products. However, this surge has led to a notable increase in the discharge of wastewater from the textile industry, posing a significant environmental hazard on a global scale. The traditional biological method employed for treating contaminated drinking water proves inadequate for removing several recalcitrant and persistent contaminants. In response to this pressing issue, utilizing biological agents such as bacteria, algae, and fungi provides an efficient and effective approach to treating textile effluent and alleviating its adverse environmental impact. Biological processes demonstrated a removal efficiency exceeding 90% and an effective dye degradation rate surpassing 96%, according to recent literature. Additionally, we have outlined the potential degradation mechanisms of dyes to establish the foundation for the biological treatment of dye wastewater.

FORECASTING OF PRODUCTION, PRODUCTIVITY AND CULTIVATED AREA OF WHEAT IN INDIA USING ARTIFICIAL NEURAL NETWORKS

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Abstract

The population of the world is increasing at a rapid rate and more specifically in India resulting in increase of the food per capita requirement. Wheat plays an important role in ensuring global food with the demand of over 40 percent estimated for the year 2030. To fulfill this requirement, it is crucial to have a dependable forecasting that allows decision-makers to formulate appropriate policies and allocate the required logistical resources. In context to this, Artificial Neural Networks has been used to forecast production, productivity and cultivated area of wheat in India and compare them with the traditional or classical time series data methods. The time series data for the period of 60 years from 1961 to 2021 of India was collected from the Food and Agriculture Organization of United Nations. The data was analysed using classical methods namely linear, exponential, logarithm, polynomial and power function. During the study, the respective trendlines and equations were drawn using MS Excel for classical methods and also evaluation matrices such as coefficient of determination (R^2), Mean Squared Error (MSE) and Mean Absolute Error (MAE) were calculated to assess the model's suitability concerning the time series dataset. The same data was then used in prediction analysis using Artificial Neural Networks (ANN) on R studio software and similar evaluation matrices were estimated. From the study, it has been observed that the ANN's proved to be the best model in predicting the production, productivity and cultivated area of the wheat with the highest R value of 0.9 and least error values of both MSE and MAE. For validation of data with the actual, the activation functions like linear and tangent function predicted the values nearer to the actual values. Furthermore, artificial neural networks (ANNs) are considered a dependable model for forecasting time series data, enabling stakeholders to plan in advance for the rising demands.



COMPARATIVE STUDY OF WEED DIVERSITY UNDER *EUCALYPTUS TERETICORNIS* SM. PLANTATION AND OPEN CONDITION IN BALASORE DISTRICT (COASTAL ECOSYSTEM) OF ODISHA

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Abstract

In this study, we investigated the impact of integrating Eucalyptus trees into potential agroforestry models in the northern district of Balasore, Odisha. Our findings revealed a notable increase in understorey herbal diversity within the *Eucalyptus tereticornis* plantation compared to control conditions outside the plantation. We selected four distinct *Eucalyptus tereticornis* plantations and employed quadrat sampling methodology. Sample plots of 10 x 10 m² were utilized to measure the girth of trees, and within these larger plots, smaller 1 x 1 m² sample plots were established for herbal diversity assessment. Inside the plantation, we identified a total of 21 species spanning 7 families, whereas outside the plantation, we observed 29 species from 12 families, with 7 species being common to both sites. The biodiversity indices displayed distinctive values, with species richness, species evenness, Shannon's Diversity Index, and Simpson's Diversity Index for herbal diversity inside the plantation measuring at 0.0305, 1.0410, 2.9494, and 0.0559, respectively. Conversely, outside the plantation, these values were recorded at 0.0225, 0.9845, 3.1690, and 0.0476, respectively. Furthermore, our investigation determined an average basal area of 101.87 ha and a density of 1175 indv ha⁻¹ for Eucalyptus trees. The diminished values of these parameters within the Eucalyptus plantation are likely attributable to factors such as allelopathic effects, competition for resources like space, light, and nutrients. We advocate for a thorough assessment of species compatibility with crop plants in experimental plots prior to incorporating Eucalyptus into agroforestry models. Additionally, careful consideration of site suitability and appropriate spacing between tree rows and crops is crucial for successful integration.

PREVALENCE OF *YERSINIA ENTEROCOLITICA* IN THE PORK SUPPLY CHAIN OF SOUTHERN KARNATAKA, INDIA

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Abstract

In numerous developed and developing nations, *Yersinia enterocolitica* stands as the predominant bacterial agent causing gastrointestinal ailments. The primary reservoir for this pathogen is animal-derived foods, particularly pork and its derivatives. This research sought to ascertain the prevalence of *Yersinia enterocolitica* by employing Yersinia selective agar for isolation, substantiated by biochemical tests and PCR confirmation. Biotypes were identified through biochemical assays, virulence genes were determined via PCR, and antimicrobial susceptibility and MAR index were assessed using Kirby-Bauer's disc diffusion method and ESBL production via the combined disc method. A total of 203 samples were gathered from the pork supply chain, encompassing 47 faecal samples, 34 water samples, 8 feed samples, 4 scalding water samples, and 20 samples each of pig meat, liver, skin and 10 samples each of pig intestine, mesenteric lymph node, butcher's hand swab, knife swab, and cutting board swab. *Yersinia enterocolitica* was isolated from five samples, reflecting a prevalence of 2.46% (5/203) within the pork supply chain, 7.69% (5/69) at the farm level, 9.43% (5/53) in intensive farming systems and 10.64% (5/47) in pig faeces. Among these isolates, two were identified as biotype 1B, while three belonged to biotype 3. Four isolates exhibited the virulence gene *ail*, and three contained the *ystB* gene. All isolates displayed resistance to amoxicillin-clavulanic acid and ampicillin, two were resistant to cefotaxime, chloramphenicol, and cotrimoxazole, and one exhibited resistance to tetracycline. The MAR index of the isolates ranged from 0.133 to 0.333, with one isolate demonstrating ESBL production. These findings underscore the presence of antimicrobial-resistant and virulent strains of *Yersinia enterocolitica* in the pork supply chain, posing a potential threat to the health of both pigs and consumers of pork products.



GUDUCHI (*TINOSPORA CORDIFOLIA*) SUPPLEMENTATION ON SCROTAL CIRCUMFERENCE, TESTICULAR BIOMETRICS, SERUM ENDOCRINE PROFILES AND SEMINAL ATTRIBUTES IN ANDAMAN LOCAL GOAT BUCK OF ANDAMAN AND NICOBAR ISLANDS

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Abstract

Tinospora cordifolia (Guduchi) stem supplementation on scrotal circumference (SC), testicular volume (TV), testicular weight (TW), hormone profiles, biochemical profiles, libido, and seminal attributes during rainy and dry summer season in Andaman local goat bucks was studied. Bucks ($n = 12$) of 3-4 years old were equally divided into control (Gr: 1) and treated (Gr: 2) groups. Treated animals received 1 g/kg body weight Guduchi stem per day for 60 days. SC and testicular biometrics 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, testosterone, TSH, T3 and T4 and antioxidants concentrations were increased ($P < 0.05$) and cortisol and prolactin and MDA were decreased ($P < 0.05$) in Guduchi treated compared to control group. Scrotal and testicular profiles were increased ($P < 0.05$) in Guduchi treated compared to control bucks. 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 Guduchi treated compared to control group. Concluded that Guduchi treatment can be utilized effectively to improve the hormone, libido, antioxidants and scrotal and testicular profiles with cascading beneficial effects on semen quality attributes in Andaman local goat bucks of Andaman and Nicobar Islands.

CULTURE OF SEA BASS (*LATES CALCARIFER*) A EURYHALINE FISH IN FRESHWATER PONDS

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Abstract

Lates calcarifer an ideal species selection which is imperative to achieve the better growth that ensures to achieve higher economic return. Marine fish seeds of sea bass were procured from Central Institute of Brackishwater Aquaculture (CIBA), Chennai. 2000 number of seeds of 1 cm in length and 2g of weight of sea bass were released in ponds. As the species were euryhaline and experiment was in freshwater pond hence it encountered 70% mortality with 30% survival rate were found. Out of survival numbers growth rate by weight gain was observed 1.2 to 2.5kg during Eight months culture period.

SPLIT APPLICATION OF NITROGEN ON GROWTH AND YIELD OF DRILLED RICE (*ORYZA SATIVA* L.)

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Abstract

A field experiment entitled "Split application of nitrogen on growth and yield of drilled rice (*Oryza sativa* L.)" was carried out at College of Agriculture, Dr. PDKV, Sonapur, Gadchiroli during kharif season of 2021-22 on sandy clay loam soil. The experiment was laid out in split plot design with three replication, to study the effect of split application of nitrogen on growth



characters, yield attributes, yield, nutrient uptake and economics of drilled rice crop. The factor A consisted application of three different dose of nitrogen viz. 75, 100 and 125 % RDN, while the factor B consisted of application of nitrogen with three different split viz. S1 (50 % RDN basal dose at sowing + 50 % RDN at 30 DAS), S2 (33 % RDN basal dose at sowing + 33 % RDN at 30 DAS + 33 % RDN at 60 DAS) and S3 (25 % RDN basal dose at sowing + 25 % RDN at 30 DAS + 25 % RDN at 50 DAS + 25 % RDN at 70 DAS). The initial and final plant stand was not influenced significantly due to different split application of nitrogen. Growth characters like plant height, number of tillers per plant, number of tillers per m², number of functional leaves per plant, leaf area index per plant and dry matter accumulation per plant were significantly affected due to different levels of nitrogen application in drilled rice crop. The application of 125 % RDN (Treatment N3) recorded significantly higher plant height (87.44 cm), number of tillers per plant (9.77), number of tillers per m² (429.30), number of functional leaves per plant (21.89), leaf area index per plant (4.59) and dry matter accumulation per plant (29.14 g). The split application of nitrogen treatment S2 (33 % RDN basal dose at sowing + 33 % RDN at 30 DAS + 33 % RDN at 60 DAS) recorded significantly higher plant height (87.22 cm), number of tillers per plant (9.73), number of tillers per m² (433.35), number of functional leaves per plant (21.96), leaf area index per plant (4.64) and dry matter accumulation per plant (28.46 g). The similar trend was observed for treatment N3 (125 % RDN) in nitrogen dose application for number of panicles per plant (12.74), length of panicle (21.18 cm), weight of panicle per plant (2.49 g), number of filled spikelets per panicle (121.33), test weight (15.88 g) and hulling % (75.19). The split application of nitrogen with treatment S2 (33 % RDN basal dose at sowing + 33 % RDN at 30 DAS + 33 % RDN at 60 DAS) recorded the significantly higher number of panicles per plant (12.63), length of panicle (21.41 cm), weight of panicle per plant (2.50 g), number of filled spikelets per panicle (122.00) and test weight (15.82 g). Application of 125 % RDN recorded significantly higher grain yield (4006 kg ha⁻¹), straw yield (5239 kg ha⁻¹) and biological yield (9245 kg ha⁻¹) and also with split application of nitrogen treatment S2 (33 % RDN basal dose at sowing + 33 % RDN at 30 DAS + 33 % RDN at 60 DAS) recorded significantly higher grain yield (3868 kg ha⁻¹), straw yield (4946 kg ha⁻¹) and biological yield (8813 kg ha⁻¹). Split application of nitrogen S2 and 125 % RDN recorded significantly higher nitrogen, phosphorous and potassium content in grain and straw at harvest and similarly recorded the higher values of nitrogen, phosphorous and potassium uptake. The GMR, NMR and B:C ratio per hectare were found higher with 125 % RDN and treatment S2 (33 % RDN basal dose at sowing + 33 % RDN at 30 DAS + 33 % RDN at 60 DAS) split application of nitrogen.

EFFECT OF MIXED NANO MICRONUTRIENT ON GROWTH AND YIELD OF FRENCH BEAN (*PHASEOLUS VULGARIS* L.)

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Abstract

French beans, also known as green beans or string beans, are a popular vegetable that belongs to the *Phaseolus vulgaris* species. They are characterized by their slender, green, and elongated pods. French beans are a versatile and nutritious addition to a wide range of culinary dishes. The investigation was carried out at Departmental Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj during the *Rabi* season of 2021 and 2022. The research was conducted with aim to study the effect of application of mixed nano micronutrients on growth and yield of French bean variety Arka Komal. The experiment was set up using a Factorial Randomized Block Design (FRBD) one factor being application of mixed nano micronutrient and other being application of nano fertilizers. The details of mixed nano micronutrient treatment given are M₀-control (Without micronutrient); M₁- 0.2ml/ L of nano mix micronutrient/L of water as foliar application; M₂- 0.4ml/L of nano mix micronutrient/ L of water as foliar application; M₃ -0.6ml/ L of nano mix micronutrient/L of water as foliar application. The details of nano-fertilizers treatment given are F₀- Control (without fertilizer); F₁- 100% RDF as traditional fertilizer; F₂-5ml/ L each of Nano NPK/ L of water as foliar application; F₃- 4ml/L each of Nano NPK/ L of water as foliar application; F₄- 3ml/L each of Nano NPK/ L of water as foliar application. From above experimental findings on effect of application of mixed nano micronutrients in French bean, it is concluded that treatment M₃ (0.6ml/ L of nano mix micronutrient/L of water as foliar application) performed best for growth parameters like plant height (54.68 cm); number of branches per plant (9.95 branches/plant) and different yield parameters like pod length (16.38 cm); pod girth (1.70 cm); pod yield per hectare (14.12 t/ha) studied in French bean for two-years.



EFFECT OF SEASON ON HORMONE AND BIOCHEMICAL PROFILES AND LIBIDO IN TERESSA GOAT BUCKS OF ANDAMAN AND NICOBAR ISLANDS

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Abstract

Teressa goat is a meat animal in Andaman and Nicobar Islands. Present study was conducted to assess the seasonal effect on hormone profiles such as follicle stimulating hormone (FSH), luteinizing hormone (LH), testosterone, thyroid stimulating hormone (TSH), triiodothyronine (T3), thyroxine (T4), cortisol and prolactin, libido profiles such as libido score (LS), mating ability score (MAS) and sex behavioural score (SBS), antioxidant profiles such as total antioxidant capacity (TAC), superoxide dismutase (SOD), catalase (CAT) and glutathione (GSH) and oxidative profile such as malondialdehyde (MDA) and kidding rate during rainy and dry summer seasons in Teressa goat bucks. A total of 10 adult intact Teressa goat bucks (body condition score: 3.0-3.5 and classified as good; 3-4 years) were selected from the goat breeding farm, ICAR-CIARI, Port Blair, ANI, India. Hormone and biochemical profiles were analysed with ELISA kits. Libido profiles were measured during rainy and dry summer seasons. Results revealed that these experimental profiles differed significantly ($p < 0.05$) between the seasons. Significantly ($p < 0.05$) higher FSH, LH, testosterone, TSH, T3 and T4 and TAC, SOD, CAT and GSH were observed in rainy than in dry summer season whereas cortisol and prolactin and MDA were higher in summer than in rainy season. Similarly LS, MAS and SBS were significantly higher in rainy season than in dry summer season. The study concluded that rainy season had higher beneficial effects than summer season on reproduction and artificial breeding programmes in semi-intensive management of Teressa goat in the present location.

STUDY ON ICHTHYOFAUNAL DIVERSITY OF VIJAYANAGARA DISTRICT OF KALYANA KARNATAKA REGION

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Abstract

Vijayanagara District of Karnataka has vast potential of aquatic bio-resources and offers considerable scope for inland fisheries development and inland aquaculture. To investigate the ichthyofaunal diversity of Harapanahalli of Vijayanagara District, data were collected with the help of local skilled fishermen and fish farmers from different locations of the Harapanahalli taluka for 8 months during 2021-2022. Collections were made from river (Tunga Bhadra), Tanks, irrigation canals and ponds. During the study period, fish species belonging to particular Genera, Families and Orders were identified. Cypriniformes was the dominated Order. The present study showed that Harapanahalli of Vijayanagara district possesses medium fish diversity but proper conservation measures are required to maintain sustainability and richness of the species diversity of the district.

BER BASED AGRI-HORTI SYSTEM FOR ENHANCING PRODUCTIVITY AND PROFITABILITY OF DRYLAND SHALLOW BLACK SOILS

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Abstract

Crop production on drylands in general and marginal rainfed lands in particular results in low, unstable, and often uneconomic



yields because of aberrant monsoon behavior. Therefore, there has been thinking to develop some alternate land use systems for these lands. Dryland horticulture and agri-horti systems are readily picked up by the farmers due to the cash benefits derived from these systems. The apple ber variety has been selected and planted at two spacings, *i.e.*, 6 x 6 m and 12 x 3 m, with four cropping systems *viz.*, no crop, pigeonpea, pigeonpea + pearl millet and pigeonpea + foxtail millet. The results indicated that among planting geometry, the highest ber fruit yield was recorded with 6 x 6 m (2774 kg/ha) compared to 12 x 3 m. However, cropping systems did not affect the ber fruit yields, plant height, collar diameter and canopy spread. Indeed, the intercropping of field crops in ber plantations was found to increase soil moisture at various growth stages compared to no intercropping. The system productivity (pigeonpea equivalent yield) was significantly highest in 12 x 3 m (1289 kg/ha) and pigeonpea + pearl millet intercropping (1549 kg/ha). The interaction of planting geometry of 12 x 3 m and pigeonpea + pearl millet intercropping system recorded significantly highest system productivity (1615 kg/ha), which was statistically on par with 12 x 3 m with pigeonpea + foxtail millet intercropping system (1607 kg/ha⁻¹). The ber planting geometry and cropping systems significantly influenced the net returns. The planting geometry of 12 x 3 m and pigeonpea + pearl millet intercropping recorded maximum net returns of Rs. 53719 /ha. From the above results, it can be concluded that planting ber in 12 x 3 m along with pigeonpea + pearl millet/foxtail millet intercropping system is more remunerative and resource efficient in dryland shallow black soils.

OPTIMIZATION OF READY-TO-USE BLACK HORSE GRAM *JHUNKA* MIX FOR NUTRITIONAL SECURITY

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Abstract

Pulses has important role in contributing to food and nutritional security and replenishing soil nutrients having a huge potential in addressing needs like future global food security, nutrition and environmental sustainability needs. Horse gram (*Macrotyloma uniflorum*) is a minor, under-exploited legume of tropics and subtropics grown under dry-land agriculture. Use of horse gram in the preparation of convenience foods like *jhunka* mix can be a better approach which can contribute to food and nutritional security. Hence present study was conducted with the objective to optimise the *jhunka* mix which was prepared using bengal gram flour and black horse gram flour in varying proportions Initially the raw black horse gram flour for the preparation of *jhunka*. The prepared *jhunka* had much bitter taste raw flavour. Later to remove the bitterness, the horse gram grains were soaked, shade dried and then milled to flour. The bengal gram flour along with this pre-treated horse gram flour was used in the *jhunka* preparation at varying proportions as T₁ (50: 50), T₂ (25: 75) and T₃ (0: 100) keeping all the other ingredients constant which was taken from traditional *jhunka* recipe. The *jhunka* of T₃ combination had very good taste and flavour along with perfect shape and texture and was highly acceptable with the overall acceptability of 8.25 on nine-point hedonic scale. Hence hundred per cent black horse gram flour was utilised effectively in the preparation of ready-to-use convenience mix.

THE IMPACT OF NUTRITION EDUCATION ON THE DIETARY HABITS OF ADOLESCENTS

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Abstract

The Present study “The impact of nutrition education on the dietary habits of adolescents” is a topic of significant interest due to the potential to improve overall health and prevent chronic diseases. The main aim of the study was to explore the impact of nutrition education on the dietary habits of Adolescents. The study concentrated on nutrition education interventions can lead to positive changes in the dietary habits of adolescents. These interventions often include a combination of nutrition knowledge dissemination, practical cooking skills, and behavioral strategies to promote healthier food choices. By equipping adolescents with the necessary knowledge and skills, nutrition education empowers them to make informed decisions about their dietary intake. Nutrition education can help adolescents develop a better understanding of portion sizes, nutritional



labels, and the overall importance of balanced nutrition. Furthermore, the impact of nutrition education extends beyond the immediate changes in dietary habits. Adolescents who receive comprehensive nutrition education have been shown to exhibit improved food-related behaviors, such as better meal planning, increased involvement in grocery shopping, and greater willingness to try new and healthy foods. These behavioral changes are indicative of a more profound shift towards a healthier lifestyle. Improved dietary choices resulting from nutrition education can contribute to better weight management, reduced risk of obesity, and lower incidence of diet-related health conditions such as cardiovascular disease, type 2 diabetes, and certain types of cancer. This abstract highlights the significance of nutrition education in shaping the dietary habits of adolescents and the potential to improve their long-term health outcomes.

BIOLOGICAL SYNTHESIS OF CHITOSAN AND COPPER CHITOSAN NANOPARTICLES : A NOVEL APPROACH FOR ENHANCED AGRICULTURAL APPLICATIONS

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Abstract

Chitosan, a natural precursor, is recognized for its extensive biocatalytic activity in diverse fields such as medicine, pharmaceuticals, and agriculture. In its native state, chitosan differs significantly from its nanoform, known as chitosan nanoparticles (Cht NPs). The increasing interest in Cht NPs is attributed to their distinctive physio-chemical properties, influenced by size, shape, and morphology, enabling interaction with pathogenic microorganisms. The study emphasizes a biological approach to synthesize nanoparticles, utilizing chitosan as a precursor and the aqueous extract of *Moringa oleifera* as a reducing/stabilizing agent. Employing sonication for Cht NPs and co-precipitation for copper chitosan nanoparticles (Cu-CHT-NPs), the process involves stabilizing with chitosan in glacial acetic acid. UV-Visible spectrum analysis monitors nanoparticle stability and formation, revealing maximum absorption at 303 nm for Cht-NPs and 318 nm for Cu-Cht-NPs. Fourier Transformed Infrared (FT-IR) spectra identify biomolecules—alcohols, phenolics, carboxylic acids, alkynes, and aliphatics—indicating chitosan reduction using *Moringa* extract. Nanoparticle size and zeta potential analysis confirm average sizes of 53 nm with -10.7 mV for Cht-NPs and 119 nm with -12.8 mV for Cu-Cht-NPs. High-Resolution Transmission Electron Microscopy (HR-TEM) reveals monodisperse spherical Cu-Cht-NPs (30-100 nm) and polydisperse Cht-NPs. Both Cu-Cht-NPs and Cht-NPs exhibit inhibitory effects on *Rhizoctonia bataticola* at 700 ppm and 125 ppm, respectively. This method holds promise for scaling up nanoparticle biosynthesis, potentially serving as an effective seed priming agent for soybeans in agriculture.

VALUE ADDITION IN WOOD APPLE (*LIMONIA ACIDISSIMA* L.)

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Abstract

A study on scope of value addition in Wood Apple (*Limonia acidissima* L.) was undertaken in ICAR-IIHR Regional Centre, Central Horticultural Experiment Station and Post-Harvest Laboratory, Department of Fruit Science and Horticulture Technology, Odisha University of Agriculture and Technology, Bhubaneswar with an objective to develop and assess the quality of fruit bars utilizing wood apple, pomegranate and dragon fruit in varying proportions. Physico-chemical properties of the developed fruit bars were studied during six months of storage at refrigerated condition with eleven treatments replicated thrice and data analysis was done following Completely Randomized Design. The moisture content of the blended fruit bars changed from 18.00 per cent and 20.50 per cent to 15.08 to 16.38 per cent. The total sugar content was highest (22.84%) in the fruit bars blended with 60% wood apple and 40% pomegranate which showed an increasing trend and after six months was 24.51%. Total soluble solids (°Brix) of the fruit bars showed an increasing trend throughout the storage period whereas ascorbic acid content of the fruit bars showed a decreasing trend during the period of study. The wood apple blended fruit bars were qualitatively and organoleptically accepted and fit for consumption up to 6 months of storage at refrigerated condition.



MATING DISRUPTION PASTE (MDP) TECHNOLOGY: AN EFFECTIVE MANAGEMENT OF COTTON PINK BOLLWORM

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Abstract

Cotton, 'the king of fibers' usually commercially referred to as 'white gold' is a the most common fiber crop grown on six continents of the world and plays a pivotal role in human civilization and the economic, political and social affairs of the world. The states of Maharashtra, Gujarat and Telangana accounted for a substantial proportion of cotton production in India. Among these states, Gujarat emerged as the largest cotton producer with a total area of 22.45 lakh hectares and production of 74.82 lakh bales of 170 kg, with a productivity of 559 kg lint/ha during 2021-22. Despite the successful management of the notorious bollworm complex with *Bt* cotton technology in India, the pink bollworm (PBW) *P. gossypiella* (Lepidoptera: Gelechiidae) vehemently emerged as a major pest problem in states such as Gujarat, Maharashtra, Karnataka, Andhra Pradesh and Telangana, resulting in yield losses of 5-10% after the second picking. Chemical insecticides are more frequently used for much more management of pink bollworms which resulted in one of the major constraints *i.e.* pesticide poisoning of farmers and environmental pollution. Mating Disruption Technology (MDT) uses synthetically produced chemicals can contribute to Integrated Pest Management (IPM) strategies mainly by confusing males and limit their ability to locate calling females. This causes a reduction of mating and thus reduces the population density of this pest. The experiment regarding the comparison of Gir Sawaj MDP @ 400 g/ha with the farmers' management practices were conducted during year 2021-22 and 2022-23. The results showed that the lowest percentage of rosette flowers (2.34% and 1.57%), green boll damage (3.18% and 2.55%), open boll damage (3.68% and 3.08%) and locule damage (3.98% and 3.55%) was recorded in the Gir Sawaj MDP @ 400 g/ha as compared to farmers' practices. The treatment also led to a reduction of moth catches (4.10 and 2.60 moths/traps/week) and an increase in cotton yield (3267 kg/ha).

EVALUATION OF GENETICALLY IMPROVED FARMED TILAPIA (GIFT) IN SHORT SEASONAL PONDS OF SEMI-ARID AREA

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Abstract

Good candidate species for inland aquaculture commonly called as Aquatic chicken (Nile tilapia) were released in earthen pond, stocking initial size were 3cm in length and 8-10g in weight. By giving the hostel waste as food for the experimental fish we could see the good growth rate of 800-900g. Stocking density was 1000 numbers and a survival rate is 65%. Seeds were procured from ZAHRS, Mudigere. The experiment was carried out at MARS, Raichur of UAS for a period of eight months.

ROBOTICS IN VEGETABLE PRODUCTION

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Abstract

Precision farming is the science of enhancing crop yields and supporting management practices with advanced sensor and analysis techniques. With fewer inputs precision horticulture can improve yields by optimizing growing conditions and maximizing quality and yield of fresh produce by monitoring the quality of the harvested produce. Tools of horticulture precision farming include GPS, GIS, VRT, Yield mapping technology, remote sensing technology, proximate sensors,



computer and internet technology. Robots and automation processes are finding many uses in precision horticulture in recent times. Robots for spraying give an engineering solution to the current human health hazards involved in spraying potentially toxic chemicals in the confined space of a hot and steamy glasshouse. This is achieved by construction of an autonomous mobile robot for use in pest control and disease prevention applications in commercial greenhouses. Labour availability, wages and increased cost of inputs now-a-days have paved the way to focus on autonomous robots in crop and weed monitoring, sensing and harvesting operations in cultivation of vegetables. Robot for intelligent perception and precision application (RIPPAF) and Ladybird are the autonomous robots developed by Horticulture Innovation Centre for Robotics and Intelligent Systems (HICRIS) at University of Sydney's Australian Centre for Field Robotics (ACFR) to monitor crop and soil health, crop growth, identification and removal of weeds and administer quantity of herbicides for the targeted weeds. Precision vegetable farming will continue to be an advanced development in many developing nations and support from public and private sectors is essential to promote its quick adoption. Instead of being seen as a magic bullet to solve every issue, precision farming should be seen as a tool to help you make the most of your current systems.

AGRI-ENTREPRENEURIAL VENTURES FOR RURAL YOUTHS

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Abstract

India is a country with large agricultural base and majority of the population depend on agriculture for livelihood. Agriculture has changed from deficit oriented to surplus oriented sector. Marketing of the agricultural produce has switched over to value added than raw selling. The vital requirement of agri-entrepreneurship is rural resource management. While designing rural entrepreneurship programs, it is vital to have a holistic view of the agricultural value chain in order to better understand the opportunities and scope available to young people. Youth feel more attracted when they find that their skills, interests, or talents are best syncing with existing aspects of the agriculture ventures other than actual agriculture practices. Agri-entrepreneurship is a boon to match the employment demands of the growing population. Nowadays the paradigm shift from harmful agricultural practices to conventional methods of production is more on wheel. So youth of this generation has a wider scope to enter the business as entrepreneurs. Major ventures which can sustainably pull the rural youth can be Vermicomposting, Dairy processing Industries, Bio fuel production, Fruit and vegetable processing, Floriculture and Seed production. These ventures have surpassed the stage of merely self sufficiency to the profit oriented business activity. With these activities abundant investment opportunities and financial assistances are there in expanding domestic market and export arena. The Indian agriculture has come a long way to "Value added agriculture". Indian youth, beyond the doubt should have patience needed to undergo metamorphosis to bring about the change in farming as tradition to farming as profession and passion.

POPULATION DYNAMICS OF APHIDS, *MACROSIPHUM EUPHORBIAE* INFESTING ROSE

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Abstract

Rose (*Rosa* spp.) is one of the most popular flowering shrubs in India as well as in other countries. Commercial rose cultivation under open-field and protected structures is gaining importance with area under its cultivation increasing day by day. Among the various factors affecting production and quality of flowers, pests are of prime importance. The uniform environmental conditions throughout the year favor the multiplication of insect pests around the year and are an ideal for the rapid proliferation of unwanted insects, which constitute an ever-present threat to the quality of flowers. Rose aphids (*M. rosae* L.) and *M. rosaeiformis*, potato aphids, *M. euphorbiae* (Thomas) and cotton aphids (*Aphis gossypii*) are serious pests of rose plants. Aphid infestations can cause leaves to curl upward and completely kill a small new plant. The current study aimed to better understand the population dynamics of aphids, *Macrosiphum euphorbiae* infesting rose. The experiment was conducted at the Karnataka State Department of Horticulture (KSDH), Shivamogga during 2017-2018. The findings revealed that, the incidence of aphids started from first fortnight of July and population ranged from 11.81 to 120.07 per 5 cm twig.



Later, the population increased gradually and peaked during the second fortnight of August. Thereafter, the incidence declined gradually and reached its minimum during second fortnight of April (11.81 per 5 cm twig). Furthermore, correlation coefficients revealed a non-significant negative relationship between the maximum temperature ($r=-0.398$) and aphid infestation. Whereas, minimum temperature ($r=0.045$), morning relative humidity ($r=0.442$) and evening relative humidity ($r=0.476^*$) showed positive correlation with population of aphids. However, rainfall, ($r=-0.200$) showed non-significant and negative correlation with aphid population. The weather parameters *viz.*, maximum and minimum temperature, morning and evening relative humidity and rainfall influenced the population of aphids to an extent of 52 per cent.

URBAN NUTRI-GARDENS : A HOLISTIC EXAMINATION OF FACTORS LIMITING SUCCESS AND RECOMMENDATIONS FOR OVERCOMING CONSTRAINTS

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Abstract

This study explores the constraints faced by urban nutri-gardens and their impact on achieving optimal objectives. Operationalizing constraint as factors limiting gardeners, six categories were identified through literature review and pretest surveys: financial, input, management, social, technical, and personal constraints. Respondents ranked these factors, and the Garret ranking method was employed for prioritization. The analysis revealed that gardeners perceived technical constraints as the most significant (mean score 61), followed by management (59), input (55), social (48), financial (44.00), and personal constraints (39). Examining financial constraints, loss of crops due to pests and diseases (61.66%) topped the list, highlighting issues related to pest control and the limited lifespan of market-available polythene bags. Socio-psychological constraints were dominated by complaints about urban farm debris falling into neighbors' premises (42.44%), emphasizing the need for effective waste management and communication to address neighbor concerns. Resource and input constraints were led by the lack of availability of quality inputs nearby (44.44%), highlighting challenges such as insufficient labor, water scarcity, and limited sunlight. Time constraints were significant, with 28.89% of respondents citing a lack of time for urban farm management. Space limitations (27.78%) emerged as a key personal constraint, especially in metropolitan areas, while harsh weather conditions (42.22%) posed social challenges, impacting plant health and community dynamics. The study underscores the importance of community engagement, training programs, and proactive measures to address the multifaceted challenges of urban gardening. Recommendations include promoting low-maintenance techniques, creative space utilization (e.g., vertical gardening), and weather-resilient structures. Addressing constraints through collaborative efforts can enhance the sustainability and success of urban nutri-gardens, fostering a harmonious coexistence with the urban environment.

MOLECULAR CHARACTERIZATION OF *SESAMUM INDICUM* L.-AN OIL SEED CROP

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Abstract

Sesame seeds are rich in oil and protein with high dietary energy value of 6,355 kcal/kg. Chemical composition of seed shows that it contains 42–63% oil, 22–25% protein, 13.5% carbohydrate and 5% ash. It is rich source of various nutritional elements including iron, magnesium, manganese, copper and calcium, and important vitamins B1 (Thiamine) and E (Tocopherol). The oil is used as the base for Ayurvedic preparations and known as the Queen of oils. Sesame seeds are called as the seed of immortality. Studies showed that lignans found in sesame seed have remarkable antioxidant effect on human body. The presence of sesamin and sesaminol lignans in its nonglycerol fraction contributed to oxidative stability and antioxidative activity of sesame oil (Wu, 2007). Most abundant fatty acids present in sesame oil include: oleic acid (43%), linoleic acid (35%), palmitic acid (11%) and stearic acid (7%) contributing toward 96% of total fatty acids.

Due to its flavor and stability as well as high- quality cooking value, sesame fat is of great significance in the food industry. Sesame seed is used for preparation of the oil for cooking, salad oils and margarine. Foods fried in sesame oil have a long self-life because the oil contains an antioxidant called sesamol. The oil can be used in the manufacture of soaps, paints,



perfumes, pharmaceuticals and insecticides. Molecular markers technique is the most widely used biochemical test for identification and characterization of genotypes for routine purpose, the use of appropriate molecular marker will help to establish the varietal identity. Molecular markers measure the genetic relationships and assess genetic diversity. With the advancement of molecular biology and biotechnology, markers are used for analyzing genetic diversity which is DNA based techniques. It covers the whole genome variability and is unaffected by environment and less time consuming. The right choice of a technique, proper sampling procedure and judicious interpretation method can provide reliable and accurate results for variety identification and genetic purity testing in a considerably short period of time. Sesame has been mentioned as an 'orphan crop' because it is not commanded to any of the CGIAR institutes which could also be one of the reasons for lack of research works. As a natural result of this condition, the use of molecular techniques for the enhancement of sesame is very restricted. SSRs have been used for a variety of applications like genetic mapping, hybrid purity testing, level of inbreeding, positional cloning of genes etc. Their flanking regions are usually genetically conserved and microsatellite primers developed for one species frequently amplify loci in related species. Therefore, SSR markers may offer a particular advantage to investigate genetic relationships within accessions of sesame in future.

OPTIMIZING GROWTH CONDITIONS FOR *FUSARIUM HUMULI*, THE CAUSE OF POD ROT IN BLACK GRAM (*VIGNA MUNGO* L. HEPPER): A STUDY ON MEDIA, PH, AND TEMPERATURE EFFECTS

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Abstract

Black gram (*Vigna mungo* L. Hepper), a vital crop in South Asia, plays a crucial role in traditional cuisines and sustainable farming practices. Despite its significance, black gram faces challenges from various diseases, with pod rot caused by *Fusarium* spp. emerging as a recent concern. This study aims to identify the *Fusarium* species responsible for pod rot in Pantnagar, Uttarakhand, India, and investigate optimal conditions for its mycelial growth and sporulation. A *Fusarium* isolate was obtained from symptomatic black gram pods and identified as part of the *Fusarium incarnatum-equiseti* species complex. Subsequent molecular analysis confirmed its similarity to *F. humuli*. The identified pathogen's mycelial growth and sporulation were examined across eight different culture media, with Potato Dextrose Agar proving most effective. pH studies revealed that the pathogen thrived best at pH 6.5 and 7.0, while temperatures of 28°C were optimal for growth and sporulation. These findings provide insights into the environmental factors influencing *Fusarium* spp. pathogenicity, guiding future studies and disease management strategies.

IMPACT OF NEEM OIL ON BACTERIAL CHARACTERISTICS OF RECYCLED MANURE SOLIDS

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Abstract

Recycled Manure Solids (RMS) are favoured due to their cost-effectiveness, availability, and suitability as a comfortable bedding material for animals. However, their high moisture content makes them a potential source of bacterial contamination. Neem oil, derived from the neem tree (*Azadirachta indica*), has been shown to possess potent antibacterial properties. This study investigated the effect of neem oil (applied at 10% of the bedding amount) as a conditioner on the in vitro bacterial properties of RMS. The total bacterial counts, *E. coli*, coliform, *Staphylococcus* spp., and *Streptococcus* spp., were measured on days 0, 3, 5, 7, and 10 using standard methods. Two distinct groups were established: a control group and another group where neem oil served as the conditioner. The findings revealed that RMS bedding treated with neem oil as a conditioner exhibited a lower total bacterial count (log₁₀ cfu/g) on the 3rd day (24.46±0.38), 5th day (24.98±0.4), 7th day (23.99±0.31), and 10th day (24.67±0.54) in comparison to the control group. Specifically, RMS bedding with neem oil demonstrated significantly reduced coliform counts (log₁₀ cfu/g) on the 7th day (6.77±1.78) than on day 3 (2.87±1.09). Moreover, the neem



oil-treated RMS bedding had significantly lower *E. coli* counts (log₁₀ cfu/g) on the 7th day (1.46±0.98) compared to the initial day (7.90±0.75). RMS bedding treated with neem oil exhibited significantly lower total bacterial counts (log₁₀ cfu/g) compared to the control group. Neem oil also significantly reduced coliform and *E. coli* counts. Additionally, neem oil-treated RMS bedding displayed significantly lower *Staphylococcus spp.* counts compared to the control group. These results demonstrate the potential of neem oil as an effective conditioner for reducing bacterial counts and enhancing the microbial hygiene of RMS.

VALUE ADDED PRODUCTS FROM BER

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Abstract

Ber (*Zizyphus mauritiana* Lamk) 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 cultivated horticultural varieties grown are *Gola*, *Umran*, *Mundia*, *Kaithli*, *Umran*, *Mehrun*, *Parbani*, *Elaichi* and *Sanam* in India. Although known for its rich taste and high nutritional value, ber is an underutilised 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. Advantages of value addition is to improve the profitability of farmers, reduces the glut in market during peak season of produce, produce that can convert into value added product increasing the profit, empower the farmers and other weaker sections of society especially women through gainful employment opportunities. The seasonal and perishable nature of Ber leads to the various value-added products like Ber candy, Ber jam, Ber wine, dehydrated and sundried ber, Ber beverages, Ber pickle are used for keeping best quality of this fruit. The medicinal properties like neurological properties, antinephritic effect, cardio-vascular activity, antifungal, antidiabetic, anti-allergic, antiulcer, anti-inflammatory, anti-oxidants and anti-bacterial activities have been used since ancient times for curing various illnesses. The shelf-life of ber fruit is extremely short and the rapid perishability of the fruits is a problem. At ambient temperature the shelf-life of ber is only 2-4 days. Due to surplus of fruits in local markets during peak season, a substantial quantity goes into waste, resulting in heavy postharvest losses. If proper efforts are made to increase the production supplemented with value addition of ber fruit such as wine production with proper handling with respect to pre-harvest, harvesting and postharvest treatments, packaging, transportation, storage, postharvest pathology and processing.

BIOEFFICACY OF ACETAMIPRID 20% SP ON CABBAGE APHID, *BREVICORYNE BRASSICAE*

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Abstract

Field trial was carried out to evaluate the bioefficacy of Acetamiprid 20% SP at 50g, 75g and 100g /ha in comparison to market sample as well as standard check against Cabbage aphid, *Brevicoryne brassicae* during *kharif* season of 2020 and 2021 at Kittur Rani Channamma College of Horticulture, Arabhavi, University of Horticultural Sciences Bagalkot. The per cent reduction in pest population was calculated over control. It was found that Acetamiprid 20% SP (Rainbow sample) @ 75 g/ha (99.18%) and Acetamiprid 20% SP (Rainbow sample) @100 g/ha (99.32%,) were more effective than Acetamiprid 20% SP (market sample) @ 75 g/ha (92.11%), and remaining treatments were less effective than above treatments in controlling aphid population on cabbage crop during each spray. Cabbage yield in all the treatments was significantly higher when compared to untreated check. Significantly higher cabbage yield of 21.52 ton/ha was recorded in Acetamiprid 20% SP (Rainbow sample) @100g/ha and it was followed by Acetamiprid 20%SP (Rainbow sample) @75g/ha which recorded 21.47 ton/ha. and the yield in other treatments was comparatively low but significantly superior to untreated control (14.10 t/ha). It was found that predatory Coccinellids were comparatively low in all the insecticidal treatment at three and seven days after spray when compared with untreated check. However all treatments were statistically non significant. Hence application of Acetamiprid 20% SL @ 75 g/ha was found to be optimum dosage in controlling aphid population in Cabbage with higher yield and to be safe to predator population.



PRODUCTION POTENTIAL AND ECONOMIC ANALYSIS OF MUSTARD (*BRASSICA JUNCEA* L.) UNDER DIFFERENT FERTILITY LEVELS OF ORGANIC AND INORGANIC FERTILIZERS

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Abstract

A field experiment was conducted to “Production potential and economic analysis of Mustard (*Brassica juncea* L.) under different fertility levels of organic and inorganic fertilizers” The experiment was carried out during Rabi season 2015-16, at Department of Biological Sciences, SHIATS, Allahabad (U.P.) which is located at 25° 24’ 42” N latitude, 81° 50’ 56” E longitude and 98 m altitude above the mean sea level. This area is situated on the right side of the river Yamuna by the side of Allahabad Rewa Road about 5 km away from Allahabad city. The experiment consisted of seven treatments with different organic and inorganic manures and laid out in randomized block design with three replications. Economics is the ultimate deciding factor to adopt a particular practice by farmers. It is governed by the cost involved in production and price given to the final product. Variable nutrient doses and application of plant growth regulator were used in the study hence they affect the total cost of individual treatment. The data presented in Table 4.17 clearly indicate among the different organic and inorganic fertilizers application practices, the maximum cost of cultivation was involved under the application of T₂ (75% recommended dose N,P,K + 5t ha⁻¹ farm yard manure). The highest gross income (Rs 60133.27 ha⁻¹), net returns (Rs 12,202 ha⁻¹) and B: C ratio (1.25) was achieved in treatment T₆ (75% recommended dose N,P,K + 20 kg ha⁻¹ Azotobacter + 20 kg ha⁻¹ phosphate solubilizing bacteria). The lower cost of cultivation (42,000 Rs ha⁻¹), gross income (42560.00 Rs ha⁻¹), net income (560 Rs ha⁻¹) and B:C ratio (1.01) was found in T₀ (Control Treatment).

IMPACT OF FAMILY TYPE ON EMOTIONAL STATUS AMONG YOUNG ADULTS

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Abstract

The many hormonal alterations connected to thoughts, feelings, behavioural responses and a level of pleasure or discomfort are tied to emotional status. These states frequently involve stress, sense of self and sense of conflictlessness. The goal of the planned study was to assess the emotional status of young adults at G.B. Pant University of Agriculture and Technology students in Uttarakhand. 240 students were selected at random from the three colleges of the G.B. Pant University of Agriculture and Technology to serve as the research sample. The MHB-Mental Health Battery (Physiological Health, Daily Routine Activity, Emotional Status, Emotional Management and Intelligence) was developed to support the research’s goal. The validity and reliability of the tool were then determined prior to use. The data was gathered online by the researcher because of the Covid-19 pandemic. The right statistical techniques including frequency, percentage, p value and correlation were applied to the collected data in order to get the research findings. Following the analysis and comparison of the data, the research’s findings revealed a substantial correlation between the respondents’ sense of self and sense of conflictlessness with regard to their family type.

DEVELOPMENT AND EVALUATION OF HYBRIDS IN LOCAL CULTIVARS OF CUCUMBER (*CUCUMIS MELO*) OF KARNATAKA

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Abstract

In the present study an attempt has been made to evaluate the parental lines for combining ability and to develop F1 in local



cultivars of cucumber. The investigation was conducted in University of Horticultural Sciences, Bagalkot during Kharif 2021. Parental lines with high yielding ability were selected for hybridization. 15 lines were crossed in a partial diallele fashion and 10 hybrids developed were evaluated in Randomized Block design with two replications. Hybrids were evaluated for growth and yield parameters. There was no significant heterosis reported for fruit length and average fruit weight, indicating there was no improvement for these traits in hybrids. Heterosis was reported for number of females, number of fruits per plant and total yield per plant in all the hybrids. The maximum significant positive heterosis over mid parent (48.83 %) was observed in the cross (UHSCS-1 x UHSCS-3) followed by the cross (UHSCS-13 x UHSCS-1). The cross UHSCS-1 x UHSCS-3 exhibited maximum and significant positive heterosis over the better parent (123.2 %) and followed by the cross UHSCS- 44 x UHSCS-21. . The maximum significant negative heterosis over mid parent (- 43.1 %) was observed in the cross (UHSCS-82 x UHSCS-16) followed by the cross UHSCS-82 x UHSCS-18. The cross UHSCS-13 x UHSCS-1 exhibited maximum and significant positive heterosis over the better parent (77.42 %) and followed by the cross UHSCS- 1 x UHSCS-3. The maximum significant positive heterosis over mid parent (512.4 %) was observed in the cross (UHSCS-1 x UHSCS- 3) followed by the cross (UHSCS-13 x UHSCS-1). The cross UHSCS-1 x UHSCS-3 1 exhibited maximum and significant positive heterosis over the better parent (644.1 %) and followed by the cross UHSCS-13 x UHSCS-1. Heterosis results revealed the effective utilization of non additive variance to develop the high yielding hybrids.

EFFECT OF SECONDARY NUTRIENTS AND BIOFERTILIZERS ON NUTRITIENT STATUS AND SOIL MICROBIAL POPULATION IN CHILLI (*CAPSICUM ANNUUM* L.)

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Abstract

An experiment was conducted during 2022-23 at the department of Vegetable Science, College of Horticulture, Mudigere to assess the impact of secondary nutrients and biofertilizers on growth, yield and quality in chilli (*Capsicum annuum* L.) using Randomised Complete Block Design (RCBD) with 11 treatments and 3 replications. Among the treatments, the treatment (T₁₁) comprising 75 % RDNPK + CaNO₃@ 0.5 % + MgSO₄ @ 0.4 % + *Azospirillum* + PSB + KSB recorded minimum available soil N (305.65 kg/ha), P₂O₅ (45.67 kg/ha), K₂O (117.56 kg/ha), calcium (146.06 mg/kg) and magnesium (109.69 mg/kg) was observed in same treatment. The maximum leaf NPK content (2.76 %, 0.42 % and 2.99 %, respectively), calcium (2.37 %), magnesium (1.23 %), fruits containing calcium (0.124 %) and magnesium content (0.052 %), soil microbial population such as bacteria (225.06 cfu g⁻¹), fungi (51.35 cfu g⁻¹), actinomycetes (41.81 cfu g⁻¹), PSB (14.10 cfu g⁻¹) and KSB (7.19 cfu g⁻¹) was observed highest in (T₁₁) 75 % RDNPK + CaNO₃@ 0.5 % + MgSO₄ @ 0.4 % + *Azospirillum* + PSB + KSB. Thus combined use of organic amendments (biofertilizers, FYM) along with chemical fertilizers not only produced highest and sustainable crop yield but also enhanced the efficiency of added fertilizers as well as fertility status of the soil and chilli plant.

FIELD EVALUATION OF AMETOCTRADIN 25% + METALAXYL20% WDG AGAINST LATE BLIGHT DISEASE IN TOMATO

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Abstract

The field experiment was conducted on late blight of tomato at College of Agriculture, Hanumanamatti, Ranebennure taluk, Haveri district for two season during Kharif-2021 and Kharif 2022. Different fungicide was tested for effective control of late blight of tomato. The tomato variety Arka vikash was used for this study. The experimental plots were laid out in Randomized block design with three replications of eight treatments. The application of Ametoctradin 25% + Metalaxyl 20% WDG significantly decreases the Late blight disease in tomato. Though, all doses of Ametoctradin 25% + Metalaxyl 20% WDG tested were found effective, the least PDI (5.33%) was observed in the treatment Ametoctradin 25% + Metalaxyl 20% WDG 1000ml/500L/ha followed by Ametoctradin 25% + Metalaxyl 20% WDG @ 750ml/500L/ha (13.33PDI). The highest late



blight disease severity was recorded in untreated control (40.0 PDI). The maximum yield was recorded in the treatment Ametoctradin 25% + Metalaxyl 20% WDG @1250ml/ha/500L of water /ha.21.47 and 20.77t/ha followed by Ametoctradin 25% + Metalaxyl 20% WDG@ 1000ml/ha [20.00 and 20.10t/ha]. The next best was Ametoctradin 25% + Metalaxyl 20% WDG @ 750ml/500L of water /ha (19.50 and 19.10t/ha). The minimum yield was recorded in untreated control [14.17 and 14.00t/ha] respectively.

TO STUDY THE EFFECT OF ORGANIC AND INORGANIC FERTILIZERS ON YIELD AND YIELD PARAMETERS OF MUSTARD (*BRASSICA JUNCEA* L.)

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Abstract

A field experiment was conducted to “To study the effect of organic and inorganic fertilizers on yield and yield parameters of Mustard (*Brassica juncea* L.)” The experiment was carried out during Rabi season 2015-16, at Department of Biological Sciences, SHIATS, Allahabad (U.P.) which is located at 25° 24’ 42” N latitude, 81° 50’ 56” E longitude and 98 m altitude above the mean sea level. This area is situated on the right side of the river Yamuna by the side of Allahabad Rewa Road about 5 km away from Allahabad city. The experiment consisted of seven treatments with different organic and inorganic manures and laid out in randomized block design with three replications. results indicated that the application of 75% recommended dose N,P,K + 20 kg ha⁻¹ Azotobacter + 20 kg ha⁻¹ phosphate solubilizing bacteria recorded significantly Number of siliqua plant⁻¹ (369.33), Length of siliqua plant⁻¹ (cm) (6.43), Number of seeds sliqua⁻¹ (17.17), 1000 seed weight (Test weight) (11.07), Seed yield plant⁻¹ (g) (13.53), stalk yield plant⁻¹ (g) (57.33), Harvest index (36.61), compared to others treatments.

UNRAVELING PRE-HARVEST SPROUTING RESISTANCE IN RICE: AMYLASE ACTIVITY AS A KEY REGULATOR

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Abstract

Rice, a crucial staple crop for half the global population, faces severe yield challenges due to the escalating impact of cyclonic storms and heavy rains associated with climate change. These climatic events lead to flooding during the grain maturation phase, triggering pre-harvest sprouting (PHS) in rice. PHS involves grain germination on the panicle post-maturity but before harvest. In response to these challenges, our experiment focused on assessing the influence of amylase activity in regulating PHS resistance in rice. For this experiment 16 genotypes were screened, comprising 8 resistant and 8 susceptible, for comprehensive phenotypic and biochemical analyses. The findings revealed that susceptible genotypes exhibited significant germination (10-90%) at 20, 25, 30, 35 and 40 days after flowering (DAF). In contrast, resistant genotypes displayed zero germination during this critical stages. Additionally, susceptible genotypes demonstrated elevated alpha and beta amylase activity (23.397 to 25.333 U ml⁻¹, 7.057 to 10.422 mg g⁻¹ FW respectively) at 20, 30 and 40 DAF, while resistant genotypes showcased markedly lower α, β amylase activity (11.333 to 13.033 U ml⁻¹, 4.822 to 5.115 mg g⁻¹ FW respectively). The heightened amylase activity in susceptible genotypes potentially contributes to increased germination by breaking down starch in grains, resulting in elevated PHS from 20 to 40 DAF. In conclusion, the identified resistant genotypes and novel traits hold promise for integration into breeding programs aimed at developing PHS-resistant rice varieties.



IMPACT OF BIOFERTILIZERS AND INORGANIC FERTILIZERS ON SOIL ORGANIC CARBON POOLS IN KHARIF MAIZE

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Abstract

A field experiment entitled “Impact of biofertilizers and inorganic fertilizers on soil organic carbon pools in kharif maize” was conducted at Agriculture College Farm, Bapatla, during both kharif 2020 and 2021. The experiment was laid out in randomized block design (RBD) with seven treatments and replicated thrice. The treatments consisted of T₁- Control; T₂- 100% RDF; T₃- 125% RDF; T₄- 100% RDF + VAM; T₅- 100% RDF + VAM + Azospirillum + PSB; T₆- 75 % RDF + VAM; T₇- 75 % RDF + VAM + Azospirillum + PSB. During kharif in two years of study the soil organic carbon pools non significantly influenced by the application of biofertilizers along with inorganic fertilizers. The maximum organic carbon pools (water soluble carbon, microbial biomass carbon, KMnO₄ oxidizable carbon, particulate organic carbon, fulvic and humic acid) received 100% RDF + VAM + *Azospirillum* + PSB and lowest was received by control at knee high, tasseling and harvest stage of maize. The results revealed that application of inorganics and combination with biofertilizers did not show any significant effect on organic carbon pools of the soil at all the three stages of crop growth during both the years of study.

SURVEY FOR MAJOR INSECT PESTS AND THEIR NATURAL ENEMY COMPLEX OF GROUNDNUT AT DHARWAD

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Abstract

A roving survey was conducted at farmer's fields & at research station during *Kharif* 2022 at AICRP on Groundnut, MARS UASD to know the status of insects pests & their natural enemies complex. Observations were recorded at vegetative, pod formation & maturity stage of the crop by following standard procedures. Survey data from ten farmer's fields revealed that, leaf hoppers & thrips damage was up to 20 and 30 % resp. Among the defoliators, incidence of semilooper was observed at 45-60 DAS (0.2 to 3.4/mt row length). *Spodoptera* leaf damage was started after 30 DAS & was 40 %. The max damage by *S. obliqua* was noticed during 75- 90 DAS and was 30%. Leaf miner incidence was noticed after 30 DAS & damage reached up to the tune of 14%. Similarly, population of *H. armigera* was also seen at vegetative & pod formation stage with a leaf damage of 18%. At research station, different larval lepidopterans population noticed in the order of dominance were *Spodoptera litura* (76-100 %) > *Spilactia obliqua* (46%)>*Thysanoplusia sp.*(20%) > *Helicoverpa armigera* (18%)>*Maruca vitrata* (14%)> *Approareama modicella* (10%). The trend was almost similar like *Kharif*-2021. The higher leaf damage recorded was up to 30 % for leafhoppers & 32 % for thrips. The activity of natural enemies started with the peak activity of defoliators and mean time their populations were also high during *Kharif* as compared to summer season. Natural enemies like coccinellids, spiders, green lacewing eggs; entomopathogenic fungi & virus viz., *Metarhizium rileyi* & nuclear polyhydrosis virus; parasitoids viz., *Apanteles sp.* & *Campoletis chloridae*; general predators viz., dragon fly, damselfly, preying mantid, ground beetle and avian predators viz., maina, black drongo, cattle egret and crow were seen both at research station as well as at farmers field.

AI (ARTIFICIAL INTELLIGENCE) BASED TECHNOLOGY FOR PEST IDENTIFICATION

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Abstract

A vital source of nutrition is agriculture. Here, detecting pests is a great way to improve the quality of the food while also



boosting the national economy. Furthermore, there could be a major issue with agricultural productivity due to the fast infestation of pests and insects. Current research attempts to detect and classify pests using photos gathered from Internet of Things sensors, but the accuracy of the results is not high enough. A unique pest detection and classification model is proposed as a solution to this problem. Using an improved classifier and object detection model, the developed system aims to detect and identify pests over crops. First, an IoT platform is shown, whereby IoT sensors based on agriculture are used to collect the necessary data. In order to mitigate the effects of crop damage, provide efficient pest detection and classification using IoT-based data for improved pest detection and an optimized deep learning model. Farmers can avoid crop loss by using the suggested model's enhanced ability in detecting pests at an earlier stage. It is used in the agricultural area to increase crop productivity, which also contributes to the farmers' increased revenue.

INVESTIGATIONS ON MATING-INDUCED TRANSCRIPTIONAL CHANGES IN FALL ARMYWORM (*SPODOPTERA FRUGIPERDA*, NOCTUIDAE, LEPIDOPTERA) FEMALE MOTHS

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Abstract

The fall armyworm (FAW), *Spodoptera frugiperda*, is a formidable global insect pest, inflicting substantial economic losses through its broad host range and elusive larval feeding habits. Traditional management approaches face challenges due to a lack of targeted insecticides and the development of resistance. This study addresses the critical gap in knowledge regarding mating-induced transcriptional changes in the Indian population of FAW, employing RNA-Seq analysis of mated and virgin female moths. A total of 13,207 differentially expressed transcripts were identified, with 846 transcripts exhibiting significant expression 24 hours postmating. It is noteworthy that transcriptional changes were subdued immediately after mating, reaching their peak at 24 hours. The differential gene expression analysis, involving 89 upregulated and 757 downregulated genes, sheds light on the intricate molecular mechanisms triggered by mating. Mapping against the reference genome revealed the involvement of these genes in diverse biological processes, cellular components, and molecular functions. Key upregulated genes, including Cathepsin B, Cytochrome P450 6B1, and Juvenile hormone esterase, and downregulated genes, such as Cuticle protein 8 and Serine protease inhibitor dipetalogastin-like, unveiled molecular insights into postmating responses. Orphan genes also demonstrated significant regulation, highlighting the complexity of the FAW's transcriptional landscape. Functional enrichment analysis revealed that upregulated genes were associated with reproduction-related terms and pathways, while downregulated genes were linked to immunity-related terms. This research underscores the importance of understanding the role of mating in influencing female traits and behaviors for effective pest management. By identifying specific genes and pathways involved in postmating transcriptional changes, this study provides a foundation for innovative and sustainable strategies in FAW control, offering potential solutions to mitigate crop losses, enhance agricultural productivity, and contribute to the global effort for food security.

EFFECTS OF PLANT GROWTH REGULATORS FOR CULTURE ESTABLISHMENTS IN SPINE GOURD (*MOMORDICA DIOICA* ROXB.)

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Abstract

Spine gourd (*Momordica dioica* Roxb.) is a dioecious in nature where different male and female bearing plant vines grow. It is perennial cucurbitaceous climber distributed throughout India and few Asian countries. Due to this exceptional nutritive value, this popular vegetable crop has high demand in market. But this crop always remained underutilized and underexploited mainly due to its vegetative mode of propagation and dioecious nature. Conventional commercial propagation of spine gourd largely depends on tuberous roots followed by stem cuttings and seeds. Commercial multiplication using the tuberous roots



and stem cuttings are critically limited due to inadequate availability of tuberous roots and late availability of stem cuttings in fruiting season. Tuberous roots have low multiplication rate and occupies the valuable cultivable land until next planting season, which is a major concern about its large scale cultivation. Stem cuttings containing 2–3 nodes from dark green vines of 2–3 months old plants are planted, but only 30-35% of the plants sprout and survive. Another difficulties are this crop is propagation by rhizome tubers, which bears dormancy and unpredictable sex ratio in seedling progenies. Sex determination of the plants is possible only when the plants start flowering. Since, fruits are the main edible portion of this species, which are harvested on female plants only; it is desirable to have commercial fields with a large proportion of female plants. Accommodating, 5–10 % male plants to act as pollinators in the field is imperative for good fruit set. As the conventional methods of spine gourd propagation impose several limitations for their large-scale propagation of sex specific plants, an efficient clonal propagation method is a must. In the present study, the treatment combination comprising of half MS media + 1.5 mg/L Kinetin + 0.5 mg/L shows highest 79.54% culture survival followed by half MS media + 2.5 mg/L Kinetin + 1.5 mg/L results into 68.51% culture survival, whereas half MS media + 1.5 mg/L Kinetin + 0.5 mg/L shows highest 82.15% culture initial establishments and same treatment results into high rate 81.42% shoot proliferation. These treatment combinations will be proved significant in micropropagation of spine gourd with slight modifications. The effects of cytokinines viz., kinetin, Zeatin on culture establishment with 88.12% and 83.74% respectively in which shoot proliferation found to be at par with each other, where as among the auxins, IBA shows greater significant effects with 89.41% on root induction than the other auxin IAA (85.45%) and NAA (82.65%) respectively.

A SURVEY OF *SPODOPTERA LITURA* DAMAGING CABBAGE CROP IN HASANPUR, AMROHA DISTRICT, UTTAR PRADESH (INDIA) FOR PEST MANAGEMENT

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Abstract

The tobacco caterpillar, scientifically known as *Spodoptera litura* cause significant damage to agricultural products intended for human foods. Damage caused by this pest is very intense and needs to be surveillance at certain period of time. Internationally and also within the countries, phytosanitary issues are viewed very seriously to prevent the spread of *S. litura*. The climatic conditions of Western Uttar Pradesh is very sultry from September to December and *S. litura* well suited for this hot and humid weather conditions prevailing at this time. Various research has indicated that cabbage serves as the most suitable host for *S. litura* and during September to December, cabbage cultivation is prevalent in the Hasanpur area district Amroha, Uttar Pradesh. So, to confirm the presence of the tobacco caterpillar a survey conducted in different villages of Hasanpur during the year 2022 and 2023 consequently. From the survey it is concluded that the prevailing environmental conditions provide a positive response to the incidence of *S. litura* and infestation of this pest leads to heavy economic loss to the farmers. So, for proper management the surveillance should be conducted in Hasanpur otherwise it will pose challenges to cabbage cultivation in future.

OPTIMIZATION OF NUTRIENT MEDIA PARAMETERS FOR MICROPROPAGATION IN INDIAN CULTIVAR OF SPINE GOURD (*MOMORDICA DIOICA* ROXB.)

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Abstract

Cucurbitaceous family possesses diversity of rare vegetables. Among them Spine gourd (*Momordica dioica* Roxb.) is also very rare wild vegetables, having great significance. It is a dioecious in nature and perennial cucurbitaceous climber distributed throughout India and few Asian countries. Due to this exceptional nutritive value, this popular vegetable crop has



high demand in market. But this crop always remained underutilized and underexploited mainly due to its vegetative mode of propagation and dioecious nature. Conventional commercial propagation of spine gourd largely depends on tuberous roots followed by stem cuttings and seeds. Commercial multiplication using the tuberous roots and stem cuttings are critically limited due to inadequate availability of tuberous roots and late availability of stem cuttings in fruiting season. It is very practically difficult to multiply its propagules in traditional methods. As the conventional methods of spine gourd propagation impose several limitations for their large-scale propagation of sex specific plants, an efficient clonal propagation method is a must. An *in vitro* propagation system offers unlimited availability of planting material early in the planting season. Micropropagation technique is well-established for rapid and large-scale multiplication of many horticultural crops including vegetables. Similarly, an attempts have to be made for rapid *in vitro* propagation of spine gourd (*M. dioica*), wherein shoots and plant will be regenerated from various nodal explants. In the present study, major focus was given to optimize the *in vitro* balance nutrient media for successful establishment of this wild vegetable crop. In the nutrient medium, treatment combination comprising of half MS media + 1.5 mg/L Kinetin +0.5 mg/L shows highest 79.54% culture survival followed by half MS media + 2.5 mg/L Kinetin +1.5 mg/L results into 68.51% culture survival, whereas half MS media + 1.5 mg/L Kinetin +0.5 mg/L shows highest 82.15% culture initial establishments and same treatment results into high rate 81.42% shoot proliferation. Full MS media + 1.5 mg/L Kinetin +0.5 mg/L shows highest 74.19 % culture survival, it indicates that half MS basal medium supplemented with cytokinines and auxins shows comparately less culture survival than the half MS medium. Hence this study suggest to optimize nutrient media judiciously in half MS as compare to full MS in spinegourd.

STUDIES ON PREPARATION AND DEVELOPMENT OF CUSTARD APPLE POWDER BASED PRODUCTS LIKE ICE CREAM MIX AND INSTANT RTS MIX

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Abstract

Custard apple is one of the important nutritionally rich minor seasonal fruit crop. Its fruits are highly perishable which cannot be stored for more than three days and preservation of pulp is one of the major problem due to discolouration and microbial spoilage. Therefore, processing of custard apple plays a major role in increasing the availability of product during off season. In this context, the present investigation was undertaken in the Department of Postharvest Management, Kittur Rani Channamma College of Horticulture, Arabhavi during 2022-23 to develop custard apple powder based products like ice cream mix and instant RTS mix and to study the biochemical changes and sensory quality of the products during ambient storage. Organoleptically most acceptable custard apple ice cream was prepared with 30 per cent custard apple powder and 15 per cent milk powder. This mixture had optimum physico-chemical parameters like moisture content (6.43%), water activity (0.52), overrun (34.17%), carbohydrates content (32.05%), protein content (3.96%), fat content (3.13%), total sugars (29.64%), ash content (0.75%) and returns per rupee of expenditure (2.39) followed by 35 per cent of custard apple powder and 10 per cent of milk powder throughout the storage period.

Organoleptically acceptable better quality of custard apple RTS was prepared with combination of 10 per cent custard apple powder and 10 per cent banana powder. This instant RTS mix also has better physico-chemical characteristics like moisture content (11.10%), water activity (0.46), carbohydrates content (32.01%), protein content (2.85%), fat content (0.40%), total sugars (15.51%), ash content (1.33%) and returns per rupee of expenditure (1.91) followed by 12.5 per cent of custard apple powder and 7.5 per cent of banana powder throughout the storage period.

DORMANCY DURATION STUDIES IN BRINJAL (*SOLANUM MELONGENA* L.) GENOTYPES

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Abstract

Brinjal is the third most important fruit vegetable crop grown in India. Now a days, demand for brinjal as a fruit vegetable is



growing rapidly due to high nutritive value. Seed dormancy is common in wild species and land races but rarely found in cultivated species. Presence of seed dormancy for a short period after maturity is beneficial in arresting seed germination within the fruit. However, long period of dormancy poses problem in immediate sowing. The experiment was conducted at department of Seed Science and Technology, University of Agricultural Sciences, Raichur to studied the dormancy duration in eight genotypes viz., R-2581, L-2332, Swarna shyamli, Arka shirish, Swarna mani, R-2580, Pant samrat and Mattigulla. The seeds were put for germination at weekly intervals from harvest up to the stage where germination reached in Minimum Seed Certification Standard (70%). The results revealed that, among the eight genotypes, longest dormancy duration of 35 days was observed in the genotype Swarna mani and slight dormancy for 14 days was noticed in the genotype R-2581. Among the eight genotypes, one genotype (R-2581) showed weak dormancy (2 week), Arka shirish showed moderate dormancy (3 week), three genotypes (R-2580, Swarna shyamli and Mattigulla) showed strong dormancy of 4 week and remaining three genotypes (L-2332, Pant samrat and Swarna mani) were classified as very strong dormancy (5 week).

KNOWLEDGE OF FARM WOMEN ABOUT IMPROVED HOUSEHOLD TECHNOLOGIES: IMPLICATIONS FOR RURAL DEVELOPMENT

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Abstract

It is critical to evaluate the effects of technological improvements in agriculture on the lives of women, who frequently occupy important positions in household management in rural communities. Technological advancement play important role in improving productivity and quality of life, it is critical to ascertain the degree to which farm women are aware of and actively utilizing these innovations. Focus groups and one-on-one interviews are used in the process to collect study data. The sample consists of agricultural women from various rural areas in the eastern and western zones of the state of Haryana, with varying socioeconomic origins. Through a structured questionnaire, participants were assessed on their familiarity with different kinds of household technologies, including kitchen related, water and sanitation related, communication and energy-efficient tools, and other technologies designed to improve overall well-being. Major findings indicated that Majority (62.50%) of the rural women belonged to medium level of knowledge about technologies followed by low (20.00%), high (13.50%) and only 4.00 per cent of women belonged to very low knowledge about all the technologies. From this information it can be concluded that the farm women had medium level of knowledge. The results of this research will contribute to a better understanding of the dynamics between household-related technologies, facilitate sustainable practices, and contribute to the overall advancement of rural communities.

STUDIES ON MAJOR NUTRIENT CONSTRAINTS IN JASMINE GROWING SOILS OF HUVINA HADAGALI TALUK, VIJAYANAGARA DISTRICT

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Abstract

A study was conducted to study the major nutrient constraints in the Jasmine growing soils of Huvina Hadagali Taluk, Vijayanagara District. A total of 60 soil samples were collected, of which 30 surface (0-20 cm) and 30 subsurface (20-40 cm) depths covered six villages. In surface soil, range of available soil nitrogen, P₂O₅, K₂O and Sulphur was 131.71 to 312.69, 21.18 to 41.76, 143.02 to 403.42 and 9.34 to 17.97 kg ha⁻¹ respectively, Mean soil pH was moderately alkaline (7.96), Mean soluble salt (0.27 dS m⁻¹) and the soil organic carbon ranged from 2.40 to 6.80 g kg⁻¹. In subsurface soil, range of available soil



nitrogen, P_2O_5 , K_2O and Sulphur was 106.62 to 275.97, 17.55 to 38.25, 114.91 to 351.23 and 7.56 to 15.81 kg ha⁻¹, respectively and Mean soil pH was 8.06, Mean soluble salt 0.32 dS m⁻¹ and soil organic carbon ranged from 1.60 to 6.00 g kg⁻¹. The correlation study showed that organic carbon and available P_2O_5 (0.646**, 0.599**, respectively) has significantly positive correlation with Jasmine yield at one per cent level. The results showed that soil nutrient status of Jasmine growing area of Huvina Hadagali Taluk was found to be low to medium range. It is due to improper nutrient management practices by farmers, like continuous use of chemical fertilizers and less use of organics which results in poor soil fertility, leading to a low yield of Jasmine.

IOT ON CROP DISEASE PREDICTION

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Abstract

Agriculture represents main economic activity i.e., food source in the world. Excess pesticides usage results in health issues. The World Health Organization (WHO) estimates that acute pesticide poisoning affects 3 million people and accounts for 20000 unintentional deaths every year i.e. 99% from developing countries. Inadequate use of agrochemicals results in approximately 25-30% yield losses. The crop damage in the country due pest and disease ranges from 10-30 %. The economic losses from such damage can reduce through proper use of pesticide and fungicides. However it is very important for the farmer to thoroughly understand the selection of right dosage and method of application. Along with dosage and application methods, the fluctuation in environmental parameters like humidity, rain fall, temperature, soil pH, light intensity, wind flow, management's results decrease in crop production. Therefore prediction of disease is very important to beat the above stated problems. The real time system like Internet of Things (IoT) and Machine learning algorithm alert the farmer about which crop is in trouble(affected by disease), so that reduction in cost of pesticides , insecticide and fungicide to improve the economic status of the farmer.

MILLET CULTIVATION IN INDIA

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Abstract

The Food and Agriculture Organization of the United Nations (FAO) declared 2023 the International Year of Nations. Millet has unique nutritional and agricultural properties and is tolerant of drought and semi-arid regions. It is a general term that refers to some small-seeded annual plants grown as food mostly on marginal lands in the arid regions of temperate, subtropical, and tropical regions. This product, grown in approximately 131 countries, is the traditional food of approximately 60 important people in Asia and Africa. Two groups of millets grow in India. Major millets include sorghum, pearl millet, and millet, while minor millets include foxtail millet, little millet, kodo, proso, and barnyard millet. The importance of millets can be attributed to the fact that millets are heat-resistant, require less water, and can grow in poor soils. This makes them a suitable crop in insecure and water-unavailable areas. Millet is a good source of fiber, protein, and minerals. On the other hand, the process occasionally encountered many problems, such as the early planting of 35 million hectares of land. But now it is cultivated on only 15 million hectares of land. Although the government has introduced many measures to develop this field, such as National Millets Mission (NMM), which was launched in 2007 to promote production and consumption, Provide financial assistance to farmers for crop cultivation. Value-added millet production also encourages an increase in demand and consumption of millet. Although the government needs to have sufficient public support, expand education and awareness, make pasta available on the market, and facilitate pasta for consumers to encourage consumption.



PHYTOCHEMICAL SCREENING AND ANTIOXIDANT ANALYSIS OF *VITEX NEGUNDO* L.

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Abstract

The use of plant-derived toothbrushes (chewing-sticks) is a common traditional dental care practice in many parts of the world. The regular use of the chewing-sticks may reduce the incidence of gingivitis and possibly dental caries. In an ethno botanical survey conducted in village Baroti, of district Bilaspur, it has been found that the inhabitants there use *Vitex negundo* bark as chewing stick for their daily dental care. This work has focused on phytochemical screening and antioxidant activity of the *Vitex negundo* bark extracts in acetone and methanol. Both qualitative (specific tests) and quantitative (GCMS) analysis of *Vitex negundo* highlight the presence of the main secondary metabolites such as tannins, flavonoids, alkaloids etc. which could be responsible for the antioxidant activity of this plant. DPPH radical scavenging activity of methanol and acetone extracts of *Vitex negundo* bark is calculated and the results are expressed in percentage inhibition corresponding to the various concentrations of *Vitex negundo* extract. The results indicate that the best antioxidant activity is shown by methanol extract (IC₅₀=65.396 µg/mL) as compared to acetone extract (IC₅₀=78.381 µg/mL).

DEEP LEARNING TECHNIQUES FOR WEED DETECTION BY MULTISPECTRAL IMAGES

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Abstract

Weed management is one of the crucial components of crop productivity. However, identifying weeds amount and location due to non uniform presence and their overlap with other crop has long been a challenge for experts for sustainable agriculture. On an average of 34% of production is lost because weeds directly compete for water, nutrients and sunlight. The manual weeding, however, it is labor intensive and time-consuming, which is inefficient for larger scale cropping. At present agriculture has chemical weeding systems, and to a lesser extent, mechanic weeding systems. Regardless of conventional control methods the field data is required for decision making. The conventional sampling widely vary with frequency, density and coverage. In addition to big data technologies and high performance computing, machine learning (ML) has emerged to open up novel opportunities for understanding, quantifying and recognizing data intensive process in agricultural operational environments. ML is defined as the branch of science that studies how to teach machine to learn without having to follow strict programming guidelines. ML for weed detection reduces the use of herbicides with the development of tools and robot for weed removal.

EFFECT OF FOUR DIFFERENT GAS MICRO NANO BUBBLES ON FERMENTATION PATTERN OF YOGHURT STARTER CULTURE

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Abstract

Fermentation is an age-old practice that has traditionally been used for extending the shelf life of milk by converting it into various value-added products like dahi, yoghurt, lassi, kefir, koumiss, and many kinds of cheese. Micro Nano Bubble (MNB) is one of the emerging area that offers a wide range of applications across various fields of science and engineering including in the field of food processing; mainly because of its specific properties like long-term stability, high gas-to-mass transfer ratio, freedom to choose the gases as per the requirement of the applications etc. Yoghurt is among the most popular and most consumed fermented dairy products which has its global footprints due to its enhanced digestibility and nutrient availability



particularly proteins with higher biological value, energy, and potential source of essential amino acids, yoghurt is considered as a healthy fermented food. Yoghurt is coagulated milk product produced by lactic acid fermentation of milk using defined bacterial cultures consisting mainly of *Lactobacillus delbrueckii ssp. bulgaricus* and *Streptococcus thermophilus* in the defined proportions. We hypothesized that the incorporation of four different gas (i.e., oxygen, carbon dioxide, nitrogen and compressed purified air) MNBs would affect the fermentation pattern of yoghurt starter culture and may enhance the fermentation and acidity development. Therefore, the present study planned with an objective to see the effect of four different gas MNBs on fermentation pattern of Yoghurt Starter Culture (YSC) compared in terms of growth of *Streptococcus thermophilus* and *Lactobacillus bulgaricus*, firstly in model system of broth media and subsequently in actual/ complex food matrix i.e., skim milk media. Growth pattern was determined with respect to incubation time as well as change in pH in presence of different gas MNBs. Results showed that incorporation of CO₂-MNBs has significantly ($p < 0.05$) affected the YSC compared to other gases and control in the model system while highest population count (i.e., ST $\sim 8.88 \pm 0.23$ log cfu mL⁻¹ and LB $\sim 7.78 \pm 0.54$ log cfu mL⁻¹) was recorded for CO₂-MNB incorporated skimmed milk yoghurt. The incorporated MNB does not resulted into any significant change in proximate composition of the product in terms of milk fat, MSNF and Total Solid content of treated as compared to the control sample. MNB treatment has found to have the potential to be applied as a processing tool to easily tweak the viscosity of yoghurt and stirred yoghurt as per consumer requirements. Therefore, it is concluded that the present study would be a piece of information and can contribute for the dairy industries to adopt and move forward for the development of innovative fermented dairy foods with enhanced functionality and acceptability.

ORGANICS FOR HIGHER PRODUCTIVITY OF FOXTAIL MILLET - *MELIA DUBIA* AGROFORESTRY SYSTEM UNDER CLIMATE CHANGE

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Abstract

Millet are important cereals which play a significant role in the food and nutritional security of developing countries in the semi arid tropics of Asia and Africa especially country like India. Among the eight millets, foxtail millet (*Setaria italica*) is extensively cultivated in Kalyana Karnataka region and it is an indigenous crop known for its rich nutritive value and fairly drought tolerant. Due to its quick growth, it can be grown as short term catch crop either as sole crop or inter crop with least management practices viz., without applying the nutrient fertilizers or with less quantity of organic manures alone. The yield of this crop is not stable under rainfed conditions due to its cultivation on marginal or low fertile soils with less inputs use. The potential yields are yet to be achieved. The crop responds very well to organics due to its low nutrient requirements and yield decline is mainly due to low soil fertility status and can be maintained on sustainable manner under organic system. In this context, either under sole cropping or with agroforestry system, it is worth to mention that nutrient management through organics plays a major role in exploiting the potential crop yields apart from maintaining soil health as a results of buildup of soil organic matter, beneficial microbes and enzymes thus improving soil physical and chemical properties under organic production system.

In an organic manurial experiment, sole foxtail millet without tree component with recommended organic manures recorded significantly higher grain yield (1656 kg ha⁻¹) than all other the treatments in agroforestry system. With tree association, FYM (50%) + poultry manure (50%) equivalent to recommended N along with foliar spray of panchagavya (3%) at 30 DAS alternated with vermiwash (5%) at 45 DAS recorded significantly higher grain yield (1487 kg ha⁻¹) over control. This treatment also resulted in significant improvement in growth and yield parameters, soil available NPK, microbial population and carbon sequestration. The system economic analysis showed that crop associated with tree with application of FYM + poultry manure + panchagavya alternated with vermiwash and FYM + poultry manure + panchagavya recorded significantly higher net returns and B: C ratio over all other treatments. The transformation of agriculture to more productive systems has often been accompanied by increased production in a fewer crop species. Concurrently, the area and production of a great diversity of traditional crops have declined. Yet in many parts of the world, traditional crops play an important role in maintaining stable and sustainable forms of agriculture. Among the crops, minor millets which are cultivated on low fertile lands are completely neglected.



ALLELOPATHY - A WAY TO SUSTAINABILITY

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Abstract

Allelopathy is a relatively newer and potential area of research. The term allelopathy was coined by Prof. Hans Molisch in 1937, which indicates stimulatory/inhibitory biochemical interactions between the plants including microorganisms. According to International Allelopathy Society(1996), allelopathy refers to any process involving secondary metabolites produced by plants, microorganisms, viruses and fungi that influence the growth and development of agricultural and biological systems (excluding animals). It has been shown that allelopathy plays a major role in various disciplines of agricultural and biological sciences and could be used for pest (weeds, insects, nematodes, pathogens) management. Sustainable agriculture aims at long-term maintenance of natural resources and agricultural productivity with minimal adverse impact on the environment. It emphasizes optimal crop production with minimal external inputs, reducing dependence on commercial inputs (fertilizer and pesticides) and substituting them with internal resources and relying on sustainable practices, which could maintain the productivity over long periods. Research has shown that allelopathic practices may meet all these requirements; and hence allelopathy may form one of the provide a basis to sustainable agriculture (organic, alternative, regenerative, biodynamic, low input, or resource conserving agriculture). A number of crops have been reported with their alleged allelopathic effects and attempts have also been made to find crop cultivars with a competitive allelopathic basis (Putnam, 1985; Rice, 1979 & 1984; Thompson, 1985). Utilizing a companion crop/plant (Putnam, 1885; Zimdahl, 1999) that is selectively allelopathic to weeds and does not interfere appreciably with crop growth has enough bearing towards weed control in the fields. In several intercropping situations such as sorghum + cowpea, maize +cowpea/soybean and agro-forestry/agro-silvi-pastoral systems, a clear advantage in weed control is obtained. Application of the residues of allelopathic crop plants as mulches or adoption of an allelopathic crop in rotational sequence and allowing the residues to remain in the field has enough importance to bring down weed population to lower level. Thus for sustainability, future weed control practices must minimize the use of herbicides and use more of allelopathic strategies and other practices for weed management (Farooq *et al.* 2011)

MECHANIZED COTTON HARVESTING IN INDIA

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Abstract

Cotton is not an exception for agriculture labour problem specially for harvesting or picking. The cost of picking accounts for 30 to 35 % of the total cost of cultivation. During the peak season, the availability of labour for cotton picking becomes even more scarce. Cotton is completely machine-picked in Australia, Israel and U.S.A. Over 90 % is machine picked in Greece, Mexico and Spain. Almost 75 % of total production is machine- picked in Brazil (Status Paper Min. of Agric. 2017). In most of other countries including China, India and Pakistan, cotton picking is done manually. But cotton mechanization faces some of the problems in India, cotton is picked in two to three pickings or even more, but mechanization means the picking can be done only once. Thus, the opening of the cotton bolls may have to be synchronized and plant height of cotton varieties/ hybrids cultivated in India grow up to six feet or even more, which does not match mechanical picking specification. Thus, managing the cotton plants' height is another major issue. To over come these problem proper agronomic practices like thick sowing specially by providing row spacing 60cm instead of 90cm, and use of growth retardant chemicals such as, defoliants, desiccants, boll openers/ conditioners/enhancers and re-growth inhibitors, etc. The use of growth regulators is required to maintain the suitable plant height of cotton for mechanical harvesting. In the past two decades many new plant growth regulators have been developed and tested under field conditions. Plant growth regulators when added in small quantity;



modify the growth of plant by stimulating or inhibiting part of the natural growth regulations. The most commonly used growth regulator in cotton is mepiquat chloride which is a inhibitors of gibberlic acid and prevents excessive vegetative growth and also increase the yield especially under irrigated and high rainfall conditions. Its application on plant maintains appropriate height, synchronizes boll set and to regulates maturity. Another problem in machine harvesting is that it will results in more percent of trash content, while hand-picking of cotton results in 2-2.5 per cent trash content, hence, in ginning mills, per-cleaning will become a big operation.

EFFECT OF WATER STRESS AND ITS MITIGATION MEASURES ON PHYSIOLOGICAL CHANGES AND YIELD AND QUALITY OF SUNFLOWER (*HELIANTHUS ANNUUS* L.)

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Abstract

Research trial on effect of growth stage based water stress and its mitigation through chemicals in sunflower was conducted in rabi 2022-23. Experiment was laid out in factorial CRD with five replications. Treatments comprised of water stress at vegetative, flowering, post flowering compared with non-stress plants. Water stress mitigating compounds viz., multi nutri mixture @10 g l⁻¹, Triacntanol @ 100 ppm, KNO₃ @ 1% were applied at 10 days after drought impose compared with CaCl₂@2% seed treatment. Multinutri mixture was developed by the University contains 12-16-4 % N-P-K, micro nutrients @ 6 % along with PGR @ 30 ppm. Results showed that flowering and post flowering stages were highly sensitive to water stress over vegetative stage stress and non-stress. Extent of yield reduction was 92.88% over non-stressed plants. Foliar sprays of either KNO₃ @ 1% 9 (18.30 g plant⁻¹), UASR nutri-mixture @ 10 g l⁻¹ (16.66 g plant⁻¹) were found effective to reduce the impact of water stress. Stress at vegetative stage, increased 70.4% proline content over unstressed plants. Correspondingly, it was 73.8% and 69% higher in stressed plants during flowering and post flowering stage, respectively. Water stress has significant effect on plant height, leaf area, dry matter, stem diameter, leaf chlorophyll content. Yield attributes seed yield, head diameter, seed volume, seed filling, oil content, were greater in early stage stress and non-stress. Root dry weight was also influenced by stress at different growth stages, less affected by stress at vegetative and non-stressed plants. Moisture stressed plants exposed during vegetative stage (20-40 DAS) had higher palmitic acid (6.59%), stearic acid (5.42%) and linoleic acid (51.56%), while it was lower in stress at flowering stage. Significantly lower palmitic acid (1.29%), stearic acid (0.87%), oleic acid (4.87%) and linoleic acid (51.56%). These were increased by foliar application of KNO₃ @ 1% sprayed 10 days after stress impose while seed treatment with CaCl₂ @ 2% resulted lower fatty acids. Both growth and yield attributes were greatly influenced by chemicals spray at 10 days after drought impose. Results confirmed that drought stress at flowering and post flowering stages were highly sensitive to water stress however impact can be reduced by spray of KNO₃ @ 1% or UASR nutri-mixture @10 g l⁻¹ in sunflower.

MALNUTRITION IN INDIA : STATUS AND GOVERNMENT INITIATIVES

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Abstract

Malnutrition in India accounts for 68% of total under-five deaths and 17% of the total disability- adjusted life years. India is home to about 30% of the world's stunted children and nearly 50 per cent of severely wasted children under the age of five. Besides, India is home to nearly half of the world's "wasted or acute malnourished" (low weight for height ratio) children in the world.

India ranked 94 among 107 nations in the Global Hunger Index 2022 and is in the 'serious' hunger category with experts blaming poor implementation processes, lack of effective monitoring, siloed approach in tackling malnutrition and poor performance by large states behind the low ranking. Despite the decrease, India has one of the highest burdens of malnutrition in the world. The Supplementary Nutrition Programme under Anganwadi Services and POSHAN Abhiyaan have been converged to form the 'Saksham Anganwadi and POSHAN 2.0, which seeks to address the challenges of malnutrition in



children, adolescent girls, pregnant women and lactating mothers. Its implementation should be expedited. Nutrition is not a peripheral concern rather a central to our existence; a pro-equity agenda that mainstreams nutrition into food systems and health systems, supported by strong financing and accountability is the greatest need. Only two years are left to meet the 2025 global nutrition targets, while the time is running out, the focus should be on an action that provides the maximum impact.

CHARACTERISATION OF BUCKWHEAT SEMOLINA FOR INNOVATIVE READY-TO-COOK UPMA MIX

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Abstract

Buckwheat (*Fagopyrum esculentum*) being gluten-free crop with many nutrients makes it precious phase of human diet. Consumer demand for convenience foods that are ready to cook (RTC) or serve is increasing as a result of changing lifestyles. One of the convenience mixes that is highly favoured by consumers is *upma* mix. *Upma* is a well-known breakfast that has historically been perfect for group of people, thus gluten-free *upma* mix can be popularized. The majority of instant mixes are made of rice and other minor millets in addition to wheat. Buckwheat (*Fagopyrum esculentum*) being gluten-free crop with many nutrients makes it precious phase of human diet. Therefore, utilizing buckwheat in preparation of instant mixes will pave way for nutrition security. Soaking buckwheat coarse semolina (600 μ) in water at 50⁰C for 1hr followed by steaming for 1.5hr and drying at 60⁰C for 2hr resulted in good textured and highly acceptable product. The optimized RTC buckwheat *upma* mix consists of pre-treated coarse semolina, bengalgram dhal (5g), blackgram dhal(5g), dehydrated onion(5g), cumin seeds(0.5g), mustard seeds(1g), salt(3.5g), greenchilli powder(3g), ginger powder(2g), turmeric powder(3g) and curry leaves(0.2g). The *upma* had appearance, colour, flavour, taste, texture and overall acceptability scores of 8.60, 8.60, 8.80, 8.70, 8.80 and 8.70 respectively. The developed RTC buckwheat *upma* mix had moisture-7.41percent, fat-1.81g, crude fibre-7.88g, ash-2.30g, protein-13.19g, total carbohydrate-60.18g and energy-380Kcal per 100g. Characterization of buckwheat semolina from whole grain can be promoted in different food products that aid in better food and nutrition security as well as can be consumed irrespective of age groups.

CONSTRAINTS FACED BY GOAT FARMERS IN ADOPTION OF IMPROVED MANAGEMENT PRACTICES

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Abstract

The present study was undertaken in the Western parts of Maharashtra to explore constraints faced by goat farmers in adoption of improved management practices in goat farming. Data collected from 240 goat farmers were revealed that majority of goat farmers faced a number of problems with respect to adoption of improved management practices viz.; lack of knowledge about animal diseases and vaccination (96.00%), ticks and other ectoparasites infestation (69.00%), shortage of green fodder round the year (68.00%), non-availability of grazing land (64.50%), unavailability of veterinary services (48.50%) problems of wild predator (48.00%), maintenance of breeding bucks (45.50%), high cost of concentrate feed (15.5%), higher mortality in kids (18.50%), and availability of medicines in the nearby area (9.50%), respectively. All the goat farmers expressed the seasonal fluctuation in goat price and need of live weight marketing system in goats. Most of the goat farmers (63.00 %) faced the middle man problem during marketing while 79.00 per cent of goat farmers felt need to have an organized marketing system of goats. The most of the goat farmers (81.00%) expressed the need of training for improvement in management practices. Majority of respondents (76.50%) preferred training at their own village. Implementing an awareness strategy will eventually lead to a higher adoption of improved management practices by goat farmers.



PYRAMIDING POD BORER RESISTANCE *CRY2Aa* GENE IN *FUSARIUM* WILT RESISTANT SUPER ANNIGERI-1 VARIETY OF CHICKPEA (*CICER ARIETINUM* L.)

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Abstract

Chickpea (*Cicer arietinum* L.) a *rabi* season legume, most extensively cultivated crop globally. It is a self- pollinated and diploid ($2n = 2x = 16$) having 740Mb genome size. But its productivity is limited majorly by the incidence of gram pod borer insect and *Fusarium* wilt disease. Combining these two biotic stress resistance in chickpea through backcross breeding by transferring *cry2Aa* gene from *Bt* events for pod borer resistance to Super Annigeri-1 (SA-1), wilt resistant variety, was initiated in the present study. A set of 177 SSR markers were screened for parental polymorphism between the parents Super Annigeri-1 × BS 100B, Super Annigeri-1 × BS 100E and Super Annigeri-1 × BS 72C₂. As a result, 13 (7.34%), 11 (6.21%) and 13 (7.34%) polymorphic markers were identified through Agarose gel electrophoresis whereas, 91(51.41), 89 (50.28%) and 84 (47.45%) polymorphic markers were identified through Automatic Capillary electrophoresis. These identified co-dominant polymorphic SSR markers will be useful in background selection for recovery of wilt resistant Super Annigeri-1 with *cry2Aa* specific markers. The F₁'s generated from crosses between SA-1 and *cry* events were confirmed through *cry* genes specific marker and polymorphic marker (ICCM0299). RT PCR analysis for *cry* genes expression in F₁'s confirmed the stable integration of *cry2Aa* gene in them. Chi-square test for *cry2Aa* gene in F₂ population found significantly accepting 3:1 Mendelian ratio indicated the presence of single copy of a gene which will be useful in transferring to wilt resistant Super Annigeri-1 through backcross breeding easily. Among segregating F₂ population, plants with *cry2Aa* and wilt resistance genes were identified through PCR using specific markers and plants with both wilt resistant QTLs and *cry2Aa* gene were identified. F₁ and F₂ seeds generated can be further used in backcross breeding programme to derive Super Annigeri-1 with both *fusarium* wilt and pod borer resistance.

PERFORMANCE OF MULTIPLE PEST RESISTANT CULTIVARS AGAINST MAJOR RICE INSECT PESTS IN TBP COMMAND AREA OF KARNATAKA

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Abstract

Rice [*Oryza sativa* L. (Poaceae)], a prevalent crop in south-east Asia is attacked by several pests due to favorable climatic conditions. 15-25% potential of rice production is lost due to different pests, weeds and diseases. It compels farmers to use a major chunk of pesticides to prevent/recover from pest attacks. 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 significant 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.

CULTURE OF SEA BASS (*LATES CALCARIFER*) A EURYHALINE FISH IN FRESHWATER PONDS

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Abstract

Lates calcarifer an ideal species selection which is imperative to achieve the better growth that ensures to achieve higher economic return. Marine fish seeds of sea bass were procured from Central Institute of Brackishwater Aquaculture (CIBA), Chennai. 2000 number of seeds of 1 cm in length and 2g of weight of sea bass were released in ponds. As the species were euryhaline and experiment was in freshwater pond hence it encountered 70% mortality with 30% survival rate were found. Out of survival numbers growth rate by weight gain was observed 1.2 to 2.5kg during Eight months culture period.

IMPACT OF FRONT LINE DEMONSTRATIONS ON THE YIELD AND ECONOMICS OF MILLETS IN VIJAYANAGAR DISTRICT OF KARNATAKA

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Abstract

Frontline demonstration on little millet and foxtail millet were carried out at Vijayanagar district to assess the impact of frontline demonstration on the yield and economics of millets improved package of practices and farmers practice during kharif seasons of 2017 to 2022. About yield of little millet under improved practices ranged from 13.16 to 17.00 qtl/ha which is 18.65 to 28.75 per cent higher than farmers' practices. Where as in foxtail millet showed 13.50 to 20.00 per cent grain yield over five years. The average technological gap for grain yield in little millet foxtail millet ranged from 8.00 to 16.00 qtl/ha and 4.00 to 12.40 qtl/ha over the five years. Highest gross returns with 43,534 Rs./ha, net returns with 35,456 Rs./ha and B:C ratio with 5.16 were calculated across the years for millets under improved practices than under farmers' practices.

IDENTIFICATION OF PARENTAL POLYMORPHIC MARKERS FOR BACKGROUND SELECTION IN CHICKPEA (*CICER ARIETINUM* L.) THROUGH MARKER ASSISTED BACKCROSS BREEDING.

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Abstract

Chickpea (*Cicer arietinum* L.) a *rabi* season legume, most extensively cultivated crop globally. But its productivity is limited majorly by the incidence of gram pod borer insect and *Fusarium* wilt disease. Combining these two biotic stress resistance in chickpea through backcross breeding by transferring *cryIac* gene from *Bt* events for pod borer resistance to Super Annigeri-1 (SA-1), wilt resistant variety, was initiated in this experiment. A set of 177 SSR co-dominant markers found distributed uniformly in Chickpea gen. and 9 (5.08 %) polymorphic markers were traced between Event-1 and Event-2, Event-1 and Event-3 and Event-2 and Event-3. 177 same pair of SSR markers were screened for polymorphism between the parents



through Automatic capillary electrophoresis. Of these markers, 91 (51.41%), 90 (50.84%) and 85 (48.02%) markers were detected as polymorphic between Super Annigeri-1 × BS 100B, Super Annigeri-1 × BS 100E and Super Annigeri-1 × BS 72C₂, respectively. Similarly 88 (49.71%), 89 (50.3%) and 68 (38.4%) polymorphic markers were traced respectively, between Event-1 and Event-2, Event-1 and Event-3 and Event-2 and Event-3. The list of polymorphic SSR markers with their respective amplicon size for the cross Super Annigeri-1 × BS 100B, Super Annigeri-1 × BS 100E and Super Annigeri-1 × BS 72C₂ were recorded for future use.

IN SILICO MANAGEMENT APPROACH FOR CHILCD: PREDICTION AND IDENTIFICATION OF THE CHILLI PROTEIN DOMAIN AND MIRNAS THAT TARGET THE BEGOMOVIRUS

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Abstract

Begomovirus evolution and the appearance of new strains within them have been shown to pose a major threat to the cultivation of chillies and cause substantial challenges for world agriculture. The current study focused primarily on the *in-silico* prediction of the domain involved in the interaction of the chilli protein with ChiLCD, as well as the identification of miRNAs that target the begomovirus genome to promote particular gene silencing in a chilli plant. Chilli and begomovirus proteins were modelled using Phyre2 and Chimaera X. While using the PyRx programme to analyse the binding energies of all DNA-A ORFs with beta C1, we observed that the best and lowest binding energies for ADK, GLO1, and SKP1 were -15.5 kcal/mol, -14.4 kcal/mol, and -16.5 kcal/mol, respectively. Based on chilli transcriptome data, the best ten miRNA results that interacted with ten begomovirus sequences were identified. During infection, these begomoviruses can behave as miRNA target mimics, up or down-regulating the function of the proteins they target in the host. These miRNAs had a high level of complementarity with the AC1 (REP) and AC2 (TrAP) genes. Subsequently, RNA22, CMII, and RNAhybrid were used to validate the MFEI of begomovirus-miRNA interactions and we found the OQ161704 (ChiLCV_KLD_01_RVA/IN/23), OQ148478 (ChiLCV_KLD_RVA/IN/23), and OQ440386 (CLCuMuV_R_RVA/IN/23) were the top three begomovirus (DNA-A) with the best mean MFEI whereas CA_miR838 and CA_miR2673 was top most among miRNA. This was, to the best of our knowledge, the first case of miRNA prediction from chilli transcriptome data that had not previously been reported in miRBase. Following laboratory validation, these miRNAs could be used to control ChiLCD. The findings of this study will help future epidemiological studies and the development of effective disease management measures for Indian chilli crops.

COMMON AND CHRONIC HEALTH PROBLEMS AMONG RURAL AND URBAN ELDERLY

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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 *et al.* (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.



EFFECT OF DIFFERENTIAL FERTIGATION DOSAGES OF PRIMARY NUTRIENTS ON VEGETATIVE CHARACTERS OF BANANA DURING THE EARLY VEGETATIVE PHASE

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Abstract

A fertigation experiment was conducted in banana using two varieties: Nendran and Mintolli. Different fertigation treatments were applied for the crop. The treatments were: T1- 100% NPK, T2- 75% N, 100% P, 100% K, T3 - 125% N, 100% P, 100% K, T4 - 150% N, 100% P, 100% K, T5 - 100% N, 75% P, 100% K, T6 - 100% N, 125% P, 100% K, T7 - 100% N, 150% P, 100% K, T8 - 100% N, 100% P, 75% K, T9 100% N, 100% P, 125% K, T10 - 100% N, 100% P, 150% K. The plant height, girth, number of leaves, leaf length and width were measured at 60 days of growing period. The results indicated that plant height, girth, leaf length and width were higher for Nendran variety during the initial period of 60 days. With increase in dosage of individual nutrients, the plant height, girth and number of leaves increased. The increase was more pronounced for varying fertigation levels of phosphorus and potassium.

FACTORS INFLUENCING COGNITIVE FUNCTION AMONG ELDERLY

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Abstract

As aging brings progressive changes in all parts of the body including changes in the structures and function of brain which leads to cognitive decline, physical and behavioural changes among older adults. According to 2011 census 7.7 per cent of the population were above the age of 60 years and estimated to be double (15.4%) by the year 2025. The objective of the study was to know the factors influencing cognitive function among elderly. The sample comprised of 180 elderly aged 60 years and above were selected through snowball technique. The tools used were general information schedule, Mini mental state examination and Mini nutritional assessment to assess the cognitive function and nutritional status among elderly. The results revealed that about 48 per cent of elderly had normal cognitive function, while 20 per cent had severe cognitive impairment. Factors like age, education, marital status, working status and nutritional status had significant influence of cognitive function, indicating that those who had completed PUC and above education, belong to young old group, married, currently working temporarily and nourished nutritional status had normal cognitive function than old old elderly. There is a need for counselling on nutrition, health and cognitive skills to enhance the better cognitive function and psychological well being among elderly.

IDENTIFICATION OF PARENTAL POLYMORPHIC MARKERS FOR BACKGROUND SELECTION IN CHICKPEA (*CICER ARIETINUM* L.) THROUGH MARKER ASSISTED BACKCROSS BREEDING.

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Abstract

Chickpea (*Cicer arietinum* L.) a rabi season legume, most extensively cultivated crop globally. But its productivity is limited majorly by the incidence of gram pod borer insect and *Fusarium* wilt disease. Combining these two biotic stress resistance in chickpea through backcross breeding by transferring *cry1Ac* gene from *Bt* events for pod borer resistance to Super Annigeri-1 (SA-1), wilt resistant variety, was initiated in this experiment. A set of 177 SSR co-dominant markers found distributed uniformly in Chickpea gen. and 9 (5.08 %) polymorphic markers were traced between Event-1 and Event-2, Event-1 and Event-3 and Event-2 and Event-3. 177 same pair of SSR markers were screened for polymorphism between the parents through Automatic capillary electrophoresis. Of these markers, 91 (51.41%), 90 (50.84%) and 85 (48.02%) markers were



detected as polymorphic between Super Annigeri-1 × BS 100B, Super Annigeri-1 × BS 100E and Super Annigeri-1 × BS 72C₂, respectively. Similarly 88 (49.71%), 89 (50.3%) and 68 (38.4%) polymorphic markers were traced respectively, between Event-1 and Event-2, Event-1 and Event-3 and Event-2 and Event-3. The list of polymorphic SSR markers with their respective amplicon size for the cross Super Annigeri-1 × BS 100B, Super Annigeri-1 × BS 100E and Super Annigeri-1 × BS 72C₂ were recorded for future use.

OCCUPTIONAL STRESS AMONG HIGH SCHOOL PRINCIPALS

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Abstract

A Study on occupational stress among high school principals was studied during the year 2020-21. The sample comprised of 60 principals from government and 60 from aided high school of Belagavi and Kalburgi Districts, who attended training at SISLEP center, Dharwad. Occupational stress index, stress management inventory and SES scales were used as tools for data collection. Results of the study revealed that majority of government (45%) and aided (44.2%) high school principals had moderate level of occupational stress. Principals belonged to age group of 46-50 (Government school) and 51-55 years (Aided school) had high level of occupational stress. Government school principals from rural locality had higher level of occupational stress as compared to aided school principals from urban locality. Principals from government schools who completed graduation, 10-20 years service and work experience as headmaster, female gender and belonged to higher socio economic status had high level of occupational stress than aided school principals. There was significant and negative relationship between occupational stress and stress management of government and aided high school principals.

OCCUPTIONAL STRESS AND STRESS MANAGEMENT AMONG HIGH SCHOOL PRINCIPALS

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Abstract

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ECONOMIC ROLE OF MILLETS IN SUSTAINABILITY AND CLIMATE CHANGE

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Abstract

Millets are collective group of small seeded annual grasses that are grown as grain crops, primarily on marginal land in dry areas of temperate, tropical and subtropical regions. The area under millets cultivation in Asia is around 162 lakh Ha with 215



lakh tons of production (FAO, 2021). India contributes around 80 per cent of Asia's millet production and 20 per cent of global millet production. The average yield of India is 1239 kg/ha which is higher than the global average yield of 1229 kg/ha (DES, 2023). Prior to green revolution the contribution of millets to total food grain basket stood at 20 per cent but currently it stands at 6 per cent (MoA&FW, 2023). The shift from millets cultivation to water-intensive crops like rice and wheat has led to negative consequences towards environment like depletion of ground water, degradation of soil health etc. The production of cereal crops has been affected by 9 to 10 per cent due to adverse climatic conditions like high temperature, drought etc (Lesk *et al.*, 2016). The continuation of these adverse climatic conditions may lead to decreased production of cereals which can affect trade balance, GDP and global economy (Saxena *et al.*, 2018). Millets are non-glutinous nutrient rich food grains with good source of fibre, protein, vitamins and minerals. Recognising the enormous potential of millets which aligns with UN sustainable development goals of zero hunger, good health and well-being, reduced inequalities, responsible consumption and production, climate action, partnership for the goals, the United Nations General Assembly has declared 2023 as the International Year of Millets. The physiological characters, nutritive value and economic role of millets make them a solution to climate change and sustainability.

ESTIMATION OF GENETIC VARIABILITY PARAMETERS IN F₂ POPULATION OF LATHYRUS (LATHYRUS SATIVUS L.)

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Abstract

Lathyrus is crop of prosperity having nutritional value. The current investigation focused on the study of 21 F₂ crosses in Lathyrus to estimate the genetic parameters in the F₂ population. During Rabi 2017-18 season, the F₂ crosses were cultivated alongside ten parents, with data collected on seven yield and yield-contributing characteristics. The genetic coefficient of variation was notably high for the number of pods per plant and yield per plant. Estimates of heritability (h) in the broad sense indicated a high range for yield per plant (40.12-92.14%) and a moderate to high range for the number of pods per plant (21.89-85.70%). Significant genetic advancement was anticipated across all F₂ populations, particularly for plant height at maturity (15.88-26.83), the number of pods per plant (10.72-47.49), and yield per plant (4.22-13.62). Fourteen crosses were identified based on their elevated means, genotypic coefficient of variation, broad-sense heritability, and genetic advances for economically significant traits, such as the number of pods per plant and yield per plant.

EVALUATION OF BIO EFFICACY OF CHLORANTRANILIPROLE 18.5% SC AGAINST DIAMONDBACK MOTH (PLUTELLA XYLOSTELLA) ON CABBAGE

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Abstract

Investigation was undertaken at Regional Horticultural Research and Extension Centre, Dharwad, Karnataka during 2019-2020 to study the bio-efficacy of new green insecticide chlorantraniliprole 18.5% SC insecticides against *Plutella xylostella* L. infesting cabbage. Treatments include chlorantraniliprole 18.5% SC along with two conventional insecticides. Results revealed that all the insecticidal treatments were significantly superior over untreated control. At 7th day after spray, among the treatments, chlorantraniliprole 18.5% SC at both the dosage @ 75 ml/ha and @ 50 ml/ha were highly effective in controlling *P. xylostella* (3.23 larvae/5 plants and 3.67 larvae/5 plants) followed by Indoxacarb 14.5 % SC @ (5 larvae /5 plants) and Novaluron 10% EC (6.10 larvae/ 5 plant). The efficacy of insecticides also reflected on marketable yield of cabbage heads. The highest yield of 285.81 q/ha with 51.12 % increase over control was recorded in the treatment of chlorantraniliprole 18.5% SC @ 75 ml/ha followed by chlorantraniliprole 18.5% SC @ 50 ml/ha (278.99 q/ha with 47.51% increase over control) and Indoxacarb 14.5 % (258.46q/ha with 36.66 % increase over control).



CORRELATION AND PATH ANALYSIS FOR GRAIN YIELD AND YIELD COMPONENTS IN CHICKPEA (*CICER ARIETINUM* L.)

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Abstract

Chickpea (*Cicer arietinum* L.) is a crucial legume crop known for its high nutritional value and adaptability to diverse agro-climatic conditions. Its significance lies in providing food security by serving as a staple food for millions of people globally. Understanding the factors that influence grain yield in chickpea is essential for enhancing productivity and meeting the growing demand. In this study, we conducted correlation and path analyses to explore the relationships between grain yield and its components in chickpea. We measured various traits, including 50% flowering, days to maturity, plant height, number of pods per plant, 100-seed weight, and grain yield in kg per hectare. The results revealed significant positive correlations between grain yield and several traits, such as days to maturity, plant height, number of pods per plant, and 100-seed weight. Furthermore, path analysis elucidated the direct and indirect effects of these traits on grain yield. Plant height, number of pods per plant, and 100-seed weight emerged as crucial factors with significant direct impacts on grain yield. Our findings provide valuable insights into the complete relationships governing chickpea grain yield, enabling targeted breeding and improved agronomic practices to enhance productivity and food security. These results contribute to the scientific knowledge base, empowering researchers and growers to optimize chickpea cultivation and ensure sustainable food production.

TO STUDY THE ECONOMICS OF DIFFERENT VARIETIES AND PLANT GROWTH REGULATORS FOR SWEET POTATO PRODUCTION UNDER AGRO-CLIMATE CONDITION OF CHHATTISGARH PLAINS

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Department of Biological Sciences, Sam Higginbottom Institute of Agriculture, Technology & Sciences, Allahabad-211007 (U.P.) India

Abstract

The present investigation entitled “To study the economics of different varieties and plant growth regulators for sweet potato production under agro-climate condition of Chhattisgarh plains” was conducted in the Horticultural Research- cum-Instructional Farm, Department of Vegetable Science, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) in the summer season during the year 2017-18 and 2018-19. Pooled data of 2 years revealed that, the maximum benefit: cost ratio was obtained in the treatment V₁P₄, V₁- Indira Nandini X P₄ - CCC-1000 ppm (7.23, 7.26 and 7.24 respectively) which was followed by the treatment V₁P₃ V₁- Indira Nandini X P₄ - CCC-500 ppm (7.21, 7.27 and 7.24), V₁P₈ (6.72, 6.65 and 6.69 respectively) while the lowest benefit: cost ratio in the treatment V₂P₁₀ (1.19, 1.17 and 1.18 respectively) during both years (2018 and 2019) and on the basis of mean data.

INFORMATION AND COMMUNICATION TECHNOLOGY FOR KNOWLEDGE MANAGEMENT IN CLIMATE SMART AGRICULTURE

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Abstract

The agriculture sector is undergoing a transformation driven by new technologies, which seems very promising as it will enable this primary sector to move to the next level of farm productivity and profitability. In this era climate-smart agriculture (CSA) was evolved as an approach for transforming and reorienting agricultural development under the new realities of climate change productivity, adaptation, and mitigation are three interlinked pillars of CSA. Nowadays, it is being enhanced



with an increase of farm knowledge systems due to the availability of larger amounts of data now it becomes cross road for changing the farmers or farms for its adoption. Any single extension approach is not enough to support them with CSA, rather multiple agricultural extension approaches are needed with appropriate methods of technology transfer with best possible tools with minimum distortion of message in real time basis. With the modern based agriculture available today can lead to sustainable and profitable actuation to nourish people while reducing harm to the environment. ICT tools are promising for Knowledge Management in CSA intervention. In the form of Agricultural Extension model for CSA intervention may give a new means for farmers, extension workers, policy makers and all the concern stakeholders under changing climate condition.

DEVELOPMENT AND PRRFOMANCE EVALUATION FRUITS AND VEGETABLE GRADER

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Abstract

The present work was aimed to develop on-farm fruits and vegetable grader which can grade different spherical shaped fruits and vegetable in single equipment by the farmer itself. The engineering properties of the different fruits and vegetables were done, For the tested 7 fruits and vegetables weight ranged from 27.1 ± 29.15 to 134.92 ± 42.35 mm, polar diameter ranged from 37.40 ± 6.64 mm to 66.61 ± 16.41 mm, shape index ranged from 0.79 to 1.03 and the bulk density of fruits and vegetables were ranged from 195.7 to 740.2 kg/m³. The co-efficient of static friction on different surface ranged from 0.16 to 0.79 for the tested fruits and vegetables. The developed prototype low cost fruit and vegetable grader is well suited for grading different spherical fruits and vegetables. The grading effectiveness of developed low cost fruit and vegetable grader for selected fruits and vegetables were found to be in the range of 0.292 to 0.322. The fruits and vegetables damage during grading in the developed low cost fruit and vegetable grader for selected fruits and vegetables were found to be in the range of 0.7 to 1.7%. The developed fruit and vegetable grader capacity was found to be in the range of 421 to 509 kg/h.

STUDY ON QUALITY ASSESSMENT AND VARIABILITY ESTIMATION OF RICE LANDRACES

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Abstract

Land races are a valuable source of genes for biotic and abiotic stress tolerance mechanisms, as well as qualitative qualities that might contribute to variety. They are essential germ plasm because they have a diverse range of adoptability, resistance, and cooking quality properties. Scientists have understood the need of collecting, conserving, and utilizing farmer's varieties/landraces in rice improvement programs for the production of high-quality rice varieties. The majority of farmer's varieties are excellent source of variability and thus, qualities traits such as fragrance, good cooking quality, a high percentage of head rice recovery, good adoptability, and resistance to local pests and diseases that limit crop productivity could be obtained from evaluation of these raw diversity. The Present Experiment was conducted at seed breeding farm, JNKVV, Jabalpur in 2021-22 with 188 landraces planted in randomized block design and evaluated for yield and quality attributing traits. The result revealed that traits, number of spikelets per panicle, fertile spikelet per panicle, thousand grain weight, days to 50% flowering and grain length were highly variable with maximum GCV and PCV values. And these could be utilized to create new and improved cultivars with desirable characteristics, due to their higher values of heritability and genetic advance.

MEDICAL VALUES OF RHIZOMATOUS HERBS BELONGING TO THE GENUS POLYGONATUM

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Abstract

The floristic diversity of Himalaya is endowed with several valuable medicinal plants which are used in traditional treatment



of various ailments. Due to the high medicinal values, demands of many himalayan herbs in national and international markets are very high (Rawat and Garg, 2005). Several nations, including the northern and eastern United States, south-central Canada, India, and Korea, have a long history of using *Polygonatum* species for food and medicine (Youn et al 2007). *P. falcatum* (Southeast Asia), *P. odoratum* var. *pluriflorum* (Korea, Japan), *P. verticillatum* (India, Pakistan), *P. multiflorum* (Europe), and *P. biflorum* (North America) are indigenous plants from which traditional medicines are derived (Khan et al. 2016). Numerous phytochemicals and pharmaceutical uses of *P. cirrhifolium* exist, including its antioxidant capabilities (Zhao et al. 2018). *P. verticillatum* is employed in the creation of cosmetics (Rana et al. 2017). The rhizome of *P. orientale* is used in traditional Iranian medicine to treat internal wounds, kidney stones, rheumatism, and diabetes (Lamardi et al. 2017). Steroid, homoisoflavanone, polysaccharide, and lectin saponins are the main chemical components of *Polygonatum* plants. Proteins, amino acids, and polyphenols have also been reported in *P. cirrhifolium*'s roots and lactones in its stems and leaves (Wang et al. 2006). Recently, Mu et al. (2021) emphasized to usage the *Polygonatum* rhizomes in the intricate alternative medicine prescriptions for COVID-19 treatment. This review is to encourage the cultivation of this species and to guarantee excellent quality and a higher return to agricultural communities, it is necessary to identify and choose genetically superior genotypes that are stable in terms of productivity.

TO STUDY THE ECONOMICS OF DIFFERENT VARIETIES AND PLANT GROWTH REGULATORS FOR SWEET POTATO PRODUCTION UNDER AGRO-CLIMATE CONDITION OF CHHATTISGARH PLAINS

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BIOTECHNOLOGICAL APPROACHES FOR TRANSGENIC COTTON IMPROVEMENT IN AGRICULTURE

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Abstract

Transgenic cotton is one of the most valuable crops developed through transgenic strategies so far. Transgenic cotton has been developed by introgressing one or more genes by either the use of genetic engineering or by advanced breeding programs. Farmers have effectively made use of Bollgard I and Bollgard II during their season. However, to counteract resistance against other insects and pests, these resistant varieties still need to be improved by introducing new genes. Transgenic technologies are an important component of plant breeding pipelines today. Nowadays, any agricultural improvement strategy developed to meet the increasing challenges brought about by the growing population must take biotechnological advancements into account. In the last twenty years, biotechnology has presented enormous opportunities, chiefly in the form of new transgenic plants to fight biotic and abiotic stresses. The researcher has always faced challenges in the development and sustenance of cotton. Therefore, the use of gene editing technology, RNA interference, antisense technology, etc has now become popular in



modifying and improving its phenotypic and genotypic traits. The result will additionally make it quicker for researchers to examine the desired feature, but it will also enable them to assist farmers who encounter difficulties with seasonal cultivation.

UTILIZATION OF ARTIFICIAL INTELLIGENCE IN CROP PRODUCTIVITY TO ENHANCE AGRICULTURAL PRACTICES

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Abstract

Agriculture constitutes a key in the field that earns income. The main one among them that is currently receiving attention on a global scale is its scientific improvement. The demand for food security is rising dramatically due to population growth across the globe. Farmers were not capable of meeting these requirements via traditional methods. As a result, more effectively automated strategies were put forward. These ground-breaking methods provided food for the entire world while also providing a means of subsistence for billions of people. Thus, artificial intelligence (AI)-based technologies have proven successful in decreasing resource consumption, enhancing reliability and honesty, while concurrently boosting agricultural supply and grade and eradicating food wastage. AI is helping the modern agricultural framework to progress to another level. In the real-time agricultural era, selecting, interpreting, and marketing have all improved with artificial intelligence. The introduction of these platforms was aided by the development of an array of highly technologically advanced devices that are effective in determining a wide range of crucial elements, including the identification of weeds, productivity, crop performance, and a host of other elements. Socioeconomic principles will improve when artificial intelligence is used in agriculture, which might persuade growers to support and believe in it.

PLANT GENETIC ENGINEERING ADVANCEMENT TO ENSURE FOOD SAFETY IN SUSTAINABLE AGRICULTURE

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Abstract

A highly relevant issue of the twenty-first century is the problem of food security. The vehicles of genetic modification in crops can be a solution by using a technique known as gene stacking. The purpose of this method is to combine two or more genetically engineered characters or traits in crops with the use of plant breeding. The process of breeding resistance will be made much simpler by gene-stacking, which can also be customized for specific local pathogen populations. Global food security and the sustainability of agriculture could be considerably strengthened by breeding for permanent resistance to pests and diseases. Moreover, the other way to create genetically modified plants is to modify already-existing engineered plants to add one or more new transgenes or one way is to use a vector holding multiple transgenes to modify a non-genetically modified plant. The field of plant genetic engineering can help to improve such feasible objectives through the emergence of better-performing plants with enhanced resistance to various biotic and abiotic stresses such as herbicide tolerance and insect resistance in soybean and maize that are required due to the rising population and developing climatic challenges. Furthermore, this can help farmers to protect their crops from the effects of global warming and retain their output.

EVALUATION OF PHOSPHATE-SOLUBILIZING BACTERIA FOR CHICKPEA NODULATION

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Abstract

Phosphorus is a vital but least mobile element in plants and soil as compared to other macronutrients. Native phosphate solubilizing bacterial strains were isolated from the rhizosphere of different crops. Based on in vitro study, the isolate showed



lower pH, remarkable phosphate solubilizing index, and thermotolerant ability selected for further morphological, biochemical and molecular characterization. The 16s rRNA sequencing of the isolates PSB1, PSB2, PSB 4, showed high similarity 99.34%, 99.38%, 99.15% with *Bacillus velezensis*. PSB 5, PSB 6, PSB 8 showed high similarity 99.72%, 99.52%, 100% with *Bacillus amyloliquefaciens*, *Brevibacillus brevis*, *Bacillus subtilis* respectively based on nucleotide homology analysis. In pot trial treatments include Rhizobium + Identified PSB alone + Recommended dose of fertilizer and one check with Rhizobium + ITCC culture + Recommended dose of fertilizer and control without PSB inoculation. The results of co-inoculation with Rhizobium + PSB1 showed the highest germination rate, increase in nodule number, and fresh nodule weight. This treatment was at par in plant height, number of branches, shoot and root dry weight per plant, number of pods per plant, seeds per pod, 100 seed weight and phosphorus uptake in seed and straw over the check treatment. Co-inoculation of Rhizobium + PSB 1 shows not only significant enhancement in nodulation, nodule fresh weight but also yield attributes and phosphorous uptake as compared to rest of the other isolates. The results infer that the native PSB1 could be considered as a proficient biofertilizer in the organic farming system.

MODERN TECHNOLOGIES IN AGRICULTURE TO MITIGATE CLIMATE CHANGE IN FUTURE

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Abstract

The agricultural sector already encounters huge obstacles which are made worse by climate change. This is particularly apparent in developing nations. The population explosion era has resulted in an all-time high demand for food supplies. Amidst worldwide warming, agricultural innovations will become even more extremely important compared to what they currently constitute. Most new technologies alter how agricultural inputs are used, frequently in ways that affect how the weather affects output and the way production affects greenhouse gas emissions. Numerous techniques have been used to reduce the impact of hunger and provide nourishing food to the expanding population to address the issue of food supply. By using innovative techniques like plant genetic engineering, molecular breeding, speed breeding, artificial intelligence, CRISPR-CAS technology, OMICS technology, and others, the burgeoning field of agricultural biotechnology is now helping crops to address these problems. These techniques can help to reduce the effects of global warming on crops by enhancing their characteristics to withstand harsh conditions. These cutting-edge technologies will strengthen the agricultural industry's supply chain by delivering high-quality, timely crop productivity, and resistance varieties in the market. Furthermore, by giving farmers access to superior crop varieties, their problems will be relieved and their means of subsistence will be supported.

VARIATION STUDIES IN SELECTED NATURAL POPULATIONS OF *QUERCUS GLAUCA* IN HIMACHAL PRADESH

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Abstract

Quercus glauca Thunb., is an important multipurpose tree species distributed in North-Western Himalayas. It is an evergreen tree species used as fodder for livestock during the fodder scarcity period (December-February). It is highly nutritious fodder and has high socio-economic benefits. Therefore, the study was carried out in five populations of *Q. glauca* viz., Ghanahatti, Deothal, Chail Chowk, Shilli, Sadhupul to find out highly nutritive population in Himachal Pradesh. For this, 10 plus trees of *Q. glauca* were selected from each population on the basis of morphological features. Morphological variation with respect to tree height, tree diameter, leaf length, leaf width, petiole length, seed weight, seed length and seed width were evaluated. Variation in nutritive parameters viz., crude protein, crude fiber, moisture content, ash content and dry matter was evaluated among selected populations. The results revealed that, trees of Shimla were larger with respect to height and diameter and minimum height and diameter was recorded for Deothal population. Crude protein content ranged from 7.50 to 18.00% and it was observed maximum for Shimla population. Dry matter content ranged from 49.60 to 59.80% and it was found maximum



for Deothal population. The outcome of this study will help the scientists and stakeholders in establishing plantations of nutritious species i.e., *Q. glauca* from superior populations of Himachal Pradesh for year-round supply of fodder for livestock.

CORRELATION AND PATH COEFFICIENT ANALYSIS IN AMARANTHUS (*AMARANTHUS SPP.*) UNDER CHHATTISGARH PLAIN CONDITION

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Abstract

In the present study Correlation and Path Coefficient Analysis in *Amaranthus* (*Amaranthus spp.*) under Chhattisgarh plain condition was conducted at Horticulture Research cum Instructional Farm, Department of Horticulture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during Rabi 2014-15. Twenty five genotypes of *Amaranthus* were evaluated in Randomized Complete Block Design (RCBD) with three replications. Path coefficient analysis revealed positive and direct effect of plant height, followed by number of branches plant⁻¹, leaf breadth, seed yield plot⁻¹ and stem girth. however, high negative direct effects on fibre content per cent, leaf length, test weight, number of leaves plant⁻¹, dry matter per cent, root length plant⁻¹, and petiole length. Result obtained in path analysis suggests that while improving leaf yield (kg) plot⁻¹ in *Amaranthus* characters like high plant height, more number of leaves, number of branches plant⁻¹, high leaf length and high leaf breadth may be considered as key traits.

TO STUDY THE ECONOMICS OF DIFFERENT VARIETIES AND PLANT GROWTH REGULATORS FOR SWEET POTATO PRODUCTION UNDER AGRO-CLIMATE CONDITION OF CHHATTISGARH PLAINS

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Abstract

The present investigation entitled “To study the economics of different varieties and plant growth regulators for sweet potato production under agro-climate condition of Chhattisgarh plains” was conducted in the Horticultural Research- cum-Instructional Farm, Department of Vegetable Science, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) in the summer season during the year 2017-18 and 2018-19. Pooled data of 2 years revealed that, the maximum benefit: cost ratio was obtained in the treatment V₁P₄, V₁- Indira Nandini X P₄ - CCC-1000 ppm (7.23, 7.26 and 7.24 respectively) which was followed by the treatment V₁P₃, V₁- Indira Nandini X P₄ - CCC-500 ppm (7.21, 7.27 and 7.24), V₁P₈ (6.72, 6.65 and 6.69 respectively) while the lowest benefit: cost ratio in the treatment V₂P₁₀ (1.19, 1.17 and 1.18 respectively) during both years (2018 and 2019) and on the basis of mean data.

CHARACTER ASSOCIATION AND PATH COEFFICIENT ANALYSIS IN RICE LANDRACES USING FOR YIELD AND YIELD ATTRIBUTING TRAITS

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Abstract

Rice (*Oryza sativa* L.) (2n=24) is self-pollinated semi aquatic annual grass that is a staple food in many parts of the world. It has 22 wild and two cultivated species. As per the present knowledge of this crop, in the total of 22 wild species, 14 are diploid



($2n=2x=24$) and 8 wild species are tetraploid ($2n=4x=48$). Twenty-two wild species have four complexes (*O. sativa* complex, *O. officinalis* complex, *O. meyeriana* complex and *O. ridleyi* complex) as per their crossing compatibility. An experiment was carried out during Kharif 2021 to estimate the correlation and direct and indirect effects of yield components on grain yield in rice. The experimental material consists of 188 landraces including two checks IR-64 and Jeerashankar, 32 genotypes planted in Randomized Block Design with three replications. Based on correlation and path analysis studies, significant positive correlation and high direct positive effect on grain yield per plant were found for traits flag leaf length, number of tillers, number of effective tillers, panicle weight, harvesting index, panicle index, fertile spikelet per panicle and biological yield per plant. It depicted that during the formulation of criterion in rice improvement program as well as for plant ideotype, these traits would be of significant relevance.

MARGINALIZATION, EXPLOITATION AND DISCRIMINATION BASED ON CASTE AND RELIGION IN INDIA: A REVIEW

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Abstract

The principles of non-discrimination and equality of position and opportunity are upheld by the Indian Constitution. The Indian government then passed legislation to prevent prejudice. We shall examine the function and potency of these laws in the abolition of discrimination based on the knowledge gained over the previous 70 years. The technique entails classifying the populace into many social groupings. Through limitations on marriages, intergroup eating, and other forms of social interaction, it not only divides the people into groups but also isolates and segregates them from one another. It fixes the economic, social, cultural, and religious rights at birth, making them inherited and unchangeable. Social justice was declared the guiding concept of society by the Constitution as social, economic, political liberty, equality, and brotherhood. Equal rights are guaranteed by the Constitution in articles 14, 15, 16, 17, 25 and 46 to all citizens. There are numerous acts that serve as legal protections for individuals. Despite laws that forbid it, discrimination still occurs to a large extent. Reforms are required since laws have only partially succeeded in overcoming violence and discrimination that deny citizens equal citizenship status. The reason for the high rate of acquittal and low rate of convictions is the biased behaviour and attitude of the judicial system. These issues are so deeply ingrained in the current philosophy and culture that prejudice will endure and continue to limit human potential and the ability to live dignified lives.

COMPOSITIONAL ANALYSIS AND ROLE OF DIFFERENT CONSTITUENTS OF KULFI

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Abstract

Kulfi is a frozen dairy product, which has close resemblance to ice cream. Indian population has recently been more found of ice cream and frozen products. The big metropolitan cities of India have seen more increase in ice cream sales. Kulfi, ice cream and frozen desserts are being made out of 0.7% of total milk produced in India. The chief difference between ice cream and kulfi is that the former is whipped with air or overrun, while the latter is not and hence, comprises no air. Cow milk comprises of whey protein 20%, which is one of the major proteins of all the others. The biological value of whey protein is higher than the others and the protein efficiency is very good which can be further used to make nutraceuticals and functional food system. The lower and the middle-class categories of population in India cannot afford the higher price of the ice cream, which causes the less consumption of it. The other relative term for kulfi is “poormans ice cream”. Kulfi is frozen dairy product produced of cow and buffalo milk or a combination thereof. Kulfi should have Total Solid of minimum 36%, fat not less than 10%, proteins 3.5% and 0.5% stabilizer. The quality of kulfi includes the sum of total of its properties of physical,



chemical and microbiological. Kulfi is considered as a complex mixture of several dairy and non-dairy ingredients. The dairy ingredients such as milk fat and milk solids not fat are used as base for kulfi whereas, the non-dairy ingredients such as sweeteners, colours, flavours and other additives are used to enhance the acceptability of the product. A satisfactory level of cane sugar in kulfi was reported to be 13.0%. A satisfactory level of cane sugar in kulfi was reported to be 13.0%. The level of cardamom as flavouring compound used from 0.1 to 0.3% in kulfi mix powder.

DETECTION OF GENOMIC REGIONS FOR DROUGHT AVOIDANCE TRAIT DEEPER ROOTING IN *INDICA* RICE (*ORYZA SATIVA* L.) THROUGH ASSOCIATION MAPPING

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Abstract

Approximately 50% of rice cultivation area in India faces drought stress under the changing climatic scenario. Deeper rooting property can help the rice plants to avoid drought stress by getting water from deeper soil layer by keeping root length same. Two major QTLs *Dro1* and *Dro2* accounting for 66.6% and 32-56% of phenotypic variance, respectively, have been mapped, of which *Dro1* has been cloned. Three minor QTLs namely *Dro3*, *Dro4* and *Dro5* have also been mapped. But all these QTLs responsible for root angle have been mapped from a population developed from cross between IR64 and Kinandang Patong (*japonica*) genotypes through bi-parental mapping. But association mapping is preferable over bi-parental mapping in recent days. Thus the present study aimed to identify novel QTLs responsible for deeper rooting in *indica* rice through association mapping. A panel of population of *indica* genotypes was constituted and phenotyping analysis of deeper rooting trait was done by basket method. By using SSR markers covering all the 12 chromosomes genotyping of the panel population was studied. To identify QTLs/genes responsible for deeper rooting trait GLM and MLM models of TASSEL5 software were used in Marker-trait association mapping. *Dro1*, *Dro2*, *Dro3*, *Dro4* & *Dro5* QTLs were validated and novel QTLs were identified which may be directly or indirectly involved for deeper rooting. The identified QTLs will be useful in future molecular breeding programs for Potential donor lines having deeper rooting trait in varietal improvement to avoid drought stress and identification of novel genomic regions governing the deeper rooting property will show light into the detailed mechanism operating behind it. And novel gene (s) those would be identified conferring deeper rooting in *indica* rice can be filed for patents.

ALTITUDINAL IMPACTS ON GROWTH PARAMETERS OF *GARCINIA GUMMI-GUTTA* IN CENTRAL WESTERN GHATS, INDIA

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Abstract

Garcinia gummi-gutta is an economically important tree species known worldwide for its excellent anti-obesity property due to the presence of (-)-Hydroxycitric acid (HCA) and due to characteristic sharp sour taste, the fruit rind, it is traditionally used extensively in fish curries as flavouring agent as well. Field study was conducted to determine the effect of altitudes on growth parameters of *G. gummi-gutta* in 3 different altitudinal zones of Uttara Kannada district. In each Zone, 3 sites were randomly selected, in each site 5 trees were selected as replications. Trees of 50-80 cm girth class were selected. The rainfall in these sites ranges between 2300 to 4722 mm per year and the altitude ranges between 418.7 to 646.3 m. Significant influence of site conditions and altitude on the growth parameters of *G. gummi-gutta* such as tree height and bole height was observed. Zone-2 (500-600 m MSL) showed highest mean tree height of 16.63 m. Whereas, Zone-1 (600 m MSL and above) recorded maximum mean bole height of 4.07 m. Girth and crown diameter showed no significant variation between the Zones. Higher growth is found in Zone-1 and Zone-2 region in growth parameters viz. total tree height and bole height. Least growth was found in Zone-3 (400-500 m MSL). The capacity of a selected site to offer adequate nutrients for a tree relies upon on several elements and the proscribing component for tree growth might also additionally vary. Trees are heavily depended upon sites and soils to



offer water, nutrients, aeration and stability for its growth and survival. So, along with altitude the edaphic factors also play role as a complex system.

INVESTIGATIONS ON SPATIAL DISTRIBUTION AND MOLECULAR VARIABILITY OF PIGEONPEA STERILITY MOSAIC VIRUS (PPSMV) CAUSING STERILITY MOSAIC DISEASE OF PIGEONPEA AND ITS TRANSMITTING AGENT, *ACERIA CAJANI* IN INDIA

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Abstract

Sterility mosaic disease (SMD) caused by *Pigeonpea sterility mosaic virus* (PPSMV) is one the most devastating biotic risk for production of pigeonpea throughout Indian sub-continent. In the present investigation, we have determined the spatial distribution of SMD covering of major pigeonpea growing states of Central and Southern India, viz., Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu, and Telangana during Kharif 2021-22 and 2022-23 and the molecular variability of PPSMV strains and its vector transmitting agent, *Aceria cajani*. Results indicated the huge variation in SMD incidence ranging from 0.40 to 82.64 per cent and 0.96 to 36.84 per cent respectively in Kharif 2021-22 and 2022-23. Based on geospatial auto-interpolation techniques and semivariogram modelling analysis, the potential SMD hotspots in Central and Southern India were largely noticed in the Chittoor, Bidar, Latur, Krishnagiri, Medak and Ranga Reddy districts which were vulnerable for the SMD occurrence in future. RT-PCR amplification of RNA-3 segment and phylogenetic analysis of 29 isolates of PPSMVs in Central and Southern India revealed the presence of significant molecular variability among all the isolates. Out of 29 isolates, three isolates were confirmed with mixed infection of PPSMV-I and PPSMV-II, while the PPSMV-II was identified as most virulent strain. PCR amplification and Sanger sequencing analysis of the rDNA of 11 *Aceria cajani* isolates revealed that no significant variability among the collected isolates.

HIGH-THROUGHPUT PLANT PHENOMICS FOR RAPID CROP IMPROVEMENT

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Abstract

High throughput phenomics in plants refers to the collection and analysis of large-scale phenotypic data from plants. It involves using various technologies and methodologies to efficiently measure and quantify plant traits on a large scale. High throughput phenotyping (HTP) allows researchers to rapidly and accurately assess plant performance, growth, development, and response to environmental variables. Some of the commonly used techniques in HTP for plants include Remote Sensing which involves the use of imaging sensors, such as drones or satellites, to capture high-resolution images of plants. These images can provide information on plant health, stress, biomass, and other traits. Machine Vision involves the use of computer vision algorithms to analyze images captured from cameras installed in growth chambers or field platforms. This allows for the automated measurement of various plant traits like leaf area, plant height, leaf color, etc. Sensors and Instrumentation involving various sensors can be deployed to monitor plant physiological parameters, such as temperature, humidity, light intensity, CO₂ concentration, and water content. These sensors provide continuous and precise measurements of environmental variables influencing plant growth. High-Resolution Phenotyping Platforms like conveyor-based systems or robotic arms equipped with sensors and imagers can rapidly scan and measure multiple plants at once. These platforms are especially useful for high-throughput screening of large plant populations. HTP can also involve help identify the genomic basis of plant traits with the help of Genomic Approaches which include genome-wide association studies (GWAS), quantitative trait locus (QTL) mapping, and transcriptomics. By integrating these technologies, HTP enables researchers to monitor and analyze plant performance in real-time, providing valuable insights into plant development, stress responses, and trait variability. This information can be crucial for plant breeding, precision agriculture, and addressing challenges related to climate change and food security.



STUDIES OF DIFFERENT WEED CONTROL METHODS UNDER HDPS COTTON.

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Abstract

A field experiment was conducted AKH-081 cotton during rainy season of 2016 at Cotton Research Station, Dr. P.D.K.V. Akola. The soil was clayey in texture to study Effect of weed management under HDPS Cotton and its effect on microbial count and soil moisture status and soil fertility. The experiment consisting of ten treatment combinations was carried out in three replications with randomized block design. The treatments were pre emergence application of pendimethalin @ 1.25 kg a.i. ha⁻¹ /b hoeing at 30 DAS and one hand weeding at 45 DAS, post emergence Spray of quizalofop-ethyl 10 EC @ 0.075 kg a.i. ha⁻¹ at 2-4 leaf weed stage /b hoeing at 45 DAS, pyriothibac sodium 10 EC @ 0.075 kg a.i. ha⁻¹ at 2-4 leaf weed stage /b hoeing at 45 DAS, pre emergence spray of pendimethalin /b quizalofop-ethyl, pendimethalin /b pyriothibac sodium at 2-4 leaf weed stage, pendimethalin /b tank mix of quizalofop-ethyl + pyriothibac sodium sprayed on weed at 2-4 leaf weed stage, weed free check, weedy check, In-situ mulching of greengram in cotton and Hoeing at 15-20 DAS /b Glyphosate 71 G @ 1.50 kg a.i./ha as directed spray at 35-40 DAS. The variety AKH-081 was sown at 60 cm x 10 cm spacing on BBF (1.66 lakh plant population/ha) with gross plot of 24 square meter area and sown in third week of June with recommended fertilizer and plant protection measures. Weed free with physical weed control method by 2H and 2 HW up to 45 DAS recorded significantly differed seed cotton yield (1750 kg ha⁻¹) from all other treatments under study and followed by pre emergence application of pendimethalin @ 1.25 a.i. kg ha⁻¹ followed by hoeing at 30 and hand weeding at 45 DAS (1626 kg ha⁻¹), in turn and was on par with application of hoeing at 15-20 DAS followed by non selective post emergence application of glyphosate 71 G 1.5 a.i. kg ha⁻¹ at 45 DAS (1553 kg ha⁻¹) and were closely followed by application of *in situ* mulching of green gram between cotton rows (1480 kg ha⁻¹) were at par to each other. Higher gross returns (Rs 58865), net returns (Rs 25575) and B.C ratio (1.77) also obtained from weed free check, followed by application of pre-emergence herbicides + cultural practices, glyphosate treatments and in situ mulching of green gram, respectively. However, weed free check, followed by *in-situ* mulching of green gram improved soil microbial biomass, soil fertility status and conserve more soil moisture as compared to other treatments under HDPS cotton. Thus, application of 2H and 2 HW up to 45 DAS found to get higher yield, higher monetary return as well as to conserve soil moisture and improve soil fertility, but not able to maintain the weed free condition due to climatic condition not match the proper time specially at initial days on broad bed furrow. The application of *in situ* bio-mulching of green gram between cotton rows found to be promising tools for control of weeds under HDPS cotton in organic farming.

ECONOMIC EMPOWERMENT OF FARMING COMMUNITY THROUGH AGROMET ADVISORY SERVICES IN BARAMULLA DISTRICT OF JAMMU AND KASHMIR

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Abstract

Weather and Climate are important factors of farming. Weather forecast and its accuracy plays very significant role in agriculture sector and helps in managing weather associated risks and modifying crop planning as per future weather conditions. Weather forecast also provides guidelines for selection of crops best suited to the anticipated climatic conditions and to increase agriculture production, reduce losses, risks, reduce costs of inputs, improve quality of yield, increase efficiency in the use of water, labor and energy and reduce pollution with judicious use of agricultural chemicals. The Indian Meteorological Department (IMD), Ministry of Earth Sciences has established District Agromet Unit (DAMU) at ICAR-CITH KVK Baramulla during 2018-19 under "Gramin Krishi Mausam Sewa" (GKMS) scheme to issue medium range weather forecast based block level Agro-meteorological Advisory Service (AAS) Bulletin on every Tuesday and Friday. The present study was conducted to assess the change in economic status of farming community through agromet advisory service provided by DAMU of KVK Baramulla. The result of the study showed that Weather forecast and weather based agromet advisories helped in increasing the economic benefit to the farmers by suggesting them suitable management practices according to the weather conditions. The main contribution of increase in economic benefit was due to reduction in cost of



cultivation by AAS based application of pesticides and chemical fertilizers leading to increased net returns. The other benefits of AAS as perceived by the farming community were; timely sowing, weeding and irrigation. The net return (income) of AAS beneficiary farmers from field crops was increased up 15 percent and from horticulture crops was up to 18 percent. The Agro-meteorological Advisory Service can be the single window solution for livestock rearing farmers to proactively manage the weather and climate risks to protect their animals and increasing livelihoods. The study also suggested that more group awareness campaigns should be organized for strengthening this services in farming communities and helping farmers to be more self dependent in handling issues related to weather and climate that affects agricultural production.

DEVELOPMENT AND OPTIMISATION OF NOVEL MILLET BEVERAGES: MILLET CAPPUCCINO AND HOT CHOCOLATE: AN OHMIC HEATING APPROACH

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Abstract

Millets were supposed to be poor people's food, but the innovative ingredients-based millet products will definitely enhance their value and encourage people to start more millet-based startups. In the present study, Barnyard millet was processed using novel processing techniques. Prepared powder was used for cappuccino and hot chocolate drink mixes with zero refined sugar. The formulations of varying ingredient ratios were prepared on the basis of response surface methodology-suggested trials. The beverages were heated using the ohmic heating method, which resulted in superior sensory characteristics compared to other heating techniques. It was found that the barnyard millet could be used to thicken the cappuccino (3 to 23 mPa.s.) and hot chocolate drink (3 to 23 mPa.s.) without adding any thickening agents. The protein content was found to be 16.437% and 19.625% for the cappuccino and chocolate drinks, respectively. The method proposed in this study can be effectively used to modulate the colour of the end products. The developed product can also be used by people who perform fasting. The production cost per sachet for our millet cappuccino was found to be 6.65 Rs, whereas it was 9.79 Rs for our millet hot chocolate mix, which is very cheap. The available cappuccino and chocolate mix contains thickening agents, emulsifiers, stabilisers, etc., whereas our product is entirely free from such ingredients. Besides, our product contains zero refined sugar, which enhances its overall value as people become more health-conscious day by day.

SCREENING OF MINI CORE COLLECTION OF SESAMUM AGAINST ALTERNARIA LEAF BLIGHT DISEASE

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Abstract

Sesamum is the oldest indigenous oilseed crop which has largest history in India. It is a very important crop due to its qualities and nutritive values. Because of its importance it is called as "Queen of oils". Among the major factors responsible for yield loss, diseases play an important role. Sesame is also affected by many abiotic and biotic stresses. Among the biotic agents, fungi cause major diseases, followed by bacteria, viruses and nematodes. Among these diseases, at present Alternaria leaf spot / blight caused by *Alternaria sesame* is widespread and has continued to be the major constraints in the production and productivity of sesame all over the country. The disease appears from seedling stage to harvesting stage of the crop. The fungus is known to infect all the above ground parts resulting in considerable loss in yield both quantitatively and qualitatively. Cultivation of resistant varieties is the most effective, cheap and ecofriendly method of combat the disease. So, screening of different mini core collections was carried out at the College of Agriculture, Vijayapur during *kharif* 2021. One hundred and forty three mini core accessions were screened by using 0-5 scale, among them 1 (IC 204658) line was found immune, 5 lines were highly resistant (IC 204495, IC 205363, IC 208679, IC 500904, IC 500944, 1-10%), 30 lines were moderately resistant (11-25%), 49 lines were moderately susceptible (26-50%), 29 lines were susceptible (51-70%) and 29 lines were found to be highly susceptible with more than 71 per cent disease incidence.



SCREENING OF MINI CORE COLLECTION OF SESAMUM AGAINST POWDERY MILDEW DISEASE

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Abstract

Sesamum is an important oilseed crop cultivated extensively from tropical region to the temperate regions. Despite the potential for increasing the production and productivity of sesame, there are a number of challenges inhibiting sesame production and productivity. Among many biotic constraints, powdery mildew is the most important disease of sesame, occurring widely throughout India and causes substantial quantitative and qualitative loss to the crop and it is caused by *Oidium erysipae*. It occurs in epidemic scale under heavy rainfall condition followed by low night temperature and high humid condition. It appears mainly at flowering to capsule formation stage as small patches of white powder on upper side and occasionally on lower surface of leaves. Defoliation of severely affected plant occurs before maturity. Powdery mildew causes yield losses ranging from 25 to 50 per cent depending upon the level of incidence. Among the many production constraints, the most important include lack of improved cultivars. With this view, one hundred and forty three mini core collection of sesamum from NBPGR, New Delhi were screened against powdery mildew disease under field conditions by using infector row technique at College of Agriculture, Vijayapur during *kharif* 2021. Different mini core accessions were screened by using 0-5 scale. The reaction of different accessions varied considerably. Out of one hundred and forty three minicore accessions screened, 12 lines were immune (IC 43144, IC 208660, IC 208679, IC 500927, IC 500940, IC 501015, IC 501135, IC 501058, IC 501061, IC 501093, IC 501096, IC 501098) with no infection. Fourteen lines were highly resistant with 1-10 per cent disease incidence. Forty eight were moderately resistant with 11-25 per cent of disease incidence. Forty nine were moderately susceptible with incidence ranging from 26-50 per cent. Fourteen were susceptible with 51-70 per cent disease incidence and 6 lines were highly susceptible which recorded more than 71 per cent of disease incidence.

EFFECT OF SURFACE COATING AND WRAPPING MATERIALS ON EXTENDING SHELF-LIFE OF LITCHI FRUITS (*LITCHI CHINENSIS* SONN.) CV. DESHI

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Abstract

Shelf-life of litchi fruits is very poor and losses its quality within two days after harvest at room temperature. To extend the shelf-life of litchi fruits the experiment was conducted at the Department of Horticulture, Institute of Agriculture Sciences, BHU, Varanasi to find out the effect of the surface coating of different concentrations of calcium nitrate (1 %, 1.5%, and 2 %) and hot water treatment for five minutes followed by fruit wrapping in newspaper and perforated polythene on extending shelf-life of litchi (*Litchi chinensis* Sonn.) cv. Deshi. Fruits without treatment were considered as controls. The experiment was conducted in a completely randomized design with three replications and observations were recorded on alternate days up to 13 days of storage. A significant minimum percentage (19.90 %) of physiological loss in weight was recorded in T₁₀ (2.0 percent calcium nitrate + perforated polythene wrapping) and a maximum percentage (29.80%) in control. It was observed that fruits treated with 1% and 2.0% calcium nitrate in combination with perforated polythene bags (T₈ and T₁₀) recorded minimum losses (16.60%) and (18.10%) due to spoilage respectively. as compared to control (38.20%) on 11th day of storage. Significantly maximum economic life up to the 11th day of storage were recorded in perforated polythene wrapping with different concentration of calcium nitrate. Significantly maximum TSS (23.00%) was recorded in T₁₀ and minimum (19.00%) in T₁₁ treatments. Total Sugar Content was recorded as significantly highest (16.60%) in polythene wrapping along with 1.5 and 2.0% calcium nitrate and hot water (T₉, T₁₀ and T₇) and minimum (14.20%) in control. On the 11th day of storage, the most



effective treatments were T₇, T₉, and T₁₀ showed the trace intensity of infestation for rotting as compared to control (T₁₁) and newspaper wrapping alone (T₁). Based on the above observations, it could be suggested that fruit dipping in calcium nitrate at 2.0 percent concentration with polythene wrapping (20% vent) gives better results for extending the shelf-life of litchi fruit at room temperature.

STUDY ON EFFECT OF DIFFERENT ORGANIC MANURES ALONG WITH MICROBIAL CONSORTIA ON GROWTH, YIELD AND QUALITY OF KALMEGH (*ANDROGRAPHIS PANICULATA* NEES.)

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Abstract

Kalmegh has wide range of medicinal and pharmacological applications. The active ingredient andrographolide is most important bioprotectant. An experiment entitled “Study on effect of different organic manures along with microbial consortia on growth, yield and quality of Kalmegh (*Andrographis paniculate* Nees)” was conducted in Department of Horticulture, COA, University of Agricultural Sciences, GKVK, Bengaluru during 2021-2022. The experiment was laid out in Randomised Complete Block Design with thirteen treatments replicated thrice. Significantly higher plant height (34.30 cm) was observed with the application of 100% RDF through vermicompost. Maximum plant spread (2209.6 cm²) and higher OC (0.53%) status of soil after harvest was recorded in the treatment consisting of 50% RDF through FYM + 50% RDF through neem cake + microbial consortia. Application of sheep manure in combination with neem cake resulted in higher number of branches per plant (14), higher number of leaves per plant (152.6), highest fresh weight (56.60g), highest dry weight (21.49 g), highest root to shoot ratio (0.59), highest fresh herbage yield (6.60 kg/ plot and 116 q/ ha), highest B:C ratio (1.66). Higher nitrogen (175.6 kgh⁻¹) status of soil was recorded with the application of 100 % RDF through poultry manure. Higher andrographolide content of 2.05% was noticed in the treatment with the use of 50% RDF through vermicompost + 50% RDF through neem cake + microbial consortia, highest count of soil microbial load was recorded in treatment consisting of 50% RDF through poultry manure + 50% RDF through neem cake + microbial consortia.

EFFECT OF RICE ESTABLISHMENT METHODS ON GREENHOUSE GAS EMISSIONS IN PADDY ECOSYSTEM

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Abstract

Rice is one of the most important staple food crops in the world. In Asia, more than two billion people are getting 60-70 per cent of their energy requirement from rice and its derived products. Demand for rice is growing every year and it is predicted that rice production needs to increase by 28% by 2050 for global food security. To sustain present food self-sufficiency and to meet future food requirements, India has to increase its rice productivity by 3 per cent per annum. Rice cultivation requires large quantity of water and for producing one kg rice, about 3000-5000 liters of water is required depending on the different rice cultivation methods such as transplanted rice, direct seeded rice (wet and dry seeded), system of rice intensification (SRI) and aerobic rice. There is need to increase rice production to feed the world population from less land with degrading nutrient base by application of less inputs and energy and rice production is the cause of global climate change by heavy emissions of carbon dioxide, methane and nitrous oxide. These gases trap the infrared long waves emitted from earth's surface in atmosphere and increase the temperature of atmosphere. Traditional rice production technology involving puddling and transplanting has often been criticized for its inefficient resource utilization, high cost of production and emission of greenhouse gases such as methane. The adoption of rice establishment method like dry direct seeded rice found to save 15-60% irrigation water with only 3-9% reduction in grain yield as compared to transplanted method of rice cultivation. In



addition to this this technology also found to enhance nutrient use efficiency and reducing 20-40% of greenhouse gases emission from paddy soils.

PLANT TISSUE CULTURE PROPAGATION IN COMMERCIAL TURMERIC CV. PDKV WAIGAON (*CURCUMA LONGA L.*)

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Abstract

The present investigation entitled “Plant tissue culture propagation in commercial turmeric cv. PDKV Waigaon (*Curcuma Longa L.*)” was conducted at Instructional Farm, Department of Vegetable Science, Dr. PDKV, Akola and Centre of Excellence, Plant Biotechnology, Department of Agricultural Botany, Post Graduate Institute (PGI), Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Dist. Akola (M.S.) during the academic year 2021-2022 and 2022-2023 with the aim to study the effective sterilization procedure for rhizome bud explant and to establish efficient system for *in-vitro* shoot and root proliferation. In this study treatment combination of Bavistin 0.1% + HgCl₂ 0.1% for 6 min of time showed highest survival percent of turmeric explants. Whereas, rhizome buds were cultured on MS media with different combinations of BAP and NAA while highest number of shoots was recorded by treatment MS+BAP4mg/l+NAA0.5mg/l. Half strength of MS medium was used with different combinations of BAP and NAA whereas treatment ½MS+NAA 0.5mg/l recorded highest number of roots. In present study above treatments were found suitable for the successful propagation of turmeric with the help of tissue culture technique and further study is going on.

INFLUENCE OF DIGITAL MEDIA ON CHILD BEHAVIOUR OF HIGHER PRIMARY SCHOOL CHILDREN

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Abstract

The study conducted in Dharwad, Karnataka, aimed to evaluate the influence of digital media usage on child behaviour of higher primary school children. The research involved 240 students (120 urban and 120 rural) in 5th, 6th, and 7th grades from both private and government schools. Various tools, including a self-structured questionnaire for digital media usage, Child behavior checklist (CBCL) by Achenbach and Rescorla (2001), and the Socio-economic Status Scale, were employed. The findings indicated that 56.7% of children exhibited moderate digital media usage, 32.9% had high usage, and 10.4% had low usage. Smart TVs were the preferred device for the majority (37.9%), followed by smartphones (27.1%), tablets (19.2%), and computers (15.8%). The most-watched digital content included National Geographic Kids (22.1%), Disney Junior (21.7%), game apps (20.8%), social media (17.9%), and Nick Jr (17.5%). In terms of purpose, the majority used digital media for homework and school-related activities (25.0%), followed by entertainment and media consumption (22.1%). Gaming was the purpose for 16.3%, while only 10% used digital media for communication. Regarding time spent, the majority spent 1 to 2 hours (42.10%), followed by 3 to 4 hours (26.70%), with fewer spending less than 1 hour (19.60%), and a minority exceeding 4 hours (11.70%) on digital media activities. Children shows that 58.80 percent of children have borderline child behaviour, while 41.30 percent of children exhibit normal behaviour. Three-fourths (72.50%) of children exhibit borderline externalizing behaviour, while 27.50 percent of children display normal externalizing behaviour and none of fall in clinical externalizing behaviour The study identified a significant association and difference between digital media usage, time spent on digital media, child internalizing and externalizing behaviour among higher primary school children.



UTILITY PATTERN AND DEPENDENCY ON MAJOR NTFP'S OF UTTARA KANNADA

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Abstract

Uttara Kannada district of Karnataka covering an area of eighty percent forest with abundant natural resources. Non-timber forest products (NTFPs) represent an essential and significant source of food security, employment, income generation and sustenance to local people particularly during the non-cropping season and after natural catastrophes. The district forests are home to a variety of non-timber forest products (NTFPs) and in order to preserve species and increase locals' incomes in a sustainable way. For about 59 and 40 different plant species yielding NTFPs are being identified in an evergreen, semi evergreen and deciduous regions of Uttara Kannada respectfully. The utility pattern of NTFPs varies such as different wild edible species like *Syzygium cumini*, *Carissa caranda*, *Artocarpus heterophyllus* fruits were directly edible due to its taste. Wild edible mushrooms and Honey also important forest based resources used as food. Some of the species like *Artocarpus lakoocha*, *Garcinia indica*, *Garcinia cambogea*, *Phyllanthus emblica* fruits were highly preferred for processing and value addition (28 to 32%), specially used in kokum and pickle making. *Calamus rotang*, *Bambusa arundinacea* species were used in Handicrafts and furniture making. *Cinnamomum zeylanicum*. *Myristica fragrans* species were locally known for its aromatic uses. *Rauvolfia serpentine*, *Asparagus racemosus*, *Salacia reticulate*, *Withania somnifera*, *Saraca asoca* etc were used for medicinal purposes. In recent scenario, the market demand for the NTFP's increased which leads to increased local dependency on NTFPs. Therefore, the sustainable harvesting of NTFPs is the key to conserve of these NTFPs and to enhance their healthy regeneration.

EFFECT OF DIFFERENT COMBINATION OF IBA AND PACLOBUTRAZOL ON THE SEMI-HARDWOOD CUTTINGS OF KIWIFRUIT CULTIVARS

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Abstract

An investigation was carried out at ICAR-CITH RS, Mukteshwar to find out the effect of different plant bio-regulators treatments i.e. IBA and Paclobutrazol on the semi-hardwood cuttings of kiwifruit cultivars Hayward, Allison, Abbott and Tomuri. The experiment comprised of sixteen treatments. The results obtained from investigations revealed that the treatment of IBA at 3500 Ppm + Paclobutrazol at 250 Ppm and IBA at 4500 Ppm + Paclobutrazol at 250 Ppm taken less 12.28 days to sprouting and maximum sprouting percentage was recorded in cuttings treated with IBA at 3500 Ppm + Paclobutrazol at 750 Ppm. Cultivar Hayward provided best results of days taken to sprouting and sprouting percentage and survival percent.

GLOBAL STATUS OF SMALL INDIGENOUS FISHES (SIS) IN BANGLADESH

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Abstract

Small indigenous fish species (SIS) contribute significantly to the nutritional as well as livelihood security of the rural mass. SIS nutrient includes copper, zinc, selenium, iodine, calcium, phosphorus magnesium, iron, cobalt, chromium and vitamin A, D and E as well as vitamins B₁, B₂, B₃ and B₁₂ that generally consumed in inadequate quantities by poorer household, and particularly important for pregnant women and children. Once, floodplain and rivers was abundant with fish fauna. Presently, multiple anthropogenic threats to the environment place ever-greater pressure on aquatic biodiversity, negatively affecting the abundance of SIS. These stresses include flood control structures, conservation of wetlands to agriculture and aquaculture, over exploitation of fish populations, invasive exotic fish species, and climate change. According to IUCN, the status of the



142 fresh water SIS fish species was ranked as four (03%) are critically endangered (CR), eighteen (13%) are endangered (EN), thirteen (09%) are vulnerable status (VU), Seventeen (12%) are lower Risk (LR), sixty six (46%) are least concern (LC) position and only twenty four (17%) are Data deficient (DD) position, respectively. But the present status of the 142 SIS fish species are ranked as twenty one (15%) are critically endangered (CR), thirty one (21%) are endangered (EN), thirty nine (27%) are vulnerable status (VU), twenty two (15%) are lower Risk (LR) and thirty one (22%) are least concern (LC) position, respectively. Some important indigenous fish species like as *Amblypharyngodon mola*, *Puntius sophore*, *Esomus danrica*, *Rohtee cotio*, *Cholisa fasciata*, *Anabas testudineus*, *Labeo bata*, *Puntius sarana*, *Ompok pabda*, *Mystus cavasius*, *Mystus tengra*, *Heteropneustes fossilis*, *Clarias batrachus* and *Macrognathus aral* are practiced for induce breeding, nursing and grow out trials. The SIS aquaculture safeguards both nutritional as well as livelihood security of the rural population.

GENETIC VARIABILITY FOR FLOWERING TIME IN F₂ POPULATION OF FIELD PEA (*PISUM SATIVUM* L.)

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Abstract

Flowering time is an important trait especially while breeding for a targeted environment, location and/or situation and more so in semi-arid regions where the crop growth is restricted by water availability and by the seasonal temperature profile. Early flowering helps in avoiding terminal stage drought and temperature stresses and sever impact of these stresses can be overcome. Further, in the changing climatic conditions, developing early genotypes suitable for late sown conditions is becoming need of the hour. In this context, the present investigation was carried out at RARS, Vijayapur during Rabi 2022-23i to understand the genetic variability in the F₂ population of the cross between a late flowering and high yielding genotype, IPF-4-9 and an early flowering poor yielder, KHANAPUR 10. The flowering time of parental lines varied from 34 (Khanapur 10) to 60 (IPF-4-9) days. In the F₁, the mean flowering time was 40 days indicating the dominance of earliness in the cross studied. The mean days to first flower in the F₂ population was 59.58 days with a range of 24-90 days. The population exhibited high variance for plant height, number of pods per plant, days to first flowering and seed yield per plant. Days to first flowering exhibited low GCV (8.31%), low PCV (8.4%) with high heritability (98.02%), high genetic advance (30.44%) were noticed for flowering time. High GCV and PCV for number of pods per axil, number of primary branches per plant, number of pods per plant, hundred seed weight, number of seeds per pod and seed yield per plant were evident, in addition, high estimates of heritability coupled with high genetic advance was observed for several important traits. The population exhibited a wide range for flowering time with the scope to isolate the superior transgressive segregants.

DESIGN AND DEVELOPMENT OF TRACTOR DRAWN CARROT CROP HARVESTING MACHINE

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Abstract

India holds the second position globally in vegetable production, trailing behind China, with an annual growth rate of 6.48% recorded over the past decade. Despite this, the average vegetable yield in India remains lower than in many Asian countries due to the continued use of traditional tools and methods by farmers. There is lot of scope for yield improvement by cultivating high-yielding varieties and adopting enhanced harvesting technologies.

In Saurashtra, a substantial number of farmers still rely on spades or hand hoes for harvesting carrot crops, a conventional practice that is labor-intensive, time-consuming, and arduous. On average, harvesting one hectare requires 350 to 400 man-hours, and the availability of skilled labor is diminishing each year. To address this challenge economically and facilitate easy handling in agricultural fields, a tractor-drawn carrot crop harvesting machine was designed and developed. To evaluate



the machine's performance in the field, carrot crops were cultivated. The design was formulated based on the physical parameters of the carrot crop and theoretical considerations. The carrot harvesting machine comprised two main units: a digging unit and a conveying unit. The digging unit featured two tynes with a length of 330 mm and a thickness of 25 mm. The conveying unit included two flat belts, each measuring 280 cm in length and 4 cm in width. The machine was operated at three different speeds (1, 2, and 3 km/h) and digging angles (15°, 25°, and 35°) to assess its effectiveness.

MANAGEMENT OF SOIL BORNE DISEASES OF GROUNDNUT BY INTEGRATED APPROACH

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Abstract

Groundnut is a major legume and oilseed crop in India. Soil borne diseases viz., stem rot, collar rot and root rot are potential threat to groundnut cultivation. These diseases cause severe seedling mortality resulting in patchy crop stands and reduce the yields by 30-40 percent. Therefore management of these diseases is very much essential. A field experiment was conducted at MARS, UAS, Raichur during *kharif* 2021 and 2022 to manage these soil borne diseases by integrated approach.. Seven treatments were laid out with three replications. The trial was set up as a randomized block design. Treatments were T₁: Deep summer ploughing with mould board plough + Seed treatment with Tebuconazole 1.5 g/kg seed followed by PGPR @ 625 g/per ha of seed + Soil application of *Trichoderma* sp. @ 4 kg/ha enriched in FYM @ 250 kg/ha at 35 and 70 DAS, T₂: Deep summer ploughing with mould board plough + Seed treatment with *Trichoderma* sp. @ 10 g/kg seed followed by PGPR @ 625 g/per ha of seed + Soil application of *Trichoderma* sp. @ 4 kg/ha enriched in FYM @ 250 kg/ha at 35 and 70 DAS, T₃: Deep summer ploughing with mould board plough + Seed treatment with Tebuconazole 1.5 g/kg seed + Soil application of *Trichoderma* sp. @ 4 kg/ha enriched in FYM @ 250 kg/ha at 35 and 70 DAS, T₄: Deep summer ploughing with mould board plough + Soil application of *Trichoderma* sp. @ 4 kg/ha enriched in 50 kg FYM/ha + Seed treatment with Tebuconazole 1.5 g/kg seed followed by seed treatment with PGPR @ 625 g/per ha of seed + Soil application of *Trichoderma* sp. @ 4 kg/ha enriched in FYM @ 250 kg/ha at 35 and 70 DAS, T₅: Deep summer ploughing, T₆: Farmers practice, T₇: untreated control. The pooled results revealed that the treatment T₄ was very effective in controlling stem rot and root rot with least incidence of 7.10 and 4.08 per cent respectively and also recorded highest pod yield (3557.50 kg/ha) and haulm yield (5175 kg/ha) with more ICBR ratio. This was followed by T₃ which recorded least incidence of 10.61 and 6.25 per cent respectively with a pod yield of 3421.83 kg/ha and haulm yield of 5270.16 kg/ha. Untreated control recorded highest disease incidence and lowest yield.

NUTRITIONAL AND HEALTH BENEFITS OF FINGER MILLET (*ELEUSINE CORACANA*)

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Abstract

Finger millet (*Eleusine coracana*) is one of the important small millets with high nutraceutical value in the world. Most of the millet farmers attracted by Finger millet cultivation due to its wide adoptability in different soil types and climate. It also grows well in hot climates with short rainfall periods and cool climates with warm millets. India is one of the major producers of millet crop in the world. Among small millets, finger millet occupies the largest areas under cultivation. Compare to cereals such as barley, rye and oats, finger millet is a unique due to higher nutritional contents. It is a rich source of calcium among all cereals and millets. It also have good amount of protein, fibre, carbohydrate, other minerals. The phytochemicals of finger millet makes it a functional food which can be utilized to reduce the incidence of various degenerative diseases such as diabetes, cardiovascular disease, cancers and other cognitive diseases. A multitude of small farmers grow finger millet with limited water resources and in many countries this crop is often referred to as "poor people's crop". Finger millet is not only used for human consumption, but it is also used as feed for cattle and birds. Finger millet is used in the preparation of different foods both in natural and malted forms, like porridge, puddings, pancakes, biscuits, roti, bread, noodles, and other snacks.



Besides this, it is also used as a nourishing food for infants when malted and is regarded as wholesome food for diabetic patients.

CORRELATION AND PATH ANALYSIS STUDIES FOR SEED YIELD AND YIELD CONTRIBUTING CHARACTERS IN INDIAN MUSTARD (*BRASSICA SPECIES*)

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Abstract

The twenty-three Indian mustard genotypes along with a check (TAM 108-1) were planted in RBD with three replications in *rabi* 2021-22 at the Research farm of AICRP on Linseed and Mustard, College of Agriculture, Nagpur, observations were recorded on days to 50% flowering, days to maturity, plant height, number of branches plant⁻¹, point to first siliqua, siliqua length, number of seeds siliqua⁻¹, number of siliquae plant⁻¹, siliqua density on main branch, 1000 seed weight and seed yield plant⁻¹. The analysis of variance shows highly significant representing available variability in genotypes for all characters under study. All eleven characters were showed higher values of phenotypic coefficient of variation than genotypic coefficient of variation. Higher estimates of heritability in broad sense coupled with higher genetic advance were recorded for number of siliquae plant⁻¹, days to 50% flowering and point to first siliqua that indicates the presence of additive gene action in the inheritance of these characters. The highest value for genotypic and phenotypic correlation was observed for the character number of branches plant⁻¹, plant height and number of siliquae plant⁻¹ except for plant height found nonsignificant at phenotypic level and negative significant for point to first siliqua and number of seeds siliqua⁻¹ with seed yield plant⁻¹ indicating importance of the characters under selection. Path analysis revealed that plant height had highest direct effect followed by number of branches plant⁻¹, siliqua density on main branch and number of siliquae plant⁻¹ on seed yield plant⁻¹. Based on the results it has been concluded that two characters *viz.*, number of branches plant⁻¹ and number of siliquae plant⁻¹ exhibited high positive correlation along with direct influence on seed yield plant⁻¹ may be consider for selection and to improve the mustard genotype.

CHEMICAL FERTILIZER USE EFFICIENCY IN REDGRAM CULTIVATION IN KALBURAGI DISTRICT OF NORTH EASTERN KARNATAKA REGION OF KARNATAKA STATE

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Abstract

The costs of cultivation in redgram crop were major cost incurred by off farm resources, these resources cost increasing over the years. However, the application of essential plant nutrients through optimum quantity and right proportion through correct methods is the key factor to increase crop production on sustained basis. The result pertaining to this aspect was based on the primary data collected through survey method from redgram cultivated farmers 60 farmers in Kalburagi district during 2015-16. The study revealed that, the coefficients of multiple determinations was found 76 per cent and 84 per cent in small and large farmers respectively for redgram cultivation. In small farmers the regression coefficients of the resource variables were found positive for seed (0.11), FYM (0.21), phosphorous (0.03), PPC (0.06) and labour usage (0.13), negative regression coefficients was observed for nitrogen (-0.18). The significant negative regression coefficient was observed in nitrogen indicating that one per cent change in its use level would decrease the output of paddy by 0.18 per cent keeping the use levels of the other variable constant. The significant regression coefficient was observed in FYM and PPC indicating that one per cent change in its use would increase the output of paddy by 0.21 per cent and 0.06 per cent. Whereas, in redgram cultivation among large farmers the regression coefficients was negatively significant as observed in nitrogen indicating that one per cent change in its use level would decrease the output of redgram by 0.12 per cent keeping the use levels of the other variable constant. While, regression coefficients of the resource variables for seed (0.09), FYM (0.38), phosphorous (0.01), PPC (0.03) and labour usage (0.10) were found positive. The significant regression coefficient was observed in FYM indicating that one per cent change in its use level would increase the output of redgram by 0.38 per cent.



CORRELATION AND PATH COEFFICIENT ANALYSIS IN CASTOR (*RICINUS COMMUNIS* L.)

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Abstract

The present investigation on study of correlation and path analysis was carried out in castor (*Ricinus communis* L.) for eleven quantitative characters of sixteen inbred lines along with two checks (48-1, DCS-9) conducted during Rabi 2020. The seed yield per plant had strong positive association with days to maturity, number of nodes upto primary spike, effective length of main spike, number of capsules on primary spike and number of effective spikes per plant at both genotypic and phenotypic level. The characters days to 50 per cent flowering, days to maturity, number of nodes up to primary spike, primary spike length, number of capsules on primary spike, number of effective spikes per plant had positive direct effect on seed yield per plant at phenotypic level. It is, therefore, suggested that simultaneous selection for number of capsules on primary spike, primary spike length, number of effective spikes per plant and number of nodes upto primary spike would result in improvement of seed yield by phenotypic selection.

EVALUATION OF TAXONOMIC CLASSIFICATION AND LAND CAPABILITY, SUITABILITY AND IRRIGABILITY CLASSES FOR GUAVA GROWING SOILS OF NORTH-EAST REGION OF HARYANA

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Abstract

The present study was carried out to classification for the soils of guava growing area in North-East region of Haryana, according to Soil Survey Manual, 2017 and evaluated land capability, suitability and irrigability classification according to Frame work of Land Evaluation (FAO, 1993). Taxonomically, the soils of the all studied pedons were placed under the three orders viz. Inceptisols, Entisols and Alfisols based on morphological and physicochemical properties. However, the soils of recent alluvial plains under order Entisols were immature, lacked pedogenic development and horizon differentiation and classified as *Typic Udorthents* and *Typic Ustorthents*. Moreover, the soils of old alluvial plains under the order Inceptisols and Alfisols formed from old alluvial parent material and great group Haplustepts having ustic moisture regime and hyperthermic soil temperature regime and classified as *Typic Haplustepts* and *Typic Natrustlf*. The soils of the study areas were placed under two land capability classes (II and III), three land suitability classes (S1, S2 & S3) and three land irrigability classes (S1, S2 & S3) due to soils, pedogenic processes and topographic limitations.

SEQUENTIAL APPLICATION OF CONTACT INSECTICIDES ON THE SURVIVAL OF *KERRIA LACCA* (KERR.) AND YIELD OF *BAISHAKHI* LAC CROP ON *CAJANUS CAJAN* (L.) MILLSP

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Abstract

Repeated use of the same insecticides at short intervals is termed as “Treadmill phenomena”. Treadmill phenomena is reported by across the countries. It is one of the many reasons for development of insecticides. The commonly used contact insecticides in Madhya Pradesh are emamectin benzoate and chlorantraniliprole. Treadmill phenomena through it is known to many but due to lack of reliable data on sequential application of contact insecticides, it is difficult to discourage the practices. In this context, the present study “Sequential application of contact insecticides on the survival of *Kerria lacca* (Kerr.) and yield of *Baishakhi* lac crop on *Cajanus cajan* (L.) Millsp.” was conducted on six landraces of *C. cajan* and two contact insecticides



during the year 2022-23 in the Jawahar Model, Jawaharlal Nehru Krishi Vishwa Vidyalaya Jabalpur Madhya Pradesh. The mean number of live lac insect settlement per 2.5 cm² on *C. cajan* branches were maximum 79.84 (Korsar 1) while it was minimum 73.25 (Amarkantak 3) after 180th days of BLI. The mean length of stick lac per plant varied from 353.11cm (TDN 1) to 434.00cm (Korsar 1). The mean weight of 100 lac cell varied from 1.36g (TDN 1) to 1.53g (Korsar 1). The mean lac yield per plant varied from 141.56g (TDN 1) to 184.11g (Korsar 1).

CLIMATE CHANGE EFFECT ON BIOLOGY OF COCCINELLID BEETLE, *CHEILOMENES SEXMACULATA* FAB

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Abstract

Climate change with respect to carbon di oxide and temperature indirectly effects on the predator devouring the pest. In this context, studies on biology of the coccinellid, *Cheilomenes sexmaculata* Fab. was undertaken under Open Top Chambers (OTC's) at Main Agricultural Research Station (MARS) and Department of Entomology, University of Agricultural Sciences, Raichur, Karnataka. Investigations revealed that, the eCO₂ and temperature effected the aphid which served as the prey to the predator *i.e.*, coccinellid beetle. After consuming the nutrient-deficient aphids, the durations of the developmental stages were reduced in elevated treatments while the fecundity and longevity of the beetle was unaffected The fitness of coccinellid was altered in response to changes in herbivore quality (aphid) and size induced by CO₂ and temperature effects. For each trophic level, the general effect of carbon dioxide and temperature change on insects include the direct effects of carbon dioxide and temperature on different life history traits such as developmental time (which affects the annual number of generations) and metabolic rate (which affects activity levels, longevity, and fecundity).

ROLE OF ROOT BORDER CELL IN DEFENCE OF BIOTIC AND ABIOTIC STRESSES CONDITION

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Abstract

Root tips of most plant species produce a large number of cells which are programmed to separate from the root cap and from each other to be released into the external environment. These are called root border cells may be abrogative as RBC. The RBC were earlier referred to as "sloughed root cap cells" because it was believed that these cells were dead. Recently, more and more evidences have revealed that sloughed root cap cells, whose development is genetically regulated are biologically viable (>90%) in the majority of higher plant species and playing multi-defense roles during plant growth and development. Plants have different defense mechanisms in order to prevent infections from soil-borne pathogens. One of these defense mechanisms is carried out by border cells and their exudates. Border cells and mucilage accumulate on root tips in the absence of free water. As soon as the root tip is immersed in the water, the mucilage swells dramatically and border cells disperse quickly into suspension within 30 to 60 seconds. These can be isolated by gentle agitation. The present investigation deals with some aspects of RBC of *Zea mays* L. (1)Enumerate the release of border cells from *Zea mays*.(2)Effect of exposure to cadmium (as CdSO₄) on the release of border cells.(3)Influence of culture filtrates of *Aspergillus niger* on release of border cell from *Zea mays* roots The maize plant (*Zea mays* L.) variety Pioneer was selected to carry out the present study as in Western Uttar Pradesh maize crop is cultivated in major proportion in comparison to pea, which is a model system for the study of border cells release and were selected by many workers for their studies previously. Different concentrations of heavy metal cadmium (as CdSO₄.7H₂O) *i.e.* 0.5, 1.0, 2.0, 3.0 ppm, were used to evaluate the effect of Cd stress. Also, different sets were exposed to different dilutions (1:100, 1:1000 and 1:10000) of filtrate of 7 days old culture of *Aspergillus niger* separately to assess the response of border cells to fungal metabolites. The seeds of four varieties of maize *i.e.* African tall,



K-25, Virat, and pioneer, which are locally cultivated in Meerut U.P. were sown in sterilized Petri dishes using routine methods. Pioneer variety was selected for further experiments because of maximum root length as well as numbers of border cells released, as compared to other 3 varieties. The results of the present studies indicate that border cells might be involved in protecting radicle from biotic and abiotic stresses, especially in the early stages of growth.

THE ROLE OF WOMEN IN SOCIO-POLITICAL AND ECONOMIC ASPECTS OF AGRICULTURE

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Abstract

Women play a critical and multifaceted role in agriculture, contributing significantly to its socio-political and economic dimensions. They serve as primary caregivers, ensuring the well-being and food security of their families, while also possessing extensive knowledge of agricultural practices that they pass down to future generations. Women actively participate in community organizations, promoting social cohesion, knowledge exchange, and collective decision-making. Increasing women's participation in decision-making processes is crucial for sustainable agricultural development, but they face systemic barriers and discriminatory norms. Addressing these challenges requires policy interventions that promote gender equality and provide women with access to resources and services. Economically, women contribute to agricultural production, but their contributions often go unrecognized and undervalued, leading to income disparities. Empowering women economically involves improving their access to financial services, training, and technology. Recognizing and empowering women's roles in agriculture is essential for sustainable development, as it enhances productivity, reduces poverty, and improves food security. Achieving inclusive and resilient agricultural systems requires promoting gender equality and women's participation in decision-making processes. Embracing the transformative potential of women in agriculture benefits both women and society as a whole.

SUSTAINABLE UTILISATION OF AGRICULTURE RESIDUES FOR THE PRODUCTION OF BIOFUELS AND OTHER VALUE ADDED PRODUCTS

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Abstract

Attempts throughout the world are underway to develop biofuel from agricultural residues to counter the problem of environment as well as scarcity of raw material. Agricultural residues are a rich source of reducing sugars beside other organic and inorganic chemicals. Different agricultural residues like sugarcane bagasse, rice and wheat straw were used in this study to attain the reducing sugars. A bio-refinery system was developed to extract as many as possible products from processing of the agricultural residues. The pentose and hexose sugars from the agricultural residues were recovered by acid hydrolysis and enzymatic treatment. These sugars were then used for the production ethanol. Two to four percent with a mean of three percent reducing sugars was recovered from different agriculture residues. Co-fermentation with *Saccharomyces cerevisiae* and *Pichia stipitis*, with a mean yield of 1.1% ethanol was achieved along with 3% pure lignin, 15% gypsum and 500 ml water. These results clearly show that agricultural residues have a potential to be used as raw material for the production of biofuel and other value added products.

IMPACT OF REGULAR PHYSICAL FITNESS AND YOGA CLASSES ON SELECTED PHYSICAL FITNESS AND PHYSIOLOGICAL PARAMETERS OF FEMALE STUDENTS

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Abstract

Scientific methods of doing regular physical activity promotes growth and development and it has multiple benefits for



physical, physiological, mental, and psychosocial health that significantly contribute to learning. Physical exercise is a subset of physical activity and it is scientifically planned, structured and repetitive in nature which is designed to target a particular outcome, for example, cardiorespiratory capacity or components of fitness. Yoga asanas are scientific oriented in nature and regular practice increases the physical strength, stamina and flexibility, improve blood circulation, enhance posture and muscle tone. Based the above concepts the present study aims to find out the impact of regular physical fitness and yoga classes on selected physical fitness and physiological parameters of female collegiate students of University of Agricultural Sciences, Raichur campus. Total 62 female students were selected from both College of Agriculture and Agriculture Engineering on random basis and their age ranged between 17-19 years. The physical fitness parameters abdominal strength, explosive strength, shoulder strength, flexibility and agility and physiological parameters body mass index, resting heart rate and breath hold capacity were chosen as criterion measures. The physical fitness and physiological parameters tests like bent knee sit-ups, standing board jump, push-ups, sit & reach test, shuttle run test, carotid & ulna pulse test, height and weight measures and breath hold test were selected to collect the data. The pre-test data of female college students were taken 3 months prior to the regular physical fitness and yoga classes and post-test data were taken in vice-versa. To examine the effect of regular physical fitness and yoga classes on selected physical & physiological parameters of students, t-test was applied and level of significance was set at .05 levels. The results have shown significant changes between two stages of tests for abdominal strength, shoulder strength, explosive strength, flexibility and agility performances. Further, significance changes in the resting pulse rate, breath hold capacity and body mass index composition measures were observed. Similar, findings were found by Cowen & Adams (2005) reported significant improvements in upper body and trunk between the means of selected physical variables muscular strength (dynamic) & muscular endurance of arm & shoulders; speed and agility; explosive strength of leg; speed of lower extremities & explosive strength; cardio-vascular endurance) of physical education students, as t-value were significant. Raub (2002), reported after his study that yoga can improve strength and flexibility. Ray et al. (2001), also reported that shoulders, hip, trunk and neck flexibility improved due to yogic exercises. The regular physical fitness and yoga classes have significant impact on physical fitness and physiological parameters of female college students.

ARTIFICIAL INTELLIGENCE IN PLANT AND SOIL NUTRIENT DEFICIENCY DETECTION

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Abstract

Agriculture is the linchpin of economic sustainability, propelling long-term growth and structural transformation. Meeting a 70% surge in agricultural production to satisfy a burgeoning population necessitates a shift from relying on unused lands (10%) to intensifying current production (90%). However, this swift intensification poses challenges, contributing to soil health degradation, nutrient depletion, and escalated pest and disease issues, culminating in diminished fertility and productivity. To surmount these challenges, the integration of advanced technologies becomes imperative. Artificial Intelligence (AI), coupled with IoT and cloud computing, emerges as a transformative force. AI involves crafting intelligent machines and computer programs, revolutionizing farming practices. Addressing crop nutritional status is pivotal, given the repercussions of nutrient imbalances on crop health and yield. Accurate assessments prevent losses, curbing financial waste and minimizing environmental impacts, including soil quality deterioration. AI's learning capabilities are harnessed globally to solve diverse agriculture-related problems. Innovative solutions include Agriculture robots like RAWBOT, AGROPAD for soil testing, SPAD meter, Green Seeker, and mobile apps like PalmHAND, enabling on-the-go diagnosis of nutrient deficiencies in oil palm plantations. Real-time N management, web-based expert systems for maize and rice, and SoilMATTic-an Automated Soil Nutrient and pH Level Analyzer—employing Digital Image Processing and Artificial Neural Network, exemplify AI's multifaceted applications in agriculture. AI's pivotal role extends to precision farming, incorporating soil mapping, interpreting vegetation indices, and predicting yields. It facilitates real-time crop monitoring, addressing challenges like nutrient deficiency detection and aiding in site-specific nutrient management. In essence, AI is a fusion and application of cutting-edge science and technology in agriculture, revolutionizing the industry to meet the demands of a dynamic and growing world.



STUDY OF SIMPLE MEASURES OF GENETIC VARIABILITY PARAMETERS IN F_{2:3} POPULATIONS OF COWPEA (*VIGNA UNGUICULATA* L. WALP.)

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Abstract

Two F_{2:3} populations of cowpea were evaluated for 10 different quantitative traits during *summer* 2021 to study genetic variability parameters. Analysis of variance revealed significant differences among all the segregants of the population for most of the traits studied. High phenotypic coefficient of variance and genetic coefficient of variance were recorded for plant height, number of primary branches/plant, dry matter/plant and seed yield/plant in F_{2:3} population of VBN-1 × RC-19; number of primary branches/plant, number of pods/plant, dry matter/plant and seed yield/plant in F_{2:3} population of KBC-9 × PGCP-6. High heritability and GAM were recorded for plant height, number of primary branches/plant, number of pods/plant, pod length, number of seeds/pod, dry matter/plant and seed yield/plant in the F_{2:3} population of VBN-1 × RC-19; plant height, number of primary branches/plant, number of pods/plant, number of seeds/pod, dry matter/plant and seed yield/plant. This indicates the scope for improvement of these characters through selection.

STUDIES OF SKEWNESS, KURTOSIS AND TRANSGRESSIVE SEGREGANTS IN F_{2:3} POPULATIONS OF COWPEA (*VIGNA UNGUICULATA* L.)

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Abstract

The present investigation was carried out to study gene action and pattern of inheritance of different traits in cowpea. Two different F₃ segregating generation of crosses viz., VBN-1 × RC-19 and KBC-9 × PGCP-6 were studied during *summer* 2021 using augmented random block design at College of Agriculture, Kalaburagi. Data were recorded on 10 different quantitative traits. Transgressive segregants with values exceeding the better parent were observed in both the F_{2:3} populations for seed yield. In both the populations, negative skewness was observed for days to initiation of flowering, days to physiological maturity and number of pods/plant whereas test weight exhibited positive skewness suggesting a mild and intense selection would be sufficient to gain maximum genetic-gain in negatively and positively skewed traits, respectively. In both the F_{2:3} populations, positive kurtosis was observed for number of branches/plant, test weight and dry matter content/plant indicating that these traits are governed by fewer numbers of genes.

GENETIC RELATIONSHIP STUDIES FOR SEED YIELD AND OTHER IMPORTANT AGRONOMIC TRAITS IN F_{2:3} POPULATIONS OF COWPEA (*VIGNA UNGUICULATA* L.)

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Abstract

The present investigation on genetic relationship studies for seed yield traits in F_{2:3} populations of cowpea involving VBN-1 ×



RC-19 and KBC-9 × PGCP-6 was carried during *summer* 2021. The results revealed that seed yield/plant recorded significant and positive correlation with pods/plant, seeds/pod, pod length, test weight and total dry matter content/plant in F_{2:3} population of VBN-1 × RC-19; pods/plant seeds/pod, pod length, test weight and total dry matter content/plant in F_{2:3} population of KBC-9 × PGCP-6 indicating the importance of these traits in improvement of cow pea yield. Pods/plant registered significant and positive association with seeds/pod and total dry matter content/plant in F_{2:3} population of VBN-1 × RC-19. Seeds/pod recorded significant and positive association with pods/plant, pod length and total dry matter content/plant and test weight registered significant and positive association with total dry matter content/plant in F_{2:3} population of KBC-9 × PGCP-6. Seed yield/plant recorded negative association with primary branches/plant in F_{2:3} population of VBN-1 × RC-19 and plant height in F_{2:3} population of KBC-9 × PGCP-6 which suggested that selection for these traits is not rewarding for yield improvement.

MODELLING SOIL MOISTURE USING SATELLITE REMOTE SENSING: A COMPARATIVE APPROACH EMPLOYING MLR AND ANN

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Abstract

Satellite remote sensing has been widely applied to estimate soil properties such as soil moisture. For the arid and semi-arid district of Devbhumi Dwarka in Saurashtra region of Gujarat, where soil moisture is utmost important factor for agriculture; a GIS-based approach was needed to develop regional model for estimation of surface soil moisture. In this study, Landsat and Sentinel data were used to develop multiple soil moisture indices. Using these spectral indices, multiple linear regression (MLR) and artificial neural network (ANN) models were developed using actual measured soil moisture data. Satellite imagery data of Landsat and Sentinel of second week of November 2022 were used to develop spectral indices. Total of 174 samples were collected from 3,77,731 ha study area. Values of soil moisture content were ranging from 3.40 % to 12.50 % with a mean value of 8.42 %. Maps of soil moisture indices i.e. LST, NDVI, NDWI/LSWI, NDDI, NSDSI3, MI and VSWI were generated on 1:550000 scale using ArcMap software. Best MLR model developed using Landsat data used LST, NDWI, MI and NSDSI3; and gave RMSE, R² and NRMSE of 0.94 %, 0.68 and 0.11 for calibration and 0.86 %, 0.61 and 0.10 for testing, respectively. Best ANN model developed using Sentinel data (8-14-1) used NDVI, NDWI, MI, NSDSI3, B, G, NIR and R as inputs; and gave RMSE, R² and NRMSE values of 0.85 %, 0.73 and 0.10 for calibration and 1.11 %, 0.54 and 0.13 for testing, respectively.

GENETIC DIVERSITY STUDIES IN M₅ GENERATION OF RABI SORGHUM (*SORGHUM BICOLOR* (L.) MOENCH)

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Abstract

The present experiment was conducted to study genetic diversity studies in 200 mutant lines of M₅ generation of sorghum along with seven checks during *rabi* 2021 in augmented block design. Seeds were induced through both physical and chemical mutagens, in which gamma radiation is an important tool for inducing the genetic variability. 1% Sodium azide is utilized as induced mutation in sorghum for enhancing germination rate, root length, shoot length, bold seeds and yield attributing traits.



15 observations were recorded viz., SPAD 45, SPAD 90, Days to 50% flowering, Days to maturity, Number of leaves, Stem girth, Plant height, Panicle length, Panicle width, Panicle weight, 100-seed weight, fodder yield, grain yield per plant, leaf length and leaf breadth on five randomly selected mutant plants in each entry. Mahalanobis D^2 statistics was applied to all 200 mutants and which classified the total mutants into eight clusters. The analysis of cluster pattern showed that, highest number of mutants were present in cluster-I (143), followed by cluster-II (38), cluster-III (10), cluster-IV (10), and cluster-V (3), while cluster-VI, cluster-VII and cluster-VIII were solitary. The maximum inter cluster distance was recorded between cluster-V and cluster-VII (46456.09), followed by cluster-I and cluster-VII (38323.85). The results showed that grain yield (15.50%) contributed the highest per cent to divergence, followed by fodder yield with 12.54 per cent, panicle length with 8.54 per cent, leaf number with 8.00 per cent, stem girth with 7.04 per cent, leaf length with 7.00 per cent, plant height with 6.54 per cent and panicle width with 6.52 per cent.

THE ASSOCIATION STUDIES BETWEEN YIELD AND ITS ATTRIBUTING TRAITS IN M₅ GENERATION OF RABI SORGHUM (*SORGHUM BICOLOR* (L.) MOENCH.)

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Abstract

The experiment was executed in Agricultural Research Station, Hagari during *rabi* 2021. The study was conducted in augmented design to ascertain the path analysis in 200 sorghum mutant lines of M₅ generation. The positive significant correlation with grain yield were shown by viz., number of leaves, stem girth, plant height, panicle length, panicle width, panicle weight, 100-seed weight, leaf length, leaf breadth and fodder yield at phenotypic level. Among these traits panicle weight ($r=0.9528$) showed highest positive association with grain yield followed by fodder yield (0.9495), leaf length (0.9408) respectively. Nine out of fourteen traits studied reveals that positive and direct effect on grain yield at phenotypic level. The traits like, panicle weight (0.4300), leaf length (0.3991), fodder yield (0.1552), days to maturity (0.0454), leaf breadth (0.0290), number of leaves (0.0202), SPAD 45 (0.0143), plant height (0.0109) and 100-seed weight (0.0003). These traits play a greater role in selection of desirable mutants and in turn improvement of these traits will effectively increase the grain yield.

BIOLOGICAL ATTRIBUTES OF NIGER APHID, *UROLEUCON COMPOSITAE* (HEMIPTERA: APHIDIDAE) UNDER LABORATORY CONDITION

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Abstract

The investigation into the biology of the Niger aphid, *Uroleucon compositae*, has revealed important insights into the developmental stages and morphological characteristics of this insect. The study found that the nymph of *U. compositae* goes through four distinct instars before reaching the adult stage. In the first nymphal instar, the aphid is wingless, elongated, delicate, and pale brownish in colour. It possesses small compound eyes located just behind the base of the antennae, which appear reddish to black. The first-instar nymph's measurements indicate a length of approximately 0.85 ± 0.04 mm and a breadth of 0.36 ± 0.03 mm. The antennae are relatively long, with five segments measuring about 0.88 ± 0.05 mm. The three pairs of well-developed, light brown thoracic legs are uniformly covered with hairs, and their lengths are 0.688 ± 0.005 mm (front), 0.824 ± 0.007 mm (middle), and 0.950 ± 0.020 mm (hind). The first instar nymphal period lasts for 2.43 ± 0.67 days. In the second nymphal instar, the aphid darkens in colour, becoming dark brown, oval, and slightly bulged in shape. The compound eyes have three dot-like ommatidia at the posterior end. The nymph measures 1.22 ± 0.06 mm in length and 0.56 ± 0.03 mm in breadth. The antennae are shorter than the body, with five segments, and their length is 1.08 ± 0.03 mm. The leg



lengths are 0.885 ± 0.014 mm (front), 0.972 ± 0.024 mm (middle), and 1.196 ± 0.023 mm (hind). Hairs are observed on all three pairs of legs, and the cornicles are distinct and cylindrical in shape. The second instar nymphal period lasts for 2.6 ± 0.55 days. In the third nymphal instar, the aphid darkens further to a dark brown colour. The compound eyes become larger, rounder, and reddish-black, and the antennae consist of six segments. The nymph's length is 1.55 ± 0.12 mm, and its breadth is 0.77 ± 0.06 mm. The antennal length measures 1.43 ± 0.06 mm. The leg lengths are 0.983 ± 0.030 mm (front), 1.165 ± 0.010 mm (middle), and 1.912 ± 0.028 mm (hind). The cornicles and cauda are dark brown. The duration of the third nymphal instar is 2.10 ± 0.70 days. In the fourth nymphal instar, the aphid appears blackish in colour and elongated in shape. The compound eyes are expanded and remain black to reddish, and the antennae are six-segmented. The length and breadth of the fourth nymphal instar are 2.65 ± 0.05 mm and 0.94 ± 0.03 mm, respectively. The antennae measure 2.41 ± 0.05 mm in length. The legs are stout, with the coxa, trochanter, distal area of the femur, and tibia being dark brown, while the remaining portions are light in colour. The leg lengths are 1.524 ± 0.043 mm (front), 1.815 ± 0.063 mm (middle), and 2.353 ± 0.106 mm (hind). The duration of the fourth instar is 2.30 ± 0.64 days. The total nymphal period for *U. compositae* is 9.43 ± 1.08 days. The adult aphid is shiny and dark black in colour, with a spindle-like to elongated pyriform body. The compound eyes are bulged and reddish-black. Alate adults are similar to apterous adults. The morphometrics of the adult reveal a length of 2.86 ± 0.04 mm and a breadth of 1.25 ± 0.03 mm. The antennae measure 2.68 ± 0.02 mm in length, and the leg measurements are 2.222 ± 0.076 mm (front), 2.328 ± 0.032 mm (middle), and 2.897 ± 0.099 mm (hind). The hind legs are particularly long and stout. The adult lifespan is 9.90 ± 0.98 days. The adult life cycle consists of pre-reproduction, reproduction, and post-reproduction periods, which last for 1.13 ± 0.76 , 7.76 ± 1.23 , and 1.00 ± 0.63 days, respectively. During the reproduction period, *U. compositae* exhibits a fecundity of 52.70 ± 8.41 nymphs, and the total lifespan is 19.33 ± 1.32 days.

INDUCED MUTATION STUDIES FOR IMPROVEMENT OF SEED YIELD IN COWPEA (*VIGNAUNGUICULATA* L.)

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Abstract

Cowpea (*vignaunguiculata* L.) commonly known as black eyed pea, is an important legume crop valued for its high protein content and dry matter content. The experiment was carried out with an objective to assess genetic variability in M_1 and M_2 generation in the cowpea varieties KBC-2 and KBC-9 by a physical mutagen (Gamma rays) and chemical mutagen (Sodium Azide). Progressive decrease in germination and survival with increase in gamma rays and Sodium Azide dose were recorded in M_1 . Stimulatory and inhibitory effects were noticed in quantitative characters with lower and higher doses, respectively. For all the characters under study in both the generations, phenotypic coefficient of variation was higher in magnitude than genotypic coefficient of variation. High GCV as well as PCV was obtained in M_1 and M_2 generation for traits number of primary branches per plant, seed yield per plant and seed yield per plot. High heritability estimates in coupled with high genetic advance expressed as percent of mean was recorded in seed yield per plant in M_1 as well as M_2 generation.

INDUCE PHYSICAL AND CHEMICAL MUTAGENESIS FOR IMPROVEMENT OF YIELD ATTRIBUTING TRAITS AND CORRELATION ANALYSIS IN COWPEA (*VIGNAUNGUICULATA* L.)

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Abstract

In the present investigation the dry and healthy seeds of cowpea varieties KBC-2 and KBC-9 mutagenised through gamma rays (30, 40 and 50 kR) and sodium azide (0.03, 0.04 and 0.05 %) respectively were evaluated for induced magnitude and directional changes in the associations and correlations in M_2 generation. Correlation studies for all the possible associations among characters in M_2 generation showed clearly that the mutagenic treatments have succeeded in generating more favourable associations between various components of yield. The magnitude and direction of change induced by a particular



treatment varied according to variety and the mutagen used. Correlation analysis showed that seed yield per plant exhibited positive and significant association with plant height (0.463), number of primary branches (0.585), number of secondary branches (0.343), number of pods per plant (0.931), pod length (0.6620), number of seeds per pod (0.927), test weight (0.743), dry matter (0.899), harvest index (0.950). In contrary to this it was significant and negatively correlated with days to initiation of flower (-0.359), days to 50% flowering (-0.413), days to maturity (-0.510).

ASSESSMENT OF VARIABILITY PARAMETERS AND TRAIT ASSOCIATION IN MAIZE POPULATIONS FOR YIELD AND QUALITY TRAITS

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Abstract

Of all the cereal crops grown worldwide, maize is the only one that can be grown in a variety of seasons in tropical and subtropical areas. Maize grain yield is a complicated trait that is genetically controlled by a large number of genes with moderate genetic effects, and is further complicated by substantial interactions between genotype and the environment. Adequate variation in any crop population provides options from which selections are made for improvement and possible hybridizations. Phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) provides the extent of variability in the population. Heritability gives the extent of trait transmission to the next generation. Selection is effective if the traits show high heritability and high genetic advance. Heritability and genetic advance give the type of gene action involved in governing the trait and suggests practicing appropriate breeding program. Through the use of proper selection indices, a thorough understanding of the interaction between grain yield and its contributing components can greatly increase the effectiveness of a breeding program. Hence, the present study was focused to assess the variability for characters on the grain yield in F_2 population of maize. Ten QPM three way cross hybrids were developed during *Rabi* 2021-22 viz., HQPM 45, HQPM 46, HQPM 47, HQPM 48, HQPM 49, HQPM 50, HQPM 51, HQPM 52, HQPM 53 and HQPM 54 using different QPM lines with the aim of hybridization to increase the genetic diversity for several quantitative traits of maize, were evaluated during *Kharif* 2022. Simultaneously part of this F_1 seed is further selfed to develop F_2 seed of these three way cross hybrids aimed to develop segregating populations of these hybrids in *Kharif* 2022. On the basis of performance of these hybrids, HQPM 46 and HQPM 50 hybrid possesses high grain yield 76.52 q/ha, 0.77% tryptophan, and fodder yield 328 q/ha over the standard checks HQPM 1 (67.05 q/ha, 0.78 % tryptophan and fodder yield 305.08 q/ha) and 76.27 q/ha, 0.80 % tryptophan and 340.24 q/ha fodder yield) respectively. During *Rabi* 2022-23, best selfed cobs of these two hybrids were taken and F_2 population comprising of 220 and 225 seeds of hybrids HQPM 46 and HQPM 50 respectively, were sown for evaluation in alpha lattice design. The F_2 population is a segregated population and it is expected that some traits will have wide genetic diversity. The genetic material was evaluated under un-replicated fashion with a spacing of 60×20cm. Parents and F_1 along with the F_2 population were evaluated and observations were made on yield and quality traits to study the variability parameters and trait association. The data on overall mean and range of F_2 revealed that in general all characters varied for two crosses. The pertinent data on range of F_2 population revealed that cross HQPM 46 possessed highest range for plant height (103-238 cm), ear height (50-103 cm), cob length (12.6-17.0 cm), number of grains per cob (206-502), grain yield per plant (43.73-124.35 g) and protein content (8.20-11.50 %) as well as had lowest range for days to 50 % tasselling (50-59), days to 50 % silking (53-62) and 100 grain weight (19.35-26.30 g). The highest range for shelling % was reported for cross HQPM 50; in addition this cross also possessed lowest range for cob diameter (3.8-4.4 cm) and number of grains per cob (216-478). The broad sense heritability was greater than narrow sense heritability for all traits studied in the crosses and indicated that the environment had an important role in the expression of these traits. For all traits studied in crosses narrow sense heritability values were lower than those of broad sense indicating that most of genetic variance was due to non-additive effects *i.e.*, dominance and/ or epistasis. In general, high estimates of broad sense heritability were observed for all the traits studied, except tryptophan content in cross HQPM 46 which showed moderate levels of heritability in broad sense. The highest genetic advance for days to maturity (5.08), plant height (20.54), and grain yield per plant (13.39), protein content (2.01) and oil content (15.60) was recorded in cross HQPM 46. For grain yield per plant the highest (16.09%) genetic advance as percent of mean was observed in cross HQPM 46 followed by (11.85%) in cross HQPM 50. There is enough scope for selection based on these characters and the diverse genotypes can provide materials for a sound breeding program.



STUDIES ON ANTIOXIDANT AND ANTIBACTERIAL ACTIVITIES OF *HYOSCYAMUS NIGER* LEAF

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Abstract

Hyoscyamus niger (Black Henbane) belongs to Solanaceae family and used as medicinal herb since ancient time. *H. niger* used to treat psychiatric disorders, insomnia, asthma, dental caries etc. Leaves of *H. niger* was collected from Spiti Valley of Lahaul and Spiti District of Himachal Pradesh. In present work antioxidant and antibacterial activities of acetone and methanol extracts of *Hyoscyamus niger* leaf were examined. Antioxidant activity was evaluated by using DPPH free radical scavenging activity and Reducing power assay, while antibacterial activity was studied by using Disk diffusion method. Antioxidant test results in terms of IC₅₀ and EC values revealed that the plant have some extent of antioxidant potential, also plant extracts depicted inhibition of growth of selected pathogenic bacteria.

ASSESSMENT OF GENETIC HERITABILITY, VARIABILITY AND GENETIC ADVANCE FOR YIELD AND QUALITY PARAMETERS IN SORGHUM GERMPLASM

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Abstract

This study investigates the genetic heritability, variability, and genetic advance associated with yield and quality parameters in sorghum germplasm. Through comprehensive assessment, the research aims to provide valuable insights into the underlying genetic factors influencing sorghum traits, contributing to informed breeding strategies for enhanced crop productivity and quality. In this experiment 60 accessions from the sorghum germplasm were used as experimental material, in which some of them were wild races, local cultivars, etc. which were planted in Randomized block design with 2 replications in Kharif season(2023). This germplasm will be further used for estimating zinc, iron, phytic acid and inorganic phosphorous contents which will be beneficial for crop improvement and breeding programmes. The main objective of this research work is to determine the potential lines in quality parameters as well as quantitative parameters which will be profitable for breeding and crop improvement programmes.

APPLICATION OF QR CODES FOR EMPOWERING FARMING COMMUNITY

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Abstract

This module explores an innovative strategy for pest management tailored to the needs of illiterate farmers in rural communities. Recognising the challenges posed by limited literacy, our approach centers on a pictorial magazine designed to empower farmers to identify and combat insect pests affecting their crops. The magazine viz. AGNI-M (Agri Guard Novus Informer Magazine) integrates images illustrating common pests and the associated crop damage, allowing farmers to compare symptoms visually. Moreover, it not limited to pest management and can also be applied to various branches like pathology, nutrient deficiencies, dissemination of information, recommendations and innovations. To enhance accessibility, each pest is associated with a unique QR code, strategically placed within the magazine. When scanned, these QR codes link to short instructional videos demonstrating effective pest control solutions. The videos are crafted to be concise, informative, and culturally relevant, ensuring comprehension without relying on written instructions. Feedback from participating farmers highlights the magazine's user-friendliness, the effectiveness of visual aids, and the practicality of the QR code-linked



instructional videos. The study also investigates the socio-economic impact of improved pest management on crop yields and overall agricultural sustainability. In conclusion, this research paper outlines a holistic and visually oriented pest management solution tailored for illiterate farmers. By combining pictorial representation, QR code technology, and instructional videos, this approach not only addresses literacy barriers but also promotes sustainable farming practices within resource-constrained communities. The findings contribute valuable insights to the broader discourse on inclusive agricultural interventions and empower marginalized farming populations to mitigate the impact of insect pests on their livelihoods.

ASSESSING GENETIC VARIABILITY AND CORRELATIONS IN ADVANCED BREEDING LINES OF CHICKPEA (*CICER ARIETINUM* L) FOR SUSTAINABLE CROP IMPROVEMENT

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Abstract

An experiment was carried at ZARS, Kalaburagi, during Rabi 2022–23 to study the genetic variability, heritability, genetic advance, and the relationship between various yield components and correlation on seed yield and yield attributing traits. The study was taken up with 14 genotypes which includes Advance Breeding Lines and released variety as check genotypes, planted in Randomized complete block design with three replications. The study of genetic variability for phenological traits, seed yield and quality traits has indicated that all characters are not influenced by the environment to the same extent. High heritability coupled with high to moderate genetic advance was observed for days to first flowering, duration of 50 per cent flowering, duration of vegetative phase, duration of reproductive phase, leaf area index, number of branches per plant, number of pods per plant, harvest index, seed yield per plant, 100 seed weight, hydration capacity, swelling capacity and cooking time. This is also indicative of the prevalence of additive gene action in their inheritance; hence, breeders can exploit these traits through phenotypic selection. In the present study number of pods per plant and the number of branches per plant were key traits that exhibited a highly significant association with seed yield while swelling capacity, hydration capacity and cooking time are positively associated with 100 seed weight. Thus, breeders can exploit additive gene effects; transgressive segregation would be fruitful for further genetic improvement in chickpea and it is possible to develop high yielding chickpeas genotypes with faster cooking time. Finally, this investigation should be repeated over years and locations to confirm future breeding program.

PRESCIENCE OF TRAIT ASSOCIATION AND GENETIC DIVERGENCE AMONG GERMPLASM LINES FOR YIELD AND IT'S COMPONENT TRAITS IN COTTON (*GOSSYPIMUM HIRSUTUM* L.)

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Abstract

Cotton is the sacred and valuable gift of nature to mankind. India has been the traditional home for cotton and cotton textiles. A comprehensive knowledge of genetic basis of quantitative traits is of prime importance in understanding the genetic potential of germplasm accessions and its use in crop improvement. The current study was focused on unravelling the genetic basis for seed cotton yield and yield attributing traits with an emphasis on isolating most potential germplasm accessions. A set of 192



cotton germplasm accessions were evaluated for two seasons and two environments. The correlation reveals the nature of relationship between yield and its component traits which helps the breeder to design selection strategies in plant breeding. The results of correlation analysis indicated the presence of significant and positive correlation between seed cotton yield with number of sympodia per plant, number of bolls per plant and lint yield. The appraisal of genetic diversity is important to understand its pattern and evolutionary relationship between germplasm. The diversity analysis categorized germplasm accessions into 8 different clusters. These results indicated the existence of adequate genetic diversity among the germplasm lines which can be exploited to manifest higher magnitude of heterosis through hybridization of genotypes belonging to different clusters.

CONTRIBUTION OF TRAITS FOR POD YIELD IN GROUNDNUT (*ARACHIS HYPOGAEA*) GERMPLASM

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Abstract

Correlation and path co-efficient analysis were carried out for pod yield and its attributing traits in 105 groundnut germplasm. The pod yield per plant had highly significant and positive correlation at phenotypic level with kernel yield per plant, number of matured pods per plant, harvest index, hundred kernel weight, hundred pod weight, haulm yield per plant, oil content and days to 50 percent flowering. Path analysis revealed that days to maturity, number of matured pods per plant, hundred pod weight, haulm yield per plant, kernel yield per plant and harvest index exhibited positive direct effects on pod yield. Hence, these are most important traits which could be used as selection criteria for effective improvement of pod yield.

INSIGHTS INTO GENETIC VARIABILITY AND CORRELATION IN F₂ POPULATION OF TOMATO (*SOLANUM LYCOPERSICUM* L.)

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Abstract

Tomato (*Solanum lycopersicum* L.) is economically most important vegetable crop and indispensable part of every Indian kitchen. There will be a higher risk for yield loss and quality deterioration whenever we are facing threats like various kinds of biotic and abiotic stresses due to a lack of genetic variability. The same plant breeding tools can be used for recovering the lost variability as the breeding strategies themselves responsible for loss of variability. Genetic variability can be created by various strategies and hybridization has got unique place in creating the variability as F₂ Provide immense amount of variability to select the desirable one. The degree of association among the various traits under study says the correlation between each pair of traits. Correlation study helps one to select the genotype with combined advantage of one or more traits. The experiment was conducted during *kharif* 2021 with the F₂ population comprised of 280 individuals and the experiment was laid in un-replicated design. The traits under the study were days to 50% flowering, number of fruits per plant, average fruit weight and fruit yield per plant. High variability was witnessed due to the higher values of PCV and GCV for all the traits except days to 50% flowering in which the moderate variability was observed. High heritability (>60%) coupled with high genetic advance as a percent of the mean (>20%) were recorded for all the traits under the study. So, the exposed variability eases the plant breeder to opt the promising genotype. Correlation indicated that yield per plant was significantly and positively associated with average fruit weight and number of fruits per plant. Direct selection can be executed considering these traits as the main selection criteria to enhance the yield.



GENETIC DIVERSITY STUDIES IN M₅ GENERATION OF *RABI* SORGHUM (*SORGHUM BICOLOR* (L.) MOENCH)

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Abstract

The present experiment was conducted to study genetic diversity studies in 200 mutant lines of M₅ generation of sorghum along with seven checks during *rabi* 2021 in augmented block design. Seeds were induced through both physical and chemical mutagens, in which gamma radiation is an important tool for inducing the genetic variability. 1% Sodium azide is utilized as induced mutation in sorghum for enhancing germination rate, root length, shoot length, bold seeds and yield attributing traits. 15 observations were recorded viz., SPAD 45, SPAD 90, Days to 50% flowering, Days to maturity, Number of leaves, Stem girth, Plant height, Panicle length, Panicle width, Panicle weight, 100-seed weight, fodder yield, grain yield per plant, leaf length and leaf breadth on five randomly selected mutant plants in each entry. Mahalanobis D² statistics was applied to all 200 mutants and which classified the total mutants into eight clusters. The analysis of cluster pattern showed that, highest number of mutants were present in cluster-I (143), followed by cluster-II (38), cluster-III (10), cluster-IV (10), and cluster-V (3), while cluster-VI, cluster-VII and cluster-VIII were solitary. The maximum inter cluster distance was recorded between cluster-V and cluster-VII (46456.09), followed by cluster-I and cluster-VII (38323.85). The results showed that grain yield (15.50%) contributed the highest per cent to divergence, followed by fodder yield with 12.54 per cent, panicle length with 8.54 per cent, leaf number with 8.00 per cent, stem girth with 7.04 per cent, leaf length with 7.00 per cent, plant height with 6.54 per cent and panicle width with 6.52 per cent.

SYNTHETIC PROMOTERS FOR PRECISE CONTROL OF GENE EXPRESSION IN PLANTS

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Abstract

Promoters are DNA regions that link with RNA polymerase to influence the frequency and site of transcription beginning. Promoters are used in agricultural research to develop transgenic methods for boosting crop production. Synthetic promoters that have recently been developed and have particular properties are becoming an effective tool for plant molecular biology. In order to create synthetic promoters, a variety of techniques have been employed, including the hybridization technique, site-directed mutagenesis, shuffling, bi-directionalization, and linker-scanning mutagenesis. Specially, Cis-motif engineering is a method for adjusting the number, spacing, and location of important cis components. The evolution of highly specialized synthetic promoters with the ability to drive gene expression in a carefully controlled manner has been made easier by recent developments in bioinformatics technologies. Synthetic promoters are adaptable tools for gene-based plant alterations and have the potential to greatly contribute to the production of a wide variety of plants with added value. Synthetic promoter technology advancements are greatly enhancing crop production and promoting sustainable agriculture. The development of effective synthetic promoters could be substantially accelerated by improvement in bioinformatics, detailed investigations of plant transcription factor networks and the elucidation of the functions of novel cis and transacting elements.



THE ASSOCIATION STUDIES BETWEEN YIELD AND ITS ATTRIBUTING TRAITS IN M₅ GENERATION OF RABI SORGHUM (*SORGHUM BICOLOR* (L.) MOENCH)

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Abstract

The experiment was executed in Agricultural Research Station, Hagari during *rabi* 2021. The study was conducted in augmented design to ascertain the path analysis in 200 sorghum mutant lines of M₅ generation. The positive significant correlation with grain yield were shown by viz., number of leaves, stem girth, plant height, panicle length, panicle width, panicle weight, 100-seed weight, leaf length, leaf breadth and fodder yield at phenotypic level. Among these traits panicle weight ($r=0.9528$) showed highest positive association with grain yield followed by fodder yield (0.9495), leaf length (0.9408) respectively. Nine out of fourteen traits studied reveals that positive and direct effect on grain yield at phenotypic level. The traits like, panicle weight (0.4300), leaf length (0.3991), fodder yield (0.1552), days to maturity (0.0454), leaf breadth (0.0290), number of leaves (0.0202), SPAD 45 (0.0143), plant height (0.0109) and 100-seed weight (0.0003). These traits play a greater role in selection of desirable mutants and in turn improvement of these traits will effectively increase the grain yield.

EXPLORING GENETIC VARIABILITY PARAMETERS OF RICE (*ORYZA SATIVA* L.) GENOTYPES UNDER KHARIF CONDITION IN HYDERABAD-KARNATAKA REGION

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Abstract

The present study was carried out at Agriculture Research Station, Gangavathi during *kharif* 2022 to assess variability for yield and its components among 46 rice genotypes introgressed with *Pup1* gene. The experiment was laid out in split plot design with two replications consisting two main treatments (Phosphorus fertilizer at 0% application and phosphorus application of 50% recommended dosage) and 46 sub treatments (genotypes) including both tolerant and susceptible checks. ANOVA revealed significant differences due to genotypes for all the traits studied. Significant difference due to fertilizer was observed for traits such as plant height, panicle length, number of tillers per plant, root length and shoot root ratio and root dry weight. Significant difference due to fertilizer-genotype interaction were observed for all the traits except days to 50 *per cent* flowering, days to maturity, test weight and kernel length. High phenotypic and genotypic coefficient of variance and high heritability along with high genetic advance were observed for some traits viz., number of spikelets/panicle, number of tillers per plant, shoot fresh/ dry weight, shoot dry weight, root fresh weight and root dry weight.

SCREENING OF SUNFLOWER GENOTYPES AGAINST POWDERY MILDEW DISEASE OF SUNFLOWER (*HELIANTHUS ANNUUS* L).

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Abstract

Powdery mildew, caused by *Golovinomyces latiporus* is now becoming a significant threat to sunflower crops worldwide.



Owing to the losses caused by this disease, identifying resistant sunflower line to powdery mildew is vital for enhancing sunflower production particularly in post rainy season. In this study, an attempt was made to identify the resistant genotype for powdery mildew. The field screening experiment was laid out in an augmented block design by using KBSH-44 as the susceptible check along with 52 genotypes during *rabi* 2022 at MARS, Raichur. Artificial screening for powdery mildew resistance was carried out during *rabi* 2022-23 by spraying the spore suspension culture in 1% sucrose solution and stapling the infected leaves in susceptible check during 20, 30 and 40 days after sowing and disease infection levels were recorded for different crop stages at 10 days interval. The procedure followed could help to establish sufficient levels of powdery mildew infections in field conditions also as indicated by KBSH-44 (80.7%) infection. This also indicates the season and location selected for powdery mildew is ideal as a hotspot. None of the lines screened were immune. However, 6 lines were found to be resistant with less than 10% of PDI, 11 lines were moderately resistant with 11-25% PDI, 28 lines were susceptible with 25-50% PDI while 7 lines were highly susceptible with >50 % of PDI where susceptible check KBSH-44 (PDI=80.7%) recorded highly susceptible reaction. Such identified resistant lines under natural screening conditions can be used in further breeding programmes.

RIL VARIABILITY STUDIES IN COTTON (*GOSSYPIMUM HIRSUTUM*) FOR YIELD AND YIELD ATTRIBUTES

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Abstract

As global scenario, the climate change is evil for agricultural sector, as looking into this problem the objective of study is to develop an elite line for dryland agriculture so the present study was carried out to study yield and yield-attributing traits in cotton, to provide information regarding the amount of variability, broad-sense heritability and genetic advance over the mean to improve cotton yield and productivity. The experiment was laid out during *Kharif* 2021 in an augmented block design with 390 RIL and 6 checks. The Recombinant Inbred Line (RIL) population was derived from intraspecific hybridization between cotton (*Gossypium hirsutum* L) genotypes *viz.*, RHAP 12 X RHAP 15, RHAP 24 X RHAP 15, and RHAP 12 X RHAP 7, which are contrastingly different *for* fibre strength, fibre length, and yield. The Recombinant Inbred Lines (RIL) population was developed using the single seed descent (SSD) method from F₂ generation until the point where stabilization was obtained. The results of the analysis of variance showed that for each of the investigated features, the phenotypic coefficient of variance is slightly larger than the genotypic coefficient of variance. Furthermore, significant variables such as plant height, the number of monopodial branches per plant, the number of bolls per plant, boll weight, lint per plant, and yield showed substantial levels of broad-sense heritability and genetic progress above the mean. This suggests that direct selection for these characteristics could result in notable advancements in the search for superior elite lines with excellent fibre quality.

MAPPING POPULATION AND ITS IMPORTANCE IN GENETIC MAPPING

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Abstract

Mapping population are used for gene mapping. The principle of genetic mapping is mainly based on sampling recombination frequency for the given genes that are available in the mapping population. Mapping population consists of individual progenies that are originated from two parents of one species or related species. The parents of mapping population must have sufficient variation for the trait of interest at both the DNA sequence and phenotypic level. The first step in linkage or genetic map construction is development of mapping population. Several types of mapping population that are used in mapping such as F₂ population, Backcross population, Recombinant inbred lines, Double haploids, Near isogenic lines and Nested



association mapping population are utilized. More accurate maps were obtained when large population size and co-dominants markers employed. RILS, NILS and DHs were powerful tools for QTL detection. Genetic map construction requires the most appropriate mapping populations, calculation of pair wise recombination frequency using these populations, establish the linkage groups and estimate the map distances and determine the map order. Mapping population are basic tool for understanding the effect of selected genetic factors and the organization of the genome of a species as a whole. They are backbone of genomics research that aims to decipher large, complex genomes at the nucleotide sequence level.

SOWING THE FUTURE : ADVANCEMENTS IN BREEDING STRATEGIES FOR DIRECT SEEDED RICE IMPROVEMENT

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Abstract

The global human population consciously or unconsciously believes rice is life, as it is a staple commodity in their daily dietary intake. The green revolution and hybrid rice technology made a huge breakthrough in terms of production. Recent advances in rice breeding have unravelled complex mechanisms underlying complex traits. Conventional breeding, uplifted by current sequence-based strategies, is now widely adapted to improve rice. Additionally, to overcome the drawbacks of traditional puddled rice, direct-seeded rice (DSR) has re-emerged as a pioneering option for farmers. DSR is popular for its water and labour-saving complexion. Several traits influence the establishment of DSR. Pre-breeding approaches aiming to exploit those genomic regions, which affect DSR improvement are of prime importance in the present era. An investigation comprising a subset of 3k panel rice genome project was undertaken to associate quantitative trait locus (QTLs) and superior haplotypes for traits attributing to DSR. 200 germplasm accessions were phenotyped for early seedling vigour (ESV) and its attributes in field condition during late *Rabi* 2022 and *Kharif* 2023. Observations pertaining to ESV were noted at 15 and 30 days after sowing (DAS), respectively. Software R studio and TASSEL v. 5.2 were employed to identify the marker trait associations (MTAs). Seven and 14 noteworthy MTAs were obtained with minimum LOD of 3 and PVE of 10% for ESV I and ESV II, respectively. This study display that, identification of candidate genes and haplotype diversity for ESV would be a potential for breeding of direct seeded rice.

MAPPING OF QTLs FOR YIELD TRAITS IN DIRECT SEEDED RICE

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Abstract

Global climate change poses a critical challenge in the 21st century, significantly impacting crop production and food security.



Traditional rice cultivation faces adverse effects due to declining water tables and unpredictable rainfall patterns, prompting the exploration of alternative methods such as Direct-seeded rice (DSR) for sustainable farming. DSR offers substantial benefits, including water savings of 35-54%, labour reduction of 11-66%, decreased methane emissions, and increased net profits for farmers. However, low productivity remains a major hurdle in maximizing the potential of DSR. Next-generation sequencing technologies have played a pivotal role in identifying genomic regions associated with yield and climate resilience, offering valuable insights for addressing productivity challenges and ensuring the success of DSR in the face of climate change. In this research, we conducted an analysis of yield and related traits in 184 backcross inbred lines obtained from the interspecific cross of IR64*1/O. *glaberrima* under Dry Direct Seeded Conditions. For the Rabi 2023 season in dry direct-seeded conditions, we recorded eleven yield-contributing traits, including single plant yield and test weight. To enhance our understanding, we employed genotyping techniques such as Genotyping by Sequencing (GBS) and the 1K-Rica method on the population. By combining genotypic data obtained from both sequencing methods, we constructed a high-density linkage map. The QTL (Quantitative Trait Loci) mapping analysis for yield and associated traits revealed a total of 46 QTLs, among which 5 were identified as major QTLs with a Phenotypic Variance Explained (PVE) exceeding 10%. Further, identification of candidate genes associated with these QTLs could significantly contribute to breeding efforts aimed at developing climate-resilient rice varieties. Understanding the genetic basis of yield and related traits is essential for creating crops that can thrive under challenging environmental conditions, thereby supporting sustainable agriculture in the face of changing climates.

ASSESSMENT OF GENETIC VARIABILITY STUDIES FOR YIELD ATTRIBUTING TRAITS AND POWDERY MILDEW DISEASE RESISTANCE IN F₂ POPULATION OF THE CHILLI USING CROSS JNA1 X BVC42 (*CAPSICUM ANNUUM* L.)

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Abstract

Genetic variability and its hereditary components play a vital role in the selection of breeding material. A fundamental grasp of genetic diversity is essential for creating an superior variety. So, the F₂ population of the cross JNA1 and BVC42 was evaluated for genetic parameters. Genetic variability results showed high GCV and PCV for traits like number of primary branches, number of seeds/fruit, number of fruits/plant and fruit yield per plant. Whereas, other traits like plant height, fruit diameter, fruit length, fruit weight and thousand seed weight showed moderate range of GCV and PCV. Higher heritability was recorded for all the traits whereas, high GAM was shown by all the traits except the fruit diameter which showed moderate GAM. This indicates that the presence of high genetic variation, heritability and GAM for many characters will help in the improvement of those characters through direct and indirect selection.

PERFORMANCE OF WHITE ONION (*ALLIUM CEPA* L.) GENOTYPES IN NORTHERN KARNATAKA

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Abstract

The study was conducted to assess extent of genetic variability among sixteen white onion genotypes along with check Bhima Safed for fifteen characters comprised of bulb yield and its contributing traits. These genotypes were evaluated in Complete Randomized Block Design with two replications during rabi-2021, at Main Agriculture Research Station, UAS, Dharwad. The mean performance of the genotypes indicates that Puna White shows highest bulb yield followed by Bhima Shubra and W-364. The analysis of variance revealed the existence of significant amount of variation for the traits studied. High PCV and



GCV were noticed for number of centres per bulb, total bulb yield and fresh weight of bulb. Whereas, moderate GCV and high PCV was observed for weight of single bulb and average weight of marketable bulbs. Therefore, these characters can aid in selection programme of onion breeding. High heritability coupled with high genetic advance over mean was recorded for number of centres per bulb, total bulb yield, fresh weight of the bulbs, average weight of marketable bulb and weight of single bulb, indicates the predominance of an additive gene effects and these provides ample scope for further improvement of these characters through selection.

RAPID CYCLE GENOMIC SELECTION: AN ESSENCE IN THE ADVANCED CROP IMPROVEMENT

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Abstract

Conventional breeding methods, though valuable, may fall short in addressing the escalating demand for nutritious food and plant-based products driven by a growing global population. Rapid cycle genomic selection (RC-GS) helps to shorten the breeding cycle and reduce the costs of phenotyping, thereby increasing genetic gains in terms of both cost and time. Genomic selection (GS), originating in livestock breeding and later applied to plants, addresses limitations of marker-assisted selection (MAS) in capturing all favourable alleles for economic traits in crop improvement. It offers a promising solution for enhancing complex traits, particularly those controlled by gene/QTL with small effects, crucial for climate resilience in maize breeding. The effect of this locus is quantified by augmenting the estimated breeding value, yielding the genomic estimated breeding value (GEBV). GS constitutes of training and breeding population, which are used to develop cycles viz., Cycle 1 (C1) was constituted based on phenotypic selection and intermating of the top 5% of families derived population, test-crossed and evaluated. C1 was advanced to the next two cycles (C2 and C3) by intermating the top 5% selected individuals with high genomic estimated breeding values (GEBVs) for grain yield. To estimate genetic gains, population bulks from each cycle were test-crossed and evaluated across locations. Modification and integration of GS with existing breeding programs increases genetic gain per unit time and cost. Present study emphasizes on developing plant breeding strategies centered on GS combined with routine conventional breeding principles to achieve enhanced genetic gain.

G×E INTERACTION AND ADAPTABILITY STUDIES FOR SEED YIELD IN COWPEA [VIGNA UNGUICULATA (L.)] GENOTYPES

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Abstract

A field experiment was conducted during *kharif* 2021 using 25 genotypes of cowpea along with six checks in randomized complete block design of three replications with three different dates of sowing to estimate stability of performance on sixteen quantitative traits. Study revealed that variances due to genotype, environment, genotype x environment, environment (linear) and pooled deviation were significant for seed yield per plot and pod length. The interaction between genotypes and environment were also significant for days to initiation of flowering, days to 50 per cent of flowering and days to physiological maturity. The environmental indices indicated that the optimum sowing time is first fortnight of July most favourable for expression of most of the characters including seed yield. Based on the stability analysis of Eberhart and



Russell (1966) model, four genotypes viz., NBC-42, KBC-9, KM-5 and PGCP-6 were found to be stable across the environments (different dates of sowing) for seed yield. These genotypes had high seed yield with a unity regression coefficient and deviation from regression equal to zero, may be effectively used for future cowpea breeding programmes.

ADOPTION AND INNOVATION IN APICULTURE: A PATHWAY FOR LIVELIHOOD SECURITY

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Abstract

In an effort to document the adoption and innovations in apiculture, a study was conducted in Koppal district of Kalyan Karnataka region. Case study of two apiculturists clearly revealed adoption of apiculture gives substantial support for their livelihood apart from keeping them engaged throughout the day relieving their mental stress condition. Utilization of natural resources available in an innovative way for attracting swarms of bees not only increased the income but offered a wide variety of advantages to the beekeeper. Value addition of byproduct is another source of income and employment which is supported by the main activity. With Innovation of new products and ITK techniques, beekeepers can keep up with the changing times and demands of the beekeeping industry. Adoption and Innovation helps in making beekeeping safer, easier, and more efficient, which is good for beekeepers and bees alike.

STUDIES ON GENETIC VARIABILITY PARAMETERS IN F₃ SEGREGATING POPULATIONS OF GROUNDNUT (*ARACHIS HYPOGAEA* L.) FOR YIELD AND YIELD ATTRIBUTING TRAITS

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Abstract

Genetic variability studies were carried out for different characters of groundnut derived from four crosses viz., Kadri-9 x GPBD-4, ICGV-00351 x GPBD-4, Kadri-9 x Sunoleic-95R, ICGV-00351 x Sunoleic-95R. Results revealed that presence of moderate to high PCV and GCV for most of the traits, further a high heritability coupled with high genetic advance was also observed for these traits indicating involvement of additive gene action in controlling of these traits making selection effective. Oil content, sound mature kernel, shelling per cent and days to physiological maturity exhibited a low to moderate category range for the genetic parameters indicating that they are under the influence of non additive gene action thus cannot be considered as a tool in selection programme to enhance groundnut productivity.

GREEN SYNTHESIS AND CHARACTERIZATION OF SILVER NANOPARTICLES FOR FOOD APPLICATIONS

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Abstract

The research was conducted to synthesize and characterize the silver nano-particles (Ag-NPs) using lime seed extract as a reducing agent at different concentrations, temperatures and pH conditions. The optimized treatment combinations resulted in the production of stable silver nanoparticles with a particle size ranging between 50 and 59 nm, zeta potential ranging between -24.20 and -17.5 mV and surface roughness ranging between 16.87 and 19.23 nm. The characterizations of produced Ag-NPs with high end equipments revealed that, the particles were in spherical shape and face cubic centered in nature. The efficacy of Ag-NPs were analyzed at different concentrations for shelf-life improvement of papaya and sapota fruits. The



results of the experiment revealed that, the green-synthesized Ag-NPs were effective in many ways to maintain the quality attributes of papaya and sapota fruits and found to be very good alternative to enhance the shelf-life of the above mentioned fruits up to 12 and 10 days, respectively. The synthesis of Ag-NPs using biological methods could be eco-friendly, economical and viable option for synthesis as well as to reduce the post harvest loss of agri-horti produces.

SCREENING OF PHYTOAGENTS FOR THE MANAGEMENT OF BLACK THRIPS IN CHILLI

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Abstract

Black thrips in Chilli is in recent introduced pest in chilli ecosystem and causing the loss to the farmers from 35 - 60% of crop damage on its infestation. The incidence appeared during 2019 onwards and the management practices were not well established. Various management practices were tried by farmers and the stake holders. The private companies are playing the pivotal role in trying various insecticides alone and in combination to manage the Black thrips. These thrips are tolerant to all kind of sprays that has been taken up and fewer options have been left with the farmer. Hence, an alternative approach needs to be tried for the management of the Black thrips consisting of phytoagents for the management a ecofriendly approach was tried in the study. The phytoagents investigation was carried out on evaluation of different concentrations of Phyto-agents and chemical pesticides against black thrips in Chilli sprayed thrice at in interval of seven days. The data was recorded on incidence of black thrips in flower on 3rd, 7th and 10th day after spray for seven plants in each treatments. It revealed that the control had an average of 10 thrips per flower, spinetoram had 1.00 thrips / plant, Dinotefuron had 0.29 thrips / plant, Flonicamide had 1 thrips / plant, Phytoagent -4 at 1ml/Liter had 1.0 thrips /plant and above one ml/liter had one or zero incidence of black thrips. On first spraying itself and phyto agent 4 of 2ml per litre and Dinotefuron of 0.5g per litre was most effective on black thrips in Chilli in maintaining the minimum thrips incidence with the yield of 824 g and 1250 g in 7 plants respectively which also shows that phytoagent 4 gives more yield than commercial chemical pesticides.

NEEM DIE BACK DISEASE INCIDENCE AND MANAGEMENT TRIAL OUT COMES

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Abstract

The neem tree has been attacked by different diseases and of late during 2019 the neem dieback caused by *Phomopsis azadirachtae* and its association with Tea Mosquito Bug infestation total (100%) loss of fruit and seed production. The disease is spreading in Indian sub-continent Karnataka, Tamil Nadu, Andhra Pradesh and Telangana from 2019 onwards and as well as other distant states of North India. Hence, the seasonal abundance of tea mosquito bug, *Helopeltis antonii* infesting neem was studied at weekly intervals between August 2022 and April 2023 by direct counting at college of agriculture, Raichur campus and its natural eco-friendly management practices were evaluated. After the northeast monsoon shower ceased, the population of tea mosquito bug started infesting neem during October-November, 2022. The bugs were active in neem until December, 2022 at varied levels of intensity and the pest population reached its peak during January, 2022. The highest number of tea mosquito bugs was recorded (9.50 per three terminal shoots per tree) in December 2022 and the lowest numbers were recorded in April of 2023 (2.00 per three terminal shoots per tree). The two sprays were taken up by the drone at the interval of seven days. The number of tea mosquito bug incidence, the disease score, foliage cover, chlorophyll content and the dry trees were counted at the end of the season. The flowering and fruiting was also accounted. The eco-friendly management trials



suggested that the Tea mosquito bug avoided the Phytoagent 4 spray on counting the number of bugs were less on the sprayed trees and this Phytoagent 4 spray also inhibited the fungal growth in the laboratory evaluation. Further the sprayed trees displayed enhanced foliage, green cover, recovery, chlorophyll content, flowering and fruiting. Hence, further evaluation of this spray is in progress before recommending for the large scale application.

EFFECT OF CAFFEINE ON MODEL SYSTEM *CAENORHABDITIS ELEGANS*

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Abstract

Caffeine's impact on the nematode *Caenorhabditis elegans* (*C. elegans*) has been extensively studied, shedding light on various aspects of its biology. *C. elegans*, a small nematode with a short life cycle of three days and a typical lifespan of 20 days, has proven to be a valuable model for studying aging, lifespan, neurobehavior, and toxicology. High-dose caffeine exposure (30 mM) induces an aversion phenotype in *C. elegans*, causing food-avoidance behaviour mediated by the JNK/MAPK pathway, serotonin, and dopaminergic neuroendocrine signals. Lower doses of caffeine, however, extend the nematode's lifespan through the DAF-2 pathway but not DAF-16. Furthermore, four caffeine analogs (1-methylxanthine, 7-methylxanthine, 1,3-dimethylxanthine, and 1,7-dimethylxanthine) also extend lifespan, suggesting a potential common target. Caffeine ingestion in *C. elegans* provides protective effects against oxidative stress and increases the expression of antioxidant proteins, potentially influencing aging-associated disorders. The mechanisms underlying caffeine's impact on aging remain unclear but, may involve the insulin/IGF-1 pathway. Intriguingly, low-dose caffeine intake alters various aspects of *C. elegans* biology including lifespan, larval development, reproduction, and body length. Exposure to adenosine partially reverses these effects hinting at a shared target in the insulin/IGF-1-like pathway. Overall, *C. elegans* research demonstrates that caffeine exerts diverse effects on its biology, ranging from behaviour and lifespan to stress resistance. These findings may contribute to our understanding of aging mechanisms and offer potential avenues for interventions in aging-related conditions.

MORPHOLOGY AND MOLECULAR CHARACTERIZATION OF *FUSARIUM OXYSPORUM* F. SP. *UDUM* OF PIGEONPEA (*CAJANUS CAJAN* L.)

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Abstract

Pigeonpea (*Cajanus cajan* (L) Mill.) is one of the most extensively grown legume crops in India, accounting for almost 90% of world's area and production. Pigeonpea wilt is a major disease caused by the fungus *Fusarium udum*, is a widely distributed phytopathogen and brings about great economic loss of crops. *Fusarium udum* presents a high biological genetic variability. With the goal of evaluating the morphological and molecular characteristics among *Fusarium udum*, an experiment was carried out involving the collection of 34 isolates of *Fusarium udum* from three different states (Maharashtra, Karnataka and Andhra Pradesh) of India. Existence of variation among thirty-four isolates of *Fusarium udum* was studied with special reference to morphological characters on PDA medium. All the isolates of *Fusarium udum* from different locations varied for different cultural and morphological characterizations such as colony colour, colony margins, growth pattern, textures, pigmentation, size and septation of macro and microconidia and type and number of chlamydospores. Further molecular diversity was also noticed between the isolates. The molecular analysis of 34 *Fusarium udum* isolates using three ITS primers and twelve SSR primers showed ITS (ITS1/ITS4) primers could amplify highest five amplicons. The study found that only nine SSR primers showed amplification, producing 43 alleles. The most informative primers were SSR-5, which had the highest marker index (83.56). UPGMA clustered 34 isolates based on geographical locations, revealing 100% similarity. PCoA analysis revealed a high degree of genetic variation among isolates, accounting for 37.22% and 22.66% of the total variation. AMOVA revealed 8% variance among populations and 92% within populations.



SCREENING OF PHYTOAGENTS FOR THE SOFT ROT OF GINGER MANAGEMENT

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Abstract

The ginger isoft rot is caused by the infestation of *F. oxysporum* f.sp. *zingiberi* and *E. chrysanthemi* pathogens causing the soft rot of the bulbs and the loss of the ginger crop to the farmers. The study was carried by surveying the disease caused fields in the Bidar district by survey by visiting to the farmers and field and inspecting the crop growth. The fungi and the bacterial colonies were extracted by following the standard methodologies. Various phytoagents were screened for their effectiveness of inhibition for the invitro by Microdilution method, Resazurin assay for the cell viability test, poisoned food technique and Cellular leakage studies were undertaken. The potential phytoagents were selected based on 80% and above inhibition in the *Invitro* studies. Further the formulation of the phytoagents was made for the evaluation. This formulation was further evaluated and the best dosage was tried to manage the soft rot disease. The formulation at different dosages were evaluated at (0.1.2.3 and 5ml/Liter). The disease management was recorded by uprooting and evaluating the recovered rhizomes. The treated samples at 2ml/liter and above showed better size and non infected. Hence, further this phytoagent formulation needs evaluation for utility.

EFFECT OF MORINGA OLEIFERA LEAVES POWDER BASED GREEN FEED ON POULTRY MEAT

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Abstract

Moringa Oleifera Leaves Powder effects on Sensory Attribution of Giriraja Poultry Meat” was conducted at Poultry Unit, Department of Poultry Science, PGIVAS, MAFSU under Deptt. A.H. & D.S., Dr. P.D.K.V, Akola to evaluate the effect of supplementation of Moringa leaves powder in the diet of Giriraja poultry birds. For present study 240 day old chicks were divided in eight treatments having three replication, each replicates has ten birds. The treatments were (T1) control with no supplementation, (T2) standard ration plus 0.4% MOLP, (T3) standard ration plus 0.6% MOLP, (T4) standard ration plus 0.8% MOLP, (T5) standard ration plus scavenging, (T6) standard ration plus 0.4% MOLP with scavenging, (T7) standard ration plus 0.6% MOLP with scavenging, (T8) standard ration plus 0.8% MOLP with scavenging. The highest net profit gain was noticed in treatment 0.4% inclusion of Moringa oleifera leaves powder with scavenging of Giriraja poultry birds.

TOXICITY EVALUATION OF METHANOLIC EXTRACT AND GREEN-SYNTHESIZED ZINC OXIDE NANOPARTICLES FROM MANGIFERA INDICA LINN. IN WISTAR ALBINO RATS

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Abstract

The aim of the present research work to assess the toxic effects of methanolic leaf extracts of *Mangifera indica* Linn (MLE) and its green synthesized ZnO nanoparticles (MLE-NPs) in both acute and subacute toxicity studies. For acute toxicity studies (male and female), MLE and MLE-NPs were administered a dose of 2000 mg/kg and were observed for 14 days. In subacute toxicity studies, animals (male and female) received 500 and 1000 mg/kg bod wt. of MLE and MLE-NPs and observed for a



period of 28 days with satellite groups of extended observation of another 14 days. Our study demonstrated that, further, administration of 2000 mg/kg body wt. the treatment did not produced any behavioural, body weight, organ weight and hematological alterations in the animals. In conclusion, the dose of 2000 mg/kg will be considered as safe in animals for both acute and subacute toxicity studies.

IN SILICO ASSESSMENT OF TOLFENPYRAD UTILIZING SWISS-ADME, PASS AND MOLINSPIRATION: A COMPREHENSIVE ANALYSIS

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Abstract

The current work pertains to the computational assessment of tolfenpyrad, a pyrazole insecticide, using various online tools including Swiss-ADME, PASS prediction, and Molinspiration Cheminformatics. As per the findings from Swiss-ADME, tolfenpyrad adheres to all established criteria for drug-likeness. Notably, it exhibits a high degree of lipophilicity while displaying limited solubility in water. Furthermore, it functions as an inhibitor for multiple cytochrome enzymes and falls within a favorable range for bioavailability radar. Additionally, it demonstrates a notable ability to permeate the blood-brain barrier and does not exhibit interactions as a substrate for p-glycoprotein. PASS prediction results suggest that tolfenpyrad serves as a substrate for CYP2H and may hold promise in the treatment of chronic obstructive pulmonary disease (COPD), antiasthmatic interventions, calcium channel activation, and significant contributions to conditions such as hypercholesterolemia, respiratory failure, and neutrophilic dermatosis. According to the Molinspiration analysis, tolfenpyrad exhibits a moderate level of biological activity.

INFLUENCE OF RESURGENCE INDUCING INSECTICIDES ON NATURAL ENEMY COMPLEX OF RICE BROWN PLANTHOPPER IN RICE ECOSYSTEM

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Abstract

Natural enemies serve a vital role in reducing potential pest levels. This has been demonstrated repeatedly when insecticides have frequently destroyed the natural enemies of potential pests. The suppression of natural enemies as a result of extensive broad-spectrum insecticidal treatment; the increased planthopper as a result of repeated application of different groups of insecticide may results in the resurgence of brown planthopper. Hence, the research was conducted to know the influence of resurgence inducing insecticide on natural enemy complex in rice ecosystem. The field study was carried to assess influence of resurgence inducing insecticides on natural enemy complex of rice brown planthopper in rice ecosystem at ARS, Gangavathi during Rabi/Summer 2022-2023. In this experiment, nine different group insecticides viz., acephate, carbofuran, deltamethrin, buprofezin, imidacloprid, fipronil, pymetrozine, dinotefuran and triflumezopyrim along with untreated control such as three replications and 10 treatments were used. The observations were recorded at day before spray and four consequent sprays revealed that the number of mirids and spiders on rice were varied after application of different groups of insecticide. The significant reduction of mirid and spider due toxic nature of insecticides viz., deltamethrin 11% EC and imidacloprid 17.8% SL (higher pray-predation ratio) may lead to resurgence in the population of brown planthopper. Among, nine insecticides two insecticide found detrimental to the beneficial organism (natural enemies). Hence, it is advised not to recommend their usage in rice ecosystem.



DEVELOPMENT OF A NUTRITIOUS, LOW-COST, MILLET-BASED RTE FRUIT BY-PRODUCT FORTIFIED EXTRUDATE PRODUCT

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Abstract

Extrusion is an advanced process to enhance the functional component and physiochemical properties to obtain the complete health benefits of the food quickly and economically. Millet is loaded with every essential nutrient to be considered an ancient superfood. Along with the lifestyle, food consumption standards have improved to get high-quality, nutritious, safe, and affordable RTE. The need of the hour is to develop a low-cost, fortified, millet-based-ready-to-eat product and check the nutritional balance. Protein-energy deficiency resulting in malnutrition is a severe risk, particularly for young people in developing nations due to inadequate dietary protein in the diet. To a certain extent, fortification or the combination of two or more food elements can provide a remedy by combining fruit by-products. Modern consumers' diets include ready-to-eat food products and millet-based extrudate with black rice can be a healthy alternative to tackle obesity. As a result, research has been done to create ready-to-eat food products with added protein and nutrients from black rice, finger millet (ragi), maize (corn), and fruit by-products using extrusion technology. From numerous juice, jam, jelly, etc processing industries using fruits primarily, produce lots of fruit byproducts that are treated as wastes although it is immensely nourishing with fiber and starch in the pulp. The fortification also leads to environmental sustainability. The product thus formed is highly nutritious and rich in minerals (like calcium, zinc, and iron), protein, starch, dietary fibers, vitamins, minerals, bioactive compounds, and antioxidants. The samples' physicochemical analysis was conducted and recorded. The physical parameters (water activity, color, texture), functional parameters (water absorption index, water solubility index), proximate analysis of protein, amylose, total soluble sugars content, and nutritional analysis of anthocyanin, phenols, flavonoids, and antioxidants of RTE products were analyzed.

EVALUATION OF PIGEONPEA + SPECIALTY CORN AND PARCHING SORGHUM INTERCROPPING SYSTEM

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Abstract

Field experiment conducted during the *Kharif* season of 2020-21 & 2021-22 at ZARS, Kalaburagi with RCBD design. Results revealed that, among the different cropping system combinations Pigeonpea + Sweet corn (1:2) treatment recorded significantly higher crop equivalent yield (2840 kg/ha) compared to other treatment combinations. In net returns, Pigeonpea + Sweet corn (1:2) treatment recorded significantly higher net returns (Rs. 1,17,064/-) compared to other treatments. Benefit to cost ratio, Pigeonpea + Sweet corn (1:2) treatment recorded significantly higher B:C (2.90) compared to other treatments. Significantly lower crop equivalent yield (1131 kg/ha), Net returns (Rs. 39853/-) was recorded in Sole pigeonpea. Significantly lower B:C (2.07) was recorded with Pigeonpea + parching sorghum (1:2).

STANDARDIZING THE AGRONOMIC PRACTICES (DOS) FOR CHIA (*SALVIA HISPANICAL*) CROP

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Abstract

Field experiment conducted during the *Kharif* season of 2020-21 & 2021-22 at ZARS, Kalaburagi with split plot design. Results revealed that, among the different treatments combinations, Black Variety (Champion B) of Chia recorded significantly higher yield (635 kg/ha) compared to white Variety (Champion W) of Chia. Similarly Net returns (Rs. 68735/-)



and B:C (4.36) also noticed in Black Variety (Champion B) compared to white Variety (Champion W) of Chia. Pooled data on date of sowing indicated that, recorded significantly higher yield (679 kg/ha) in First fortnight of July compared to other date of sowing and it was on par with second fortnight of July (654 kg/ha). Similarly, net returns (Rs.73925/-) and B:C (4.42) also recorded significantly higher in July month of sowing compared to others treatment combinations.

HANDLING OF DYSTOCIA DUE TO POSTURAL AND STRUCTURAL FETAL DEFECTS THROUGH FETOTOMY IN MARE

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Abstract

A 7 years old pregnant mare with history of second parity and complete gestation was presented in university clinics. The mare was showing straining since last 24 hours and water bags were already ruptured. Following cleaning of perineal area and epidural anaesthesia (5ml, Lignocaine hydrochloride), vaginal examination was performed with well lubricated hand. The birth canal was fully dilated and the dead fetus was in anterior longitudinal presentation with all the limbs approaching towards birth canal. Head was deviated upward and backward. All the joints of fore and hind limbs were rigid and ankylosed. Ample lubrication of birth canal was done with 2% solution of sodium salt of carboxymethyl cellulose gel. Initially, both the hindlimbs were repelled back and correction of head was done using eye hook and mild traction on it. After that moderate traction on both the forelimbs and head, was applied to bring the fetus in proper alignment but due to ankylosis of limbs, the fetus could not be delivered. Then a transverse cut at the level of lumbo-sacral region of fetus was given using Utrecht type of fetotome and anterior half of the fetus was removed out. However, due to severe ankylosis of hock joints, the right hindlimb was amputated to create space. The remaining posterior portion of fetus was delivered by moderate traction. The placenta was expelled out partially. The animal was administered with oxytocin 40 IU dissolved in normal saline solution slow intravenously along with conventional therapy like antibiotics (Ceftiofur 1g x 5 days, and anti-inflammatory (Inj. Flunixin Meglumine 20ml x 3 days). Following medication, the placenta was expelled out completely. The animal recovered uneventfully.

MILLETS FOR FOOD SECURITY: CONSTRAINTS AND RECOMMENDATIONS

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Abstract

Millets are usually a small seeded grains with nutrient dense in comparison to rice, wheat and maize. Millet is gluten-free, therefore an excellent option for people suffering from celiac diseases often irritated by the gluten content of wheat and other more common cereal grains. It is also useful for people who are suffering from atherosclerosis, diabetic and heart disease. Millets hold enormous hope for food and nutritional security. Thus, it is essential to know the constraints faced by millet growers in the millet cultivation and in millet processing units. The constraints experienced by millet growers were poor prices, low productivity, low procurement, non-availability of labour, high cost of labour, high cost of fertilizer, lack of proper marketing channel, involvement of middle men is more in marketing, yield loss due to inconsistent climatic condition, lack of adequate trainings. Further, the recommendations on millets were research on hybrids is expected to lift yields, raising rural demand through awareness campaigns & urban demand through promotional campaigns, distributing millet-based meals through mid-day meal programmes in schools and anganwadis, welfare schools & hostels, universities to raise demand, high MSP must be backed by proper procurement, ready to cook millets can work for the young in particular. As, Millets play a major role in the food as well as nutritional security, this is the time where we should increase the production of millets throughout the World by decreasing per hectare production of cereal grains and by focusing on nutritional value added food products of millets.



COMBINING ABILITY STUDIES FOR YIELD AND ITS ATTRIBUTES IN MAIZE (*ZEA MAYS* L.)

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Abstract

Maize is one of the important cereal crops due to its diversified use as food, feed, and raw material for industrial products and hence it is also called by unique name 'Queen of Cereals'. For a systematic breeding programme, it is essential to identify the parents as well as crosses that could be exploited to bring about further genetic improvement in yield. Combining ability of parents gives useful information regarding the selection of parents in terms of the performance of their hybrids. The material for the present study comprised of 39 hybrids which were derived by crossing 13 lines and 3 testers in a line $\times$ tester mating design. The mean sum of squares due to testers was higher than that of lines for majority of traits indicating that the testers were more genetically diverse than lines. Out of 39 crosses, 18 hybrids manifested positive SCA effect for grain yield per plant and cross VL181693 $\times$ CAL1426 manifested highest positive significant SCA. This hybrid also showed SCA effects in desired direction for days to 50 per cent anthesis, days to 50 per cent silking, ASI, shelling percentage, ears per plant, test weight and kernel rows per cob followed by the cross KL156009 $\times$ CAL1514 in desirable direction. Among 13 lines VL19208, VL20236 and ZL155414 are best general combiners which exhibited high GCA effects in desirable direction for yield related traits. Among three testers, ZL153493 tester is best for yield and yield related traits.

IDENTIFICATION OF SUPERIOR GENERAL AND SPECIFIC COMBINERS FOR DROUGHT AND YIELD RELATED TRAITS IN MAIZE (*ZEA MAYS* L.)

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Abstract

Maize is highly productive under optimal environmental and crop management conditions, but very susceptible to drought and heat. Every year on an average of 15 to 20 percent of the world's maize production is lost due to drought and heat stress. High temperatures have a profound impact on yield compared to drought in maize. An increase in temperature by 2°C would reduce maize yield by 13 percent while a 20 percent increase in intra-seasonal variation reduced the maize yield by only 4.5 percent. In the present study on combining ability, 39 crosses were evaluated for yield and drought related traits along with checks 900MGold, NK6240, RCRMH2, RCRMH3 and RCRMH4. Observations were recorded on NDVI, SCMR, RWC (%), SLA (cm²/g), Proline content (µg /g dry weight), Days to 50% anthesis, Days to 50% silking, ASI, Plant height (cm), Ear height (cm), Ears per plant, Cob length (cm), Test weight (g), Kernel rows per cob, Shelling percentage and Yield per plant (g). ANOVA clearly indicates the presence of significant differences for mean sum of squares by Line $\times$ Tester for some characters like SCMR value, RWC, SLA, Days to 50% anthesis, and yield related traits like cob length, kernel rows per cob, shelling percentage and yield per plant (g). Among 13 lines VL19208, VL20236 and ZL155414, are the best general combiners which exhibited high GCA effects in desirable direction for drought tolerant traits and for yield related traits. Among three testers CAL1514 is best for drought tolerant traits. The cross VL181693 $\times$ CAL1426 showed SCA effects in desirable direction for days to 50 per cent anthesis, days to 50 per cent silking, ASI, proline content, shelling percentage, ears per plant, test weight and kernel rows per cob followed by the cross KL156009 $\times$ CAL1514.

MANAGEMENT OF FOILAR DISEASES OF GROUNDNUT BY NEW FUNGICIDES

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Abstract

Groundnut (*Arachis hypogea*) also known as peanut or earthnut is a member of family Papilionaceae, largest and most important of the three divisions of leguminosae. Early leaf spot, late leaf spot and rust are the economically important fungal foliar diseases affecting groundnut which may cause yield losses up to 60-70%. Among all the three foliar diseases, late leaf spot is more severe followed by rust. The efficacy of different fungicides was tested against these foliar diseases under field condition during Kharif 2019, 2020 and 2021 at Main Agricultural Research Station, UAS, Raichur. Seven treatments were



laid out with three replications. The trial was setup as randomized block design. The seven treatments included seed treatment with different fungicides followed by sprays at 40 and 65 days after sowing. Control without any treatment was maintained. The results (pooled) revealed that among all the treatments, the treatment T4: seed treatment with tebuconazole 2DS @ 1.5 g/kg of seeds + foliar spray of tebuconazole 50% + trifloxystrobin 25% WG @ 1 g/litre at 40 and 65 days after sowing effectively controlled ELS, LLS and rust which recorded least percent disease index of 8.35, 23.35 and 16.67 respectively with higher pod yield of (3420 kg/ha), haulm yield (5508 kg/ha). and highest BC ratio of 3.11 was observed. Untreated control recorded maximum PDI of ELS (25.77), LLS (67.50) and Rust (32.36).

SHORT TERM ASSESSMENT OF INSECT POLLINATOR DIVERSITY IN THE FOREST ECOSYSTEM OF SERAJ VALLEY OF INDIAN HIMALAYAN REGION

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Abstract

The Indian Himalayan Region (IHR) is home to a variety of flora and fauna including insect pollinators. These pollinators are essential for the pollination and conservation of many native and cultivated plant species, providing numerous provisioning services such as food security, livelihood and carbon sequestration. Most angiosperms are pollinated by insects, making insect pollinators crucial for the survival of these plants. The insect diversity and distribution are affected due to climatic disturbances and anthropogenic activities like habitat loss, degradation and fragmentation, hence, there is a need for the study of insect diversity. Thus, keeping in view these facts, the present study was conducted in Seraj valley, of the North-western Himalaya, to document the insect pollinators of the study area between altitudes ranging from 1000-3500 m amsl. Insects were collected and brought to the laboratory for identification. The study found that the order Lepidoptera was the most dominant among all the insect pollinators, followed by Hymenoptera and Coleoptera. Diptera and Hemiptera were the least dominant among all the insect pollinators found in the study area. The findings of this study can be used to develop conservation strategies for insect pollinators in the region, which are essential for the pollination and conservation of many native and cultivated plant species.

IDENTIFICATION OF PROMISING LINSEED BASED CROPPING SYSTEM UNDER DIFFERENT NUTRIENT LEVELS

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Abstract

A field experiment was conducted during 2022-23 at Agriculture Research Station Dhadesugar, UAS, Raichur to find out the promising linseed based cropping system under different nutrient levels for the linseed based cropping system. The soil of the experiment was medium black clayey in texture with alkaline in reaction, medium in organic matter (0.68 %), low in available nitrogen (232 kg ha⁻¹), medium in phosphorus (23 kg ha⁻¹) and potassium (243 kg ha⁻¹). The experiment was laid out in split plot design with three replications. The main plot consist of four cropping systems viz., C₁- Soybean- Linseed, C₂- Green gram- Linseed, C₃- Black gram- Linseed, C₄- Drilled rice- Linseed and sub plot consist of four fertilizer levels viz., F₁- 50 % NPK, F₂- 75% NPK, F₃- 100% NPK, F₄- 125% NPK. The results of the experiment showed that, soybean- linseed cropping system recorded significantly higher seed yield (838 kg ha⁻¹), system productivity (14.21 kg ha⁻¹ day⁻¹), net returns (Rs. 1,06,013 ha⁻¹) and B:C ratio (3.83) compared to other cropping systems. Whereas, higher crop equivalent yield of 2925 kg ha⁻¹ was recorded under drilled rice-linseed cropping system which was on par with soybean- linseed cropping system (2869 kg ha⁻¹). However, lower seed yield and B: C ratio of 652 kg ha⁻¹ and 1.95, respectively were observed under drilled rice- linseed cropping system over others. Among the fertilizer levels, application of 125% NPK recorded significantly higher seed yield (786 kg ha⁻¹), crop equivalent yield (2515 kg ha⁻¹), system productivity (12.64) and net returns (Rs. 80,540 ha⁻¹) compared to others and lower values were recorded with application of 50% NPK (711 kg ha⁻¹, 2440 kg ha⁻¹, 12.25 kg ha⁻¹ day⁻¹, Rs. 78,593 ha⁻¹, respectively).



EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON YIELD OF NAGPUR MANDARIN

Anjali Gaharwal, D.L.Wasule, P.R.Shingote and N.D. Parlawar

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Abstract

Mandarin *Citrus reticulata* is a major fruit crop in Yavatmal district. It is an irrigated crop required critical nutrient management for better orchard management. Soils of Yavatmal district is black cotton soil mostly vertisols, entisols and inceptisols. Mandarin is growing on jambheri i.e. rangpur lime and rough lemon rootstock under the present soils conditions. Mandarin is successfully grown in such soils pertaining to well drained condition of soils. Soil fertility is of medium type with organic matter av. at 0.2 to 0.5. Potash is found in ample quantity in soils of this district. Av. Rainfall of the district is 950 mm. Rains are well distributed with 90 to 120 rainy days. However from past certain years, irregularity in rainfall may lead soil sometimes in stress condition and sometimes cause premature fruit drop due to unfavourable climate. Therefore, nutrient management with timely irrigation are the major practices that not only contribute the quality but assured high yield also. As a traditional practice farmers were applying nutrients in inadequate dose. Hence on farm trials in farmers orchards were conducted to assess the recommended INM practice with use of biofertilizers on yield of Nagpur mandarin. Application of 75% RDF (50 kg FYM + 900 g N + 300 g P₂O₅ + 300 g K₂O/tree) + 100g PSB + 100g *Azospirillum* + 100 g *Trichoderma*/tree were assessed against farmers practice of unrandom nutrient application through chemical fertilizers. It was observed that, application of 75% RDF+ 100g PSB, *Azospirillum* and *Trichoderma* each/tree recorded higher yield and B:C Ratio with 40.53% increased yield over farmers practice.

PREPARATION OF QUALITY WINE AT DIFFERENT PH LEVELS FROM NAGPUR MANDARIN

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Abstract

An experiment entitled “Studies on different pH levels on quality wine production from Nagpur mandarin using yeast *Saccharomyces cerevisiae*” was carried out at Vasantrao Naik College of Agricultural Biotechnology, Yavatmal. Mandarin fruit juice extracted from Nagpur Mandarin of mrig bahar was taken for the physicochemical analysis. The objective was to assess four different levels of pH for quality wine production. All the treatment were inoculated with 5% yeast inoculums of *Saccharomyces cerevisiae* adjusted at 25°C and placed at 20 to 22°C for fermentation. After 30 days of fermentation it was observed that the pH, of wines were found gradually increased with the pH levels and found that, the must pH 4.5 gave the less acidic wine with minimum pH. It was observed that there found reduction in TSS, titrable acidity, ascorbic acid, and reducing sugar at 30 days of fermentation with increased in alcohol content of wine. Wine prepared at higher level of pH 4.5 reported maximum total soluble solids, minimum reducing sugar, maximum total sugar and alcohol and vice versa. The organoleptic evaluation of wine, reported that Nagpur Mandarin wine prepared at 4.5 pH scores 8.03 points for overall acceptability categorized as like very much wine and found acceptable for winery. Wine prepared at pH levels 4 also reported acceptable as scored ‘like moderately’ for sensory evaluation and physiochemical parameters and stood next to wine prepared at pH 4.5.

INFLUENCE OF DIGITAL MEDIA ON CHILD BEHAVIOUR OF HIGHER PRIMARY SCHOOL CHILDREN

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Abstract

The study conducted in Dharwad, Karnataka, aimed to evaluate the influence of digital media usage on child behaviour of higher primary school children. The research involved 240 students (120 urban and 120 rural) in 5th, 6th, and 7th grades from both private and government schools. Various tools, including a self-structured questionnaire for digital media usage, Child



behavior checklist (CBCL) by Achenbach and Rescorla (2001), and the Socio-economic Status Scale, were employed. The findings indicated that 56.7% of children exhibited moderate digital media usage, 32.9% had high usage, and 10.4% had low usage. Smart TVs were the preferred device for the majority (37.9%), followed by smartphones (27.1%), tablets (19.2%), and computers (15.8%). The most-watched digital content included National Geographic Kids (22.1%), Disney Junior (21.7%), game apps (20.8%), social media (17.9%), and Nick Jr (17.5%). In terms of purpose, the majority used digital media for homework and school-related activities (25.0%), followed by entertainment and media consumption (22.1%). Gaming was the purpose for 16.3%, while only 10% used digital media for communication. Regarding time spent, the majority spent 1 to 2 hours (42.10%), followed by 3 to 4 hours (26.70%), with fewer spending less than 1 hour (19.60%), and a minority exceeding 4 hours (11.70%) on digital media activities. Children shows that 58.80 percent of children have borderline child behaviour, while 41.30 percent of children exhibit normal behaviour. Three-fourths (72.50%) of children exhibit borderline externalizing behaviour, while 27.50 percent of children display normal externalizing behaviour and none of fall in clinical externalizing behaviour. The study identified a significant association and difference between digital media usage, time spent on digital media, child internalizing and externalizing behaviour among higher primary school children.

NANOTECHNOLOGY IN AGRICULTURE

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Abstract

Sustainable agriculture has the potential to be greatly enhanced by nanotechnology. The use of nanotechnology in agriculture for crop protection and production is reviewed in this article, with a focus on nano-pesticides, nano-fertilizers, nano-biosensors, and nano-enabled remediation techniques for contaminated soils. Nanomaterials are a crucial component of various biotic and abiotic remediation techniques and have a significant impact on the destiny, mobility, and toxicity of soil contaminants. This review also critically discusses how the characteristics and interactions of nanomaterials with soil constituents strongly affect their efficiency and fate. Research on the use of nanoparticles in remediation and their destiny in soil is still rare and primarily restricted to lab experiments. The impacts of nanomaterials on nutrient release in target soils, soil biota, soil organic matter, and plant morphological and physiological responses are examined in relation to their potential effects on soil quality and plant growth once they are incorporated into the soil system. There has also been discussion of the defence systems linked with the uptake and translocation of nanomaterials in plants. Future directions for research have been determined in order to further the study of sustainable development in agriculture facilitated by nanotechnology. Numerous agricultural uses of nanotechnology have been developed, including nano-pesticides, nano-fertilizers, nano-biosensors, and agents for environmental cleanup. In agricultural and environmental sciences, gaining a thorough understanding of nanomaterials' fate and effects on the environment is still a significant problem. To produce effective, multifunctional, stable, and affordable nanomaterials, institutes should collaborate on research investigating various applications of nanomaterials.

MODERN TECHNOLOGIES IN STORED GRAIN STRUCTURE FOR STORED GRAIN

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Abstract

Storage keeps agricultural products in good condition, keeps them available to consumer markets during the off-season, and allows production to be commercialized when prices are more favourable. But this isn't how things really work in the industry. On the other hand, significant quantitative and qualitative losses in grain that has been stored have been noted over time. In order to store grain produced and keep it in optimal condition to avoid physical and chemical changes, the post-harvest stage



requires a technological infrastructure. Grain can be stored using a variety of methods, including airtight storage, bulk storage in concrete, metal, raised, and horizontal silos, and storage in altered or controlled atmospheres. After 180 days of storage in bag silos, monitoring indirect qualitative factors produced positive results for the retention of grain quality. Other options to help with the monitoring of grains stored in bag silos include the use of temperature sensors, sensors that measure the water content of the grains based on the hygroscopic balance unit, and the CO₂ concentration by the respiration of the grain mass. In precision agriculture, where grain output is increased through the monitoring and control of critical environmental factors through remote sensing, the usage of IoT technology and intelligent sensing is becoming a must. The technologies that use Middleware IoT models and wireless sensor networks (WSN) stand out from the rest. Machine learning (ML) approaches are characterized as data categorization or forecasting algorithms that have several potential uses in the post-harvest domain. The importance of machine learning has increased due to the amount of data generated by items communicating with each other. A type of artificial intelligence called machine learning allows data to be used to teach a new system.

IMPACT OF SODIC WATER IRRIGATION AND AMENDMENT ON SOIL QUALITY AND GROWTH PARAMETERS OF GUAVA CULTIVAR 'TAIWAN PINK'

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Abstract

The detrimental impact of sodic water on agricultural sustainability is well-recognized, as it disrupts soil structure and fertility due to heightened sodium levels. To address this challenge and promote long-term soil health and crop productivity, a study was conducted from 2021 to 2023 at ICAR-Central Soil Salinity Research Institute in Karnal, Haryana. The study aimed to assess the effects of sodic water irrigation, with and without amendments such as press mud and gypsum, on key soil quality parameters (soil EC, soil pH, soil organic carbon, soil available nitrogen, and soil available phosphorus) and various growth parameters (percentage increase in plant height, spread east-west, spread north-south, stem girth, canopy volume, number of branches per plant, length of new emerging shoots, and leaf area) for the guava cultivar Taiwan Pink. In this study, plants were subjected to irrigation using two types of water, non-sodic water as a control (considered the best available) and three different levels of Residual Sodium Carbonate (RSC_{iw}) water, specifically at concentrations of 2.5 meq/L, 5.0 meq/L, and 7.5 meq/L. These irrigation treatments were administered both with and without the addition of amendments, namely press mud and gypsum. The results obtained from the experiment indicated a significant impact of irrigation with varying RSC_{iw} levels, with or without amendments, on soil quality parameters such as soil pH, as well as the availability of phosphorus and nitrogen in the soil. However, the effects on soil electrical conductivity (EC₂) and soil organic carbon were found to be non-significant. It was observed that increasing RSC_{iw} levels led to a rise in soil pH, accompanied by a decrease in the availability of nitrogen and phosphorus in the soil. Likewise, the escalating RSC_{iw} levels exerted a diminishing effect on all mentioned growth parameters. The lowest values for these growth parameters were recorded at the highest RSC_{iw} level (7.5 meq/L) without any amendment, while the maximum values were observed when plants were irrigated with the control, non-sodic water. Notably, the addition of amendments (press mud and gypsum) to each RSC_{iw} level proved to have a beneficial impact on the growth parameters at every RSC_{iw} level. Gypsum demonstrated a more favourable impact as compared to press mud. Notably, irrigation with RSC at 2.5 meq/L yielded comparable effects on growth parameters to non-sodic water irrigation, recommending it as a sustainable approach for guava cultivation. This study reveals useful insights into sustainable farming methods as well as effective solutions for guava production in adverse soil conditions of India.

PERFORMANCE EVALUATION OF DIFFERENT TYPES OF SUGAR CANE CUTTER PLANTER-REVIEW STUDY

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Abstract

Sugarcane (*Saccharum officinarum* L.) is a globally significant cash crop cultivated across more than 90 countries, spanning



from 32°N to 32°S latitude. It accounts for approximately 64.6% of the world's total sugar production, with India and Brazil in close competition for the leading position. India, contributing 13.25% of global and 41.11% of Asian sugar production, cultivates sugarcane in 4.10 million hectares, resulting in an annual production of 300.25 million tonnes of cane and 18.90 million tonnes of sugar. Sugarcane cultivation traditionally involves intensive manual labor, making it a laborious process. However, the adoption of machinery for planting has proven to be more cost-effective and significantly reduces the labor-intensive nature of the planting process. The recent introduction of sugarcane cutter planters has gained widespread acceptance among sugarcane growers. Proper planting practices, including achieving a uniform crop stand, employing the correct seed rate, ensuring appropriate depth of sett placements, and maintaining the required overlapping for sett uniformity, are crucial for optimal crop development and yield.

SCOPE OF GENETICALLY MODIFIED MICROBES AND PARASITIDS IN BIOLOGICAL CONTROL

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Abstract

Genetic engineering, also known as genetic modification has various potential applications, such as crop pest management, vector management and genetic improvement of beneficial insects like parasitoids and predators. Genetic engineering of arthropod natural enemies involves identification of beneficial traits, clone genes that influence these traits, and developing techniques to introduce these genes into the natural enemy species such that they are appropriately expressed and stably transmitted to offspring. Natural enemies are genetically modified using genetic manipulation tactics viz., Artificial selection, hybridization and use of recombinant DNA techniques. Techniques like CRISPR-Cas9 are used to modify genes in predators, parasitoids, and entomopathogens, enhancing their ability to target specific pests and resist toxins. The process involves identifying the target pest and natural enemy, selecting pest control genes, genetically modifying the natural enemy, conducting safety and efficacy assessments, and implementing controlled release and monitoring. Development of endosulfan, monocrotophos, fenvalerate-tolerant strain with high host searching range of 10 m of *Trichogramma chilonis*, superior strains of *T. chilonis* such as Bio Sc1 for graminaceous tissue borers, Bio H3 for *Helicoverpa armigera* and Bio C1 and Bio C6 for cotton bollworm, monocrotophos tolerant strain of *Chrysoperla carnea* at NBAIR are recent examples of use of genetic engineering techniques in biocontrol programme. The strains of *T. chilonis* namely TcUPI and TcUP2, tolerant to high temperatures of 32-40°C and with high biotic potential have been used against borer pests in hot weather conditions. *Metaseiulus occidentalis*, a very versatile mite predator is genetically modified for resistance to carbaryl and permethrin. Azinphosmethyl resistant parasitoid, *Trioxys pallidus* of walnut aphid and Carbaryl resistant parasitoid *Aphytis melinus*, parasitizing several species of armored scales is commercialized in California. A CryIIIA protein expressing *spoOA* mutant strain of *Bacillus subtilis* is found effective against Coleoptera. Additional copies of the *pil* gene in *M. anisopliae*, which encodes a subtilin-like protease involved in host cuticle penetration., were engineered for the enhancement of insecticidal efficacy. Genetic engineering to improve limitations with Entomopathogenic nematodes like vulnerability to environmental stress, extreme temperatures, solar radiation, and desiccation is being actively explored.

EFFECT OF DIETARY INCLUSION OF RICE DISTILLERS DRIED GRAINS WITH SOLUBLES (RDDGS) ON COST ECONOMICS IN KUROIILER CHICKEN

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Abstract

Many food processing, beverages, slaughter and pharmaceuticals industries leaves few by-products with appreciable nutritive values that is being utilized by the poultry feed manufacturers to make the cost-effective poultry feed. Rice Distillers Dried



Grains with Solubles (rDDGS) is a by-product of ethanol production which is used as alternative protein source in the poultry diet. Present investigation was conducted at Poultry Research and Training Centre, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (UP) to evaluate the growth performance, haemato-biochemical profile, carcass characteristics and production economics of Kuroiler chickens from January 24th, 2021- March 22nd, 2021. Feeding trial was designed into four dietary groups viz. T₀ (Control, without rDDGS), T₁ (7.5% rDDGS), T₂ (15% rDDGS) and T₃ (22.5% rDDGS) in different treatment groups along with basal corn soyabean diet. Significant differences due to supplemented rDDGS were recorded for feed cost, growth cost, profit, profit/kg growth and feed cost/kg growth during starter period. During finisher period only feed cost was found to have significant variations and rest of the parameters were observed statistically non- significant for varying levels of feeding rDDGS. Overall feed cost, growth cost, profit/kg growth and feed cost/kg growth were estimated as significantly influenced by feeding rDDGS. Maximum profit was estimated as Rs. 129.48 in T₂ followed by T₃ (Rs. 121.63), T₁ (Rs. 113.59) and T₀ (Rs. 105.33), respectively. It was concluded that rice based dry distiller grain with soluble is a good source of protein for poultry and it can replace costly conventional feedstuffs like soybean meal up to 15% level in diet of Kuroiler chicken.

POPULATION DYNAMICS OF BEAN APHIDS, *APHIS CRACCIVORA* KOCH DURING RABI SEASON ON LABLAB BEAN IN RELATION TO WEATHER PARAMETERS

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Abstract

The field experiment was carried out during two consecutive years of Rabi season 2017-18 and 2018-19 at Botany farm, College of Agriculture, Dapoli, Tal: Dapoli, Dist: Ratnagiri (M.S.) to study the population dynamics of bean aphids, *Aphis craccivora* Koch during rabi season on lablab bean in relation to weather parameters. Results indicated that the maximum population (2.50 and 12.38) of aphids three leaves⁻¹ plant⁻¹ was recorded in 12th Standard Meteorological Week i.e. SMW (19-25 March, 2018) and 11th SMW (12-18 March, 2019). The data on correlation between aphids infesting lablab bean and different meteorological parameters revealed that, the meteorological parameters like minimum temperature ($r = 0.620$), wind speed ($r = 0.763$ and 0.779) and evaporation ($r = 0.721$ and 0.859) were found to be positively significant with aphid population. While, morning relative humidity ($r = -0.529$) had found to be negatively significant with aphid population. Remaining all of the weather parameters was found to be non- significant.

STATUS OF CLIMATE CHANGE IMPACT ON RICE INSECT PESTS IN INDIA

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Abstract

The importance of climate and weather events to the distribution of insects and their population dynamics has long been recognized. The climate change and global warming have affected the rice insect pests scenario drastically. Several insect pests, that were important in the past or the minor pests are likely to become more devastating with global warming and climate change. Insect pests cause an estimated annual loss of 13.6% globally and 23.3% in India. Losses due to insect pests are likely to increase as a result of change in crop diversity and climate change. An increase of 0.4°C average surface temperature over past century in India has led to rice insect pests losses increase from 10% during the pre-green revolution period to 25% during the post-green revolution period. The plant hoppers (*Nilaparvata lugens* & *Sogatella furcifera*) in northern India have been affected crop failure on more than 33,000 ha area for rice. The changes in rice insect pests losses low to severe has been inference with impact of climate change on rice insect pests scenario under eastern Uttar Pradesh conditions. The climate change has affected the number of major insect pests of rice have increase from 3 to 15 (500 times). Meanwhile, the rice stem borers (*Scirpophaga incertulas* and *Chilo suppressalis*) and rice leaf folder (*Cnaphalocrocis medinalis*) have been maintaining the major insect pest status. 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. The adaptation, mitigation and natural resource management are basic components of remedial measures taken to combat the adverse impact of climate change on rice insect pest management. To combat the adverse impact of climate change on rice insect pests, its urgent need to adopt climate resilient strategies and initiatives for insect pest management in India. This paper attempt to analyse the review of reported studies on the status of climate change impact on rice insect pests in India to reduce the risk of strategy for effective insect pest management.

WEED MANAGEMENT IN SOYBEAN WITH PRE-AND POST-EMERGENCE HERBICIDES

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Abstract

An on farm trail was conducted at Belconi (bk) village of biloli taluka of nanded district in Maharashtra to study the efficacy of different pre and post emergence herbicides and their combinations to control the weeds in soybean during Kharif season of the year-2022. Application of imazethapyr 0.100 kg/ha + quizalofop ethyl 0.075 kg/ha as post emergence was found to be more efficient to control monocot and dicot weeds in soybean which recorded lowest weed density, dry matter and weed index. It also found superior in respect of various growth and yield attributes. Highest seed yield (2.45 t/ha) and straw yield of soybean and maximum gross return (81,500/-) and net return (56,269/-) were also recorded in imazethapyr 0.100 kg/ha + quizalofop-ethyl 0.075 kg/ha as PoE with highest B:C ratio of 3.23. It was also found responsible for highest uptake of N, P and K by soybean crop and lowest uptake of these plant nutrients by weed plants.

HYDROPONIC GREEN FODDER PRODUCTION FACILITATED LIVESTOCK IN NORTH EASTERN DRY ZONE OF KARNATAKA

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Abstract

There is a need of growing hydroponic green feed due to factors such as water scarcity, climate change and rapid urbanization. Hydroponic technology is familiar for growing of plants that only use water or nutrient solution for growing. A mere five percent of cropped land is used for the production of fodder, although India has the greatest number of cattle worldwide and generates the large quantity of milk. In this study the different crops such as cowpea, greengram, maize, paddy, fodder sorghum and sunhemp were grown hydroponically for green fodder purpose during 2022-2023 at Centre for Hydroponic Technology, University of Agricultural Sciences, Raichur, Karnataka. The green fodder of the above mentioned crops were grown in the automated hydroponic machine where light, temperature, relative humidity and water supply were maintained automatically or can shift to manual mode as per requirement of the crop irrespective of the season. The results of this study revealed that the yield of hydroponically grown green fodder of crops like maize (8-10 kg green fodder per kg seed), paddy (7-8 kg green fodder per kg seed), fodder sorghum (7-8 kg green fodder per kg seed), sunhemp (8-10 kg green fodder per kg seed), cowpea (10-12 kg green fodder per kg seed) and greengram (10-12 kg green fodder per kg seed) was produced in the short growth period with around 10-12 days.

BIOCHAR APPLICATION INFLUENCED PLANT NUTRIENTS AVAILABILITY IN SALINE SOIL

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Abstract

Saline soils are having the excessive salt concentration which limit the crop growth and yield. In this situation, plant nutrient availability and crop yield potential try to reclaiming salt-damaged soils are crucial for addressing global food security



challenges. Various organic and inorganic amendments are utilized to rehabilitate areas affected by salinization. The selection of a sustainable ameliorate is largely influenced by the soil's physico-chemical properties and the specific geography of the site. Biochar has garnered significant attention as a supplement for saline soils in recent times. In this incubation experiment nine treatments comprised with biochar (BC), pressmud (PM), farm yard manure (FYM) were applied *i.e.*, T₁-control, T₂-RDF, T₃-FYM @ 10 t/ha, T₄-PM @ 10 t/ha, T₅-BC @ 10 t/ha, T₆-FYM @ 5 t/ha + PM @ 5 t/ha, T₇-FYM @ 5 t/ha + BC @ 5 t/ha, T₈-PM @ 5 t/ha + BC 5 t/ha, T₉-FYM @ 5 t/ha + BC @ 2.5 t/ha + PM @ 2.5 t/ha. During the incubation period soil moisture was maintained and destructive soil samples were taken. With the help of standard analysis process, different physico-chemical parameters were analyzed. Biochar application @ 10 t/ha in saline soil didn't affect the soil pH; whereas, plant nutrient availability (available N, K, S) and soil organic carbon enhanced 0.32 to 0.46 %. However, potassium concentration much affected over rest of the nutrients. In this experiment addition of organic substances significantly ($p=0.05$) reduced the EC of saline soil. These findings are important for enhancing the soil health parameters and plant nutrient dynamics under saline soils.

EFFECT OF FOLIAR SPRAY OF PLANT GROWTH REGULATORS AND NUTRIENTS ON PHYSIOLOGICAL AND BIOCHEMICAL PARAMETERS AND YIELD OF PADDY AT TWO SITUATIONS

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Abstract

A field experiment was conducted at Agricultural Research Station, Gangavati, University of Agricultural Sciences, Raichur, Karnataka, during *Kharif* season in the year 2019 to know the physiological approaches to sustain the rice (*Oryza sativa* L.) productivity under late sown situation (RNR-15048). The experiment was laid out in factorial RCBD with three replications, where two dates of transplanting were taken *i.e.* D₁ (Normal) and D₂ (Late) and six treatments along with control *viz.*, T₁: NPK-19:19:19 (20000 ppm), T₂: 6-BAP (20 ppm), T₃: salicylic acid (250 ppm), T₄: mepiquat chloride (1000 ppm), T₅: borax @ (10000 ppm) and T₆: control. The results of physiological parameters obtained at 65 DAT and biochemical parameters obtained at 55 DAT indicated that D₁ (Normal DOT) showed higher values as compare to D₂ (Late DOT) in all the treatments. Among different treatments, T₁ (NPK-19:19:19 @ 20000 ppm) recorded the significantly greater results of physiological parameters *viz.*, photosynthetic rate ($9.20 \mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$), transpiration rate ($2.10 \text{ mmol H}_2\text{O m}^{-2} \text{ s}^{-1}$), SPAD value (28.42), NDVI value (28.42) and biochemical parameters such as chlorophyll content 'a' ($2.64 \text{ mg g}^{-1} \text{ F.W.}$), 'b' ($0.85 \text{ mg g}^{-1} \text{ F.W.}$) and total ($3.49 \text{ mg g}^{-1} \text{ F.W.}$). Whereas the next best treatment was T₂ (6-BAP @ 20 ppm) over rest of the treatment, the highest grain yield plant⁻¹ (21.55) were recorded in T₁ (NPK-19:19:19 @ 20000 ppm) than other treatments. It was concluded that D₁ (Normal DOT) was the best situation and among foliar application of different agrochemicals T₁ (NPK-19:19:19 @ 2.0%) was found to be the best treatment, it was ideal and economically feasible at 35, 45 DAT and at 55 DAT.

POPULATION FLUCTUATION OF MAJOR INSECT PESTS AND THEIR CORRELATION WITH ABIOTIC FACTORS ON LONG DURATION PIGEONPEA

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Abstract

For people all throughout the world, pulses constitute an essential source of plant-based proteins and amino acids. Pulses are one of the important segments of Indian Agriculture. Pigeonpea [*Cajanus cajan* (L.) Millsp.] is a significant pulse-cum-grain legume crop among pulses, infested about 300 species of insect pests from 61 families and 8 orders at different growth phases, beginning with the seedling stage and continuing through harvest and storage. Among which gram pod borer [*Helicoverpa armigera* (Hubner)], tur pod fly [*Melanagromyza obtusa* (Malloch)], tur pod bug [*Clavigralla gibbosa* (Spinola)] and plume moth [*Exelastis atomosa* (Walsingham)] are the most damaging pests, causing the plant's reproductive organs significant harm. The present investigations entitled "Seasonal incidence of major insect pests and their correlation with abiotic factors in



long duration pigeonpea [*Cajanus cajan* (L.) Millsp.]” was carried out at Agriculture Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during *Kharif* 2020–21. Pest activity began with the beginning of pod development and persisted, albeit at various intensities, throughout the crop’s reproductive cycle. The first incidence of tur pod fly (*M. obtusa*) was observed in the 2nd standard week, whose maggot population highest in 11th standard week (8.07 maggots/plant). The presence of tur pod bug (*C. gibbosa*) was noticed for the first time in 2nd standard week, which reached its peak (6.13 bugs/plant) in 12th standard week. Gram pod borer (*H. armigera*) initially appeared in the 3rd standard week, with the maximum population (4.40 larvae/plant) in the 12th standard week. The plume moth (*E. atomosa*) first appeared in the 4th standard week and the maximum larval population (2.20 larvae/plant) was found in the 12th standard week. The correlation between weather factors and population of pod pest complex (*M. obtusa*, *C. gibbosa*, *H. armigera* and *E. atomosa*) in 2020-21, revealed a positive correlation with maximum temperature, minimum temperature, and sunshine hours, but a negative correlation with morning & evening relative humidity and rainfall respectively.

STATISTICAL MODELS FOR RAINFALL DISTRIBUTION: ENHANCING PREDICTIVE ACCURACY AND WATER RESOURCE MANAGEMENT

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Abstract

This investigation delves into the intricacies of rainfall distribution using sophisticated statistical models to elevate predictive precision and optimize water resource management. By applying advanced statistical techniques like time-series analysis and data-driven modeling, the research aims to unravel the complexities within rainfall data, pushing the boundaries of accuracy. Key findings underscore the vital role of statistical models in decoding rainfall variability and trends, particularly in the context of evolving climate change impacts. Integration of hydrological modeling and scrutiny of spatial-temporal patterns provides novel insights, enabling a comprehensive understanding of extreme events and facilitating judicious water resource allocation. The implications of this work extend beyond statistical analysis, resonating in resilience planning, climate variability assessments, and strategic decision-making in water management. In a world confronted by escalating water scarcity challenges, adopting advanced statistical models for rainfall analysis emerges as imperative for fostering sustainability and adaptive water resource practices. This abstract encapsulates the salient aspects of our investigation, emphasizing the transformative potential of leveraging statistical models to enhance the understanding of rainfall distribution and fortify water resource management protocols.

INDIGENOUS TECHNICAL FARMING IN ORGANIC FARMING

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Abstract

Indigenous Technical Knowledge (ITK) has immense potential for innovation. India is a country of indigenous communities, most of which have their own set of unique traditional knowledge and technology base. The population of India is growing rapidly and demand for food is also increasing. ITK is the sum total knowledge and practices which are based on people’s accumulated experiences in dealing with situations and problems in various aspects of life and such knowledge and practices are special to a particular culture. Many of these knowledge and technologies are at par with the modern knowledge and technology system and have been provided the indigenous communities with comfort and self-sufficiency. These traditional knowledge and technologies can play a significant role in the overall socio-economic development of the communities. But because of no proper documentation and preserve the Indigenous Technical Knowledge (ITK) of different communities are unknown.

As these ITKs are able to maintain the agricultural sustainability as well as food and nutritional security by focusing on efficient utilization of eco-friendly resources which is economically affordable, sustainable, involves minimum risk. With the involvement of experts from traditional knowledge and modern scientists it creates a more effective solution for contemporary



problems. Hence it may be concluded that Indigenous Technical Knowledge plays an essential role in sustainable grassroots innovations and knowledge of indigenous practices provides valuable inputs to make efficient use of natural resources and extends relevant support for sustainable development.

CORRELATION AND PATH COEFFICIENT ANALYSIS IN CASTOR (*RICINUS COMMUNIS* L.)

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Abstract

The present investigation on study of correlation and path analysis was carried out in castor (*Ricinus communis* L.) for eleven quantitative characters of sixteen inbred lines along with two checks (48-1, DCS-9) conducted during Rabi 2020. The seed yield per plant had strong positive association with days to maturity, number of nodes upto primary spike, effective length of main spike, number of capsules on primary spike and number of effective spikes per plant at both genotypic and phenotypic level. The characters days to 50 per cent flowering, days to maturity, number of nodes up to primary spike, primary spike length, number of capsules on primary spike, number of effective spikes per plant had positive direct effect on seed yield per plant at phenotypic level. It is, therefore, suggested that simultaneous selection for number of capsules on primary spike, primary spike length, number of effective spikes per plant and number of nodes upto primary spike would result in improvement of seed yield by phenotypic selection.

ASSESSING THE IMPACT OF *BACILLUS SUBTILIS* INTERACTION ON YIELD AND RELATED TRAITS IN DIFFERENT RICE GENOTYPES

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Abstract

The investigation took place at ARS, Gangavati, during Kharif 2021, comprising 20 rice genotypes with 2 replications for both separate *Bacillus subtilis* treated and untreated in an RCBD design. Assessment of heritability, genetic variability and genetic advance was conducted for days to 50% flowering, number of tillers per hill, plant height, number of panicles per hill, flag leaf length, panicle length, panicle weight, grain number per panicle, test weight and yield per plant. Analysis of variances for both treated and untreated rice genotypes revealed sufficient genetic variation in all studied traits. Notably, high heritability, along with a substantial genetic advance as a per cent of mean, was observed in traits such as plant height, panicle number, flag leaf length, panicle weight, grain number per panicle and test weight. For *Bacillus subtilis* treated genotypes, there was high heritability, but a moderate value of genetic advance for days to maturity, days to 50% flowering, and panicle length. Selection based on these traits would be effective in improving grain yield in rice along with seedling treatment by *Bacillus subtilis*. The presence of wide genetic variability is crucial for advancements in crop improvement.

ELECTROSPINNING : A VERSATILE TECHNIQUE FOR NANOFIBER FABRICATION FOR FOOD ENGINEERING

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Abstract

Electrospinning is a versatile and efficient technique for the production of nanofibers with diameters ranging from a few



nanometers to several micrometers. This process involves the application of an electric field to a polymer solution or melt, leading to the formation of ultrafine fibers through the stretching and elongation of the polymer jet. The resulting nanofibers possess unique properties and find applications in various fields, including biomedical, environmental, food engineering and materials science. The unique properties of electrospun nanofibers make them promising for various applications in the food industry. Electrospinning is employed to encapsulate bioactive compounds such as antioxidants, vitamins, and flavorings within nanofibers. These nanofibers act as protective carriers, preventing degradation and enhancing the stability of sensitive compounds during storage and processing. Electrospun nanofibers can be used to create edible packaging materials with enhanced barrier properties. These materials can be tailored to control the release of gases (such as oxygen and carbon dioxide) and moisture, thereby extending the shelf-life of perishable food products. By incorporating electrospun nanofibers into food formulations, it is possible to enhance textural properties, such as mouth feel and viscosity. This is particularly valuable in the development of low-fat or reduced-calorie food products where maintaining desirable textures can be challenging.

IMPACT OF CLIMATE CHANGE ON HUMAN WILDLIFE CONFLICT

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Abstract

Climate change is a global phenomenon with far-reaching consequences, affecting ecosystems and wildlife in profound ways. One significant, yet often overlooked, consequence is the impact on human-wildlife conflict (HWC). This study explores the intricate interplay between climate change and the escalation of HWC, highlighting the potential implications for both human communities and wildlife populations. As climate change continues to alter landscapes and disrupt traditional habitats, wildlife species are compelled to adapt to changing environmental conditions. This adaptation often leads to shifts in migration patterns, alterations in feeding behavior, and modifications in habitat selection. These changes, coupled with the scarcity of resources in certain regions, result in increased encounters between wildlife and human populations. Consequently, instances of HWC intensify as competition for space and resources escalates. Rising temperatures and extreme weather events associated with climate change further exacerbate the situation. Human communities, particularly those in vulnerable regions, face heightened risks as changing climatic conditions force wildlife to venture into populated areas in search of food and water. Crop raiding, predation on livestock, and even direct threats to human safety become more prevalent, creating a complex web of challenges for communities already grappling with the impacts of climate change. This study also explores potential mitigation strategies and adaptation measures to address the evolving dynamics of HWC in the context of climate change. Collaborative efforts between conservationists, policymakers, and local communities are crucial to developing sustainable solutions that balance the needs of both humans and wildlife. The role of technology, community-based conservation initiatives, and innovative policy frameworks will be examined as essential components in managing and mitigating the impacts of HWC under the changing climate scenario. In conclusion, understanding the intricate relationship between climate change and HWC is imperative for developing effective strategies to mitigate conflicts, ensure the coexistence of humans and wildlife, and foster resilient ecosystems in the face of ongoing environmental transformations.

SCREENING FOR MAJOR FOLIAR DISEASES IN GROUNDNUT (*ARACHIS HYPOGAEA* L.)

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Abstract

Oil and fats are essential items in human diet since they provide energy; improve taste and palatability of food. Oilseed crops are next to cereals in production of agricultural commodities in India, which occupy a place of prime importance in Indian economy. Groundnut (*Arachis hypogaea* L.), also known as peanut, is an important oilseed crop in tropical and subtropical regions of the world. Known as poor man's almond, groundnut is a crop of global economic significance due to its use as a source of diverse food products. The seed is most important part, which is utilized for the production of edible oil and also eaten as snack food. The low productivity of the crop in India is ascribed to many biotic and abiotic stresses. Among the biotic



stresses, the three major foliar diseases viz., early leaf spot late leaf spot and rust. Keeping this in view an experiment was conducted at the Agricultural college Bapatla farm, ANGRAU during *kharif* 2017, to screen the forty groundnut advanced breeding lines including released varieties for early, late leaf spot and rust disease under natural epiphytotic conditions. Screening was done at 30, 40 and 50 days after sowing (DAS) for early leaf spot and late leaf spot and rust at 60, 70 and 90 DAS. The advanced breeding lines like K1800, K1812, and K1813 showed resistance compare to the checks TAG 24 and Kadiri -6 which are highly susceptible genotypes.

COMBINING ABILITY STUDIES FOR YIELD AND ITS ATTRIBUTES IN MAIZE (*ZEA MAYS* L.)

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Abstract

Maize is one of the important cereal crops due to its diversified use as food, feed, and raw material for industrial products and hence it is also called by unique name 'Queen of Cereals'. For a systematic breeding programme, it is essential to identify the parents as well as crosses that could be exploited to bring about further genetic improvement in yield. Combining ability of parents gives useful information regarding the selection of parents in terms of the performance of their hybrids. The material for the present study comprised of 39 hybrids which were derived by crossing 13 lines and 3 testers in a line $\times$ tester mating design. The mean sum of squares due to testers was higher than that of lines for majority of traits indicating that the testers were more genetically diverse than lines. Out of 39 crosses, 18 hybrids manifested positive SCA effect for grain yield per plant and cross VL181693 $\times$ CAL1426 manifested highest positive significant SCA. This hybrid also showed SCA effects in desired direction for days to 50 per cent anthesis, days to 50 per cent silking, ASI, shelling percentage, ears per plant, test weight and kernel rows per cob followed by the cross KL156009 $\times$ CAL1514 in desirable direction. Among 13 lines VL19208, VL20236 and ZL155414 are best general combiners which exhibited high GCA effects in desirable direction for yield related traits. Among three testers, ZL153493 tester is best for yield and yield related traits.

PERFORMANCE OF WHITE ONION (*ALLIUM CEPA* L.) GENOTYPES IN NORTHERN KARNATAKA

Kushal, Amerullah and Shashidhar T.R

Abstract

The study was conducted to assess extent of genetic variability among sixteen white onion genotypes along with check Bhima Safed for fifteen characters comprised of bulb yield and its contributing traits. These genotypes were evaluated in Complete Randomized Block Design with two replications during *rabi*-2021, at Main Agriculture Research Station, UAS, Dharwad. The mean performance of the genotypes indicates that Puna White shows highest bulb yield followed by Bhima Shubra and W-364. The analysis of variance revealed the existence of significant amount of variation for the traits studied. High PCV and GCV were noticed for number of centres per bulb, total bulb yield and fresh weight of bulb. Whereas, moderate GCV and high PCV was observed for weight of single bulb and average weight of marketable bulbs. Therefore, these characters can aid in selection programme of onion breeding. High heritability coupled with high genetic advance over mean was recorded for number of centres per bulb, total bulb yield, fresh weight of the bulbs, average weight of marketable bulb and weight of single bulb, indicates the predominance of an additive gene effects and these provides ample scope for further improvement of these characters through selection.

IDENTIFICATION OF SUPERIOR GENERAL AND SPECIFIC COMBINERS FOR DROUGHT AND YIELD RELATED TRAITS IN MAIZE (*ZEA MAYS* L.)

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Abstract

Maize is highly productive under optimal environmental and crop management conditions, but very susceptible to drought and



heat. Every year on an average of 15 to 20 percent of the world's maize production is lost due to drought and heat stress. High temperatures have a profound impact on yield compared to drought in maize. An increase in temperature by 2°C would reduce maize yield by 13 percent while a 20 percent increase in intra-seasonal variation reduced the maize yield by only 4.5 percent. In the present study on combining ability, 39 crosses were evaluated for yield and drought related traits along with checks 900MGold, NK6240, RCRMH2, RCRMH3 and RCRMH4. Observations were recorded on NDVI, SCMR, RWC (%), SLA (cm²/g), Proline content (µg /g dry weight), Days to 50% anthesis, Days to 50% silking, ASI, Plant height (cm), Ear height (cm), Ears per plant, Cob length (cm), Test weight (g), Kernel rows per cob, Shelling percentage and Yield per plant (g). ANOVA clearly indicates the presence of significant differences for mean sum of squares by Line × Tester for some characters like SCMR value, RWC, SLA, Days to 50% anthesis, and yield related traits like cob length, kernel rows per cob, shelling percentage and yield per plant (g). Among 13 lines VL19208, VL20236 and ZL155414, are the best general combiners which exhibited high GCA effects in desirable direction for drought tolerant traits and for yield related traits. Among three testers CAL1514 is best for drought tolerant traits. The cross VL181693 × CAL1426 showed SCA effects in desirable direction for days to 50 per cent anthesis, days to 50 per cent silking, ASI, proline content, shelling percentage, ears per plant, test weight and kernel rows per cob followed by the cross KL156009 × CAL1514.

EFFECT OF PLANT BASED MANURES AND VERMICOMPOST ON CHILLI SUCKING PESTS

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Abstract

Field experiment was conducted at Main Agricultural Research Station, Raichur under the University of Agricultural Sciences, Raichur during 2014-15 to assess the effectiveness of Neem cake, Vermicompost and Pongamia cake against chilli thrips (*Scirtothrips dorsalis* Hood) and mites (*Polyphagotarsonemus latus* Banks). The results revealed that the chilli crop grown in the soil amended with neem cake (250 kg/ha) and vermicompost (1t/ha) were most effective in managing the sucking pests, being comparable to recommended insecticides. 15 Days after chilli transplanting blanket application of fipronil and dicofol and 30 DAT second sprays of fenpyroximate and spinosad. Followed by Pongamia cake (250kg/ha) for the effectiveness against sucking pest management. At the same time organics were more effective in managing leaf curl manifestations also. Significantly highest red chilli yield was noticed in the neem cake at 250 kilo gram per hectare (10.42 q/ha) applied plot, followed by vermicompost at 1tonne per hectare (10.12 q/ha). Whereas, Untreated crop yield was significantly lowest (6.73q/ha). The research highlights that the use of organics in managing sucking pests of byadagi chilli, has export potential.

GREEN SYNTHESIS AND CHARACTERIZATION OF SILVER NANOPARTICLES FOR FOOD APPLICATIONS

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Abstract

The research was conducted to synthesize and characterize the silver nano-particles (Ag-NPs) using lime seed extract as a reducing agent at different concentrations, temperatures and pH conditions. The optimized treatment combinations resulted in the production of stable silver nanoparticles with a particle size ranging between 50 and 59 nm, zeta potential ranging between -24.20 and -17.5 mV and surface roughness ranging between 16.87 and 19.23 nm. The characterizations of produced Ag-NPs with high end equipments revealed that, the particles were in spherical shape and face cubic centered in nature. The efficacy of Ag-NPs were analyzed at different concentrations for shelf-life improvement of papaya and sapota fruits. The results of the experiment revealed that, the green-synthesized Ag-NPs were effective in many ways to maintain the quality attributes of papaya and sapota fruits and found to be very good alternative to enhance the shelf-life of the above mentioned



fruits up to 12 and 10 days, respectively. The synthesis of Ag-NPs using biological methods could be eco-friendly, economical and viable option for synthesis as well as to reduce the post harvest loss of agri-horti produces.

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Ramappa K.T.¹, Jayashree¹, Udaykumar Nidoni¹, Sharanagouda, Hiregoudar¹ Shekharagouda S. Patil²

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Abstract

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SCREENING OF CHARCOAL ROT RESISTANCE IN M6 GENERATION OF SORGHUM (*SORGHUM BICOLOR* (L.) MOENCH)

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Abstract

Total 100 mutants and 7 checks were used to study the charcoal rot resistance in the present experiment. This study was carried out in augmented design during Rabi 2022 at Agriculture research station, Hagari. Charcoal rot disease is caused by *Macrophomina phaseolina* (Tassi) Goid. It appears in severe form on the improved varieties in hot dry weather with soil moisture stress. The screening results revealed that 28 mutant lines shown moderate resistant reaction compared to the resistant check DSV-4 (0.72) and E-36-1 (0.37), among them six mutants had exact only one node crossed by the pathogen. These mutants' lines exhibited comparatively lowest number of mean nodes crossed. 40 mutant lines shown moderate resistant response to charcoal rot index trait. These resistant lines can be used for further confirmation and also for future resistant breeding programmes.

ADOPTION AND INNOVATION IN APICULTURE: A PATHWAY FOR LIVELIHOOD SECURITY

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Abstract

In an effort to document the adoption and innovations in apiculture, a study was conducted in Koppal district of Kalyan Karnataka region. Case study of two apiculturists clearly revealed adoption of apiculture gives substantial support for their



livelihood apart from keeping them engaged throughout the day relieving their mental stress condition. Utilization of natural resources available in an innovative way for attracting swarms of bees not only increased the income but offered a wide variety of advantages to the beekeeper. Value addition of byproduct is another source of income and employment which is supported by the main activity. With Innovation of new products and ITK techniques, beekeepers can keep up with the changing times and demands of the beekeeping industry. Adoption and Innovation helps in making beekeeping safer, easier, and more efficient, which is good for beekeepers and bees alike.

IDENTIFICATION OF PROMISING LINSEED BASED CROPPING SYSTEM UNDER DIFFERENT NUTRIENT LEVELS

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Abstract

A field experiment was conducted during 2022-23 at Agriculture Research Station Dhadesugar, UAS, Raichur to find out the promising linseed based cropping system under different nutrient levels for the linseed based cropping system. The soil of the experiment was medium black clayey in texture with alkaline in reaction, medium in organic matter (0.68 %), low in available nitrogen (232 kg ha⁻¹), medium in phosphorus (23 kg ha⁻¹) and potassium (243 kg ha⁻¹). The experiment was laid out in split plot design with three replications. The main plot consist of four cropping systems viz., C₁- Soybean- Linseed, C₂- Green gram- Linseed, C₃- Black gram- Linseed, C₄- Drilled rice- Linseed and sub plot consist of four fertilizer levels viz., F₁- 50 % NPK, F₂- 75% NPK, F₃- 100% NPK, F₄- 125% NPK. The results of the experiment showed that, soybean- linseed cropping system recorded significantly higher seed yield (838 kg ha⁻¹), system productivity (14.21 kg ha⁻¹ day⁻¹), net returns (Rs. 1,06,013 ha⁻¹) and B:C ratio (3.83) compared to other cropping systems. Whereas, higher crop equivalent yield of 2925 kg ha⁻¹ was recorded under drilled rice- linseed cropping system which was on par with soybean- linseed cropping system (2869 kg ha⁻¹). However, lower seed yield and B: C ratio of 652 kg ha⁻¹ and 1.95, respectively were observed under drilled rice- linseed cropping system over others. Among the fertilizer levels, application of 125% NPK recorded significantly higher seed yield (786 kg ha⁻¹), crop equivalent yield (2515 kg ha⁻¹), system productivity (12.64) and net returns (Rs. 80,540 ha⁻¹) compared to others and lower values were recorded with application of 50% NPK (711 kg ha⁻¹, 2440 kg ha⁻¹, 12.25 kg ha⁻¹ day⁻¹, Rs. 78,593 ha⁻¹, respectively).

G×E INTERACTION AND ADAPTABILITY STUDIES FOR SEED YIELD IN COWPEA [VIGNA UNGUICULATA (L.)] GENOTYPES

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Abstract

A field experiment was conducted during *kharif* 2021 using 25 genotypes of cowpea along with six checks in randomized complete block design of three replications with three different dates of sowing to estimate stability of performance on sixteen quantitative traits. Study revealed that variances due to genotype, environment, genotype x environment, environment (linear) and pooled deviation were significant for seed yield per plot and pod length. The interaction between genotypes and environment were also significant for days to initiation of flowering, days to 50 per cent of flowering and days to physiological maturity. The environmental indices indicated that the optimum sowing time is first fortnight of July most favourable for expression of most of the characters including seed yield. Based on the stability analysis of Eberhart and Russell (1966) model, four genotypes viz., NBC-42, KBC-9, KM-5 and PGCP-6 were found to be stable across the environments (different dates of sowing) for seed yield. These genotypes had high seed yield with a unity regression coefficient and deviation from regression equal to zero, may be effectively used for future cowpea breeding programmes.



STUDIES ON GENETIC VARIABILITY PARAMETERS IN F₃ SEGREGATING POPULATIONS OF GROUNDNUT (*ARACHIS HYPOGAEA* L.) FOR YIELD AND YIELD ATTRIBUTING TRAITS

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Abstract

Genetic variability studies were carried out for different characters of groundnut derived from four crosses viz., Kadri-9 x GPBD-4, ICGV-00351 x GPBD-4, Kadri-9 x Sunoleic-95R, ICGV-00351 x Sunoleic-95R. Results revealed that presence of moderate to high PCV and GCV for most of the traits, further a high heritability coupled with high genetic advance was also observed for these traits indicating involvement of additive gene action in controlling of these traits making selection effective. Oil content, sound mature kernel, shelling per cent and days to physiological maturity exhibited a low to moderate category range for the genetic parameters indicating that they are under the influence of non additive gene action thus cannot be considered as a tool in selection programme to enhance groundnut productivity.

ESTIMATION OF LYCOPENE CONTENT ON DIFFERENT STAGES OF TOMATO (*SOLANUM LYCOPERSICUM* CV. ARKA SAMRAT)

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Abstract

Tomatoes, being a key crop with significant health benefits, are often subjected to various treatments to influence their ripening process. Ripening rate and lycopene content are crucial factors in determining the quality of tomato products. In this study, we aimed to evaluate the effect of different ripening stages and estimate lycopene content without the use of any growth regulator. The experimental design involved observing tomatoes at various maturity stages, focusing on the natural ripening process. Results indicated a natural ripening advancement, with maturity occurring approximately 3 days earlier than usual. Interestingly, despite the absence of any growth regulator like Ethrel, the lycopene content remained consistent across the different maturity stages. The average lycopene content ranged from 2.11 to 9.85 mg per 100g of fresh weight. These findings emphasize the intrinsic ripening dynamics of tomatoes and the stability of lycopene content without the need for external growth regulators. Understanding these natural processes contributes valuable insights for sustainable agricultural practices and ensures the production of high-quality tomato yields for consumers.

SEED QUALITY OF STORED SOYBEAN SEEDS AS INFLUENCED BY DIFFERENT PACKAGING MATERIALS AND STORAGE CONDITIONS

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Abstract

A lab experiment was carried out to study the Seed quality of stored soybean (*Glycine max*) seeds as influenced by packaging materials and storage conditions. Soybean seeds (JS-335) were stored in different packaging materials viz., gunny bags and high-density polythene bags and vacuum-packed bags stored at room temperature ($25 \pm 2^\circ\text{C}$) and cold storage ($4 \pm 1^\circ\text{C}$) for a period of 18 months during 2020-21. The treatments having six combinations and consisting of different containers viz., gunny bags, high-density polythene bags, and vacuum-packed bags were replicated four times in both cold and ambient storage conditions in a completely randomized design. The results of the study revealed that the seed quality parameters viz., Seed germination, moisture content and electrical conductivity, seedling length, SVI, and seed physiological parameters such



as mineral content (Cu, Mn, Zn and Mn) values were higher in vacuum-packed seeds than gunny, HDPE bags for soybean seeds stored under cold storage compared to room temperature throughout the storage period. Among the containers, the seeds stored in vacuum-packed bags maintained the seed quality and seed physiological parameters with least deterioration compared to seeds stored in gunny bags and high-density polythene bags.

EFFECT OF BIOFUMIGANTS ON SEED QUALITY IN CHICKPEA

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Abstract

The laboratory experiment was conducted in the Department of Seed Science and Technology, College of Agriculture, UAS, Raichur to know the effect of biofumigant on seed longevity in chickpea during 2022-23, consisting of five plant extracts viz.,lantana, eucalyptus, mustard, sweet flag, basil with three different concentrations (15µl, 20 µl, 25 µl) exposed for seven days. These plant materials were shade dried and ground into powder, bioactive compound was extracted by using Soxhlet apparatus. Plant extracts in liquid formulation were tested for their fumigant action against pulse beetle. The results revealed that, lantana and sweet flag caused 100 per cent insect mortality (at 25 µl conc. & seven days exposure period), the least insect mortality was observed in basil (21.67%), where as 0% insect mortality observed in control. For biochemical studies, chickpea seeds were stored in gunny bags with 5 plant extract treatments (25µl/100gm of seeds). The seed quality parameters viz., dehydrogenase enzyme activity (1.494 OD), -amylase activity (33.72 mm), were high in seeds fumigated with leaves of lantana up-to eight months of storage with lower electrical conductivity (0.545 dsm⁻¹), per cent insect infestation (1.56 %) and per cent weight loss (0.34 %). It was concluded that biofumigation with lantana found to be the most promising means of controlling storage insects in an ecofriendly manner without disturbing seed quality parameters, used as an alternative for chemical fumigation.

A STUDY ON PERFORMANCE ASSESSMENT OF HORTICULTURAL FARMER PRODUCER ORGANIZATION (FPOS) AS PERCEIVED BY THE FARMERS IN KOPPAL DISTRICT OF KARNATAKA

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Abstract

The present study entitled as A Study on Performance assessment of horticultural farmer producer organization (FPOs) as perceived by the farmers in Koppal district of Karnataka during the academic year of 2022-2023 assesses the performance of horticultural farmer producer organization. Expost-facto research design was employed in this study. Four villages were selected from each of the FPOs comprising a total of 12 villages from 3 FPOs. Ten members from each village were selected. Thus, the total sample size of the study was 120. A well-structured schedule was used for data collection and collected data was analyzed. This study scrutinizes the significance of small farmers in poverty reduction in India, highlighting the limitations in access to resources like land, water, credit, and technology due to inadequate local-level support systems and governance challenges. Despite these hurdles, joint efforts and technological advancements are fostering productivity and income growth among small farmers. The research focuses on horticultural Farmer Producer Organizations (FPOs) in Karnataka's Koppal district, encompassing 120 participants from villages with significant FPO presence. Findings reveal demographic trends, service preferences, and perceptions among FPO members. Notably, AHFPCL, KHFPCL, and YHFPCL emerged as prominent FPOs. The study highlights the strengths (equity grants, state facilities) and weaknesses (CEO turnover) of these FPOs, along with opportunities (direct marketing amid COVID-19) and threats (political interference). Constraints like limited credit facilities and suggestions such as processing unit establishment were emphasized. The implications stress the need for enhanced awareness among farmers about FPOs, institutional support to bolster FPO operations, technological backing for processing, improved credit access, and streamlined registration procedures. Such measures aim to empower FPOs and benefit small farmers in India.



EFFECT OF NANO UREA AND NANO DAP ON GROWTH AND YIELD OF TOMATO (*SOLANUM LYCOPERSICUM* L.)

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Abstract

A field experiment was conducted during *rabi* 2022-23 at New-Orchard, MARS, University of Agricultural Sciences, Raichur, to study the effect of nano urea and nano DAP on growth and yield of tomato. There were ten treatments consisting of different doses of RNP (three treatments with 25% RNP, three with 50% RNP, three with 75% RNP and one with 100% RDF) with different doses of nano urea and nano DAP sprayed at 30 & 45 DAT. Results revealed that application of 75% RNP as basal + nano urea & nano DAP spray @ 6 ml l⁻¹ each at 30 and 45 DAT has produced significantly higher plant height (150.08 cm), leaf area per plant (3951.92 cm²) and chlorophyll content of leaves (65.89 SPAD readings). It has resulted in enhanced yield (93.70 t ha⁻¹) by 22.73% over RDF (72.40 t ha⁻¹). Hence, the results confirmed that reduced rate of conventional fertilizer can be substituted by foliar application of nano fertilizers to enhance growth and yield of tomato.

INVESTIGATING DORMANCY DURATION AND BREAKING METHODS IN SUNFLOWER HYBRID RSFH-700 SEEDS

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Abstract

Dormancy, while an essential survival mechanism in plants, poses challenges in agriculture by delaying seedling establishment. This study investigates the dormancy duration and effective breaking methods for the sunflower hybrid RSFH-700, especially relevant for seed analysts and producers requiring prompt germination assessments. Two experiments were conducted at the Department of Seed Science and Technology, UAS- Raichur. The first explored dormancy duration. Germination percentage, shoot and root length, seedling dry weight, and seedling vigour indices I and II were assessed in a completely randomized design with four replications. Seeds were subjected to germination tests at 10, 20, 25, 30, 35, 37, 39, 41, 43, and 45 days after harvest. The second experiment aimed to identify effective dormancy breaking methods. Twelve treatments were evaluated are T₁, Exposing seeds to sunlight for 24 hours; T₂, Soaking seeds in water for 15 hours; T₃, Heat treatment at 80 °C for 10 minutes; T₄, Soaking seeds in 500 ppm GA₃ for 24 hours; T₅, Soaking seeds in 0.2 per cent KNO₃ for 10 minutes; T₆, Soaking seeds in 0.3 ml L⁻¹ ethrel for 24 hours; T₇, Soaking seeds in fresh butter milk over night; T₈, Soaking seeds in 5 per cent panchagavya for 15 hours; T₉, Soaking seeds in 6 per cent vermiwash for 15 hours; T₁₀, Soaking seeds in acetone @ 25 per cent for 15 minutes; T₁₁, Hot water treatment at 80 °C for 15 minutes; T₁₂, Control (without soaking). Treatments were applied immediately after harvest, and seeds were subjected to germination tests. Observations included germination percentage, abnormal seedlings, ungerminated seeds, dead seeds, root length, shoot length, seedling dry weight, and seedling vigour indices I and II. Results revealed that initial germination of the hybrid seeds was 20.50% at 10 days after harvest. This progressively increased, reaching 74.75% at 35 days after harvest, exceeding the Minimum Seed Certification Standards (70%). Germination parameters also showed significant increases with progressing germination, indicating dormancy release. Pre- treatments significantly impacted the seeds' physiological parameters. Untreated seeds displayed the lowest values, highlighting the need for dormancy breaking methods to ensure uniform emergence and plant stand. Among the tested treatments, ethrel (0.3 ml L⁻¹) for 24 hours (T₆) proved most effective, achieving a significantly highest normal seedling percentage (94.75%). This was followed by GA₃ @ 500 ppm for 24 hours (93.00%) and KNO₃ @ 0.2% for 10 minutes (92.75%). This study concludes that sunflower seed dormancy can be effectively broken by ethrel (0.3 ml



L?) for 24 hours, providing valuable information for seed analysts and producers seeking improved germination and seedling establishment.

CORRELATION AND PATH ANALYSIS STUDIES FOR POD YIELD AND ITS ATTRIBUTING CHARACTERS IN SAFFLOWER (*CARTHAMUS TINCTORIUS* L.)

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Abstract

Correlation and path analysis among yield and yield attributing traits has been carried out in a twenty safflower genotypes during Rabi 2018-19 at Zonal Agricultural Research Station, Kalaburagi to assess direct and indirect effects of different morphological traits and its attributing traits on yield. Correlation analysis revealed significant positive correlation between seed yield per plant and other characters like plant height, number of capitula per plant, number of seeds per capitulum and 100 seed weight and significant negative correlation with days to 50% flowering and days to maturity. Path coefficient analysis indicated that 100-seed weight exhibited maximum direct effect followed by number of seeds/capitulum.

STUDIES ON GENETIC VARIABILITY IN RIDGE GOURD (*LUFFA ACUTANGULA* L.) GENOTYPES

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Abstract

An experiment entitled “Studies on genetic variability in ridge gourd (*Luffa acutangula* L.) genotypes” was carried out at PG research block, Main Agricultural Research Station, University of Agricultural Sciences, Raichur during the *kharif* season of 2022-23. Sixteen genotypes were evaluated by using Randomized Block Design (RBD) with three replications. The results revealed that highest vine length (625.86 cm) was recorded in the genotype RGG-2247. The genotype RGG-2222 took minimum number of days for first female flower emergence and 50 per cent flowering (33.67 and 36.33 days, respectively). Significantly highest fruit length (38.75 cm) and average fruit weight (149.75 g) were recorded in the genotype RGG-2248, highest fruit diameter (37.35 mm) and number of fruits per vine (19.13) was recorded in the genotype RGG-2222. The Genotype RGG-2247 recorded maximum fruit yield per vine (2.41 kg), fruit yield per plot (30.22 kg) and fruit yield per hectare (23.32 tons) and it was found to be superior for yield and its attributing traits. The genotype RGG-2233 (8.69 %) exhibited significantly minimum incidence of fruit fly with moderately resistance reaction type. Variability study revealed that high PCV, GCV and high heritability coupled with high genetic advance as per cent of mean was observed for the characters viz., fruit yield per plot and fruit yield per vine followed by fruit length, average fruit weight, number of fruits per vine and leaf area per vine which shows that the heritability is due to additive gene effects and selection will be effective for these characters.

SEED BIO-PRIMING WITH MICROBIAL INOCULANTS IN SESAME: A TAILORED APPROACH TOWARDS IMPROVED CROP PRODUCTIVITY.

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Abstract

Sesame is an important oilseed crop, popularly known as “Queen of Oilseeds” due to its high degree of resistance to oxidation and rancidity. Sulphur requirement for sesame crop and the role of microorganisms in making available to it is very important



to understand. The present study was conducted with the aim to evaluate the efficacy of seed priming with sulphur oxidising bacteria for improving seed quality attributes of sesame. The seed priming agents such as Azophos (*Azospirillum* + *Phosphobacteria*) and two different Sulphur Oxidising Bacteria namely *Dyella thiooxydans* ATSB10 and *Achromobacter xylooxidans* ON9503241 were utilised for improving germination and vigour along with hydropriming and nonprimed seeds used as control. The seeds primed with sulphur oxidising bacteria shown 10 and 8 per cent increase in germination over non-primed seeds and hydroprimed seeds, respectively. Similar increase in other seed quality attributes viz., speed of germination, germination, root and shoot length, dry matter production and vigour index were observed. The seeds primed with *Achromobacter xylooxidans* at 6 per cent for 8 hrs recorded maximum speed of emergence, germination per cent, seedling length, dry matter production and vigour index followed by seeds primed with *Dyella thiooxydans* at 8 per cent for 8 hrs compared with hydropriming and nonprimed seeds. This may be due to the favourable impact of plant growth promoting microbial inoculant as they excrete phytohormones, which results in improved seedling growth and vigour.

INDUCED MUTATION STUDIES FOR IMPROVEMENT OF SEED YIELD IN COWPEA (*VIGNA UNGUICULATA* L.)

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Abstract

Cowpea (*vigna unguiculata* L.) commonly known as black eyed pea, is an important legume crop valued for its high protein content and dry matter content. The experiment was carried out with an objective to assess genetic variability in M₁ and M₂ generation in the cowpea varieties KBC-2 and KBC-9 by a physical mutagen (Gamma rays) and chemical mutagen (Sodium Azide). Progressive decrease in germination and survival with increase in gamma rays and Sodium Azide dose were recorded in M₁. Stimulatory and inhibitory effects were noticed in quantitative characters with lower and higher doses, respectively. For all the characters under study in both the generations, phenotypic coefficient of variation was higher in magnitude than genotypic coefficient of variation. High GCV as well as PCV was obtained in M₁ and M₂ generation for traits number of primary branches per plant, seed yield per plant and seed yield per plot. High heritability estimates in coupled with high genetic advance expressed as percent of mean was recorded in seed yield per plant in M₁ as well as M₂ generation.

STUDIES ON GENETIC VARIABILITY OF CLUSTER BEAN (*CYAMOPSIS TETRAGONOLOBA* L.) GENOTYPES

Shubham Jayade and Ashok Hugar

Abstract

An experiment was carried out for evaluation, genetic variability and correlation studies of cluster bean genotypes at Herbal garden, Department of Horticulture, College of Agricultural Sciences, Raichur during late *kharif* season of 2022 by using twenty seven genotypes and laid out in Randomized Block Design (RBD) with three replications. The results revealed that the highest plant height (91.02 cm) number of nodes on main stem (18.00) and leaf area per plant (2801.42 cm²) was recorded in the genotype Raichur Local. The genotypes CBR-CM-32 and Raichur Local recorded the minimum days to 50 per cent flowering (27.33) which indicates the earliness of the genotypes. The genotype Raichur Local which recorded significantly maximum pod length (11.57 cm), average pod weight (2.34), pod yield per plant (186.40) and pod yield per hectare (13.42 t) and it is found to be superior over all other cluster bean genotypes under study. Variability study revealed that high GCV, PCV and high heritability coupled with high genetic advance as per cent of mean were reported for the traits viz., plant height, number of branches per plant, leaf area per plant, leaf area index, first flowering node, number of clusters per plant, number of pods per plant, pod length, average pod weight, pod yield per plant, pod yield per plot, pod yield per hectare, shelf life and protein content which shows that high heritability is due to involvement of additive gene effect and selection would be more effective. Significant positive correlation of pod yield per plant was observed with the plant height, internodal length, leaf area per plant, leaf area index, number of nodes on main stem, chlorophyll content, pod length, number of pods per plant, number of clusters per plant, pod diameter, number of pods per cluster and average pod weight at both phenotypic and genotypic level.



INDUCE PHYSICAL AND CHEMICAL MUTAGENESIS FOR IMPROVEMENT OF YIELD ATTRIBUTING TRAITS AND CORRELATION ANALYSIS IN COWPEA (*VIGNA UNGUICULATA* L.)

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Abstract

In the present investigation the dry and healthy seeds of cowpea varieties KBC-2 and KBC-9 mutagenised through gamma rays (30, 40 and 50 kR) and sodium azide (0.03, 0.04 and 0.05 %) respectively were evaluated for induced magnitude and directional changes in the associations and correlations in M₂ generation. Correlation studies for all the possible associations among characters in M₂ generation showed clearly that the mutagenic treatments have succeeded in generating more favourable associations between various components of yield. The magnitude and direction of change induced by a particular treatment varied according to variety and the mutagen used. Correlation analysis showed that seed yield per plant exhibited positive and significant association with plant height (0.463), number of primary branches (0.585), number of secondary branches (0.343), number of pods per plant (0.931), pod length (0.6620), number of seeds per pod (0.927), test weight (0.743), dry matter (0.899), harvest index (0.950). In contrary to this it was significant and negatively correlated with days to initiation of flower (-0.359), days to 50% flowering (-0.413), days to maturity (-0.510).

CORRELATION AND PATH COEFFICIENT ANALYSIS IN CASTOR (*RICINUS COMMUNIS* L.)

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Abstract

The present investigation on study of correlation and path analysis was carried out in castor (*Ricinus communis* L.) for eleven quantitative characters of sixteen inbred lines along with two checks (48-1, DCS-9) conducted during Rabi 2020. The seed yield per plant had strong positive association with days to maturity, number of nodes upto primary spike, effective length of main spike, number of capsules on primary spike and number of effective spikes per plant at both genotypic and phenotypic level. The characters days to 50 per cent flowering, days to maturity, number of nodes up to primary spike, primary spike length, number of capsules on primary spike, number of effective spikes per plant had positive direct effect on seed yield per plant at phenotypic level. It is, therefore, suggested that simultaneous selection for number of capsules on primary spike, primary spike length, number of effective spikes per plant and number of nodes upto primary spike would result in improvement of seed yield by phenotypic selection.

EFFICACY OF *A. EXCELSA* AGAINST CIGARETTE BEETLE A NOVEL ECOFRIENDLY APPROACH TOWARDS FOOD SECURITY

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Abstract

There is an increase in storage losses due to insect pests and the most important pest of spices is cigarette beetle. Since chemical pesticides are not tolerated in food storage as they remain residue, use of botanicals and other safe methods is the best choice to combat this pest. Therefore, investigations were made to explore leaf extract of *Ailanthus excelsa* to combat the cigarette beetle problem in coriander. Supercritical fluid extract of *A. excelsa* was extracted using supercritical carbon dioxide. Supercritical fluid extract of *A. excelsa* leaves and powder of *A. excelsa* leaf, a control and chemical check malathion, as well



as sweet flag rhizome powder as a standard check, were used as treatments. Adult mortality, adult emergence, seed damage and seed weight loss were recorded. Supercritical fluid extract of *A. excelsa* at 1 per cent proved to be superior by recording cent per cent mortality of cigarette beetle at one day after treatment, followed by chemical check malathion at 1 per cent which was superior over other treatments and there was no mortality in control. There was no adult emergence seen in SFE of *A. excelsa* at 1, 1.5 and 3 per cent Effectiveness of supercritical fluid extract may be attributed to the presence of bioactive compounds such as the phenols, tannins, flavonoids and also derivatives of fatty acid methyl esters such as hexadecenoic acid and octadecenoic acid, ricinoleic acid present in the leaves of *A. excelsa* as these are the compounds proven to be having insecticidal properties. Coriander seeds treated with SFE of *A. excelsa* at 1.0 per cent showed neither seed damage nor weight loss of seeds so, it was significantly superior to other treatments of *A. excelsa* SFE and powder

COMBINING ABILITY STUDIES FOR YIELD AND ITS ATTRIBUTES IN MAIZE (*ZEA MAYS* L.)

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Abstract

Maize is one of the important cereal crops due to its diversified use as food, feed, and raw material for industrial products and hence it is also called by unique name 'Queen of Cereals'. For a systematic breeding programme, it is essential to identify the parents as well as crosses that could be exploited to bring about further genetic improvement in yield. Combining ability of parents gives useful information regarding the selection of parents in terms of the performance of their hybrids. The material for the present study comprised of 39 hybrids which were derived by crossing 13 lines and 3 testers in a line $\times$ tester mating design. The mean sum of squares due to testers was higher than that of lines for majority of traits indicating that the testers were more genetically diverse than lines. Out of 39 crosses, 18 hybrids manifested positive SCA effect for grain yield per plant and cross VL181693 $\times$ CAL1426 manifested highest positive significant SCA. This hybrid also showed SCA effects in desired direction for days to 50 per cent anthesis, days to 50 per cent silking, ASI, shelling percentage, ears per plant, test weight and kernel rows per cob followed by the cross KL156009 $\times$ CAL1514 in desirable direction. Among 13 lines VL19208, VL20236 and ZL155414 are best general combiners which exhibited high GCA effects in desirable direction for yield related traits. Among three testers, ZL153493 tester is best for yield and yield related traits.

IDENTIFICATION OF SUPERIOR GENERAL AND SPECIFIC COMBINERS FOR DROUGHT AND YIELD RELATED TRAITS IN MAIZE (*ZEA MAYS* L.)

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Abstract

Maize is highly productive under optimal environmental and crop management conditions, but very susceptible to drought and heat. Every year on an average of 15 to 20 percent of the world's maize production is lost due to drought and heat stress. High temperatures have a profound impact on yield compared to drought in maize. An increase in temperature by 2°C would reduce maize yield by 13 percent while a 20 percent increase in intra-seasonal variation reduced the maize yield by only 4.5 percent. In the present study on combining ability, 39 crosses were evaluated for yield and drought related traits along with checks 900MGold, NK6240, RCRMH2, RCRMH3 and RCRMH4. Observations were recorded on NDVI, SCMR, RWC (%), SLA (cm²/g), Proline content (µg /g dry weight), Days to 50% anthesis, Days to 50% silking, ASI, Plant height (cm), Ear height (cm), Ears per plant, Cob length (cm), Test weight (g), Kernel rows per cob, Shelling percentage and Yield per plant (g). ANOVA clearly indicates the presence of significant differences for mean sum of squares by Line $\times$ Tester for some characters like SCMR value, RWC, SLA, Days to 50% anthesis, and yield related traits like cob length, kernel rows per cob, shelling percentage and yield per plant (g). Among 13 lines VL19208, VL20236 and ZL155414, are the best general combiners which exhibited high GCA effects in desirable direction for drought tolerant traits and for yield related traits. Among three testers CAL1514 is best for drought tolerant traits. The cross VL181693 $\times$ CAL1426 showed SCA effects in desirable direction for days to 50 per cent anthesis, days to 50 per cent silking, ASI, proline content, shelling percentage, ears per plant, test weight and kernel rows per cob followed by the cross KL156009 $\times$ CAL1514.



GENETIC VARIABILITY STUDIES FOR GRAIN YIELD AND YIELD ATTRIBUTES IN COLOURED SORGHUM [*SORGHUM BICOLOR* (L) MOENCH] GENOTYPES

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Abstract

An experiment was conducted at College of Agriculture, Raichur during *rabi* 2022-23 using 16 promising coloured sorghum genotypes and four checks to study the genetic variability for grain yield and yield attributes. The experiment was laid out in Randomized Complete Block Design with two replications. The genotypes were evaluated for morphological and grain yield and yield attributing characters. Genetic variability studies were carried out. The results revealed that high Phenotypic Coefficient of Variation (PCV), Genotypic Coefficient of Variation (GCV) and high heritability coupled with high genetic advance as per cent of mean was observed for the characters viz., panicle length, neck of panicle, panicle width, grain yield per hectare, 100 grain weight, grain yield per plant, peduncle length and panicle weight. This shows that high heritability is due to additive gene action and selection would be effective for these characters.

CORRELATION AND PATH ANALYSIS STUDIES FOR GRAIN YIELD AND YIELD ATTRIBUTES IN COLOURED SORGHUM [*SORGHUM BICOLOR* (L) MOENCH] GENOTYPES

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Abstract

An experiment was conducted at College of Agriculture, Raichur during *rabi* 2022-23 using 16 promising coloured sorghum genotypes and four checks to study the correlation and path analysis for grain yield and yield attributing characters. The experiment was laid out in Randomized Complete Block Design with two replications. The genotypes were evaluated for morphological and grain yield and yield attributing characters. Correlation and path analysis studies were carried out for these characters. Significant and positive correlation of grain yield per plant was observed with the characters viz., panicle weight, panicle width, plant height, days to 50 per cent flowering, days to maturity and 100-grain weight at both phenotypic and genotypic levels. Among these characters, panicle weight showed high magnitude of positive association at both levels with grain yield compared to other characters. Path analysis revealed that panicle weight had high direct positive effect on grain yield per plant. Panicle width, peduncle length, plant height, days to maturity and 100-grain weight were showed the low magnitude of positive direct effects on grain yield. As a result, the these characters will be used for selection for increasing grain yield in coloured sorghum genotypes.

GREEN MANURING : A KEY COMPONENT IN ORGANIC FARMING

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Abstract

Organic farming is a production system that refrains from or significantly limits the use of synthetic fertilizers, growth regulators, and livestock feed additives. The degradation of soil quality stands out as a significant environmental concern. Enhancing soil quality is a pivotal aspect of organic farming, with a focus on bolstering microbial biomass, organic carbon,



nitrogen, and fostering higher microbial activity in the soil. Principally, organic farming adheres to the fundamental principle of soil care, emphasizing the importance of organic carbon conservation for soil fertility. Soil organic matter plays a vital role in improving the physical, chemical, and biological properties of the soil. A key component in managing soil fertility within the context of organic farming is the incorporation of green manure. Recognized as economically viable and environmentally acceptable, the use of green manure in crop production serves as a substitute for agrochemicals. Green manures, crops integrated into agricultural fields to provide nutrients for subsequent crops, play a vital role in the restoration and enhancement of soil quality. Across the globe, numerous green manure plants have been identified, contributing to the improvement of soil biological, physical, and chemical characteristics. Beyond improving and restoring soil quality, the use of green manure also assists in managing agricultural diseases, pests, and weeds.

EFFECT OF IRRIGATION WATER SALINITY ON PHYSIOLOGY OF WHEAT

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Abstract

Salinity stress is one of the most detrimental factors among the abiotic stresses which adversely affect plant growth, metabolism and productivity. In India about 6.74 m ha area is affected by soil salinity. An assured source of irrigation in the wheat growing states of Punjab, Uttar Pradesh, Haryana, Madhya Pradesh and Rajasthan is brackish by 41%, 63%, 67%, 25% and 84% in respective states. Wheat is an irrigated crop and use of saline groundwater for irrigation is the major cause of salinity stress. Saline water use induced stress brings several metabolic and physiological changes in plants. Therefore, in respect of above issues, a systematic research was conducted for two successive years from 2020-21 to 2021-22 in controlled condition lysimeters at ICAR-Central Soil Salinity Institute (ICAR-CSSRI), Karnal, Haryana experimental farm. The experiment was conducted in factorial randomized block design with six replications. It comprised of 8 treatment combinations viz. two different varieties (KRL-210 & HD-3226) and four irrigation salinity levels (EC) of 0.5 (S₁), 3 (S₂), 6 (S₃) and 9 dS m⁻¹ (S₄). Effect of different levels of saline water irrigation to wheat revealed that there was decrease in yield and yield attributes with increasing salinity levels. Among the salinity levels, highest and lowest values of chlorophyll content were obtained under S₁ and S₄ at vegetative and reproductive stages, respectively. LAI significantly decreased with the increase in salt stress at each successive levels of irrigation water salinity. By application of varying levels of salinity, Na/K ratio in leaves at vegetative and reproductive stages had varied. Amongst salinity levels, the highest and lowest Na/K ratios were obtained under S₄ and S₁ levels of salinity.

CLIMATE CHANGE–A THRUST TO FOOD SECURITY ?

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Abstract

Since last two three decades Climate change became a major serious concern as it has both direct and indirect impacts on food security and biodiversity. Food security is a measure of people's access to safe and nutritional food. It depends on several factors, including the availability and affordability of food. The UN Committee on World Food Security defines the concept as : Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. It is one of the humanity's most serious threats, putting at risk the functioning of the natural systems that sustain human health. In the Anthropocene, human activities have significantly altered the Earth through global warming, habitat loss and changes to the atmosphere. Large changes in biodiversity are expected to occur if climate change continues at its current pace. Adverse effects include changes in species habitats and compositions, and consequently changes in ecosystem functioning. The UN Convention on Biological Diversity defines biodiversity as the diversity and variability among living organisms within the terrestrial, marine and other aquatic



ecosystems they are part of. According to the World Wildlife Fund, there has been an average 68% fall in the monitored populations of mammals, birds, amphibians, reptiles and fish since 1970.. Climate change is happening due to natural factors and human activities. It expressively alters biodiversity, agricultural production, and food security. Mainly, narrowly adapted and endemic species are under extinction. Nevertheless, the impact of climate change on biodiversity and food security has been recognized, little is explored compared to the magnitude of the problem globally. Therefore, the this matter of concern needs to be look out and judicious measures needs to apply to combat it so as to balance climate change, biodiversity, and food security.

ENHANCING PRODUCTIVITY AND PROFITABILITY OF SOYBEAN THROUGH DIFFERENT AGRO CHEMICALS UNDER RAINFED CONDITIONS IN MAHARASHTRA REGION

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Abstract

In Maharashtra, the economic exploitation of soybeans dates back almost forty years. The crop has demonstrated unparalleled expansion in both area and productivity throughout this time. In central and peninsular India's rainfed agro-ecosystem, soybeans have become a significant rainy season crop. The introduction of soybeans has increased cropping intensity, which has raised profitability per unit of land area. Soybean will persist as a significant rainfed oilseed crop in India. This extraordinary growth has been the product of numerous bred kinds. Based on modelling studies and on-farm demonstrations, the rainfed potential of soybean in India with current varieties is approximately 2.1 t/ha, compared with a national productivity average of only 1.2 t/ha. As a result, there are significant yield gaps between the potential and actual yields that farmers actually collect. The production of soybeans might double if this yield difference closes. The National Agricultural Research System has so far been effective in satisfying the agricultural and industrial communities' needs for research. By applying novel research techniques and taking advantage of recent developments in biology, it will be feasible to further increase the production of soybean grain and the quality of soybean oil.

USE OF ARTIFICIAL INTELLIGENCE IN AGRICULTURE

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Abstract

Twenty first century is the era of Artificial intelligence (AI). It is predicted that global population by 2050, would be 10 billion which would be creating high pressure on agricultural sector to increase yields and productivity. Presently the Indian agricultural is facing barriers like declining soil fertility, labour shortages, climate change and limited land holdings in achieving the targeted production. Artificial intelligence (AI) could certainly play a crucial role in solving a global food problem. AI enables farmers to minimise crop loss and prepare for unfavourable weather events. It also enables farmers to know well in advance about pricing and demand changes in the market, and thus to choose their best times to sow, harvest, and sell produce in order to maximize profits. Precision farming methods have been greatly improved by AI, allowing farmers to maximise crop yield and reduce resource wastage. AI also enables to gather data on crop health, soil quality, and moisture levels in real time using satellite imaging, drones, and sophisticated sensors. Farmers can utilise this data to improve their decisions about pest control, fertilisation and irrigation, which will result in a more focused and effective use of resources. By using less water, herbicides and fertiliser, this precision method not only increases crop yields but also supports sustainable farming practices. AI has developed a new programme called Plantix to address this problem. Farmers may forecast market trends and comprehend consumer preferences with the use of AI-powered market analysis tools. Artificial intelligence (AI) algorithms enable to know about price trends and swings in demand. Disease and pests are the major threats to the economy, environment, and food security. Early detection of the disease play a crucial role in effective management of crop



diseases. AI-based picture recognition systems enable to identify specific plant diseases and accordingly farmers can take effective control measures on their fields.

STUDIES ON CROP MANAGEMENT TO HIGHER YIELD IN GOA (*PSIDIUM GUAJAVA* L.) CV TAIWAN PINK

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Abstract

The trial on improved management practices in guava was conducted in 45 ha with 50 number of farmers at Mittekellur, Bayyapur, Karadakal, Mattur, Nagaral, Rampur and Yaradihal villages of Lingasugur and Maski taluk of Raichur district. The result revealed that management of fruit fly along with improved management practices right from pruning to fruiting and harvesting yield up to 23.6 % increases in demonstration plot compared to farmers practices with support of technology as recommended by package of practices on Horticulture UHS, Bagalakot.

A STUDY ON MARIGOLD EXTRACT FOR DISEASE MANAGEMENT

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Abstract

Environmental problems caused by extract use of chemical fertilizers is topic of matter from the past year. It has been estimated that damage caused by chemical fertilizers is in billions annually. Excess use of nitrogenous fertilizers can lead to release of toxic gases that is Greenhouse gases which causes global warming. Continuous use of chemical fertilizers can causes permanent damage to the soil health. With the help of organic fertilizers we can prevent all these damages by treating the farm as a leaving system and use everything already present in farm to prevent financial losses and maintain soil health. This review paper focuses on the management of various diseases with the help of marigold extract and low marigold extract can be used as organic fertilizers so that there is harm on environment, producer's financial state and consumer health.

DEVELOPMENT AND EVALUATION OF READY TO COOK SAMBAR POWDER USING PIGEONPEA (*CAJANUS CAJAN*)

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Abstract

Sambar is a legume based curry prepared with vegetables and spices. It is used as an accomplishment to cooked rice. Owing to rapid urbanization and more women joining the workforce, use of ready-to-eat and ready-to-use convenience foods is gaining increasing popularity. Women require dhal that cooks fast and increases in volume when cooked/ they need a packet of powder to cook instantly just by adding it to the hot water. Motivated by the consumer demand there is a need for development of short cooking time, microbial safety and high quality foods. Pigeon pea (*Cajanus cajan*) value added product ready to cook sambar powder was developed using milling residues of pigeon pea like grits (broken dal) and the recipe was optimized by sensory evaluation. The proximate analysis of the developed product and the influence of different packaging material on shelf life of RTC sambar powder was studied. Microbial and sensory evaluation was done on initial, 30th day, 60th day and 90th day of storage life. Based on test results, the developed powder was found to be 'liked extremely' by evaluators with respect to taste



and appearance whereas, 'very much liked' with respect to texture, aroma and overall acceptability. Regarding shelf life, the powder stored in retort pouch found to be having good shelf life with less microbial load.

A STUDY ON CHILLI BLACK THRIPS SURVEILLANCE AND INFESTATION

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Abstract

Thrips Parvispinus (Karny) is cosmopolitan pest species, it is commonly called as black thrips and has been reported from Thailand, Australia and Europe. It is a polyphagous species and has been reported infesting on beans, eggplant, papaya, chilli, pepper and potato. In India this species was reported on papaya from Bangalore in 2015. Considering pest status regular monitoring of this pests was carried out in other parts of India after its first record. The survey was conducted by expert team constituted by State Horticulture/Agriculture Universities, State Government Departments of the concern state and DPPQ&S for assessment of infestation of thrips in chilli growing areas. The results of the survey revealed that infestation of this invasive pest was reported in chilli growing areas of Andra Pradesh, Telangana and Karnataka and it caused significant damage during rabi 2021-22 compared to kharif season.

MOLECULAR DIVERSITY OF THRIPS ON RABI/SUMMER GROUNDNUT IN NORTH KARNATAKA

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Abstract

Thrips population was collected on Rabi/summer groundnut from six geographical regions viz., Kerur (Bagalkot; Badami), Korti (Bagalkot; Bilgi), Devapur (Vijayapur) and Handigona (Uttar Kannada; Kumta), Narendra (Dharwad) and Naregal (Gadag). Genomic DNA was isolated and subjected to molecular analysis of COI gene and the results of COI gene sequences of all the six geographical locations indicated as *Scirtothrips dorsalis* cytochrome oxidase subunit I (COI) gene, partial cds; mitochondrial. The sequence comparison revealed that there is more than 94 per cent similarity with NCBI published sequence of *S. dorsalis* COI gene (KM355471.1) between the thrips samples of all the six locations. The sequences of all the six population were compared using alignment editor 'Bioedit'. There was no sequence variation among the six population (isolates) for the 190 bp region of cytochrome oxidase I (COI) gene, indicating that the populations were similar with respect to this region of cytochrome oxidase I (COI) gene.

ROOT STUDIES TO IDENTIFY BEST DROUGHT TOLERANT HYBRIDS IN MAIZE (*ZEAMAYS* L.)

Anaji Abhishek, H.C. Sowmya and P.H. Kuchanur

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Abstract

The experiment to study root traits was carried out in pot to examine the relationship between root system architecture and drought tolerance. Nine crosses were used viz., five good performed crosses and four poor performed crosses and five checks. Observations were recorded on six drought tolerant traits viz., Root length (cm), Shoot length (cm), Root to Shoot ratio, Root volume (cm³), Proline (µg/g dry weight) and Relative Water Content (%) under both drought and irrigated condition. It was found that the crosses ZL155414 × CAL1426 and ZL155414 × ZL153493 showed better performance for all studied traits especially shoot length, root length and root to shoot ratio as compared with other crosses. The effects of drought were increased with the increase in concentration of drought stress. It was concluded from study that the selection of maize crosses on the basis of root length, shoot length, Root to Shoot ratio, Root volume, Proline and RWC may be fruitful to produce drought tolerance maize hybrids. The hybrids which exhibited good root traits have shown good performance for yield and related traits and these can be used in drought conditions.



STUDIES ON HETEROSIS FOR YIELD AND DROUGHT TOLERANCE RELATED TRAITS IN MAIZE (*ZEA MAYS* L.)

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Abstract

With the aim of identifying superior heterotic hybrids, the present research was carried out at UAS, Raichur. In this study 39 crosses were evaluated along with checks 900MGold, NK6240, RCRMH2, RCRMH3 and RCRMH4. Observations were recorded on sixteen different characters viz., NDVI, SCMR, RWC (%), SLA (cm²/g), proline content (µg /g dry weight), days to 50% anthesis, days to 50% silking, ASI, plant height (cm), ear height (cm), ears per plant, cob length (cm), test weight (g), kernel rows per cob, shelling percentage and yield per plant (g). The magnitude of commercial heterosis of hybrids over checks for yield per plant varied from -39.22 to 231.37 over 900MGold, and -67.02 to 79.79 over NK6240, -59.74 to 119.48 over RCRMH2, -46.55 to 191.38 over RCRMH3 and -75.59 to 33.07 over RCRMH4. The cross ZL155414 × ZL153493 registered maximum positive standard heterosis over all the five checks, and significant over three checks. Five crosses showed positive significant heterosis on 900MGold, two crosses showed positive significant heterosis on RCRMH2, three hybrids showed significant positive heterosis on RCRMH3. None of the hybrids showed positive significant heterosis over NK6240 and RCRMH4.

GREEN SYNTHESIS AND CHARACTERIZATION OF SILVER NANOPARTICLES FOR FOOD APPLICATIONS

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Abstract

The research was conducted to synthesize and characterize the silver nanoparticles (Ag-NPs) using lime seed extract as a reducing agent at different concentrations, temperatures and pH conditions. The optimized treatment combinations resulted in the production of stable silver nanoparticles with a particle size ranging between 50 and 59 nm, zeta potential ranging between -24.20 and -17.5 mV and surface roughness ranging between 16.87 and 19.23 nm. The characterizations of produced Ag-NPs with high end equipments revealed that, the particles were in spherical shape and face cubic centered in nature. The efficacy of Ag-NPs were analyzed at different concentrations for shelf-life improvement of papaya and sapota fruits. The results of the experiment revealed that, the green-synthesized Ag-NPs were effective in many ways to maintain the quality attributes of papaya and sapota fruits and found to be very good alternative to enhance the shelf-life of the above-mentioned fruits up to 12 and 10 days, respectively. The synthesis of Ag-NPs using biological methods could be eco-friendly, economical and viable option for synthesis as well as to reduce the post harvest loss of agri-horti produces.

DEVELOPMENT AND EVALUATION OF READY TO COOK SAMBAR POWDER USING PIGEONPEA (*CAJANUS CAJAN*)

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Abstract

Sambar is a legume based curry prepared with vegetables and spices. It is used as an accomplishment to cooked rice. Owing to rapid urbanization and more women joining the workforce, use of ready-to-eat and ready-to-use convenience foods is gaining increasing popularity. Women require dhal that cooks fast and increases in volume when cooked/ they need a packet of powder to cook instantly just by adding it to the hot water. Motivated by the consumer demand there is a need for development of short



cooking time, microbial safety and high quality foods. Pigeon pea (*Cajanus cajan*) value added product ready to cook sambar powder was developed using milling residues of pigeon pea like grits (broken dal) and the recipe was optimized by sensory evaluation. The proximate analysis of the developed product and the influence of different packaging material on shelf life of RTC sambar powder was studied. Microbial and sensory evaluation was done on initial, 30th day, 60th day and 90th day of storage life. Based on test results, the developed powder was found to be 'liked extremely' by evaluators with respect to taste and appearance whereas, 'very much liked' with respect to texture, aroma and overall acceptability. Regarding shelf life, the powder stored in retort pouch found to be having good shelf life with less microbial load.

STUDIES ON CROP MANAGEMENT TO HIGHER YIELD IN GUAVA (*PSIDIUM GUAJAVA* L.) CV TAIWAN PINK

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Abstract

The trial on improved management practices in guava was conducted in 45 ha with 50 number of farmers at Mittekellur, Bayyapur, Karadakal, Mattur, Nagaral, Rampur and Yaradihal villages of Lingasugur and Maski taluk of Raichur district. The result revealed that management of fruit fly along with improved management practices right from pruning to fruiting and harvesting yield up to 23.6 % increases in demonstration plot compared to farmers practices with support of technology as recommended by package of practices on Horticulture UHS, Bagalakot.

FABRICATION OF CONTINUOUS SOLAR DRYER FOR FRUITS AND VEGETABLES SLICES

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Abstract

The world population is more than 8 billion and about 20-25 percent people does not have enough food to eat. It has been estimated that world as a whole more than 30-50 percent vegetables, fruits etc. are lost before it reaches to the consumers. To overcoming spoiling problems of vegetables and fruit; various preserving methods are used and renewable sources are best for this purpose by which we can save energy for preservation and keeping the product in their natural flavor by drying it. Drying is one of the oldest methods of preserving food. The solar drying system utilizes solar energy to heat air and to dry any food substance. It brings about a substantial reduction in weight, volume, minimizing packing, storage, and transportation costs, and enables storability of the product under ambient temperatures. The Construction of Continuous solar dryer which can be used for drying various fruits and vegetables products in rural areas under hygienic conditions. The Continues solar dryer was constructed consisting of a solar collector cum drying chamber. The overall dimension of the continues solar dryer is 1830×300×620mm and the drying chamber was painted black to absorb maximum solar radiations. The glass was covered it permits the solar radiation into the system but resists flow of heat energy out of system and product were moving continually from inlet to outlet through chain conveyors. This chain conveyors was connected to the Rollers and the roller was connected to belt pully to reduction motor and VFD to control the chain conveyor from inlet to outlet to dry the product at required moisture content.

THE ROLE OF IMMUNE SYSTEMS IN FISH

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Abstracts

The fish's immune system consists of two major components, innate and adaptive immunities. Innate immunity is non-specific and acts as the primary line of protection against pathogen invasion while adaptive immunity is more specific to a certain



pathogen/ following adaptation. Innate immunity consists of the non-specific cellular and the nonspecific humoral components. On the other hand, the adaptive immune system consists of highly specialized systemic cells and processes that are separated into two main components: the humoral and cellular components. Three types of antibodies, the IgM, IgD and IgT, are the major constituents of the humoral immunity, which act on invaded extracellular pathogens. The cytotoxic T-lymphocyte cells are the major component of the cellular immunity that frequently kills virus-infected and intracellular bacterial or parasitic-infected cells. Both innate and adaptive immunities complement each other in the host's attempt to prevent infection.

INFLUENCE OF CONTAINERS AND SEED TREATMENT CHEMICALS AND BOTANICALS ON SEED QUALITY AND PHYSIO-BIOCHEMICAL PARAMETERS OF BLACKGRAM (*VIGNA MUNGO* (L.) HEPPER) CV. DU-1 DURING STORAGE

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Abstract

The quality of seeds are known to be regulated by variations in storage containers, seed treating chemicals, seed initial quality, packaging conditions, physiochemical factors etc., Among these, Seed packaging materials and treating chemicals are considered as most vital factors influencing durability of seeds in storage in many field crops in general and blackgram in particular. In observation of the above facts, the laboratory experiment was carried out to assess effect of the seed treatment chemicals, botanicals and packing materials on seed quality parameters in the Department of Seed Science and Technology, Agricultural College, UAS, Bengaluru and the observations were taken bimonthly from February 2015 to February 2016. The seeds stored in super grain bag and treated with Thiram 2 g kg⁻¹ + spinosad 0.04 ml kg⁻¹ combination recorded highest quality parameters viz., highest germination (97.00 to 82.00 %), root length (16.78 to 13.31 cm), Shoot length (15.99 to 12.63 cm), seedling length (33.41 to 26.02 cm), dry weight of the seedling (41.98 to 27.50 mg), vigour index I and II (3241 to 2134 and 407 to 226), total dehydrogenase activity (1.987 to 1.143) and lowest moisture content (8.01 to 8.94 %), seed infection (4.00 %), seed infestation (0%) and electrical conductivity (0.350 to 0.814 dSm⁻¹) compared to control i.e. seeds stored in cloth bag without treatment recorded lowest quality parameters (97.00 to 72.00%, 16.78 to 11.40 cm, 15.99 to 11.01 cm, 33.41 to 22.49 cm, 41.98 to 20.51 mg, 3241 to 1619, 407 to 148 and 1.987 to 0.713, respectively), while highest moisture content (8.01 to 10.90 %), seed infection (21.00 %), seed infestation (24.17 %) and electrical conductivity (0.350 to 0.998 dSm⁻¹) during twelve months of storage.

CONSTRAINTS AND SUGGESTIONS BY FAMILY HEADED WOMEN RELATED TO FAMILY FARMING

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Abstract

The present study was conducted in purposively selected Tumakuru district, covering three agro-climatic zones namely Central Dry Zone, Eastern Dry Zone and Southern Dry Zone. From each zone two taluks and from each taluk two hoblis were selected based on the major crop farming systems. From each hobli, list of villages having maximum number of women headed households practicing family farming was prepared. Further four to eight villages and two to four respondents from each village were purposively selected by using 'snow ball technique' thus making total sample of 160. Data were gathered through structured interview schedule and analyzed using appropriate statistical tools. The study revealed that major constraints faced by the family headed women are electricity problem (Rank I) followed by lack of irrigation facilities (Rank II), lack of transportation facility (Rank III), and poor accessibility of extension agencies for technical guidance (Rank IV). With respect to Suggestions given by family headed women, to improve family farming efficiency and livelihood security are



regular supply of power (Rank I), establishment of markets at local level (Rank II), provide irrigation facility (Rank III) and establishment of storage facilities (Rank IV) were suggested. Half (50.63%) of the respondents are taking the responsibility of household because of temporary migration of male member to city for jobs, nearly one fourth (23.13) of the respondents due to widowhood followed by desertion (10.63%), loss of economic function due to disability (6.88%), Lack of mature sons to take over the household (5.63) and divorce (2.50).

CORRELATION AND MULTIPLE REGRESSION ANALYSIS ON THE FACTORS INFLUENCING FARMER SUICIDE SYNDROME AMONG THE AFFECTED FARMERS OF KARNATAKA

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Abstract

The phenomenon of farmer suicide syndrome is a complex and multi-dimensional issue influenced by a wide range of factors. These can vary from region to region and are often interconnected. This communication focuses on suicide syndrome developed among the farmers which pushed them to commit suicide and factors responsible for such a drastic and irreversible decision by them with special reference to Mandya and Haveri districts of Karnataka. A total of 60 kin member of an affected farmers family was interviewed personally to obtain first-hand data using well-structured and pre-tested interview schedule. The results indicated that, correlation coefficient of independent variables of affected farmers, age, education, farming experience, cosmopolitaness, scientific orientation, information seeking behaviour and deferred gratification have exhibited positive and highly significant ($p < 0.01$) relationship with suicide syndrome among pooled affected farmers. Correlation coefficients of independent variables for non-affected farmers, farming experience, family type, caste, economic motivation, innovativeness, and risk orientation have exhibited positive and highly significant ($p < 0.01$) relationship with suicide syndrome among pooled non-affected farmers. Results of multiple regression analysis carried out for affected farmers in Mandya and Haveri districts reveal that, scientific orientation ($t = 2.82^{**}$), information seeking behaviour ($t = 2.50^{**}$) and management orientation ($t = 2.81^{**}$) have shown positive and highly significant contribution at one per cent level. Multiple regression analysis for non-affected farmers indicates that, among six independent variables, management orientation (X_{18}) contributed significantly ($t = 2.68^{**}$) for the suicide syndrome level at one per cent level. Addressing farmer suicide syndrome requires a holistic approach that considers the interconnectedness of these factors and involves collaboration among policymakers, agricultural experts, mental health professionals, and local communities. It is essential to create sustainable and resilient farming systems that prioritize the well-being and livelihoods of farmers.

SATISFACTION LEVEL OF THE FARMERS REGARDING KISAN CALL CENTRE (KCC) ADVISORIES

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Abstract

The Kisan Call Centre (KCC), initiated on January 21st, 2004, by the Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, serves as a crucial support system for farming communities across India. This study, conducted in 2021-22 in Chamarajanagar District of Karnataka, aimed to assess the Satisfaction Level of 200 KCC beneficiaries regarding its advisory services. Utilizing stratified random sampling, the study employed an ex-post facto research design to gather insights. The data collection involved secondary data from the KCC in Bengaluru and primary data through structured interviews with beneficiaries. Results revealed that 76.00% of beneficiaries expressed high satisfaction with the technical knowledge of KCC experts, with 74.50% satisfied with expert availability, and 73.50% with expert guidance in advisory services. Additionally, 70.50% were highly satisfied with patience of expert in listening to the complete



query of the farmers through helpline services. Regarding technological information provided by the KCC 53.00% expressed high satisfaction with the technological information provided by the KCC, and 52.50% acknowledged the assistance of advisory services in crop preservation and yield improvement. However, including all the aspect like technical information, helpline services and advisory services provided by the KCC. Notably, a significant 44.00% of both dryland and irrigated land farmers expressed high satisfaction with the overall services of the KCC. This research highlights the importance of ICT-driven initiatives like the KCC in empowering farmers and improving agricultural productivity and sustainability.

DEVELOPMENT OF THRIPS, *SCIRTOTHRIPS DORSALIS* HOOD INFESTING CHILLI AT CONSTANT TEMPERATURE CONDITIONS IN THE LABORATORY

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Abstract

A study on the developmental biology of thrips was carried out in the laboratory under constant temperature conditions of 20° to 35° at Department of Entomology, UAS, GKVK, Bengaluru. As the rearing temperature increased, incubation period decreased from 5.50 days to 3.50 days, nymphal period from 4.90-6.83 days to 3.49-3.08 days and pupal period from 3.56 to 1.98 days. As a result, the total developmental period was found decreased from 20.79 days to 12.05 days. Adverse effect of extreme temperature conditions of 10°, 15° and 40° was apparent on all the developmental stages of thrips. Eggs did not hatch at 10°, 15° and 40°. Though the nymphal stage survived for a brief period of 1 to 3 days at 40°, its survival was fairly better (i.e., 3 to 6 days) at 10°. Pupa did not survive at 10°, while it remained alive for only one day at 40° rearing temperature.

POPULATION DYNAMICS OF *OLIGONYCHUS INDICUS* HIRST AND ITS NATURAL ENEMIES ON ARECANUT IN SHIVAMOGGA

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Abstract

Study on seasonal incidence on *Oligonychus indicus* Hirst and its natural enemies was carried out at Sominkoppa, Shivamogga taluk during May 2016 to April 2018. The pooled analysis revealed that, the *O. indicus* population was highest during second fortnight of February (16.85/ cm² of leaflet), while the lowest mites of 2.08 / cm² of leaflet were recorded during first fortnight of December. The natural enemies population viz., *Stethorus pauperculus* and *Scolothrips sexmaculatus* was highest during second fortnight of February coinciding with peak density of *O. indicus*. Whereas, the predatory mite, *A. longispinosus* was highest in the month of January, May and November months. Correlation studies revealed a significant positive association with maximum temperature (r = 0.502*) while negative non-significant correlation with morning relative humidity (r = - 0.225) and Rainfall (r = -0.030).

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**).

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