12th International Conference
On
Emerging Issues in Agricultural, Food Technology, Biological & Applied Sciences for Global Development (EIAFTBASGD-2025)

Venue : Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India

November 15-17, 2025

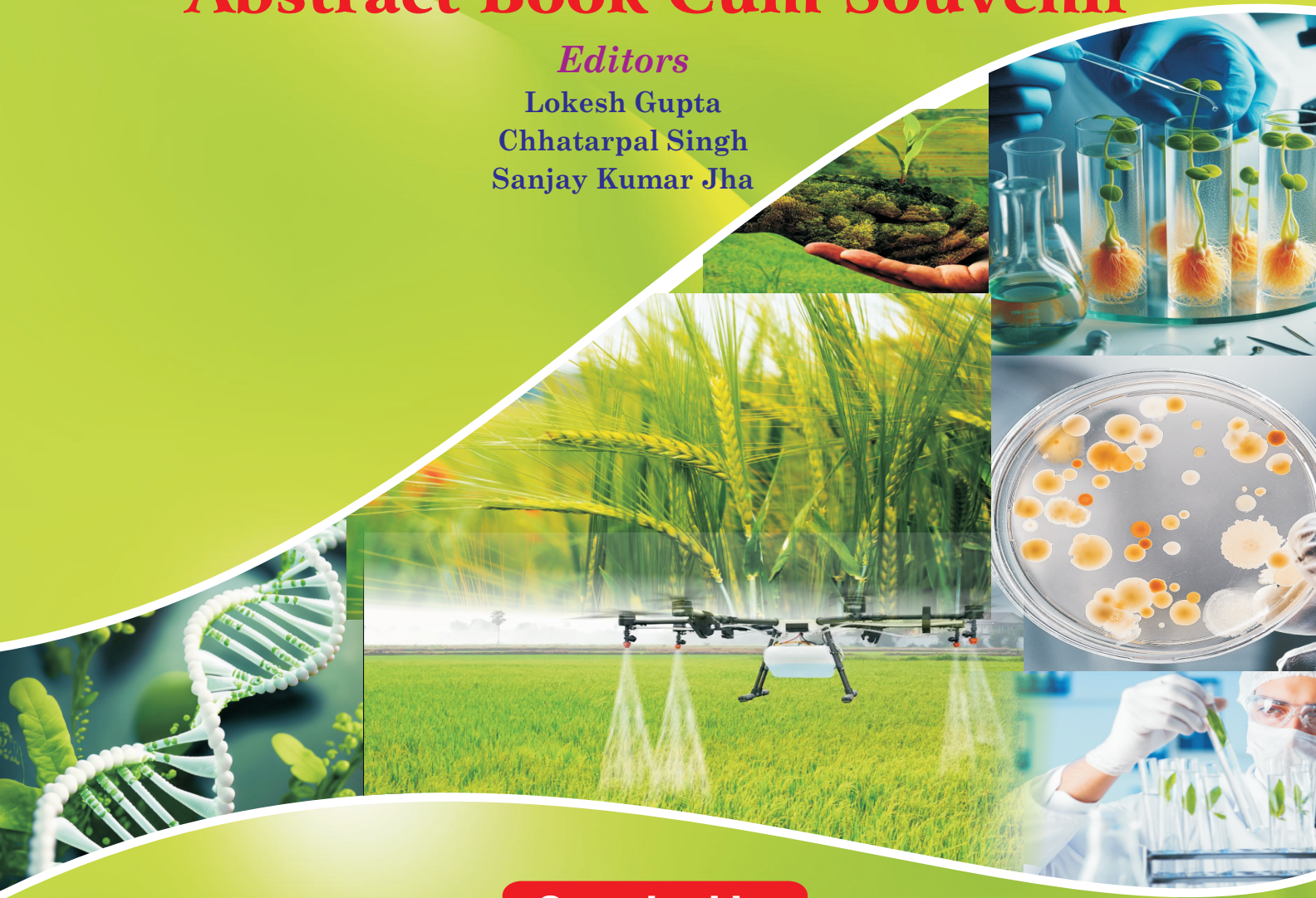
Abstract Book Cum Souvenir

Editors

Lokesh Gupta

Chhatarpal Singh

Sanjay Kumar Jha



Organized by

College of Dairy and Food Technology (CDFT),
Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India
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AEDS

Agro Environmental Development Society (AEDS)
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Disclaimer

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MAHARANA PRATAP UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, UDAIPUR
महाराणा प्रताप कृषि एवं प्रौद्योगिकी विश्वविद्यालय, उदयपुर

Dr. Pratap Singh,
Vice-Chancellor

No. PS/VC/MPUAT/2025/
Dated : 6th November, 2025

FOREWORD

It gives me immense pleasure to convey my warm greetings and best wishes to all participants of the International Conference on Emerging Issues in Agricultural, Food Technology, Biological & Applied Sciences for Global Development, being organized by the College of Dairy and Food Technology (CDFT), MPUAT, Udaipur, from 15th to 17th November, 2025.

In this era of rapid scientific and technological progress, the convergence of agriculture, food technology, biological, and applied sciences offers tremendous potential to ensure global food and nutritional security. This international conference serves as an excellent platform for academicians, researchers, inudstry professionals, and students to exchange ideas, innovations, and experiences that can drive sustainable global development.

I commend the dedicated efforts of the organizing team at CDFT for bringing together experts from diverse disciplines and regions to deliberate upon emerging challenges and opportunities in these crucial fields. I am confident that the deliberations and outcomes of this conference will contribute significantly towards advancing research collaborations, policy initivatives, and innovations for a better and sustainable future.

I extend my best wishes for the grand success of the conference and hope it fosters meaningful dialogue, innovation, and enduring global partnerships.

(Dr. Pratap Singh)
Hon'ble Vice Chancellor
Maharana Pratap University of Agriculture and Technology, Udaipurr

INRAE

IFSDAA International Foundation for Sustainable Development in Africa and Asia

in

International Foundation for Sustainable Development in Africa and Asia

in

National Agronomical Research Institution (INRAe) France

Prof. Arthur Riedacker
Honorary Research Director at INRA, France
Co-Nobel Peace Prize Recipient (Nobel Laureate) with IPCC in 2007

Message

As we are becoming more and more numerous on this planet, we are to become more efficient and innovative everywhere in the world, if we want to maintain life on the earth acceptable. In particular we are to provide enough food for everybody.

In 1950 we were about 1.5 billion people. In 1987, when the UN Report called "Our Common Future" promoting sustainable development was published, we were already about 5 billion. And in 2075, in but 50 years from now, we shall be about 10 billion. That means we are to use land more efficiently everywhere in the world not only to feed more people, but also to produce more renewable energy and raw material, and to avoid land use change (forest and grassland conversion into cropland). Otherwise GHG emissions may drastically increase instead of decreasing as requested in UN climate negotiations (e.g. as today in Belem, in COP30 in Brazil).

In Subsaharan Africa the population is about to increase by more 1.6 billion, between now and 2075. That means that staying with present yields (but 1.5 t of maize per hectare per year) we are to convert about more than 300 million hectares of grassland and forestland into cropland. But that land use change and associated emissions can be decreased by increasing land use efficiency (total annual biomass production per ha and per year). For that the Indian experience and knowledge deserves to be transferred to Sub Saharan Africa: not only technical innovations (to increase crop yields , for instance by better rainwater harvesting techniques, by increasing mineral input etc.) but also policy relevant innovations (such as subsidizing fertiliser, controlling food imports , protecting nascent activities etc.) and having worked during many years with Professor Rishi Behl in IFSDAA (International Foundation for Sustainable Development in Asia and Africa)

We do propose also to consider some other relevant innovations that might be helpful to increase "land use efficiency" and promoting more sustainable development in Africa.

Arthur Riedacker

Prof. Arthur Riedacker

डेयरी एवं खाद्य प्रौद्योगिकी महाविद्यालय

Maharana Pratap University of Agriculture & Technology, Udaipur

महाराणा प्रताप कृषि एवं प्रौद्योगिकी विश्वविद्यालय, उदयपुर (राज.) 313001

Dr. Lokesh Gupta
Dean

Message from The Dean

It gives me immense pleasure to extend my warm greetings to all participants of the *International Conference on Emerging Issues in Agricultural, Food Technology, Biological & Applied Sciences for Global Development* during 15 to 17th November 2025 at CDFT, MPUAT, Udaipur

This conference provides a valuable platform for scientists, academicians, industry experts, and young researchers to exchange innovative ideas and explore sustainable solutions addressing global challenges in agriculture, food, and allied sciences. Such collaborative efforts are essential to foster research excellence, technological advancement, and holistic development.

The dairy and food processing sector is a cornerstone of food and nutritional security, rural livelihood, and economic growth. India, the world's largest milk producer, is witnessing rapid modernization in its dairy industry with a focus on automation, quality assurance, and value-added products such as probiotic curds, cheese, and functional beverages. Strengthening cold chain infrastructure and promoting entrepreneurship are key priorities for enhancing efficiency and farmer income.

The food processing industry serves as a vital bridge between agriculture and consumers, reducing post-harvest losses and creating employment. Growing demand for ready-to-eat foods, plant-based proteins, and functional foods has accelerated innovation in processing, packaging, and preservation technologies.

Emerging trends emphasize sustainability, safety, and nutritional quality, supported by advances in biotechnology, digital tools, and smart manufacturing. However, challenges such as food waste management, quality control, and environmental sustainability call for stronger research–industry collaboration and skill development.

With its vast raw material base, skilled manpower, and expanding market, India's dairy and food processing sector holds immense potential to become a global leader, driving innovation, inclusivity, and sustainable growth.

I congratulate the organizers for their dedicated efforts and wish the conference great success in achieving its objectives. May the deliberations inspire meaningful collaborations and contribute significantly to global scientific progress.

Dean
College of Dairy and Food Technology (CDFT)
MPUAT, Udaipur, Rajasthan

Central Department of Botany
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Message

It is immense pleasure that "Agro Environmental Development Society (AEDS)" is going to organize 12th International Conference on **"Emerging Issues in Agricultural, Food Technology, Biological & Applied Sciences for Global Development**" at Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan during November 15-17, 2025 in collaboration with College of Dairy and Food Technology (CDFT), Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India. I warmly welcome to all the delegates at Udaipur, Lake city of Rajasthan, a rich treasure of biodiversity with different natural resources. The city has historical land and surrounded by beautiful lakes.

This types of seminar and symposia are an important platform which helps in harnessing the research and communication skills of scientists, researchers, students and farmers. Such scientific gathering is the important part of knowledge shearing among the scientists. The topic of conference is very relevant because multi-disciplinary interactions are more useful to take a holistic view of a problem. After industrialization, Environment and climate changing has been the main causality, thus forcing all the countries to build a consensus to combat the same.

I am pleased to welcome all the delegates and participants in the 12th international conference and I wish all the members of organizing committee for their great efforts and suggestion to make this conference a grand success.

(Dr. Sanjay Kumar Jha)

एग्रो एनवायर्नमेंट्ल डेवलपमेंट सोसाइटी (ए.ई.डी.एस.)
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Message

As organizing secretary, I warmly welcome to all the dignitaries, delegates and participants in the 12th International Conference on "**Emerging Issues in Agricultural, Food Technology, Biological & Applied Sciences for Global Development**". The conference is going to be organized by Agro Environmental Development Society (AEDS) Rampur, Uttar Pradesh & College of Dairy and Food Technology (CDFT), Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, at Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India from November 15-17, 2025. The AEDS is continuously working in the agriculture and organizing various training, seminar and conference to keep the students, researchers and scientists encourage. The main focus of the society and conference is how to overcome the problems that are arising for the sustainable development and how to increases entrepreneurship with the low expenditure in agriculture and allied sectors.

I am very much thankful to our respected Chief Patron, Prof. Pratap Singh Ji, Hon'ble Vice Chancellor, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, Organizing Chairman, Prof. Lokesh Gupta Ji, Dean, College of Dairy and Food Technology (CDFT), Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India for supporting and conducting this conference in joint collaboration.

I am also thankful to Prof. Arthur Riedacker for being eminent guest of this conference and respective participants and committee members of this conference for their valuable support and guidance during the conference.

I once again express my heartfelt gratitude to all esteemed Delegates and Participants for taking part and enhancing the dignity of this conference and sharing their views on different aspects of Agriculture, Biological & Applied Sciences and making this conference grand success.

(Dr. Chhatarpal Singh)

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Macrofungal Diversity and Nutrient Contents of Selected Wild Edible Mushroom of Brahakshetra Community Forest, Ghorahi, Dang

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Abstract

Fungi are a diverse group of organisms ranging from microscopic to macroscopic mushrooms. Being a major group of decomposers they are essential for the survival of other organisms in the ecosystem and they are important for the degradation of organic matter and play a vital role in nutrient cycling. They receive less concern from the locals and the government and have faced a threat of extinction. The main aim of this study was to study the macrofungal diversity and nutrient analysis of some wild edible mushrooms in the given study area. In the present study, a total of 66 species were recorded in the study area belonging to 21 families, 8 orders. Among them, 65 belong to basidiomycetes and 1 belongs to Ascomycetes. Agaricales was found as the largest order followed by Russulales and Boletales. The study was made from June to September 2020 in the Brahakshetra community forest of Ghorahi-13. The sampling was done by using a 10×10m quadrat in three transects.
This investigation also assessed four wild edible mushroom species (*Laccaria laccata, Lactarius volemus, Russula delica, and Russula poichilochroa*) that were analyzed for nutrient contents according to the Association of Official Analytical Chemists (AOAC, 2005). The analysis includes moisture, fat, protein, carbohydrate, ash, and minerals including potassium, calcium, phosphorus, magnesium, iron, copper, manganese, and zinc. The moisture content of mushrooms varied from 5.16% to 5.51%, Protein 24.28%–24.59%, fat 2.20% – 2.97%, ash 11.25% to 15.16%, and 58.37%–61.28% carbohydrates. The minerals content of mushroom samples ranged 1.13–2.00 µg/g for Ca, 0.90–1.03 µg/g for Mg, 25.99–100.37 µg/g for Mn, 1.03-2.87 µg/g for Fe, 3.06–3.36 µg/g for K, 16.83–17.94 µg/g for Cu, 2.17–4.87 µg/g for P, 39.61–60.56 µg/g for Zn.

Keywords: *Macrofungal diversity, Brahakshetra, Edible, AOAC, Nutrients analysis, Minerals.*

Effect of method of application and different nutrient solutions in *Dendrobium* orchid under polyhouse

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Abstract

The present investigation entitled "Nutrient Management in Dendrobium Orchid Under NV Polyhouse Condition" was conducted at Floriculture Research Farm, Navsari Agricultural University, Navsari, Gujarat, during October 20, 2020 to October 19, 2022. The vegetative growth parameters are recorded at every 6, 12, 18 and 24 months after starting of experiment on 6 years old already established plants. For the easy understanding, the vegetative parameters were analysed with split plot design, where, treatments acted as a main plot and months (6, 12, 18, and 24) acted as sub plot. There are different nutrients which used in the experiment likewise, N, P, K, Ca, Mg, S, Fe, Mn, Zn, Cu, B, Ni and Mo and made treatments as T_1: Solution P, T_2: Solution P + S, T_3: Solution P + M_1, T_4: Solution P + S + M_1, T_5: Solution P + M_1 + M_2, T_6: Solution P + S + M_1 + M_2, T_7: Solution P + S + M_1+ M_2 (Fortnightly), T_8: Solution D (Drenching) and T_9: T_7 + T_8. The vegetative parameters were influenced significantly by different levels of macro and micronutrients. The maximum plant height (53.27 cm), number of shoots (13.77), number of leaves per plant (9.03), stem diameter (3.52 cm) were recorded in treatment T_6 (Solution P + S + M_1 + M_2) and plant height was at par with T_5 (52.61 cm), T_4 (51.19 cm). While, leaf area (33.83 cm^2) and chlorophyll content (35.95 SPAD) were found maximum in T_4 (Solution P + S + M_1). Thus, the present findings that i.e. N: 200 mg/l weekly spray while, P:50 mg/l, K: 200 mg/l, Ca and Fe: 100 mg/l, each of Mg, Mn, Zn: 50 mg/l, S: 232.3 mg/l, Cu: 10 mg/l, B: 25 mg/l and Ni, Mo: 5 mg/l (each) at every 15 days interval spray enhanced growth of *Dendrobium* orchid under polyhouse.

Keywords: *Orchids, Dendrobium, Nutrients, Polyhouse, Nitrogen, Phosphorus, Potassium.*

Screening of major pests of cashew germplasms.

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Abstract

Seven germplasm of cashews were screened against major pests and categorized as a susceptible(V3) and less susceptible(V1, V2, V4, V5, V6 and V7) against TMB. For other pest *viz*., thrips, leaf blossom webber, apple and nut borer, all germplasms showed more or less similar infestation and in low proportion. Irrespective of germplasms, the key pest, TMB damage was noticed to initiate at November month on cashew tree and reaches maximum level in February and seen till June month coinciding with flowering and fruit setting stages of cashew.Farmer of cashew groweres are advised to follow the TMB damage grade calendar and take appropriate measure during that month to reduce TMB damage.

Keywords: *Cashew, Tea Mosquito Bug and Thrips*

Clinical Investigation and Therapeutic Management of Dystocia in Rabbit Doe

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Abstract

Dystocia in rabbits is uncommon but constitutes a life-threatening obstetrical emergency due to their unique duplex bicornuate uterine anatomy and rapid progression of toxaemia. A 2-year-old, 3 kg rabbit doe was presented with persistent straining, vulvar discharge, lethargy, and in appetence one day after spontaneous delivery of a live kit. Clinical examination revealed systemic stress, and abdominal radiography confirmed a retained fetal skeleton within the pelvic cavity, consistent with dystocia secondary to uterine inertia. Therapeutic management included intramuscular oxytocin (0.2 mL), intravenous infusion of 5% DNS (60 mL), calcium gluconate (1.5 mL of 10% solution), and multivitamins (1 mL) through the marginal ear vein. The treatment facilitated expulsion of a dead foetus, followed by supportive antibiotic and nutritional therapy. The doe recovered uneventfully within five days. This case highlights the significance of timely radiographic diagnosis, correction of metabolic imbalance, and a multimodal therapeutic approach in the successful management of dystocia in rabbits.

Keywords: *Rabbit, dystocia, uterine inertia, oxytocin, therapeutic management*

Unravelling the Pathobiome of *Alternaria* Leaf Blight of Mustard

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Abstract

In India and other mustard-growing regions, *Alternaria brassicicola* and *Alternaria brassicae* are the main causes of mustard leaf blight, a serious foliar disease that has a major effect on mustard yield and oil quality. According to recent studies, plant diseases should now be understood as the result of complicated interactions within a larger microbial community, or in the context of a particular pathogenic species. This idea is called the "pathobiome." In order to better understand the pathobiome linked to mustard leaf blight, this study concentrate on microbial diversity and community structure studies. Leaf samples from various regions of India i.e. Punjab, Rajasthan and Uttar Pradesh, both symptomatic and asymptomatic, were gathered in order to do this. The microbial components of the mustard phyllosphere were identified by high-throughput sequencing of the fungal ITS gene sections. To identify differentially abundant species, define microbial diversity, and investigate co-occurrence patterns between harmful and non-pathogenic organisms, bioinformatics methods and multivariate statistical analysis were employed. Findings show that several Alternaria species were coexisting to cause this disease with *Alternaria alternata* being the most common species. Other pathogens that may influence the development or cessation of disease were also found to coexist with known pathogen. Pathogenicity test revealed significant variations in the microbial community structure between infected and healthy leaves, suggesting that pathogen dominance alters the defensive enzyme production concentration. This study emphasizes how crucial it is to know about leaf blight as a disease arising from dynamic interactions within the mustard phyllosphere microbiome, rather than just as the product of a single

pathogen. Innovative, microbiome-informed disease control techniques to improve the tolerance and production of mustard crops may be made possible by pathobiome-based approaches.

Mapping of Soil Organic Carbon using Machine Learning Algorithms: A Case Study of South Gujarat Region, India

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Abstract

Soil organic carbon (SOC) serves as a fundamental indicator of soil quality and ecosystem functionality and climate resilience. This present study evaluated the performance of four machine learning (ML) algorithms, Random Forest (RF), Extreme Gradient Boosting (XGBoost), Cubist, and Support Vector Machine (SVM) for predicting surface SOC (0-30 cm) across the South Gujarat region, India. Using 507 soil samples and 58 environmental covariates selected via the Boruta feature selection method, model performance was compared. The SOC content ranged from 0.13% to 3.20%, with an average of 0.95%. Among all prediction models, RF model achieved the highest predictive accuracy (R^2 = 0.92, RMSE = 0.16% for calibration; R^2 = 0.47, RMSE = 0.34% for validation), followed by XGBoost, while SVM and Cubist models performed relatively poor. Bioclimatic variable (Mean Temperature of Wettest Quarter) was the most influential covariate across most models. The RF model demonstrated a 91% prediction interval coverage probability (PICP), indicating strong spatial reliability. The generated high-resolution SOC maps provide valuable insights for regional soil health assessment, carbon sequestration monitoring, and sustainable land-use planning in tropical agroecosystems.

Keywords: *Soil organic carbon, Machine learning algorithms, Boruta package, Random forest, Digital soil mapping, South Gujarat region*

Effect of nanoparticles on physiological processes of plants

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Abstract

The growing use of nanoparticles (NP) in agriculture has provoked considerable interest to study their effects on various physiological processes in plants. In this context, we address the effects of engineered nanomaterials on the growth, photosynthesis, water relations, and oxidative metabolism accumulation process in plants. At optimal level, metal, and metal oxide NPs (ZnO, TiO, , Fef O,,) improves chlorophyll synthesis, efficiency of photosynthesis and nutrition assimilation through induction of key enzymes while maintaining reactive oxygen species (ROS) scavenging at an appropriate level. NPs can

also mediate stomatal conductance and enhance water-use efficiency under abiotic stresses. Nevertheless, over-accumulation of nanoparticles induces oxidative damages, the permeability changes of cell membrane and suppression of photosystem II activity with decreased carbon assimilation and metabolic disturbance. The physiological response of the plant to nanoparticles depends greatly on particle size, concentration, chemical composition, and species-specific tolerance. The study highlights the importance of understanding nanotechnology effects and development of toxicity protocols to promote safe and prudent use of nanotechnologies in agricultural systems.

Keywords: *Nanoparticles, Photosynthesis, Oxidative stress, Nutrient uptake, Plant physiology*

Assessment of Soil Chemical Parameters as Influenced by Biochar, Vermicompost, and Microbial Inoculants in Wheat (*Triticum aestivum* L.)

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Abstract

A field experiment entitled *"Assessment of Soil Chemical Parameters as Influenced by Biochar, Vermicompost, and Microbial Inoculants in Wheat (Triticum aestivum L.)"* was carried out at the Instructional Farm, Rajasthan College of Agriculture, MPUAT, Udaipur during the Rabi seasons of 2020–21 and 2021–22. The study was conducted in a randomized block design with eleven treatments, combining varying doses of biochar (0.5–4.0 t ha{ ¹) and vermicompost (5 and 10 t ha{ ¹) along with microbial inoculants (Azotobacter and phosphate-solubilizing bacteria), replicated thrice. The experimental findings revealed that the integrated use of organic and microbial amendments significantly influenced soil chemical parameters compared to the control. Application of 10 t ha{ ¹ vermicompost with Azotobacter and PSB (T*f*) resulted in the most favorable improvement in soil chemical properties. This treatment notably reduced soil pH (7.90) and electrical conductivity (0.68 dS m{ ¹), while enhancing organic carbon content (0.68%) and cation exchange capacity (16.01 Cmol (Pz) kg{ ¹). Similarly, the same treatment registered maximum availability of nitrogen (313.87 kg ha{ ¹), phosphorus (26.68 kg ha{ ¹), potassium (463.23 kg ha{ ¹), zinc (3.32 mg kg{ ¹), iron (4.59 mg kg{ ¹), manganese (13.16 mg kg{ ¹), and copper (2.82 mg kg{ ¹) in post-harvest soil. as compared to other treatments but remained at par with the application of 5 t ha^{-1} Vermicompost + Azotobacter + PSB(T_2). Overall, the integrated application of vermicompost and microbial inoculants (Azotobacter + PSB) markedly improved the soil chemical properties over the control. The treatment 10 t ha{ ¹ vermicompost + Azotobacter + PSB (T*f*) enhanced soil organic carbon by 13%, cation exchange capacity by 15%, and increased the availability of nitrogen, phosphorus, and potassium by 23%, 32%, and 16%, respectively compared to the control. Thus, the combined use of vermicompost and microbial inoculants significantly enhances soil fertility and nutrient status, offering a sustainable, biologically driven, and eco-friendly alternative to conventional fertilization practices in wheat cultivation.

Keywords: *Biochar, Vermicompost, Microbial inoculants, Wheat, Soil fertility*

Effect of *Sesbania aculeata* as brown manure on economics of dry direct seeded rice-wheat system

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Abstract

Present study was undertaken to assess the scope of *Sesbania aculeata* as brown manure on economics as well as to cut down the nutritional requirement of direct seeded rice and transplanted rice-wheat system cropping system in the changing climate scenario. Results revealed that Puddle transplanted treatment having 100% NPK with *Sesbania aculeata* recorded highest rice grain yield (42.8 q/ha) which was statistically at par to dry direct seeded rice treatment having 100%, 75% and 50% NPK with *Sesbania aculeata*. The yield of wheat after puddled transplanted rice was recorded lower than the wheat grown after direct-seeded rice. System productivity, net returns and B: C ratio of DSR-wheat was higher (74.9 q/ha, 25 kg grain/kg nutrient applied, 3.3%, Rs. 64349.1/ha, 1.18) compared to puddle transplanted rice-wheat (73.8 q/ha, 24.5 kg grain/kg nutrient applied, 0.6 %, Rs. 58138.2 /ha, 0.96, respectively). The highest B: C ratio (2.37) was recorded in treatment having 50% NPK of recommended dose, which was statistically at par with the treatment having 75% NPK of recommended dose. Interaction effect of nutrient application coupled with crop establishment method revealed that the highest B: C ratio (1.77) was registered also in DSR-wheat system having 50% NPK of recommended dose.

Key words*: Direct Seeded Rice, Wheat, Economics, Yield*

Effect of a formulated diet on growth and digestive enzyme activities in *Tor putitora* larvae

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Abstract

The study evaluated the effectiveness of a formulated diet on the growth performance, survival, and digestive enzyme activities of *Tor putitora* larvae, an endangered cyprinid species. For that, three thousand and six hundred golden mahseer larvae, immediately after their yolk sac absorption (10 days post-hatching), were randomly distributed into six treatment groups in triplicate. The larvae were fed under different feeding regimes (different combinations of live feeds such as *Chlorella*, *Artemia*, *Panagrellus*, goat liver, and formulated diet) for 42 days. After each phase (5, 12, and 42 days) of feeding, growth and survival were recorded. At the end of 42 days of exogenous feeding, growth was found to be apparently similar in all the groups, irrespective of their weaning strategy. However, survival was noticeably higher in groups that were initially fed with C*hlorella* and lower in *Panagrellus* (microworm) fed groups. Analysis of various digestive enzymes indicated that early weaning onto formulated diets can support digestive functions, as evidenced by the similar or even higher levels of digestive enzymes at 12 days of feeding. Overall, the results suggest that golden mahseer larvae can be successfully weaned

onto formulated diets offering a sustainable alternative to goat liver and live feed in the early nursery rearing of this species.

Keywords: *Larval feed; Growth; Survival; Digestive enzymes; Golden mahseer*

Productivity Trends and Instability in Seed Spice Cultivation Across Major Producing States of India: A Temporal Analysis

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Abstract

Growth and instability in area, production, and productivity of major seed spices i.e. coriander, cumin, fennel and fenugreek was analyzed for major producing states of India for a period of three decades (1994–95 to 2024–25). A log-linear regression model was used to estimate the Compound Annual Growth Rate, and the Cuddy–Della Valle Instability Index (CDVI) was employed to assess the degree of variability. The study period was divided into Pre-NHM (1994–95 to 2004–05), NHM (2005–06 to 2015–16), and Post-NHM (2016–17 to 2024–25) phases to capture the influence of major policy interventions. The results revealed significant positive growth in both area and production across all seed spices, with the highest increase observed during the NHM and Post-NHM periods. On average, the area under seed spices expanded by 4–7% per annum, while yield improved by 1–3%, resulting in an overall production growth of 6–9% during the study period. The instability analysis indicated that production was more volatile than area and productivity, with CDVI values ranging between 12–18% for area, 14–25% for production, and 6–10% for productivity across crops and states. However, a declining trend in instability was reported in the later sub-periods, reflecting improved technological adoption and better management practices. The study concludes that India's seed spice sector has achieved sustained growth with increasing stability over the last three decades. The findings emphasize the importance of strengthening research on high-yielding and climate-resilient varieties, enhancing irrigation and infrastructure support, and promoting value addition and organized marketing systems. Such measures will be crucial for sustaining productivity gains, minimizing production volatility, and improving farmers' income from seed spice cultivation in the years to come.

Keywords: *CAGR, CDVI, NHM, Seed spices, Temporal analysis*

Role of Vine Pruning to Enhance Fruit Quality Attributes of Winter-grown Watermelon

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Abstract

This research study compares the impact of various pruning regimes on the vegetative growth, yield potential, and fruit refinement characteristics of watermelon (*Citrullus lanatus*) harvested during winter, especially as a way of enhancing saccharine levels and commercial value. The experiment was conducted at the Central University of Tamil Nadu over two consecutive winter cycles (December 2023 - February 2024), using single-stem pruning (T2), double-stem pruning (T3), and fruit thinning (T4) as the major treatments. Single-stem pruning (T2) significantly increased fruit set (2.03 fruits per plant in the field), percent fruit retention (63.59% in the field), pulp mass (1.25 kg in the field), rind mass (0.52 kg in the field), and total fruit yield (3.59 kg per plant in the field). This program also provided the highest levels of chlorophyll a (2.69 mg g{ ¹ FW) and chlorophyll b (1.37 mg g{ ¹ FW), thus enhancing photosynthetic activities and accumulation of sucrose, hence giving the ultimate highest Total Soluble Solids (TSS), and sweetness indices. Moderate improvements were obtained with double-stem pruning (T3), with the fruit set of 1.94 fruits per plant and the fruit yield of 3.27 kg per plant. Fruit thinning (T4) enhanced the *fruit pulp brightness (L)** (28.01 in the field), but had a relatively small influence on general fruit dimensionality and quality measurements. The findings support the fact that single-stem pruning (T2) is the most effective method used to maximize resource utilization, promote the increase in fruit size, sweetness, and marketability of watermelon grown in the winter.

Keywords: *Winter-grown watermelon, Single-stem pruning, Double stem pruning, Fruit thinning, Fruit quality, Sweetness, Total Soluble Solids*

Edible cutlery: Manufacturing, Scope and challenges

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Abstract

Edible cutlery refers to eatable spoons, forks, and knives, that are used during food consumption and are designed to be consumed after use. They are biodegradable in nature and provide an environmentally responsible substitute for single-use plastic cutlery because they are created from natural substances including grains, millets, and flours. Because the utensils are either eaten with the meal or can be composted if not consumed, this method helps reduce plastic waste and can be a wholesome and sustainable option. The widespread use of single-use plastic cutlery is a threat to the environment since it adds a significant volume of non-biodegradable waste to landfills and marine environments. Even though they are only used for a few minutes, disposable plastic spoons, knives, and forks endure for hundreds of years in the environment. Edible cutlery, typically manufactured from composite flours such as sorghum, rice, or wheat, offers a fundamentally circular solution for waste management. Bowls, cups, and spoons are being made from plant-based, environmentally friendly edible flour materials. The physical and functional performance of the edible cutlery and tableware are improved by the

fortification and enrichment of additives to the flours. Furthermore, the integration of edible cutlery, available in neutral, sweet, or savory flavors, enhances the consumer experience by becoming an integral, functional part of the meal. Its adoption is vital in steering global consumption habits toward a viable, zero-waste future.

Keywords: *Edible cutlery, composite flours, zero-waste, plastic waste*

Effect of microbial formulations against *Meloidogyne incognita* causing root-knot of okra

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Abstract

Five Assam Agricultural University (AAU) developed bioformulations *viz.,*Bio-Veer, Bio-Monas, Biofor-Pf-2, Biogreen and AAU Bioguard were evaluated against *Meloidogyne incognita* in okra under Net house condition. Bioformulations were applied in the pots as per the treatments *viz.,* T_1 : Bio-Veer @20g/kg soil; T_2 : Bio-Monas @ 20g/kg soil; T_3 : Biofor- Pf2 @ 20g/kg soil; T_4 : Biogreen @ 20g/kg soil; T_5: AAU Bioguard @ 20g/kg soil one week prior to sowing the seeds. One untreated control was kept for comparison. Three to four leaved okra seedlings were inoculated with freshly hatched second stage juvenile of *M. incognita* $1J_2$/g of soil. The experiment was terminated at 60 days after sowing. It was revealed that all the AAU developed bio-formulations significantly increased the growth of okra and reduced the nematode infestation. However, Biogreen exhibited the best result in increasing the plant growth parameters and reducing the nematode infestation, followed by and Biofor-Pf2. Two promising AAU developed bio-formulations (Biogreen and Biofor-Pf2) were tested under field condition in a naturally infested field of *M. incognita* in okra during *Kharif* 2023. The treatments were: T_1 : Application of Biogreen @ 1.5 tons/ha; T_2 : Application of Biogreen @2 tons /ha; T_3 : Application of Biofor Pf2 @ 1.5 tons/ha; T_4 : Application of Biofor Pf2 @ 2 tons/ha; T_5 : Application of decomposed cowdung @ 2 tons/ha; T_6 : Chemical control (Fluensulfone 2% Gr @ 1 kg ai/ha) T_7 : Control. The experiment was conducted in 3mx4m size plots following RBD. The result revealed that both the bio-formulation was effective in increasing plant growth parameters of okra and reducing the infestation of *M. incognita*. Amongst the bio-formulations, application of Biogreen @ 2t/ha gave the best result in increasing plant growth parameters of okra and reducing the infestation of *M. incognita* followed by application of Biogreen @ 1.5 t/ha.

Keywords: *Okra, Meloidogyne incognita, Bioformulation*

Identification of some common weeds and study their ecology in wheat growing fields of district Sirsa, Haryana

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Absract: Wheat (*Triticum aestivum* L.) belongs to family "Graminae" and genus "Triticum". It is a crop of temperate zone with cool winters and hot summers being very conducive for its growth. In India wheat is one of the major *rabi* crops of north Indian plains and is the backbone of food security of nation as evident from its contribution to nearly one third of total food production. Weed infestation during the early stages of crop growth is one of the major factors responsible for low productivity of wheat. The short stature of new dwarf varieties coupled with higher fertilizers and irrigation requirements creates favourable ecological conditions for weed growth. Moreover, weeds also increase the cost of cultivation, reduce input efficiency, interfere with agricultural operations, impair quality, act as alternate hosts for several insects-pests, diseases, affect aesthetic look of the ecosystem as well as affect human and cattle health, Wheat crop is badly infested with narrow and broad leaved weeds like *Parthenium hysterophorus Portulaca oleracea, Euphorbia mollis, Amaranthus viridis, Convolvulus arvensis, Commelina benghalensis, Chenopodium album, Cyperus rotundus, Sonchus arvensis* etc. With this consideration in view, the present investigation reveals identification of common weeds and their distribution in wheat growing fields of district Sirsa.

Keywords: *Integrated weed management, wheat yield, Herbicides*

Introduction: In India presence of weeds in general reduces crop yields by 31.5 and 22.7 % in *rabi* and summer season and 36.5% in kharif season and in some cases can cause complete devastation of the crop (Anonymous, 2007) Weed management is one of the major input costs of production . In wheat the earlier period up to 30-40 days is critical period for weed control. Weeds can be controlled by adopting different methods. However, each weed control method has its limitations. Mechanical methods are laborious and time consuming, besides weeds with similar morphological characters like crops are likely to be escaped. Herbicides have benefited the agricultural community in many ways. However, heavy reliance on herbicides creates an environment favourable for weed resistance to herbicides, weed population shifts and off-site movements of herbicides (Rao and Nagmani, 2010). A number of weed species that were once susceptible to and easily managedby certain herbicides have developed resistance with time. These weeds are no longer controlled by application of previously effective herbicides.

Objective

The main objectives of the study were as follows:-

a. To study distribution of weeds of Wheat in the Sirsa.

b. To sort out the weeds of Wheat in the Sirsa,.

Materials and methods

During the field survey following material was used:- Field notebook, lead pencils, tags, digital camera, white glue, hand lens, cutter, plant presser, herbarium sheet, paper etc.

As research material weeds samples were collected from three different stations of study area during cultivation season. Weeds specimens were collected from field and wastelands along with extensive field notes including habit, habitat, life form, phonological status, and abundance. Collections of weed samples were based on random sampling during different time periods of wheat growth.

Soon after collection all specimens were individually covered with paper and properly dried with the help of presser under room temperature in open space. The dried specimens were than mounted and

preserved on herbarium sheet. (Judd, 2002) The entire collected specimens were then subjected to identification. Weed samples were identified with the help of flora of India and for future reference all specimens were submitted to the herbarium in department of Botany, CCHAU, Hisar and department of environmental science MGS University, Bikaner.

Result and Discussion

Wheat crop is badly infested with narrow and broad leaved weeds like *Parthenium hysterophorus Portulaca oleracea, Euphorbia mollis, Amaranthus viridis, Convolvulus arvensis, Commelina benghalensis, Chenopodium album, Cyperus rotundus, Sonchus arvensis* etc.Panwar *et al.* (1996a) from Hisar, Haryana observed that the wheat field was infested with *Lathyrus aphaca* , *Chenopodium album, Melilotus indica* and *Avena ludoviciana* during both the years. Pandey *et al.* (1998) noticed that *Polygonum plebeium, Phalaris minor, Stellaria media, Anagallis arvensis* and *Avena ludoviciana were* dominant weed species in wheat. Among the grassy weeds, *Phalaris minor*, *Avena ludoviciana* and *Cynodon dactylon* were found in wheat. Sardana (2001) stated that the experimental field of wheat was heavily infested with broad leaved weeds like *Anagalia arvensis* (57.6%), *Lepidium sativum* (24.8%), *Vicia sativa* (9.3%), *Medicago denticulata* Willd.(6.2%) and *Lathyrus aphaca* (2.1%). Among the grasses, *Avena ludoviciana* was present in small number. Pandey and Verma (2002) found that predominant weed species that infested wheat field were *Avena ludoviciana, Phalaris minor* and *Melilotus indica.* Besides, *Spergula arvensis, Fumaria parviflora, Convolvulus arvensis* and *Cyperus rotundus* also occurred in scanty population. Punia *et al*. (2005) from Hisar revealed that key weed species in experimental wheat field were *Phalaris minor, Avena ludoviciana, Chenopodium album, Melilotus indica, Coronopus didymus* and *Convolvulus arvensis.* Idapuganti *et al*. (2006) noted that *Echinochloa* colonum , *Cyperus rotundus and Digitaria sanguinalis* were the narrow leaved weeds infecting wheat field. Chopra *et al.* (2008) observed that the dominant weed species in wheat were *Phalaris minor* (29.3 %), *Poa annua* (15.0 %) , *Melilotus indica* (7.8 %) , *Anagallis arvensis* (11.1 %) , *Coronopus didymus* (20.2 %) , *Rumex maritimus* (11.9 %) and *Chenopodium album* (4.1 %). The grasses present were *Phalaris minor, Avena ludoviciana* and *Poa annua.* Gupta *et al*. (2008) revealed that *Anagallis arvensis* was the dominant weed in wheat followed by *Chenopodium album, Phalaris minor, Poa annua, Vicia hirsuta, Trifolium tomentosum , Medicago polymorpha, Soliva anthemifolia,Veronica biloba, Polygonum plebeium ,Gnaphalium luteoalbum,Veronica persica, Lathyrus sphaericus, Alopecurus geniculatus,Medicago lupulina, Ranunculus muricatus, Stellaria media* and *Spergula arvensis*. Dhawan *et al*. (2009) stated that *Phalaris minor* constituted about 49 % of the total weed flora in the wheat field at the start. The other predominant weeds were 9 % *Rumex maritimus,* 7 % *Chenopodium album,* 5 % *Chenopodium murale,* 4 % *Conoropus didymus* ,6 % *Anagallis arvensis,* 3.7 % *Melilotus indica,* 4.0 % *Malwa parvifloraa,* 2.5 % *Medicago denticulata,* 2 % *Spergula arvensis.*. Weeds like *Polypogon monspeliensis, Poa annua , Avena ludoviciana, Cirsium arvense, Vicia sativa, Fumaria parviflora, Convolvulus arvensis* constituted rest of the weed flora Radhey Shyam *et al*. (2009) noticed that wheat field was heavily infested with *Phalaris minor* (56.0 %), *Melilotus indica* (12.4 %),*Medicago denticulata* (8.2 %), *Chenopodium album* (7.5 %) and *Rumex acetosella* (6.3 %). Other minor weeds were *Conoropus didymus, Lathyrus aphaca, Fumaria parvifloraa, Vicia sativa, Polygonum plebeium* and *Cyperus rotundus* constituting 9.6 % of total population. Singh *et al.* (2009a) noted that relative composition of major weed flora in the wheat field comprised of *Phalaris minor* (22.5 %), *Cynodon dactylon* (18.6 %), *Cyperus rotundus* (14.41 %), *Avena ludoviciana* (17.84 %), *Solanum sp*. (6.86 %) *and Fumaria parviflora*

(5.88 %). *Besides, Anagallis arvensis* (2.88 %) *Euphorbia sp.* (2.2 %) , *Vicia sativa* (2.3 %), *Rumex dentatus* (4.2 %), *Convolvulus arvensis (*3.01%), *Polygonum plebeium* (0.2 %), *Ageratum conyzoides* (0.4 %) and *Spergula arvensis* (0.6 %).

Conclusion: The current challenge for producers is to manage herbicides and other inputs in a manner that prevents adapted species attaining troublesome proportions. As the future weed problems will be multipronged, a holistic multidisciplinary approach would be imperative. In this context, integrated weed management (IWM) may provide a more sustainable measure for crop protection. IWM is a science-based decision-making process that coordinates the use of environmental information, weed biology and ecology, and all available technologies to control weeds by the most economical means, while posing the least possible risk to people and the environment (Sanyal, 2008). By using different appropriate management practices against weeds, farmers have more options for controlling them, thereby reducing the possibility of escapes and weed adaptations to any single weed management tactic. Traditional methods of weed control such as crop rotation, manual hoeing or tractor drawn cultivator and costly labour have made the use of herbicides more popular among the Indian farmers. The irradication of weeds through chemicals is considered more suitable as they cover more area during short period of time. Keeping the importance of these circumstances in view, it is necessary to select suitable chemicals capable of controlling effectively and economically all the weeds present in wheat field. Nowadays herbicides such as atrazine, butachlor, pendimethalin, metribuzin, 2,4-D etc. are used for weed control in wheat along with cultural and mechanical methods. Majority of the farmers prefer post emergence herbicides mostly due to unavailability of herbicides in market. However, conclusive information is not available on relative efficacy of such herbicides alone or in combination with other weed control methods and economics of different weed control methods in Haryana.

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Livelihood Security through Opportunities in Agriculture and Allied Sectors

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Abstract

Livelihood security is a cornerstone of rural development in India, where nearly 46.1% of the workforce remains engaged in agriculture and allied sectors, though the sector contributes only 16-18% to Gross Value Added (GVA). This imbalance underscores the fragility of farm-based incomes, particularly for the 89% small and marginal farmers with less than two hectares of land. To mitigate risks, rural households increasingly diversify into allied sectors such as livestock, fisheries, horticulture, and poultry, which together contribute nearly 45% of the sector's output value, providing stability, year-round employment, and improved nutrition. Over the years, the government and institutions have launched multiple support mechanisms: credit and insurance schemes (Kisan Credit Card, PMFBY), employment programs (MGNREGA), market reforms (e-NAM, Farmer Producer Organizations), and dedicated missions for horticulture, livestock, and fisheries. Extension and research institutions like ICAR, MANAGE, and State Agricultural Universities also provide capacity building and knowledge dissemination. These interventions have expanded livelihood opportunities and reduced rural vulnerability. However, critical gaps remain. Access to institutional credit is still limited for smallholders; crop and livestock insurance often fail to ensure timely compensation; extension systems are overburdened and unevenly distributed; and rural infrastructure for storage, transport, and value addition remains inadequate. Gender and youth engagement in agricultural enterprises also face structural constraints. These gaps prevent policies from fully realizing their intended impact on sustainable livelihood security. Livelihood security in India relies on strengthening agriculture and allied sectors as complementary income sources. Beyond productivity gains, diversification into allied activities must be scaled up and backed by inclusive,

accessible, and responsive institutional support. Bridging policy gaps through a holistic approach ensures resilient, equitable, and sustainable rural development.

Keywords: *Livelihood security, Agriculture and allied sectors, Institutional support, Policy gaps, Rural resilience*

Soil Remediation through Conditioners as a Pathway to Sustainable Development

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Abstract

The degradation of peri-urban soils is an emerging critical issue that threatens resilient food systems and ecosystem health, directly challenging global sustainable development. This research addresses this problem through the interdisciplinary design of a novel, bio-augmented soil conditioner, integrating innovations from biological and applied sciences. The study focuses on formulating a sustainable alternative to conventional amendments by developing a synergistic microbial consortium housed within a biocompatible carrier. This design specifically targets the restoration of soil structure, enhancement of nutrient cycling, and remediation of contaminants prevalent in peri-urban environments. The development of this technology is intrinsically linked to advancing several key Sustainable Development Goals (SDGs). Primarily, it contributes to SDG 2: Zero Hunger and SDG 15: Life on Land by aiming to restore agricultural productivity and soil biodiversity in marginalized lands on the urban fringe. By enhancing soil organic carbon and reducing reliance on synthetic fertilizers, the conditioner directly supports SDG 13: Climate Action through carbon sequestration and the mitigation of agricultural greenhouse gas emissions. Furthermore, the use of organic waste streams for biochar production aligns with SDG 12: Responsible Consumption and Production, promoting a circular economy. Finally, by revitalizing local food production capacity, the research contributes to sustainable cities and communities, thereby supporting SDG 11. This research exemplifies how applied bioscience can create tangible, nature-based solutions to intersecting challenges of soil degradation, food insecurity, and climate change, offering a scalable pathway for achieving global sustainability targets.

Keywords *- Peri-Urban Soil, Sustainable Development Goals (SDGs), Microbial Consortium, Soil Degradation, Circular Economy*

Standardization of Fermentation Conditions for *Chakhao Amubi* Rice and Its Bioactivity

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Abstract

Fermentation is a traditional practice which was historically used for food preservation and is now increasingly recognized for its health benefits. In this study, *Chakhao Amubi* rice, an indigenous black aromatic variety of Manipur, known for its rich phenolic and anthocyanin was selected to explore bioactive and functional enhancement due to fermentation. Fermentation conditions were optimized by modulating parameters such as soaking and fermentation time, water ratio, cooking time, and temperature to ensure consistent microbial activity. The standardized fermentation protocol resulted in enhanced antioxidant and antimicrobial activity. The antioxidant activity, determined using the ascorbic acid equivalent assay, exhibited a significant increase, reaching 77.20 µg AAE/mL in the fermented extract compared to 12.46 µg AAE/mL in the unfermented control. The ethyl acetate extract exhibited an even higher antioxidant potential of 215.24 µg AAE/mL. The antimicrobial activity, evaluated through the agar well diffusion method, demonstrated inhibition against *Escherichia coli, Bacillus subtilis, Pseudomonas fluorescence,* and *Micrococcus luteus,* with mean inhibition zones ranging between 11-13 mm. these results suggest that the standardized fermentation process enhances the bioactive profile of *Chakhao Amubi* rice, potentially positioning it as a valuable functional ingredient for nutraceutical and therapeutic applications.

Keywords: *Standardized fermentation, antioxidant activity, antimicrobial activity, therapeutic applications.*

Global Research Trends on Banana, Flaxseed, Yogurt-Based Synbiotic Products and their Impact on Gut Health

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Abstract

The human gut microbiota, hosting trillions of microorganisms, plays a central role in overall health, including obesity management, metabolism, immunity, and mental well-being. Probiotics are live microorganisms that confer health benefits when consumed in adequate amounts, whereas prebiotics are substrates that selectively support the growth and activity of probiotics. Synbiotics, combining probiotics with prebiotics, offer a promising approach to enhance gut health. This bibliometric analysis examines global research trends on synbiotic products formulated with banana, flaxseed, and yogurt, and their impact on gut function. A total of 2,837 Scopus-indexed publications from 2015 to 2024 were analysed using Biblioshiny and VOSviewer to assess publication growth, leading authors, institutions, countries, journals, keyword co-occurrence, and thematic evolution. The analysis reveals a notable increase in research activity after 2020, with China, Iran, Brazil, and Australia among the top contributing countries. Core themes include probiotics, gut microbiota, dietary fibre, and prebiotic compounds such as inulin and fructooligosaccharides. While these individual components are widely studied, synbiotic

formulations specifically incorporating banana, flaxseed, and yogurt remain limited, indicating potential for innovation. The field has progressed from traditional food science towards integrated biomedical and biotechnological applications, linking fermentation, metabolic health, and gut microbiome studies with emerging areas such as psychobiotics and chronic disease management. These patterns suggest significant opportunities to develop value-added synbiotic products using to support gut health and overall wellness.

Keywords*- Bibliometric analysis, synbiotic products, gut health, banana, flaxseed, yogurt*

Environmental Pollution and management

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Abstract

Environmental pollution has become a global concern and one of the most pressing challenges of modern civilization. It refers to the introduction of contaminants into the natural environment, causing adverse effects on humans, animals, plants, and the overall ecosystem. The primary forms of pollution include air, water, soil, noise, and radioactive pollution, each of which poses significant threats to environmental and human health.

Air pollution is largely caused by industrial emissions, vehicular exhaust, and the burning of fossil fuels, leading to climate change, global warming, and respiratory diseases. Water pollution results from the discharge of industrial effluents, untreated sewage, plastics, and agricultural chemicals into water bodies. This not only harms aquatic organisms but also creates a shortage of safe drinking water. Soil pollution is triggered by excessive pesticide use, industrial waste, and poor solid waste management, whi...

Noise pollution, although less visible, is equally harmful, as it contributes to stress, hearing impairment, and reduced quality of life in urban areas. Radioactive pollution from nuclear plants and medical waste has long-term hazardous effects, including genetic disorders and cancer. To address these problems, effective environmental management practices are required. Management strategies include reducing industrial emissions, adopting renewable sources of energy, implementing waste segregation and recycling, promoting afforestation, and enforcing strict environmental regulations. Public participation through awareness campaigns and eco-friendly practices also plays a crucial role in pollution control. Furthermore, international cooperation is vital, since environmental issues transcend national boundaries. In conclusion, environmental pollution threatens sustainable development and human well-being. With proper management strategies, technology, and active participation of society, it is possible to minimize the damage and create a cleaner, healthier, and more sustainable future.

Keywords*: Environmental Pollution, Air Pollution, Water Pollution, Soil Pollution, Management, Sustainability*

Abiotic Stress in Enhancement of Phytochemicals in Crop Plants: Integrating Plant-Microbe Interactions for Global Agricultural Sustainability

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Abstract

Climate change has significantly intensified abiotic stresses, including drought, salinity, temperature extremes, and heavy metal contamination, thereby threatening global food security. However, these environmental challenges simultaneously present opportunities to enhance the nutritional and therapeutic value of crops through stress-induced phytochemical accumulation. When subjected to abiotic stress, crop plants activate complex biosynthetic pathways—particularly the phenylpropanoid, shikimic acid, and terpenoid routes—leading to the production of bioactive secondary metabolites such as flavonoids, phenolic acids, anthocyanins, and carotenoids, which possess significant health-promoting properties in plants. Importantly, the plant-associated microbiome, comprising plant growth-promoting rhizobacteria (PGPR), endophytic fungi, and arbuscular mycorrhizal fungi (AMF), plays a crucial role in modulating both stress tolerance and phytochemical biosynthesis. Specifically, beneficial microorganisms such as Bacillus, Pseudomonas, and Rhizophagus species enhance plant resilience through multiple mechanisms, including the production of phytohormones, siderophores, and microbial elicitors that activate Induced Systemic Resistance (ISR) and upregulate genes encoding biosynthetic enzymes. These integrated plant-microbe interactions offer multiple agricultural benefits, including improved crop resilience and superior nutritional quality. Thus, this interdisciplinary research domain (including Agricultural, microbial and biochemical) provides transformative strategies for developing climate-resilient, nutrient-dense crops that simultaneously address food security challenges in a rapidly changing global environment.

Keywords: *Abiotic stress, phytochemicals, PGPR, Induced systemic resistance, biosynthetic pathways*

Structural Responses of Reproductive Organs to Temperature Stress in *Capsicum annuum*

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Abstract

Capsicum annuum L., encompassing both hot and sweet pepper types, is highly sensitive to temperature extremes, which adversely affect fruit and seed set. The present study examines the anatomical and histological alterations in the male and female reproductive organs of Capsicum genotypes exposed to temperature stress. Sweet pepper (*Capsicum annuum var. grossum*) was evaluated under low-temperature conditions, while chilli (*Capsicum annuum* var. *annuum*) genotypes with contrasting heat tolerance were studied under high-temperature stress. Cross-sections of anthers and ovaries were analyzed using Periodic Acid–Schiff (PAS) and Haematoxylin–Eosin (H&E) staining to assess tissue organization, carbohydrate localization, and pollen development. Under low-temperature stress, sweet pepper exhibited abnormal ovary enlargement, degeneration of vascular bundles, increased giant cell formation, and

intense PAS-positive staining in anther tissues, suggesting impaired carbohydrate utilization. Although pollen count remained largely unaffected, disorganization of ovular and tapetal tissues indicated reduced reproductive efficiency. In contrast, under high-temperature stress, the heat-tolerant chilli genotype maintained distinct anther structure, higher pollen viability, and well-preserved ovary tissues. The heat-susceptible genotype showed severe vascular bundle degeneration, accumulation of giant cells, reduced pollen number, and weak PAS reactivity. Overall, the study highlights the vulnerability of reproductive organ development to temperature stress and identifies key histological traits distinguishing tolerant from susceptible genotypes. These findings contribute to understanding the anatomical basis of thermo-tolerance in Capsicum and provide valuable insights for breeding climate-resilient genotypes.

Keywords: *Low temperature stress, Heat tolerance, Periodic acid–Schiff staining, Haematoxylin–Eosin staining, Pollen viability*

Tillage and Nutrient Management Effects on Growth and Productivity of Strawberries in Rice Field Conditions

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Abstract

The present research was carried out at the ICR Farm, Assam Agricultural University, Jorhat, during 2021 and 2022, to investigate the affect of tillage, stubble mulch, and fertilizer management on growth, yield, and quality of strawberry (Var. Winter dawn). The experiment was carried out using a split plot design, with three main plots each having Bed planting with rice stubble mulch (M 1), Minimum tillage with rice stubble mulch (M 2) and Conventional tillage practise (M 3) and four sub plots each having different fertilizer and manure combination viz. N1=10-7-7 g/m 2 N-P-K with 5kg/m 2 FYM, N2=7.5-5-5 g/m2 N-P-K + vermicompost 200g/m2 (instant mixture), N3= 5-3.5-3.5 g/m2 N-P-K + vermicompost 200g/m2 (instant mixture), N4= 200-20-2 g (FYM-lime-wood ash) per plant. Vermicompost was incubated with Azospirillum and Azotobacter before application. The findings showed that the strawberry plants were strongly impacted by all of the treatments in terms of growth, yield, and quality.Under tillage and mulching practices in main plots maximum plant height of (18.26 cm), leaf number (14.98) and crown diameter (54.73 mm) at 120 DAP, maximum number of flowers (17.03), maximum fruits per plant (13.86), fruit set percentage (80.94%), maximum fruit weight (26.08 g), maximum yield of (368.78 g) per plant and the best quality parameters like maximum TSS (7.88 0 B), reducing sugars (5.63 %), total sugars (6.38 %),minimum acidity content of (0.54%) and maximum ascorbic acid of (50.45 mg/100g) was observed in M 1 .Under nutrient management (sub plots) maximum plant height (18.81 cm), leaf number (18.73) and crown diameter of (52.53 mm) at 120 DAP, minimum (62.26) days to first flowering, maximum flowers/plant (17.59),maximum fruits/plant (14.35), maximum yield of (374.53 g/plant) and (18.30 t/ha) under N 4 [200-20-2 (FYM-lime-wood ash) g/plant]. Best

quality parameters like highest TSS, sugars and low acidity were observed under N 3 (5-3.5-3.5 g/m 2 N-P-K + vermicompost 200g/m 2).This field study clearly shows that the treatment combination of (M 1 N 4) Bed planting with rice stubble mulch along with 200-20-2 (FYM-lime-wood ash) g/plant in equal split at 10 and 30 DAP (as instant mixture) gave maximum growth attributes, yield and highest monetary returns. And (M1N3) Bed planting with rice stubble mulch along with 5-3.5-3.5 g/m2 N-P-K + vermicompost 200g/m2 in equal split at 10 and 30 DAP (as instant mixture) found to be suitable for best quality fruits.

Unlocking Digital Agriculture in India: AI, IoT, and Convergence for Sustainable Growth

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Abstract

The global population is projected to exceed 10 billion by 2050, intensifying the pressure on agriculture to meet growing food demand. In India, where the population currently surpasses 1.4 billion, this challenge is compounded by limited arable land, declining water resources, and the impacts of climate change. Precision farming, powered by the convergence of Artificial Intelligence (AI), Machine Learning (ML), and the Internet of Things (IoT), is emerging as a critical solution to optimise resource utilisation, improve crop yields, and ensure sustainable food security.

This approach leverages IoT-enabled sensors to collect real-time field data, including soil moisture, pH, NPK levels, temperature, humidity, and light irradiance. When integrated with satellite and drone imagery, this comprehensive dataset fuels AI models that generate actionable insights for the precise management of water, fertiliser, and pesticides. Ultimately, AI-driven analytics enable predictive decision-making for crop production, disease prevention, and yield optimisation, directly enhancing farmers' profitability and resilience.

Specifically, the CSIR - Central Scientific Instruments Organisation (CSIO) has developed indigenous IoT nodes and gateways tailored to Indian agricultural conditions. These scalable, locally developed technologies provide robust, real-time data collection and processing capabilities, positioning Indian agriculture for greater productivity and sustainability amid escalating global and national challenges.

Keywords: *Digital Agriculture, AI and IoT Convergence, Precision Farming, Sustainable Agriculture, Indian Farming, Crop Yield Optimisation, Sensor Networks*

Improvement of Soil Physical Health and Maize Productivity through Biochar Application

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Abstract

Biochar, a carbon-rich and porous material formed by the pyrolysis of organic biomass, has received a lot of interest as a sustainable soil additive for improving soil health and crop yield. Its absorption into soil considerably affected soil physical qualities, promoting maize (*Zea mays* L.) growth and yield. The use of biochar increased soil structure, porosity, bulk density, and water-holding capacity, increasing aeration and root growth. These improvements in soil physical conditions aided root development and nutrient uptake, resulting in improved plant physiological responses. Furthermore, biochar increased soil aggregation and decreased compaction, which improved microbial activity and soil moisture retention. In maize cultivation, biochar boosted plant height, root and shoot biomass and, eventually, grain output. Biochar's greater nutrient retention capacity reduced nutrient leaching and increased fertilizer efficiency, resulting in more sustainable production systems. Furthermore, biochar reduced the negative effects of abiotic stresses like drought and salinity by enhancing soil moisture dynamics and buffering capacity. Overall, biochar demonstrated to be an effective and environmentally friendly amendment that improved soil physical characteristics and maize plant parameters, providing a long-term solution for soil fertility management and crop productivity enhancement.

Keywords: *Biochar, soil physical properties, maize, nutrient uptake, plant growth, sustainable agriculture*

Root Endophytic Microflora of *Ricinus communis L.*: Insights from Agroforestry vs Monoculture Systems

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Abstract

Agroforestry or Agriculture with tree is an integrated land use concept that combines crops with trees is a more sustainable production system i.e. cultivation of trees in combination with agricultural crops or pastoral with the beneficial effect of on biodiversity and natural ecosystem. It enhances the production and also very helpful in the soil restoration and soil quality. *Ricinus communis* is highly drought resistant and economically important plant and it seed contain 46%-55% of oil, also, it is a raw material of industrial, medical and chemical products. The microflora of plant comprises a wide range of microbial communities that generally interact with plants and soils. Plant root-associated microflora plays an important role in plant health and ecological functions. Recent studies suggested that *Ricinus communis* plants root-associated microbes can promote plant growth in contaminated soils and enhance the phytoremediation efficiency in multi-metal contaminated soils. This study compares the microbial diversity in root of *R. communis* grown under both agroforestry and monoculture systems. The endophytic microflora (Bacteria and Fungi) from root were isolated by collecting root samples from both fields and then surface sterilized them to remove epiphytes. Then small pieces of surface sterilized roots were inoculated on Luria Bertani Agar plates (Bacteria) and Potato Dextrose Agar (fungi) by culture plate method. The Culture plates were incubated for 2 days on 37^0C for growth endophytic bacteria and 7- 10 days on 25^0C for growth of endophytic fungi. The finding reveals that a total of 7 bacterial and 6 Fungal species in AFS field grown R. communis while only 4 Bacterial and 3 Fungal species in Monoculture Field grown R. communis. This shows that root endophytes isolated from R.

communis grown in Agroforestry Field root show more microbial (bacterial and Fungal) diversity compared to R. Communis grown in Monoculture Field.

Keywords: *Agroforestry, Ricinus Communis, Endophytes, Microflora, sustainable Agriculture, Phytoremediation*

Bioinformatic analysis of the phylogenetic relationship and identification of *GLR* genes in three *Brassica* species.

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Abstract

Plant glutamate receptors (*GLRs*) are nonselective cation channels involved in various physiological processes. Thus, knowledge about *GLR* genes is crucial which can lead to effective way of improving agronomic traits in crop plants. *Brassica,* crops are used for human nutrition and many of them have been domesticated as important crops for agriculture, ornaments or condiment. The genome data (gene, cds and protein data) of allopolyploid *B. napus* and its two diploid progenitors, *B. rapa* and *B. oleracea*, were obtained from the BRAD database (http://brassicadB.org/brad/). We have identified 11, 27 and 65 genes as *GLR*s in *B. oleracea*, *B. rapa* and *B. napus*, respectively and named them species-wise according to their distribution on chromosomes (*BoGLRs* for *B. oleracea*, *BrGLRs* for *B.rapa* and *BnGLRs* for *B.napus*). We analyzed the molecular characteristics of these *GLR* genes in *B. oleracea*, *B. rapa* and *B. napus*. The full-length *GLR* protein sequences of the three *Brassica* species were aligned with MUSCLE and subsequently, a phylogenetic tree was constructed by MEGAX based on Maximum Likelihood (ML) method with 1000 bootstrap replicates. To determine the phylogenetic relationship among the *GLRs* in three *Brassica* genomes, we constructed the Maximum-Likelihood phylogenetic tree using the total length amino acid sequences of these proteins with 1000 bootstrap values. In this study, considering the importance of plant *GLR* genes as well as the economic importance of *Brassica*, we made use of the publicly available sequenced genomes of the allotetraploid *B. napus* and its diploid progenitors *B. oleracea* and *B. rapa* to trace the evolution of *GLR* genes in these species. This study enhances our understanding of the effect of polyploidization events on the evolution of the *GLR* gene family in *Brassica* as well as their structural and functional aspects.

Keywords: *Three-dimensional structure, Polyploidy, Gene expression, Phylogeny*

Biochemical characterization of Borpat (*Ailanthus grandis* Prain) leaves

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Abstract

The study was conducted in the Department of Sericulture and the Department of Agricultural Biotechnology, Assam Agricultural University (AAU), Jorhat, during 2023–2025, to assess the nutritional composition of Borpat (*Ailanthus grandis* Prain) leaves collected from ten populations across Assam (AAU Campus, Dhemaji, Lahdoigarh, Mariani, North Lakhimpur, Sadiya, Tinsukia, Titabar, Dibrugarh) and Arunachal Pradesh (Pasighat). Both cultivated and wild genotypes were analyzed for nitrogen, crude protein, total carbohydrate, total soluble sugar, reducing sugar and non-reducing sugar on a dry-weight basis. The Mariani genotype recorded the highest crude protein (24.54%) and nitrogen (3.86%), Tinsukia had the maximum total carbohydrate (27.08%) and non-reducing sugar (22.55%), Arunachal showed peak reducing sugar (7.50%), and North Lakhimpur exhibited the highest total soluble sugar (7.51%). Pearson's correlation analysis revealed a near-perfect association between crude protein and nitrogen ($r = 0.995^{**}$, $p < 0.01$), and strong positive correlations between total carbohydrate and non-reducing sugar ($r = 0.847^{**}$, $p < 0.01$) and total soluble sugar ($r = 0.697^{*}$, $p < 0.05$). The observed variation reflects genetic diversity and environmental influences. The findings provide a biochemical baseline supporting Borpat as a nutritionally rich, regionally adaptable, and sustainable secondary host plant for eri silkworm rearing and sericultural improvement breeding programmes.

Keywords: *Ailanthus grandis, biochemical variability, crude protein, carbohydrate, eri silkworm host plant*

Assessment of rice suitability using geospatial techniques in the Central Gujarat region

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Abstract

Cropland suitability assessment plays a vital role in ensuring effective agricultural planning, sustainable land management, and optimal resource utilization. The present study evaluated rice suitability in the Central Gujarat region by integrating the Analytic Hierarchy Process (AHP) with geospatial techniques. Key parameters considered included clay content, slope, rainfall, soil depth, soil organic carbon (SOC), pH, and electrical conductivity (EC). The AHP-derived weights for these parameters were clay (0.376), slope (0.248), rainfall (0.148), soil depth (0.105), SOC (0.058), pH (0.042), and EC (0.024), with a consistency ratio (CR) less than 0.10, confirming the reliability and accuracy of the pairwise comparison process. The suitability analysis revealed that 12.5%, 18.4%, and 34.8% of the area were categorized as highly suitable (S1), moderately suitable (S2), and marginally suitable (S3), respectively. This study demonstrates the effectiveness of combining AHP and GIS-based geospatial techniques for precise

crop suitability mapping. The outcomes serve as a valuable tool for farmers and decision-makers for improved agricultural productivity, and sustainable management of soil and water resources in the Central Gujarat region.

Keywords: *Rice, AHP, crop suitability, Central Gujarat region,*

In Silico Evaluation of Bioactive Compounds from Seed Cycling and Their Interaction with PCOS -Associated Proteins

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Abstract

Introduction

Polycystic Ovary Syndrome (PCOS) is a complex endocrine disorder commonly affecting women of reproductive age, marked by hormonal imbalance, insulin resistance, and metabolic disturbances. Nutrigenomics, which studies the interaction between diet and genes, provides a novel approach to understanding the nutritional regulation of such disorders. Because of its high lignan, phytosterol, and omega fatty acid content, seed cycling a dietary practice that includes flax, pumpkin, sunflower, and sesame seeds at various stages of the menstrual cycle is believed to support hormonal balance. However, the molecular mechanisms underlying these effects remain largely unexplored.

Methodology

Bioactive compounds from the four seeds were identified for this study using scientific literature and chemical databases like PubChem. Target proteins linked to PCOS were chosen from databases such as GeneCards and UniProt. The Protein Data Bank (PDB) provided their three-dimensional structures. To assess the binding affinity and interaction patterns between the seed bioactives and the PCOS-related proteins, molecular docking was performed using the Schrödinger suite.

Results and Discussion

The docking analysis revealed several bioactive compounds with favorable binding affinities toward key proteins involved in hormonal regulation and metabolic processes related to PCOS. The observed interactions suggest potential modulation of pathways linked to insulin sensitivity, oxidative stress, and steroidogenesis. These findings support the nutrigenomic concept that dietary seed bioactives may influence molecular targets associated with PCOS, thereby contributing to symptom management.

Conclusion : The study provided a preliminary molecular justification for the traditional use of bioactive compounds from seed cycling in hormonal regulation by demonstrating their promising molecular interactions with PCOS-related proteins. Future experimental research will be built upon these in silico findings, which could aid in the creation of evidence-based dietary plans for PCOS management.

Keywords: *Nutrigenomics, Seed cycling, PCOS, Bioactive compounds, Molecular docking, Schrödinger.*

Environmental Xenobiotics in Bu3alo Ovarian Follicular Fluid: Implications for Reproductive Toxicology

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Abstract

Xenobiotics are foreign chemical substances that enter an organism and are not naturally produced or expected to be present in its body. These include pesticides, plasticizers, aflatoxins, and antibiotic residues**,** which are widely distributed in the environment and may exert serious adverse effects on human and animal health**,** such as endocrine disruption, immunotoxicity, neurotoxicity, and reproductive dysfunction**.** The present study aimed to investigate the occurrence and levels of selected environmental xenobiotics in the ovarian follicular fluid of buffaloes to assess potential reproductive toxicological risks.

Ovaries were collected from slaughterhouses, and ovarian follicular fluid was aspirated. Aspirated follicular fluid was centrifuged and clear supernatant devoid of granulosa cells was used for analysis. Quantification of specific xenobiotics (maneb, paraquat, bisphenolA, antibiotics and aflatoxinM1) was performed using high-performance liquid chromatography (HPLC) with a UVVisible detector.

The results revealed extensive contamination of the follicular fluid with varying concentrations of the studied compounds. Maneb and Paraquat were detected at mean concentrations of 247.06 ¼g/mL and 0.019 ¼g/mL, respectively, while Aflatoxin M1 ranged from 238.2 to 340.8 ¼g/mL. Bisphenol A was present at an average concentration of 65 ¼g/mL, and detectable levels of antibiotic residues were also observed. These findings indicate significant environmental exposure of buffaloes to xenobiotics, which may pose a potential risk to ovarian function and reproductive health. The study underscores the importance of environmental toxicological surveillance in assessing the impact of chemical contaminants on animal fertility and ecosystem health.

Keywords: *Environmental toxicants, Follicular fluid, Maneb, AflatoxinsM1, BisphenolA, HPLC*

Emerging Challenges and Prospects in Disease and Pest Management of Subtropical Fruit Crops in India

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Abstract

Subtropical horticultural crops such as mango, guava, jamun, bael, and papaya form the backbone of India's fruit industry, contributing substantially to farmers' income, nutritional security, and export potential. However, their productivity and quality are increasingly threatened by a wide spectrum of diseases and insect pests including wilt complexes, anthracnose, powdery mildew, blossom blight, stem borers, fruit borers, fruit flies, and mealybugs. At present, management practices rely heavily on chemical pesticides, which offer short-term control but have led to rising production costs, ecological imbalance, pesticide residues, and the development of resistance among pest and pathogen populations. In recent years, Integrated Disease and Pest Management (IDM/IPM) strategies that combine tolerant varieties, eco-friendly cultural practices, biological control agents, and need-based chemical interventions have shown encouraging results in reducing chemical dependence while sustaining crop yields. Technological advances such as molecular diagnostics, bioformulation development, drone-assisted spraying, and digital surveillance tools are further enhancing the precision and efficiency of pest and disease management. Yet, challenges persist in scaling up these technologies to smallholder farmers, addressing climate-change-driven pest shifts, and ensuring economic and environmental sustainability. Looking ahead, the emphasis must be on developing eco-smart and climate-resilient management modules that integrate host resistance, microbiome utilization, precision agriculture, and natural farming principles, supported by robust capacity-building and policy frameworks. Such holistic and sustainable approaches will help minimize crop losses, enhance export competitiveness, and strengthen the resilience of subtropical horticultural production systems in India.

Keywords: *Management, wilt complex, IPM, ecofriendly*

Assessing Economic and Operational Efficiency of Drone-Based Agri-Input Application in Rejuvenated Mango Orchards

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Abstract

The integration of drone technology for pesticide application in perennial fruit crops, particularly mango, represents a transformative step toward precision and efficiency in orchard management. A comparative assessment conducted in six villages of the Lucknow namely Napipanah, Hasnapur, Devridanda, Masidhahamir, Dhhakwa, and Shahilamau, covering 1,148 trees (11.48 ha), evaluated drone-based spraying against conventional manual methods. Manual spraying required an average of 121.98 hours/ha, whereas drone spraying completed the same operation in 4.28 minutes/ha, marking an average 98%

reduction in operational time. Site-wise savings ranged from 32 to 63 minutes per hectare, illustrating drones' efficiency in large and tall mango canopies. Economic evaluation revealed substantial cost advantages. The average cost of manual spraying was ₹ 2,770/ha, while drone-based application cost ₹ 1,708/ha, yielding a 39.97% cost reduction overall. Among the locations, Dhhakwa recorded the highest saving (67.57%), while others demonstrated consistent savings exceeding 35%. The results emphasize that drone-assisted spraying is both time-efficient and economically viable, significantly reducing dependency on manual labor while optimizing input use. The technology ensures timely, uniform, and precise delivery of plant protection inputs, which is crucial for managing pests and diseases effectively in extensive mango orchards. This innovation promises to enhance productivity, profitability, and sustainability paving the way for widespread adoption of smart mechanization in horticultural crop management.

Sustainable soil management, conservation agriculture, organic farming, INM, soil-microorganisms-plant interactions

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Abstract

Sustainable soil management is a key component of modern agriculture aimed at maintaining soil fertility, ecological balance, and long-term productivity. Increasing soil degradation due to intensive cultivation, excessive fertilizer use, and climate change has emphasised the need for sustainable approaches. Practices such as conservation agriculture (CA), organic farming, and Integrated Nutrient Management (INM) are essential strategies for improving soil quality and ecosystem resilience. Conservation agriculture promotes minimal soil disturbance, permanent soil cover, and crop diversification, which enhance soil structure, water retention, and microbial activity. Organic farming emphasises the recycling of organic residues, the use of compost and biofertilizers, and the avoidance of synthetic chemicals, thereby improving soil organic carbon and biodiversity. Integrated Nutrient Management (INM) combines organic, inorganic, and biological nutrient sources to achieve balanced nutrient supply, optimise fertiliser use efficiency, and reduce environmental risks. At the core of these approaches lie soil–microorganism–plant interactions, which drive nutrient cycling, decomposition, and plant growth promotion. Beneficial microorganisms such as mycorrhizal fungi, rhizobia, and phosphate-solubilising bacteria enhance nutrient uptake and improve soil biological activity. Integrating these sustainable soil management practices enhances soil fertility, improves crop yield stability, and mitigates the impacts of climate-related factors. This study emphasizes the synergistic role of CA, organic farming, and INM, supported by active soil–microbe–plant interactions, as a comprehensive framework for achieving sustainable agricultural productivity and environmental conservation.

Keywords*: Sustainable soil management, conservation agriculture, organic farming, Integrated Nutrient Management, soil–microorganism–plant interactions, soil health.*

Radiographic Morphometric Measurement of Urinary System in Clinically Healthy Canines Following Intravenous Urography Using Non-Ionic an Ionic Contrast Agents

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Abstract

Urinary tract affections in canines are usually associated with variation in renal and bladder size that are indicative of associated disease. So, morphometic measurements help to distinguish between normal and diseased urinary system, guide diagnostic and surgical interventions alongwith monitoring of gradual post treatment recovery. Therefore, the present study was undertaken to determine normal radiographic morphometric measurement of canine urinary system following intravenous urography using non-ionic (iohexol) and ionic (sodium and meglumine diatrizoate) contrast agents for obtaining reference values. Twelve apparently healthy canines were randomly divided into I and II group consisting of six animals of either sex in each. Both the contrast agents were administered at the same dose rate i.e.1100 mg I/kg body weight and diluted with an equal amount of 5% dextrose saline solution and infused intravenously over a period of 10-15 minutes under general anaesthesia. Subsequently, ventro-dorsal/lateral radiographs were taken at 5, 15, 30 minutes intervals. The morphometric measurement of kidney length and width, ureter length and diameter, urinary bladder length, width and length of second lumbar vertebrae and its correlation with size of kidney and ureter was done using the in-built calipers in the CR system. Non-significant differences were observed in the radiographic morphometric measurement of the left and right kidney, left and right ureter and urinary bladder between groups I and II. Urethra could not be visualized in any of the radiographs. Therefore, the present study provides information about the normal radiographic morphometric measurements of the canine urinary system which may be helpful to the practicing veterinarians and clinicians as reference values.

Microencapsulation of plant polyphenols in yogurt using whey protein–polysaccharide matrices

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Abstract

The enrichment of dairy products with natural antioxidants is becoming more popular as consumers increasingly seek functional foods that offer additional health benefits. However, directly adding plant-derived polyphenols into fermented dairy products often leads to poor stability, low bioavailability, and unwanted sensory changes due to interactions with milk proteins and fermentation byproducts. This study investigates microencapsulation of plant polyphenols using whey protein–polysaccharide matrices

to improve their stability, antioxidant retention, and controlled release in yogurt. Polyphenols extracted from fruit by-products such as pomegranate peel and green tea leaves were encapsulated via complex coacervation of whey protein isolate (WPI) with pectin and gum Arabic. The resulting microcapsules were examined for encapsulation efficiency, particle size, morphology (SEM), zeta potential, and antioxidant stability during refrigerated storage. Encapsulated polyphenols were added to stirred yogurt, and the formulations were tested for pH, titratable acidity, viscosity, syneresis, color, and sensory acceptability compared to yogurts with free polyphenols. Microencapsulation is expected to greatly improve oxidative stability, bioactive compound retention, and sensory quality of yogurt without harming fermentation or texture. In-vitro gastrointestinal digestion tests will also assess how well the encapsulated polyphenols are released and made accessible in simulated gastric and intestinal conditions. The combination of whey protein and plant-derived polysaccharides not only creates an effective natural encapsulation matrix but also supports circular bioeconomy principles by adding value to whey and fruit waste. This research aids in developing advanced functional dairy products with enhanced health benefits, better shelf life, and increased consumer appeal through sustainable ingredient use and innovative dairy chemistry techniques.

Keywords: *Microencapsulation, Polyphenols, Whey protein isolate, Polysaccharides, Functional yogurt, Bioavailability*

"Milk Fat Globule Membrane as a Bioactive Dietary Component Mitigates Metabolic, Reproductive, and Bone Dysfunctions in a PCOS Rat Model"

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Abstract

Polycystic Ovarian Syndrome (PCOS) is a multifactorial endocrine disorder associated with hormonal imbalance, insulin resistance, oxidative stress, and impaired folliculogenesis, often leading to infertility and compromised bone health. The Milk Fat Globule Membrane (MFGM), a bioactive fraction of milk rich in phospholipids, sphingolipids, and glycoproteins, exhibits antioxidant, anti-inflammatory, and metabolic regulatory activities, suggesting its potential therapeutic role in PCOS. This experimental study evaluated the efficacy of MFGM in mitigating metabolic and reproductive dysfunctions associated with PCOS in a letrozole-induced rat model. Female Swiss albino rats were divided into 6 groups (n = 8): Control, PCOS, Metformin, High-Fat Diet (HFD), Goat MFGM, and Sahiwal MFGM. PCOS was induced by oral administration of letrozole (1 mg/kg BW) and HFD for 30 days, while MFGM (850 mg/kg BW) was administered simultaneously throughout the induction period to evaluate its preventive potential. Vaginal cytology demonstrated that MFGM-treated rats maintained regular estrous cyclicity, preventing the persistent diestrus phase associated with PCOS. MFGM co-supplementation reduced body weight gain, serum testosterone, and luteinizing hormone levels while increasing estradiol and enhancing insulin sensitivity. Favorable effects were also observed on fasting glucose and lipid profiles. Histological analysis revealed preserved follicular development, reduced cystic follicles in the ovaries,

and improved uterine gland morphology. Micro-CT examination showed an osteoanabolic effect of MFGM through elevated trabecular thickness, bone mineral density, and bone volume fraction. Furthermore, MFGM improved superoxide dismutase and catalase activities in ovarian and brain tissues, reinforcing antioxidant defense. In conclusion, simultaneous administration of MFGM with letrozole effectively prevented hormonal, metabolic, and reproductive disruptions while promoting bone remodeling. These findings underscore MFGM's potential as a safe nutraceutical intervention for preventing PCOS and associated systemic impairments.

Keywords: *Milk Fat Globule Membrane, Polycystic Ovary Syndrome, Estrous Cycle, Bone Health, Antioxidant Activity*

^{14}C-labelling: A potential tool to study the source-sink relationship in perennial fruit crops

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Abstract

In perennial fruit crops, canopy management is an important aspect that decides the productivity over the years. Pruning plays an important role in canopy management, and the time and method of pruning for quality production over the years depend on the bearing habit and source-sink relationship in the respective fruit crop. Kinnow mandarin, being a citrus group of fruit is difficult to prune, and hence an understanding of source-sink relationship is required. In this backdrop, ^{14}C-labelling is used to study source-sink relationship in Kinnow. The findings of the study indicated that the sink-fruit whether present at the proximal or distal end, they are capable of drawing the photoassimilates from the source leaves. The main branch acts as the photoassimilate reserves, hence heavy pruning is not a healthy practice for Kinnow. Later, pruning of shoot tips of 10 cm length resulted in minimal increment in plant height and can be used for canopy management. The findings suggested that ^{14}C-labelling can be used to study source-sink relationship in perennial fruit crops successfully to design pruning practices on sustainable basis.

Keywords: *Source-sink relationship, Perennial fruit crops, Pruning, Kinnow, Guava.*

Gender-Smart Agriculture: A Pathway to Sustainable Food Systems

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Abstract

Smart Agriculture, is the adoption of advanced technologies and data-driven farm operations to optimize and improve sustainability in agricultural production. Climate-Smart Agriculture is leading the way to a more sustainable and secure agricultural future. This approach focuses on three key goals: enhancing agricultural productivity and income sustainably, fostering adaptation and resilience to climate change, and minimizing or eliminating greenhouse gas emissions where feasible. The goal of smart agriculture technology is to help farmers make more informed decisions regarding irrigation, pest control, and weather-related challenges. Gender-smart agriculture refers to agricultural practices and systems that are designed and implemented with a focus on addressing gender disparities and ensuring that both women and men have equal access to and benefit from resources, technologies, and opportunities within the agricultural sector. It's a way to promote gender equality and empowerment within agriculture, while also enhancing climate resilience and productivity. Agriculture, the single largest production endeavour in India and contributing substantially to the GDP, is increasingly becoming a female activity. Agriculture sector employs 80% of all economically active women; they comprise 33% of the agricultural labour force and 48% of self-employed farmers. As per the Annual Periodic Labour Force Survey (PLFS) Report 2022-23, agriculture had the highest estimated percentage distribution of female workers, ie. 64.3 %, with 76.2 % in rural areas and 11.7 % in urban areas. The major goal of sustainable agriculture is to produce food and fibre in a way that protects the environment, conserves natural resources, and maintains the economic viability of farms while enhancing the quality of life for farmers and society. It aims to balance environmental, economic, and social considerations to ensure long-term food security and well-being. J&K has potential for high-value crops like saffron, kala zeera, and hill garlic. Gender-smart initiatives can empower women to participate in value addition and enterprise development related to these crops, boosting their incomes and economic resilience, according to the Director of Agriculture, Jammu. Gender mainstreaming in agriculture is crucial in the present scenario because it enhances overall agricultural productivity, promotes food security, and ensures equitable development. By addressing gender disparities in access to resources, technology, and markets, it unlocks the full potential of women in agriculture, leading to increased yields and improved livelihoods.

Key Words: *Smart Agriculture, Sustainability, Productivity, Gender-Smart, Natural-Resources.*

Growth Response of Selected Mangroves to Biofertilizer Inoculation in Saline Coastal Soils of Thane Creek and Ulhas River Estuary

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Abstract

The present investigation was carried out along the Thane Creek (19°002 –19°152 N, 72°552 –73°002 E) and the adjoining Ulhas River estuary, Maharashtra, India, with the objective of assessing the growth performance of selected mangrove species under biofertilizer supplementation and evaluating their potential utility for farmers in coastal agroforestry systems. Three dominant mangrove species, Avicennia marina, Rhizophora mucronata, and Sonneratia alba, were raised under controlled nursery conditions

and subsequently transplanted to the intertidal mudflats of the study area. Biofertilizers including Azospirillum brasilense, phosphate solubilizing bacteria (PSB, Bacillus megaterium), and arbuscular mycorrhizal fungi (AMF, Glomus spp.) were applied individually and in combinations. The experimental design comprised control and four treatment groups monitored for survival, height, biomass, and physiological parameters over 24 months. Results revealed that biofertilizer application significantly enhanced seedling growth, nutrient uptake, and survival under saline conditions. The combined treatment (Azospirillum + PSB + AMF) recorded the highest performance with up to 25% improvement in seedling height and 20% higher survival over control. The study concludes that biofertilizer-based interventions can be integrated with mangrove plantation programmes to promote sustainable coastal farming practices, soil health improvement, and climate resilience.

Keywords: *Mangroves, Biofertilizers, Avicennia, Rhizophora, Sonneratia, Thane Creek, Ulhas River, Coastal agroforestry.*

Prognostic Blood miRNAs and lncRNAs During the Estrous Cycle of Buffalo

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Abstract

Estrus detection in buffalo is a major challenge as they are silent breeders, resulting in significant economic losses to farmers and the livestock industry. To address this, the present study aimed to identify sensitive and precise blood biomarkers by profiling miRNAs, mRNAs, and lncRNAs during the estrous cycle in buffalo heifers (n = 5).

Next-generation sequencing (NGS) revealed 94 significantly differentially expressed (DE) miRNAs ($p < 0.05$), with 63 upregulated and 31 downregulated during estrus. Of these, 25 miRNAs showed strong upregulation (log2 fold change > 1; $q < 0.05$). Notably, *miR-497* was highly upregulated (log2 fold change > 5) and exhibited a degree centrality > 60, linking it to more than 60 nodes, followed by *miR-93*. KEGG pathway analysis of target genes highlighted enrichment in p53 signaling, Wnt signaling, NGF signaling, and progesterone-mediated oocyte maturation pathways.

Transcriptome profiling identified 1,137 DE mRNAs between estrus and diestrus, with 81 upregulated and 80 downregulated (log2 fold change > 2). Key upregulated genes included *CASKN1, PDE6B, FOS, ACTN2,* and *SLC44A1*, while *RF00012, RPS29, PIN1, IF1T3,* and *RF00563* were downregulated. Functional enrichment (KEGG, Reactome, WikiPathways) revealed associations with estrogen response (early and late), TNF-á signaling, and metabolic regulation. GO analysis further indicated roles in catabolic and biosynthetic processes, small molecule metabolism, Golgi apparatus and ER functions, and molecular activities such as oxidoreductase, helicase, acyltransferase, kinase, and peptidyl transferase activity. Network analysis identified *MAPK13, FOSB, TEK,* and *PLCâ4* as hub genes.

lncRNA profiling identified candidates such as *ALDBBTAG0000005527, ALDBBTAG0000004492, ALDBBTAG0000005417,* and *ALDBBTAG0000005983*, located on chromosome 7. Computational analysis showed *NEAT1* with the highest degree centrality, followed by *XIST, HELLPAR, KCQNIOT1,*

and *SNHG1*. Integrative mRNA–miRNA–lncRNA network analysis revealed that *NEAT1* regulates *miR-497* and *miR-223*, highlighting potential regulatory interactions.

This study provides novel insights into the molecular mechanisms underlying estrus in buffalo and identifies *miR-497* and *NEAT1* as promising prognostic biomarkers. Further investigation into these networks may help develop precise, non-invasive estrus detection strategies to improve reproductive efficiency in buffalo.

Preventing Losses from Lumpy Skin Disease through Biosecurity Management Practices: A Cross-Sectional Analytical Study across India

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Abstract

Lumpy Skin Disease (LSD) is an emerging transboundary disease of cattle in India, causing economic losses through reduced milk yield, mortality, treatment costs, decreased animal productivity, and trade restrictions. The estimated economic loss due to LSD outbreaks during 2022 and 2023 was ¹ 20,250 crore as reported in a 2025 study. The present study conducted during 2023-24 assessed the adoption of LSD-specific biosecurity measures, hygiene practices, and constraints faced by dairy farmers across six Indian states namely Assam, Haryana, Karnataka, Madhya Pradesh, Odisha, and Tamil Nadu. A cross-sectional survey was conducted among 1,971 cattle farmers using a structured interview schedule. Data on socio-economic characteristics, farm-level management, and disease prevention practices were collected and analysed using descriptive statistics, Constraint Severity Index (CSI), Analysis of Variance (ANOVA), Principal Component Analysis (PCA) and cluster analysis. The results showed that moderate to low adoption of LSD-preventive biosecurity measures were found among the surveyed states with Haryana (62.26%) achieving the highest adoption score and Assam (39.84%) was the lowest. The most commonly adopted biosecurity practices included adoption of fumigation process for mosquito control (77.48%) and disinfectants (69.75%), whereas awareness-related practices such as sources of infection including vectors were weak. On constraint severity index administered among them showed farmers in Karnataka (2.70) and Madhya Pradesh (2.69) faced the most severe constraints mainly lack of knowledge, high labour cost, and vaccine unavailability. Structural and hygiene assessments showed that Haryana (Total rank points = 11) and Tamil Nadu (Total rank points = 15) performed better, whereas Assam and Odisha lagged behind. PCA clustering grouped Haryana and Madhya Pradesh together, indicating higher socio-economic status and better adoption levels. The study highlighted significant regional differences in LSD prevention across the states and emphasized the need for targeted, state-specific interventions. It concludes that biosecurity practices such as capacity building of farmers, improved timely vaccine access, and adoption of low-cost disinfection strategies are essential to reduce the national-level economic losses from LSD virus infection.

***Key Words**: Adoption behaviour, Cluster analysis, Constraint Severity Index, Farm hygiene, Principal Component Analysis, Socio-economic factors*

Intervention of RHB-234 (Biofortified Pearl Millet) value added products to increase Hemoglobin level in College going girls

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Abstract

Micronutrient malnutrition, particularly iron deficiency anemia, remains a major public health concern among adolescent girls in India. The present study aimed to evaluate the effect of an intervention using value-added laddoos prepared from biofortified pearl millet variety RHB 234 on the hemoglobin concentration and nutritional status of college-going girls. Pearl millet (*Pennisetum glaucum*) variety RHB 234 is biofortified with enhanced levels of iron and zinc. Value-added laddoos were formulated by incorporating RHB 234 flour with jaggery, ghee, and dry fruits to improve palatability and nutrient density. A group of selected college-going girls was provided with these laddoos for a defined supplementation period, and pre- and post-intervention assessments were conducted for hemoglobin concentration, dietary intake, and general health parameters. The results revealed a significant improvement in hemoglobin levels and energy intake among participants following the intervention. The study demonstrates that regular consumption of value-added products developed from biofortified pearl millet can contribute substantially to reducing iron deficiency and improving the overall nutritional status of adolescent females. Furthermore, such interventions support the dual objectives of nutrition security and livelihood enhancement, promoting the wider adoption of biofortified crops at the community level.

***Keywords:** Biofortified Pearl Millet RHB 234, Value-added product, Nutritional intervention, Anemia reduction, Adolescent girls, Micronutrient enrichment*

Information Seeking Behavior of the farmers about natural farming in Navsari and The Dangs districts of South Gujarat

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Abstract

Natural Farming offers a solution to various problems, such as food insecurity, farmers' distress, health problems arising due to pesticide and fertilizer residue in food and water, global warming, climate

change, natural calamities etc. Natural Farming is considered a form of regenerative agriculture-a prominent strategy to save the planet. Training and information plays a vital role when any go for new enterprise. Timely training and credibility of information & sources of information are directly and indirectly influencing to farmers. Study was conducted in two districts of South Gujarat namely; Navsari and The Dangs. The two talukas from each district and two villages from each taluka was randomly selected thus, total 4 villages selected from each district. The 11 farmers were randomly selected from each village as respondents and thus, 44 farmers have been selected from each district as respondents. Total 88 respondents were interviewed from two districts of South Gujarat. Farmers needed the training related to preparation and use of Brahmastra (ranked I), Preparation and use of Jeevamrit and Preparation and use of Agniastra (ranked II) and Preparation and use of Neemastra (ranked III). Moreover, farmers needed information related to management of plant diseases and price of produce (ranked I), crop management (ranked II), soil health management (ranked III) and government policy and plans (ranked IV). In case of effectiveness of collected information, 75.00% of the farmers had upgrade their knowledge with collected information, 51.14% of the respondents completely improves their level of understanding with collected information and 46.59% of the respondents were apply the collected information in their field. In case of form of information needed by the farmers about natural farming, majority (81.82%) of the respondents needed information in form of verbal.

Keywords: *Natural farming, Training needs, Information Seeking Behavior*

Innovative Microbial Nano-Electrigen Approaches for Sustainable Bioelectricity Production from Wastewater

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Abstract

Water bodies rich in biodiversity are vital sources for drinking and irrigation; however, increasing contamination from anthropogenic activities and inadequate sewerage systems has progressively degraded their quality. Untreated wastewater poses serious environmental and public health risks, underscoring the need for effective and sustainable treatment methods. Recent studies have shown that certain electrogenic microorganisms can utilize organic matter in wastewater to generate bioelectricity, offering a promising avenue for energy recovery and pollution mitigation. Our study aims to isolate, characterize, and evaluate selected microbial strains (bacterial and fungal) for their potential to produce bioelectricity using wastewater as a substrate. A novel Microgen-Based Electrochemical Cell (MBEC) is developed to harness this bioenergy. Unlike conventional wastewater treatment systems that are energy-intensive, this approach leverages the intrinsic chemical energy of wastewater through microbial fuel cells (MFCs), where microorganisms oxidize organic compounds such as saccharides, amino acids, fatty acids, and organic acids (e.g., acetic, butyric, and propionic acids). The generated electrons are transferred to the electrode, producing measurable electrical output. This microbial-based nano-electrigen

technology demonstrates a sustainable and eco-friendly strategy for simultaneous wastewater treatment and renewable energy generation, contributing to the advancement of green bio electrochemical systems.

Keywords*: Microbial Fuel Cell, Electrigen, Wastewater, Nanotechnology, Bioelectricity*

Towards Climate-Resilient Hills: A Review of Adaptation and Mitigation Strategies

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Abstract

Climate change poses a major challenge for hilly and mountain regions which are markedly vulnerable on account of their unique topographical characteristics, ecological sensitivity and socio-economic challenges. Hilly regions are increasingly exposed to uncertain weather events such as landslides, melting glaciers, loss of biodiversity and low agricultural productivity. Around 44 percent (According to TOI) of all disaster occur in India were in Himalayan region. Adaptation in such regions solely focuses on nature and land-based and ecosystem centered initiatives. Traditional practice such as terrace farming, mixed crop production and forest use continues to play a key role in maintaining ecological balance. Around 75 percent of people in the Himalayan region are engaged in agriculture or allied practices. At the same time, innovative interventions such as climate-smart agriculture, early weather warnings and microirrigation technologies hold a lot of promise. However, implementation of such approaches is often hampered in many cases through a lack of funds, policy cohesion and institutional weaknesses. For instance, Micro-irrigation adoption in hilly regions remains below 30 percent in most areas due to high installation cost and lack of awareness (NMMI Report 2023). Mitigation measures entail carbon sequestration through forestation, preservation of existing forests, promotion of renewable power and improvement in waste disposal. Importance of Payment for Ecosystem Services (PES) initiatives and Reducing Emissions from Deforestation and Forest Degradation (REDD+) plans gained consideration as potential instruments for promotion of hill communities toward sustainable use. The REDD+ program globally has helped 17 countries report 11.6 billion tons of avoided CO_2 emissions, covering ~1.35 billion hectares of forest. Apart from such initiatives, a gap continues to remain in linking local-level responses to national and international climate plans. Building stronger institutions in communities, enhancing adaptive capacity, ensuring policy coordination and calling for location-specific innovations hold key to ensure longevity and resilience.

Keywords: *Climate change, Climate-resilient, Adaptation, Mitigation, hilly region and ecosystem.*

Cryobiotechnology for the long-term preservation of Indian *Piper* genetic resources

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Abstract

India is home to rich genetic resources of various species of the genus *Piper*, containing some of the world's most economically important plants. Some species are utilized by local tribes and many are used in the traditional medicine system of ayurveda. Indian Long pepper (*Piper longum*), commonly known as 'Pipli', is primarily harvested from the wild, which has led to overexploitation and a threat to its survival. An *ex situ* base germplasm collection of genetic resources this species has not yet been established, attributed to the lack of knowledge on its low temperature storability. A protocol for induction and regeneration of adventitious buds on petiole explants for large-scale multiplication has been developed. Direct organogenesis from petiolar explants was achieved on a high-cytokinin-supplemented Murashige and Skoog (MS) medium, resulting in rosette-like structures with clusters of shoot buds within 40 days of culture. Subsequently, shoot regeneration and plantlet formation was observed on transfer of the developed buds onto a low-cytokinin- supplemented medium. Further, efforts were undertaken to develop a long-term conservation strategy using droplet vitrification-based cryopreservation. Shoot tips isolated from one-month-old cultures were precultured on a high sucrose medium for 16 hours. Subsequently, the osmotically dehydrated shoot tips were desiccated with a loading solution for 20 minutes at room temperature followed by treatment with Plant Vitrification Solution (PVS2) for 10, 20, 30, 45, and 60 minutes to identify the optimal cryoprotectant dehydration regime. The cryoprotected shoot tips were then immersed in liquid nitrogen. For recovery, the shoot tips were rapidly thawed and cultured on a regeneration medium. A 20-minute PVS2 exposure was optimal for shoot tip survival, achieving a 10-40% survival rate. All surviving shoot tips successfully regenerated into normal shoots. These findings support the effectiveness of combining micropropagation with cryopreservation for the long-term preservation of this species.

Supplementation of digestive enzyme for enhancing the productivity of eri silkworm (*Samia ricini* Donovan)

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Abstract

The investigation was conducted during 2023–25 in the Department of Sericulture, Assam Agricultural University (AAU), Jorhat, aimed to evaluate the impact of digestive enzyme supplementation on the

economic traits of the eri silkworm (*Samia ricini* Donovan*)* which was administrated from the first day of the first instar until maturity as a food supplement by fortifying the castor leaves with three different concentrations (1%, 3% and 5%) of Lipase enzyme. This experiment has been conducted in four different groups of silkworms such as one control group and three experimental groups in two different seasons *i.e.,* autumn and spring. From the present investigation it could be inferred that fortification of castor leaves with lipase 5% significantly increased the rate of ingestion (3.64 g), digestion (3.00 g), efficiency conversion of ingesta (68.35%), efficiency conversion of digesta (88.34%), full-grown larval weight (9.40 g), matured larval weight (7.53 g), silk gland weight (1.90 g), silk gland tissue somatic index (27.76), cocoon weight (3.00 g), shell weight (0.50 g), pupal weight (2.50 g), shell ratio (16.88%), fibroin content (84.77%) and fecundity (423 eggs/female). Moreover, yarn parameters like yarn size (14.58 S), breaking load (0.61 kg), tenacity (0.59 gm/d) and elongation (15.98%) were also found highest in the lipase 5% fortification than other groups of lipase concentrations and control group. Nutritional, larval, cocoon and yarn parameters were found to be superior in lipase 5% fortification in the spring season when compared to the autumn season except reproductive parameter, which was found to be superior in the autumn season.

Keywords: *Eri silkworm, digestive enzyme, nutritional indices, larval weight, cocoon and yarn parameters*

Herbal-Based Functional Beverages: Bridging Traditional Medicine and Nutrition Science

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Abstract

Herbal-based functional beverages represent one of the fastest-growing categories within the nutraceutical sector combining consumer preference for natural wellness solutions with traditional knowledge and modern scientific validation. They are being reformulated into innovative ready-to-drink (RTD) products that serve as carriers of bioactive phytochemicals while offering convenience, sensory appeal and preventive health benefits. Medicinal plants such as hibiscus, moringa, aloe vera, ashwagandha etc. have emerged as leading candidates in herbal beverage formulations. The phytochemical diversity of herbal functional drinks, which includes flavonoids, polyphenols, alkaloids, terpenes and saponins, forms their scientific basis. By modifying oxidative stress, inflammatory pathways and metabolic processes, these substances lower the chance of developing chronic illnesses. The functional and sensory qualities of herbal beverages are improved by contemporary developments such as cold brewing, fermentation and natural sweeteners, which make them appropriate for a variety of consumer groups, including athletes, senior citizens and health-conscious people. Bridging cultural legacy with contemporary consumer preferences is another important aspect of herbal functional beverages. Plant-based ingredients are perceived as environmentally friendly, safe alternatives to synthetic additives.

Furthermore, the use of agricultural by-products such as fruit peels and herbal residues in functional beverages enhances circular economy principles while reducing waste. In conclusion, herbal-based functional beverages offer a unique synergy between traditional medicine and nutrition science. They provide holistic health solutions, align with global wellness trends and contribute to sustainable food innovation. With further research in herbal functional beverages, they can establish themselves as pivotal contributors to preventive healthcare and sustainable nutrition in the modern era.

Keywords: *Herbal beverages, phytochemicals, functional foods, preventive healthcare, Ayurveda, consumer health.*

Weed Management Practices and Its Effect on Yield and Quality in Summer Groundnut (*Arachis hypogaea* L.) Under South Gujarat Condition

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Abstract

A field experiment was conducted during the *summer* 2023 at Agricultural experimental Station, Paria, Gujarat with the objectives to determine the effect of different weed management treatment on growth and yield of *summer* groundnut under south Gujarat condition. The experiment designed in randomized block design with four replications. The treatments were T_1: unweeded control, T_2: weed-free hand weeding at 20, 30, and 40 DAS, T_3: pre-emergence application of pendimethalin (EC) at 1.0 kg/ha + 1 HW, T_4: pre-emergence application of pendimethalin (CS) at 1.0 kg/ha + 1 HW, T_5: pre-emergence application of flumioxazin (SC) @ 0.05 kg/ha + 1 HW, T_6: pre-emergence application of diclosulam (WDG) at 20 g/ha (PE) + 1 HW; T_7: pre-emergence application of pendimethalin (EC) at 1.0 kg/ha (PE) + imazamox + imazethapyr at 70 g/ha in pre-mix as post-emergence; T_8: post-emergence application of propaquizafop (EC) at 75 g/ha. The results revealed that significantly higher values of growth parameter viz, plant height, yield attributing parameters *viz*., number pods per plant, shelling percentage, test weight, harvest index and pod as well as haulm yield were recorded under weed free (Hand weeding at 20, 30 and 40 DAS) (T_2). Treatment T_3 and T_4 were found equally effective in recording higher values of growth parameters and yield attributes and yield than rest of treatments. Whereas weed management treatments did not excert any significant effect on oil content of groundnut. The highest net profit and B:C ratio were accrued from weed-free (T_2), closely followed by pendimethalin EC @ 1.0 kg/ha as pre-emergence + 1 HW (T_3) and pendimethalin CS @ 1.0 kg/ha as pre-emergence + 1 HW (T_4). The results of the study showed that T_2 (weed-free, hand-weeding at 20, 30, and 40 DAS) produced the best outcomes, whereas T_3 and T4 herbicide treatments produced results that were comparable to T_1

Keywords: *Groundnut, weed, Pendimethalin, growth, yield.*

Development and Analytical Standardization of a TaqMan-Based Real-Time qPCR Assay Targeting the E2 Gene of Classical Swine Fever Virus (CSFV)

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Abstract

Classical Swine Fever Virus (CSFV), a member of the genus *Pestivirus* within the family *Flaviviridae*, continues to cause significant economic loss in the swine industry in worldwide. Accurate detection and quantification of viral load is critical for disease surveillance. The present study describes the development and analytical standardization of a TaqMan probe-based quantitative real-time PCR (qPCR) assay targeting the conserved E2 gene of CSFV. Primers and a hydrolysis probe were designed based on multiple sequence alignments of representative Indian and reference CSFV sequences. The target fragment was amplified (120bp) by conventional one-step RT-PCR and TA cloned into *E. coli* TOP10 cells for generation of recombinant plasmid standards. Purified plasmid DNA was quantified spectrophotometrically and serially diluted (10p –10{ x) to establish a standard curve for assay calibration. The assay exhibited excellent linearity ($R^2 = 0.994$) over a 10-w fold dynamic range with a slope of 3.1666, corresponding to an amplification efficiency of 102.5 %. The limit of detection was determined to be 10^2 genome copies per reaction (10 ul volume). Quantitative analysis demonstrated consistent amplification profiles with mean Ct values ranging from 8.90 to 29.40 across the dilution series, corresponding to 4.5 × 10v to 2.3 × 10^1 copies per reaction. The intra-assay coefficient of variation was <2 %, confirming assay reproducibility.

The results establish a robust and sensitive qPCR platform suitable for quantitative detection of CSFV RNA in a sample. Ongoing work involves diagnostic validation using field samples to assess diagnostic sensitivity and specificity.

Keywords: *Classical Swine Fever Virus (CSFV); E2 gene; Real-time qPCR; Analytical sensitivity; Standard curve*

Reviving Indigenous Traditional Knowledge for Sustainable Hill Farming and Livelihood Security

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Abstract

Indigenous Traditional Knowledge (ITK) is the foundation of sustainable hill farming. It offers environment-friendly and culturally rooted solutions for managing natural resources and providing rural livelihood security. Hill communities particularly in Himalayan regions, have acquired a deep

understanding of their serene surroundings through centuries of observation and adaptation. Their traditional practices which includes terrace farming, agroforestry, naulas and kuhls for water management, mixed cropping systems such as Barahnaja and community-based pasture management highlights principles of sustainability, biodiversity conservation and resilience to climate change. These locally evolved systems ensure optimal resource use, soil and water conservation and food security with minimal resources available. However, rapid modernization, migration and loss of traditional wisdom among younger generations have threatened the continuity of these practices. Recognizing and integrating ITK with modern scientific practices can strengthen sustainable hill farming and enhance livelihood opportunities. The present study focuses on the importance of using indigenous knowledge systems, promoting participatory approaches and formulating supportive policies to preserve and revive traditional practices. By bridging traditional wisdom and modern innovation, hill farming can become more resilient towards climate stress ensuring livelihood security while conserving the natural heritage of hill communities.

Keywords: *Indigenous knowledge, hill farming, livelihood security, sustainability, natural resource management, traditional practices*

Comparative Sequence–Structure Analysis Reveals Conserved Functional Motifs and Divergent Conformations in P2X Receptors

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Abstract

P2X receptors are ATP-gated ion channels involved in immune regulation, inflammation, and cellular signaling. The family comprises seven members (P2X1–P2X7), each exhibiting distinct sensitivities to extracellular ATP (eATP). Among them, P2RX7 is a trimeric cation channel uniquely characterized by its long cytoplasmic C-terminal domain and activation at millimolar ATP concentrations. Despite functional diversity, conserved residues across P2X receptors are believed to govern ATP binding and conformational transitions, though their structural context remains poorly defined. In this study, amino acid sequences and three-dimensional structures of all P2X family members were retrieved from UniProt, PDB, and AlphaFold databases. Multiple sequence alignment (Clustal Omega) and structural mapping using PyMOL were performed with P2RX7 as the structural reference. Comparative analysis showed that P2RX7 shares the highest similarity with P2RX4, followed by P2RX1, P2RX3, P2RX2, P2RX5, and P2RX6. Conserved residues were primarily located within the ATP-binding pocket (K64, K66, T189, N292, R294, K311), transmembrane regions (Y40, K49, Y51, Q52, D352, G27, Y13), and the â13–â14 “turret-like” loop (N292–G323) associated with activation. Gating residues S339 and S342 were not conserved in P2RX7. Structural superposition revealed close similarity of P2RX7 to P2RX4 and P2RX3 (RMSD H” 1.4 Å), whereas P2RX5 and P2RX6 were more divergent (RMSD > 2.0 Å). The C-terminal domain of P2RX7 was notably the longest and most heterogeneous. Interestingly, the structural orientation of these conserved residues is remarkably similar across all P2X receptor family members. Overall, this comparative analysis highlights that conserved residues are both sequence- and

structure-preserved, underpinning the differential ATP sensitivity and desensitization mechanisms across P2X receptor subtypes.

Bridging Agriculture and Antioxidant Science: A PRISMA-Based Review of *Clitoria ternatea* L. for Functional Foods and Health Promotion

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Abstract

Clitoria ternatea (butterfly/blue pea) flower is a rich source of anthocyanins and phenolic compounds and is increasingly recognized for its potential as a functional food ingredient and natural colorant. Agriculturally, it is valued for its adaptability to diverse agro-climatic conditions, nitrogen-fixing ability, and contribution to sustainable farming systems, making it a promising crop for small-scale farmers and value-added agricultural practices.

The flower's bioactive compounds exhibit strong antioxidant properties that play a critical role in neutralizing oxidative stress, which is implicated in the pathogenesis of several chronic disorders. This systematic review synthesizes available human interventional evidence on its antioxidant and metabolic effects, focusing particularly on conditions such as diabetes, PCOS, and cancer. It also contextualizes these findings within mechanistic pathways, highlighting its relevance for prevention and management strategies targeting oxidative-stress-linked disorders.

Additionally, preclinical and formulation studies are reviewed to bridge existing gaps between laboratory findings and clinical applications. This holistic perspective underscores the translational potential of blue pea flower not only as a nutraceutical and therapeutic ingredient but also as a sustainable agricultural resource that can enhance both human health and farm-level economic value.

Keywords: *Clitoria ternatea, butterfly pea, blue pea, antioxidant, randomized controlled trial, diabetes, PCOS, free radical scavenging, postprandial lipemia, PRISMA.*

Relationship Between Profiles Crop Of Growers And The Level Of Knowledge Of Crisis And Management In Crop Production

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Abstract

The present study was carried out in six districts of South Gujarat. Paddy, Mung, Tomato and Banana crops were taken under the present study. Out of six districts, 360 crop growers and 48 researchers were

selected. Thus, total sample size was 408 respondents for the present study. The study discloses that out of twenty independent variables; Education, occupation, farming experience, source of information, social participation, risk orientation, economic motivation, innovativeness, overall modernity and market orientation were positively and highly significantly correlated while, annual income, scientific orientation, management orientation and cropping pattern were positively and significantly correlated with the knowledge of farmers about crisis and its management practices in crops. In case of researchers, the age, source of information, economic motivation, management orientation and overall modernity were positively and highly significantly correlated while, risk orientation, scientific orientation, material possession and market orientation were positively and significantly correlated with the knowledge of researchers about crisis and its management practices in crops.

Keywords - *Crisis and its management practices, Crop growers, Knowledge and Relationship*

Barriers in Adoption of Improved Cultivation Practices Among the Pigeon Pea Farmers

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Abstract

Pigeon pea is the important legume crop of Gujarat. It was observed that there is a wide gap in adoption of improved cultivation practices. Looking to the importance of the problem, a study was conducted in Dediapada and Sagbara taluka of Narmada district. Five villages from each taluka were purposively selected. Twelve respondents were randomly selected from each selected village for making total of 120 respondents. Data was collected from the selected sample through personal interview with the help of pretested structured interview schedule. Findings of the study revealed that high cost of farm inputs, unavailability of labour and high wages, fluctuation in the price, lack of knowledge about disease control, unavailability of inputs in time, financial constraints and high incidence of pests and diseases were major constrains faced by the pigeon pea growers in adoption of improved cultivation practices of pigeon pea crop.

Keywords- *Improved Cultivation Practices Farmers and Adoption*

Adoption of Recommended Tomato Cultivation Technologies Among the Farmers

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Abstract

Tomato is an important vegetable crop with significant nutritional and economic value. The adoption of recommended production technologies improved varieties, planting methods, nutrient management, irrigation, insect, pest and disease control is essential for enhancing tomato production and good quality. The study aims to evaluate the extent to which tomato growers adopt these recommended practices and to identify factors influencing their adoption. A study was conducted in Dediapada and Sagbara taluka of Narmada district. Five villages from each taluka were purposively selected. Twelve respondents were randomly selected from each selected village for making total of 120 respondents. Data was collected from the selected sample through personal interview with the help of pretested structured interview schedule. Findings of the study revealed that Results indicate that while most farmers adopt basic practices like improved/Hybrid seed, there is limited adoption of integrated pest management. Economic Constraints High input costs, Limited awareness of best practices in tomato farming, Socio-Cultural Constraints, Unpredictable weather or climate change effects, inadequate training, and limited access to quality inputs were identified as key barriers. The study highlights the need to strengthen extension services and promote farmer education to improve adoption rates, thereby enhancing tomato productivity.

Keywords- *Improved production Technologies, Adoption and Farmers*

Association Between Crop Growers and Their Level of Adoption About Crisis and its Management

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Abstract

The present study was carried out in six districts of South Gujarat. Paddy, Mung, Tomato and Banana crops were taken under the present study. Out of six districts, 360 crop growers and 48 researchers were selected. Thus, total sample size was 408 respondents for the present study. The study discloses that out of twenty independent variables; education, occupation, annual income, farming experience, source of information, economic motivation, scientific orientation, management orientation, innovativeness, overall modernity and cropping pattern were positively and highly significantly correlated where age, land holding, social participation, risk orientation, market and credit-seeking behavior were positively and significantly correlated with the adoption of farmers about crisis and its management practices in crops. Scientific orientation were positively and highly significantly correlated while, age, source of information, risk orientation, economic motivation, management orientation, material possession and market orientation were positively and significantly correlated with the adoption of researchers about crisis and its management practices in crops.

Keywords- *Crisis and its management practices, Crop growers, Adoption and Association.*

Phage-resistant starter cultures for the Indian cheese and paneer industry

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Abstract

The high microbial load and diverse phage populations in raw milk, combined with the traditional processing environment, often marked by artisanal methods, limited sanitation, and repeated culture propagation, make these dairy products particularly prone to bacteriophage infections. Phage attacks can cause delayed or failed fermentation, poor curd formation, reduced yields, altered sensory attributes, and significant economic losses. Therefore, developing and deploying phage-resistant LAB strains like *Lactococcus lactis*, *Lactobacillus plantarum, Lactobacillus helveticus*, and *Streptococcus thermophilus*, tailored to indigenous dairy products such as paneer and regional cheeses, has become a strategic priority. Current methods to enhance phage resistance include natural strain rotation, adaptive evolution, CRISPR-Cas mediated immunity, receptor modification, anti-phage plasmids, and the use of protective adjuncts or multi-strain starter blends that offer functional redundancy. Additionally, genomic analysis, phage typing, metagenomics, and real-time phage monitoring enable the precise selection of resilient cultures with stable fermentation performance under Indian climatic and processing conditions. Incorporating phage-resistance mechanisms not only improves process reliability but also supports product standardization, as required by the Food Safety and Standards Authority of India (FSSAI) regulations, and increases industrial automation. Future developments are expected to integrate microbiome engineering, bacteriophage monitoring tools, and smart starter culture design compatible with both traditional dairy practices and modern technological advances. Overall, phage-resistant starter cultures hold significant potential for enhancing quality assurance, productivity, and competitiveness in India's cheese and paneer market, while preserving the distinct sensory qualities of indigenous dairy products.

Keywords: *Phage-resistant starter cultures; Lactic acid bacteria (LAB); Paneer and Indian cheese; Bacteriophage interference; Fermentation reliability; Dairy biotechnology*

Biosynthesis and Characterization of the AgNPs from *Eudrilus eugeniae* and its bactericidal property of Human Pathogens

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Abstract

Green synthesis has recently emerging field due to eco-friendly method. In the present study, the Earthworm *Eudrilus eugeniae* was used to synthesize AgNps and evaluation of its antimicrobial activity. UV spectroscopy helps to know the qualitative analysis. So, to confirm the presence of Silver Nitrate nanoparticles UV spectroscopy analysis was performed. The presence of Silver Nitrate nanoparticle shows in the range of 200 to 800nm. The peak in the wavelength of 412nm which confirmed the Silver Nitrate nanoparticle (AgNPs). FTIR analysis showed peaks corresponds to the wavenumber 3432, 2926, 2103, 1638, 1414, 1385, 1025, 550, which to different functional groups and consists of alcohol group, amides, ether, alkyl halides and nitro compounds. TEM analysis was showed the average size of the AgNPs was 35 nm. XRD analysis used to know the structure and size of the nanoparticle. The synthesized nanoparticle was in crystalline type and the size of synthesized Ag NPs 5.27nm. The XRD analysis showed the peaks values at 31.76°, 35.45°, 42.49°, 56.45° were the indicators of the Ag NPs. The zeta potential of Ag NPs – 36.2 mV was obtained for AgNPs synthesized. The polydispersity index of the Ag NPs was considered to be 0.30 which shows it has good polydispersity index. *E.eugeniae* extract and AgNPs showed inhibition against *V. cholerae* and *K. Pneumoniae* respectively.

Keywords*: Earthworm, Eudrilus eugeniae, Ag Nps, Antimicrobial, Bioindicator, TEM*

Evaluation of Crossandra genotypes for growth, floral attributes and yield under Konkan agroclimatic conditions

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Abstract

The present investigation entitled "Evaluation of Crossandra (*Crossandra infundibuliformis*) genotypes for growth, floral attributes, and yield under Konkan agro-climatic conditions" was conducted at the Floriculture Farm, College of Horticulture, Dapoli, during the Kharif seasons of 2022–23 and 2023–24. The experiment was laid out in a Randomized Block Design (RBD) with two replications, comprising 15 genotypes including local types and standard checks, viz., Arka Kanaka (G_4), Arka Chenna (G_6), Arka Shreeya (G_9), and Arka Ambara (G_{11}). The objective was to identify suitable crossandra genotypes for growth, floral attributes, and yield performance under Konkan agro-climatic conditions. Marked variability was observed among the genotypes with respect to vegetative, floral and yield traits. The genotype G_8 (Jalgaon type 2) attained the maximum plant height (84.29 cm), whereas G_4 (Arka Kanaka) produced the highest number of branches (24.77). The maximum leaf area (34.87 cm²) was recorded in

G_{12} (Jalgaon type 3), while G_{10} (Ladghar type 1) and G_6 (Arka Chenna) exhibited the highest plant spread in the east–west (26.35 cm) and north–south (30.93 cm) directions, respectively. With respect to flowering parameters, G_4 (Arka Kanaka) was the earliest to flower (71.55 days) and recorded the highest number of spikes per plant (42.75). The same genotype also registered the highest flower yield both on a per plant basis (237.42 g) and per plot basis (5.68 kg). In terms of floral quality, G_{11} (Arka Ambara) produced the widest florets (2.17 cm), while G_4 (Arka Kanaka) recorded the longest vase life (8.30 days). Overall, the results clearly indicated that G_4 (Arka Kanaka) outperformed other genotypes in terms of growth, floral attributes, yield, and post-harvest quality, thereby establishing its superiority under Konkan agro-climatic conditions.

Keywords: *Evaluation, Crossandra, Arka, Genotypes, Konkan, Kanaka.*

Gamma radiation induced nutrient-rich and low-allergen buckwheat cultivars for sustainable crop improvement of Uttarakhand

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Abstract

Buckwheat (*Fagopyrum* spp.) is a nutritionally rich yet underutilized pseudocereal valued for its antioxidant and therapeutic properties, making it particularly suitable for sustainable cultivation in the Himalayan region. However, its widespread consumption is limited by the presence of anti-nutritional factors such as phytic acid, tannins and oxalates, as well as allergenic proteins that can cause allergenic reactions. This study shown the impact of ã-irradiation on the nutritional profile, anti-nutritional components and allergenic proteins of common (*F. esculentum*) and Tartary (*F. tataricum*) buckwheat cultivars from Uttarakhand. Dose-dependent responses were observed, with 0.25-0.35 kGy identified as optimal for inducing beneficial yeild attributes and phytoconstituents without compromising seed viability. Moderate irradiation doses (0.45-0.55 kGy) enhanced key nutritional constituents, notably rutin and â-carotene, while simultaneously reducing anti-nutritional components. SDS-PAGE profiling revealed limited but significant alterations in seed proteomes, with major allergenic proteins (notably the 25 kDa Fag e 2 and 35 kDa bands) in M, seeds of buckwheat local cultivars from Shimla, suggesting partial suppression of allergenicity. Buckwheat local cultivars from Chamoli exhibited the highest tolerance and minimal proteome disruption, while buckwheat local cultivars from Shimla and Almora showed marked reductions in allergenic bands at moderate doses. Overall, ã-irradiation effectively modulated the nutritional and allergenic properties of buckwheat in a cultivar and dose-dependent manner. The findings demonstrate the potential of ã-irradiation as a non-chemical, eco-friendly mutagenic tool for developing nutrient-rich, low-allergen buckwheat cultivars suited for sustainable crop improvement and enhanced dietary security in the Himalayan region.

Keywords: *ã-irradiation, allergenic proteins, anti-nutritional factors, sustainable agriculture, phytoconstituents*

Electrochemical Sensing Platform Based on Pt-Citrate Nanoparticles for Simultaneous Pb²z and Cd²z Detection

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Abstract

We report a novel electrochemical sensor addressing the gap in simultaneous, highly sensitive detection of priority heavy metal contaminants, Pb²z and Cd²z **,** in complex environmental matrices. The sensor utilizes a nanostructured electrode modified with citrate-capped platinum nanoparticles (Pt-Citrate)**,** quantified using Square Wave Voltammetry (SWV)**.** This specific Pt-Citrate nanostructure significantly enhances both sensor sensitivity and selectivity**,** effectively suppressing interference from co-existing ions. The resulting analytical performance is exceptional: the sensor achieves ultra-low limits of detection (LODs) of 0.046 ¼M for Pb²z and 0.041 ¼M for Cd²z **,** with corresponding high sensitivities of 42.19 ¼A¼M{ ¹ and 30.04 ¼A¼M{ ¹ within a linear range of 0.1 to 0.5 ¼M; crucially these achieved LODs fall well below safe regulatory levels for human exposure. Furthermore, excellent repeatability, validated selectivity, and successful heavy metal quantification in tap water samples confirm its real-world viability. This Pt-Citrate-based electrode represents a robust, highly sensitive, and promising platform for real-time, in-field environmental monitoring.

Keywords: *Pt-Citrate. Pb2+, Cd2+, Sensitivity, Selectivity, Repeatability, Real-world viability*

Clustering and Interaction Profiling Reveal Hydrophobic Dominance in Protein–Cholesterol Recognition

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Abstract

Cholesterol is an amphipathic lipid essential for membrane structure and as a precursor of bioactive molecules. In addition to modulating membrane properties, it directly interacts with proteins, often through CRAC ((L/V)-X1"5-(Y)-X1"5-(K/R)) or CARC ((K/R)-X1"5-(Y/F)-X1"5-(L/V)) motifs. Building on our previous analysis of 100 protein–cholesterol complexes, we expanded to 200 PDB structures, incorporating residue clustering by distance and frequency, and non-covalent interaction profiling of 67structures using Arpeggio. The hydroxyl group of cholesterol predominantly interacts with polar residues (H, Q, E, C, N, D, R, S), while the tetracyclic ring contacts a mix of polar and non-polar residues (Y, W, T, S, I, V, G, M, F, C). The iso-octyl tail is chiefly surrounded by non-polar residues (P, F, M, K, L, Y, I, V), with minor polar contributions (K, Y, D). Clustering analysis showed that hydrophobic residues form dense, compact interaction networks at shorter distances, whereas polar

residues display broader, variable distributions. Notably, clustering did not segregate residues strictly by polarity, highlighting the role of hydrophobic microenvironments occasionally stabilized by polar side chains. Arpeggio non-covalent interactions analysis further confirmed that hydrophobic interactions dominate, followed by hydrogen bonds. In summary, cholesterol binding is driven primarily by hydrophobic residues, with polar contacts contributing to fine-tuning of orientation and stability within protein binding pockets.

An Evaluation of the Systemic Impact and Clinical Efficacy of Sequential Vincristine Sulfate Versus Doxorubicin in the Post-operative Management of Canine Mammary Tumours (CMT)

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Abstract

The present study was conducted to evaluate the systemic impact and clinical efficacy of sequential vincristine sulfate compared to doxorubicin in the post-operative management of Canine Mammary Tumours (CMT) on 18 clinical cases of mammary tumour of various breed, irrespective of their age, sex and divided into three groups consisting of 6 animals in each. Group Surgery was treated with surgical removal of tumouronly while animals of Group Surg Dox and Group Surg Vin were treated with surgical excision followed by administration of Doxorubicin (30mg/m2) BSA and Vincristine sulfate (0.025 mg/kg) intravenously along with DNS at 7th and 14th post-operative days respectively. The haemato-biochemical parameters and wound evaluation were done at different time intervals. Systemic impact on hematological and biochemical parameters were briefly altered and chemotherapeutic medications does not induce any adverse reactions or detrimental effects on vital organs, but these changes remained within the normal physiological range. Doxorubicin and vincristine sulfate therapy showed minimum to no reoccurrence of tumour with few adverse reactions such as inappetence, vomition, anaemia and alopecia. However, these conditions were managed by supportive therapy. Therefore, it could be concluded that sequential vincristine therapy is best for the post-operative management of canine mammary tumours as it effectively regressed the tumour without relapse.

Comparative Evaluation of Efficacy and Systemic Effect of Different Surgico-Chemotherapeutic Regimens for Management of Canine Malignant Mammary Tumours

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Abstract

The present study was conducted to compare the efficacy and systemic effect of different surgico-chemotherapeutic regimens for treatment of canine malignant mammary tumours. The study was conducted on 18 clinical cases of mammary tumour of various breed, irrespective of their age, sex and divided into three groups consisting of 6 animals in each. Based on treatment regimens, animal were divided into three groups. In Group S, only surgical excision of tumour was performed while animals of Group SD and Group SV were treated with surgical excision followed by administration of Doxorubicin (30mg/m^2) BSA and Vincristine sulphate (0.025 mg/kg) intravenously alongwith DNS at 7th and 14th post-operative days respectively. Different physiological and haemato-bichemical parameters i.e. Hb, PCV, TLC, TPC, DLC, Serum glucose, TSP, SUN, SC, ALT, AST and ALP were recorded preoperatively, postoperatively and after chemotherapy at 10th, 30th and 60th day intervals. There was transient change in physiological, haematological and biochemical parameters post surgery and post chemotherapeutic management which remained within normal physiological range. Histopathological examination revealed more cases of adenocarinoma followed by mixed carcinoma. Surgery alongwith chemotherapy (doxorubicin and vincristine) showed minimum to no reoccurrence with few adverse reactions such as inappetance, vomition, anaemia and alopecia. However, these conditions were managed by supportive therapy. The present study showed that surgical excision combined with sequential vincristine therapy is best for the management of canine malignant mammary tumours as it effectively regressed the tumour without relapse.

Genetic Divergence Studies for Yield Components and Nutritional Traits in Foxtail Millet (*Setaria Italica* (L.)

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Abstract

Foxtail millet (*Setaria* species), a staple food in certain regions, stands out for its rich content of carbohydrates, proteins, dietary fiber, and essential minerals, contributing to a well-balanced diet. Knowledge of genetic diversity in germplasm resources is a prerequisite for crop improvement and successful breeding programs. Consequently, breeding crops with broad genetic bases becomes imperative to better acclimate to changing environments and emerging threats. The significance of genetic diversity for crop improvement, including foxtail millet has been widely reported (Vetriventhan et al., 2020; Ramesh et al., 2023). Analysis of variance in the present investigation revealed existence of significant differences among the genotypes studied and ample genetic variability for all the 16 quantitative and nutritional traits. All the 40 foxtail millet genotypes were grouped into six distinct non-overlapping clusters with maximum number of genotypes in cluster I (19) followed by cluster II (13), cluster V (five) and the remaining three clusters, III, IV and VI were mono-genotypic clusters with single genotype per cluster through Mahalonobis D^2 analysis .Maximum inter-cluster distance was observed between cluster II and III, II and IV, I and II, II and V. Maximum inter-cluster distance was found between clusters II (SiA 4349, SiA 4363, SiA 3156(C), SiA 4340, SiA 4334, SiA 4321, KOPF x 2126, SiA 4332, SiA 4325, KMF 2, SiA 4229, SiA 4323, SiA 4336) and III (SiA 4261) indicating high

degree of genetic diversity in the genotypes. Cluster IV contained one genotype SiA 4316 with desirable traits and can be selected directly for immediate usage. Hybridization between the genotypes *viz;* SiA 4244, SiA 4251 and IIMR F x M15with high means for majority of traits from divergent clusters can be made to incorporate all the desired traits and to get high frequency of heterotic hybrids. Inter crossing of genotypes from the cluster II (SiA 3156) and cluster III (SiA 4261) could be suggested to generate a wide range of variability followed by effective selection. Iron, Protein, Zinc content in grain and grain yield per plant were the major contributors towards divergence. The genetic insights presented in this study are valuable for the utilization of foxtail millet germplasm in future breeding endeavours.

Keywords*: Foxtail millet, Yield components, Nutritional traits, Genetic diversity*

Nanotechnology: A Promising Approach for Cleaner Textile Wastewater Management

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Abstract

The textile market results in very high quantities of wastewater, which contain dyes, surfactants, heavy metals, and other toxic substances which have severe environmental effects. The traditional ways of treating wastewater do not always eliminate these pollutants, which makes the control of wastewater a significant problem. Over the past few years, the field of nanotechnology has become a promising solution to the pursuit of maximizing the effectiveness of wastewater treatment in the textile industry. Titanium dioxide, zinc oxide, iron oxide, and carbon-based nanomaterials have excellent adsorption, photocatalytic, and antimicrobial properties that can be used to degrade and remove the hard-to-removal contaminants. A nanomaterial that is incorporated in a membrane and catalyst system enhances the rate of purification, decreases the production of sludge, and allows water to be reused. In addition, nanotechnology-based treatment is in line with the idea of sustainability and the circular economy in that it encourages resource recovery and cleaner production methods. This article demonstrates the possibility of nanotechnology in the treatment of textile wastes, its benefits compared to the traditional processes, and future opportunities of its use in large scale industrial use towards realizing environmentally friendly and sustainable cloth production.

Keywords: *Nanotechnology, Textile wastewater, Environmental sustainability, Water treatment, Green technology*

Somatic Embryogenesis-Derived Regeneration, Morphogenetic Pathways and Genetic Stability in *Musa spp.*

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Abstract

Somatic embryogenesis was employed for the multiplication of banana cultivars Grand Naine (*Musa* AAA, Cavendish subgroup) and Rasthali (*Musa* AAB, Silk subgroup). The study evaluated the effects of male flower bud position, amino acid supplementation, and the field performance of plants regenerated from embryogenic cell suspensions (ECS). Among the tested explants, immature male flower buds located at the 6th–8th bract whorls exhibited superior callus induction and embryogenic potential. The inclusion of 400 mg L{ ¹ glutamine, together with a 20:20 g L{ ¹ sucrose:maltose combination in the maturation medium, enhanced somatic embryo formation by nearly tenfold compared with the control. Cotyledonary-stage embryos desiccated for two hours demonstrated higher germination rates than non-desiccated counterparts. Regenerated plantlets were successfully hardened, and their genetic fidelity was confirmed using ISSR markers. To assess field performance, ECS-derived plants were established alongside those from meristem and sucker propagation. The regenerated plants displayed morphological uniformity and normal phenotypes comparable to conventionally propagated controls. The developed protocol offers an efficient system for large-scale micropropagation and potential genetic improvement of commercially important banana cultivars.

Keywords: *Banana, Immature male flower bud, Somatic embryogenesis and Genetic fidelity*

Pearl Millet Microgreens: Effect of different media on growth

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Abstract

Microgreens, emerging food product, are developed from seeds of grains, pulses and vegetables and consist of developed cotyledons along with partially expanded true leaves. Pearl millet microgreens have a mellow, earthy flavor with a faint nutty undertone, making them perfect for salads, smoothies, sandwiches and warm dish garnishes. This study was conducted to evaluate the growth performance of pearl millet microgreens in four different growing media as a to substitute of hydroponics systems. These media were (i) sandy loam soil (M_1), (ii) vermi-compost (M_2), (iii) coco peat (M_3) and (iv)mixture of above three in the ratio of 2:1:1 (M_4). First germination day was observed for microgreens grown in different media. Additionally height of microgreens and root length were measured, yield noted and duration of harvesting recorded. Results show that among four growing media, M_2 and M_4 performed best. M_3 showed faster germination days (3.0±0.0), better height (8.34±1.20) was recorded in M_1, root length was better (6.0±0.34) in M_4, yield (19.52±7.22) was highest in M_2 and duration of microgreens harvesting (5.33±0.57) was shortest in M_2 compared to other media. It can be concluded that vermi-compost media can be used to improve the yield and shorten the duration of microgreens harvesting for use by human beings as functional foods.

Keywords: *Coco peat, germination, microgreens, pearl millet, vermi compost, yield.*

Salicylic acid mitigates the adverse effect of high temperature stress on yield of wheat (*Triticum aestivum L.*)

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Abstract

Regarding the global climate change the past few decades, the impact of rising temperature on wheat production is gaining concern in the country. Wheat is much sensitive to heat stress. High temperature alters different physiological, biological and biochemical process in wheat. Heat stress in wheat cause decrease in grain filling duration, reduction in grain number, deactivation of Rubisco enzyme, decrease in photosynthetic capacity, reduction in rate of assimilate translocation, premature leaf senescence, decrease chlorophyll content and ultimately decrease in yield. Salicylic acid (SA), a naturally occurring plant signaling molecule, plays a key role in activating stress-responsive pathways and enhancing crop resilience. The present study investigates the role of exogenous application of salicylic acid in mitigating heat-induced damage and improving physiological performance and yield in wheat. The result demonstration of foliar application of salicylic acid @100 ppm to enhanced the heat stress tolerance in wheat for higher production at 10 farmers field in 4 hectare area, which resulted 17.82% more yield than non-treated Field. Farmers earned a net return of Rs. 90543/ha with 1.55 B:C ratio in comparison to non-Treated Field (Rs. 71458/ha with B:C ratio of 1.28).

Keywords: *Salicylic acid, heat stress, wheat, foliar application, chlorophyll content, stress tolerant*

Impact of Salt Tolerant Variety Of Barley (HordiumValgare L.) RD-2794 in Climate Resilient Agriculture

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Abstract

Climate change poses a major challenge to sustainable crop production, especially in salt-affected soils where reduced productivity threatens food security. Barley (*Hordeum vulgare* L.) is recognized as a highly resilient cereal crop with better tolerance to saline conditions compared to other major cereals. The salt-tolerant variety RD-2794 has been developed to improve yield stability and enhance economic returns in regions facing soil salinity and water stress. The present study assesses the impact of barley variety RD-2794 in promoting climate-resilient agriculture by evaluating its performance in saline environments with respect to yield attributes. Additionally, RD-2794 contributes to soil rehabilitation due to its ability to grow under marginal land conditions and reduce further degradation. In Bharatpur district of Rajasthan 20.0 % area is of alkali water and 63.0 per cent area is saline water and rest only 13.0 per cent area is of good quality. Salinity tolerant barley variety RD-2794 having good yield potential and rust resistant. In present study RD-2794 variety was demonstrated at 63 farmers' fields in 25.20 ha area. Results indicated that barley variety RD-2794 performed better than local varieties under saline

soil and water condition, which resulted 11.65% more yield when compared to the local variety. Farmers earned a net return of Rs. 67388/ha with 1.31 B:C ratio in comparison to farmers' variety (Rs.57977/ha with B:C ratio of 1.14).

Keywords: *Salt Tolerant, Climate resilient, Barley, Salinity, RD-2794*

Influence of foliar-applied salicylic acid on *Curcuma longa* L. under drought stress

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Abstract

Curcuma longa L., also known as turmeric belongs to family Zingiberaceae, has been used for thousands of years as a treatment in traditional Ayurvedic, Unani, and Siddha medicine system. *C. longa* L.'s main bioactive constituents are curcuminoids includes, curcumin, desmethoxycurcumin, and bisdemethoxycurcumin. Abiotic stress impacts on plant growth, physiological and biochemical attributes from germination to maturity, significantly reducing crop yield and secondary metabolites. Drought stress has a negative impact on plant development because it reduces water availability and inhibits photosynthesis. It causes stomatal closure, reduced leaf area, transpiration and chlorophyll loss. Salicylic acid (SA) is a vital plant hormone that regulates growth and enhances resistance to drought stress via maintain growth and physiological balance by enhancing antioxidant activity and reducing oxidative damage. We conducted an experiment on *C. longa* L. at Dayalbagh Educational Institute, where salicylic acid was sprayed at five different concentrations — 0.125, 0.25, 0.5, 1.0, and 2.0 mM — under drought stress conditions maintained at 25%, 50%, and 75% field capacity, with applications given at 7-day intervals. SA at 0.5 mM concentration significantly increased plant height, leaf area, plant biomass, antioxidant activity (SOD, POD and CAT), essential oil content, while decreased electrolyte leakage and proline content under drought condition. We concluded that SA reduces drought stress in the *C. longa* L. by dramatically increasing photosynthetic rate, antioxidant activities, relative water content, rhizome weight and essential oil yield.

Keyword*: Turmeric, essential oil, salicylic acid, drought, foliar application, antioxidant activity.*

Molecular Characterization and Tissue-Specific Expression of Myostatin (MSTN) in *Clarias magur*: Elucidating Growth Regulation for Aquaculture.

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Abstract

Myostatin (MSTN) is a critical regulator of muscle growth in vertebrates, primarily functioning to inhibit muscle development. Variations in the MSTN gene have been associated with increased muscle

mass and body size across various species, including fish. This study aimed to analyze the MSTN gene in *Clarias magur*, a commercially important catfish species in aquaculture, to explore its role in muscle growth under different rearing conditions. We retrieved the MSTN gene sequence for *C. magur* from the NCBI database and identified a gene spanning 2680 nucleotides. Using Sanger sequencing, we successfully assembled a 4551 nucleotide-long MSTN gene. This gene was predicted to contain three exons (433, 371, and 378 nucleotides) and two introns (1886 and 122 nucleotides). A phylogenetic analysis based on the coding sequence (CDS) further clarified the genetic relationships of *C. magur* within Siluriformes, emphasizing microsatellite-rich regions in intron 1. In addition to gene characterization, MSTN expression was also evaluated at various developmental stages (larval, juvenile and adult) and in different tissues through quantitative real-time PCR (RT-qPCR). Significant increases in MSTN expression were observed in exons 1 and 2, indicating their involvement in muscle growth regulation. This study offers a detailed molecular characterization of the MSTN gene in *C. magur*, revealing its dynamic expression in various stages of development. These findings are significant for aquaculture as they enhance our understanding of muscle growth regulation in fish. By exploring MSTN gene regulation and genetic variations, future research could optimize growth in aquaculture species, supporting more efficient and sustainable production practices.

Keywords: *Clarias magur, housekeeping gene, Myostatin gene, phylogeny, annotation, Real-time PCR*

Promoting Millet Processing and Value Addition through Participatory Training for Farm Women and Farmers in Etah District of Uttar Pradesh

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Abstract

The training and demonstration programme on millets was organized in Etah district of Uttar Pradesh to promote the processing and utilization of nutri-cereals among farm women and farmers. The objective was to create awareness about the nutritional, economic and ecological importance of millets and to build practical skills for their inclusion in household diets. A total of 1120 participants, including 880 farm women and 240 farmers from different villages, attended the training sessions conducted by Krishi Vigyan Kendra (KVK), Etah from 2022 to 2024. The programme included lectures, hands-on demonstrations on millet value addition and recipe preparation using locally available millet varieties such as bajra (pearl millet) and jowar (sorghum). Pre- and post-training evaluations revealed a significant increase in participants' knowledge, with awareness about the health benefits of millets improving by over 60%. Many women initiated preparation of millet-based food items for home consumption and local marketing, . The intervention demonstrated that capacity-building through participatory training and on-farm demonstrations can effectively revive millet utilization, contributing to nutritional security, climate resilience, and income diversification in the Etah district of Uttar Pradesh.

Keywords: *Millet, processing, value addition and demonstrations*

Graphene Oxide–MIP Sensor for Benzene Detection in Early Lung Cancer Diagnosis

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Abstract

Early detection of cancer plays a pivotal role in significantly improving patient survival rates. However, achieving this goal relies heavily on widespread screening, which is often limited by the high cost and restricted accessibility of current diagnostic technologies. Emerging nanomaterial-based sensors offer an effective solution to these challenges due to their portability, ease of use, and low production costs. Volatile organic compounds (VOCs) emitted by the human body have been found to exhibit altered profiles in individuals with life-threatening diseases. Among these, benzene has been identified as a critical biomarker found in the breath and blood of individuals at risk of developing lung cancer. Building on this association, we have developed an electrochemical sensor capable of reliably detecting benzene. The sensor is fabricated on a screen-printed electrode (SPE) platform, sequentially modified with graphene oxide (GO) and a molecularly imprinted polymer (MIP). The SPE design enables the development of a compact, cost-effective, and user-friendly sensing system. The incorporation of GO enhances the electrochemical response owing to its superior conductivity and high surface area, while the MIP—synthesized using benzene as a molecular template—provides specific recognition sites that greatly enhance selectivity. This design effectively addresses the long-standing challenge of poor selectivity in VOC-based medical sensors. The fabricated sensor exhibited a broad linear detection range (0.1–1000 ppb) and a high sensitivity of 15.5 μA/ppb, along with exceptional selectivity toward benzene. These results demonstrate the potential of the proposed GO/MIP-modified SPE sensor as a robust, sensitive, and selective tool for early and accessible lung cancer diagnosis.

Keyword: *Benzene, Graphene oxide, Molecularly imprinted polymer, Electrochemical sensor, Lung cancer.*

Climate Smart Agriculture: Adaptive Agro-Technologies for Enhancing Crop Resilience under Climatic Aberrations

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Abstract

Climate change poses a critical and growing threat to global agriculture, especially in India, where crop production depends heavily on monsoonal rainfall and natural resources. Rising temperatures, erratic precipitation, prolonged droughts and flash floods have disrupted agroecosystem stability and reduced crop productivity. These climatic anomalies have also accelerated the depletion of soil organic carbon and intensified water scarcity, undermining agricultural sustainability. Climate Smart Agriculture (CSA) provides a scientifically grounded and adaptive framework that enhances productivity, builds resilience and mitigates greenhouse gas (GHG) emissions. It integrates multiple approaches under the broader paradigm of sustainable development. Conservation agriculture (CA), a core CSA component, promotes zero or minimum tillage, permanent soil cover and diversified crop rotations.

These practices improve soil aggregation, enhance infiltration and increase soil organic matter (SOM). They also reduce CO, and N, O fluxes, contributing to emission mitigation. Agroforestry systems integrate perennial trees with annual crops, enhancing carbon sequestration both above and below ground. They regulate microclimatic conditions, reduce erosion and support biodiversity. Precision water management technologies such as broad bed and furrow (BBF), compartmental bunding, farm ponds and percolation tanks increase water-use efficiency (WUE) through better moisture conservation. Nutrient recycling through composting, vermicomposting and residue incorporation enhances soil microbial biomass carbon and nutrient availability. The System of Rice Intensification (SRI) uses younger seedlings, wider spacing and alternate wetting and drying (AWD) irrigation to improve soil aeration and reduce CH,, emissions. Empirical evidence shows that zero tillage can cut fuel use by 80% and increase wheat yield by 10–12%, while agroforestry sequesters 12–15% of global carbon. SRI reduces irrigation demand by 25–50% and improves yield efficiency. Overall, CSA represents a paradigm shift toward climate-resilient agroecosystem management, essential for ensuring food security, livelihood stability and ecological sustainability.

Keywords*- Climate Smart Agriculture, Conservation agriculture, Climate change, Greenhouse gas, Carbon sequestration.*

Energy Use Pattern in Shrimp Production: Optimizing Energy Utilization for Sustainable Shrimp Farming

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Abstract

Efficient energy use is central to achieving the United Nations Sustainable Development Goals (SDGs), particularly SDG 7, Affordable and Clean Energy and SDG 14, Life Below Water, which emphasize sustainable resource utilization and responsible aquaculture practices. Understanding the energy dynamics in shrimp production is therefore vital for promoting energy efficiency and environmental sustainability in the aquaculture sector. This study analyzed the energy use pattern in shrimp production with the objective of optimizing energy utilization for sustainable shrimp farming. Primary data were collected

through face-to-face interviews using a structured questionnaire from 60 shrimp farmers 30 from South 24 Parganas, West Bengal, and 30 from the districts of Nellore, Prakasam, and Bapatla in Andhra Pradesh. The total input energy used per hectare for shrimp production was 738,555.18 MJ in West Bengal and 354,988.03 MJ in Andhra Pradesh. In West Bengal, diesel accounted for the highest share of total energy consumption (50.45%), while electricity was the major contributor in Andhra Pradesh (37.21%). The higher consumption of diesel and electricity was primarily due to the continuous operation of aerators, pumps, electric and diesel motors, lighting, and heating systems. Feed also contributed substantially, accounting for 42.65% and 36.96% of the total input energy in West Bengal and Andhra Pradesh, respectively.

The calculated Energy Ratio was 0.99 for West Bengal and 0.93 for Andhra Pradesh, indicating low energy use efficiency in shrimp production. The average energy productivity across the study areas was 0.02 kg/MJ, meaning that 0.02 kilograms of shrimp output were produced per megajoule of energy input. The findings revealed that shrimp farming in both regions heavily relies on non-renewable and indirect energy sources. Enhancing energy efficiency either by increasing shrimp yield or reducing energy inputs could significantly improve energy savings and promote sustainable aquaculture practices in line with global sustainability goals.

Keywords: *energy use, shrimp farming, energy ratio, energy productivity, sustainable aquaculture, non-renewable energy*

Evaluation of Lotus (*Nelumbo nucifera*) genotypes for vegetative growth and yield attributes under Mid-Hill Ecosystem of Meghalaya

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Abstract

The present investigation was carried out at the Horticulture Section, DSRE Division, ICAR Research Complex for NEH Region, Umiam, Meghalaya, (2024-2025) to evaluate the performance of different lotus (*Nelumbo nucifera*) genotypes under the mid-hill ecosystem. Fifteen genotypes were studied in a Randomized Complete Block Design (RCBD) with three replications to assess vegetative growth, flowering behavior, and quality attributes. Significant variation was observed among the genotypes for all vegetative and floral parameters. The earliest coin leaf emergence was recorded in Thai Dwarf (10.33 days) followed by Raane Red (11.67 days), whereas Yellow Pror Pink (16.33 days) exhibited the longest duration. Thai Dwarf also recorded the earliest aerial leaf emergence (21.01 days) and the highest number of leaves per plant (45.04), while Yellow Pror Pink (24.04) and Buccha (25.01) had the lowest. The tallest stem length was observed in Hong Taiyang (37.78 cm) followed by Happy Lover (36.14 cm), while Thai Dwarf (16.28 cm) recorded the shortest. With respect to floral traits, the earliest flowering was observed in Yellow Pror Pink (44.31 days), while Octopus (68.36 days) was the latest. The highest number of flowers per plant (10.74) was recorded in Octopus, followed by Sium Ruby (10.24), whereas Yellow Pror Pink (2.74) produced the least. The longest field life of flowers (7.33

days) was recorded in Sium Ruby, and the maximum number of petals per flower (145) in New Star, compared to the lowest (12 petals) in Yellow Pror Pink.

Keywords: *Lotus (Nelumbo nucifera), Genotypes, Mid-hill ecosystem, Floral and vegetative traits, Performance evaluation*

Fish Waste Valorization: A new-age technology for empowering coastal entrepreneurs and doubling farmers' income

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Abstract

Fish waste to wealth technology, Plankton^{Plus}, has developed to minimize the environmental problems generated by fish waste by transformation into products and use as ingredient in animal rations. Mostly fish wastes are mostly dumped in seashore and backwaters and environment gets polluted. To address this concern, through multiple awareness campaigns in coastal villages, a group was formed and incubated as a startup named "Nambikkai Fish Farmers Group", Pattinapakkam, Chennai, comprising seven members, to transfer the technical knowledge for producing these fish waste-derived products. This initiative has significantly improved the group's livelihood and their socio-economic condition. Building on this success, one of the group members, adopted the technology and established a micro-enterprise, "V.S. FishWaste Hydrolysate", at Kasimedu, Chennai. The unit is successfully processing fish waste and producing fish waste hydrolysate branded as Plankton^{Plus} and supplied to various states. Plankton^{Plus} are being marketed and supplied to shrimp and fish farmers especially for carp culture across Kerala (15.86%), Tamil Nadu (14.14%), Andhra Pradesh (36.43%), Gujarat (12.71%), Odisha (4.71%), and West Bengal (14.29%). During 2024-25, unit has realized Rs. 20.658 lakhs by the production of around 18780 litres of Plankton^{Plus}. In addition, livelihood assessment using Sustainable Livelihood Framework was conducted at Chennai, to find out changes in livelihood scenario. The capital components like human, economic, natural, physical and social were assessed and respective indices were calculated for 'before and after' the technology implementation. Results shows that social (45%), natural (42%) and human (25%) are having significant changes after implementation and these changes are more drastic as compared with physical (10%) and financial (5%). Results shows that Sustainable Livelihood Index has moderately increased (26%) in the livelihood scenario. Application of these products not only enhance the aquaculture production of the country but also provide livelihood security and help in doubling of farmer's income to the coastal communities as well as in improving their socio-economic status.

Keywords: *fish waste; aquaculture, Plankton^{Plus}, micro-enterprise, livelihood security*

Study on the Residual Effect of Integrated Nitrogen Management on the Yield, Quality Parameters and Economics of Fodder Cowpea

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Abstract

Two-year field experiment on integrated nitrogen management on fodder maize and its residual effects on succeeding fodder cowpea was conducted at Main Forage Research Station, Anand Agricultural University, Anand during *rabi*-summer season of 2021-22 and 2022-23. Experiment consists of twelve integrated nitrogen management treatments with three replications. Experimental data results revealed that the application of 125% RDN (100 kg N/ha) with micronutrient-enriched FYM @ 0.5 t/ha followed by Jeevamrut drenching @ 500 L/ha at 15, 30, and 45 DAS recorded the highest green fodder yield (391 q/ha), which was 49.24% and 37.67% greater than 75% RDN + FYM and 100% RDN, respectively. In case of quality analysis, the application of 125% RDN (100 kg N/ha) + micronutrient-enriched FYM @ 0.5 t/ha *fb* Bio NP drenching @ 1 L/ha at 15, 30 and 45 DAS resulted in superior forage quality with maximum dry matter (20.70%), dry matter yield (81.22 q/ha), crude protein content (17.90%) and crude protein yield (14.59 q/ha). These values were substantially higher (13.74% to 96.63%) compared to 75% RDN (60 kg N/ha) + micronutrient-enriched FYM @ 0.5 t/ha. Moreover, minimum fiber fractions, namely ADF (32.88%) and NDF (61.85%) were also recorded under this treatment, indicating improved digestibility and nutritive value of fodder. From an economic perspective, the treatment of 125% RDN + FYM + Bio NP produced the highest net realization (₹ 1,64,238/ha) with the maximum benefit-cost ratio (6.22), thereby proving its superiority over other nutrient management practices.

Keywords: *Integrated nitrogen management, Enriched FYM, Bio NP, Jeevamrut, ADF, NDF and nutritional quality*

Assessment of salinity stress and fertilizer treatments on physiological indices of wheat (*Triticum aestivum L.*)

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Abstract

Wheat (*Triticum aestivum L.*) is the world's primary food grain crop and its a fundamental component of the agricultural economy. It is cultivated globally, with the largest producers being China, the USA, Russia, France, Australia, and India. Wheat is high source of protein, good source of fibre and rich in Mn and Mg. Nevertheless, wheat production is impeded by significant challenges, a primary one is the availability of quality water for irrigation. Salinity is widespread in arid and semi-arid regions, where it

adversely impacts crop growth. Plant systems such as cell division, leaf elongation, evapotranspiration rate, nutrient and water absorption etc. are negatively impacted by salinity. Moreover, salinity stress adversely affects photosynthesis, a critical process for plant growth, as it disrupts the functioning of chloroplasts and reduces the efficiency of carbon fixation. Therefore, an experiment was carried out during the *rabi* season of 2023–24 to assess the impact of saline water (EC H" 7.62 dS/m) and canal water (EC H" 0.33 dS/m) on the physiological parameters of wheat in combination of ten fertilizer treatment. The results shows that Application of saline water significantly reduced total chlorophyll content and carotenoids in wheat as compared with canal water irrigation. The maximum total chlorophyll content and carotenoids was recorded with application of 100% RDF + ST3 + PSB + KSB in treatment T_7. The canopy temperature and proline content significantly increased with saline water irrigation as compared with canal water irrigation. The maximum canopy temperature and proline was recorded under control. However, lowest canopy temperature was recorded in T_7. Relative water content in wheat percent significantly reduced from 74 to 56.26 % with saline water irrigation compared to canal water irrigation. The highest Relative water content was obtained with application of 100% RDF + ST3 + PSB + KSB in T_7.

Keywords*: Physiological indices, wheat, salinity, fertilizers*

Exploring the potential of germplasm of *Garcinia gummi-gutta* and *G. dhanikhariensis* as a source of industrially important seed fat

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Abstract

Seed fat from *Garcinia* species has received significant attention from the researchers in the recent past. *Garcinia dhanikhariensis*, an endemic species from the Andaman Islands, has been identified as a source of several bioactive compounds including anthocyanins, hydroxycitric acid and phenolic acids in its rind. Its pulp is consumed by the locals while the usage of rind for preparation of various value-added products was proposed by ICAR-CIARI. *Garcinia gummi-gutta* is a pharmaceutically important species from the Western Ghats of India, which is valued for its dried fruit rind as a source of hydroxycitric acid. Traditionally, the rind is used as an acidulant in the curries. In both the species, seeds constitute a significant proportion of fruit weight; however, they are generally discarded by the growers or processors. In the present study, six collections each of both the species were studied for their seed fat content. Further, to understand the composition of the extracted fat, fatty acid profiling was also carried out using GC-MS analysis. Study suggested considerable intraspecific variations for fat content in both the species. In *G. dhanikhariensis*, the seed fat content varied between 36.64% and 43.58%, while in *G. gummi-gutta*, it varied between 27.17% and 43.19%. Fatty acid profiling revealed 9-Octadecenoic acid and Stearic acid as the dominant compounds in most of the accessions studied, however in varied concentrations. Several other compounds of pharmaceutical significance were also present, some of which were specific to some accessions. The paper discusses the diversity and abundance of these

compounds and their possible applications in various industries. These diversified uses will provide an impetus for systematic cultivation of these species in the humid tropics.

Keywords: *Andaman Kokum, Bay Islands; Cosmetics, GC-MS, Malabar tamarind, Pharmaceutics*

Effect of orchard age on tree growth, yield efficiency and fruit biochemical status in mango

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Abstract:

An experiment was carried out during 2024-25 to assess the tree growth, yield and fruit biochemical status of orchards of 3 age groups (young orchards of 10-20 years, mid-age orchards of 20-30 years and old Orchards of 30-50 years) in 5 commercial mango varieties of Malda (Himsagar, Langra, Fazli, Amrapali and Lakhanbhog) in order to formulate strategies for management of nutrients, pests, diseases of selected mango orchards for higher yield and quality thereby augmenting farmers income in mango growing regions of Malda, West Bengal. Results revealed significantly 677.22 and 230.77 per cent more canopy volume and trunk cross-sectional area in 30–50-year-old orchards compared to 10–20-year-old orchards. However, we observed 6.69, 49.31, 135.84 and 94.92 per cent higher contents of edible pulp, total phenols, total flavonoids and ascorbic acid in fruits of 10–20-year aged orchards than those of 30-50 years age. Our study observed better performance of 10-20 years old mango trees compared to those of 20-30 years age and 30-50 years age for canopy yield efficiency (52.75 and 182.83%, respectively). Irrespective of tree age, highest canopy volume and trunk cross-sectional area were recorded in mango cv. Ashwina, while lowest in Langra. However, Langra was found superior to other varieties in terms of yield efficiency, which was statistically insignificant with all other varieties except cv. Ashwina. Mango cv. Ashwina produced fruits of highest edible pulp content (76.25%) while minimum pulp content was observed in Lakhanbhog (64.93%). The fruits of mango cvs. Himsagar, Ashwina and Langra had highest content of total phenols, total flavonoids and ascorbic acid, respectively while lowest content of these biochemicals was observed in Fazli. Regression analysis inferred that for every 1 m^3 increase in canopy volume, the yield efficiency was decreased by 0.32 kg m^{-2} and thus needs technical intervention with increasing orchard age.

Keywords: *Ascorbic acid, Edible pulp content, Flavonoids, Orchard age, Phenols, Yield efficiency*

Spatial prediction of soil properties and nutrient management zones using digital soil mapping

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Abstract

Digital Soil Mapping (DSM) is increasingly adopted worldwide, producing diverse soil maps that vary in resolution, coverage, modeling methods, and uncertainty. Given the limited knowledge regarding the spatial variability of soil properties, the primary objective of this research is to utilize ML techniques to predict soil properties across the region. Soil properties, including depth, pH, EC, soil organic carbon (SOC), and available nutrients, were predicted at the district level across various depths 0–5, 5–15, 15–30, 30–60, 60–100, and 100–200 cm using the *GlobalSoilMap* project guidelines. To accomplish this, data from legacy soil profiles and local environmental covariates, such as Landsat imagery, terrain attributes, and bioclimatic variables, were utilized. Model performance was evaluated using 10-fold cross-validation. The results indicated that soil depth within the study area varied between 55 and 200 cm. Elevation, MRVBF, and land use emerged as the most significant covariates for predicting soil depth. The Random Forest (RF) model accounted for 12% of the variance (R^2) and had a root mean square error (RMSE) of 44 cm in soil depth prediction. The R^2 values for SOC were found to be 0.961 during model training and 0.368 during testing. The PICP for available nitrogen, phosphorus, and potassium across various depths ranged between 87.2 and 89.7%, while for micronutrients, the PICP ranged from 86.4 to 91.1%. Temperature-related variables and remotely sensed data products are crucial for accurately predicting SOC concentrations in arid environments. Uncertainty was quantified as the difference between the lower and upper prediction limits within a 90% confidence interval. The broad range of uncertainty indicates that there is potential for enhancing the current spatial predictions of soil properties. We expect that this digital mapping of soil properties will be beneficial for land use planning in semiarid regions.

Keywords: *Digital soil mapping; environmental covariates; random forest; soil properties*

Complementary use of RICE HUSK ASH (RHA) with inorganic fertilizers on growth, tuber yield and economics of potato.

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Abstract

Potato (*Solanum tuberosum* L.) is a crop of immense global significance because to its high tuber yield, short duration and ease of cultivation. In India, potato is grown in entire Indo-gangatic plains during the rabi season. Owing to its short duration cash crop, nutrient exhaustive nature and high bulking potential , the crop require NPK in readily available form. Inappropriate application of macronutrients NPK is followed by potato growers in these plains. To produce more in short span crop, most of the farmers are applying high amount of phosphorus in the form of costlier fertilizer diammonium phosphate

consequently amplifying cost of cultivation and negative impact on environment, soil health and sustainable yields. Phosphorus consumption in India geared up in the green revolution era after mid-twentieth century along with nitrogen and phosphorus owing to fertilizers responsive varieties and intensified cropping system. Rock phosphate is used for commercial fertilizer production and about 90 % of the rock phosphate required for soluble P fertilizer manufacturing is imported. Phosphorus reserve exploitation and current utilization rate, it is presumed that phosphate reserve are expected to last for 50-400 years. India is at vulnerable position as there is huge import dependency on raw material. Therefore, certain modification such as by utilizing local waste/ by-product complemented with P-fertilizer may be explored for fertilizers saving, crop availability, soil heath and sustainable yields. Initially pot and then field experiments were conducted at the ICAR - Central Potato Research Institute during 2020-21, 2021-22 and 2022-23. Application of rice husk ash (RHA) significantly increased the plant height, haulms biomass, root weight, chlorophyll content (SPAD value), per cent P content in above ground biomass and tuber yield. Thus, RHA may play a significant role in improving nutrient use efficiency particularly of P and sustainable yields.

Keywords*: Potato, Rice husk ash, Tuber yield*

Awareness of Integrated Nutrient Management among Next Generation Agriculturists

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Abstract

The increasing nutrient imbalance in soils poses a serious threat to agricultural productivity, which is essential to meet the food demand of the ever-growing population. Beyond macronutrient deficiencies, the disturbed input-output balance of micronutrients and secondary nutrients has raised concerns for the long-term sustainability of agriculture. Integrated Nutrient Management (INM) offers a viable approach to replenishing soils with essential nutrients, thereby meeting crop requirements and enhancing yields. Raising awareness among the next generation of farmers about INM is crucial for improving soil health and ensuring sustainable crop production. Although most agricultural students have rural backgrounds, only a few are highly aware of INM, which may hinder their ability to use soil-restoring and yield-sustaining practices in future farming. This knowledge gap puts long-term soil fertility and crop productivity at risk. To assess the level of awareness, a social experiment was conducted with agricultural undergraduates. Results indicated that 45% of respondents belonged to rural backgrounds, 42% had family farming as their primary livelihood, while only 25% of respondents had prior hands-on farming experience. Based on responses to INM related questions, knowledge levels were categorized as low, medium and high. Only 15% of respondents demonstrated high awareness, 77.5% showed medium-level awareness, and 7.5% displayed low awareness. The findings suggest that despite many respondents coming from farming families, awareness and understanding of INM remain limited. Strengthening educational programs and experiential learning can play a key role in bridging this gap and awareness campaigns by government to farmers is also necessary for sustainable farming practices. Enhancing curriculum integration with practical exposure could further encourage students to adopt

nutrient-smart farming methods. Such steps are vital for building a resilient agriculture sector capable of meeting future food security challenges.

Keywords*: Integrated Nutrient Management (INM), Soil health, Agricultural productivity, Awareness, Sustainable farming and Agricultural undergraduates*

Precision Weed Management: A Technological Revolution for Sustainable and Efficient Crop Production

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Abstract

Weeds remain one of the most significant biotic constraints limiting agricultural productivity, causing estimated crop losses exceeding $11 billion annually in India. Conventional weed control strategies including manual, mechanical, biological, and chemical methods are becoming less effective due to herbicide resistance, escalating labor costs, and environmental challenges. In this context, Precision Weed Management (PWM) has emerged as an innovative, data-driven, and site-specific approach designed to optimize weed control through the integration of advanced technologies. PWM employs tools such as GPS, drones, sensors, robotics, and artificial intelligence to accurately detect and manage weed-infested zones, thereby reducing excessive herbicide usage and minimizing ecological harm. Techniques like patch and spot spraying have been shown to reduce herbicide consumption by up to 99% without sacrificing control efficacy. Core components of PWM include multispectral and hyperspectral imaging for real time weed mapping, smart sprayers and autonomous robots for targeted operations, and machine learning algorithms capable of distinguishing between crops and weeds. Cutting edge robotic systems such as Robovator, EcoRobot, Ladybird, and RIPPA exemplify the practical application of automation in precision agriculture. Empirical evidence from India and Europe demonstrates the effectiveness of PWM drone-assisted herbicide spraying in rice and greengram fields reduced chemical and water use while enhancing yields, while automated hoeing in soybean and sugar beet fields decreased weed density by 87–89% and improved productivity. Beyond agronomic efficiency, PWM offers substantial economic and environmental benefits by reducing herbicide costs by up to 60%, lowering chemical exposure, and promoting soil and water health. Overall, PWM represents a transformative innovation that aligns technological advancement with ecological stewardship, paving the way for sustainable, profitable, and environmentally responsible farming in the era of smart agriculture.

Keywords: *Precision Weed Management, Artificial Intelligence, Drones, Robotics, Site-Specific Weed Control, Smart Agriculture*

Sustainable Land Use Planning of Narmada District, Gujarat using Geospatial Approach

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Abstract

A study was carried out in the Narmada district of Gujarat which covers an area of 2820.5 km^2 to develop scientific inventory and database of soil resources, identification of constraints and potentials of the district, and to develop comprehensive land use plans. The detailed soil survey was carried using Conditional Latin Hypercube (cLHS) technique. In this investigation, the Random Forest model was employed for mapping of all soil properties whereas Analytic Hierarchy Process (AHP) was used for suitability assessment of major crops. Results showed that soils of Narmada districts are moderately shallow (50-75 cm), clay loam texture, slightly acidic to slightly alkaline pH, and medium to high SOC content in nature. In Narmada district about 2.54%, 3.51% and 11.22% area of TGA is highly suitable for the cultivation of rice, wheat and pigeon pea, whereas, about 11.38%, 13.84%, 11.83%, 30.97%, 4.13%, 22.71%, 27.48%, 28.39% and 29.10% area is moderately suitable for the cultivation of rice, wheat, pigeon pea, chickpea, cotton, sugarcane, banana, mango and sapota, respectively. In line with the crops traditionally grown and after performing the suitability analysis, alternate crop plan for *Kharif* season such as Pigeon pea/Sugarcane/Rice/ Cotton/Groundnut (17.43% of TGA) followed by Cotton/ Pigeon pea/Groundnut (12.14%), Pigeon pea/ Groundnut/ Cotton/ Rice/Sugarcane (10.05%) and Sugarcane/Cotton/Pigeon pea/Rice/ Groundnut (10.02%) are proposed. Similarly, Chickpea/Maize/ Vegetables (22.65%), Sugarcane/Wheat/Chickpea/*Rabi* Pulses (18.74%) and Chickpea/Maize/*Rabi* Pulses/Sugarcane (9.59%), are the optimal combinations for *Rabi* season.

Keywords: *Land resource inventory, cLHS, Crop Suitability and Land Use Plan.*

Assessment Of Different Staining Methods for Screening Cellulase Activity Using CMC (Carboxy Methyl Cellulose) Agar

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Abstract

The present experiment was conducted at Department of Plant Pathology, College of Agriculture, Navsari Agricultural University, Waghai. cellulolytic bacterial isolates CD11, CD17, CD19, CD22 and CD35

were screened to determine the staining efficiency of various stains for cellulase activity on CMC (Carboxy Methyl Cellulose) agar and it was observed that all the isolates conferred clear zone around the colonies through different staining dyes and bacterial isolate CD35 showed the highest cellulolytic index in all the dyes. The cellulolytic index of CD35 was highest with gram's iodine (3.34) next in order of coomassie brilliant blue (2.96), safranin (2.55) and congo red (2.15). Significantly, higher cellulase activity was recorded in CD35 (0.169 U ml-1) at 24 hrs after inoculation It was followed by CD17 (0.124 U ml-1), CD19 (0.101 U ml-1) and CD11 (0.081 U ml-1), while it was lowest in CD22 (0.052 U ml-1). Maximum cellulase activity was recorded at 72 hrs after inoculation by all the selected isolates except CD22 isolate, which was maximum 96 hrs after inoculation. CD35 gave significantly maximum cellulase activity (0.822 U ml-1) at 72 hrs after inoculation. Next in order to cellulase activity was CD17 (0.477 U ml-1) which was at par with CD19 (0.471 U ml-1) followed by CD11 (0.292 U ml-1) while, it was lowest in CD22 (0.199 U ml-1). Cellulolytic bacteria CD35 was identified as Bacillus subtilis by morphological, biochemical and molecular methods and submitted to NCBI GenBank database with accession numbers MW715021.

Keywords: *Bacillus subtilis, cellulase activity, cellulolytic index*

Marker-Trait Associations and superior haplotypes for rice silica content

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Abstract

Rice (*Oryza sativa L.*) is a staple crop generating vast quantities of straw as a by-product. However, its high fibre and silica content make the straw difficult to utilize as quality livestock feed, necessitating improved genetic resources with enhanced straw digestibility. A multi-locus genome-wide association study was conducted on 154 rice accessions from a diverse panel to identify significant marker-trait associations (MTAs) governing key straw cell wall component traits focussing on silica content. A multi-locus genome-wide association study (ML-GWAS) was conducted on 154 rice accessions to identify significant marker-trait associations (MTAs) and candidate genes controlling silica content in rice straw. Using 208,846 genome-wide SNPs and six ML-GWAS models, seven significant MTAs for silica content were detected on chromosomes 1, 6, 8, and 11, with LOD scores ranging from 4.95 to 14.17%. The most significant association was located on chromosome 1 at 29.29 Mb, explaining up to 16.7% of phenotypic variation. Within ±150 kb of these MTAs, 47 candidate genes were identified which are involved in silicon uptake and transport. Key transporter genes included NRT2.3, OsOPT2, OsOPT3, and OsUCP2, known to facilitate silica uptake and translocation. In silico expression profiling revealed that 14 of these genes were differentially expressed in silica-accumulating tissues such as root, leaf, lemma, and palea. Haplotype analysis identified superior haplotypes *viz*, OsOPT2-H005, OsOPT3-H002, and OsBGL2-H004, associated with significantly reduced silica content. These loci and haplotypes provide valuable genetic resources for developing rice varieties with optimized silica deposition,

improving straw digestibility.

Keywords: *rice straw, silica, multi-locus genome-wide association, Haplotype analyses*

Integrated Bioinformatics and Experimental Evaluation of a Rationally Designed Milk Casein-Derived Fused Bioactive Peptides Exhibiting Multifunctional Attributes

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Abstract

Bioactive peptides, short amino acid sequences encrypted within food proteins, exhibit diverse physiological effects such as antioxidant, ACE-inhibitory, and immunomodulatory activities. Harnessing their potential requires multifunctional peptide candidates that can generate stable, bioactive fragments upon digestion. In this investigation, four well-characterized milk casein-derived peptides with overlapping antioxidative, ACE-inhibitory, and anti-inflammatory functions were rationally fused using an Arg-Arg (RR) linker to generate a multifunctional synthetic peptide. The fused construct was chemically synthesized and subjected to simulated gastrointestinal digestion to mimic physiological processing. The digested product was experimentally validated through multiple in-vitro assays, demonstrating its retained antioxidative, ACE-inhibitory and immunomodulatory potential. To further confirm the stability and identity of digestion products, LC-MS analysis was performed, revealing several peptide fragments derived from the fused sequence. Each LC-MS-identified fragment was subsequently analyzed using various bioinformatics tools to predict physicochemical and biological attributes, followed by molecular docking studies that confirmed stable interactions with ACE enzyme, antioxidative and inflammatory mediators. The in-silico results corroborated the experimental findings, indicating that the digested fragments preserved the multifunctional properties of the parent fused peptide. Altogether, this integrative approach establishes a strong link between simulated digestion, peptide stability, and retained bioactivities, highlighting the rationally designed casein-derived fused peptide as a promising candidate for nutraceutical and biomedical applications.

Keywords: *Bioactive peptides; Milk casein; Fused peptide; Simulated digestion; LC-MS; Bioinformatics; Molecular docking; ACE inhibition; Antioxidant activity; Nutraceutical potential.*

Integrated transcriptome and Small RNA profiling reveals molecular defense responses of Bhut Jolokia (*Capsicum chinense* Jacq.) against Potato Virus Y

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Abstract

Potato virus Y (PVY), a member of the genus Potyvirus (family Potyviridae), infects over 495 plant species across 72 genera and 31 families, causing significant yield losses in solanaceous crops. Bhut Jolokia (Capsicum chinense Jacq.), a globally recognized chilli cultivar from Northeast India known for its extreme pungency and cultural value, suffers yield and quality reductions of up to 80% due to PVY infection. However, the molecular mechanisms underlying its antiviral response remain poorly understood. This study employed RNA sequencing (RNA-Seq) and small RNA sequencing to investigate mRNA and miRNA expression profiles in Bhut Jolokia following mechanical inoculation with PVY under controlled conditions. Transcriptomic analyses identified numerous defense-associated genes, including pathogenesis-related proteins, receptor-like kinases, heat shock proteins, and components of salicylic acid, jasmonic acid, and ethylene signalling pathways. Several regulatory miRNAs were also identified, indicating their potential role in fine-tuning antiviral defense mechanisms. Selected candidate genes were validated using quantitative real-time PCR (qRT-PCR), and expression levels were quantified through the 2^-ÄÄCt method, confirming RNA-Seq results. This integrated transcriptome–small RNA analysis provides the first comprehensive insight into Bhut Jolokia's molecular responses to PVY infection. The identification of key defense-related genes and regulatory miRNAs offers valuable targets for breeding PVY-resistant cultivars, contributing to the sustainable cultivation of this unique chilli variety.

Keywords: *Bhut Jolokia, PVY, mRNA, miRNA, RNAseq, qRT-PCR,*

Gender, Empowerment and Sustainability: Women as Human Resources in Indian Agriculture

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Abstract

Women's empowerment lies at the core of sustainable agriculture and natural resource management, yet gender disparities continue to constrain their potential as vital human resources. In India, women account for nearly 33% of the agricultural workforce, and over 80% of rural women are engaged in farming and allied activities. Despite their significant contribution to food security and ecological stewardship, women remain marginalized in access to land, credit, extension services, and decision-making spaces. Bridging this gender gap is essential for fostering sustainable and climate-resilient farming systems. Across India, women are increasingly emerging as drivers of climate solutions as farmers, entrepreneurs, consumers, activists, and community leaders. Yet, the climate crisis exacerbates gender inequalities, disproportionately impacting women who depend directly on natural resources for livelihoods. They are addressing sustainability challenges through organic farming, water conservation, and renewable energy adoption, reinforcing the link between women's empowerment and climate-resilient agriculture. Therefore, keeping in view the importance of women's empowerment in ensuring

sustainable agriculture and resource management, the present study was conducted among 200 farmers (100 male and 100 females from the same households) in the Hisar and Bhiwani districts of Haryana, India, to assess women's empowerment within the household context. The findings revealed marked gender-based disparities in agricultural participation as men dominated decision-making across major farm operations, while women's roles were concentrated in labour-intensive and household-linked tasks. This imbalance highlights the urgent need to integrate women's voices in agricultural governance and resource management. Mainstreaming gender-responsive strategies in agricultural planning, capacity building, and climate adaptation will unlock the transformative potential of women as human resources. Empowered women not only sustain households and ecosystems but also lead India's transition toward equitable, resilient, and sustainable agriculture.

Keywords: *Women's Empowerment, Gender Disparity, Sustainable Agriculture, Climate Resilience, Natural Resource Management*

Effect of Age and Physiological Status on hematobiochemical profile of Nellore Sheep and Osmanabadi Goats: THI based study

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Abstract

Biochemical parameters are important indicators of the health condition and metabolic activity irrespective of the physiological status of the animals. The variations in hematological parameters is multifactorial some of which are altitude, feeding level, age, sex, breed, diurnal and seasonal variation, temperature and physiological status of animals. Nellore sheep and Osmanabadi goat are the most commonly reared breeds in the state of Andhra Pradesh. The present study was conducted to report the effect of age and physiological status on few blood biochemical parameters of Nellore sheep and Osmanabadi goat breed from the hot and humid areas of Gannavaram. A total of 18 animals of age 0-1 year, Pregnant and lactating each belonging to small farmers at Gannavaram, Krishna District, Andhra Pradesh during the months of April-May were used for our study. The results of that in Nellore sheep evidenced significantly higher RBC, Hb in pregnant group compared to others. Significantly higher PCV values were recorded in the 0-1 age group of animals. The total protein, creatinine were significantly higher ($p < 0.05$) in the lactating group compared to the other two. The albumin levels were found to be significantly higher ($p < 0.05$) in pregnant group. The cholesterol, calcium, phosphorus levels were found to be significantly higher ($p < 0.05$) in 0-1year group and decreased in periparturient period. While in Osmanabadi goats, significantly higher ($p < 0.05$) levels of RBC, Hb, PCV, phosphorus and significantly lower cholesterol levels in lactating group. While significantly higher ($p < 0.05$) levels of calcium, albumin, total protein and significantly lower levels of creatinine were observed in the 0-1

year group of goats. The study established baseline values of Nellore sheep and Osmanabadi goats across different physiological status and age groups in the hot and humid areas of Andhra Pradesh and therefore can be used as reference values for further experimentation on sheep and goat located in these areas.

Keywords: *Physiological status, hematological, biochemical, Lactating group, Osmanabadi goats, Nellore Sheep.*

Uptake, Transport, and Fate of Nanoparticles in Plants

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Abstract

The interaction of nanoparticles (NPs) with plants has gathered increasing attention due to their prospective applications in precision agriculture and potential ecological implications. The uptake of nanoparticles by plants primarily occurs through root epidermal cells via apoplastic and symplastic pathways, and through foliar entry facilitated by stomatal openings or cuticular pores. The efficiency of NPs internalization is governed by their physiochemical Bcharacteristics, including particle size, surface charge, solubility, and functionalization. Once internalized, NPs are translocated through the vascular system—xylem and phloem—mediating their redistribution to aerial organs. During this process, NPs may undergo physicochemical transformations such as dissolution, redox reactions, aggregation, or interaction with organic ligands, thereby altering their mobility and bioavailability. Inside plant cells, NPs can localize within cell walls, vacuoles, chloroplasts, and mitochondria, potentially influencing metabolic and physiological processes including photosynthesis, reactive oxygen species (ROS) generation, and enzymatic activity.

The ultimate fate of NPs in plant tissues involves accumulation, transformation into ionic or complexed forms, or detoxification through sequestration and biotransformation pathways. Comprehensive understanding of NPs uptake, translocation, and transformation mechanisms is essential for the development of sustainable nano-enabled agro-inputs, risk assessment, and formulation of biosafe nanomaterials for agricultural systems.

Keywords*: Nanoparticles, Apoplastic–symplastic transport, Phloem translocation, Bioavailability, Nanotoxicity, Sustainable agriculture*

Sensor-Based Characterization and Correlation of Electrical Properties of Yoghurt from varied milk sources.

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Abstract

This study examines electrical and physicochemical properties of inoculated milk during yoghurt fermentation from varied milk sources. Lactic acid bacteria ferment lactose to lactic acid, lowering pH and altering the milk matrix structure via ionic release, water redistribution, and protein rearrangement. These changes impact electrical conductivity (EC), total dissolved solids (TDS), and capacitance - indirect markers of fermentation dynamics. Results show EC rises during fermentation due to increased ionic dissociation (calcium, hydrogen, phosphate) at lower pH. Capacitance increases due to microstructural changes, water binding, and protein gelation in the yogurt matrix. Compositional differences among milk sources significantly influenced electrical responses. Buffalo milk, characterized by higher protein and mineral contents, exhibited greater capacitance (680.05±38.98) due to enhanced dielectric polarization and bound water content, while its EC (3471.5± 157.2) remained lower owing to higher fat concentration and larger fat globules, which restricted ionic mobility. Conversely, skim milk displayed the highest EC (5740 ± 125.5) because of the dominance of the aqueous phase and minimal dielectric shielding from fat globules, but showed lower capacitance (528.48±44.66) due to reduced protein-mediated dielectric storage also TDS value highest in skim milk (3731±55.86) and lower in buffalo milk (2256±41.84). Cow milk demonstrated intermediate behavior between these two extremes. Statistical modeling and validation were done using linear regression models and it was confirmed strong correlations between electrical parameters and physicochemical attributes, with linear relationships ($R^2 > 0.9233$) observed between EC, capacitance, fermentation time, and pH, underscoring their potential as predictive markers of fermentation progress. Overall, the findings highlight the feasibility of using electrical properties as non-invasive, real-time indicators of yoghurt fermentation and quality attributes, while also establishing statistical models that integrate compositional variability across different milk sources.

Keywords: *- Electrical conductivity, Capacitance, Yoghurt fermentation, Milk composition, Dielectric properties, Real time monitoring.*

Conservation Agriculture: A Sustainable Approach for Climate-Resilient Farming

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Abstract

Conservation Agriculture (CA) represents a paradigm shift toward sustainable crop production systems that emphasize ecological balance, resource efficiency, and long-term soil health. It is built on three core principles: minimal soil disturbance through reduced or zero tillage, permanent soil cover using crop residues or cover crops, and diversified crop rotations for pest and nutrient management. These practices collectively enhance soil structure, improve infiltration, and minimize erosion, leading to improved soil organic matter, better moisture retention, and increased resilience against drought and heat stress. Globally, CA has demonstrated the potential to enhance productivity while reducing dependency on chemical inputs and fossil fuels, thereby lowering production costs and carbon footprints. Research studies have shown that CA can increase crop yields by 10–25% in rainfed systems, reduce water use by up to 30%, and improve soil microbial biomass, enzymatic activity, and aggregate stability. In Indian agro-ecosystems, especially in rice–wheat and maize-based systems, CA has shown significant benefits in improving soil carbon sequestration, reducing greenhouse gas emissions, and enhancing nutrient-use efficiency. Furthermore, the integration of CA with precision farming tools, climate-smart technologies, and integrated pest and nutrient management practices offers new opportunities for sustainable intensification. However, challenges such as limited farmer awareness, high initial machinery costs (like zero-till seeders), residue management issues, and weed pressure continue to restrict widespread adoption. Addressing these constraints through targeted policy support, capacity building, research extension linkages, and incentives for sustainable practices can accelerate the transition toward conservation-based farming. Therefore, CA stands as a key pillar of climate-resilient agriculture, ensuring productivity, profitability, and environmental sustainability for present and future generations.

Keywords: *Conservation agriculture, soil health, residue management, sustainable intensification, climate-smart farming, carbon sequestration, resource efficiency.*

Genetic Variability in Distinct Genotypes of Forage Pearl Millet (*Pennisetum glaucum* (L.) R. Br.) for Forage Yield and Forage Yield Attributing Traits

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Abstract

The experiment was conducted during *kharif* at Centre for Forage Research, S. D. Agricultural University, Sardarkrushinagar, Gujarat, India to study to appraise genetic variability in pearl millet genotypes for fodder yield and associating traits. Thirty forage pearl millet genotypes were evaluated for genetic parameters in terms of days to flowering, days to maturity, plant height (cm), number of tiller plant^{-1}, stem thickness (cm), number of leaf plant^{-1}, leaf length (cm), leaf: stem ratio, dry fodder content (%), dry fodder yield plant^{-1} (g), crude protein content (%), green forage yield plant^{-1} (g). Range, mean,

phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability, and genetic advance as per cent of mean were studied. The phenotypic coefficient of variation was higher than the genotypic coefficient of variation for all the traits indicating slight dominance of environment in the expression as compared to genetic contribution. Genotypic and phenotypic coefficient of variation were high for green forage yield plant^{-1}, dry fodder yield plant^{-1}, plant height, and number of tiller plant^{-1}. The high heritability with high genetic advance as a per cent of mean has been observed for green forage yield plant^{-1}, crude protein content, dry fodder yield plant^{-1}, leaf: stem ratio, leaf width, number of leaves plant^{-1}, plant height, number of tiller plant^{-1}, and stem thickness. This indicated that there is a lesser influence of environment in the expression of these traits and are predominantly governed by additive genes in their inheritance and selection for these traits will be effective for improvement of both forage yield and quality.

Keywords: *Genetic variability, forage pearl millet, heritability, forage yield*

Effect of green manuring on soil microbial biomass and enzyme activities

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Abstract

The present investigation evaluated the effect of leguminous green manures, Dhaincha and Mungbean, on soil biological properties such as enzyme activities (urease, alkaline phosphatase, and dehydrogenase) and microbial biomass (carbon and nitrogen). The experiment comprised nine treatments, including control, green manure crops alone, and their combinations with different fertilizer nitrogen levels (50%, 75%, and 100% RDN) replicated thrice and was conducted at research farm, College of Agriculture, Kaul during kharif 2024. Results revealed a significant enhancement in soil biological activities due to green manuring and integrated nutrient management. Urease activity varied from 92.1 to 103.2 µg NH,, z g{ ¹ soil hr{ ¹, with the highest recorded under 75% RDN + Dhaincha and the lowest in the control. Alkaline phosphatase activity ranged from 148.1 to 167.4 µg PNP g{ ¹ soil hr{ ¹, showing a similar trend, while dehydrogenase activity varied between 132.3 and 141.4 µg TPF g{ ¹ soil day{ ¹, indicating improved microbial oxidation potential under green manuring treatments. Microbial biomass carbon (MBC) ranged from 417.1 to 453.2 µg g{ ¹ soil, and microbial biomass nitrogen (MBN) from 51.4 to 61.2 µg g{ ¹ soil, with maximum values observed in 75% RDN + Dhaincha treatment. The integration of leguminous green manures with chemical fertilizers significantly enhanced soil enzyme activities and microbial biomass, reflecting improved soil biological health and nutrient cycling potential.

Keywords: *Green manuring, Dhaincha, Mungbean, microbial biomass, enzyme activity, soil biology.*

Healthy Soils, Sustainable Futures: Soil Health Card Scheme

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Abstract

The Indian economy and society depend heavily on agriculture. Approximately two thirds of the nation's people make their living either directly or indirectly from agriculture. Healthy soil is the foundation of sustainable farming and long-term food security. In India, the *Soil Health Card (SHC) Scheme*, started in 2015, was a major step toward improving soil fertility and guiding farmers to use fertilizers more efficiently. Haryana, being one of the most progressive agricultural states, has shown commendable efforts in putting this scheme into action. So far, nearly 70 lakh soil samples have been collected, 55 lakh tested, and more than 86 lakh Soil Health Cards distributed to farmers across the state. To support this, the government has set up 17 soil and water testing laboratories, 54 smaller testing units, and 240 mini-labs in schools and colleges. However, while awareness about the scheme is widespread, its actual use by farmers in day-to-day soil management remains limited. Many farmers still rely on traditional fertilizer habits rather than SHC recommendations. This gap shows that simply providing data is not enough—farmers also need continuous guidance, training, and motivation to adopt sustainable practices. Strengthening cooperation between research institutions, extension workers, and farming communities can make the SHC program more effective. With stronger implementation, the scheme can truly become a model for improving soil health, reducing input costs, and promoting climate-resilient agriculture in Haryana and beyond.

Keywords: *Soil Health Card, Sustainable Soil Management, Fertilizer, Agricultural Sustainability, Soil Fertility*

In silico development of novel genomic SSRs for *Chenopodium album* Linn

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Abstract

Identifying and exploring potential crops that can be successfully incorporated into existing cropping systems is essential. *Chenopodum album*, also known as Bathua or lamb's quarters, is a plant of significant value in multiple domains. The young leaves and stems of *C. album* are highly nutritious, possess protein with balanced amino acid profile, and rich in vitamins A, C, several B vitamins, as well as minerals such as calcium, iron, and magnesium. This makes *C. album* an important food source, particularly in regions with limited dietary options, and a valuable candidate for further exploration and use in both traditional and modern contexts. Moreover, domestication and integration of *C. album* into existing cropping systems could play a significant role in addressing the challenges posed by climate change. This requires evaluating indigenous germplasm for key agro-morphological traits and developing genomic resources. Identifying species-specific markers and genomic regions associated with these

traits will be crucial for accelerating the breeding of improved varieties. Novel genomic-wide simple sequence repeats (SSRs) were identified using chromosome level genome assembly of *C. album* (Mian and Christenhusz, 2024) with the help of krait software. The criteria for SSR identification were set as follows: 12 for Mono-, 7 for Di-, 6 for Tri, 4 for Tetra-, Penta-, and Hexa-nucleotide repeats. Total 573758 SSR markers were identified with a relative abundance of 361.27 loci/Mb and relative density of 8305.6 bp/Mb. Mono-nucleotide repeats (360089) were most abundant (62%) followed by di- (68014), tri- (60384), tetra- (43583), penta- (34643) and hexa- nucleotide repeats (7045). From the identified SSRs, 178981 primer pairs were designed using Primer3 script embedded in Krait software (GC content 40-60%, Product size 150-300 bp, primer size 18-22 bp).

Keywords: *Chenopodium album, genomic SSR, potential crops, genomic resources*

Nutritional variability in *V. stipulacea* (pillipesara), an orphan crop: A comparison with representative prominent germplasm of *Vigna* crops viz. V. radiata, V. mungo and *V. umbellata*

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Abstract

The present investigation was carried out to determine the nutritional variability in *V. stipulacea* (pillipesara). To make a comparative assessment of nutritional status and to identify superior traits the representative varieties or prominent germplasm collections of related *Vigna* crops viz. *V. radiata* (green gram), *V. mungo* (black gram), and *V. umbellata* (rice bean) were examined. Analysis of variance showed a high variability among the investigated accessions. Further, the results showed that different species of the *Vigna* genus contain crude protein (19.2 to 33.9%), total sugar (0.28 to 9.3%), available starch (1.67 to 22%), total phenols (1.71 to 3.36%), and antioxidants (0.03 to 1.1 mmol Fe2+/g). Among Urd beans, KU-6 (30.5%) contains higher protein concentration, while in Rice beans, PRR-1 (28.7%), and in Mung beans, IC-550532 (33.89%) are rich in proteins. Mung beans were high in carbohydrate content (19.8 to 28.4%), while Rice beans and Urd beans were found to be very low in carbohydrates (1.6 to 2.3%). Among these three species of *Vigna*, Mung beans were found to be rich in antioxidants and phenolic compounds (0.06-1.1%), while Chait Mung was found to be highest in antioxidants (1.1 mmol Fe2+/g). We found that there is a very high significant correlation between proteins and starch (0.74), and proteins and sugar contents (0.79). Principal component analysis shows that component 1 has the highest variation percentage (54.6). Clustering revealed that IC-553512 and IPU-2-43 are the farthest placed germplasm, followed by IC-553564 and PRR-2007-2, having the highest diversity in their nutritional profiling. In the future, these rich value accessions of *V. stipulacea* can be utilized for the improvement of these crops, nutritional security as well as nutritional labelling. Further, this orphan crop can be utilized as important protein source to alleviate protein energy malnutrition.

Keywords: *Vigna stipulacea; Legume; Principal component analysis (PCA); Germplasm; Nutrition, Orphan crop*

Green Synthesis of Biodiesel from Crotalaria juncea seed oil Using Eggshell-Derived Calcium Oxide Nanocatalyst

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Abstract

The present study focuses on the green synthesis of biodiesel from Crotalaria juncea seed oil (CJSO) using a waste-derived calcium oxide nanocatalyst prepared from eggshells. The research aims to develop an eco-friendly, cost-effective, and sustainable route for biodiesel production by valorizing agricultural and domestic wastes. The oil content for the extracted CJSO was found to be 48.30%. It is characterized for its physicochemical properties, including oil content, saponification value, iodine value, and refractive index, confirming its suitability as a biodiesel feedstock. The eggshell-derived CaO nanocatalyst (EgNC) was synthesized through calcination and characterized using FT-IR, XRD, SEM, and DLS techniques, which confirmed the formation of highly crystalline, nanosized CaO particles with enhanced surface area. Transesterification of CJSO was carried out using methanol and the EgNC catalyst under optimized conditions. The produced biodiesel was analyzed for key fuel properties such as density, viscosity, flash point, and cetane number, which were found to comply with ASTM-D6751 and EN-14214 standards. The biodiesel yield for the $(CJBD)_{EgNC}$ was found to be 95.21% with the CV of 42.80KJ/Kg. The results demonstrated that the EgNC exhibited excellent catalytic activity and conversion efficiency, thereby offering a sustainable alternative to conventional catalysts. This study highlighted an integrated approach toward waste-to-energy conversion, aligning with the principles of green chemistry and circular economy for renewable fuel development.

Keywords: *Crotolaria juncia, eggshell nanocatalyst, transesterification and biodiesel*

Ectoparasitic infestation in canines: A study of Hematological profile

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Abstract

Ectoparasites are an important and common cause of pruritic and nonpruritic skin disorders in dog and cats. Among the several ectoparasites, tick is a blood sucking arthropod which persists in most tropical and semi-tropical regions, and infects most domestic and wild animals resulting in serious external and internal illness (Dantas-Torres et al., 2012). Hematological profile is one of most important aspect in diagnosis of many diseases to assess the health status of animals (Ariyibi et al., 2002). In addition, ectoparasitic infestation is associated with physiological changes and stress which can be detected and evident through alterations in hemato biochemical profile (Sakina et al., 2012). Hence the present study is designed to explore these hematological alterations (total erythrocyte count, Hb, PCV, MCV, MCH, MCHC, and total leukocyte count) in tick infected dogs presented to Veterinary Poly Clinic, Vijayawada.

Two groups each comprising of eight dogs; one infested with ticks and the other healthy groups were selected for the study. Hematological parameters like Total erythrocyte count, Hemoglobin and packed cell volume, decreased significantly ($P<0.05$) while oesinophil and lymphocyte count showed a significant ($P<0.05$) increase in the infected group as compared with healthy group. The total leucocyte count, granulocyte and monocyte count did not reveal any siginificant difference. In conclusion, dermatosis associated with parasitic infestation is of major and principal concern to canine species. A proper baseline diagnostic testing during examination is critical to evaluate each dermatological case. A significant alteration in hematobiochemical parameters were detected which should be taken into consideration to improve the therapeutic management, avoid major complications and speed up the prognosis.

Keywords: *Canine, ectoparasites, ticks, hematological, blood sucking, dermatosis*

Formulation and Functional Evaluation of Nettle–Thyme Herbal Tea for Nutraceutical and Antioxidant Potential

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Abstract

The increasing prevalence of lifestyle-related metabolic disorders has intensified the search for functional foods with natural antioxidant potential. The present study aimed to develop and standardize a herbal tea blend using *Urtica dioica* (nettle) and *Thymus vulgaris* (thyme) leaves, focusing on sensory optimization and functional evaluation. Three formulations were prepared by varying the ratio of nettle and thyme leaves (1:1, 2:1, and 1:2 w/w) and assessed by a semi-trained sensory panel. Among the samples, the 1:2 (nettle:thyme) blend received the highest overall acceptability for its balanced color, aroma, and taste attributes. Steeping time standardization revealed that infusions brewed for 5–7 minutes offered superior flavor extraction and color development without bitterness, thus selected as the optimal brewing duration. To evaluate functional potential, Total Phenolic Content (TPC) and DPPH radical scavenging activity were determined for individual herbs and the optimized blend. Thyme showed the highest TPC (8.57 mg GAE/g) and DPPH inhibition (91.20%), while nettle exhibited moderate activity (2.39 mg GAE/g; 41.60%). The optimized 1:2 blend demonstrated synergistically enhanced antioxidant potential with TPC of 6.78 ± 0.14 mg GAE/g and DPPH inhibition of 84.35 ± 1.22%, confirming improved functionality over single-ingredient teas. The findings highlight that combining nettle and thyme in suitable proportions can yield a sensory-acceptable and functionally potent herbal infusion for natural health-promoting beverages and supporting sustainable approaches to nutritional well-being.

Keywords: *Nettle, Thyme, Herbal tea, Antioxidant activity, Sensory evaluation, Functional food*

Impact of plant growth promoting bacteria on biochemical responses of green gram to anthracnose disease

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Abstract

Green gram [*Vigna radiata* (L.) R. Wilczek] is the third most important pulse crop in India, after chickpea and pigeon pea. It is cultivated during both *kharif* and summer seasons and serves as a rich source of protein, carbohydrates, minerals, and vitamins. Due to its high nutritional value, it is often referred to as the "golden bean." However, green gram productivity is significantly affected by various biotic and abiotic stresses, among which anthracnose is a major yield-reducing disease. Plant growth-promoting bacteria (PGPB) are soil-borne, free-living, or root-associated microorganisms that enhance plant growth and health. The present study aimed to characterize the biochemical responses of PGPB-treated green gram plants under anthracnose infection and to evaluate the role of PGPB in disease management. The anthracnose pathogen was isolated and identified as *Colletotrichum tropicale*. Four PGPB strains—*Bacillus velezensis*, *B. halotolerans*, *B. cereus*, and *Pantoea alhagi*—were characterized for their plant growth-promoting traits.Among all treatments, *B. velezensis* demonstrated the highest disease control efficacy, reducing anthracnose prevalence by 80.71%. Plants treated with *B. velezensis* exhibited increased levels of total soluble sugars (18.12 mg g{ [1] f.w.), total phenols (3.05 mg GAE g{ [1] f.w.), and total soluble proteins (41.78 mg g{ [1] f.w.). Moreover, *B. velezensis* showed enhanced biocontrol potential when applied in combination with other PGPB cultures such as *P. alhagi* and *B. halotolerans*, by stimulating the activities of chitinase and polyphenol oxidase in green gram plants.Overall, the results suggest that *B. velezensis* is a promising biocontrol agent for managing anthracnose disease in green gram through the activation of plant defense mechanisms and biochemical modulation.

Keywords: *Green gram, Anthracnose, Colletotrichum tropicale, PGPB, Bacillus velezensis, Biocontrol*

Computational Insights into the Interactions of PPCPs with Human, Algal, and Plant Targets

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Abstract

Pharmaceuticals and personal care products (PPCPs) have emerged as a significant group of micropollutants in the environment, as they are widely used in daily life and frequently detected in aquatic systems worldwide. Among them, triclosan (TCS) is a halogenated aromatic hydrocarbon widely used as an antimicrobial agent in numerous personal care products (PCPs), including soaps, toothpaste, detergents, disinfectants, and cosmetics.The increasing production and usage of triclosan, have

exacerbated concerns regarding its environmental entry and accumulation. TCS poses significant ecological risks due to its persistence, bioaccumulation, endocrine-disrupting effects and antimicrobial resistance development, impacting aquatic organisms and potentially human health. In this study, molecular docking approaches were employed to investigate triclosan interactions with representative protein targets from humans, algae, and plants. Docking simulations were conducted using the CB-Dock2 platform, to predict binding affinities and identify key interaction sites. Docking analyses indicated that triclosan formed energetically favorable complexes across species studied, stabilized mainly through hydrophobic interactions and hydrogen bonding. Variations in binding strength and interaction patterns reflected differences in protein structure and pocket hydrophobicity. Overall, the molecular evidence supports species-specific susceptibility and highlights triclosan's potential to affect biochemical pathways across biological kingdoms.

Keywords: *PPCPs, Triclosan, Molecular Docking, Environmental Toxicology.*

Evaluation of medium duration (135-150 days) non-scented rice genotypes for higher grain yield and yield attributes in North-eastern Haryana

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Abstract

Rice is one of the major staple food crops all over the world. In present scenario, there is an urgent need to enhance the production of rice to meet the demand of growing population and also for ensuring food security. The present investigation for evaluation of medium duration non-scented rice genotypes for grain yield and yield attributes was carried out at Rice Research Station, Kaul, CCS HAU Hisar during *Kharif* 2022-23. The experimental material was sown in three replications with randomized block design (RBD). The medium (M) duration non-scented rice genotypes were evaluated against HKR 128 (LC), NDR 359 (NC) and PR-121 (ZC) varietal checks in 3 types of trials *viz.* Final Yield Trials (FYT-M), Large Scale Trials (LST-M) & Small Scale Trials (SST-M). The characters such as grain yield, days to 50% flowering, plant height, panicles/m2, grains/panicle, panicle length, chaffs/panicle, 1000 grain weight along with reactions to major insect pest & diseases were recorded. The Genotypes; HKR 18-40 (8105 kg/ha), HKR 09-104 (7852 kg/ha), HKR 16-35 (7700 kg/ha) and HKR 17-29 (7548 kg/ha) yielded significantly higher than checks *i.e.* HKR-128 (6738 kg/ha), NDR 359 (5851 kg/ha) and PR-121 (5826 kg/ha). Genotypes; HKR 19-22 (8167 kg/ha), HKR 19-24 (7767 kg/ha) and HKR 19-23 (7367 kg/ha) yielded significantly higher than all the checks namely HKR 128 (6533 kg/ha), NDR 359 (5467 kg/ha) and PR 121(5933 kg/ha). However, two genotypes *viz.* HKR 19-21(7167 kg/ha) and HKR 19-07 (7133 kg/ha) yielded numerically higher than all three checks. The genotypes; HKR 19-22, HKR 19-23 and HKR 16-35 were found promising against leaf folder and BPH/WBPH. The genotype HKR 18-40 was observed as resistant to sheath blight and stem rot disease and found promising against leaf folder.

Keywords: *Evaluation, Genotypes, Non-scented, Rice, Yield*

Eco-Thermal Treatment: Advancing Green Durability in *Salix tetrasperma* Roxb. Wood

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Abstract

The present investigation, titled "Eco-Thermal Treatment: Advancing Green Durability in *Salix tetrasperma* Wood" was undertaken during 2020-2022 at the Department of Forest Products and the Department of Plant Pathology, with mechanical strength testing conducted at the Wood Workshop, College of Forestry, Dr. YS Parmar University of Horticulture and Forestry, Nauni-Solan (HP). Thermal modification is an emerging eco-friendly technique aimed at enhancing wood durability and dimensional stability without the use of chemical preservatives. In this study, *Salix tetrasperma* wood samples were subjected to thermal treatment at seven distinct temperatures: 60°C, 80°C, 100°C, 120°C, 140°C, 160°C, and 200°C. The treated samples were then evaluated for changes in their physico-chemical, mechanical, and biological properties. Results demonstrated significant alterations in wood behaviour with increasing treatment temperature. Moisture content and specific gravity exhibited a strong inverse relationship with heat intensity; the control samples recorded the highest moisture content (192.03%) and lowest specific gravity (0.401), whereas wood treated at 200°C showed a reduced moisture content (140.09%) and an enhanced specific gravity (0.515). Similarly, volumetric shrinkage and swelling were substantially minimized at higher temperatures (3.42% and 3.85% at 200°C respectively), compared to 7.42% and 8.03% in untreated wood, indicating improved dimensional stability due to thermal degradation of hygroscopic components such as hemicelluloses. Microscopic characteristics such as fiber length, vessel diameter, and wood texture remained largely unaffected by thermal exposure, suggesting that structural integrity at the cellular level was preserved. However, noticeable darkening in wood color was observed with increasing temperature, resulting in ten distinguishable color grades, an outcome attributed to the thermal degradation of lignin and carbohydrate compounds, producing chromophoric structures. Regarding chemical composition, the highest values for cold (7.44%) and hot water soluble extractives (11.56%) were observed at 120°C, while alcohol-benzene extractives (13.61%) and lignin content (20.54%) peaked at 200°C. This reflects the redistribution and concentration of extractives due to polymer breakdown and volatilization during heating. Conversely, holocellulose content declined from 79.18% in the control to 70.89% at 200°C, indicative of thermal degradation of cellulose and hemicelluloses. Mechanical performance exhibited a non-linear response to thermal treatment. Tensile strength peaked at 120°C (0.059 kN/mm²) and declined significantly at 200°C (0.040 kN/mm²), while bending strength similarly decreased from 0.012 kN/mm² (control) to 0.006 kN/mm² at the highest treatment temperature. The optimal strength for compression parallel (0.039 kN/mm²) and perpendicular (0.033 kN/mm²) to grain was also achieved at 120°C, followed by a decline at 200°C (0.029 and 0.021 kN/mm² respectively), reflecting thermally induced embrittlement and polymer reconfiguration. Biological resistance showed marked improvement with thermal treatment. Fungal colonization by wood-rotting fungi was highest in untreated samples (81.25%) but reduced significantly at 200°C (42.28%). Correspondingly, the highest fungal inhibition (60.27%) was recorded at 200°C, suggesting

enhanced durability due to the degradation of nutrient-rich compounds and the formation of fungi toxic substances during thermal modification. Thermal treatment of *Salix tetrasperma* wood significantly improves its dimensional stability and resistance to fungal decay, with moderate temperatures (~120°C) enhancing certain mechanical properties. However, elevated temperatures (200°C) offer superior biological durability at the expense of reduced mechanical strength. These findings support the potential of thermal modification as a sustainable wood enhancement technique, particularly in non-structural and outdoor applications where decay resistance is paramount.

Keywords: *Thermal treatment, dimensional stability, holocellulose, mechanical strength, Salix tetrasperma*

Screening and molecular evaluation of drought tolerant pearl millet genotypes for A_1 zone

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Abstract

Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is a dual purpose climate resilient crop widely grown in arid and semi-arid climatic regions of Africa and Asia. It can endure in dry and harsh climatic conditions due to its numerous climate-resilient features like C_4 anatomy, deep root system, growth in less fertile soil under water scarcity, less nutrient and irrigational requirements, adaptations to a wide range of ecological conditions. Pearl millet production has constantly increased over time and high-yielding disease-resistant cultivars have played a major role in this direction. But, its productivity has been highly affected since past many years due to variability in climatic patterns and erratic rainfall which lead to requirement of selecting drought tolerant genotypes with better water use efficiency and survival in adverse conditions. Thus, it is necessary to develop drought/heat tolerant hybrids and varieties of pearl millet in the present context of changing climatic scenario. Here, we analyzed 19 pearl millet drought/heat tolerant lines suitable for A_1 zone using 15 drought/heat specific SSR primers. All the 15 SSRs amplified products of varying sizes ranging between 100-550 bp. **A total of 35 alleles were obtained in this study and the number of alleles per locus varied between 2 to 3 with an average of 2.33 alleles.** Polymorphic Information Content (PIC) values ranged from 0.38 to 0.73 with an average of 0.51. This study is anticipated to be useful for developing drought tolerant hybrids and varieties specifically for drought prone areas i.e. A_1 zone and ultimately increase productivity of pearl millet.

Keywords: *Climate-resilience, drought stress, molecular characterization, pearl millet, SSRs*

Development and evaluation of fermented millet beverage.

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Abstract

Millets are small grained, annual warm weather cereals belonging to the grass (Poaceae) family. Millets are under-utilized and often neglected in terms of promotion and research. They are only used as staple by some fraction of the poor in marginalized agricultural regions. Millets are rich in crude fibre, protein, fat, calcium, iron and other minerals and vitamins. They are also rich source of micronutrients and have high nutraceutical and antioxidant properties. In the present study, fermentation is used as a low-cost means of preservation of millet based beverage along with added benefit of viable beneficial microorganisms. The millet flour was analysed for its moisture content, swelling power, water solubility and foaming capacity, ash content, fat content, protein which were found to be 11.09 ± 0.01%, 5.45 ± 0.62, 8.95 ± 0.60, 4.22 ± 0.90, 2.96 ± 0.01%, 1.17 ± 0.10%, 4.37 ± 0.87% respectively. The three components of beverage viz. finger millet flour, jaggery and water were optimized by using Design Expert software. Inoculum isolated from 'Marcha', Lactic acid bacteria (L1) and yeasts (Y1) with count of $5.2X10^5$ cfu/ml and $4.0X10^4$ cfu/ml were used in all combinations at 3% and 0.5% respectively. Emulsifier, xanthan gum was added at 0.05% concentration for all combinations. After inoculation, preparations were incubated at 37! for 8hrs. Parameters such pH, total soluble solids and titratable acidity sensory were analysed for all 14 runs predicted by the software. The combination of 188.0ml of water, 4.0g of millet flour and 8.0 g of jaggery showed maximum desirability of 0.778. The experimental run using this combination resulted in sensory score of 7, pH of 4.4, TSS of 5.2°Brix and microbial load of $6.3X10^6$ cfu/ml L1 and $8.3X10^6$ cfu/ml Y1.

Keywords*: Finger millet; Marcha; Lactic acid bacteria (LAB); Yeast, Fermentation*

Conjoint application of basal and foliar nitrogen improved the growth and yield of sprouting broccoli (*Brassica oleracea* L. var. *italica*) under field conditions

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Abstract

Nitrogen (N) fertilisation plays a crucial role in enhancing the growth and yield of sprouting broccoli (*Brassica oleracea* L. var. *italica*). While higher N application generally promotes better broccoli production, under sub-optimal conditions the crop may require less N, and excessive application can cause environmental issues. Although urea has been the most widely used nitrogenous fertiliser worldwide to fulfil agricultural needs, around 30-35% of the applied urea is lost to the environment due to its low use efficiency. This loss can be minimised through foliar application, which provides faster and more effective results than soil application. Hence, the present study was conducted at the Vegetable Research Centre, G. B. Pant University of Agriculture & Technology, Pantnagar, during the *rabi* seasons of 2023-24 and 2024-25 to assess the combined impact of soil and foliar N applications on growth and yield

performance of sprouting broccoli under field conditions. The field experiment included soil application of urea [50, 75 and 100% of the recommended dose of nitrogen (RDN)], combined with foliar applications of urea (2%) and nano urea (4 mL/L) at 25 and 45 days after transplanting (DAT), in three replications. Results (pooled over both years) indicated that applying 75% RDN through urea along with two foliar sprays of 2% urea at 25 and 45 DAT achieved the maximum plant height (82.68 cm), leaf length (65.30 cm), leaf width (21.18 cm), stem + head length (46.07 cm), stalk diameter (44.70 mm) and total head yield (129.11 q/ha).

Keywords: *Growth, nano urea, nitrogen, sprouting broccoli, urea, yield*

Innovations in Integrated Nutrient Management for Modern Agriculture

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Abstract

Modern agriculture faces a variety of serious challenges, including soil degradation and nutrient imbalances. Climate variability increases these challenges, complicating efforts to sustainably meet the food demands of an expanding population. Integrated Nutrient Management (INM) is a practical and innovative solution for modern agriculture. It combines traditional and advanced techniques to optimize crop nutrient supply, support healthy soils and strengthen resilience against environmental challenges in different farming systems. Integrated Nutrient Management (INM) combines precision agriculture, data-driven fertilizer use, and advanced biofertilizers to optimize nutrient application and boost crop yields efficiently. Remote sensing, satellite imagery and variable-rate technology are now transforming fertilizer use. These tools help farmers apply nutrients at just the right place and time, which reduces waste and increases how efficiently crops use nutrients. One of the biggest advantages of INM is its emphasis on combining organic amendments, like farmyard manure and compost, with chemical fertilizers and biological agents. This practice naturally increases soil organic carbon and encourages greater microbial diversity. These improvements help soil structure and water-holding capacity, making soils more resistant to droughts and floods. INM reduces farmer's dependency on costly synthetic fertilizers and encourages recycling of on-farm resources. It also boosts farm profits by stabilizing crop yields, even when market prices fluctuate or weather conditions change. Balanced crop nutrition through INM prevents nutrient deficiencies and increases both yield and crop quality, helping ensure food security. Additionally, the reduction in fertilizer losses to the environment leads to cleaner water and less air pollution, which benefits the broader ecosystem. With climate change intensifying, healthy soils managed under INM can better withstand extreme weather events, helping safeguard food supply in the future. Supported by government policies, educational outreach, and digital technologies, INM is driving the transition to more sustainable, productive, and eco-friendly agricultural practices worldwide.

Keywords: *Integrated Nutrient Management (INM), Precision agriculture, Biofertilizers, Soil health, Climate variability and Sustainable agriculture*

Microbial concerns on processing and storage of silkworm pupal powder

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Abstract

Microbial enumeration on four edible sericigenous insect species *viz*., *Bombyx mori* L*., Anthrerea proylei* J*., Antherea frithi* M. and *Cricula trifenestrata* were carried out in the Department of Entomology, Post Graduate Laboratory and in collaboration with the Department of Plant Pathology, Assam Agricultural University, Jorhat. Microbial loads/total viable counts (log cfu/g of sample) of the four insect species were varied significantly from one another. Total viable counts of *B. mori, A. proylei* and *A. frithi* silkworm pupal powders stored under ambient temperature (28 to 32°C) had higher bacterial population (3.331, 3.073 & 3.095 log cfu/g), whereas the lowest viable bacterial counts (2.639, 2.520 and 2.564 log cfu/g) were observed in *B. mori, A. proylei* and *A. frithi* silkworm when they stored under temperature at -16 to -21°C. *Cricula trifenestrata* recorded the highest population of bacteria (2.870 log cfu/g) under the temperature (15 to 20°C) and found least (2.075 log cfu/g) stored under the temperature (-16 to -21°C). The highest yeast and mould population (3.102, 3.069, 2.855 & 2.714 log cfu/g) was observed when *B. mori, A. proylei A. frithi* and *C. trifenestrata* pupal powder were stored at -16 to -21°C. Microbial enumeration showed that *B. mori* pupal powder had the highest microbial contamination among the other studied sample. Total viable counts were under the advised limit of fresh minced meat (< 6 log cfu/g, TAC). Through microbial test kits, it was further confirmed the absence of two most common food borne pathogens *i.e., Escherichia coli* and *Salmonella* sp. in all the studied sericigenous insect samples.

Keywords*: Sercigenous insects, bacterial count, yeast and mould count and storage temperature*

Tropical Wetlands under a Changing Climate: Greenhouse Gas Emission Dynamics from Floodplains of West Bengal

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Abstract

Wetlands play a vital role in regulating atmospheric greenhouse gases (GHGs) such as methane (CH,,), nitrous oxide (N, O), and carbon dioxide (CO,), yet our understanding of their emission dynamics in tropical regions remains limited. Although tropical wetlands account for nearly 30% of the world's wetland area, data on their seasonal GHG fluxes and controlling factors are still scarce. In this study, we quantified the seasonal fluxes of CH,, , N, O, and CO, using the closed chamber technique across two floodplain wetlands in West Bengal, India viz. Bortir Beel and Kulia Beel. Emissions of all three GHGs were considerably higher in Bortir Beel, with mean fluxes of 6850 mg m{ ² day{ ¹ for CO, , 537.36 mg m{ ² day{ ¹ for CH,, , and 0.112 mg m{ ² day{ ¹ for N, O. In contrast, Kulia Beel exhibited lower fluxes, averaging 400 mg m{ ² day{ ¹ for CO, , 60.96 mg m{ ² day{ ¹ for CH,, , and 0.071 mg m{ ² day{ ¹ for N, O. Interestingly, the reference upland site in Kulia showed CO, and N, O fluxes nearly six times higher than those at Bortir Beel, suggesting complex spatial variability and the influence of localized environmental factors. Overall, the pronounced differences between the two wetlands highlight the strong impact of pollution and hydrological conditions on GHG emissions. These findings emphasize the need for region-specific assessments of tropical wetland emissions to better inform climate change mitigation strategies.

Keywords: *Greenhouse Gas Emission, floodplain wetlands, CO_2, CH_4, N_2O*

Comprehensive Phytochemical, Nutritional, and Mineral profiling of *Justicia Wynaadensis*: Bridging Traditional Knowledge with Modern Therapeutic Potential

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Abstract

The Acanthaceae family's seasonal plant, *Justicia wynaadensis*, also known locally as Maddu Soppu or Atti Soppu, is historically consumed in Kodagu, Karnataka, during the monsoon month of Aati Maasa due to its therapeutic and healing properties. Because it contains a variety of bioactive substances, it is admired for its rich nutritional and medicinal qualities. The goal of this study was to evaluate *Justicia wynaadensis* phytochemical composition, mineral profile, and protein content.

The maceration procedure was used to prepare the extract after the plant sample had been dried and ground into a fine powder. Phytochemical screening verified the existence of phenols, flavonoids, glycosides, terpenoids, alkaloids, and fixed oils. Moisture (0.995), Ash (0.1476) Protein (6.885 g), Fat (0.68), inorganic matter (4.23 mg), magnesium (1.73 mg), zinc (88.4 mg), and iron (40 mg) were all determined by quantitative analysis. while steroids, quinones, and coumarins were not found, in comparison to the liquid and gum extracts, the powdered extract showed better nutrient retention, suggesting higher stability after drying.

The plant's antibacterial, anti-inflammatory, antidiabetic, and antioxidant benefits are all enhanced due to its bioactive components. These results demonstrate *Justicia Wynaadesis* potential as a functional food and natural source of nutraceuticals, additionally confirming its historic use as a nutrient-rich and pharmacologically significant plant.

Key words*: Moddu Soppu / Atti Soppu, Functional food, Traditional medicine, Seasonal nutraceutical*

Critical period of crop weed competition and its impact on productivity of summer pearl millet

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Abstract

A field experiment was conducted at the Instructional Farm, Department of Agronomy, Navsari Agricultural University, Navsari, during the summer seasons of 2021 to 2023 to determine the critical period of crop-weed competition in summer pearl millet. The experiment consisted of ten treatments, including initial weed-free periods of 10, 20, 30, and 40 days after sowing (DAS) and weedy periods of 10, 20, 30, and 40 DAS, along with a weedy check (un weeded till harvest) and a weed-free check (weed-free till harvest). Treatments were replicated thrice in a randomized block design. The results revealed that maintaining a weed-free condition from 20 to 40 DAS significantly enhanced the grain yield of pearl millet, whereas the lowest yield was observed when weeds were allowed to grow during this period. The significantly higher grain yield (4162 kg/ha) and straw yield (7240 kg/ha) were obtained under treatment W_5 (weed free up to harvest) in pooled results and remained at par with treatments W_4, W_6 and W_7, however significantly lower grain yield (2438 kg/ha) and straw yield (4278 kg/ha) were recorded under treatment W_{10} (weedy up to harvest). The maximum competition between crop and weeds occurred between 20 and 40 DAS, which was identified as the critical period of crop-weed competition. To minimize yield losses, adoption of integrated weed management practices is essential, as it can effectively address weed shifts, delay resistance development, reduce the weed seed bank, and maintain weed populations below the economic threshold level, thereby ensuring sustainable pearl millet production during the summer season.

Keywords: *Critical period, Crop weed competition, Pearl millet, Weed management*

Effect of nano urea on growth and yield of summer pearl millet

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Abstract

A field experiment was carried out during the summer season of the year 2024 at College Farm, N. M. College of Agriculture, NAU, Navsari, Gujarat. The experiment was laid out in randomized block design having ten treatments comprising of T_1 (100 % RDN through urea), T_2 {80 % RDN + Spray of

nano urea at 25 DAS (4 ml L^{-1})}, T_3 {60 % RDN + Spray of nano urea at 25 DAS (4 ml L^{-1})}, T_4 {80 % RDN + Spray of nano urea at 25 DAS + 50 DAS (4 ml L^{-1})}, T_5 {60 % RDN + Spray of nano urea at 25 DAS + 50 DAS (4 ml L^{-1})}, T_6 {80 % RDN + Spray of urea at 25 DAS (2 %)}, T_7 {60 % RDN + Spray of urea at 25 DAS (2 %)}, T_8 {80 % RDN + Spray of urea at 25 DAS + 50 DAS (2 %)}, T_9 {60 % RDN + Spray of urea at 25 DAS + 50 DAS (2 %)}, T_{10} {Control (0% nitrogen)}with three replications. Among the different treatments, application of 80 % RDN + Spray of nano urea at 25 DAS + 50 DAS (4 ml L^{-1}) was recorded significantly higher plant height at 60 DAS (164.90 cm) and harvest (172.87 cm), number of tillers $hill^{-1}$ at 45 DAS (5.65) and at harvest (6.43), number of effective tillers $hill^{-1}$ (2.93), number of ear head m^{-2} (29.31), ear head length (24.97 cm), grain yield (4986 kg ha^{-1}) and straw yield (8528 kg ha^{-1}) and it was statistically at par with the treatments 100 % RDN through urea. Significantly lower growth, yield attributes and yield were recorded under treatment control.

Keywords: *Nano urea, RDN, Pearl millet, Grain and Straw yield*

Genetic Diversity Studies of Bottle Gourd [*Lagenaria siceraria* (Mol.) Standl.] Genotypes using PCA

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Abstract

Research was conducted to assess the genetic diversity among twenty-four accessions of bottle gourd (*Lagenaria siceraria*), comprising twenty-three diverse genotypes and one check variety, Pant Lauki-3. The experiment was laid out in a randomized block design with three replications during the spring season of 2024. To reduce the dimensionality of the multivariate data and identify the most significant factors contributing to genetic variation, Principal Component Analysis (PCA) was performed. PCA is a robust statistical technique that distills a large set of variables into a smaller number of uncorrelated components, where the first principal component accounts for the maximum possible variance. The analysis successfully extracted nine principal components (PCs) that collectively explained a substantial portion of the total genetic variability among the accessions. The results demonstrated that the first principal component, PCA 1, contributed the highest variation at 22.01%. The subsequent components, PCA 2 (15.02%) and PCA 3 (13.61%), further accounted for a considerable proportion of the total variance, confirming that a few initial components sufficiently capture the major patterns of diversity. The distribution of the twenty-four accessions indicated a non-random pattern of scattering across all four quadrants, signifying distinct genotypic groups. The differentiation of these groups was primarily driven by the high contribution of a select few traits rather than a uniform influence from all studied parameters. These findings are instrumental for bottle gourd breeding programs, furnishing critical information on trait associations and grouping. This insight allows breeders to execute targeted selection

strategies for accessions that exhibit superior performance in high yield, desirable fruit quality, and other important agronomic characteristics.

Keywords: *Genetic diversity, PCA, principal components, bottle gourd.*

Enhancement of Seed Viability and Vigour in *Acacia catechu* (Khair) Using Optimized Organic Pelleting Formulations: A Laboratory Assessment

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Abstract

Acacia catechu is a crucial species for reforestation and agroforestry, but its large-scale propagation is limited by low and erratic seed germination. Seed pelleting is a vital pre-sowing treatment that can enhance the microenvironment around the seed. This study was conducted to evaluate the effect of fifteen organic pelleting formulations on the laboratory viability and initial vigour of *A. catechu* seeds. Fifteen treatments (T1 to T15), including combinations of Sawdust, Rice straw, Neem leaf powder and Pongamia leaf powder with soil, vermicompost, or clay, were tested alongside an unpelleted control (T1). The experiment was conducted in a Completely Randomized Design (CRD). Parameters measured included Germination Percentage (GP), Mean Germination Time (MGT), Germination Index (GI), Germination Value (GV), and Peak Value (PV). Data were analysed using One-Way ANOVA and Tukey's HSD post-hoc test. The ANOVA showed a highly significant effect ($P < 0.001$) of the pelleting treatments on all germination and vigour parameters. The treatment Sawdust: soil: vermicompost (1:2:1) (T3) achieved the highest final viability (GP- 61.50%), significantly exceeding the unpelleted control (GP- 37.00%). However, Rice straw + soil (1:1) (T5) demonstrated the best overall vigour, recording the highest Germination Index (GI- 3.37) and the shortest Mean Germination Time (MGT- 2.73 days). Conversely, treatments with high clay content, such as Pongamia + clay (1:2) (T12), performed poorly, showing significant inhibition compared to the control. The Rice straw + Soil (1:1) and Sawdust: soil: vermicompost (1:2:1) formulations are identified as the optimal candidates for rapidly and effectively boosting *Acacia catechu* seed quality. This finding provides a crucial, reliable, and cost-effective method to improve the quality of planting material, laying the foundation for successful nursery production and field establishment of this valuable tree species.

Keywords: *Acacia catechu, Seed Pelleting, Germination, Viability, Laboratory.*

Expression Of Heterosis for Yield and Associated Parameters in Okra Genotypes

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Abstract

Twelve genotypes of okra and their 66 F_1 crosses derived by diallel pattern of crossing without reciprocals were studied to evaluate the extent of heterosis for yield and yield attributing parameters. The magnitude of heterosis differed for all the characters examined in all crosses. As earliness is desirable character, negative heterosis is preferable for days to 50% flowering and days to edible fruit maturity. Beneficial heterosis for days to 50% flowering *i.e.,* crosses which exhibited significant negative heterosis was observed in crosses Sel-4 × Pusa Makhmali (-8.82 %) over mid parent, Sel-4 × VRO-3 (-10.32 %) over better parent and Sel-4 × VRO-3 (-6.89 %) over standard check. Out of 66 hybrids, 50, 32 and 38 F1 hybrids exhibited positive significant heterosis over mid parent, better parent and standard check respectively for fruit yield per plant and fruit yield per hectare and the highest was reported in IC-45831 ×IC-43733 (MPH= 59.01, BPH= 56.1 and SPH= 11.36) followed by IC-45831 ×Pusa A-4 (MPH= 50.03, BPH= 34.56 and SPH= 16.53). The best performing hybrid IC-45831 ×IC-43733 which recorded 11.36 per cent heterosis for yield over standard check may be exploited for commercial cultivation.

Keywords: *Okra, heterosis, diallel analysis, hybrids and fruit yield*

Ameliorative Role of Biochar and Nano DAP in Mitigating Sewage Sludge-Induced Cadmium Stress in *Praecitrullus fistulosus*

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Abstract

Sewage sludge (SS) is valued for its nutrient-rich properties but often contains cadmium (Cd), posing risks to plant growth and human health. Cadmium stress has a big impact on plant growth. It disrupts important physiological and biochemical functions. This stress slows down nutrient intake, which leads to slower development and reduced biomass. Cadmium also creates reactive oxygen species that cause oxidative stress, damaging cell components such as lipids, proteins, and DNA. This damage lowers chlorophyll levels, making photosynthesis harder and stunting growth. Cadmium's toxicity disrupts hormone balance, enzyme activity, and cell structure, resulting in poor plant growth and lower agricultural output. Acidified biochar can effectively address this issue. Biochar has a high cation exchange capacity and contains oxygen-rich functional groups that help immobilize heavy metals in the soil through surface complexation and precipitation. Treating biochar with acid increases cadmium immobilization by providing more adsorption sites. It can greatly improve plant growth by enhancing soil structure, promoting water retention, and boosting microbial activity as a slow-release nutrient. Cadmium (Cd) contamination from sewage sludge (SS) is a critical challenge for sustainable agriculture, as it suppresses plant growth, disrupts nutrient uptake, and reduces crop yield. This study evaluated the ameliorative

role of rice husk biochar (RHB) and Nano-diammonium phosphate (Nano-DAP) in mitigating sewage sludge–induced cadmium stress in *Praecitrullus fistulosus* (Tinda). The experiment included eight treatments: control, SS alone, SS + Cd, SS + Cd + biochar, SS + Cd + Nano-DAP, and their combinations. Results showed that cadmium stress (SS + Cd) significantly reduced plant height (36%), leaf area (50%), biomass, photosynthetic pigments, and fruit weight (45%) compared to control. Physiological parameters such as chlorophylls, carotenoids, and nutrient uptake (P and K) also declined sharply under Cd stress. Application of biochar improved soil properties by immobilizing Cd, while Nano-DAP alleviated nutrient deficiencies, both contributing to partial recovery of plant growth and yield. The combined treatment (SS + Cd + RHB + Nano-DAP) was most effective, improving plant growth and fruit weight by ~45% and reducing Cd accumulation in shoots by ~50%. Two-way ANOVA confirmed highly significant effects of treatments on both morphological and physiological parameters ($p < 0.0001$). These findings highlight the potential of integrated **biochar–nanofertilizer strategies** for sustainable management of heavy metal–contaminated soils and safe crop production.

Keywords: *Cadmium toxicity, sewage sludge, Praecitrullus fistulosus, biochar, nanoDAP, phytoremediation*

Assessing impact of novel eco-friendly iron nanoparticles synthesized via green route on grapevine cv. Thompson Seedless

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Abstract

Eco-friendly nanoparticles of iron were synthesized through novel green route using grapevine cv. Manjari Medika pomace. The obtained product (assumed as Fe-NPs) was subsequently characterized by Fourier Transform Infrared Spectroscopy (FTIR), UV-Vis spectra, Scanning Electron Microscopy (SEM) and Particle Size Analysis (PSA) techniques. The appearance of two well-defined peaks at 433.98 and 518.85 cm^{-1} were due to the presence of iron- oxygen (Fe-O) bond which confirmed that the synthesized nanoparticles are iron oxide. The morphology of Fe-NPs was monitored by SEM analysis and the particles were found in spherical form. The size of iron nanoparticles synthesized was found to be 74.52 nm. To assess the impact of iron nanoparticles on grapes, 2 years field experiments were conducted. A significant increase of +47.26% in chlorophyll concentration was recorded on applying iron- NPs over conventional iron sulphate since iron takes part in electron transport during photosynthesis and deficiency of iron leads to interveinal chlorosis. The petiole iron content increased from 161.76 to 174.13 ppm and leaves iron content increased from 567.53 to 580.73 ppm. An increase of +12.50, 12.28, 24.07, 4.17 and 4.09 was recorded in 50 berry weight, bunch count, bunch weight, berry size and berry firmness respectively after application of iron nanoparticles over conventional iron sulphate. Application of iron-NPs acted as novel trigger for inducing the secondary metabolic pathway (biosynthesis) of L-Tyrosine, 2-Oxo-3- phenylpropanoate, L-Methionine as compared to conventional iron sulphate. These findings

suggested that iron nanoparticles have potential applications and could be used as a promising candidate for enhancing iron content in grapes.

Keywords: *Nanoparticles; iron; grapes; scanning electron microscopy; particle size analysis*

Correlation of ELISA and FAVNT for Assessing Age-Specific Antibody Responses in Pigs Vaccinated Against Classical Swine Fever Virus

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Abstract

This cross-sectional study aimed to evaluate the temporal dynamics and persistence of antibody responses in pigs following vaccination against Classical Swine Fever Virus (CSFV), a highly contagious and economically significant disease affecting swine populations in India. The objectives were to assess post-vaccination immune status, analyse age-wise variations in antibody titres, and establish the relationship between Indirect Enzyme-Linked Immunosorbent Assay (ELISA) and Fluorescent Antibody Virus Neutralization Test (FAVNT) results to improve seromonitoring accuracy. Serum samples were obtained from vaccinated pigs (**n = 3784**), and **5% of these samples** were subjected to FAVNT for comparison with ELISA titres. Age-wise comparison using one-way ANOVA revealed statistically significant differences ($p < 0.05$) in antibody titres, with younger pigs (<6 months) showing lower seropositivity compared to those aged 6–8 months, where antibody titres peaked. A strong positive Pearson's correlation ($r > 0.8$, $p < 0.01$) was observed between ELISA optical density values and FAVNT titres, indicating excellent agreement and validating the use of ELISA as a reliable screening tool for large-scale seromonitoring. The results demonstrated that protective antibody levels were maintained for nearly one-year post-vaccination, reflecting sustained vaccine-induced immunity in most pigs. These findings emphasize the importance of integrating both ELISA and FAVNT assays for accurate immune assessment. Overall, this study provides crucial insights into the duration and magnitude of CSFV vaccine-induced immunity.

Keywords: *ELISA, FAVNT, CSFV, pigs, post vaccination immunity, antibody titres*

First Report of the Invasive Giant Resin Bee *Megachile sculpturalis* in Uttarakhand with Notes on Host Plant Associations and Pollinator Interactions

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Abstract

Bees are crucial pollinators, playing a vital role in maintaining biodiversity, supporting ecosystems, and ensuring food security through their pollination services. They contribute not only to the reproduction of a majority of flowering plants but also to agricultural productivity worldwide by facilitating the pollination of many crops. *Megachile sculpturalis* Smith, 1853, a solitary resin bee native to the Eastern Palaearctic region, is an invasive species known for its rapid spread and potential ecological impacts. This study documents the first record of *M. sculpturalis* in the Almora district of Uttarakhand, India, providing detailed taxonomic descriptions based on morphology. Observations reveal its polylectic foraging behavior with new host plant associations documented. Although *M. sculpturalis* does not exhibit aggressive territorial behavior, its presence poses risks to native pollinators by competing for nesting sites and foraging resources, potentially disrupting local pollination networks. The invasion by this bee may have repercussions on native biodiversity and ecosystem services. The study highlights the urgent need for early detection, monitoring, and management strategies to contain its spread. The use of bee hotels for monitoring coupled with citizen science involvement is recommended as effective tools for population tracking. This research provides essential baseline data for understanding the distribution and ecological interactions of this invasive pollinator in India, forming a foundation for conservation measures and management plans aimed at safeguarding native pollinators and ecosystem health.

Keywords: *Bees, Megachile, invasive species, pollinators, taxonomy, host plant interactions, biodiversity conservation, native pollinators.*

Humic Acid and Seaweed Extract Foliar Spray: A Promising Approach to Enhance Chlorophyll, Proline, and Quality in Custard Apple cv. Balanagar

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Abstract

This study investigated the effects of foliar application of humic acid (HA) and seaweed extract (SWE) at varying concentrations (1000, 2000, and 3000 ppm) on the physiological and quality parameters of custard apple (*Annona squamosa* L.) cv. Balanagar. The combined application of HA and SWE significantly influenced plant growth, flowering, fruiting, and fruit quality traits. The treatment comprising HA @ 3000 ppm + SWE @ 2000 ppm recorded the highest plant height, number of flowers per branch, number of fruits per plant, total chlorophyll content, photosynthetically* active radiation (PAR), total soluble solids (TSS), ascorbic acid, and total sugars. Conversely, this treatment resulted in the lowest proline content and titratable acidity. The findings highlight the synergistic potential of HA and SWE as effective biostimulants for enhancing growth, yield, and fruit quality in custard apple. This approach offers a sustainable and eco-friendly strategy for improving productivity and fruit quality in perennial fruit crops.

Utilization of Digestate from Compressed Bio Gas (CBG) on the crops

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Abstract

Modern agriculture faces critical challenges including declining soil health, over-reliance on chemical fertilizers, and rising production costs due to fossil fuel dependency. Inorganic fertilizers, while essential for boosting crop yields, are energy-intensive to produce and contribute significantly to greenhouse gas emissions. Additionally, excessive use of these fertilizers leads to nutrient leaching. water pollution, and long-term deterioration of soil health. Digestate, a nutrient-rich by-product of compressed biogas (CBG) production, emerges as a promising solution. When used as an organic fertilizer, digestate not only supplies essential nutrients but also enhances soil microbial activity, improves organic carbon content, and supports sustainable crop production. Its integration with chemical fertilizers has shown to improve nutrient use efficiency while reducing the environmental footprint of farming. There is a great potential for digestate use in agriculture, particularly in combination with chemical fertilizers. Pandey et al. (2019) on rice. Yadav et al. (2017) on mustard-maize, and Kumar et al. (2021) on wheat, demonstrated that using digestate significantly improves crop yield and soil health. These findings support digestate as a key input in promoting sustainable and climate-smart agriculture.

Abiotic Stress in Enhancement of Phytochemicals in Crop Plants: Integrating Plant-Microbe Interactions for Global Agricultural Sustainability

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Abstract

Climate change has significantly intensified abiotic stresses, including drought, salinity, temperature extremes, and heavy metal contamination, thereby threatening global food security. However, these environmental challenges simultaneously present opportunities to enhance the nutritional and therapeutic value of crops through stress-induced phytochemical accumulation. When subjected to abiotic stress, crop plants activate complex biosynthetic pathways—particularly the phenylpropanoid, shikimic acid, and terpenoid routes—leading to the production of bioactive secondary metabolites such as flavonoids, phenolic acids, anthocyanins, and carotenoids, which possess significant health-promoting properties in plants. Importantly, the plant-associated microbiome, comprising plant growth-promoting rhizobacteria (PGPR), endophytic fungi, and arbuscular mycorrhizal fungi (AMF), plays a crucial role in modulating both stress tolerance and phytochemical biosynthesis. Specifically, beneficial microorganisms such as Bacillus, Pseudomonas, and Rhizophagus species enhance plant resilience through multiple mechanisms, including the production of phytohormones, siderophores, and microbial elicitors that activate Induced Systemic Resistance (ISR) and upregulate genes encoding biosynthetic enzymes. These integrated plant-

microbe interactions offer multiple agricultural benefits, including improved crop resilience and superior nutritional quality. Thus, this interdisciplinary research domain (including Agricultural, microbial and biochemical) provides transformative strategies for developing climate-resilient, nutrient-dense crops that simultaneously address food security challenges in a rapidly changing global environment.

Keywords: *Abiotic stress, phytochemicals, PGPR, Induced systemic resistance, biosynthetic pathways*

Hydroponics Fodder Production Through Low-Cost Devices at KVK Farm

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Abstract

Hydroponics fodder production through low-cost devices is an effective solution for the fodder scarcity and is a very promising technology for sustainable livestock production in different regions of India. Hydroponics fodder can be grown in different types of low-cost devices, which can be divided, from bamboo, wood brick masonry or lean to structure using the sidewall of the house. The net profit of the small ruminant farmers increase due to improved milk yield with increase milk fat, improvement in health and conception rate of the small ruminant, reduction in feed requirement, reduction in labour cost, requirement of less space and water, freshness and high palatability of the hydroponic fodder etc. During last two month, 26 farmers visited at KVK, Bhilwara, who had adopted the technology for production and feeding of hydroponic fodder production through different types of low-cost devices. Hydroponic fodder can be grown in different types of low-cost devices with locally available or homegrown grains. The cost of production of the hydroponics fodder was about Rs.1.50 per kg fresh fodder if seed was home grown, however, if seed was purchased from the market, the cost of production of the same was little bit higher (Rs. 2-3 per kg fresh fodder).

Keywords: *Low cost, Devices, hydroponics, fodder.*

Study on Yellow discoloration issue of Pangasius fillets cultured in Pond and Cage

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Abstract

Pangasius fillets have become an affordable substitute for the white fleshed fish in the aqua product markets due to its tender white flesh, good textural properties and high nutritive value. However, the Indian farmers encounter difficulties in meeting this market demands due to the increased feed price and poor fillet quality. The fillet quality is determined by several factors like culture environment, feed supplied etc. Towards this goal, study was conducted in pond and cage cultured pangasius samples of varying size groups. Pangasius of size groups ranging from 250 to 1000g (±200g) were taken from both pond and cage environments and the fillets prepared were evaluated for its quality during ice storage. There was a significant difference in yellowness b* value and other biochemical parameters among the three different size groups cultured in different environments. The xanthophyll content was in correlation with the b* value showing the increased pigment deposition during storage. The feed and water quality parameters were also ascertained from the respective sampling locations. Conclusively, the work focuses to identify the reasons for yellow discoloration in pangasius fillets, pertaining to its growth and culture environments.

Key words: *Pangasius, quality, sensory, color, algae.*

Livelihood security through KVK interventions

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Abstract

Agriculture and allied sectors form the foundation of livelihood and food security in arid regions like the Churu district of Rajasthan, where farming is challenged by low rainfall, poor soil fertility, and limited irrigation. The Krishi Vigyan Kendra (KVK), Sardarshahr, Churu, under ICAR, plays a crucial role in ensuring agricultural security and sustainability through the dissemination of location-specific technologies and farmer-oriented interventions. The KVK promotes various technologies such as soil and water testing, seed processing, front-line demonstrations, Azolla units for green fodder production, drought-tolerant fruit nurseries, and custom-hiring of farm machinery—all aimed at improving productivity, resource use efficiency, and livelihood resilience. Special emphasis is given to empowering women in agriculture through gender-friendly technologies like improved sickles and weeders, kitchen gardening models for household nutrition, backyard poultry units, vermicomposting, value addition of farm produce, and training in small-scale processing of pulses and spices. These initiatives enhance the income, nutritional, and social security of rural women while reducing drudgery and promoting entrepreneurship. By integrating crop, livestock, and horticulture-based interventions, the KVK strengthens seed, fodder, and income security across the region. Its continuous efforts in training, capacity building, and digital extension have enhanced resilience and sustainability among the farming community. Strengthening such institutional linkages and promoting climate-smart, women-inclusive technologies will be essential to ensure long-term security, sustainability, and equitable growth in the agriculture and allied sectors of Churu district.

Keywords: *Azolla, KVK, Technologies*

Impact of Different Fodder Crops on Feed Utilization and Productivity of Kenkatha and Non-descript Cattle under Bundelkhand Conditions

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Abstract

This controlled feeding trial compared fodder-crop productivity (dry matter yield and nutritive parameters) and evaluated the effects of three cultivated fodder crops Sorghum (Sorghum Sudan Grass), SugarGraze (a high-yielding hybrid/variety of sorghum-type forage), and Pearl Millet (Kaveri Nutricut Hybrid Bajra) on feed intake and production parameters in two cattle groups (Non-descript and Kenkatha) at Banda University of Agriculture & Technology. Crop productivity was measured across replicated plots (n=10 per fodder) for dry-matter yield (t/ha), crude protein (CP, %), and NDF (%). A feeding trial used 72 animals (2 breeds × 3 fodder treatments × 12 animals/treatment) run for a standard 90-day feeding period; individual average daily dry matter intake (DMI), milk yield (kg/d), and average daily body weight change (kg/d) were recorded. Data were analyzed using two-way ANOVA (Breed, Fodder, Breed×Fodder), with Tukey post-hoc pairwise comparisons and correlations between fodder nutritive value and animal responses. In the simulated dataset, fodder type had a highly significant effect on intake ($P < 0.001$) and milk yield ($P < 0.001$); breed had significant effects on milk yield and intake. SugarGraze produced the highest DM yield and CP, and animals fed SugarGraze exhibited higher DMI and milk yield. Results demonstrate the potential productivity benefits of high-yielding, higher-CP fodder varieties for smallholder systems using indigenous cattle such as Kenkatha, and provide a template for replicable experimental design and statistical evaluation.

Keywords: *Sorghum, SugarGraze, Pearl Millet, Kenkatha, feed intake, fodder productivity, dry-matter yield*

Unleashing the effect of Pink Pigmented Facultative Methylotroph (PPFM) Seed Coating on Germination and Storability of Greengram (*Vigna radiata L.*)

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Abstract

Microbial seed coating technology has emerged as a sustainable approach to enhance seed quality, germination, and storage potential in pulse crops. Among the plant growth-promoting microorganisms, Pink Pigmented Facultative Methylotrophs (PPFM) are gaining significance for their ability to improve plant growth, seedling vigour, and stress tolerance through the production of phytohormones and other beneficial metabolites. The present study was undertaken to evaluate the influence of PPFM seed coating on the storage potential and viability of greengram (*Vigna radiata L.*) seeds var. CO 9 during prolonged storage under ambient conditions. Freshly harvested greengram seeds var. CO 9 were coated with different concentrations of PPFM inoculum, and their physiological and biochemical parameters were assessed at periodic intervals during storage. Among the treatments, seeds coated with PPFM @ 35 ml/kg of seed exhibited superior performance by maintaining the highest germination percentage and vigour index after six months of storage. The PPFM-coated seeds recorded 82 per cent germination after six months of storage, compared to 68 per cent in the untreated control. In addition, the PPFM-treated seeds showed enhanced seedling length, higher dehydrogenase activity, and better maintenance of membrane integrity, which collectively contributed to improved seed storability. The beneficial effects of PPFM coating may be attributed to its ability to colonize the seed surface and release growth-promoting substances such as cytokinins and auxins, which delay seed deterioration and sustain metabolic activity during storage. The study clearly demonstrates that coating greengram seeds with PPFM @ 35 ml/kg not only enhances initial seed quality but also preserves germination and vigour over an extended storage period. This eco-friendly microbial seed treatment could serve as a promising strategy for improving the longevity and field performance of pulse seeds under ambient storage conditions.

Keywords: *Greengram, PPFM, seed coating, storage potential, germination, vigour, seed quality*

Identification of effector proteins of *Spodoptera frugiperda* through diet-specific transcriptome analysis

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Abstract:

Insect/pests release saliva while feeding on plants, which contains effector proteins that modulate plant defence responses. The fall armyworm, *Spodoptera frugiperda*, is one of the world's destructive polyphagous pests which feeds on multiple crop species. Despite severe economic losses caused by this insect, very limited information is available on the effector proteins produced by it.

To explore these effectors, transcriptome datasets of *S. frugiperda* larvae reared on different diets, for example artificial diet, tomato and chickpea plants, were generated and analysed. Several genes were found to be upregulated in the salivary glands of plant-fed larvae upon comparing the gene expression patterns between plant-fed larvae and artificial diet-fed larvae. Using secretome prediction tools, secretory proteins were identified among the differentially expressed genes. We hypothesized that these included potential effector candidates of *S. frugiperda*.

In-silico protein interaction studies revealed several effector candidates that interact with plant immune pathway proteins. These analyses identified possible plant targets for several salivary candidates, providing clues on how the insect may alter plant defence machinery.

Overall, this study highlights a set of potential effector proteins of *S. frugiperda* and provides early evidence on their likely interaction with key defence-related proteins of host plants. These findings contribute to better understanding of insect-plant molecular interactions, thus offering a basis to design strategies for improved crop protection in future.

Key words: *Spodoptera frugiperda, transcriptome, secretome, effector proteins.*

Characterization, Phylogeny and Diversity Study in Pigs of Bastar Region of Chhattisgarh State Through Mitochondrial Dna D-Loop Nucleotides Sequence

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Abstract

As there is no recognized breed of pig from Chhattisgarh state this study was aimed to characterize the pig in view of preserving rich indigenous genetic resources biodiversity and to investigate genetic diversity, relationship and matrilineal lineage of Bastar pigs. The data were recorded on about 1500 pigs (of different age groups) at random from homogenous population from different areas of Bastar region comprising Narayanpur, Bastar and Dantewada district on various parameters as per the standard guidelines and format of NBAGR Karnal for characterization of the pig breed. For genetic/molecular characterization of the pigs, a total 60 blood samples were collected from different pockets of Bastar region. The *Chhattigarhi* pigs are of medium size, generally black in colour and their body is covered with medium sized bristles, have medium size horizontal ears with long straight snout and straight back. Principal Component Analysis extracted 5 components and first principal component comprising body measurements alone accounts 70% describing the general size & shape of the animal. The D loop region of different pig populations was sequenced and analyzed to identify distinct mtDNA haplotypes and it was found that non protein coding sequences of Bastar region pig sample had 06 polymorphic sites in a patch of 313 bp. The pig population under study had a total of 33 haplotypes with haplotype (gene) diversity of 0.275. Two of the Bastar region samples were identified as singletons in haplogroups 32 & 33. From the above study it may be concluded that the indigenous pigs of Chhattisgarh state have good performance and systematic breeding plan for their selection is needed. The multi variate approach has proven to be effective in differencing Bastar pigs from other indigenous breeds of India with clear morphometric differences that help in identifying the pure phenotype for future propagation.

Keywords*: Indigenous pig, Bastar, Phenotypic traits, Descriptive traits, Carcass traits, Mitochondrial DNA, D-loop, phylogenetics, genetic diversity*

Application of biofertilizers in mango orchards (cv. Dashehari) to modulates the physicochemical and biological profile of soil.

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Abstract

This study investigated the influence of biofertilizer applications on key physico-chemical attributes of soil in mango (Mangifera indica L.) orchards under Jhalawar conditions. A field experiment was conducted using randomized block design with three replications, evaluating various combinations of Azotobacter, Phosphate-Solubilizing Bacteria (PSB), and vermicompost. Soil samples collected from the rhizosphere were analyzed before and after the experimental period for pH, electrical conductivity (EC), organic carbon content, and the availability of major nutrients (N, P, K).

Results revealed that combined applications of Azotobacter (50 g/plant), PSB (50 g/plant) and vermicompost (3 kg/plant) significantly improved soil health indicators. The consortium treatment markedly reduced soil pH and EC, while enhancing organic carbon and the availability of nitrogen, phosphorus, and potassium, compared to control and single biofertilizer applications. Specifically, the lowest soil pH (7.51) and EC (0.35 dS/m), alongside the highest organic carbon (0.75%), available nitrogen (341.87 kg/ha), phosphorus (24.92 kg/ha), and potassium (356.81 kg/ha) were recorded under the combined treatment. These improvements are attributed to enhanced microbial activity, increased nutrient cycling, and better retention of soil moisture and organic matter. The findings underscore the potential of integrating biofertilizers as an eco-friendly strategy to ameliorate soil quality and sustainability in fruit crop production systems. Adoption of these practices can contribute to reduced reliance on chemical fertilizers and promote long-term soil health for sustainable horticultural productivity.

Keywords:*Biofertilizers, Mango, Nutrient Management, Ecological Restoration, Environmental Sustainability.*

In vitro efficacy of different combi fungicides, bio-agents and neem formulations against Alternaria blight of cumin

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Abstract

Cumin (*Cuminum cyminum* L.) is an important seed spice crop commonly known as "Zeera", belongs to family *Apiaceae* (*Umbelliferae*) under order *Apiales* and genus *Cuminum.* This spice crop is subjected to many diseases causing pathogens which negatively influences the yield. Among various biotic stresses, Alternaria blight of cumin incited by *Alternaria burnsii* is second most economically important disease

after wilt. *Alternaria burnsii* pathogen is major constraint resulting in significant economic loss in cumin production. At present the disease is prevalent in all the cumin growing regions of India. The effectiveness of different new generation fungicides, bio-agents and neem formulations were tested using the poisoned food and dual culture techniques. All the fungicides significantly inhibited the mycelial growth of *Alternaria burnsii*. Among fungicides, the combi fungicide Tebuconazole 50% + Trifloxystrobin 25% WG was found most effective and showed minimum mycelial growth of 2.20, 0.00 and 0.00 mm and 97.56%, 100% and 100% growth inhibition at 0.20%, 0.25% and 0.30% concentrations, respectively and this was followed by Azoxystrobin 18.2% + Difenoconazole 11.4% SC. Azadirectin was found least effective with 56.50, 53.20 and 48.03mm mycelial growth and 37.22%, 40.89% and 46.63% growth inhibition at 0.10% 0.15% and 0.20% concentrations, respectively.

Keywords- *Apiaceae, Alternaria burnsii, combi fungicides, bio-agents, neem formulations, combi fungicide.*

Crop protection technology and precision agriculture

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Abstract

Crop production technology and precision agriculture represent transformative approaches in modern farming, improving input-use efficiency, and promoting environmental sustainability. With increasing food demand, shrinking natural resources, and climate variability, farmers are shifting from conventional practices to scientifically managed and technology-driven systems. Crop production technology includes the adoption of high-yielding and optimal nutrient and water management strategies, mechanization, and integrated pest and disease control methods. These techniques contribute to improved soil health, efficient resource management, and enhanced yield stability under diverse agro-ecological conditions. Precision agriculture complements these advancements by incorporating satellite-based remote sensing, drones, GIS, GPS-guided machinery, soil and crop sensors, and artificial intelligence tools to monitor field variations and apply inputs site-specifically. This technology-driven approach ensures precise delivery of water, fertilizers, and pesticides according to crop requirements, thereby reducing input waste, production costs, and negative environmental impacts. Real-time data collection and smart decision-support systems help farmers evaluate crop performance, predict risks, and implement timely interventions. As a result, precision-based crop systems foster sustainable intensification, climate-resilient agriculture, and improved farm profitability.

The integration of crop production technology with precision agriculture is essential for achieving future food security goals while maintaining ecological integrity. This study highlights the significance of modern crop production and precision agriculture approaches and underscores their role in shaping a sustainable and productive agricultural future.

Keyword: *Precision agriculture; Crop production technology; Remote sensing; Resource-use efficiency; Sustainable farming; Smart farming.*

Applications of Livestock Monitoring Devices and Machine Learning Algorithms in Animal Production and Reproduction

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Abstract

The integration of livestock monitoring devices with machine learning (ML) algorithms has emerged as a transformative approach in modern animal production and reproduction systems. These technologies form the foundation of Precision Livestock Farming (PLF), which utilizes real-time data to enhance productivity, animal welfare,andsustainability. Livestock monitoring devices such as accelerometers, pedometers, RFID tags, GPS trackers, and biosensors continuously record parameters including feed intake, body temperature, movement patterns, heart rate, and environmental conditions. The data collected are processed through ML algorithms to identify patterns, detect abnormalities, and make predictive assessments. For instance, predictive models can forecast growth rate, feed conversion efficiency, or early signs of disease, enabling timely management interventions that reduce losses and improve overall efficiency.

In the field of reproduction, machine learning applications have shown remarkable potential in estrus detection, ovulation prediction, pregnancy monitoring, and identification of reproductive disorders. Devices such as vaginal sensors, activity monitors, and thermal cameras generate precise data that ML models analyze to determine optimal breeding times or detect fertility-related issues. Advanced algorithms can also interpret image and sound data to recognize behavioral cues associated with reproductive events, enhancing the success rate of artificial insemination programs.

Moreover, ML-driven analytics help optimize herd management by integrating data from multiple sources nutrition, health, genetics, and environment—offering holistic insights for decision-making. . In conclusion, the combination of livestock monitoring devices and machine learning algorithms represents a major advancement in the livestock sector. By transforming raw data into actionable insights, these technologies enable data-driven decisions that enhance productivity, reproductive efficiency, and overall farm profitability, paving the way toward a more sustainable and intelligent livestock production system.

Keywords *-Precision Livestock Farming; Machine Learning; Livestock Monitoring; Animal Production; Reproduction; Artificial Intelligence; Smart Farming.*

Prolonging Mango Freshness through Application of Nano-Hexanal

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Abstract

Postharvest deterioration of mango (*Mangifera indica* L.) is a critical constraint in the fresh fruit supply chain, primarily due to rapid ripening, softening, and cellular membrane disintegration. Hexanal, a natural C† aldehyde, has been reported to inhibit phospholipase D activity, thereby stabilizing membrane integrity and delaying senescence. However, its high volatility and rapid dissipation limit field-scale application. The present investigation aimed to develop and evaluate a nanoformulated delivery system of hexanal to achieve controlled release and prolong mango freshness. A stable hexanal nanoemulsion was synthesized using a biocompatible surfactant system through high-energy ultrasonication. The resulting Nano-Hexanal was characterized for droplet size distribution, polydispersity index and zeta potential, confirming nanoscale stability and uniformity. Mature green mango fruits were treated with optimized Nano-Hexanal concentrations and stored under ambient conditions. Postharvest parameters including weight loss, firmness, peel color (L*, a*, b* values), total soluble solids, titratable acidity, and sensory attributes were periodically evaluated. Treated fruits exhibited significantly delayed ripening and extended marketable shelf-life by 6–8 days compared with untreated controls. The study demonstrates that Nano-Hexanal effectively modulates physiological and biochemical changes during mango storage, offering a sustainable, residue-free, and environmentally benign approach for postharvest preservation.

Keyword *- Hexanal nanoformulation, Mango, Postharvest preservation*

Impact of drought stress on grain and bran nutritional profiles in contrasting rice genotypes

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Abstract

Drought is a key environmental element that affects rice (*Oryza sativa* L.) productivity and quality. Control and drought treated rice grain (milled) and bran fractions of two contrasting rice genotypes (N22-drought-tolerant and IR64-droughtsensitive) were evaluated based on proximate composition, vitamins, minerals, and nutritional quality indices. Except for carbohydrates and amylose content, bran from both genotypes had higher concentrations of all parameters (proximate, minerals, vitamins, phenols, amino acids, and phytic acid) analyzed in this study. Protein level ranged from 9–11% in grain to 13–15% in bran. Macronutrients (Na, Ca, K, Mg, P) increased after drought in both genotypes. Under drought, thiamine level ranged from 0.07 to 1.97 mg/100 g, riboflavin level from 0.02 to 0.43 mg/100 g, and á-tocopherol from 1.67 to 8.34 mg/100 g in both fractions. N22 showed higher amylose (20.44% and 4.84%) and phenol (0.46 mg/GAE and 2.54 mg/GAE) content in both grain and bran fractions under drought condition. Proline accumulated at higher concentration (2.732 g/100 g) than

other amino acids in N22 under drought. Phytic acid ranged from 0.213 to 2.752 g/100 g in drought. To the best of our knowledge, this is the first preliminary report on nutritional quality analysis of rice grain and bran under drought stress. The current findings may help breeders in development of high-quality, drought-tolerant rice varieties, and will also provide a strong foundation for utilizing bran as an essential food ingredient to improve human nutrition and may help breeders to use this tolerant genotype as better parents in further crossings.

Keywords*: Drought, Rice, Grain, Bran, Nutrition*

Nano biochar and mineral fertilizer impacts soil properties and rice yield

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Abstract

The efficient use of agriculture waste biomass and chemical fertilizer is necessary due to the increase in the food demand and water scarcity. The application of biochar has been proved as a beneficial strategy. Biochar is a carbon-rich material produced through the pyrolysis of organic biomass under limited oxygen conditions. When this biochar is further processed using techniques such as ball milling, ultrasonication, or chemical oxidation, its particle size is reduced to the nanoscale, resulting in the formation of nanobiochar. This nanosized form exhibits enhanced surface reactivity, porosity and adsorption capacity; making it more effective in improving soil properties and crop productivity. Owing to these characteristics, nanobiochar can be efficiently loaded with essential nutrients to serve as a slow-release fertilizer. Experimental results showed that application of potassium loaded nanobiochar along with mineral fertilizer has showed remarkable improvements in soil properties and rice yield. It enhanced soil organic carbon, cation exchange capacity and nutrient availability. This combination further improved both active and passive soil carbon fractions, along with key hydro-physical properties such as soil moisture content, infiltration rate and maximum water-holding capacity. The improved soil structure and moisture retention foster better root growth and nutrient uptake. Consequently, rice plants exhibit enhanced biomass accumulation, higher grain yield and improved overall productivity under nanobiochar-amended soils.

Keywords: *Nano biochar, Soil fertility, Hydro-physical properties, Rice yield*

Identification of novel probiotic strains from camel milk/buffalo colostrum of India

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Abstract

Camel milk and buffalo colostrum symbolize unique and underexplored sources of beneficial microbiota in India, holding significant potential for probiotic innovation within the dairy sector. Unlike traditional

probiotic sources such as cow milk and fermented foods, these substrates provide distinctive ecological environments rich in bioactive compounds, immunoglobulins, and stress-resistant microbial communities. This study concentrates on the isolation, identification, and functional analysis of novel probiotic strains from raw camel milk and buffalo colostrum collected from select regions of Rajasthan and North India. Standard microbiological techniques were used for initial culturing, followed by phenotypic screening of lactic acid bacteria (LAB) and related genera. Advanced molecular identification through 16S rRNA gene sequencing was employed to determine strains at both species and strain levels. The isolates were tested for key probiotic characteristics, including acid and bile tolerance, surface hydrophobicity, antimicrobial activity against common intestinal and foodborne pathogens, and ability to adhere to intestinal epithelial cell models. Additional assessments measured exopolysaccharide production, antioxidant activity, and enzymatic activities, including â-galactosidase, supporting improved lactose digestion. Safety screening involved hemolytic activity, antibiotic resistance profiling, and ensuring the absence of transmissible virulence factors. Selected strains showing superior probiotic potential were incorporated into model fermented dairy products to evaluate fermentation behavior and sensory qualities. The main goals of this research include discovering novel, culturally relevant probiotic strains tailored for Indian dietary habits and lactose-intolerant groups. These strains could facilitate the development of functional dairy products with added health benefits like enhanced gut health, immune support, and antioxidant effects. Overall, the study aims to expand India's traditional probiotic resources, promote value addition in camel and buffalo dairy sectors, and enhance commercialization opportunities for region-specific functional foods.

Keywords*: Camel milk, Buffalo colostrum, Probiotics, Indigenous strains, Gut health,*

Exploration of physiological and biochemical processes of onion (*Allium cepa* L.) as affected by water deficit and exogenous plant growth regulators under drought stress

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Abstract

Drought stress adversely affects onion crop growth and yield. Plant growth regulators (PGRs) has become a promising approach to enhance crop productivity under drought stress. This study aims to evaluate the effect of different PGRs on growth, physiological, biochemical traits, and bulb yield of the onion crop under drought stress. PGRs namely; Salicylic acid (20, 50 ppm), Thiourea (100,250 ppm), BAP (20, 50 ppm), IAA (10, 20 ppm), Kinetin (25, 50,100 ppm), Melatonin (50,100 ppm), Putrescine (100 ppm), Spermidine (100 ppm), KNO3 (1 and 2%), and Gibberellic acid (100, 200 ppm) and popular onion cultivar Bhima Shakti was used in the study. Plants were exposed to drought stress (45% field capacity), 55 days after transplanting by withholding irrigation for a continuous 25 days; control plants were maintained under a rainout shelter with a routine irrigation schedule. Foliar application of PGRs was done 10 days before drought stress treatment. The findings showed that PGRs treatment significantly enhanced plant growth and development under drought stress compared to the control without PGRs

treatments. The findings further revealed that drought stress drastically affects the bulb yield as assessed in both controlled and drought stress-treated plants. Correlation analysis revealed a significant positive association between various drought adaptive traits like leaf area, photosynthesis, chlorophyll, and Proline level, with bulb yield. Compared to other treatments, the highest photosynthesis, stomatal conductance, antioxidant enzyme activity, cellular membrane stability, with low canopy temperature, lipid peroxidation, and ROS accumulation were recorded from Kinetin @ 25 ppm treated plants under drought stress. Foliar spray of Kinetin @ 25 ppm improved plant growth and bulb yield under both control (37 t/ha) and water deficit conditions (33 t/ha) compared to other treatments. Taken all together, findings from the study thus highlights the potential role played by PGRs particularly, Kinetin in mitigating drought stress effect in onion crop which can be an eco-friendly approach for sustainable onion crop production under drought conditions.

Keywords*: Plant growth regulators, Onion, Drought, Photosynthesis, Oxidative stress, Bulb yield*

Exogenous Salicylic Acid Ameliorates Drought Stress in Mungbean by Improving the Structural and Reproductive Health

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Abstract

Drought stress poses a significant threat to mungbean (*Vigna radiata* L.) production worldwide. This study investigated the effects of drought stress on the reproductive anatomy and physiology of three mungbean genotypes (Asha, MH125, and MH215) and evaluated the potential of exogenous salicylic acid (SA) application as a mitigation strategy. Anatomical analyses revealed significant drought-induced changes in pedicel, filament, root, and nodule structures, including reduced vascular bundle size and altered xylem characteristics. Reproductive parameters, including pollen viability, germination rates, tube length, and ovule numbers, were severely impacted by drought stress, with reductions of up to 57.7% observed under severe stress conditions. Exogenous SA application partially alleviated these negative effects, improving anatomical integrity and reproductive performance across all genotypes. SA treatment increased pollen viability by up to 13.8%, pollen germination by up to 19.8%, and pollen tube growth by up to 39.4% under stress conditions. These findings highlight the detrimental impacts of drought stress on mungbean reproductive biology and demonstrate the potential of SA as a management tool to enhance drought tolerance. This research contributes to our understanding of mungbean drought responses and offers insights to improve crop resilience in water-limited environments.

Key words: *Drought Stress, Pollen viability, Salicylic Acid, Vascular bundle, Pedicel*

Effect Of Scion Age and Kinetin on Growth of Softwood Grafting in Mango CV. Kesar

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Abstract

The investigation was entitled "effect of scion age and kinetin on growth of softwood grafting in mango cv. kesar" was carried out at Hi-Tech Horticulture Park, Department of Horticulture, Junagadh Agricultural University, Junagadh during the year 2020-21. The treatments comprised of eight level of scion age three level of kinetin (K). The experiment was laid out in CRD with Factorial with three replications. The result indicated that among scion age. Maximum number of leaves per graft (12.94 and 13.62) were, respectively, noted in S_5 at 90 and 120 DAG. Maximum plant height (60.49, 62.58, 64.41 and 68.81 cm) were noted in S_5 at 30, 60, 90 and 120 DAG, respectively. However, at 120 DAG maximum graft girth (0.78 cm) was recorded in S_5. Maximum scion length (13.13, 14.09, 15.44 and 16.63 cm) were recorded in S_5 at 30, 60, 90 and 120 DAG, respectively. Maximum rootstock length (47.36, 48.49, 49.96 and 52.17 cm) were recorded in S_5 (S_5 =130-140 day old scion). at 30, 60, 90 and 120 DAG, respectively. In case of kinetin the result revealed that Maximum number of leaves per graft (9.64, 11.55, 12.58 and 13.13) were noted in K_2 at 30, 60, 90 and 120 DAG, respectively. Maximum plant height (56.32, 59.06, 61.65 and 64.06 cm) were recorded in K_2 at 30, 60, 90 and 120 DAG, respectively. Maximum scion length (12.07, 13.13, 13.82 and 15.02 cm) were noted in K_2 at 30, 60, 90 and 120 DAG, respectively. Maximum rootstock length (44.25, 45.93, 47.75 and 49.04 cm) were noted in K_2 (Kinetin 250 ppm) at 30, 60, 90 and 120 DAG, respectively

Keywords*: Mango, softwood grafting, scion age, kinetin*

Adoption of climate smart interventions by farmers under Technology Demonstration Component of NICRA project

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Abstract

Climate change has emerged as a major challenge recently, affecting various aspects of agricultural productivity and sustainability, therefore, the Technology Demonstration Component (TDC) of National Initiative on Climate Resilient Agriculture (NICRA) project plays a vital role in improving the resilience of Indian agriculture to climate change. NICRA project is a change mechanism in India's agroclimatic-vulnerable regions. Pre-experimental research design (with and without NICRA interventions) was employed to evaluate the Technology Demonstration Component of NICRA Project in Kathua District of Jammu region. A sample of 160 NICRA farmers was selected i.e., 40 farmers from each sampled village using simple random sampling technique without replacement. Besides, 40 farmers were selected from each non-NICRA village i.e., a total of 160 farmers through simple random sampling. Thus, a total sample of 320 farmers was selected for the purpose of the study. The results stated that the largest difference between NICRA and non-NICRA farmers among the adoption of promoted crops was for Paddy. Other promoted crops with large adoption gaps included Ghobi Sarson, Toria, Blackgram, and chickpea. Sesamum also showed a notable difference of 29 per cent among promoted crops, smallest difference was observed for maize and wheat. Further, majority (81%) of NICRA farmers have adopted

'conservation tillage' followed by seasonal vegetables as nutrition garden and fodder storage methods'. The average adoption score was significantly higher among NICRA farmers (13.53) compared to non-NICRA farmers (5.44).

Keywords: *Adoption, Agriculture, Climate change, Interventions, NICRA project, Resilience.*

Postbiotic formulations for lactose-intolerant populations

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Abstract

Postbiotic formulations are emerging as a promising strategy to support lactose-intolerant populations by alleviating gastrointestinal symptoms and enhancing gut health without requiring viable microbial supplementation. Lactose intolerance, primarily resulting from lactase non-persistence, leads to malabsorption of lactose and subsequent fermentation by colonic microbiota, causing bloating, abdominal pain, and diarrhea. Traditional interventions such as dietary restriction and probiotic supplementation exhibit variable effectiveness, particularly due to strain survival challenges in harsh gastrointestinal environments. Postbiotics—defined as non-viable bacterial components, metabolic by-products, cell wall fragments, short-chain fatty acids (SCFAs), and enzymes such as â-galactosidase—offer functional benefits independent of live bacterial viability. In formulations targeting lactose-intolerant individuals, postbiotic components derived from *Lactobacillus*, *Bifidobacterium*, and *Streptococcus thermophilus* have demonstrated improved lactose hydrolysis, modulation of gut microbiota, reduced intestinal inflammation, and enhanced mucosal barrier function. Technological advancements in controlled fermentation, enzymatic extraction, and microencapsulation facilitate the incorporation of stable postbiotics into dairy alternatives, functional beverages, and nutraceutical supplements suitable for populations with minimal dairy tolerance. Furthermore, controlled-release postbiotic systems ensure delivery of bioactive compounds to the site of lactose fermentation in the colon, reducing symptom severity and promoting metabolic homeostasis. Safety advantages, superior shelf stability, and regulatory flexibility further accelerate their application in personalized nutrition for lactose-intolerant consumers. Ongoing research utilizing high-resolution omics, in vitro digestion models, and placebo-controlled clinical trials will refine formulations toward targeted outcomes, including enhanced enzyme activity, microbiome rebalancing, and fermentation-related discomfort reduction. Overall, postbiotic-based nutritional strategies represent an innovative and scalable solution to improve dietary inclusivity and quality of life for lactose-intolerant populations, while supporting functional food sector growth and consumer demand for scientifically validated gut-health products.

Keywords: *Postbiotics; Lactose intolerance; â-galactosidase; Gut microbiome modulation; Functional foods; Non-viable microbial metabolites*

Unveiling the Taxonomic Diversity and Biocontrol Potential of Chalcidoidea (Hymenoptera) in Kumaon, Uttarakhand

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Abstract

The superfamily Chalcidoidea (Hymenoptera) encompasses some of the most important natural enemies of insect pests, playing a vital role in biological control. This study presents an integrative taxonomic survey conducted across various districts of Kumaon, Uttarakhand, from 2023 to 2025. Specimens were systematically collected through sweep netting and rearing of infested plant materials, with rearing providing valuable ecological insights into host plants, pests, and parasitoids, thereby elucidating complex trophic interactions vital for pest management. Combining morphological identification with DNA barcoding, a total of 60 species belonging to multiple families were documented, including several species recorded for the first time from the region. The study highlights the significant diversity of Chalcidoidea in high-altitude ecosystems, emphasizing cryptic species resolution and ecological associations that are crucial for local biodiversity conservation and sustainable agriculture. The findings underscore the importance of an integrative approach for accurate species delimitation, which enhances the effectiveness of indigenous parasitoids as biological control agents. This research provides a vital baseline dataset necessary for the development of targeted, eco-friendly pest management strategies, promoting both ecological sustainability and food security in the region.

Keywords: *Chalcidoidea, Integrative Taxonomy, Parasitoid Wasps, Host-Parasitoid Relationships, Molecular Identification, Species Richness, Pest Management.*

Biochar balls for remediation of nutrients from eutrophic water

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Abstract

In Intensive agriculture and Aquaculture, large quantity of inputs in the form of fertilizer and feed is used and this excess input causes the eutrophication of the water bodies. Aquaculture as a rapidly growing industry, generates significant amounts of wastewater containing nutrients and organic pollutants. This pollution poses environmental challenges and causes eutrophication of the water and calls for effective treatment methods. Biochar, a carbon-rich material derived from waste agriculture biomass, has shown promise as an adsorbent for wastewater treatment. However, conventional biochar has limitations in terms of surface functional groups and adsorption capacity. Engineered biochar (EB), in the for mof biochar balls produced through modification techniques, offers improved properties such as higher specific surface area, cation exchange capacity and adsorption capacity. Physical and chemical modifications enhance the biochar's surface area, pore structure, and functional groups. The resulting EB demonstrates enhanced adsorption capabilities for contaminants like heavy metals and nutrients. The study concludes that sugarcane bagasse biochar produced at 600°C with a retention time of 1 hour exhibited the highest yield among the various agro-waste materials tested for biochar preparation. This

study investigated the potential of sugarcane bagasse biochar for the removal of ammonia and phosphate from water. Lower dosage of biochar balls @ 0.4g/L resulted in the highest ammonia removal percentage. Overall, sugarcane bagasse biochar pyrolyzed at 600°C demonstrated potential for water treatment and environmental remediation. This research enhances our understanding of biochar's suitability as a sustainable solution for various environmental challenges, highlighting its efficacy as an adsorbent for water pollutant removal.

Keywords*: Biochar, SBB, Biochar balls, Eutrophication, Circular economy, waste utilization*

Spatio-temporal Analysis of Long-Term Mangrove Change Along the Mumbai Coastline Using Landsat 7 and Sentinel-2A Imagery

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Abstract

Mangrove forests play a significant role in main- taining coastal ecology and biodiversity. However, despite these being high-yielding ecosystems, they have increasingly faced anthropogenic effects through urban expansion, aquaculture proliferation, and highly unsustainable resource extraction. Such activities lead to considerable degradation and fragmentation of these vital biomes . This report presents a detailed spatio- temporal analysis of mangrove forests in the vicinity of Mumbai coasts. A time span of over an 18-year period (2006–2024) is considered for this study. The multi-source satellite data is analysed in conjunction with advanced machine learning techniques. Imageries from Landsat 7 (2006, 2012) and Sentinel- 2A (2018, 2024), were processed within the Google Earth Engine (GEE) platform and further classifications were made. Four supervised classifiers, namely, Classification and Regression Trees (CART), Random Forest (RF), Gradient Boosted Trees (GBT), and Support Vector Machines (SVM) were trained on labelled samples of land cover types. High classification reliability as reached, which was, further corroborated by standard metrics such as the Kappa coefficient and Matthews correlation coefficient. Change detection analysis revealed spatial patterns of mangrove gain, loss, and inter-type transitions, highlighting both recovery trends and pressure zones. The results, thus obtained, demonstrate the efficacy of combining remote sensing, multi-temporal satellite imagery, machine learning, and cloud-based geospatial platforms for long-term ecosystem monitoring in data- scarce and rapidly urbanizing contexts. The study outcomes could be useful for targeted conservation planning and policy making.

Keywords: *Remote sensing, Machine learning, Mangrove ecosystems, Land cover classification, Change detection*

Community dynamics of *Juniperus macropoda* forests in Gurez region of Kashmir

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Abstract

The temperate and high-altitude regions of the Kashmir Himalaya harbor unique conifer ecosystems that play a crucial role in biodiversity maintenance, soil conservation, and climate regulation. Among them, *Juniperus macropoda* (Himalayan Pencil Cedar) forms distinct forest stands in the Gurez Valley, providing ecological, cultural, and socio-economic benefits to local communities. However, anthropogenic pressures, grazing, and changing climatic conditions have threatened its natural regeneration and distribution. Understanding the vegetation structure and community dynamics of *Juniperus macropoda* forests are essential for designing sustainable conservation and management strategies. Therefore, the present study aims to assess the floristic composition, species diversity, and community structure of *J. macropoda* forests in the Gurez Valley of the Kashmir Himalaya. The study was conducted across three representative forest sites: Kanzalwan, Dawar, and Burnai, located in the Gurez Range of northern Kashmir. Standard quadrat sampling techniques were used along systematic transects to quantify vegetation composition. Tree, shrub, and herb layers were analyzed separately using 10×10 m, 5×5 m, and 1×1 m quadrats, respectively. Phytosociological parameters such as frequency, density, abundance, and Important Value Index (IVI) were calculated following Curtis and McIntosh (1959). Diversity indices including Shannon-Wiener and Simpson's Index were also determined to evaluate species richness and dominance patterns. A total of 80 plant species belonging to 72 genera and 38 families were recorded across the study sites. These included 6 tree species, 4 shrubs, and 71 herbs, indicating a predominance of herbaceous vegetation. *Juniperus macropoda* was the dominant tree species in all sites, with IVI values of 205.57, 279.62, and 239.00 in Kanzalwan, Dawar, and Burnai, respectively. Among shrubs, *Rosa webbiana* and *Hippophae rhamnoides* showed the highest IVI values, while *Stipa sibirica* dominated the herbaceous layer. Species richness was highest at Dawar, followed by Kanzalwan and Burnai, suggesting microclimatic and edaphic influences on community diversity. Shannon diversity indices ranged from 1.1 to 3.99 across different life forms, reflecting moderate diversity. The findings underline the ecological importance of *Juniperus macropoda* forests in maintaining biodiversity and landscape stability. These results serve as a scientific baseline for future conservation, restoration, and sustainable management efforts in the fragile Himalayan ecosystems.

Keywords: *Juniperus macropoda, community structure, Conservation, Gurez Valley, species Diversity*

Use of Prosopis cineraria in Environmental Conservation

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Abstract

Prosopis cineraria (L.) Druce fam: Leguminosae, Synonym *Prosopis spicigera*, known locally as Khejri, Janti & Sami, is a deep-rooted, nitrogen fixing and multipurpose tree endemic to the hot deserts of India, which is contributing to the ecological stability of the region and providing extensive support to human beings, livestock and the nutrient deficient soils. It is the state tree of Rajasthan and Telangana. It is also the national tree of the United Arab Emirates. It has been used for centuries for human diet in the desert of Rajasthan, besides its use as fuel and fodder. Dry pods (Sangri), reduce the craving of water in summer and are eaten by farmers in lean periods. Leaves are a nutrition and highly palatable source of fodder for major desert livestock, such as camel and cattle. Pods increase milk production in milch animals. Studies by Gupta and Saxena [1978] and Shankar et al. [1976] shows higher biomass and soil moisture status under the canopy of the Khejri. According to Mann & Muthana [1984], this tree enhances herbaceous plants and crop yield. Singh and Lal [1969] reported better growth of the plant in its vicinity due to high organic matter, total nitrogen, available P and soluble Ca. Aggarwal [1980] concluded that the status of available micronutrients generally improved under *P. cineraria* plantation. The crop improving effect of tree legumes, especially khejri, is generally ascribed to the input of microbial fertilizers in the soil through nodulation. Since in arid regions, this is the only tree species, it provides much needed shade and shelter to the farmers working in the fields as well as to the cattle and wildlife during the summer months. Because of its extensive root system, it stabilizes shifting sand dunes and is also useful as windbreak shelterbelt and in afforestation of dry areas.

Keywords: *Prosopis cineraria, Khejri, livestock, micronutrients, legumes, afforestation.*

Modern Approaches in Animal Husbandry to Enhance Livelihood Security

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Abstract

Animal husbandry plays a vital role in enhancing livelihood security, particularly in rural and agrarian communities where livestock serves as a major source of income, nutrition, and employment. Current approaches in animal husbandry emphasize sustainable, technology-driven, and climate-resilient practices to improve productivity and profitability. The integration of Precision Livestock Farming (PLF), involving sensors, automated data collection, and artificial intelligence, enables efficient monitoring of animal health, nutrition, and reproduction, thereby optimizing resource use. Breed improvement programs, including selective breeding and the use of indigenous breeds adapted to local environments, contribute

to higher resilience and productivity. Additionally, nutritional interventionssuch as balanced feed formulations, mineral supplementation, and the inclusion of herbal feed additives like turmeric and vitamin C enhance growth performance and disease resistance.

To ensure sustainable livelihoods, emphasis is also placed on disease prevention and biosecurity measures, including vaccination, sanitation, and veterinary extension services. Integrated farming systems (IFS)combining livestock with crops, fishery, or horticulture create diversified income sources and reduce economic risk. Furthermore, value addition and market linkages such as dairy processing, poultry product branding, and digital marketing platforms help farmers obtain better prices and access wider markets. Government initiatives and cooperative models like dairy cooperatives and self-help groups empower smallholders through collective action, training, and credit support.

Overall, these innovative approaches in animal husbandry not only enhance livestock productivity and farm income but also strengthen the resilience and livelihood security of rural households. The integration of modern technologies with traditional knowledge represents a sustainable pathway toward achieving nutritional self-sufficiency, economic stability, and rural prosperity.

Keywords *-Animal husbandry, livelihood security, precision livestock farming, breed improvement, disease prevention, integrated farming, value addition, sustainability.*

Optimizing Feed Reduction in Biomimicry Systems: Impact on Growth, Immunity and Stress-related Gene Response in *Penaeus vannamei*

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Abstract

A 60-day study was conducted to assess the gene expression response of Pacific whiteleg shrimp, *Penaeus vannamei* to various feed reduction strategies within a biomimicry culture system. The experiment comprised a conventional culture system (Control, C) and five biomimicry treatments with varying feed reductions: 0% (T1), 25% (T2), 50% (T3), 75% (T4), and 100% (T5), using fermented de-oiled palm kernel meal (DPKM) as the carbon source. The expression levels of growth-related genes (Myo and Paramyo), a stress-related gene (HSP-70), and an immune-related gene (Prophenoloxidase) were analyzed. The results indicated that the biomimicry treatment with 0% feed reduction (T1) exhibited the highest growth, which was associated with a significant upregulation of Myo and Paramyo genes ($p < 0.05$) and a downregulation of HSP-70 and Prophenoloxidase genes, suggesting enhanced muscle development and reduced stress. The biomimicry treatments with a feed reduction of up to 50% (T2 and T3) demonstrated superior growth performance (17.15±0.49g and 16.67±0.92g, respectively)

compared to the conventional control group (14.91±0.62g). The economic evaluation revealed that T3 treatment, with a 50% feed reduction, proved to be the most cost-effective strategy, yielding a higher net profit than the conventional system and other treatments. While upregulation of stress-related gene expression was observed under increasing feed-restricted conditions, the findings suggest that a biomimicry system with up to 50% feed reduction provides a sustainable and economically advantageous aaproach for *P. vannamei* culture, maintaining strong growth performance with substantial reduction in production costs.

Keywords*: Biomimicry, Economic evaluation, Feed reduction, Gene expression, Penaeus vannamei*

Resilience through land and water management interventions, water management and governance.

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Abstract

Building resilience in socio-ecological systems hinges on the effective management of land and water resources. As climate variability intensifies and population pressures mount, integrated approaches to land and water management have emerged as critical pathways toward sustainable development. This paper explores how land and water management interventions—ranging from watershed restoration, soil conservation, and rainwater harvesting to adaptive irrigation and wetland rehabilitation—contribute to resilience at both community and ecosystem levels. These interventions not only enhance agricultural productivity and water security but also strengthen livelihoods by reducing vulnerability to droughts, floods, and other environmental shocks. A central theme in resilience-building lies in governance structures that enable participatory, equitable, and adaptive water management. Effective governance frameworks emphasize decentralized decision-making, multi-stakeholder engagement, and the incorporation of traditional and indigenous knowledge alongside scientific innovation. Moreover, transparent institutional mechanisms and policies that promote integrated water resources management (IWRM) enhance coordination among sectors—agriculture, energy, and environment—ensuring that land and water systems are managed holistically rather than in isolation. Case studies from various regions demonstrate that when governance systems align with local capacities and ecological realities, they catalyze resilience by improving ecosystem services, restoring degraded landscapes, and securing reliable water access. Conversely, fragmented governance, inadequate policy enforcement, and limited stakeholder participation can undermine the effectiveness of even well-designed interventions. Strengthening institutional coherence and data-driven monitoring is therefore essential to adaptively manage land and water resources under changing climatic and socio-economic conditions. In conclusion, resilience through land and water management interventions is best achieved through an integrated governance approach that harmonizes environmental sustainability, social inclusion, and economic viability. By embedding flexibility, transparency, and inclusivity within water management institutions, societies can better navigate uncertainty and build adaptive capacity for the future. The synergy between sound land use practices, effective water governance, and empowered local participation forms the

cornerstone of resilient landscapes and communities capable of thriving amid global environmental change.

Keyword: - *wetland rehabilitation, flexibility, transparency, climate variability.*

Climate change and its effect on environmental ecology and mitigation strategies.

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Abstract

Climate change represents one of the most pressing environmental challenges of the 21st century, profoundly altering the Earth's ecological balance. Driven primarily by anthropogenic greenhouse gas emissions, deforestation, industrialization, and unsustainable agricultural practices, climate change has led to significant variations in global temperature, precipitation patterns, and extreme weather events. These changes have cascading effects on biodiversity, soil fertility, hydrological systems, and ecosystem productivity. Rising temperatures and altered rainfall regimes disrupt phenological cycles, accelerate species extinction rates, and promote the spread of invasive species and pests, thereby threatening ecological stability. The environmental consequences of climate change are closely intertwined with human well-being, as ecosystem degradation affects food security, water availability, and livelihood sustainability. Mitigation strategies, therefore, must focus on reducing greenhouse gas emissions while enhancing ecosystem resilience. Key approaches include promoting renewable energy adoption, sustainable land use management, and afforestation-reforestation initiatives to enhance carbon sequestration. Conservation of biodiversity hotspots, restoration of degraded ecosystems, and adoption of climate-smart agricultural practices can also mitigate ecological vulnerabilities. Technological innovations such as carbon capture and storage (CCS), precision farming, and early warning systems for climate extremes play pivotal roles in managing environmental impacts. In addition, strengthening policy frameworks and fostering international cooperation under mechanisms like the Paris Agreement are vital for coordinated climate action. Public awareness, community participation, and education about sustainable consumption and production patterns further enhance mitigation and adaptation efforts. Integrating traditional ecological knowledge with modern scientific approaches can ensure context-specific, locally relevant solutions for ecosystem conservation and climate resilience. In conclusion, climate change poses a multidimensional threat to environmental ecology, demanding a holistic and collaborative response. Effective mitigation strategies must address the root causes while promoting sustainable development pathways that balance economic growth with ecological preservation. Strengthening the adaptive capacity of ecosystems through integrated management, innovation, and inclusive governance will be essential to safeguard the planet's natural resources for future generations.

Keywords: *Climate change, Environmental ecology, Biodiversity loss, Ecosystem resilience, Mitigation strategies, Sustainable development.*

Assessment of physical fitness of young women (20-25 years) in relation to diet and body composition

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Abstract

Present study was undertaken to assess the physical fitness of young women (20-25 years) in relation to diet and body composition. Sixty young women were selected to carry out the present investigation. Background information was collected through structured interview schedule. The nutritional status and body composition were analyzed. Physical fitness of the subjects was assessed by standard fitness tests.

Results revealed that majority (98.3%) of the subjects were Hindus vegetarian and belonged to nuclear family. Educational level showed that majority of subjects (58.3%) were under graduate. It was found that 35 percent subjects were doing exercise, nineteen percent subjects were doing only cardiac exercise while 4.7 percent of the subjects were doing muscular exercise. Consumption of roots and tubers, fats and oils, and sugar was higher than the recommendations. Average intake of energy, protein, carbohydrate and fat was 96.8 percent, 82.6 percent, 81.7 percent and 364.1percent respectively of RDA. Physical fitness assessment revealed that majority of the subjects (36.67%) were in fair category of cardiorespiratory endurance, 90 percent in very poor category of muscular strength, 36.66 percent subjects needed improvement in flexibility while majority (81.68%) of the subjects were in very poor category of abdominal muscular endurance and very poor category (26.66%) of upper muscular endurance. Physical fitness in relation to diet and body composition revealed that cardiorespiratory endurance was negatively correlated with fat free mass while flexibility was negatively correlated with body fat but no correlation between upper body muscular endurance and body fat was found. Abdominal muscular endurance and energy and carbohydrate intake was found to be significantly correlated whereas Muscular strength was significantly correlated with energy intake only. Hence it was concluded that physical fitness, diet and body composition are strongly associated.

Keywords: *Body composition, Nutritional assessment, Physical fitness, Young women, Udaipur*

Integrating AI assisted Tools for Pre-Evaluation Quality Screening of Answer Scripts in Applied and Life Sciences Examinations

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Abstract

The effective management of post-examination processes is critical to ensuring fairness, transparency, and accuracy in academic evaluation, especially in Applied and Life Sciences programs where large volumes of handwritten answer scripts are handled each semester. Traditionally, the pre-evaluation

quality screening of scanned answer sheets has been performed manually, making it vulnerable to human error, delays, and inconsistencies. This study presents the design and implementation of an AI-assisted digital solution that automates the detection of missing pages, unordered sequences, registration number mismatches, and scan-quality issues before answer scripts are forwarded for evaluation. Developed using Python with OCR and pattern-recognition techniques, the system integrates seamlessly with the university's Digital Valuation System (DVS). A comparative analysis of operational data before and after deployment demonstrates significant improvements, including a 75% reduction in processing time, enhanced detection accuracy, and reduced rescan requests. The AI-enabled workflow not only optimizes manpower but also strengthens the integrity of the evaluation process, ensuring more reliable outcomes for Life Sciences students. The approach outlined in this study offers a scalable model for digital transformation in examination management across higher education institutions.

Keywords: *Artificial Intelligence (AI), Digital Valuation System (DVS), Automated Answer Script Screening, OCR and Pattern Recognition, Life Sciences Examination Management, Academic Quality Assurance*

Influence of fermented whey protein fractions on the growth performance, haematological traits, serum biochemistry, faecal and caeca microbiota of broiler chickens

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Abstract

Our current study examined the effects of whey peptides in basal diets as an alternative of immunomodulator for organic poultry production by analysing growth performance, blood metabolites, histological examination, faecal bacterial count, and metagenomic analysis of broiler ceca. A total of 96, zero-day old commercial broiler chicks were randomly allotted to 4 treatment groups in a completely randomized and groups were as follows: T1 (Control: basal diet with immunomodulatory factor and commercial probiotics), T2 (Basal diet with whey peptides & <3kDa), T3((Basal diet with whey peptides &<10kDa), T4(Basal diet with whey peptides & >10kDa). The findings showed that adding whey peptides to broiler diets did not have an impact on live body weight or body weight gain values when compared to the control group. During this study, control group birds had higher feed intake, compared to whey peptide treated groups. T1 and T2 diet group broiler chickens showed the highest and lowest feed consumption ($p<0.05$) respectively. However no significant difference was observed in T4 diet group body weight (2707.88 ± 51.349) and control diet group body weight (2730.13 ± 28.277) of chicken birds but FCR was highest in control diet group (1.76) comparison to T4 diet group (1.70) respectively. A significant reduction in blood glucose, triglycerides, total lipids was found in <3kDa, <10kDa and >10kDa fed group compared to those in the control. Whey peptide supplementation exhibitd no significant influence on red blood corpuscles (RBC), haemoglobin, hematocrit, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration while exhibit significant impact on leukocytes (WBC) and platelets. The effect of adding whey peptides in basal diet

decreased the number of E. coli and enterococci counts and increased Lactic acid bacteria counts in stools of broiler chickens. Histological analysis of all diet group chickens revealed no evidence of organ toxicity. The current findings indicate that WPH used in animal feed as an feed additive and cost effective, substitute for commercial immunomodulator in broiler diet for better growth performance of the birds without any harmful effects.

Keywords*: Blood cholesterol; Cheddar cheese whey; Lactobacillus; Metagenome; Whey peptides*

Response of rice to different methods of establishment and weed management practices

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Abstract

A field experiment was conducted at the College Farm, Navsari Agricultural University, Navsari (Gujarat) during summer seasons of 2019-20 and 2020-21. The experiment was laid out in split-plot design and replicated four time. Three crop establishment methods were assigned to main plots viz. S_1- Direct Seeded Rice, S_2- Conventional Transplanted Rice, S_3- Sprouted Seed (line sowing) whereas five weed management practices in sub-plots within each main plot viz. W_1- Weedy check (control), W_2- 2 HW at 20 and 40 DAS/T, W_3- Pretilachlor 50 % EC 1000 g ai/ha (Pre) fb Bispyribac sodium 10 % SC 25 g ai/ha at 30 DAS/T, W_4- Pyrazosulfuron-ethyl 10 % WP 15 g ai/ha (Pre) fb Bispyribac sodium 10 % SC 25 g ai/ha at 30 DAS/T and W_5- Pretilachlor 50 % EC 1000 g ai/ha (Pre) fb Chlorimuron ethyl + Metsulfuron methyl 20 % WP 4 g ai/ha at 30 DAS/T were evaluated on rice cv. NAUR-1. The total weed density (grasses, broad leaved weeds and sedges) and weed dry biomass at 20 and 40 DAS/T were significantly reduced under Conventional transplanted rice (S_2) than other establishment methods of rice (S_1- Direct seeded rice and S3- Sprouted seed line sowing). The Conventional transplanted rice (S_2) had also inferior weed seed counts after crop harvesting on top layer of soil than as compared to remaining establishment methods of rice. Among weed management practices, the total weed density was enhanced at 40 DAS/T over their intensity at 20 DAS/T under Weedy check (W_1), while it declined at 40 DAS/T with application of Pretilachlor 50 % EC 1000 g ai/ha (Pre) fb Bispyribac sodium 10 % SC 25 g ai/ha at 30 DAS/T (W_3), Pretilachlor 50 % EC 1000 g ai/ha (Pre) fb Chlorimuron ethyl + Metsulfuron-methyl 20 % WP 4 g ai/ha at 30 DAS/T (W_5) and Pyrazosulfuron-ethyl 10 % WP 15 g ai/ha (Pre) fb Bispyribac sodium 10 % SC 25 g ai/ha at 30 DAS/T (W_4). The higher weed seed count/kg of top layer soil was obtained extensively under weedy check (W_1) than other four weed management practices.

Keywords: *Establishment method, Herbicide, Seed bank, Weed management.*

Socio - Economic status of local cattle farmers in Dantewada district of the Bastar Plateau of Chhattisgarh

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Abstract

The livelihoods of cattle farmers in the Bastar Plateau Zone of Chhattisgarh largely depend on both agriculture and livestock rearing. To understand their living conditions, a survey was conducted in 2024 among 23 local farmers from Dantewada district. Information on social and economic aspects was collected through a structured questionnaire and personal interviews. The study found that most respondents belonged to the Scheduled Tribe and Scheduled Caste communities, with 57% and 30% representation, respectively. Only a small proportion came from Other Backward Classes (4%) and the General category (9%). Literacy levels were very low (26%), as nearly three-fourths of the farmers (74%) were illiterate. The majority of farmers (87%) had marginal landholdings, and only 13% owned small farmers. Most families (83%) were joint, while 17% were nuclear. In terms of age, middle-aged farmers formed the largest group (65%), followed by younger (26%) and older (9%) farmers. All respondents were involved in both crop cultivation and animal husbandry to earn their livelihood, and many also worked as laborers to supplement their income. Overall, the study highlights the poor socioeconomic status of local cattle farmers and suggests the need for better education, income opportunities, and support programs to improve their standard of living.

Assessing the Impact of Weekly Agro-Climatic Variables on Soybean Yield Leveraging Hybrid Machine Learning

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Abstract

Burgeoning progress in artificial intelligence (AI) is redefining the landscape of digital agriculture, where accurate soybean yield prediction plays a vital role in addressing the growing demand for edible oil, reducing protein-energy malnutrition, optimizing input use, and ensuring sustainable farm productivity. Traditional statistical and empirical models often fall short in representing the nonlinear and dynamic relationships between climatic and agronomic factors, especially under fluctuating environmental conditions. To overcome these limitations, this study concentrates on soybean-intensive districts (50–75% soybean area to Net Cropped Area) in Madhya Pradesh, India, and introduces an advanced Hybrid Ensemble Feature Selection (HEFS) framework. This framework synergizes **Stepwise**

Multilinear Regression (SMLR), Least Absolute Shrinkage and Selection Operator (LASSO), and Random Forest Regression (RFR) to extract the most relevant predictors from fine-grained, multi-source weekly datasets integrating weather, soil moisture, and fertilizer information. Using XGBoost for feature importance analysis, the study identifies TMin33, SR33, RF27, P4Soy, TMax38, K4Soy, SR25, TMin31, SR34, and SMT25 as the most critical variables influencing yield during major growth phases. The proposed HEFS-SVR model achieved strong predictive accuracy (R^2 = 81.95%, MAE = 0.35, RMSE = 0.43), reflecting its efficiency in capturing nonlinear dependencies between climatic and management parameters. The results highlight the importance of precise temperature, radiation, and moisture regulation at key developmental stages for maximizing soybean productivity. Although constrained by limited data availability, the framework demonstrates high scalability and adaptability, with potential applications across different crops and agro-climatic zones. Ultimately, the HEFS-SVR approach establishes a robust and interpretable model for early, data-driven yield forecasting, providing a pathway toward climate-smart agriculture and IoT-based agro-advisory systems for enhanced regional planning and decision support.

Keywords*: Soybean, Yield Prediction, Hybrid Ensemble Feature Selection (HEFS), Machine Learning, Weekly Agro-climatic data*

To study on the seasonal incidence and varietal resistance against major sucking insect pests of Cluster bean

[Cyamopsis tetragonoloba (Linn.) Taubert.]

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Abstract

An investigation entitled "To study on the seasonal incidence and varietal resistance against major sucking insect pests of Cluster bean [*Cyamopsis tetragonoloba* (Linn.) Taubert.]" was conducted during the *Kharif*season,2024 at the Research Farm, Rajmata Vijyaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh. The results showed that incidence of three insect pests were observed during crop season, namely Jassid*, Empoasca kerri* (Pruthi), Whitefly, *Acaudaleyrodes rachipora* (Singh), and Mite, *Polyphgotarsonemus latus* (Banks). Peak population of jassid were observed during 38th SMW (6.2 jassids/plant); and peak population of whitefly were observed during 38th Standard meteorological week (5.0whiteflies/plant). While peak population of mitesob served during 38th SMW with the population of 4.6 mites per three leaves. The results showed that jassid had positive significant correlation with rainfall (r=+0.573),whitefly had positive significant correlation with minimum temperature (r = +0.641) and rainfall (r = +0.559), also mites significantly correlated with minimum temperature (r=+0.725).Thet reatments consisted of 13 genotypes of cluster bean *viz.* CAZG 20-17, GG 2111, Karan Guar15(ch),HG20-3,CAZG21-3,RGR18-1(KaranGuar14)(CH),GD594,CAZG20-21,GujratGuar3(ch),CAZG2038,GG2210,Gujrat Guar1(ch),GD 591,were tested in randomized block design with three replications. The lowest mean population of jassid was observed on genotype Gujrat Guar 1 (ch) and the highest mean jassid population was observed on genotype CAZG20-21. The

genotypes GG 2111 and Gujrat Guar 1 (ch) were recorded as least susceptible.The minimum population of whitefly wasrecordedongenotypeGD 591 and the maximum population of whitefly was observed on genotype RGR 18-1 (Karan Guar 14) (ch). The genotypes GD 591, Karan Guar 15 (ch) were recorded as least susceptible.

Key words : *Rainfall , mean , genotypes*

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