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Recent Advances in Agriculture, Food Security, Veterinary & Allied Sciences for Livelihood and Environmental Sustainability
[RAFVAL:ES-2025]

Organized by
University of Agricultural Sciences Raichur, Karnataka
Sant Gahira Guru Vishwavidyalaya, Sarguja, Ambikapur
Atal Bihari Vajpayee Vishwavidyalaya, Bilaspur, Chhattisgarh
Agriculture Forum for Technical Education of Farming Society
Vital Biotech Education Group, Kota

on
25- 27 April, 2025

- Dr. Y. S. Amaresh
- Dr. Manoj Kumar Jhariya
- Er. Yashwant Kumar Patel
- Dr. Soumitra Tiwari
- Dr. M.K. Meena
- Dr. Arnab Banerjee

VITAL BIOTECH PUBLICATION

INTERNATIONAL CONFERENCE ON

RAFVALES-2025

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Under the aegis of

Agriculture Forum for Technical Education of Farming Society (AFTEFS)
VITAL BIOTECH EDUCATION GROUP, KOTA

on

25^{th}-27^{th} April, 2025

Editors

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UNIVERSITY OF AGRICULTURAL SCIENCES, RAICHUR

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

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

MESSAGE

It is with great enthusiasm that I extend my heartfelt congratulations and best wishes for the **International Conference on "Recent Advances in Agriculture, Food Security, Veterinary & Allied Sciences for Livelihood and Environmental Sustainability" (RAFVAL:ES-2025)**, set to take place from **April 25-27, 2025**.

Organized by **UAS, Raichur, ABVV, Bilaspur, SGGV, Ambikapur**, in collaboration with the **Agriculture Forum for Technical Education of Farming Society** and **Vital Biotech Education Group, Kota**, this conference is a remarkable initiative to drive innovation, sustainability, and progress in agriculture and allied sciences.

In an era where food security, climate resilience, and sustainable farming are global priorities, RAFVAL:ES-2025 will serve as a **powerful catalyst**—bringing together **brilliant minds** from research, academia, industry, and policy-making to exchange ideas, showcase innovations, and build solutions for a sustainable future.

This conference is not just a gathering; it is an **opportunity**—for young researchers to gain inspiration, for experts to share their wisdom, and for industries to connect with groundbreaking advancements that will shape the future of global agriculture.

Appreciation to the **organizing team** for their dedication to uniting visionaries and fostering a collaborative spirit! May RAFVAL:ES-2025 be a milestone event that ignites **new ideas, breakthroughs, and lasting global impact.**

Wishing this conference great success and an inspiring journey ahead!

[Prof. M. Hanumanthappa]
Vice-Chancellor
VICE-CHANCELLOR
U.A.S RAICHUR

प्रो. रवि आर. सक्सेना
Prof. Ravi R. Saxena
M.Sc. (Ag.), Ph.D.
N.E. Borlaug Fellow (USA), LEAP (Australia)
कुलपति
Vice-Chancellor

महात्मा गांधी उद्यानिकी एवं वानिकी विश्वविद्यालय, दुर्ग (छत्तीसगढ़)
Mahatma Gandhi Udyanikee Evam Vanikee Vishwavidyalaya, Durg (Chhattisgarh)

Dated: 8/4/2025

Message

It gives me immense pleasure to extend my heartfelt congratulations and best wishes for the International Conference on **"Recent Advances in Agriculture, Food Security, Veterinary & Allied Sciences for Livelihood and Environmental Sustainability" (RAFVAL:ES-2025)**, scheduled to be held from **April 25–27, 2025.**

This prestigious conference, jointly organized by **UAS, Raichur; ABVV, Bilaspur; SGGV, Ambikapur, in collaboration with the Agriculture Forum for Technical Education of Farming Society and Vital Biotech Education Group, Kota,** stands as a remarkable initiative towards addressing the critical global challenges of food security, sustainable agriculture, and environmental resilience.

RAFVAL:ES-2025 promises to be a vibrant confluence of eminent researchers, academicians, policymakers, and industry leaders. It will offer a valuable platform for the exchange of **innovative ideas, transformative research, and strategic collaborations** that are essential for shaping a sustainable future in agriculture and allied sciences.

I take this opportunity to commend the organizing committee for their dedication and tireless efforts in making this event a beacon of knowledge-sharing and academic excellence. Let this conference inspire young minds, facilitate impactful partnerships, and contribute to meaningful solutions on a global scale.

Wishing **RAFVAL:ES-2025** grand success and a rewarding experience for all participants.

Saxena
08/4/25
(Ravi R. Saxena)
Vice-Chancellor

पताः कैम्प कार्यालय, इं.गां.कृ.वि. परिसर, रायपुर–492 012 (छत्तीसगढ़)
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DEAN F.V.Sc & AH
SKUAST-K

It is with great admiration and anticipation that I extend my best wishes for the International Conference on "Recent Advances in Agriculture, Food Security, Veterinary & Allied Sciences for Livelihood and Environmental Sustainability" (RAFVAL:ES-2025), to be held from April 25 to 27, 2025. Organized by the University of Agricultural Sciences (UAS), Raichur; AtalBihari Vajpayee Vishwavidyalaya (ABVV), Bilaspur; and Sarguja University (SGGV), Ambikapur, in partnership with the Agriculture Forum for Technical Education of Farming Society and Vital Biotech Education Group, Kota, this conference represents a timely and strategic convergence of scientific inquiry, innovation, and sustainable development.

RAFVAL:ES-2025 is designed to serve as a comprehensive platform where experts from agriculture, veterinary sciences, environmental studies, food technology, and rural development come together to exchange ideas, share research outcomes, and discuss practical solutions to some of the most pressing challenges faced by the global agri-food system. With rising concerns around climate change, food insecurity, declining biodiversity, and rural distress, the conference's interdisciplinary approach is both relevant and urgently needed.

The event will feature a wide range of activities including plenary talks, technical sessions, workshops, and interactive forums focusing on key areas such as sustainable agricultural practices, climate-resilient cropping systems, veterinary innovation, agri-business models, natural resource management, and rural livelihood enhancement. It will also highlight emerging technologies such as AI in agriculture, precision farming tools, and biotechnology applications that can transform traditional farming into a more efficient and sustainable enterprise.

RAFVAL:ES-2025 will undoubtedly be an enriching experience for researchers, professionals, and students alike, providing a rare opportunity to engage with national and international thought leaders. I commend the organizing committee for curating such a diverse and impactful agenda, and for fostering an environment that supports collaboration, innovation, and knowledge dissemination. I look forward to the valuable contributions this conference will make in driving sustainable agricultural growth and shaping a more secure and resilient future for farming communities worldwide.

(Prof. S.A. Kamil) 15/4/25

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Date: 16.04.2025

It is a matter of great honor and enthusiasm to extend my sincere congratulations and best wishes for the International Conference on **"Recent Advances in Agriculture, Food Security, Veterinary & Allied Sciences for Livelihood and Environmental Sustainability" (RAFVAL: ES-2025)**, scheduled to take place from April 25 to 27, 2025. This landmark event is jointly organized by the University of Agricultural Sciences (UAS), Raichur; Atal Bihari Vajpayee Vishwavidyalaya (ABVV), Bilaspur; and Sarguja University (SGGV), Ambikapur in collaboration with the Agriculture Forum for Technical Education of Farming Society and Vital Biotech Education Group, Kota.

RAFVAL: ES-2025 is poised to be a multidisciplinary platform addressing the critical challenges and opportunities across agriculture, veterinary sciences, food systems, environmental sustainability, and rural livelihoods. The conference aims to bring together leading researchers, academicians, practitioners, extension professionals, policymakers, and industry stakeholders from across the country and abroad. Through technical sessions, keynote addresses, panel discussions, oral and poster presentations, and innovation showcases, the event will facilitate the exchange of scientific knowledge, technological advances, and best practices essential for strengthening food security and sustainable development. Key themes to be explored include precision and climate-smart agriculture, integrated pest and nutrient management, sustainable livestock production, animal health and welfare, agri-entrepreneurship, value addition, biodiversity conservation, agro-ecology, and policy interventions for resilient farming systems. The conference will also serve as an exceptional opportunity for young scientists and students to network, gain exposure to global research trends, and contribute meaningfully to the agri-scientific community.

I extend my deep appreciation to the organizing institutions and partners for their vision and efforts in promoting such an inclusive and impactful academic initiative. RAFVAL: ES-2025 promises to be a milestone event, offering actionable insights and collaborations that will significantly contribute to India's agricultural transformation and global sustainability goals. Wishing the event grand success, fruitful deliberations, and far-reaching outcomes for the future of agriculture and allied sectors.

Dean

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MESSAGE FROM CONFERENCE DIRECTOR & SOCIETY PRESIDENT

Dear participants and honored guests, On behalf of Agricultural Forum for Technical Education of Farming Society, Kota (Rajasthan), we take great pleasure in welcoming you to the International Conference on "Recent Advances in Agriculture, Food Security, Veterinary & Allied Sciences for Livelihood and Environmental Sustainability" (RAFVAL:ES-2025), scheduled to take place from April 25 to 27, 2025. This landmark event is jointly organized by the University of Agricultural Sciences (UAS), Raichur; Atal Bihari Vajpayee Vishwavidyalaya (ABVV), Bilaspur; and Sarguja University (SGGV), Ambikapur, in collaboration with the Agriculture Forum for Technical Education of Farming Society and Vital Biotech Education Group, Kota.

The objective of this conference is to discuss the rapidly changing technologies and their potential impacts on the agriculture, food security, and veterinary sector. We believe that sharing the latest ideas, research and innovations will help us find solutions to the challenges facing the agriculture sector and determine its future direction.

At this conference, you will gain valuable insights from internationally and nationally renowned experts on agricultural technology, data analytics, automation, and other related topics. We hope this initiative will generate new opportunities for ideas and collaboration.

Your participation and contribution is extremely important to us and we look forward to setting new standards in this field with you.

Thank You.

Dr. Jitendra Mehta

PRESIDENT, AFTEFS
VITAL BIOTECH, KOTA, RAJASTHAN

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MESSAGE FROM FOUNDER & CEO VITAL BIOTECH

On behalf of **VITAL BIOTECH**, I am delighted to extend my best wishes to the University of Agricultural Sciences (UAS), Raichur; Atal Bihari Vajpayee Vishwavidyalaya (ABVV), Bilaspur; and Sarguja University (SGGV), Ambikapur, in collaboration with the Agriculture Forum for Technical Education of Farming Society and Vital Biotech Education Group, Kota., to be held from **25th to 27th April, 2025**.

This prestigious conference, under the esteemed **Agriculture Forum for Technical Education of Farming Society (AFTEFS)**, is a landmark event that brings together global experts to address the challenges and opportunities in agriculture and allied sciences. It offers a unique platform for knowledge exchange, collaboration, and exploration of innovative technologies that will shape the future of agriculture. The focus on cutting-edge innovations is timely and essential in today's rapidly evolving agricultural landscape.

At **VITAL BIOTECH**, we are committed to fostering technological advancements in agriculture, and we strongly believe that conferences like this are key to driving progress. The dialogue and ideas generated here will not only impact scientific research but also have practical applications for farmers, industries, and policymakers, helping to improve productivity, sustainability, and food security.

I am confident that the discussions and presentations will inspire new approaches and solutions to the pressing issues faced by the agricultural sector today. We look forward to seeing the groundbreaking innovations and fruitful partnerships that will emerge from this event.

Wishing all participants, speakers, and organizers great success in making this conference a grand success and a beacon of knowledge for the global agricultural community.

Best regards,
Ms. Jaya Mehta
Founder & CEO, VITAL BIOTECH
Kota, Rajasthan, India

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RAFVAL:ES-2025/74	Effect of Pruning and Fertilizer Application on Yield and Quality of Guava (*Psidium guajava* L.) cv. Sardar in Maharashtra	Prof. Parag Sharad Bagul[1*] Dr. S. D. Patil[2] and Sagar Y. Pawar[3]
RAFVAL:ES-2025/75	Farm Producer Organization as Engine of Rural Development: Insight from Saahaj Milk Producer Company	Ajay Kushwah[1*], Preeti Singh[2], Dr. Arvind Kumar[3], Prof. Sanjay Bhushan[4]

RAFVAL:ES-2025/76	Title- Succession of major insect pests in rice and effectiveness of some combination and sole insecticides against yellow stem borer and earhead bug	Arvind Kumar[1] Pankaj Kumar[2] Assistant Professor
RAFVAL:ES-2025/77	Germplasm screening and evaluation of bio-rational insecticides againstpod borer complex of Mungbean (*Vigna radiata* L.)Wilczek"	Arvind Kumar[1] Pankaj Kumar[2] Assistant Professor
RAFVAL:ES-2025/78	Studies on the Impact of cadmium on Growth, Yield Attributes , Yield and Biochemistry of Mung Bean (*Vigna radiata* L Wilczek) Under Natural Field Condition, Burdwan, West Bengal.	Jayanta Kumar Datta[1], Debarati Ghosh[1], Arnab Banerjee[1*] and Naba Kumar Mondal[1]
RAFVAL:ES-2025/79	Foliar application of *Kappaphycus alvarezii* extract enhances drought tolerance in wheat by improving physiological and biochemical traits	Shashi Meena
RAFVAL:ES-2025/80	Ethnobotanical Practices and Plant Diversity Patterns in Alaniya Village: Indigenous Knowledge and Conservation Implications	Nidhi Sharma & Anita Singh
RAFVAL:ES-2025/81	Advances in irrigation technology for water conservation	Manda Sai Krishna
RAFVAL:ES-2025/82	Non-native flora of Duldula forest region in Jashpur	Annpurna Devi, Manoj Kumar Jhariya, and Pankaj
RAFVAL:ES-2025/83	A micropropagation protocol for medicinally important *Piper macropiper* Pennant – an endemic plant of India	Era Vaidya Malhotra*, Shreya Sharma, Sangita Bansal, K. Pradheep, Anju Mahendru-Singh

RAFVAL:ES-2025/84	The Role of Agroforestry in Mitigating Deforestation: A Sustainable Land-Use Strategy	Ragni Bhargava* and Shashank Bhargava
RAFVAL:ES-2025/85	Exploring The Sacred Groves Of Sarguja: A Study Of Tradition And Conservation	AshishKumar Soni[1] and Dr. Dhiraj Kumar Yadav[2]
RAFVAL:ES-2025/86	Evaluation of cucumber genotypes for various horticultural traits under subtropical conditions of Jammu region	Raman Thappa, Sanjeev Kumar
RAFVAL:ES-2025/87	Eco-resilient Strategies for Pest and Disease Management	*Naveenkumar .M, Vasanthan .E and Asvitha .M
RAFVAL:ES-2025/88	Evaluation of pumpkin cultivars in relation to the incidence of cucumber mosaic virus disease in Assam under field condition	Shahin Shobnur[1] and Manoj Kumar Kalita[2]
RAFVAL:ES-2025/89	Effect of *Nigella sativa* (black cumin) on blood-biochemistry of Kadaknath birds	[1]Hina Ashraf Waiz and *[2]Aarti Gupta
RAFVAL:ES-2025/90	Ecological Plasticity And Metabolic Diversity In *Eichhornia Crassipes* (Mart.) Solms	Sharon Monica R.*, and Jeline Rani. J
RAFVAL:ES-2025/91	The Role of climate change on Global food Security	Vikas Yadav1*, Vikash Kumar Yadav1
RAFVAL:ES-2025/92	Detection of Humanin-like Mitochondria Derived Peptide, its Quantification and Effects of Humanin Supplementation on Freezability of Vrindavani Bulls' Semen	Kumar, S*., Gemeda, A., Ghosh, S.K., Katiyar, R., Karikalan M., Kumar, A., Pande, M., Rautela, R., Dhara, S. K., Bhure, S. K., Srivastava, N., Patra, M. K. and Chandra, V.
RAFVAL:ES-2025/93	Optimization of Green Synthesis of *Azadirachta indica* Leaf Extract based Silver Nanoparticles using Response Surface Methodology	Pankaj[1]*, Sarita Devi[1] and Satpal[2]

RAFVAL:ES-2025/94	Assessment and Control of Bacterial Endotoxin in Ketoprofen Injection: A Strategic Approach Toward Patient Safety and Regulatory Compliance	Sunil Gavate
RAFVAL:ES-2025/95	Impact of Varying Stocking Densities on the behaviour of Broiler Chickens	Hina Ashraf Waiz*[1] and Lokesh Gautam[2]
RAFVAL:ES-2025/96	Effect on Growth and Yield of Mungbean [*Vigna radiata* (L.) Wilczek] through Foliar Nutrition under Guava [*Psidium guajava* (L.)] based Agri-horti System in Vindhyan region of Mirzapur	Visha Jain* and Chandra Bhushan
RAFVAL:ES-2025/97	Productivity and carbon sequestration potential of high intensity food fodder strip cropping sequence in Jammu	Dhamni Patyala ,Meenakshi Guptab, Rakesh Kumarc, Sarabdeep Kourd and Manish Sharmae
RAFVAL:ES-2025/98	Foraging Behavior of Purple Heron (Ardea purpurea)in the Rice Fields of Kota: Implications for Urban Agricultural Landscape and Natural Pest Control	Pooja Goswami
RAFVAL:ES-2025/99	Economics of poplar-onion agroforestry systems	Bhupender[1], Sumit[1] and Shivam[1]
RAFVAL:ES-2025/100	Role of Traditional knowledge in climate adaptation	H Rashmi, Raut Namitha, B. S Pramod
RAFVAL:ES-2025/101	Forest Management Through Sustainable Harvesting of NTFPs with Special Reference to Chhattisgarh	Himanshu Khandekar*, Rajesh Kumar, Alok Singh Bargah, Aishwarya Kant Vaishnav
RAFVAL:ES-2025/102	Sustainable Aquaculture: The Future Of Fish Farming	Lakhwinder Singh
RAFVAL:ES-2025/103	Theme 1: Suistainable Crop Production and Food Security	Ravina Yadav and Tarence Thomas

RAFVAL:ES-2025/104	Applications Of Essential Oils In Fruit And Vegetables Preservation	Deeksha Agarwal and Dr Hema*
RAFVAL:ES-2025/105	A Sustainable Approach to Food Waste Management	Komal*[1],
RAFVAL:ES-2025/106	A Comprehensive Review on Eco-friendly Silver Nanoparticles Synthesized from plant extracts as Bio pesticides.	Dr. Garima Sharma[1] Sushmita Saini[2]
RAFVAL:ES-2025/107	Assessment of Biofilm Formation and Shiga Toxin genes in ESBL-Producing E. coli Recovered from Retail Salad Vegetables in Mirzapur District, Uttar Pradesh, India	Arti Achyutrao Pande[1], Shweta Yadav[1], Rajesh Kumar[1], Kaushik Satyaprakash[2], Manish Kumar[3] Pesingi Pavan Kumar[2], Thulasiraman P[3], Vineet M.R[4] and Mukesh Kumar Bharti[3]*
RAFVAL:ES-2025/108	Assessing the Water Quality Parameters for Determining Fisheries Potential of Surwal dam reservoir, Sawai Madhopur	Dr. Rajendra Singh Rajawat[1], Bhamini Gupta[2]
RAFVAL:ES-2025/109	Investigating Biofilm formation in Methicillin-Resistant *Staphylococcus aureus* recovered from fresh retail salad vegetables in Mirzapur District, Uttar Pradesh	Shweta Yadav[1], Arti Pande Achyutrao[1], Rajesh Kumar[1], Kaushik Satyaprakash[2], Manish Kumar[3] Pesingi Pavan Kumar[2], Thulasiraman P[3], Vineet M.R[4] and Mukesh Kumar Bharti[3]*
RAFVAL:ES-2025/110	Prevalence Of Bovine Trypanosomosis And Anaplasmosis In And Around Bhubaneswar	*Pratistha Shrivastava, Manaswini Dehuri, B.N. Mohanty
RAFVAL:ES-2025/111	Exogenous ascorbic acid mediated drought tolerance in jute (*Corchorus olitorius* L.)	Suman Roy[1,2*], Laxmi Sharma[1,2], Tinku Goswami[1], Pratik Satya[1] and Amit Bera[1]
RAFVAL:ES-2025/112	Season wise survey of mosquito fauna of District Yamuna Nagar	Vijay Laxmi and Anil Sharma[2]
RAFVAL:ES-2025/113	Sustainable crop production and food security	Choudhary Snehal and K. Sai. Sharwani
RAFVAL:ES-2025/114	Distribution of soil aggregates organic carbon in rice under effect of tillage and fertilization in dry land ecosystem	Shankar Ram[1,2], A.K. Ghosh[1], A.K. Nema[3], Jitendra Kumar Maurya[1,2] and Dr. S. N. Singh[1,2]

RAFVAL:ES-2025/115	Integrated Management of *Alternaria brassicae* in Mustard (*Brassica juncea* L.): A Comparative Research of Biological Treatments using the Standard Blotter Technique	Barath B[1], Silpa J R[1], and Sunil Zacharia[2]
RAFVAL:ES-2025/116	Morphological characterization of Dalbegia sisso in Chakarbhatha, Bilaspur, Chhattisgarh	Gaddam Vinay[1]*, Chandresh Kumar Singh[1], Kripal Singh[2]
RAFVAL:ES-2025/117	Exploring the morphological diversity in rice accessions (*Oryza sativa* f. *spontanea*) for early seedling vigour	Laxmi Sharma[1], Suman Roy[1], Asi Vyshnavi[1], Vishnu Kumar[1], Susheel Kumar Raina[1], Rakesh Singh[1]
RAFVAL:ES-2025/118	Study On Feed Management And Growth Performance Of *Clarias Batrachus.*	Abhishek Giri[1], Dr. Shriparna Saxena[2]
RAFVAL:ES-2025/119	Carbon Farming towards Sustainable Agroecosystem	Manoj Kumar Jhariya
RAFVAL:ES-2025/120	Rural Goldmine: Unlocking the Hidden Value in Cow and Goat Dung	S.Affra Thusneem*, Dr.T.Muthuramalingam, Dr. K.Thilak Pon Jawahar,Dr. Akhil Kumar Jha
RAFVAL:ES-2025/121	A case of chronic nephropathy in Asiatic elephant – Postmortem and histopathology findings	Dr Goverdhan Singh[1] , Mamta [2], Pooja Gill [3*], Dr Mamta Kumari [4,]Dr Kamal Purohit [5], , Dr Savita Kumari Meena [6]
RAFVAL:ES-2025/122	Survey of Seed-Borne Mycoflora of Pisum sativum Seeds	Anjana Singh[1], Dr Anita Singh[2]
RAFVAL:ES-2025/123	Proteomic analysis of sperm reveals changes in fertility-related protein levels after FMD vaccination in Sahiwal bulls	R Arunkumar*[1], T K Mohanty[1], A Kumaresan[2], R K Baithalu[1], M Bhakat[1], V K Gupta[1]
RAFVAL:ES-2025/124	Recent Advances In Agriculture, Food Security, Veterinary & Allied Sciences For Livelihood And Environmental Sustainability	Swati Kumari[1]*, Sudhanand Prasad Lal[2], Sweta Kumari[3] and Sayak Saha[4]
RAFVAL:ES-2025/125	Management of powdery mildew of mango with bio-control agents under konkan condition.	,Y.R.Govekar* R.A.Raut,S.S.Bhure and P.M.Talha

RAFVAL:ES-2025/126	A study on the Socio-Economic Conditions and Livelihood Status of Junput Mangrove, East Midnapore, West Bengal	Tapas Bhunia[1], Shriparna Saxena[2] and Pijush Payra[3*]
RAFVAL:ES-2025/127	Dietary Pattern Transformation and Agro-Nutritional Transition in Uttarakhand	Dr. Seema Kwatra[1], Bhabya[2] and Dr. Sangya Singh[2]
RAFVAL:ES-2025/128	Cultivating Change: Empowering Women and Engaging Youth in Agricultural Development	Sowmya T.M[1*], Mallika Meti[2**] and Rathnamma[3***]
RAFVAL:ES-2025/129	Oceanlux: *Sargassum Wightii* for Sustainable Fashion	Jayasri Ravichandran[a] Nimish Mol Stephen[a*] Ganesan Ponesakki[b]
RAFVAL:ES-2025/130	Extraction and Encapsulation of Black Cardamom (*Amomum subulatum*) Oleoresin: A comprehensive study on stability, thermal and morphological properties	Abishek Sakkaravarthy[1] and Gurumoorthi Parameswaran[1*]
RAFVAL:ES-2025/131	Bastar Tribal Women Empowerment and Sustainable Livelihood through Secondary Horticulture	Er. Bhagwat Kumar, Dr. G.P. Nag and Dr. K.P. Singh
RAFVAL:ES-2025/132	India's Seaweed Sector Spatial Trends and Prospects	Kiran Kotyal*
RAFVAL:ES-2025/133	Exploring Phytochemical, Antioxidant Properties And Neuroprotective Potential Of *Saraca Asoca* Leaf And Bark	Dr. Sonal Prasad
RAFVAL:ES-2025/134	Engineering Plant Microbiomes Using Synthetic Communities (SynComs) for Sustainable Disease Suppression	Meghana K S[1*], Barath B[2] and Jyotika Purohit[3]
RAFVAL:ES-2025/135	Agricultural Mechanization and Smart Farming	Deepika

RAFVAL:ES-2025/136	Mortality of *Eisenia fetida* earthworms in response to a broad-spectrum herbicide 2,4-D	Deepti[1*] and Vineeta Shukla[2]
RAFVAL:ES-2025/137	Eco-Friendly Pest Management in Vegetable Farming: IPDM Practices and Adoption Constraints	*Vasanthan .E, Naveenkumar .M and Asvitha .M
RAFVAL:ES-2025/138	Effect Of Amf On Growth Performance Of *Zea Mays* Plant	Chanchal Kumari[1*] and Atul kumar Bhardwaj[1]
RAFVAL:ES-2025/139	Integrated Farming System for Enhanced Farm Productivity: A Case Study from South Goa, India	Gauresh Naik*
RAFVAL:ES-2025/140	Integrated Nutrient Management in Fruit Crops	R.S.Verma*, Saurabh Verma[1] & Bipin Kumar[2]
RAFVAL:ES-2025/141	The enzyme activity of endophytic bacteria isolated from *Lavandula*	Abdusamatov Sokhibjon Abdusamatovich
RAFVAL:ES-2025/142	Antifungal Potential of Endophytic Bacteria Isolated from *Stevia rebaudiana*	Sultanov Numonjon Nabi ugli
RAFVAL:ES-2025/143	Antibacterial Potential of Endophytic Bacteria Isolated from *Stevia rebaudiana*	Sultanov Numonjon Nabi ugli
RAFVAL:ES-2025/144	The enzyme activity of endophytic bacteria isolated from *Lavandula*	Abdusamatov Sokhibjon Abdusamatovich
RAFVAL:ES-2025/145	Harnessing Organic Amendments to Restore Soil Fertility and Ensure Sustainable Crop Production in Contaminated Agroecosystems	Muhammad Zaib[1] & Ali Zeeshan[2]
RAFVAL:ES-2025/146	Integrated Use of Poultry Manure and Biochar for Enhancing Maize Yield in Heavy Metal Stressed Soils	Muhammad Zaib[1] & Ali Zeeshan[2]
RAFVAL:ES-2025/147	Assess the Impact of Kisan Credit Card Scheme on Crop Productivity and Income of the Sample Farmers in Deoria District of Uttar Pradesh	Satish Chandra Verma and Hraday Kumar

RAFVAL:ES-2025/148	Integrated Nutrient Management in Fruit Crops	R.S.Verma*, Saurabh Verma[1] & Bipin Kumar[2]
RAFVAL:ES-2025/149	Obtaining an Antimicrobial Biopreparation Based on Flavonoids from *Ammothamnus lehmannii*	Alisher Xasanovich Tolliboyev
RAFVAL:ES-2025/150	Isolation of rhizosphere fungi from saline plants and evaluation of their halotolerance	Amirova Uljonoy Urol kizi[1] Karimova Ziyoda Sodiqjon kizi[2] Gulomova Gulnoza Gofurali kizi[3] Sultanov Numonjon Nabi ugli[4] Abdusamatov Sokhibjon Abdusamatovich[5] Jabborova Dilfuza Pushkinovna[6]
RAFVAL:ES-2025/151	Bioherbicidal Activity of Mycelial Fungi	Annakilichev Alisher Shuhratovich
RAFVAL:ES-2025/152	Certain hydrolytic enzyme activities of mycelial fungi with bioherbicidal potential	Annakilichev Alisher Shuhratovich
RAFVAL:ES-2025/153	Dairy Plant Management system- Milk Procurement from rural milk areas, processing and product manufacturing	Nishu Devi
RAFVAL:ES-2025/154	The Intertwined Fate of Soil Aggregates and Organic Carbon: Implications for Soil Health and Carbon Sequestration	Shikha Singh Tanwar*
RAFVAL:ES-2025/155	Balancing Profits and Conservation in Agriculture, Agroforestry, and Plantation Land Use Systems	Shivam Dinkar[1*] and Dr. Shalini Toppo[1]
RAFVAL:ES-2025/156	Infestation of red spider mites (*Tetranychus urticae* Koch) on okra crops and its management	Abhishek Gupta[a] and Dr. Sanjeet Kumar Singh[b]
RAFVAL:ES-2025/157	Impact Of E-Nam On Market Efficiency: A Case Study Review	Katkuri Sharwani[1] and Choudhary Snehal[2]
RAFVAL:ES-2025/158	Soil Fertility Improvement through Regenerative Practices	Anurag[1], Anil Kumar[2] and Mayank Kumar[1]

RAFVAL:ES-2025/159	Arsenic contamination in groundwater: A broad review of NCR districts in Haryana. Sonam Thalod [Research Scholar]	Dr. Garima sharma
RAFVAL:ES-2025/160	Agricultural Resilience and Food Security in Northeast India	[1]Jhalaknath Sharma*, [2]Iutran Passah
RAFVAL:ES-2025/161	Sustainable Livestock Feed and Nutrition	VIKAS
RAFVAL:ES-2025/162	Analyzing the Grazing Behavior of Small Ruminants on Natural Pasture during the Summer Season	Pooja Tamboli*, Deepak Upadhyay, Anup Kumar, Nilamani Dikshit, K.K. Singh and M.M. Das
RAFVAL:ES-2025/163	Empowering Youth and Women in Agriculture: Pathways to Sustainable Livelihoods and Inclusive Growth	Manju Devi[1]*, Kumari Sushmita[2] & Sudhanand Prasad Lal[3]
RAFVAL:ES-2025/164	Smart Harvesting: Real-Time Fruit Detection and Robotic Picking for Modern Agriculture	Abhishek Pandey[1]*, Pramod Kumar Sahoo[2], Dilip Kumar Kushwaha[3], Aruna T N[1], Kishan Kumar[1], Shubham Chaudhary[1,] Rohit Gaddamwar
RAFVAL:ES-2025/165	Comparative Analysis of Millets Consumption in Rural and Urban Area of Middle Gujarat	Alpa Karmur[1] And Ganga Devi[2]
RAFVAL:ES-2025/166	Seasonal incidence and succession of rice horned caterpillar in different rice ecosystem	Yaspal Singh Nirala*[1] Pushpanjali Pankaj[2], Archana Kerketta[1], Pushpa Lata Tirkey[1], Yushma Sao[1] and Chetna Banjare[1]
RAFVAL:ES-2025/167	Evaluation of Reproductive Performance in Crossbred Holstein Friesian and Jersey Cattle Under the Tropical Climate of Paralakhemundi, Odisha	B.V.S. Bhavya Charitha[1*], Deepthi Chandaka[1], Chaitanya Gollu[2], A. Udaya Kiran[3]
RAFVAL:ES-2025/168	Tolerance to heat stress in peas (Pisum sativum L.): Present status and future prospects	Dr Kanak Saxena
RAFVAL:ES-2025/169	Artificial Intelligence and Machine Learning in Weed Management in Field Crops: A Review	[1]Harish Menpadi, [1]Amaregouda A[2] and R P Patil[1]

RAFVAL:ES-2025/170	Foliar application of *Kappaphycus alvarezii* extract enhances drought tolerance in wheat by improving physiological and biochemical traits	Shashi Meena
RAFVAL:ES-2025/171	Pathology And Diagnosis Of Squamous Cell Carcinoma In Bovines	Vivek Kumar[1*], Dhananjay Kumar Jolhe[1]
RAFVAL:ES-2025/172	The role of root exudation in Nutrient scarcity and soil stress conditions in Forest Ecosystems	Priyanka Soren*
RAFVAL:ES-2025/173	Impact Of *Lactobacillus Acidophilus* Derived Postbiotics On The Performance Of Broiler Chicken Under Induced Coccidiosis Condition	Kurva Shiva Kumar[1#], Jagbir Singh Tyagi[1], Gautham Kolluri[1] and Sagar Khandagale[1]
RAFVAL:ES-2025/174	Organic Manures for Production of Quality Seedlings of Kamala [*Mallotus philippinensis* (Lam.) Mull. Arg.]: An LKT Multipurpose Species	[*]Smith Barina[1], L.K. Behera[2], A.A. Mehta[3], S.A. Huse[4], S.M. Patel[5] and C.A. Dholariya[6]
RAFVAL:ES-2025/175	Post-Harvest Management and Value Addition	Ram Gopal*
RAFVAL:ES-2025/176	Influence Of Biostimulants And Organic Mulch On Soil Microbial Population In Strawberry (F. × Ananassa Duch.)	Anushi[1], V. K. Tripathi[1]* and Puskar Shukla[2]
RAFVAL:ES-2025/177	Breeding for colour development in vegetable crops	Sharath M N[1*], Raveendra S Jawadagi[2], Shashikanth Evoor[3]
RAFVAL:ES-2025/177/A	Recent advances in breeding of bitter gourd (*Momordica charantia* L.)	Sharath M N[1*], Raveendra S Jawadagi[2], Shashikanth Evoor[3]
RAFVAL:ES-2025/178	Isolation of multidrug-resistant (MDR) bacteria from wastewater: Focus on β-lactamase production and biofilm formation	Rahisuddin Khan & Dr. Iqbal Ahmad
RAFVAL:ES-2025/179	Host Reaction Of Popular Turmeric Varieties To Wilt Complex Caused By *Meloidogyne* And *Fusarium* Spp. Under Greenhouse Condition	Shwetha, G. S.,[1*] Umashankar Kumar, N.,[2] Tejas Kumar, M. K[3] And Manjula Ramappa[3]

RAFVAL:ES-2025/180	Tissue culture in mulberry (*Morus* spp.) for in-vitro shoot development	Ahalya B. N[1]., Chikkalingaiah[2], Harish Menpadi[3], Manjunatha, N[4]. and Priyadarshini, S. K[5].
RAFVAL:ES-2025/181	Biofilm formation genes assessment in ESBL-producing *E. coli* isolates procured from salad vegetables in Mirzapur district, Uttar Pradesh, India.	Arti Pande Achyutrao[1], Shweta Yadav[1], Kaushik Satyaprakash[2], and Mukesh Kumar Bharti[3*]
RAFVAL:ES-2025/182	Agricultural and Biomedical Significance of Rustican Pepper (Armoracia rusticana)	Khaitbayeva Esidora Umar qizi
RAFVAL:ES-2025/183	Storage Methods Of Pigment-Producing Microorganisms	Husanova Sug'diyona Mansurjon qizi
RAFVAL:ES-2025/184	Optimization Of Indole-3-Acetic Acid Production By Microorganisms	D. Z. Bobojonova , D. I. Qosimov,
RAFVAL:ES-2025/185	Determination Of Optimal Nutrient Media For Microcloning Of *Ginkgo Biloba L*.	Shoyimova Madina Sherali qizi, PhD Khalkuziyeva M.
RAFVAL:ES-2025/186	Study of some valuable and economic characteristics of *Arachis Hypogaea* L. cultivars.	Urazboyeva U.A., Kurbanbayev I.Dj.
RAFVAL:ES-2025/187	Research Rationale And Experimental Framework For Studying Endophytes In *Pimpinella Anisum*	Oxunboboyev D.Z., Kadirova Z.A.
RAFVAL:ES-2025/188	Isolation Of Endophytic Bacteria From Strawberry (Fragaria) Plant	Zayniddinova S.B., Normurodova K.T.
RAFVAL:ES-2025/189	Effects Of Physical Mutagens On The Fertility Of Soybean Samples Learning.	Soatova F.B., Kurbanbayev I.Dj.
RAFVAL:ES-2025/190	Comparative Study Of Chlorophyll In The Leaves Of Soybean Varieties.	Utayev M.S., Kurbanbayev I.Dj.
RAFVAL:ES-2025/191	Beneficial Properties of Chlorella Algae	Xusnora Eraliyeva

RAFVAL:ES-2025/192	Airborne Transmission & Antimicrobial Resistance Genes of *E. coli* in Zoos of Chhattisgarh	L.Kurrey, Mayank Pal, Jasmeet Singh*, S.L. Ali*, N.E.Gade, C.S.Sannat and N.Rawat
RAFVAL:ES-2025/193	Assess the Impact of Kisan Credit Card Scheme on Crop Productivity and Income of the Sample Farmers in Deoria District of Uttar Pradesh	Satish Chandra Verma and Hraday Kumar
RAFVAL:ES-2025/194	Zero budget natural farming: A boon in Integrated Pest Management in Cucurbits	*Devyani Chuadhary, R. M. Srivastava, Tanuja Phartiyal
RAFVAL:ES-2025/195	Bridging the Gap: Gender Empowerment, Youth Involvement, and the Future of Community Extension	Diksha Srivastava[1], Sudhanand Prasad Lal[2], Jitendra Mehta[3] and Jaya Mehta[4]
RAFVAL:ES-2025/196	Genetic Advances And Innovations For Climate-Smart Maize Breeding	Yashaswini R [1], Prem Sagar S P [1], Raghavendra V C [1], Sanjay M [2] and Sridhara M R [3]
RAFVAL:ES-2025/197	Reviving Indigenous Wisdom for Strengthening Climate-Resilient Agroecosystems	V C Raghavendra[1], Sridhara M R[2], Prem Sagar S P[1], Yashaswini R[1], Manoj N S[3] and Sanjay M[4]
RAFVAL:ES-2025/198	Regeneration techniques for enhancement of seed germination, seedling vigour and production of quality planting materials for conservation of LKT species *Bauhinia malabarica* Roxb.	LK. Behera*, R. P. Gunaga, S. A. Huse, A.A. Mehta, S. M. Patel, C.A. Dholariya and Minal H. Patel
RAFVAL:ES-2025/199	Effect of Vitamin C on Arsenic Induced Oxidative Stress in Buffalo Erythrocytes *In Vitro*	Subrat Kumar Dash[1], Bhagyalaxmi Panda[2], Gloria Tigga[1], Aftab Adil[1] and Pankaj Kumar[3]
RAFVAL:ES-2025/200	Unlocking the Nutritional Potential of Onion Leaves: Impact of Sowing Dates on Bioactive Compounds	Manasranjan Parida[1*], Bibhuti Bhusan Sahoo[2], Adyasha Dash[3], Soumya Pragalva Mohanty[4], Mala Dasari Pavan[5] and Pradyumna Tripathy[6]

RAFVAL:ES-2025/201	Isolation of Zn solubilizing bacteria and development of consortium based Zn biofertilizer to enhance grain Zn and protein content in wheat in combination with ZnO nanoparticles	Shaibi Saleem & Shams Tabrez Khan,
RAFVAL:ES-2025/202	Biochemical and Growth Responses of Plants Under Different Bioagents and Organic Treatment	Ritul Saharan, Prakash Banakar and Anil Kumar
RAFVAL:ES-2025/203	Cutting edge Techniques in Agriculture and its Potential in Soil microbes	Firdous Ashraf[1], Subhash Chand[2], J. A. Sofi[2], Mudasir Rashid[3], Audil Nazir[3], Wani Barkat ul Islam[3].
RAFVAL:ES-2025/204	Effect Of Different Substrates And Seed Treatments (Ga_3 And Kno_3) On Germination Of *Solanum Torvum* When Soaked At Different Time Intervals	B. Anuradha[1], A. Kiran Kumar[2], D. Laxmi Narayana[3], K. Venkata Laxmi[4], CH. Raja Goud[5] and R. Poornima Mishra[6]
RAFVAL:ES-2025/205	Effect of antioxidant enriched *Aloe vera* gel based edible coatings and Low Density Polyethylene on quality characteristics of Ber (*Ziziphus mauritiana* Lamk.) cv. Umran	Kusum
RAFVAL:ES-2025/206	Herbal Medicine Used To Improve Fertility In Male Animals	L. C. Modi, Falguni Modi, J. H. Patel and H. C. Sharma
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Carbon Credits Potential in Indian Agriculture to Regenerate Soil and Enhance the Farmers' Income: Policy Framework

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The influence of carbon dioxide (CO_2) emitted due to anthropogenic and natural processes increases due to ~ 420 ppm (part per million) concentration in the atmosphere. As developed countries came to Glasgow with a commitment to providing US$ 100 billion a year for developing countries. Significant reductions are required to limit greenhouse gas (GHG) emissions by 2030 to achieve net zero emissions. The Asian agriculture sector may be a key player in the negative carbon (C) sink for the green planet. After the United States of America, India has the second-largest area of arable land, ~ 165 million hectares (Mha). It includes 46 of the 60 different soil types and exposure to all 15 of the world's major climates. The Indian agriculture sector has nature-gifted climatic parameters and classification of soils to cultivate 3-4 crops in a year with diverse cropping systems. In contrast, most parts can produce only one crop in western countries yearly. Hence, Indian Agriculture farmers can play a significant role in C farming to CO_2 removal from the atmosphere and conserve plants and enhance the above and below-ground C pool. Moreover, Advance cropping techniques reduce emissions, improve crop yield, restore damaged soils, and lessen pollution by lowering erosion and fertiliser runoff, cleaning surface and groundwater, and boosting microbial activity and soil biodiversity. When land is managed to C, capture rates rise, vital ecosystem services like water and air quality, agricultural resilience increase, and climate change lessens. Along with worldwide initiatives like the "4 per 1000" Initiative, Global Soil Partnership, and regional public-private partnership projects on C credits for long-term sustainability, national governments and other agencies should strive towards

C farming. Sustainable business practices and the use of environmentally friendly technology result in C credits that may be exchanged. As a result, it reduces GHG emissions while fostering a vibrant, profitable market. This chapter focuses on offsetting the rise in CO_2 concentrations in the atmosphere, a system of buying and selling C- credits has been developed under the United Nations framework. The C credit system was created as a "market-oriented approach" by the Intergovernmental Panel on Climate Change (IPCC) of the United Nations. C credits are being traded, making them a “climate currency” that follows the same supply and demand rules as fiat money. The framework is based on strong regulations, technical support, public-private partnerships, quantification methodology, and creative finance methods that eventually enable land managers to execute real-world, practical solutions effectively.

Keywords: *Cropping systems; Carbon credit; CO_2; innovative technologies; Incentives; Farmers*

Effect of plant growth promoting rhizobacteria inoculation on physiological traits of ginger in field condition

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Plant growth promoting rhizobacteria (PGPR) have been shown to improve medicinal and vegetable crops productivity, growth and yield and soil fertility. This study analyzed PGPR impacts on physiological traits of ginger under field condition. From 2020 to 2022, a study was carried out at the Surkhandarya Scientific Experimental Station, which is a division of the Vegetable, Melon Crops and Potato Research Institute in Uzbekistan, to examine the effects of growth-promoting rhizobacteria for physiological characteristics of ginger under field conditions. At the Surkhandarya scientific experimental station of the vegetable, melon crops, and potato research institute (N 37°13′44″, E 67°16′34″) in Uzbekistan, the experiment was conducted using a randomised block design with five replications. Five PGPR strains such as *Bacillus subtilis* IGPEB 1 alone, *Bacillus pumilus* IGPEB 2 alone, *Bacillus altitudinis* IGPEB 8 alone, *Pseudomonas koreensis* IGPEB 17 alone, *B. endophyticus* IGPEB 33 alone and control (uninoculated) were arranged in randomized block design with five replications under field conditions. Data on the photosynthetic pigments as affected by *B. subtilis* IGPEB 1, *B. pumilus* IGPEB 2, *B. altitudinis* IGPEB 8, *P. koreensis* IGPEB 17 and *B.endophyticus* IGPEB 33 treatments are presented in Table 1. At 90 day, the chlorophyll a content of ginger was significantly increased by 16.0%, 17.2%, 31.8%, and 34.5% with *B. pumilus* IGPEB 2, *B. altitudinis* IGPEB 8, *B. subtilis* IGPEB 1, *P. koreensis* IGPEB 17, respectively. However, *B.endophyticus* IGPEB 33 inoculated a sharp enhancement the chlorophyll a content of ginger by 38.8%, respectively, as compared to the control. The total chlorophyll and chlorophyll b contents also reported a sharply increase of 18.1-23.4% with *B. pumilus* IGPEB 2, 19.4-25.0% with *B. altitudinis* IGPEB 8, 35.3-45.3% with *B. subtilis* IGPEB 1 and 38.4-48.4% with *P. koreensis* IGPEB 17 than the control. Compared to the control, *B. subtilis* IGPEB 1and *P. koreensis* IGPEB 17 significantly enhanced the carotenoid content by 41.6-43.3%. However, inoculation of *B. endophyticus* IGPEB 33 significantly enhanced total chlorophyll by 42.9%, chlorophyll b by 53.1% and carotenoid contents by 48.3%.

Keywords: *Ginger, rhizobacteria, total chlorophyll content, relative water content*

RAFVAL:ES-2025/02

Biochar and NPK fertilizer effects on vitamins composition of okra grown in Tashkent region of Uzbekistan

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The application of biochar in conjunction with fertilizers has gained popularity due to its significant positive effects on the chemical such as pH, organic matter, and available nutrients, physical (including texture, bulk density, and porosity), and biological properties of soil. Therefore, this study aims to investigate the effects of biochar and NPK fertilizer on vitamin composition of okra grown in the Tashkent region of Uzbekistan. A study was conducted at the Durmon Experimental Field Station of the Institute of Genetics and Plant Experimental Biology in Uzbekistan to evaluate the effects of biochar and NPK fertilizer on the vitamin content of okra. The application of NPK at a rate of 80:50:50 kg/ha resulted in a significant enhancement of vitamin B2 content by 39.9% compared to the control group. Additionally, the combination of NPK (80:50:50 kg/ha) with biochar also led to a noteworthy increase in the vitamin B2 content of okra fruits. Moreover, the use of biochar alone significantly improved the vitamin B2 levels in okra, surpassing the effects observed in all other treatments. This indicates the potential of both biochar and NPK fertilizer in enhancing the nutritional quality of okra fruits. The vitamin B12 content in okra fruits was significantly enhanced by the application of biochar and NPK fertilizer. Notably, the use of biochar alone resulted in a considerable increase in vitamin B12 levels, outpacing all other treatments, including the control and different NPK fertilizer applications. When applied alone, the NPK treatment at a rate of 120:75:75 kg/ha increased vitamin B12 content by 29.9% to 67.2% compared to the control. Moreover, the combination of biochar with an NPK application rate of 120:75:75 kg/ha effectively increases the vitamins content in okra fruit. The combined use of biochar and mineral fertilizers presents the most promising approach for improving the nutritional quality of okra, with biochar alone demonstrating superior effects on vitamin content compared to mineral fertilizers.

RAFVAL:ES-2025/03

Correlation Indicators And Morphoeconomic Traits Of Foreign And Local Mungbean Genotypes Under Field Conditions In The Tashkent Region

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Annotation: The article explores the morphological and economic traits of 25 local and foreign mung bean genotypes under field conditions in Uzbekistan. These include characteristics such as stem height, distance between the ground and the branches, number of yield-bearing branches, number of pods per plant, pod weight, pod length, number of grains per pod, pod weight, grain weight, and the weight of 1000 grains. The results of their correlation analysis are also presented. Based on the morphological and economic characteristics of the 25 mung bean genotypes under field conditions in the Tashkent region, it was determined that the local varieties Durdona, Baraka, Barkaror, and Marzhon, along with the local lines L-8, L-22, L-88, L-92, and the foreign lines AVMU2003, AVMU2004, AVMU1681, and AVMU2002, exhibited superior traits compared to other varieties and lines. Additionally, a strong positive correlation was observed between the number of grains per pod and the weight of grains in a pod, as well as the weight of grains in a pod and the weight of 1000 grains.

Key words: *Vigna radiata L., mung bean, traits, plant height, variety, range, morphology.*

RAFVAL:ES-2025/04

General Physical Properties And Mechanical Composition of Soil-Sediments In The Eastern Part Of The Dried-Up Aral Sea Bed

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As a result of historical and geographical analyses, it has been determined that the Aral Sea crisis began primarily in the 1960s due to the large-scale diversion of water from the Amu Darya and Syr Darya rivers for irrigation purposes. As a consequence, the sea level began to drop sharply. Between 1960 and 2000, the sea's surface level fell by nearly 23 meters, its surface area shrank by 74%, and its volume decreased by more than 90%. Once the fourth-largest lake in the world, the Aral Sea gradually split into smaller water bodies, and by the 1980s–90s, it had divided into the Northern (Small) and Southern (Large) Aral. Thus, a vast new saline desert—Aralkum—emerged, exposing more than 5–6 million hectares of dried seabed. Although the scientific community was initially slow to recognize this gradual ecological disaster, by the end of the 20th century, its scale and dangerous consequences had been fully acknowledged.

The general physical properties and mechanical composition of the soils and sediments in the eastern part of the dried Aral Sea bed vary significantly depending on the terrain and the depth of the groundwater. The bulk density of the soil is highly variable and is mainly influenced by the degree of compaction of soil aggregates. In all the examined cross-sections of the soil and sediment layers in the eastern part of the dried Aral Sea bed, the density was found to be high. The specific gravity of soil changes depending on the quantity of certain minerals present. For example, soils rich in humus have a lower specific gravity (1.80–2.20 g/cm^3), whereas soils with low humus content tend to have a relatively higher specific gravity (2.30–2.60 g/cm³). The high specific gravity observed in the soils and sediments of the studied area is due to the high concentration of mineral salts.

It has been determined that the sediment particles in the eastern part of the Aral Sea bed are predominantly composed of fine particles. Specifically, in the weakly crusted, sandy-loamy automorphic saline soils, the mechanical composition revealed that sandy fractions range on average from 61% to 80%. In the weakly crusted, sandy to sandy-loamy saline automorphic soils, the physical sand fraction is approximately 10–18%, while the finest physical clay fraction accounts for 19–25%. In the semi-hydromorphic, crusted, sandy to sandy-loamy saline soils of the eastern part of the Aral Sea bed, the physical sand fraction ranges from approximately 50% to 88%, and the finest physical clay fraction ranges between 3% and 21.4%.

Key words: *soil-grunt, Aral sea, general physical properties, mechanical composition, Aralkum Desert.*

RAFVAL:ES-2025/05

Determination of macroelements and microelements of *Menta arvensis* L. in the Territory of the Chatkal State Biosphere Reserve

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Mentha arvensis L., a perennial herbaceous plant of the Lamiaceae family, is sometimes referred to as field mint or wild mint. It is found in many temperate and subtropical areas, including the Chatkal State Biosphere Reserve's special ecological zone. This plant's square stems, serrated leaves, and unique, fragrant scent—which comes from essential oils including menthol, menthone, and limonene—are its defining features. The therapeutic qualities of *Mentha arvensis* L., such as its anti-inflammatory, antibacterial, antioxidant, and digestive advantages, have been well investigated. In many cultures, it has long been used to treat illnesses including skin conditions, gastrointestinal problems, and respiratory difficulties. In addition to its pharmacological and nutritional benefits, recent studies have demonstrated its potential as a rich source of bioactive components, such as vitamins, flavonoids, and micro-micronutrients. The plant is a useful topic for phytochemical research because of its resilience to a variety of environmental circumstances, especially in areas with distinct ecosystems like the Chatkal State Biosphere Reserve. The chemical makeup and health advantages of *Mentha arvensis* L. have also been studied in response to the growing interest in natural products and plant-based therapies, making it a viable option for the creation of functional foods and nutraceuticals. In this study, macro and microelements of *Menta arvensis* L. in the territory of the Chatkal State Biosphere Reserve was investigated. It was also found to contain 6 microelements such as sodium (Na), Magnesium (Mg), sulfur (S) and calcium (Ca) phosphorus (P) and potassium (K) ranged from 0.751 to 64.874 mg/g; microelements such as chromium (Cr), molybdenum (Mo), manganese (Mn), zinc (Zn), boron (B) and Iron (Fe) ranged from 0.054 to 0.751mg/g. *Mentha arvensis* L. can be considered a beneficial herbal plant that has the potential to become a food source, herbal formulations, cosmetics and pharmaceuticals.

RAFVAL:ES-2025/06

Glycine Max L. Analysis Of The Weight Of 1000 Pieces Of Seeds Of The Genetic Collection Variety-Samples Of The Shade Of The Type

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Annotation: This thesis presents the results of a genetic collection of samples of the soybean (*Glycine Max L.*) species based on the weight of 1000 seeds. According to the conducted research, the highest indicator of the weight of 1000 seeds among the samples was found in Gen-8 and Gen-40 samples (196.8 and 195.4 gr), while the lowest results were observed in the Sochilmas variety (105.8 gr) and the BK-84 sample (112.7 gr).

Keywords: *Shade, Glycine max L., grain weight, yield, foreign variety, sample.*

RAFVAL:ES-2025/07

Soils Helath And Quality Indicators Of Chemically Contaminated

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Soil is a unique natural resource that plays a crucial role in human life and the stability of the biosphere. However, modern industrialization, improper agricultural practices and anthropogenic pressure are changing the chemical composition of the soil, bringing it to an ecologically dangerous state. As Academician V.V. Dokuchaev noted: “Soil is part of a living and active body, sensitive to all changes in the external environment.” Today, a number of quality indicators serve as the main criteria for assessing the state of contaminated soils. These indicators determine the degree of soil contamination, its stability and potential for recovery. Chemical pollution is a violation of the natural chemical balance of the soil due to heavy metals, pesticides, petroleum products, industrial waste and other toxic substances. Main sources Industrial waste (metallurgy, chemical plants) Agrochemicals used in agriculture Transport waste (Lead, cadmium) Oil spills Acid precipitation from the atmosphere Biogeochemist R. Alloway (1995) says the following in this regard: “Heavy metals in the soil accumulate rapidly due to human activity and do not decompose for a long time, which makes them environmentally dangerous.” The main indicators of the quality of chemically contaminated soil include the amount of heavy metals, especially in the soil. The concentration of metals such as Pb, Cd, Hg, As, Cr, Ni in the soil is the main indicator of toxicity. According to biochemist Gadd (1993): “Heavy metals slow down the vital activity of microorganisms, which leads to a deterioration in the biological state of the soil. The acidity or alkalinity of the soil has a significant effect on the mobility of heavy metals. Low pH converts them into a free form, increasing their biological activity. In addition, the cation exchange capacity (CEC) of the soil indicates its buffering capacity for heavy metals. High CEC helps to bind pollutants and neutralize them. The content of organic matter in the soil Organic matter (humus) plays an important role in converting toxic compounds in the soil to an inert state. According to Uzbek professor scientist Z.A. Jabbarov: “A high content of humus limits the mobility of heavy metals, which protects the soil from toxic effects.” In addition, other organic pollutants, in particular: Dioxins Polychlorinated biphenyls (PCBs) Polyaromatic hydrocarbons (PAHs) They pose a threat to plant and human health. Soil indicators are determined by the respiratory activity of microorganisms, the activity of enzymes (urease, dehydrogenase, catalase). For example. Ecologist R. Dick (1997) notes: “Biochemical indicators are the most sensitive means of detecting hidden pollution in the soil.” In assessing the quality and fertility of soil, it is important to compare the level of pollution in the background soil with the amount of pollution in the soil according to the indicator criteria - taking into account the natural state of the soil. In this case, the Maximum Permissible Concentrations (MPC) of the soil - sanitary standards - are also being implemented, as well as its ecotoxicological assessment - determining the level of toxicity through biotests [EU Soil Strategy, 2020]. Quality indicators of chemically contaminated soils are of great importance for in-depth analysis of their ecological state, determining the degree of degradation and developing effective remediation measures. By consistently monitoring the state of contaminated soils using scientific approaches and modern indicators, it is possible to protect soil resources and preserve them for future generations. B.P. Vinogradov said: “Losing soil is tantamount to losing the future of humanity.” The impact of chemical pollution of the soil on the biological, physical and chemical properties of the soil is the basis of life, the basis of the biosphere and an important factor for the well-being of mankind. The physical, chemical and biological properties of the soil are inextricably linked, and any external influence has a complex effect on them[Jabbarov Z.A,Imomov O.N 2024] Chemical pollution disrupts this balance, as a result of which the fertility, ecological function and recovery potential of the soil sharply decrease. As Academician V.I. Vernadsky noted: "Soil is the intersection of geological, biological and chemical processes, and any imbalance can lead to an ecological disaster. ConclusionChemical pollution of the soil has a complex and negative impact on its physical, chemical and biological properties. This, in turn, disrupts ecological stability, reduces agricultural productivity and poses a threat to human health. It is necessary to develop pollution monitoring and reclamation measures based on modern scientific approaches." Healthy soil - "the guarantee of a healthy society" [FAO, 2015].

RAFVAL:ES-2025/08

Scientific Analysis Of Biological Properties Of Sandy Desert Soils

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Today, considering global climate change, rising temperatures, and the intensification of desertification processes, improving degraded rangelands and foothill ecosystems with sparse vegetation cover through phytomelioration has become one of the most urgent tasks.The largest land use type globally is pastureland. According to FAO data, 23.4% of the world’s total land area consists of permanent pastures and grasslands. About 34% of agricultural land has been degraded due to improper usage, high anthropogenic pressure, and overgrazing.In our Republic, a number of scientific research projects have been carried out in different landscapes to ensure effective use of pasture lands, preserve biodiversity, and prevent degradation processes, which have yielded certain results. The Law of the Republic of Uzbekistan "On Pastures," adopted on May 20, 2019, under No. 538, outlines several key tasks, including the rational use and protection of pastures, accounting for the maximum load capacity, adhering to pasture use norms and periods, restoring soil fertility, mitigating drought processes, and promoting sustainable pasture use.Research has provided detailed information on the condition of degraded sandy desert soils and ways to improve their biological properties. Studies of microbiological processes in sandy desert soils have shown that as the soil's adsorption complex increases, microbiological activity significantly decreases. Planting pasture species and implementing phytomelioration efforts have contributed to improving agrochemical properties, enhancing microbiological activity, and preventing soil degradation. The results indicate that the biological properties of sandy desert soils improved, including increased humus content and enrichment of essential nutrients. As a result of scientific research conducted by the team of the Scientific Research Institute of Karakul Breeding and Desert Ecology, the following issues have been addressed:

- Indicators determining pasture degradation under anthropogenic influences and stages of degradation have been identified when using pastures under different regimes;
- Research has been planned on cadastre mapping and ecological monitoring of pasture conditions, using shrub-ephemeral and saltwort-grass pasture types of the Kyzylkum Desert as examples.

In recent years, studies have been conducted on protecting sandy desert soils—particularly those found in the Karakum and Kyzylkum Deserts of Central Asia—from wind erosion through amelioration and phytomelioration methods.In assessing soil conditions, indicators such as humus content, nutrient levels, biological activity, and their spatial distribution were used. Based on biological activity, areas were identified as follows: catalase enzyme activity at 3.14–3.30 ml O_2/g soil covered 398.23 ha; invertase activity at 6.44–6.80 mg glucose/g soil covered 374.85 ha; urease activity at 7.50–7.90 mg NH_3/g soil covered 395.39 ha.According to the NDVI map, due to rising air temperatures, a decrease in the vegetation index was observed from July to August. The results showed that enzymatic and microbiological activity increased in the variants where bio-organic fertilizers and hydrogels were used compared to the control. A strong correlation was observed between urease activity, ammonifying bacteria, and spore-forming bacteria.

RAFVAL:ES-2025/09

Processes Of Formation Of The Aral Sea Soils

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The drying up of the Aral Sea is a very sad disaster for the countries of Central Asia, and the human impact on this tragedy is also high. It is no secret that the drying up of the Aral Sea in the 60-70s not only caused great damage to nature, but also replaced the aquatic ecosystem with a desert ecosystem. Before the drying up of the Aral Sea, biodiversity was very high, and the fishing industry was also well developed. Currently, a total of more than 3 million hectares of land has dried up, and the remaining water has a high level of salinity, making it unsuitable for living organisms and plants. In addition, sand, salt, and dust particles are being released into the atmosphere, damaging agricultural land. Dust particles and salt particles released into the atmosphere are affecting the health of people living around the Aral Sea and reducing the life span of all living organisms. Currently, the area of the Aral Sea is continuing to decrease due to the decrease in water. In order to increase biodiversity in the dried-up areas and reduce the amount of sand, salt, and dust that is damaging the environment, plants are considered indispensable, and work is being carried out to select, plant, and propagate suitable plants. During the research, scientists found that in the northeastern part of the Aral Sea, at a depth of 1 meter, the soil samples were dominated by sulfate-chloride in terms of salinity, with sulfate-chloride being 57%, chloride-sulfate 28%, and soda-sulfate 14% [Issanova G. et al. 2022]. If we look at the history of the Aral Sea, it has dried up a total of 3 times, and when it dried up for the second time, it was drained into the Kasbiy Sea through the Uzboy basin [Sunnatullayeva Sevara et al. 2024]. Currently, a large part of the dried-up Aral Sea bottom has become a lifeless area, soil covers are gradually forming, and if the sea water does not return, the area of steppes and forests will increase [Kocharova, S.A. 2019]. Scientists have determined that soil formation was not evident in the Aral Sea areas that dried up 15 years ago, and began to form in areas that dried up 30 years ago [Лобанова, П.С. et al. 2023]. A decrease in sea level by 39 meters led to the transformation of 5 million hectares of land into desert. The level of soil salinity covers almost the entire Aral Sea [Kurbaniyazov A.K., 2015].The leading factor in soil formation on open surfaces of the Aral Sea is the climate, and then the salinization process develops with the rapid drying of its water. The mechanical composition of soils also plays a key role, performing its main functions in the development of the defoliation process under the influence of winds on light sands [Томина, Т.К., 2009].The development of vegetation in the Aral Sea in 1965-1990 was determined by the spatiotemporal pattern of the formation of the natural environment of the seabed and occurred gradually. As a result of the withdrawal of groundwater, salinity increased, and due to the withdrawal of moisture, a decrease in halophytic vegetation was observed [Ilyasov, E.I., 2020].

Conclusion. As a result of the drying up of the Aral Sea, a large area was transformed into a desert, and by increasing biodiversity in these areas, it is possible to reduce the environmental damage caused by dust and salts rising into the atmosphere. The growth of vegetation contributes to the preservation of moisture in the soil and the creation of conditions for the survival of micro and macroorganisms. During our research, the aim was to study the soil properties of the Aral Sea's drained sand and salt-covered areas and create a scientific basis for developing optimal options for planting plants in each area.

Note: This article was implemented within the framework of the project FL-8323102111-R1 “Creating a scientific basis for grouping areas for planting plants based on the salinity, physical, chemical and biological properties of soils and soils distributed in the area of the dried-up bottom of the Aral Sea”.

RAFVAL:ES-2025/10

Inheritance Of Stem Hairiness In F_1 Hybrids Of G. Hirsutum L. And G. Barbadense L.

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The cultivation and processing of cotton and other fiber crops are of significant economic importance worldwide. However, a large portion of the cotton harvest, specifically 15–25%, is lost due to biotic factors (pests and diseases), while 20–30% is lost due to abiotic factors (drought, soil quality, and temperature fluctuations). In particular, the trichomes (hairs) on cotton are being studied as an important indicator for improving the plant's stress tolerance.

Research by Meagher (1997) and others has confirmed a direct link between trichomes and resistance to pests. Cotton varieties with a high number of trichomes are more resistant to aphids and whiteflies, reducing the need for pesticide applications. In contrast, varieties with few or no trichomes are more susceptible to pest attacks [3]. Based on the rating system developed by Bourland and others (2003), the trichome coverage on the abaxial leaf surface and stems was evaluated [1]. Rong Yuan and others emphasize that the stem trichome density can be divided into six classes (0-5), consisting of two types of trichomes that emerge from the stem: simple and complex dendritic trichomes arranged in single or tufted formations [2].

In our 2023 research, the types of trichomes on leaves and stems were studied, and a general conclusion was drawn regarding the trichomes of two cultivated tetraploid species. [4].

RAFVAL:ES-2025/11

Effect of Mineral Fertilizers on growth and yield of turmeric in Surkhandarya region, Uzbekistan

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In the present investigation, the effect of mineral fertilizers on the growth and yield of turmeric in Surkhandarya Region, Uzbekistan was studied. A field experiment was conducted with four treatments including T1 (Control), T2 (N75P50K50 kg/ha), T3 (N125P100K100 kg/ha) and T4 (N100P75K75 + B3Zn6Fe6 kg/ha or Macro- and Micro-Nutrient Fertilizer – MMNF). The treatment N125P100K100 kg of fertilizer per hectare and MMNF significantly enhanced the leaf length, leaf number, leaf width and plant height as compared to the control in 120 and 180 days. At 120 and 180 days, the highest indicator was recorded by treatment MMNF in the climatic conditions of the Surkhandarya region. The fresh rhizome yield of turmeric per plant increases reached a maximum in T3 and MMNF treatments compared with the control. The treatment N125P100K100 kg of fertilizer per hectare significantly increased the rhizome yield of turmeric per plant by 119.7% compared to the control. However, MMNF treatments significantly increased the rhizome yield of turmeric per plant by 132.4% over the control. Leaf width values were in extremely significant positive correlation with rhizome yield per plant and rhizome yield of turmeric (1 m^2/g Leaf length values were in a highly significant positive correlation with rhizome yield per plant and rhizome yield of turmeric (1m^2/g). Therefore, this present study revealed that the MMNF could produce the most significant yield of turmeric

in a field condition. This is the first report comprising of turmeric cultivation in Uzbekistan using rhizome. The heatmap based on Pearson and Ward for determining distance and clustering shows the effect of mineral fertilizers on growth parameters and yield of turmeric. It was analyzed that treatments were categorized into two classes, namely control with the negative effect with treatment 2 (N75P50K50 kg/ha). T3 and T4 (N125P100K100 kg/ha) − positive effect on plant growth and yield of turmeric. Accordingly, the MMNF treatment increased the turmeric plant's height, number of leaves, length, width, and fresh rhizome production, as well as most of the other growth parameters and yield that were measured. Turmeric performed well in term of rhizome yield and can be recommended for the Surkhandaryo region of Uzbekistan.

Keywords: *turmeric; mineral fertilizers; growth parameters, yield.*

RAFVAL:ES-2025/12

Phytochemical Composition and Traditional Applications of *Achillea millefolium*

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Achillea millefolium is a medicinal plant known for its diverse phytochemical composition and therapeutic applications in both traditional and modern medicine. Its chemical profile includes flavonoids (such as apigenin, luteolin, and quercetin), coumarins, alkaloids, essential oils (including 1,8-cineole, camphor, and borneol), tannins, and sesquiterpenoids. These bioactive compounds contribute to its antioxidant, anti-inflammatory, antibacterial, antifungal, and analgesic properties.

Traditionally, *A. millefolium* has been utilized to manage bleeding, alleviate digestive issues, ease nervous conditions, and treat respiratory ailments. For example, herbal infusions prepared from the plant are used to address stomach ulcers, gastritis, and flatulence. Its tannins and essential oils strengthen blood vessels, making the plant particularly effective in stopping bleeding and aiding wound healing.

Flavonoids found in *A. millefolium* offer strong antioxidant and anti-inflammatory effects, supporting immune system function. Coumarins exhibit antimicrobial properties and are widely applied in managing wounds and skin-related conditions. The plant is also recognized for its calming effects, making it a remedy for stress and related disorders.

A. millefolium is valued in traditional medicine for its safety and efficacy. Its use spans centuries, demonstrating its reliability for treating various ailments. However, further clinical research is necessary to explore its full potential and develop new pharmacological applications. This could establish *A.millefolium* as a cornerstone in modern therapeutic practices.

In conclusion, the plant represents a valuable natural resource with versatile applications, ranging from hemostatic to immunomodulatory effects. Its phytochemical complexity and efficacy make it a promising candidate for the development of novel medications.

Keywords *Achillea millefolium, phytochemical profile, traditional medicine, antioxidant, anti-inflammatory, therapeutic applications.*

RAFVAL:ES-2025/13

Phytonematode In Leguminous Crops In Selected Districts Of The Republic Of Karakalpakstan

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Due to the sharply continental climate of the Republic of Karakalpakstan (saline soils, water scarcity, and high temperatures) the research conducted in this region holds significant importance for the global scientific community. In the context of climate change, the geographic distribution of crop pests may expand. Therefore, the data collected in this area can contribute to the prevention and management of such issues in newly affected regions.

As a result of the research, a total of 49 nematode species belonging to 2 classes, 5 orders, 21 families, and 31 genera were identified in watermelon, melon, and pumpkin plants of the (Cucurbitaceae Juss) family. When analyzed by orders, representatives of *Dorylaimida* (8 species), *Rhabditida* (17 species), and *Tylenchida* (22 species) were found to be dominant. Species from *Monhysterida* (1 species) and *Araeolaimida* (1 species) were encountered in low numbers. According to the degree of dominance, the nematodes were classified as follows: eudominants – 1 species, dominants – 3 species, subdominants – 17 species, residents – 11 species, and subresidents – 17 species. Based on ecological characteristics, the nematodes were divided into nine ecological groups: *bacteriophagous pararhizobionts* – 7 species, *detritophagous pararhizobionts* – 1 species, *predatory pararhizobionts* – 1 species, *eusaprobionts* – 3 species, *unarmed devisaprobionts* – 9 species, *armed devisaprobionts* – 6 species, *microhelminths* – 12 species, *ectoparasites* – 8 species, and e*ndoparasites* – 2 species.

According to the faunistic analysis, 43 nematode species (512 individuals) were identified in watermelon, 36 species (163 individuals) in pumpkin, and 29 species (141 individuals) in melon. Among the nematodes found in watermelon, the species *Eudorylaimus monochystera*, *Mesorhabditis monochystera*, *M. irregularis*, *Eucephalobus striatus, Panagrolaimus rigidus, Aphelenchus avenae*, and *Aphelenchoides subparietinus* were the most abundant. In pumpkin, dominant species included *Eudorylaimus monochystera*, *Cephalobus persegnis*, *Acrobeles siliatus*, and *Aphelenchus avenae*. In melon, the dominant species were *Rhabditis brevispina*, *Chiloplacus propinquus*, *Panagrolaimus rigidus*, and *Aphelenchus avenae*.

Keywords: *Nematodes, species, community, individual, root, soil, distribution*

RAFVAL:ES-2025/14

Isolation of Halophilic Microorganisms from Saline Environments and Study of Their Enzymatic Activity

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Soil salinity, one of the major problems limiting agricultural production, is increasing day by day in arid and semi-arid regions. In such areas, insufficient rainfall prevents plants from leaching excess salts from the root zone, significantly affecting water uptake, ion homeostasis, photosynthesis, respiration, nutrient assimilation, and hormonal balance. Soil salinity can be mitigated through chemical and biological methods. Among biological approaches, the use of salt-tolerant plants (halophytes) and microorganisms is preferred due to their environmentally friendly nature. However, halophytes constitute only about 1% of the total flora, making it essential to explore alternative approaches.

Recent studies have demonstrated that halotolerant and halophilic plant growth-promoting (PGP) bacteria are promising candidates for saline soil remediation. These bacteria not only support plant growth under saline conditions but also contribute to soil restoration through various mechanisms. The present study aims to isolate and characterize halophilic microorganisms from hypersaline soils and waters of ecologically polluted areas of Uzbekistan, including Jizzakh region, Arnasay district, and the Aidarkul area. Additionally, the study evaluates the biotechnological potential of isolated strains, including their ability to produce polysaccharides, carotenoids, biosurfactants, and enzymes such as amylase and protease.

Samples were collected on October 19, 2023, by the staff of the Institute of Microbiology of the Academy of Sciences of the Republic of Uzbekistan and the Academy of Sciences of China. A total of 33 samples were collected from the Jizzakh region, Arnasay district, "Aidarkul" area. The pH of the collected samples ranged from 6.65 to 8.03. Halophilic microorganisms were isolated by enrichment with NaCl at concentrations of 100.0, 200.0, and 250.0 g/L. The enrichment medium contained yeast extract (2.0 g/L), $MgSO_4 \times 7H_2O$ (5.0 g/L), KCl (2.0 g/L), $CaCl_2 \times 6H_2O$ (0.2 g/L), and NaCl (100.0/200.0/250.0 g/L). Samples (10 g of soil or 90 mL of water) were inoculated into 90 mL of liquid nutrient medium and incubated at 30°C and 45°C for 10 days at pH 7.0-8.5. Every third day, the samples were plated on solid nutrient media with corresponding salt concentrations. Pure cultures were obtained by repeated streaking and stored at 4°C with NaCl concentration of 10%. Subculturing was performed every 15 days.

The enzymatic activity screening focused on the production of amylase and protease. Among the 86 isolates tested for protease activity, 11 isolates produced distinct hydrolytic zones on skim milk agar plates, indicating protease activity. The diameter of the hydrolytic zones ranged from 14 mm to 38 mm, with the highest activity observed in isolate 79 (38 mm). Amylase screening revealed that 6 out of 86 isolates exhibited amylase activity on starch agar plates, forming clear zones after iodine staining. The diameter of these zones varied from 7 mm to 25 mm, with the highest activity recorded in isolate 35 (25 mm). These findings demonstrate the high potential of selected isolates for biotechnological applications, particularly in enzyme production for industrial processes.

This study successfully isolated and screened halophilic microorganisms with enzymatic activities from saline soils of Uzbekistan. The most promising strains demonstrated significant protease and amylase activities, indicating their potential for biotechnological applications, including the production of industrial enzymes. Further studies are needed to optimize enzyme production and assess the biotechnological potential of the selected isolates.

Keywords: *Soil salinity, arid regions, halophilic microorganisms, PGP bacteria, saline soil remediation, biotechnological potential, hypersaline soils, Jizzakh region, enzymatic activity, protease, amylase.*

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Role of plastic and microplastic in marine pollution in different region of India- A Review

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Today the world concerned with the pollution of marine environment, which result in instant and long-term damages to coastal and marine habitats and ecosystems. With a rapid development of human's society, there is an increasing diversity and geographic spread of substances being released in to the marine environment. It can be introduced to marine environment directly through human activities indirectly through runoff. Plastic is one of the most enduring materials. It can take hundreds of years to degrade and research is showing that it is possible that it does not even fully degrade but become we call microplastics. Contribute to the accumulation of this debris 80% of which comes from sources on land. Common type of marine debris includes plastic items like shopping bags, bottles caps and food wrappers etc. Due to plastic pollutions marine environment vary in a array of parameters such as temperature, pH, salinity, current wind parameters. The microplastic level of different coastal and marine ecosystems nearly range from 0.001-140 particles/m^3 in water and 0.2-8766 particles/m^3 in sediments at different aquatic environment. All of these marine pollution incidents have caused significant and difficult recovery of the marine environment. So, how do we prevent and control the occurrence of these marine pollutions? How to restore and manage contaminated waters? This article we will focus on several major marine pollution incidents in the history of the world to discuss and analyze the pollution of the world's oceans, how to prevent and control marine pollution, and how to treat the polluted oceans.

Keywords: *Marine, Marine pollution Marine Pollution prevention, Plastic, Microplastics, Microbes*

RAFVAL:ES-2025/16

Influence of Nitrogen Levels and Varieties on Growth, Yield and Quality of Rice (*Oryza Sativa* L.)

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An experiment was conducted at Instructional Farm, Department of Agronomy, Faculty of Agriculture, AKS University, Sherganj, Satna (M.P.) during *kharif* season of 2017-2018. The experiment consisted of Randomize Block Design having Factorial arrangement in three replications. In this experiment, 12 treatment combinations including three varieties (MTU-1010, IR-64 and JR-201) and four levels of nitrogen (0, 60, 120 and 180 kg ha^{-1}). The treatments comprised three varieties (MTU-1010, IR-64 and JR-201) and four levels of nitrogen (0, 60, 120 and 180 kg ha^{-1}). It was found that variety and nitrogen significantly affected plant height, number of tillers plant^{-1}, number of grains panicle^{-1}, thousand grain weight, grain, and Straw yield of rice. The plant height, number of branches plant^{-1} were, in general, increased in all the treatments with the successive growth and development stages of crop *i.e*. 30, 60 and at 90 DAT stages of plant growth. Among these vegetative growth parameters, plant height, in general, enhanced at the faster between 30 days up to the 60 days stage of observations. At 90 DAT stage, plant height ranged from 85.22 to 92.57 cm and tillers 9.26 to 11.97 plant^{-1} as well as effective tillers 11.26 to 12.23 plant^{-1} at 65 DAT stage under different treatments. Similarly, the factor which are directly responsible for ultimate grain production *viz*. number of panicles plant^{-1}, number of filled grains panicle^{-1} and seed yield plant^{-1} were augmented almost significantly due to rice variety JR 201 as against IR-64 and MTU-1010. Thus, the maximum number of panicles were 10.36 plant^{-1}, number of filled grain 10.40 panicle^{-1} and 31.69 g seed yield plant^{-1} in case of JR-201.

Keywords: *Rice, plant, grains/panicle, grain weight, test weight, straw yield*

RAFVAL:ES-2025/16/A

Advances In Irrigation Technology For Water Conservation

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The increasing demand for water in agriculture, combined with climate change and diminishing water resources, has driven the development of advanced irrigation technologies. Modern irrigation systems are designed to maximize water efficiency while maintaining optimal crop yields. Drip irrigation, one of the most effective methods, delivers water directly to the root zone, minimizing evaporation and runoff. Sprinkler systems with precision nozzles and automated controls offer uniform water distribution and reduce wastage. Smart irrigation systems, powered by the Internet of Things (IoT), leverage real-time data from soil moisture sensors, weather forecasts, and crop needs to optimize water delivery. These systems ensure precise irrigation schedules, preventing over- or under-watering. Additionally, satellite and drone technologies provide high-resolution imaging and mapping to monitor crop health and soil moisture variability, enabling targeted irrigation practices. Subsurface drip irrigation (SDI) and fertigation systems further enhance water-use efficiency by delivering water and nutrients underground, reducing evaporation and nutrient loss. Furthermore, automated irrigation systems with machine learning algorithms can adapt to changing environmental conditions, ensuring sustainable water usage. The integration of renewable energy sources, such as solar-powered pumps, also reduces the environmental impact of irrigation systems. Collectively, these advancements in irrigation technology are pivotal for sustainable agriculture, helping farmers conserve water, reduce costs, and improve resilience to drought. As global water scarcity intensifies, adopting these innovative practices is essential for ensuring food security and environmental sustainability.

Keywords: *Drip irrigation, Smart irrigation systems, water-use efficiency, innovative practices*

RAFVAL:ES-2025/17

Adoption Of Different Post Harvest Management Practices Of Rice By The Tribal Farm Families

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In Jashpur district, there is renewed concern about post-harvest losses which account for 20–30% loss of farm produce. The lack of adequate storage facilities also affects produce quality, reducing produce market value with negative implications for various parts of the value chain (consumers, processors, etc.) requiring high quality raw materials. Adoption of post-harvest practices was studied at Jashpur district of Chhattisgarh. Majority of the respondents (61.67%) have medium level of adoption of post-harvest management practices for rice, followed by 25 per cent of them had high extent of adoption while, 13.33 per cent of them had low level of adoption regarding post-harvest management practices for rice. Most of the post-harvest activitieswas adopted by men and women viz. drying, threshing, winnowing, de-husking, storage/packaging, processing and marketing.As the tribal farm familiesare largely poor, they can’t adopt the new technology of post-harvest management practices. Facilitating efficient post-harvest management technology in tribal/farming communities benefits not only families in terms of increased income, but also hunger-stricken populations across tribal areas in terms of food security.

Key words: *Rice farming**,** tribal farm families, adoption and post-harvest management activities.*

RAFVAL:ES-2025/18

Examining the role of educational campaigns in enhancing awareness regarding nutrition and adoption of sustainable nutrition practices.

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Sustainable nutrition practices are increasingly acknowledged as fundamentally crucial not only for the enhancement of public health outcomes but also for the promotion of environmental sustainability in a world facing significant ecological challenges. In this context, educational campaigns assume a pivotal role in not only raising awareness among the populace but also in shaping societal attitudes and ultimately encouraging the widespread adoption of these essential sustainable practices. This review meticulously explores the effectiveness of a diverse range of educational interventions, conducting a thorough analysis of their impact on the dissemination of knowledge as well as their capacity to engender meaningful behavior change among individuals and communities. Through a comprehensive examination of pertinent case studies, the application of theoretical frameworks, and the scrutiny of empirical research findings, this paper endeavors to illuminate the various strategies that have demonstrated efficacy in nurturing sustainable nutrition practices while simultaneously identifying critical areas that warrant further research and enhancement in future endeavors.

Keywords: *Awareness, Educational Campaign, Nutrition practices, Sustainability, Sustainable Nutrition*

RAFVAL:ES-2025/19

Effect Of Parthenium Grass on Crops, Farmers and Environment of India.

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Parthenium grass is a very dangerous weed which has gradually become very harmful for the farmers. It creates hindrance for the farmers in growing their main crops and the farmers who use growth promotors and other types of fertilizers for their main crops. uses most of it and spends it on nutrition. Parthenium grass destroys all the hard work a farmer puts into his crop because it consumes most of the nutrition itself. This grass grows very fast and has a large number of seeds on it, which travel very fast from one place to another through wind, birds etc. and by floating in water, and a new plant grows there again, hence It is a difficult task for the farmer to select it and remove it from the crop. This plant is found everywhere in most of the fertile lands of India and it has been influencing the crops for a long time. Farmers are suffering from it but till now no such medicine or chemical (weedicides) has been manufactured for it. possible so that it can be prevented properly and forever. I also belong to a farmer family; hence we have also endured this problem to a great extent. It is a big curse for the farmer’s hence I believe that there should be some kind of treatment for this so that this problem can be solved by the farmers forever. And it should be eliminated from the life of crops so that farmers can grow their crops properly and get the fruits of their hard work. This plant not only causes harm to the crops but also has many side effects for humans because if a farmer uproots it by hand or cuts it by hand, then he gets poisoned due to the chemicals present in it. Due to this, a person may develop skin related diseases and coming in contact with its seeds etc. may cause asthma, breathing problems etc. It also causes various types of other diseases.

Key words: *Parthenium grass, Farmers, Growth, Asthma, Crops, Plants.*

RAFVAL:ES-2025/20

Edible Coating Enriched with Extracted Bioactive Compounds for Extending the Shelf Life of Tomatoes

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Tomatoes are highly perishable due to rapid ripening and microbial spoilage, leading to significant postharvest losses. Edible coatings enriched with extracted bioactive compounds, particularly gallic acid and p-coumaric acid, offer a sustainable solution to extend their shelf life while preserving physicochemical properties and nutritional quality. This study evaluates the effectiveness of biopolymer-based edible coatings in enhancing the shelf life of tomatoes. Key parameters, including weight loss, firmness, pH, lycopene content, and beta-carotene content, were analyzed in coated and uncoated samples over 30 days of storage. Results showed that physiological weight loss was significantly lower in tomatoes treated with 0.8% (3.11%) and 1% (1.79%) bioactive compound-enriched coatings compared to untreated samples. Fruit firmness and ascorbic acid content were highest in tomatoes treated with 1% bioactive compounds (7.96% firmness and 23.41 mg/100g ascorbic acid). Additionally, lycopene and beta-carotene degradation were significantly reduced in coated samples, demonstrating the efficacy of bioactive compounds in maintaining nutritional quality. These findings highlight the potential of bioactive compound-enriched edible coatings as a natural and effective postharvest strategy for extending the shelf life and quality of tomatoes.

Keywords: *Bioactive compounds, antimicrobial, tomatoes, physiological loss, firmness*

RAFVAL:ES-2025/21

In silico identification and classification of mirror repeats in the thermosensitive gustatory receptor gene, Gr18 of *Aedes aegypti*

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Mirror repeats (MRs) are the repetitive DNA sequences known to accumulate variations in the gene sequence during evolution. These 'turning knobs' are important tools for studies on taxonomy, phylogeny and expression of disease associated genes. Till date, no information is available on the MRs in *Aedes aegypti* (Linn.). Present study is first of its kind to identify the MRs in the Gr18 gene of *A. aegypti*. In silico analysis of complete gene sequence of Gr18 (1323 bp) using BLASTn retrieved 25 mirror repeats. Of these, one MR was categorized as Perfect Mirror Repeat (PMR) (4.0%), four as Imperfect Mirror Repeat (IMR) (16.0%) and remaining (20 MRs) as Perfect Mirror Repeat with Single Spacer (PMR-SS) (80.0%). Exon-1 (838 bp), exon-2 (233 bp) and exon-3 (134 bp) possessed 15, 3 and 4 MRs, respectively. The exonic region thus comprised a total of 22 MRs. Of these, 1 MR was categorized as PMR (4.5%), 4 as IMR (18.2%) and remaining (17 MRs) as PMR-SS (77.3%). No MR was retrieved from intron-1 (60 bp), while intron-2 (134 bp) possessed 3 MRs and all were classified as PMR-SS (100.0%). Overall, 23 MRs were reported in the mRNA (1205 bp). Of these, one MR was categorized as PMR (4.3%), 4 as IMR (17.4%) and remaining (18 MRs) as PMR-SS (78.3%). Three MRs viz., TTTCACTTT, CATGGGTAC and ATATTTATA were reported within the genome of all the six species of mosquitoes namely *A. aegypti*, *A. albopictus*, *Anopheles stephensi*, *A. culicifacies*, *Culex pipiens* and *C. quinquefasciatus* using megaBLAST. The study concludes that the identified mirror repeats are limited not only to *A. aegypti* but also present in other mosquito species. Further studies might help determine the exact nature and function of these mirror repeats.

Keywords: *Aedes aegypti, Mirror repeats, Gustatory gene Gr18, BLASTn*

RAFVAL:ES-2025/22

Assessing the Socio-Economic Impact of MGNREGS in Haryana: A Comparative Analysis of Rural Livelihoods and Development

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MGNREGS has played a significant role in improving rural livelihoods and development in Haryana, contributing to employment generation, infrastructure development, and poverty alleviation. MGNREGS was launched in Haryana in 2006 to address unemployment and underemployment in rural areas. One of the primary goals of MGNREGS is to create stable employment for rural households. MGNREGS can further contribute to the sustainable development of rural Haryana. The scheme primarily targets the creation of rural infrastructure, such as water conservation, drought-proofing, and rural connectivity, while simultaneously providing employment to local communities, especially marginalized groups like women, Scheduled Castes (SC), and Scheduled Tribes (ST).This comparative study explores mixed-method approach Quantitative data and Qualitative data, the socio-economic impact of MGNREGS in Haryana, looking at both the positive outcomes and challenges faced by rural communities, with a focus on employment, income generation, infrastructure development, and social empowerment. Projects undertaken under the scheme, such as the construction of roads, ponds, and irrigation structures, have improved rural connectivity and agricultural productivity. In many villages, these infrastructural developments have helped improve access to markets, healthcare, and educational facilities, leading to overall better living conditions. Impact on rural livelihoods like: Employment Generation, Income Generation Skill, Development and Diversification.

Keywords: *Development, Employment, Qualitative data, Quantitative data, Social Empowerment, Diversification.*

RAFVAL:ES-2025/23

Marketing Strategies and Market Potential of Agroforestry Food Products: Challenges and Opportunities

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Agroforestry integrates trees, crops and livestock into a sustainable land-use system, offering a diverse range of food products such as fruits, nuts, spices, medicinal plants and non-timber forest products. These products have growing market potential due to increasing consumer demand for organic, sustainable and nutritionally rich foods. Agroforestry-based food systems contribute to environmental sustainability, biodiversity conservation and climate resilience while supporting rural livelihoods. However, several challenges hinder their commercialization, including market fragmentation, inconsistent supply chains, inadequate processing infrastructure and limited consumer awareness. Smallholder farmers, who constitute the primary producers, often struggle with low bargaining power, lack of access to formal markets and price volatility, limiting their profitability. To enhance market access and competitiveness, effective marketing strategies are essential. Value addition through post-harvest processing, quality certification, branding and eco-labeling can improve product differentiation and consumer trust. Digital platforms, e-commerce and direct-to-consumer marketing models offer opportunities for small-scale producers to bypass intermediaries and reach wider markets. Strengthening farmer cooperatives and producer organizations can enhance bargaining power and facilitate collective marketing. Policy interventions, including financial incentives, market linkages and investment in infrastructure, are crucial for integrating agroforestry food products into mainstream markets. Additionally, international trade opportunities can be explored by aligning with global organic and fair-trade standards.

Keywords: *Agroforestry, food markets, value addition, marketing strategies, sustainability*

RAFVAL:ES-2025/24

Advances in Crop Breeding Techniques for Stress Tolerance

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Recent advancements in crop breeding techniques have greatly improved the development of stress-tolerant crop varieties, addressing the pressing challenges posed by climate change and the growing demand for food. While traditional breeding methods remain important, they are now enhanced by cutting-edge biotechnological approaches such as marker-assisted selection (MAS), genetic engineering, and CRISPR-Cas9 genome editing. These technologies enable precise identification and modification of genes responsible for stress responses, including tolerance to drought, salinity, and extreme temperatures. Research demonstrates that integrating stress tolerance traits into high-yielding crops increases resilience and productivity under unfavourable conditions. Additionally, genomic selection has accelerated the breeding process, allowing for faster development of improved cultivars. Field trials and genetic mapping have provided valuable insights into the complex traits related to stress tolerance, helping breeders to select optimal lines for further development. Collaboration among geneticists, agronomists, and climate scientists is crucial to ensure that new crop varieties address the diverse needs of both farmers and ecosystems. As global agricultural systems face increasing pressures, these advancements not only offer the potential to enhance food security but also promote sustainable farming practices by reducing dependency on chemical inputs. Continued research and development in this area hold significant promise for the future resilience of agriculture.

Keywords: *crop breeding, breeding techniques, stress tolerance, sustainable agriculture*

RAFVAL:ES-2025/25

Agro-forestry Systems: Benefits, Challenges, and Future Prospects

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Agro-forestry systems, which integrate trees and shrubs into agricultural landscapes, offer a diverse array of environmental, economic, and social benefits. These systems contribute to biodiversity conservation, enhance soil fertility, and increase carbon sequestration, playing a vital role in climate change mitigation. Furthermore, agro-forestry supports sustainable land use by providing farmers with multiple income streams through the production of crops, timber, and non-timber forest products. However, the adoption of agro-forestry faces significant challenges. These include limited awareness and knowledge among farmers, insufficient policy support, and competition for land use. Additionally, transitioning from conventional agriculture to agro-forestry systems may pose economic risks during the initial phases. Despite these obstacles, the future prospects for agro-forestry are encouraging. Advancements in agro-ecological research and growing recognition of sustainable farming practices are driving interest and investment in agro-forestry. With increasing concerns about food security and environmental degradation, agro-forestry is poised to play a key role in building resilient agricultural systems. Collaborative efforts involving governments, non-governmental organizations (NGOs), and local communities are essential to address these challenges and promote the broader adoption of agro-forestry. Ultimately, embracing agro-forestry can lead to more sustainable agricultural practices, improved rural livelihoods, and healthier ecosystems.

Keywords: *agro-forestry, agro-forestry systems, benefits of agro-forestry.*

RAFVAL:ES-2025/26

The Role of Organic Amendments in Enhancing Soil Structure and Fertility

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This study examines the significant role of organic amendments in improving soil structure and fertility, which are critical factors for sustainable agricultural practices. Organic amendments, such as compost, manure, and green manures, contribute essential nutrients and organic matter to the soil, enhancing its overall health and functionality. The application of these materials improves soil physical properties, including porosity, aggregation, and water retention, facilitating better root penetration and moisture availability for plants. Moreover, organic amendments stimulate microbial activity and promote a diverse soil ecosystem, which is vital for nutrient cycling and the breakdown of organic matter. This biological activity enhances the availability of macro- and micronutrients, thereby increasing soil fertility and supporting crop growth. The study also highlights the long-term benefits of incorporating organic amendments, such as improved soil resilience to erosion and compaction, as well as increased carbon sequestration, which contributes to climate change mitigation. The research underscores the importance of selecting appropriate organic amendments based on specific soil types and agricultural practices to maximize their benefits. By integrating organic amendments into soil management strategies, farmers can enhance soil structure and fertility, leading to improved agricultural productivity and sustainability.

Keywords*: organic amendments, soil structure, soil fertility, sustainable agriculture, compost, manure*

RAFVAL:ES-2025/27

Advances in Soil Testing and Analysis Techniques

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Recent advancements in soil testing and analysis techniques have significantly improved our understanding of soil health and fertility, which are crucial for sustainable agriculture and environmental management. Traditional methods of soil analysis, while effective, often require lengthy processing times and can be limited in their scope. Newer techniques, such as near-infrared spectroscopy (NIRS), X-ray fluorescence (XRF), and hyper spectral imaging, provide rapid and non-destructive ways to assess soil properties. These technologies enable precise measurements of soil nutrients, pH, organic matter content, and contaminants, leading to more accurate assessments of soil quality. Additionally, the integration of remote sensing technologies with soil sampling allows for more comprehensive spatial analysis of soil properties across larger areas, facilitating targeted soil management practices. Advances in data analytics and machine learning also play a crucial role in interpreting complex soil data, allowing for more informed decision-making in agricultural practices. Furthermore, the development of portable soil testing kits has empowered farmers and land managers to conduct on-site analyses, promoting proactive soil management and enhancing productivity. These innovations not only support efficient agricultural practices but also contribute to environmental sustainability by minimizing the over-application of fertilizers and reducing soil degradation.

***Keywords**: soil testing, soil analysis, NIRS, XRF, sustainable agriculture, soil health*

RAFVAL:ES-2025/28

Soil-Water-Plant Relationships in Arid and Semi-Arid Regions

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This study investigates the complex interactions between soil, water, and plants in arid and semi-arid regions, where water scarcity plays a critical role in shaping ecological and agricultural systems. The research focuses on the physical and chemical properties of soils in these regions, particularly their capacity to retain and provide water to plants. Key factors influencing soil moisture retention include texture, organic matter content, and salinity. The adaptive strategies of plants, such as deep rooting systems, reduced transpiration, and efficient water-use mechanisms, are also examined to understand how vegetation survives in these water-limited environments. Additionally, the study highlights the importance of soil moisture dynamics and plant physiology in maintaining plant growth under extreme conditions. It further addresses the increasing challenges posed by climate change, including more frequent droughts and unpredictable rainfall patterns, which exacerbate water stress in these fragile ecosystems. The impact of these changes on soil-water-plant relationships is crucial for predicting future agricultural productivity and ecosystem resilience. this research offers insights into sustainable land management strategies, focusing on improving water conservation and optimizing plant growth in arid and semi-arid regions. The findings contribute to efforts aimed at enhancing agricultural productivity and supporting ecosystem health in areas most vulnerable to water shortages.

***Keywords**: soil-water-plant relationships, arid regions, semi-arid regions, water scarcity, sustainable land management*

RAFVAL:ES-2025/29

Evaluation of Suitable Extractant and Determination of Critical Limit of Nitrogen in Onion (*Allium cepa* L.) Under Temperate Conditions of Kashmir Valley.

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Pot culture experiment was conducted to evaluate the suitability of extractants and to determine the critical limit of Nitrogen (N) in soil and onion plant in temperate conditions of Kashmir valley. Fifteen bulk soil samples were collected from different onion growing areas and were used to grow onion in pots. Four extractants namely, alkaline permanganate ($KMnO_4$), Potassium chloride (2N KCl), Hydrogen peroxide (30% H_2O_2) and Potassium dichromate **(**0.02M $K_2Cr_2O_7$) were assessed by correlating the amount of nitrogen assessed through various extractants with Bray's per cent yield and N-uptake by onion. Nitrogen extracted by alkaline permanganate showed significant correlation with brays per cent yield (r = 0.99**) and N-uptake (r = 0.98**). The order of suitability of the extractants was found to be alkaline permanganate> Hydrogen peroxide > Acid dichromate> 2N KCl. The critical limit of nitrogen in onion growing soils and plant in accordance with the procedure of Cate and Nelson was found to be 243 ppm and 0.25 per cent. Soil containing available N below the critical limit responded to N fertilization.

Key words: *Critical limit, Extractants for N, Onion, Temperate valley*

RAFVAL:ES-2025/30

Standardization of process technology for starch extraction from tikhur (*Curcuma angustofolia*) using Starch extraction machine

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Tikhur (*Curcuma angustofolia*) is traditionally valued as a medicinal plant and contains starch in its rhizome. This study focuses on the standardization of process technology for starch extraction from tikhur rhizomes. Experimental observations indicate that rasping tikhur rhizomes of 5–10 cm at a speed of 2000 rpm in the rasping chamber resulted in maximum starch recovery of 8.72%. The optimized process parameters also yielded a machine capacity of 65.52 kg/h with an energy consumption of 1.64 kWh. These conditions were found to be the most efficient compared to other variations in rasping speed and rhizome sizes. A constant water flow rate of 2 liters per minute was maintained throughout the process. The study concludes that optimizing the machine at 2000 rpm and a rhizome size of 5–10 cm enhances starch recovery, capacity and energy efficiency.

***Keywords**: Tikhur, rasping, starch, rhizome and energy.*

RAFVAL:ES-2025/30/A

Revolutionizing Indian Agriculture and Allied Sciences through Artificial Intelligence: Challenges and Opportunities

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Artificial Intelligence (AI) has emerged as a transformative tool in Indian agriculture and allied sciences, addressing critical challenges such as food security, climate change, and resource management. India, being an agrarian economy, faces issues like unpredictable weather, pest infestations, and inefficient resource utilization. AI technologies, including machine learning, computer vision, and robotics, offer solutions to enhance productivity, optimize resource use, and minimize environmental impact. Precision farming, powered by AI, aids in real-time monitoring of crops through drones and IoT devices, ensuring better crop health and yield predictions. AI-driven platforms like e-NAM and KisanSuvidha connect farmers directly to markets, empowering them with competitive pricing and reducing dependency on intermediaries. Additionally, AI is pivotal in livestock management, enabling health tracking and optimizing milk production through predictive analytics. In aquaculture, AI tools predict water quality and fish health, boosting efficiency and reducing losses. Despite these advancements, challenges such as digital illiteracy, limited infrastructure, and affordability remain significant barriers to AI adoption among small and marginal farmers. Collaborative efforts among government, private sectors, and research institutions are essential to bridge these gaps. Policies promoting AI integration, coupled with farmer-centric training programs, can revolutionize the Indian agricultural landscape. AI thus holds immense potential to transform Indian agriculture into a sustainable, technology-driven sector, addressing both present and future needs.

Keywords: *Artificial Intelligence, Precision Farming, Indian Agriculture, Livestock management and Sustainable Farming*

RAFVAL:ES-2025/31

FTIR profiling of Cellulose Nanoparticles extracted from agricultural wastes

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The aim of the present study was to analyze various organic and inorganic compounds in extract from agricultural waste, including rice straw and rice bran. These extracts were prepared using both conventional (Soxhlet, magnetic stirrer) and non-conventional (ultrasonicator) extraction methods. Two different solvents- ethanol and water were used for the analysis, followed by the characterization of functional groups using Fourier Transform Infrared (FTIR) spectroscopy. Samples were ground into powders and blended with KBr powder, then pressed into a disk at 30 MPa. The spectrum for each sample was recorded in the region of 4000–400 cm^{-1}. All samples were vacuum dried before analyses.

Two main wavenumber regions ranging from 3500 to 2900 and 1750 to 600 cm^{-1} were in all curves. A broad and prominent peak at 3330 cm^{-1} corresponded to the O-H stretching band, while a distinct peak at 2910 cm^{-1} was attributed to C-H stretching vibrations in cellulose and hemicellulose. The absorption peaks at 1161 and 896 cm^{-1} in each sample were interpreted as typical cellulose structure. The peak at 1736 cm^{-1} in the spectra of acetic acid and uronic ester groups in hemicelluloses and the ester linkages of the carboxylic group of ferulic and *p*-coumaric acid in lignin or hemicelluloses. FTIR analysis of the agricultural waste extracts confirmed the presence of various compounds, including aldehydes, ketones, alkenes, primary amines, aromatics, water, amines which showed major peaks. The H-O-H bond in molecular water is liable for the bending vibration, the band saw at roughly 1626.26 cm-1. The carboxyl side groups show a symmetric stretching peak at 1406.01 cm-1. As in charged amines (C=NH+), the 2359.78 cm-1 band exhibits NH+ stretching. The results of this study generated an FTIR spectrum profile of the extracts, which can be used for further research.

***Keywords:* -** *Compounds, Extract, Agricultural waste, Ethanol.*

RAFVAL:ES-2025/32

Green Manure and Its Role in Sustainable Soil Management

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Green manure is a sustainable agricultural practice in which specific crops, such as legumes or cover crops, are grown and then incorporated into the soil to improve its health and fertility. This technique increases organic matter, promotes nutrient cycling, and enhances microbial activity, all of which contributes to improved soil structure and reduced erosion. Leguminous green manure crops are particularly beneficial because they fix atmospheric nitrogen, reducing the need for synthetic fertilizers and lowering the associated environmental impacts. Beyond boosting nutrient levels, green manure also helps suppress weeds, manage pests, and improve water retention, making soils more resilient to climate variability. By fostering a natural balance, green manure promotes biodiversity and strengthens the ecological health of agricultural systems. It offers farmers a practical way to reduce dependence on chemical inputs and enhance the long-term sustainability of their land. Integrating green manure into farming practices supports sustainable soil management by maintaining soil fertility, reducing erosion, and promoting biodiversity. This practice not only protects soil health for current use but also preserves it for future generations. Overall, green manure plays a crucial role in building resilient agricultural ecosystems, ensuring that soils remain productive and capable of supporting crops in the face of environmental challenges. This technique is a key component of sustainable agriculture, contributing to both ecological balance and long-term agricultural productivity.

***Keywords**: Green manure, soil fertility, sustainable agriculture, soil management*

RAFVAL:ES-2025/33

Versatile Optimized Protocol For Protoplast Isolation And Transient Assay From Leaf Of Monocots And Dicots.

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Protoplast isolation and transient gene assay has emerged as a versatile tool for the rapid analysis of gene function, protein localization and gene editing studies in plant molecular biology. However, a simple, efficient protoplast-based protocol still poses a challenge in terms of efficiency, yield and viability, for serval crops such as monocots and dicots due to species-specific and complex cell wall composition. In this study, we have established a simple, optimised leaf-based protocol for the isolation of viable protoplasts from monocots and dicots and their polyethylene glycol (PEG)-Ca(NO3)2 mediated transient transfection using the transient expression vector green fluorescent protein (GFP) as a reporter gene. We systematically optimized the enzyme ratios to target both monocot and dicot-specific walls while minimizing cytoplasmic damage and refining osmotic and incubation conditions as well as PEG concentration, and transfection time. Protoplast isolation was most optimal when D-mannitol concentration (0.5 M), digestion enzyme concentration (0.5% w/v Macerozyme R-10 and 1.6% w/v Cellulase R-10), and digestion time (12 h). This resulting in a protoplast yield of 8.5 × 105/g FW, and a viability of 97 %. The transfection efficiency was measured by the expression of the transient plasmid consisting of the reporter gene (GFP). Transformation efficiency was high when protoplasts were incubated in 20% (w/v) of PEG transfection solution for 20 minutes. Thus, this protocol ensures consistent, high-quality protoplast isolation and transient assay performance across both plant groups (Monocots and dicots).

***Keywords**: green fluorescent protein; PEG-mediated transfection; protoplast yield; transfection efficiency; transient gene expression, monocots and dicots.*

RAFVAL:ES-2025/34

The Impact of Urbanization on Heat Islands

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In most of the large cities, the temperature at the heart or the centre of the city is noted to be higher than its surroundings or the suburban area. The phenomenon is called Urban Heat Island (UHI) effect. There forms a temperature difference between the cities and the surrounding suburbs because of the effect, which causes discomfort to the city dwellers. When a huge amount of natural land is replaced by artificial built surface that absorbs incoming solar radiation or heat and re-radiate it at night, UHI develops.
Alterations of surface area, improper urban planning, air pollution, etc. are causing this increasingly growing phenomenon and it is accountable for human discomfort, human casualties and decline of climate. Using high albedo materials and pavements, green vegetation and green roofs, urban planning, pervious pavements, shade trees and existence of water bodies in city areas are the potential UHI mitigation strategies on which discussion is done with their limitations. Green vegetation seems to be the most effective measure and other strategies can play a major role under proper condition.

Key words-: *Urban planning , Mitigation , Air pollution, Temperature*

RAFVAL:ES-2025/35

Chrysanthemum : An emerging Commercial Important flowering crop

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Chrysanthemum (mum) is a very popular flower crop due to ornamental ,medicinal and bioinsecticidal values. It has commercial importance among other flowers because of there are more than 175 species of Chrysanthemum with variation in height, spread,colors,size of flower and bloom type. The flowers occur in various forms such as daisy like, decorative, anemone, spoon shaped, spider, pompon or button like. They are useful in garlands, garden display ,cut flowers and perfume industries. Chrysanthemum are also one of the most vibrant indoor plant due to its beautiful flowers and air-purifier quality by effectively reduced toxins like benzene, ammonia, formaldehyde and xylene in the air. It is also emerging as popular herbal tea formulation which is used to cure cold, indigestion, influenza, diarrohoea, migraine and Parkinson disease. C.cinerariefolim Linn..and C. coccineum Linn.are cultivated as source of pyrethrum an important bioinsecticide. Although Chrysanthemum is cultivated throughout the country but mainly cultivated in West Bengal,Maharashtra,Karnatka,Tamilnadu,Andhra Pradesh ,Uttarpradesh ,Delhi,Rajasthan and Gujrat.In present study,the effect of different plant nutrients(N,P,K) on growth and flowering of Chrysanthemum are found to be significant.

Keywords : *Chrysanthemum,flower, bioinsecticide,Nutrients*

RAFVAL:ES-2025/36

The Economics of Producing Multiple Varieties of Turmeric And Eucalyptus tereticornis Using the Agri-Silviculture Model

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Through overcoming the gap between forestry and agriculture, agroforestry creates integrated systems that achieve socioeconomic and environmental objectives. It reduces the negative effects of climate change and improves the resilience of agricultural systems. In addition to offering agricultural families food, medicine, lumber, and several other productive and protective advantages, the agroforestry system in conjunction with spiece crops is economically viable. In order to evaluate the economic viability of intercropping *Eucalyptus tereticornis* (3 x 3 m spacing) with multiple turmeric types in agri-silviculture models and mono turmeric cropping systems, the current study was carried out across two year rotations. The Factorial Randomized Block Design (FRBD) was used to assess both manufacturing systems. We considered eight different types of turmeric: T1 (Suranjana), T2 (Selam), T3 (Chhattisgarh Haldi-1), T4 (Chhattisgarh Haldi-2), T5 (Roma), T6 (Ranga), T7 (NDH-98), and T8 (Sonali). Based on turmeric variety output, the maximum Gross Returns per hectare ₹1750850 ha^{-1} $year^{-1}$ were obtained from the Eucalyptus-based agri-silviculture approach. On the other hand, the mono cropping system had the lowest gross returns per hectare, at ₹255611 ha^{-1} $year^{-1}$. Additionally, the agri-silviculture model was the most profitable in terms of the Benefit-Cost Ratio (BCR), with a BCR of 3.72 as opposed to 1.50 for the solo cropping system.

Keywords: *Eucalyptus, Turmeric, Agri-silviculture, Economics, Net returns, BCR*

RAFVAL:ES-2025/37

Genetic Variability And Diversity Studies In White Onion (Allium Cepa L.) Genotypes

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The study was conducted at MARS, UAS, Dharwad during the late kharif season of 2023-24, evaluating 26 white onion genotypes in an RBD with three replications. Data on growth, yield, quality, storage, and pest and disease severity were analyzed for variability, genetic divergence, correlation, and path analysis. Among the genotypes, Safed Ghavriyu, Indus WG-5, Bhima Safed, and Gadag Local showed promising performance across multiple traits, making them suitable for further crop improvement. Significant differences were observed for all traits, indicating ample genetic variability. High heritability and genetic advance were recorded for marketable yield, purple blotch incidence, and total yield, suggesting additive gene action. The D^2 analysis revealed that genotypes showed significant diversity and were grouped into six clusters. The highest inter cluster distance exist between cluster II and VI. Genotypes from these clusters can be utilized as parents in breeding programme for obtaining superior recombinants. Character association studies revealed that traits like plant height, number of leaves, leaf length, bulb diameter, fresh weight of plant, average bulb weight, harvest index, neck diameter and dry weight of plant exhibits positive and significant correlations with onion bulb yield. Path coefficient of analysis of plant height, leaf number and bulb diameter had high positive and direct effect on bulb yield ton per hectare.

Key words: *White onion genotypes, Variability, D^2 analysis and Correlation*

RAFVAL:ES-2025/38

Laboratory Studies On Operational Parameters Of Drone Mounted Sprayer

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An unmanned aerial vehicle (UAVs) is modern spraying technology which helps for efficient spraying. The effect of operational parameters on deposition in target zone is required for uniform spraying which needs to be determined. Operational parameters of sprayer and weather conditions effect the droplet size, droplet density, spray deposition and spray coverage on the target. The laboratory trials were conducted at various combinations of spray heights (1, 1.5, 2, 2.5 and 3 m) and discharge rate (0.1, 0.2, 0.45, 0.69 and 0.8 l min^{-1}). Deposit scanner was used to determine droplet size and droplet density, spray deposition and spray coverage. The results showed that the minimum and maximum swath width was found to be 1.8 m and 5.3 m for operating height of 1 m and 3 m respectively. The maximum VMD =630 µm was observed at combination of 1.5 height and 0.2 l min^{-1}, the minimum VMD=491 µm was observed at combination of 2 m height and 0.80 l min^{-1} pressure. The maximum uniformity of spray distribution was 96 % achieved at combination of 3 m height of operation and 0.45 l min^{-1} operating pressure.

Keywords: *UAVs, Droplet size, Spray deposition, VMD and Uniformity of spray distribution.*

RAFVAL:ES-2025/39

Estimation of Rice and Wheat Yield using Logistic Regression and Discriminant Function Analysis in Karnal District

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Planning, formulation and implementation of any policy is only possible when we have timely and effective pre-harvest forecast of crop yield data is available. So, that crop procurement, price structure, distribution and import-export related decisions can be implemented accordingly. These are very useful for farmers to decide their future prospects and course of action in advance. The statistical modelling approaches viz., multiple linear regression, ordinal logistic regression and discriminant function analysis were used to achieve pre-harvest wheat yield forecasting in Karnal region of Haryana. The weather-yield forecast models have been developed using data from 1980-81 to 2014-15 whereas, the data from 2014-15 to 2017-18 were used for validation of the fitted models. Fortnightly weather data in wheat crop starting from 1st November to one month before harvest were utilized for the model building. Data for the last one month of the crop season were excluded as the idea behind the study was to forecast yield in advance of the crop.

The performance(s) of the developed models were observed on the basis of PRESS residuals, root mean square error(s) (RSME), mean absolute percentage error (MAPE) and mean absolute deviation (MAD) as well. The overall result indicates the preference of using prediction equations based on multiple regression, scores/ probabilities of response categories obtained in logistic and discriminant analysis over the regression models using weather parameters as predictors and found that discriminant analysis based on scores gives better results than other techniques.

Keywords: *Multiple linear regression, Ordinal logistic regression, Discriminant function analysis and weather- yield models*

RAFVAL:ES-2025/40

Theme : 09. Agricultural Mechanization and Smart Farming
Sub-theme : 4. Small-scale machinery for marginal farmers.
Guar productivity influenced by farm mechanization among farmers of Haryana

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The present study was conducted during 2011-12 in district Sirsa to see the impact of mechanization on the guar productivity of farms among the farmers of Haryana. There were 120 farmers under study selected purposively. The average productivity of guar per hectare was found maximum under own mechanized farms (13.42 q/ha) as compared to custom hiring farms (10.50 q/ha). The per cent increase in the guar productivity on own mechanized farms was 27.81 over custom hiring farms. The guar productivity of large farmers was found to be maximized under own mechanized farms (14.50 q/ha) as compared to custom hiring farms (11.25 q/ha). The per cent increase in the guar productivity on own mechanized farms was 28.89 per cent. The maximum benefit-cost ratio was achieved in own mechanized farms (1.70) as compared to custom hiring farms (1.31). In nut shell, it can be concluded that farmers who owned their machines were more beneficial as compared to custom hiring farm implements.

Keywords: *Custom hiring farm, Guar, Own Mechanized Farms, B:C ratio, productivity*

RAFVAL:ES-2025/41

Beyond the Harvest: Techniques to Preserve Quality and Reduce Waste

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This study examined the secondary data published on post-harvest management techniques with the aim to explore and understand the various techniques and technologies that can extend the shelf life of perishable goods while maintaining their nutritional value, flavor, appearance and waste management. By examining methods such as Controlled Atmosphere Storage (CAS), rapid cooling systems, smart packaging solutions, Modified Atmosphere Packaging (MAP), ethylene management and advanced preservation techniques like ozone treatment and UV-C light, identify effective strategies to preserve the quality of perishable produce. These techniques work synergistically to slow down spoilage, inhibit microbial growth and retain the essential attributes of perishables, ensuring they reach consumers in optimal condition. The integration of these methods into a cohesive and sustainable system will not only reduce food loss across the supply chain but also enhance food security and support environmental conservation efforts. The preservation of perishable produce is paramount to maintaining quality, minimizing waste. Post-harvest losses can account for a significant portion of the total produce, leading to economic losses and environmental concerns. But it is misfortune that farmers are not much aware and knowledgeable regarding these type of post-harvest techniques. Hence there is need to promote these techniques through awareness campaigns and extension activities with the help of Agricultural Universities and State agriculture departments. These efforts not only benefit farmers and retailers but also support global food security and environmental sustainability.

Keywords: *Agriculture, Food security, Post-harvest, Techniques, Waste management.*

RAFVAL:ES-2025/42

Organic Farming: Benefits and Challenges in Modern Agriculture

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Organic farming has increasingly gained recognition as a sustainable and environmentally friendly alternative to conventional agricultural methods. This approach prioritizes the use of natural inputs, such as organic fertilizers and biological pest controls, while minimizing synthetic chemicals and genetically modified organisms (GMOs). Organic farming also emphasizes ecological processes that support healthy soil ecosystems, promote biodiversity, and enhance the resilience of crops against pests and diseases. These methods aim to create a balanced agricultural system that is both productive and ecologically sound. One of the most significant benefits of organic farming is its contribution to environmental sustainability. By avoiding synthetic fertilizers and pesticides, organic farms reduce the risk of chemical runoff, which can contaminate water sources and harm wildlife. Organic practices also foster improved soil health through composting, crop rotations, and the use of cover crops, which help maintain soil structure, reduce erosion, and enhance nutrient cycling. Moreover, organic farming supports biodiversity by providing habitats for various species, from beneficial insects to soil microbes, which contribute to overall ecosystem health. organic farming can positively impact local economies.

Keywords: *organic farming, benefits of organic farming, challenges in modern agriculture, sustainable agriculture*

RAFVAL:ES-2025/43

Nitrogen Use Efficiency in Crop Production Systems

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Nitrogen Use Efficiency (NUE) is a pivotal factor in crop production, significantly impacting both agricultural yields and environmental sustainability. Given nitrogen's essential role in plant growth, its efficient utilization is crucial for optimizing productivity while reducing negative ecological effects, such as soil degradation and water contamination. This paper explores the key drivers of NUE across different crop systems, emphasizing the interplay between soil properties, crop varieties, and management practices. Excessive nitrogen application commonly results in poor NUE and environmental damage. This review synthesizes findings from existing research and case studies, identifying strategies to improve NUE, such as precision agriculture, optimized fertilization methods, and the integration of cover crops and nitrogen-fixing species. These approaches enhance nitrogen absorption, minimize losses, and foster healthier ecosystems. Technological innovations, including remote sensing and data analytics, are instrumental in optimizing nitrogen management. By embracing a comprehensive approach that accounts for both agronomic and environmental factors, stakeholders can enhance NUE and promote more sustainable farming practices. In summary, improving NUE is vital for addressing global food security while minimizing agriculture's environmental impact. This study offers valuable recommendations for policymakers, agronomists, and farmers to adopt practices that increase nitrogen efficiency in crop production systems.

***Keywords**: crop production, nitrogen use efficiency, maximizing productivity, global food security.*

RAFVAL:ES-2025/44

Seed Source Variation in Fruit Morphology, Seed and Germination of *Prunus cerasoides* (D. Don).

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Prunus cerasoides is indigenous multipurpose tree species of the Himalayan regions and is also used for religious purpose, edible fruit, seed and gum as well as different medical applications, lumber, dyestuff, tannins and beads. The present investigation was carried out to estimation the variability in fruit, seed characteristics and seed germination of *P. cerasoides* from different sources of Garhwal regions of Uttarakhand. The experiment consisted of six seed sources and fifteen different pre-sowing treatments, the data regarding on fruit and seed morphology were analyzed for Randomized Block Design, while seed germination and seedling growth data were analyzed for Completely Randomized Design. Among the seed source, Silyara, Kuteti and Sadargaun seed source were showed superiority with respect to fruit and seed morphology. For seed germination and growth attributes, the highest (72.86%) germination percent was recorded in Silyara seed source followed by Sadargaun (69.00%), Kuteti (66.66%), Develgaun (64.4%), Chaurangikhal (63.06%) and Ranichauri (55.00%). In pre-sowing treatments, Gibberellic acid and hot water for 100ºC at 24 hours was showed maximum germination percent and total seedling growth as compared to other treatments. The maximum heritability, genetic advance and genetic gain were found in seed length and seed weight. These two characters might be considered for the improvement in *P. cerasoides*. Correlation coefficient among various geographical, edaphic and climatic factors of seed source with different fruit and seed characteristics were showed significant interrelationship between fruit and seed parameters. The overall study indicated that Silyara, Kuteti and Sadargaun seed source were superior with respect to fruit, seed, seedling morphology and germination attributes as compared to Develgaun, Chaurangikhal and Ranichauri seed source. The application of treatment GA_3 solution and hot water for 100ºC at 24 hours was better for seed germination and seedling growth in case of *P.cerasoides.*

RAFVAL:ES-2025/45

Technological Advancements in Precision Nutrient for Fruit Production

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Precision nutrient management is an innovative approach to optimizing nutrient delivery in fruit crops, ensuring that plants receive the exact amounts of essential nutrients at the appropriate times and locations. Traditional methods of nutrient management often result in nutrient deficiencies, over-fertilization, uneven nutrient distribution, environmental pollution and economic inefficiency. This review addresses these challenges by emphasizing the importance of real-time data regarding soil conditions, plant health and nutrient levels. Key technologies like remote sensing, variable rate technology, fertigation, controlled-release fertilizers and organic amendments play a vital role in aligning nutrient applications with the specific needs of each crop and individual plant within a field.

The approach shows great potential for enhancing plant growth and development, increasing crop yields, optimizing resource use and reducing environmental impact. By fine-tuning nutrient application, farmers can improve economic returns while promoting more sustainable agricultural practices. However, the field of precision nutrient management for fruit crops remains underexplored, with a lack of studies examining the application of advanced technologies and data-driven approaches. More comprehensive research is necessary to develop and validate precision nutrient management strategies suited to the unique needs of various crops. Bridging this research gap will support the advancement of sustainable and optimized fruit crop production.

***Key word**: (Crop, Soil, Fertilizers and Precision)*

RAFVAL:ES-2025/45/A

Enhancing Fruit Yield Through Effective Canopy Management

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The canopy of a fruit tree comprises its physical structure, including the stem, branches, shoots, and leaves. The number and size of the leaves determine the canopy's density. Canopy management in fruit trees has been practiced for years to enhance the productivity and quality of fruits. It involves managing the architecture of large and unmanageable trees to make them more efficient and productive. Canopy management focuses on optimizing tree production potential while ensuring high-quality fruits. This practice includes the development and maintenance of tree structures, with specific attention to their size and shape, to maximize productivity and fruit quality. Techniques such as training, pruning (dormant, summer, and root pruning), branch orientation (bending), scoring, girdling, using appropriate rootstocks, applying plant growth regulators, balanced fertilization, deficit irrigation, and genetically engineered plants with modified architectural traits are employed to maintain ideal tree canopies. The primary goal of canopy management is to maximize light interception and optimize its distribution within the canopy, while maintaining proper airflow. Effective canopy management improves productivity, enhances fruit quality, facilitates cultural practices, and aids in pest and disease control. For new plantations, initial training and pruning establish a strong tree framework, while in older plantations, the aim is to reduce tree height and thin excessive biomass to allow solar radiation to penetrate the canopy.

Key word: *(canopy, stem, tree, training and pruning)*

RAFVAL:ES-2025/45/B

Revolutionizing Horticulture with Artificial Intelligence

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The role of automation in horticulture has become a **central** focus globally due to its significant contribution to the economic sector. With a **growing** population, the demand for food and employment has surged. Traditional farming methods have proven insufficient to meet these rising demands, prompting the adoption of automated approaches that not only fulfill food requirements but also generate **numerous** employment opportunities. The rise of **Artificial Intelligence (AI)** has sparked a revolution by protecting crop yields from climate variability, population growth, employment gaps, and food security challenges. This study aims to evaluate the **various** applications of AI in horticulture. AI is playing a key role in the development of **advanced** irrigation systems. These systems make use of real-time data from soil sensors, weather forecasts, and plant conditions. By leveraging AI, crop health and yield are enhanced while promoting **efficient** water usage.

Key word : *horticulture, artificial, yields and climate*

RAFVAL:ES-2025/45/C

Enhancing Fruit Yield Through Effective Canopy Management

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The canopy of a fruit tree comprises its physical structure, including the stem, branches, shoots, and leaves. The number and size of the leaves determine the canopy's density. Canopy management in fruit trees has been practiced for years to enhance the productivity and quality of fruits. It involves managing the architecture of large and unmanageable trees to make them more efficient and productive. Canopy management focuses on optimizing tree production potential while ensuring high-quality fruits. This practice includes the development and maintenance of tree structures, with specific attention to their size and shape, to maximize productivity and fruit quality. Techniques such as training, pruning (dormant, summer, and root pruning), branch orientation (bending), scoring, girdling, using appropriate rootstocks, applying plant growth regulators, balanced fertilization, deficit irrigation, and genetically engineered plants with modified architectural traits are employed to maintain ideal tree canopies. The primary goal of canopy management is to maximize light interception and optimize its distribution within the canopy, while maintaining proper airflow. Effective canopy management improves productivity, enhances fruit quality, facilitates cultural practices, and aids in pest and disease control. For new plantations, initial training and pruning establish a strong tree framework, while in older plantations, the aim is to reduce tree height and thin excessive biomass to allow solar radiation to penetrate the canopy.

***Key word**: (canopy, stem, tree, training and pruning)*

RAFVAL:ES-2025/46

The Underground Climate Warriors: Soil Carbon and Nutrient Cycling in Action

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As a carbon sink and center for vital nutrient cycling, soil is an essential yet often underappreciated component of climate regulation. Soils act as underground climate warriors, absorbing atmospheric CO_2 and storing it as soil organic carbon (SOC), thereby reducing greenhouse gas emissions while sustaining ecosystem resilience and agricultural productivity. This dynamic process is driven by microbial activity, organic matter decomposition, and root interactions, which promote nutrient exchange and preserve soil fertility. However, deforestation, intensive agriculture, and soil degradation compromise the soil's capacity to effectively recycle nutrients and sequester carbon. Sustainable land management practices—such as conservation tillage, agroforestry, biochar application, and regenerative agriculture—are essential to counteract these threats. These strategies enhance SOC levels, improve soil structure, boost biodiversity, and increase water retention, thereby ensuring long-term ecological stability. Designing climate-resilient agricultural systems and environmental policies requires a comprehensive understanding of the synergy between carbon sequestration and nutrient cycling. We can fully realise the potential of soil in reducing climate change and ensuring food security by fusing scientific discoveries with conventional ecological understanding. In essence, soil is not merely a passive medium but a vital ally in the global fight against climate change.

Keywords: *Soil carbon sequestration, nutrient cycling, sustainable land management, ecosystem resilience, agroforestry*

RAFVAL:ES-2025/47

Maize-cowpea intercropping system - A Review

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The Indian population is growing rapidly (1.25 billion) and it has to fulfil its food and nutrition requirement. A collaborative strategy should be adopted for increasing productivity by intensifying available land use system. Intercropping is advanced management practices of soil fertility status, consisting of cultivating two or more crops in the same space at the same time, which have been practiced in past decades and achieved the goals of agriculture. The most common advantage of intercropping is the production of greater yield on a given piece of land by making more efficient use of the available resources using a mixture of crops of different rooting ability, canopy structure, height, and nutrient requirements based on the complementary utilization of growth resources by the component crops. Moreover, intercropping improves soil fertility through atmosphere nitrogen fixation from atmosphere (150 tons/year) with the use of legumes, increases soil conservation through greater ground cover than sole cropping. The principal reasons for smallholder farmers to intercrop are flexibility, profit maximization, risk minimization, soil conservation, improvement of soil fertility, weed, pests and diseases minimizing and balanced nutrition. In this study, the work carried out by researchers about different intercropping system is discussed, and it would be beneficial to the researchers who are involved in this field.

Key words- *Maize-cowpea, intercropping.*

RAFVAL:ES-2025/48

Prediction of miRNAs and their target in Pearl Millet (*Pennisetum glaucum*)

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Pearl millet (*Pennisetum glaucum*), an important cereal crop known for its resilience to adverse environmental conditions. Small, non-coding RNAs known as microRNAs (miRNAs) are essential for post-transcriptional gene control in plants. The aim of this study was to predict pearl millet's miRNAs and their targets. Pearl millet's seven chromosomes was obtained from the International Pearl Millet Genome Sequencing Consortium (IPMGSC). After converting DNA sequences into RNA, palindromic regions were found to identify main miRNAs. Sequences with stable structure (minimum free energy <-70 kcal/mol) were chosen as main miRNAs after secondary structure prediction was carried out using the ViennaRNA Package. Predicted from the primary miRNA sequences, putative miRNAs are mature miRNAs. Validation of these putative miRNAs was performed using the miRBase database through standalone BLAST analysis. Using psRNATarget, which detected putative miRNA-target interactions based on complementary binding, predicted mature miRNA were then used for target prediction. Functional annotations of the target genes were conducted using BLAST against the genomic data of Foxtail millet (*Setaria italica*), a closely related species, due to the unavailability of a complete pearl millet dataset in NCBI. The DAVID tool was used for Gene ontology (GO) analysis to assign biological roles, molecular functions and cellular components to the predicted target genes. The findings of this research reveal important new information about the pearl millet's miRNA-mediated regulatory network. This discovery provides the way for future research focused at improving pearl millet's resistance to stress, growth, and production through genetic and molecular methods.

Keywords: *Pearl millet, miRNAs, Palindromes, mature miRNAs, miRBase, NCBI, DAVID, Gene ontology.*

RAFVAL:ES-2025/49

Exploring the potential involvement of pathogenesis-related enzymes in Pearl millet Blast resistance

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Pearl millet [*Pennisetum glaucum* (L.) R. Br.] belonging to the family Gramineae is an important cereal and forage crop in the arid and semi-arid regions of India (Kumar & Manga, 2011). India produces 26.6% of the total pearl millet produced in the world (Kumar *et al.*, 2022). Its productivity has been hindered due to several constraints (Chelpuri *et al*., 2019). Blast, also known as leaf spot caused by *Pyricularia grisea* Sacc. has emerged as a serious threat in major pearl millet growing areas in India. The objective of this study was to evaluate 38 Pearl millet hybrids developed by crossing blast resistant lines with elite lines. Artificial spray inoculation of *P. grisea* was done and estimation of the activity of pathogenesis related enzymes phenylalanine ammonia lyase (PAL), peroxidase (POX) and lipoxygenase (LOX) was done; 1-, 3- and 7-days post inoculation along with the physical scoring of the blast disease reaction. Based on the blast scoring data, the hybrids were classified into categories of highly resistant, resistant, moderately resistant, susceptible and highly susceptible. All the enzyme activities were found higher in the resistant inoculated plants as compared to the susceptible and control. The susceptible inoculated hybrids were found to have higher enzymatic activities than control. Also, a significant increase in the enzyme activities was observed on consecutive days of sampling after the inoculation. The enzyme activities exhibited good correlation with the blast disease reaction, thus showing possible involvement of these enzymes in providing resistance to the blast disease in pearl millet.

Keywords: *Pearl millet, Peroxidase, Lipoxygenase, Blast scoring*

RAFVAL:ES-2025/50

Standardization Of Technology For Preparation Of Hill Lemon (*Citrus Pseudolimon* Tan.) Peel Candy Using Alternative Sweeteners

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The utilization of agricultural by-products has gained increasing attention as a sustainable approach in the food industry. The study focuses on the standardization of technology for the preparation of hill lemon (*Citrus pseudolimon*) peel candy using different sweeteners such as sugar, jaggery, honey and sorbitol. Hill lemon peel, often discarded as waste, results of study revealed that it contains various valuable component in appreciable amount such as vitamin C (39.84 mg/100g), pectin (1.70%), limonin (11.54 mg/100g), naringin (32.81 mg/100g), phenols (5.28 mg/100g), tannins (30.62%), antioxidants (89.46%) and many other bioactive compounds. The candy was developed using different sweeteners, including sugar, jaggery, honey and sorbitol, to cater to interest consumers and individuals with dietary restrictions such as diabetes. The formulation was optimized based on sensory evaluation, physicochemical properties (moisture content, total soluble solids, acidity, and sugar profile), and storage stability in different packaging materials high density polyethylene (HDPE), aluminium laminated pouches and glass jars for 3 months at ambient temperature. Results indicated that alternative sweeteners could effectively replace conventional sugar while maintaining desirable sensory attributes and nutritional benefits. Out of all sweeteners, candies prepared with jaggery syrup and packed in aluminium laminated pouches was effective in retaining better physico-chemical characteristics and scored highest in terms of sensory scores on 9-point hedonic scale up to 3 month of storage period. This study highlights the potential of hill lemon peel candy as a healthier confectionery option and promotes sustainable utilization of citrus by-products.

Keywords: *Hill lemon peel, candy, sweeteners, packaging material, self-life*

RAFVAL:ES-2025/51

Recent Advances In Biopesticides Research And Development

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A safer substitute for industrial pesticides, biopesticides are an essential part of sustainable agriculture. An overview of recent developments in biopesticides, including their types, effectiveness, and effects on the environment, is given in this article. In terms of managing pests and illnesses, microbial, plant-based, and biochemical biopesticides have demonstrated encouraging outcomes. Biopesticides are more environmentally friendly due to their lower toxicity to non-target organisms and biodegradability, even though their efficiency is on par with that of synthetic pesticides. Nonetheless, issues with public acceptance, regulation, and registration still exist. Nanotechnology, genetic engineering, and integrated pest management techniques are some potential future prospects. The potential of biopesticides to lessen agriculture's environmental impact and guarantee food security is highlighted in this review. Because synthetic pesticides kill natural enemies, their use, overuse, and misuse have resulted in environmental contamination, pesticide residual issues, and disruptions to ecological equilibrium. Scientists were compelled by these issues to search for more modern approaches of controlling the insect infestation, such integrated pest management (IPM). The use of "green chemistry" pesticides, especially those derived from microorganisms, is crucial among all the techniques recommended in IPM because they are found in nature. The bioproducts produced by actinomycetes are invaluable to humanity. This chapter provides a brief overview of actinomycetes that produce insecticidal products, including their distribution, isolation, mode of action, and use of contemporary technologies like gene sequencing and quantitative structure–activity relationships (QSAR) to improve their insecticidal qualities.

Keywords: *Biopesticides, Sustainable agriculture, Efficacy, Environmental impact, Microbial biopesticides, Plant-based biopesticides*

RAFVAL:ES-2025/52

Floral Sources and Pollen Composition of Apis florea Winter Honeys from Nalgonda district of Telangana state

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Melissopalynological studies play a important role in the identification of bee forage plants and has a significant application in Beekeeping industry. On an ongoing melissopalynological studies of Telangana state, the present work deals with the pollen analysis of honeys samples of Nalgonda district, in order to identify the nectar source plants and to assess this area for any bee keeping activity. seven honey samples of Apis florea collected from Nalgonda district during winter season, 2022 were palynologically analysed with a view to identify the botanical origin of honey samples. For the recovery, analysis, and quantification the methodology recommended by International Commission for Bee Botany(ICBB), Louveaux et al, 1978, was followed. One sample was unifloral/monofloral and six multifloral in nature. Borassus flabellifer pollen was recorded in predominant condition in the unifloral samples studied. The other noteworthy pollen types recorded include Borassus flabellifer , Eucalyptus globulus, Sapindus emarginatus ,Citrus limon, Tridax procumbens, Prosopis juliflora,, Ageratum conyzoides, Cucumis sativus, Tribulus terrestris,, Alternanthera sessilis, Ocimum basilicum, Mangifera indica Terminalia arjuna, Psidium guajava(, Coriandrum sativum ,Lannea coromandelica, Syzyzgium cumini, Sphaeranthus indicus, Leucaena leucocephala, Phyllanthus sp, and Peltophorum pterocarpum.Altogether 23 pollen types referable to 18 families were recorded. The bee forage plants highlighted are useful for the beekeepers involved in commercial beekeeping ventures.

Keywords: *Apis florea honeys; Pollen analysis; Nectar source plants, Nalgonda district; Telangana State.*

Effects Of Biofloc And Stocking Density On The Gonadal Development, Immune Responses, Hematological Parameters And Disease Resistance In Koi Carp (*Cyprinus Carpio Var.* Koi)

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The impact of stocking density on gonadal development, immune response, hematology parameters, and disease resistance in Koi carp reared in clear water and biofloc system was investigated in a 60-day experimental period. The study was performed using a 2×3 factorial design comprised of two systems, namely clear water and biofloc, and three different stocking densities, such as 100, 150, and 200 fish/m^3 (designated as C100 (100 fish/m^3), C150 (150 fish/m^3), C200 (200 fish/m^3), B100 (100 fish/m^3), B150 (150 fish/m^3), and B200 (200 fish/m^3). Koi carp juveniles (average body weight of 0.64 ± 0.003 g) were stocked in 19 fiberglass-reinforced plastic (FRP) tanks of 500 l capacity and reared for 60 days. After 60 days, immune parameters include respiratory burst activity (1.26±0.005 OD at 540nm), myeloperoxidase activity (1.54±0.003 U/ml of enzyme), and serum protein

(1.68±0.058 g/dl) were significantly higher ($p<0.05$) in the biofloc system at a lower stocking density (B100) in comparison with other treatments. Similarly, heamatological parameters such as red blood cells (1.95 ± 0.046 million/mm^3), white blood cells (44.38±0.563 cells/cum m), hemoglobin (5.63±0.053 g/dl), mean corpuscular hemoglobin (33.54±0.073 pg), mean corpuscular hemoglobin concentration (18.46±0.101 g/dl), mean corpuscular volume (157.23±0.567 fl), and haemocrit value (24.33±0.053%) were found to be significantly higher in B100. The challenge study against Aeromonas hydrophila showed a higher disease resistance and survival rate of 64.5% was observed in B100, followed by B150 (56.1%). After 60 days of experimental trial, 50 koi carp (initial weight 8.24 ± 3.12 g) were reared for further 30 days in a 5m x 3m outdoor pond. By the end of this experimental period, the fish gained an average weight of 20.24 ± 11.31 g with a survival percentage of 90.02%. The pond-raised koi carp showed enhanced skin pigmentation, gonadal maturation, and a higher Gonadosomatic Index, indicating improved growth and reproductive development Hence, the current study suggested that Koi carp reared in a biofloc system at stocking density B100 showed a better physiological response and higher disease resistance to pathogens like Aeromonas hydrophila.

***Keywords**: Biofloc system, Stocking density, Immune response, heamatological parameters, Koi carp, Aeromonas hydrophila*

RAFVAL:ES-2025/54

Traditional Conservation Practices and Their Impact on Biomass in Sacred Groves

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This study explores the traditional conservation practices implemented by ethnic communities in Jashpur District, Chhattisgarh, and their subsequent impact on biomass within sacred groves. Sacred groves are vital ecological reserves, characterized by rich biodiversity and significant Biomass. The research meticulously the distribution of biomass across various sacred groves. The findings reveal that traditional conservation methods—such as restrictions on logging, hunting, and selective harvesting—substantially promote floral diversity and enhance the ecological stability of these groves. Biomass measurements indicate a range from 364.83 t ha^{-1} to 421.69 t ha^{-1}**,** with dominant species such as *Shorea robusta* contributing significantly to the total biomass. Furthermore, the analysis establishes a positive correlation between grove size and biomass density, demonstrating that larger groves tend to exhibit higher ecological importance and greater species richness. This research underscores the effectiveness of integrating traditional ecological knowledge with modern conservation strategies, emphasizing the role of sacred groves as crucial areas for biodiversity preservation and carbon storage. The results advocate for the recognition and support of indigenous conservation practices to ensure the sustainable management of these ecosystems in the face of environmental change.

Keywords- *Sacred groves, Traditional conservation practices, Ethnic communities, Biodiversity.*

RAFVAL:ES-2025/55

Harnessing Traditional Knowledge for Climate Adaptation: Insights from Indigenous Communities

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Traditional knowledge, encompassing the intergenerational practices, beliefs, and ecological insights of Indigenous and local communities, serves as a critical yet underutilized resource in adapting to the escalating impacts of climate change. India, characterized by its diverse agroecological zones and rich cultural heritage, faces escalating climate change impacts that threaten the livelihoods of its vulnerable populations, particularly indigenous communities. This study delves into the critical role of traditional knowledge systems in enhancing climate adaptation strategies across the Indian subcontinent. It examines how Indigenous communities residing in regions ranging from the Himalayan highlands to the coastal plains and arid deserts have developed and sustained practices that foster resilience in the face of environmental variability. Through a qualitative and participatory research approach, this investigation explores the intricate relationship between traditional ecological knowledge (TEK) and climate adaptation, focusing on domains such as agriculture, water resource management, and biodiversity conservation. The study highlights the unique insights possessed by indigenous communities regarding local climate patterns, soil fertility, and ecosystem dynamics, which have been refined through generations of observation and experiential learning. These insights manifest in traditional agricultural practices like millet cultivation, intercropping, and seed preservation, demonstrating remarkable adaptability to changing climatic conditions. Similarly, indigenous water management techniques, including traditional ponds, rainwater harvesting, and watershed management, offer sustainable solutions to water scarcity and flood risks. The research underscores the importance of recognizing and integrating these traditional practices into mainstream climate adaptation policies, acknowledging the deep-rooted understanding of local ecosystems and the ability of these communities to navigate environmental uncertainties. By addressing these barriers and amplifying marginalized voices, this integration not only strengthens climate resilience but also safeguards cultural diversity, offering a holistic model for sustainable development in an era of uncertainty.

Keywords: *Climate Adaptation, Indigenous Communities, Resilience, Sustainability, Traditional Knowledge*

RAFVAL:ES-2025/56

Impacts of Climate Change on Soil Health and Crop Production

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Climate change poses significant threats to soil health and crop production, fundamentally altering the dynamics of agricultural systems worldwide. Rising temperatures, shifting precipitation patterns, and increased frequency of extreme weather events disrupt the delicate balance of soil ecosystems, affecting their physical, chemical, and biological properties. Soil degradation processes, such as erosion, compaction, and nutrient depletion, are exacerbated by climate change, leading to reduced soil fertility and diminished agricultural productivity. Moreover, changes in temperature and moisture availability directly influence crop growth and yield. Many staple crops exhibit altered growth patterns and increased susceptibility to pests and diseases under climate stress, compromising food security. The increase in atmospheric carbon dioxide levels can initially boost photosynthesis; however, the long-term consequences of nutrient imbalance and water scarcity often counteract these benefits, resulting in lower nutritional quality of crops. The interconnectedness of soil health and crop production emphasizes the need for adaptive management strategies that enhance resilience to climate impacts. Practices such as cover cropping, conservation tillage, and organic amendments can improve soil structure and fertility, promoting sustainable agricultural practices.

***Keywords**: climate change, soil health, crop production, food security, sustainable agriculture.*

RAFVAL:ES-2025/57

Integrated Farming System for economic growth

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Integrated Farming System is considered the most powerful tool for profitability. Integrated Farming System is a system where many enterprises are working together. It includes livestock, crop production, poultry, fish, duck, tree crops and plantation crops. etc. In Integrated Farming model many other units like piggery, mushroom cultivation, fruit cultivation, apiary, fishry and many units may involve. In this system a waste or by product of a production system are used as a input within another production system. The crop residues can be used as manure or in biogas/energy system. Drooping of poultry & ducks are raised by the fishes for their nutrition. Integrated Farming System provides food security for a long period of time as it solved malnutrition problems. There is high return from Integrated Farming System in a given area of land. Due to crop rotation, there are fewer problems of weed, insect etc. Integrated Farming System is a unique approach for rural community & conserving nature. Poultry & ducks are raised is a home over the pond. So we can say Integrated Farming System is profitable for Agriculture growth system.

Key words: *Integrated Farming System, crop, livestock & Poultry.*

RAFVAL:ES-2025/58

Innovations In Non-Timber Forest Products

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Non-Timber Forest Products (NTFPs) are valuable resources for communities living in and around forests they are playing a significant role in providing income, food, medicine, and more. This paper examines innovative approaches that could be promoted within indigenous communities, focusing on the sustainable management of NTFPs. It emphasizes the importance of NTFPs through case studies from countries such as India, Ghana, and Brazil. The paper highlights marketing strategies for NTFPs, utilizing modern technologies like blockchain and mobile applications. It also discusses the role of biotechnology in driving innovation within the NTFP sector. By incorporating modern technologies, the paper explores the potential value-added products that can be derived from NTFPs. Additionally; it addresses the role of policy frameworks, particularly regarding Intellectual Property Rights (IPRs), in promoting fair benefit-sharing and biodiversity conservation.

Keywords: *Biodiversity, Food, Intellectual Property Rights, Medicine, Non-Timber Forest Products.*

Title- Succession of major insect pests in rice and effectiveness of some combination and sole insecticides against yellow stem borer and earhead bug”

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The present investigation entitled “Succession of major insect pests in rice and effectiveness of some combination and sole insecticides against yellow stem borer and earhead bug” were carried out at Students’ Instructional Farm, A. N. D. U. A. & T., Kumarganj, Ayodhya (U.P.) during Kharif 2021-22 and 2022-23. The population of yellow stem borer, leaf folder, ear head bug, brown plant hopper, white backed plant hopper and green leaf hopper initiated after sowing till harvesting. The maximum damage of yellow stem borer was observed on rice crop at 36th SMW (12.20 per cent dead heart) and minimum in 29th SMW (0.50 & 0.60 per cent dead heart), whereas maximum white ear in 40th SMW (16.80 & 17.20 per cent) and minimum 36th SMW (0.70 & 2.00 per cent), leaf folder 35th SMW (16.35 & 15.55 per cent) and 29th& 43th SMW (1.10 & 0.25 per cent), ear head bug 38th SMW (10.90 & 11.70 ear head bug/hill) and 43th SMW (1.50 & 1.10 ear head bug/hill), BPH 37th SMW (11.25 & 12.45 BPH/hill) and 29th& 40th SMW (0.20 BPH/hill), WBPH 38th SMW (12.80 & 13.70 WBPH/hill) and 30th& 41th SMW (0.50 & 0.25 WBPH/hill). The maximum GLH was found in 37th SMW (20.80 & 20.60 GLH/hill) and minimum 41th&30thSMW (0.20 & 1.10 GLH/hill). The dead heart per cent was non-significant positively correlation with minimum & maximum temperature and RH% whereas, significant positive correlation was observed with sunshine hours during Kharif 2021. The leaf folder damage percent showed non-significant positive correlation with minimum temperature and RH% and non-significant negative correlation with maximum temperature, rainfall and sunshine.

During Kharif 2022, the leaf folder damage percent had non-significant positive correlated with minimum & maximum temperature, RH%, rainfall and sunshine hours. Ear head bug population had non-significant correlation with weather parameters. Sun shine hours had significant negative impact on BPH population during Kharif 2021. During Kharif 2022, brown plant hopper had non-significant positive correlation with all weather factors viz., minimum and maximum temperature, RH%, rainfall and sunshine hours. The incidence of WBPH had non-significant positive correlation with minimum temperature, RH, rainfall and non-significant negative correlation with maximum temperature & sunshine during Kharif 2021 and 2022. GLH population showed significant negative correlation with sunshine hours during Kharif 2021. During Kharif 2022, the infestation of green leaf hopper had non-significant positive correlation with minimum and maximum temperature, RH%, rainfall and sunshine hours. Among the various treatments evaluated for the management of rice yellow stem borer and ear head bug, T2-Chlorpyriphos 50% + Cypermethrin 5% EC 750 ml/ha treated plots found most effective and gave maximum yield of 31.69 q/ha followed by T3-Novaluron 5.25% + Indoxacarb 4.5% SC 750 ml/ha treated plot with 30.09 q/ha. The maximum net return and cost: benefit ratio of Rs. 14964.17 and 1:5.16 was found in T2-Chlorpyriphos 50% + Cypermethrin 5% EC 750 ml/ha followed by T8-Thiamethoxam 25% WG 100 g/ha i.e., Rs. 8715.73/ha and 1:3.96. The efficacy of remaining treatments in order to their superiority wereT1-Profenofos 40% + Cypermethrin 4% EC 1250 ml/ha (1:3.17), T5-Acephate 70% SP 500 g/ha (1:2.85), T3-Novaluron 5.25% + Indoxacarb 4.5% SC 750 ml/ha (2:1.59), T7-Imidacloprid 70% WG 150 g/ha (1:1.20), T4-Imidacloprid 40%+ Ethiprol 40% WG 400 g/ha (1:0.82) and T6-Emamectine Benzoate 5% SG 250 g/ha (1:0.21).

RAFVAL:ES-2025/60

Effect Of Automobile Emission On Nitrogen Content Of Soil During Bajra Crop

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The soil samples were collected from a bajra field along Rewari – Kotputli National Highway in Rewari district. The study site was 20 meters away from roadside and a control site was also established at 200 meters away from roadside. Soil samples were collected during different growth stages of the Bajra growing in the field. The Subbiah and Asija method, a rapid procedure for estimating available nitrogen in soils, involves digesting soil with alkaline potassium permanganate, distilling the liberated ammonia, and titrating it against a standard acid. The soil samples were air-dried, ground and passed through a 2 mm sieve. For digestion, 20 g of prepared soil sample was taken in a 1-liter distillation flask with 20 ml distilled water, 100 ml of 0.32% $KMnO_4$ solution and 100 ml of 2.5% NaOH solution. For distillation, the flask was heated and distilled the contents at a steady rate. Collected the liberated ammonia in a conical flask (250 ml) containing 20 ml of a 2% boric acid solution with a mixed indicator (methyl red and bromocresol green). Titrated the collected distillate with a standard N/50 acid (e.g., HCl) using a methyl red indicator. Calculated the amount of nitrogen present in the soil using the titration values and the known factors of the reagents and sample weight.

Keywords: *- Digestion, Potassium Permanganate, Distillation, Titration, Indicator, Reagents.*

RAFVAL:ES-2025/61

Abundance Index of *Cyprinus carpio* in Dal lake and Wular Lake of Kashmir – A comparative study

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Nestled in the majestic embrace of the Himalayas, the Valley of Kashmir is a paradise known for its breathtaking landscapes and rich cultural heritage. With its stunning lakes and rivers, the Valley of Kashmir is blessed with water resources that are not only vital for local ecosystems but also essential to the livelihoods of the communities that thrive along their banks. These pristine waters are swarming with life. Dal lake and Wular lake are the major lakes of Kashmir. Besides known for their beauty and tourist destinations, these two lakes are equally important fisheries habitats. These lakes are home for indigenous species that have thrived for centuries to exotic introductions that have been introduced few decades ago. The introduction of common carp in two lakes has greatly affected their ecosystem. Common carp because of its resilience, rapid growth and its ability to withstand different temperatures soon becomes a dominated species in both the lakes of Kashmir. The Abundance index of common carp is far more than other species in both the lakes, however the common carp is more abundant in Dal lake than Wular lake.

***Key words** – Common carp, Kashmir, Dal lake, Wular lake, Status*

RAFVAL:ES-2025/62

Multipurpose Tree Species: A Sustainable Economic Resource for Communities.

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MPTS (multipurpose tree species) are an important catalyst of sustainable development in terms of their economic, environmental and social context. These trees provide a variety of goods, including timber, fuelwood, fodder, fruit, medicine, etc., and ecological services like carbon sequestration and soil conservation etc. As per the Food and Agriculture Organization (FAO), over 1.6 billion people depend on forests for their livelihood. MPTS contributes a lot to the rural economy. Plants like *Moringa oleifera, Leucaena leucocephala, and Azadirachta indica* are grown for different uses. *Moringa* leaves are rich in nutrition to combat malnutrition, while *Leucaena* helps in bettering the soil quality by fixing nitrogen. Also, for tackling climate change, MPTS absorbs CO_2, and forests presently absorb nearly 7.6 billion metric tons of CO_2 each year. MPTS-based agroforestry can generate 20-30% more income than mono-cropping. Bamboo cultivation in India earns ₹50,000–₹100,000 per hectare annually, making it useful for handicrafts and paper. Similarly, shea (*Vitellaria paradoxa*) tree in Africa, benefits over 16 million women who comprise rural economies. Sustainability initiatives to promote MPTS can make biodiversity rich, check deforestation, and boost the local economy. Afforestation programs are being promoted by governments and NGOs. India's Green India Mission aims to afforest over 5 million hectares. When MPTS are incorporated in community-based forestry programs (CBFPs), societies will obtain long-term economic resilience.

Keywords: *Multipurpose Tree Species, Sustainable Economy, Agroforestry, Climate Mitigation, Rural Development.*

RAFVAL:ES-2025/63

A Small-Scale Machinery for Marginal Farmers

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Marginal farmers, who often cultivate small plots of land with minimal resources, face ongoing difficulties accessing advanced machinery and affordable technologies. This study proposes an innovative, AI-assisted small-scale agricultural implement tailored specifically to their needs. Compact and multifunctional, the machine performs key agronomic operations such as primary tillage, precision sowing, and site-specific nutrient application—streamlining tasks that would otherwise require extensive manual labor. The design incorporates basic artificial intelligence elements, including sensor-based feedback and simple decision-support algorithms, to guide farmers in optimizing input use and timing of operations. These features help improve resource-use efficiency and minimize waste, aligning with the principles of precision agriculture and sustainable intensification. Manufactured using locally available, lightweight, and corrosion-resistant materials, the equipment is cost-effective, easy to maintain, and suitable for small, fragmented landholdings. Field trials conducted across varied agro-ecological zones indicated enhanced uniformity in seed placement, a 30–40% reduction in labor dependency, and improved time efficiency. The ergonomic design also makes it accessible to women and older farmers, promoting inclusivity in farming practices and reducing physical strain.

This approach supports the democratization of agricultural mechanization by integrating smart technologies into accessible tools for smallholder systems. Policy-level support and targeted subsidies for such innovations can play a transformative role in enhancing rural livelihoods, reducing drudgery, and promoting resilient, climate-smart agriculture.

Keywords: *precision agriculture, marginal farmers, AI-enabled tools, sustainable mechanization, smart farming.*

RAFVAL:ES-2025/64

Optimizing Maize Productivity Through Real-Time Nitrogen Management Using LCC, SPAD Meter and Green Seeker

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A field experiment was conducted at the Research Farm of Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu during *kharif* season of 2024. The experiment comprising of fourteen treatments aimed to investigate the effect of leaf colour chart (LCC), SPAD meter and GreenSeeker based nitrogen management on maize crop and was laid in randomized block design (RBD) replicated thrice. The soil of the experimental field was sandy clay loam in nature and was slightly alkaline, low in available nitrogen (221.16 kg ha^{-1}) and medium in available phosphorus (18.39 kg ha^{-1}) and potassium (146.25 kg ha^{-1}). The results revealed that LCC ≤ 5 @ 30 kg N ha^{-1} showed highest plant height (cm), dry matter accumulation (g m^{-2}), yield attributes and yield (kg ha^{-1}) which remained statistically at par with LCC ≤ 5 @ 20 kg N ha^{-1} and Sufficiency index ≤ 95% @ 30 kg N ha^{-1}. Further, LCC, SPAD meter and GreenSeeker showed positive correlation with grain yield at 5% level with correlation coefficient (r) of 0.98, 0.76 and 0.98, respectively. However, maximum net returns (₹ 108384.38) and B:C ratio (2.58) were obtained under LCC ≤ 5 @ 30 kg N ha^{-1}.

Keywords: *GreenSeeker, LCC, Maize, Nitrogen, SPAD, Yield*

RAFVAL:ES-2025/65

Economic Benefits of *Albizia Lebbeck* in Sustainable Agriculture

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Albizia lebbeck, or the Siris tree, is a fast-growing, nitrogen-fixing species found in tropical and subtropical regions. It's known for its incredible versatility, benefiting both farmers and the environment. One of the tree's most important roles is improving soil health- it naturally fixes nitrogen, reducing the need for chemical fertilizers and helping prevent soil erosion with its dense canopy. This makes it an excellent addition to agroforestry systems, where it boosts soil fertility and promotes biodiversity. For farmers, *Albizia lebbeck* offers multiple income opportunities. The tree grows quickly, so farmers can harvest timber in a relatively short time. Its leaves, pods, and bark also provide high-quality fodder for livestock, particularly during dry spells when other feed sources are scarce. Beyond these, the tree produces gum, which is used in a range of industries, adding yet another income stream. By integrating *Albizia lebbeck* into their farms, farmers can reduce costs for feed and fertilizers, thereby creating more self-sufficient and sustainable operations. The tree's wood is highly valued in furniture and construction, and its medicinal uses in traditional systems make it a key resource in many communities. Overall, *Albizia lebbeck* is a powerful tool in promoting both sustainable agriculture and resilient livelihoods, playing an essential role in boosting food security and environmental health.

Keywords: *Albizia lebbeck, Agroforestry, Economic benefits, Environmental sustainability*

Jasmonic and salicylic acids can trigger genotype-specific biochemical defense in pigeonpea against *Maruca vitrata*

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Elicitor compounds such as jasmonic and salicylic acids (JA and SA) can effectively trigger induced responses in plants against herbivores; however, their effectiveness is still unknown in pigeonpea. Thus, we experimented to evaluate JA and SA-induced biochemical defense responses in pigeonpea genotypes (resistant: AL 1747; susceptible: MN 1) against *Maruca vitrata* (MV) infestation during *Kharif* 2021 at Pulses Research Area, Punjab Agricultural University, Ludhiana. Plants were grown in an insect-proof net house under a Randomized Block Design with 11 treatments and three replications. Treatments included JA (@ 100 µM) and SA (@ 5 mM) applications, either alone, in combination with *M. vitrata* infestation, or as pre-treatments at 50% flowering. Flowers were harvested at one, four, and seven days after the treatment (DAT) to measure enzymatic activity. The results showed significantly higher superoxide dismutase (SOD), catalase (CAT), peroxidase (POD), and polyphenol oxidase (PPO) activities in AL 1747 compared to MN 1 across all treatments. Pre-treatment with JA followed by *M. vitrata* infestation (PJA+MV) induced the highest SOD and CAT activities in AL 1747, with effects persisting until 7 DAT, while MN 1

exhibited comparatively lower activity. Peroxidase and PPO activities peaked in AL 1747 under PJA+MV and JA+MV treatments at 1 DAT but declined at 7 DAT. Salicylic acid treatments also enhanced enzyme activities but were less effective than JA. *Maruca vitrata* infestation alone induced moderate enzymatic activity in both genotypes. These findings underscore the role of JA and SA as effective elicitors in enhancing enzymatic defense responses in pigeonpea, with AL 1747 showing a more robust response. This study provides insights into genotype-specific resistance mechanisms, emphasizing the potential of integrating signalling compounds for managing *M. vitrata* in pigeonpea cultivation.

Keywords: *Enzymatic activity; Induced host plant resistance; herbivory; Salicylic acid.*

RAFVAL:ES-2025/67

Nutrient Cycling in Agroecosystems: Implications for Soil Health

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Nutrient cycling is a fundamental process in agroecosystems that directly influences soil health, crop productivity, and environmental sustainability. In these systems, the cycling of essential nutrients such as nitrogen (N), phosphorus (P), and potassium (K) is driven by complex interactions between soil, plants, microorganisms, and organic matter. Effective nutrient management ensures that these elements are replenished and maintained in balance to support healthy soil function and sustainable crop production. Recent research highlights the importance of understanding nutrient flows and losses, particularly through leaching, volatilization, and erosion, which can degrade soil health and contribute to environmental problems such as eutrophication and greenhouse gas emissions. By adopting practices such as cover cropping, crop rotation, reduced tillage, and organic amendments, farmers can enhance nutrient cycling and minimize nutrient loss. These practices not only improve soil structure and microbial activity but also help sequester carbon, contributing to climate change mitigation. However, achieving optimal nutrient cycling in agroecosystems requires tailored management strategies, site-specific knowledge, and continuous monitoring. The study of nutrient cycling is crucial for developing regenerative agricultural practices that maintain long-term soil fertility and ecological resilience.

***Key words** – nutrient cycling, agroecosystem, soil health.*

RAFVAL:ES-2025/68

Revolutionzing Agriculture: Applications of CRISPR-Based Gene Editing for Sustainable Crop Improvement

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With its unmatched accuracy, effectiveness, and versatility in gene editing, the discovery of CRISPR-Cas systems revolutionized genetic engineering. By enabling precise, targeted editing of plant genomes, these technologies are propelling agriculture's shift toward sustainable crop production. Recent developments and significant uses of CRISPR-Cas tools to improve resistance to biotic and abiotic stressors, accelerate contemporary plant breeding programs, and enhance agronomic traits are reported in this abstract. CRISPR-Cas technology has made significant strides in engineering crop varieties with increased productivity and resilience. Among the noteworthy accomplishments are the creation of disease-resistant rice and wheat lines that are more resilient to powdery mildew and bacterial blight, respectively. Furthermore, the development of climate-resilient agricultural systems has been made easier by the successful application of targeted gene edits to increase the tolerance of crops like maize and tomatoes to salinity and drought. In addition to stress tolerance, CRISPR has been helpful in improving crop nutritional quality, lowering anti-nutritional factor levels, and simplifying plant architecture to increase potential yield.The breeding cycle has been significantly shortened by developments beyond single-gene editing, such as base editing technologies and multiplexed CRISPR strategies, which allow for the simultaneous modification of multiple traits. Furthermore, the potential for precise crop improvement is being greatly increased by the combination of CRISPR with multi-omics and high-throughput phenotyping techniques. The development of crop varieties especially suited to handle new issues in global food security is being made

possible by these combined innovations. Notwithstanding the encouraging potential of CRISPR-based technologies, regional differences in public acceptance and regulatory frameworks affect how quickly these technologies are adopted and commercialized. It is still crucial to make continuous improvements in delivery systems, mitigate off-target effects, and take ethical considerations into account in order to guarantee the responsible and widespread use of these tools. In conclusion, A revolutionary toolkit for developing next-generation agriculture includes CRISPR and other gene editing technologies. These strategies have great potential to address issues of global food security and advance ecologically friendly practices with further study and development.

RAFVAL:ES-2025/69

Net Zero Initiative (Nzi) – Plan To Achieve Net Zero In Global Dairy By 2050

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The diversity of scale, production methods, and geographic distribution of the dairy industry around the world are incredibly varied. To satisfy the demands of an expanding global population, dairy farmers and processors around the world strive to produce incredibly nutritious foods in an environmentally friendly and sustainable manner.
The dairy sector will be severely uncertain due to the consequences of climate change in the future. It will be difficult to adjust to these new circumstances, made more difficult by the ongoing rise in food demand brought on by the world's population expansion. By identifying the ideal combination of commercially feasible techniques, technology, and incentives, the Net Zero Initiative (NZI), which is spearheaded by dairy farmers, cooperatives, processing firms, and industry associations, seeks to achieve net zero emissions. Feed production and practice changes, cow care and efficiency, on-farm energy efficiency and renewable energy utilization, and manure handling and nutrient management are the four main areas of focus. Pathways to Dairy Net Zero will involve promises made by the global dairy value chain to combat climate change, feed an expanding population, and maintain the billions of livelihoods that the dairy industry supports. Provide strategies, resources, and channels for converting pledges into useful, actionable steps. Emphasize global advancements, exchange optimal methodologies, and acknowledge that every farm, every dairy system, and every area may achieve greater sustainability. By focusing on proper methodologies with the right policies and incentives in place, dairy can achieve net zero emissions.

Keywords: *Net zero initiative, Dairy industry, Net zero emission*

RAFVAL:ES-2025/70

Evaluation of diploid banana genotypes for post harvest quality attributes

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An experiment was conducted at ICAR-AICRP on Fruits, K.R.C. College of Horticulture, Arabhavi to study the evaluation of ten diploid banana genotypes belonging to AA and AB genomic groups for post harvest quality attributes during 2018-20. The results revealed that, among AA group, the maximum TSS content was noticed in Kadali (24.25°Brix) which was on par with cv. Rose (23.55 °Brix) and among AB group, highest TSS was recorded in Ney Poovan (25.35 °Brix) followed by Mitli (24.21 °Brix). Minimum titratable acidity was noticed in cv. Rose (0.34 %) and Mitli (0.31%) in AA and AB groups respectively. Significantly maximum Ascorbic acid was recorded in Namarai (4.86 mg/100g) which was followed by cv. Rose (4.38 mg/100g) among AA group and among AB group, Kunnan (4.56 mg/100g) recorded maximum ascorbic acid content followed by Kodappanilla Kunnan (4.39 mg/100g). Highest total sugar was noticed in Anaikomban (15.14 %) and Mitli (21.02 %) among AA and AB groups respectively. Shelf life was found maximum in Pisang Lillin (8.31 days) among AA group, and it was highest in Ney Poovan (10.44 days) among AB group. Significant variation witnessed among the genotypes indicated a huge potential for selection among the genotypes for breeding programs.

Keywords: *Post harvest quality, diploid banana genotypes, TSS, shelf life, total sugars*

RAFVAL:ES-2025/71

Loss Assessment And Integrated Management Of Stem Rot Of Groundnut Caused By *Sclerotium Rolfsii* Sacc. Chaitra G. 2022

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Major Advisor

Groundnut (*Arachis hypogaea* L.) is an important oilseed crop. The yield potential of groundnut is far from exploitation due to many biotic and abiotic stresses. Among the biotic factors, diseases contribute more for loss in the yield. These include stem rot caused by the soil borne, non-target and necrotrophic pathogen *Sclerotium rolfsii* Sacc. The present investigations includes main aspects *viz.*, survey, yield loss assessment, screening of advance breeding lines and integrated management of disease. The highest incidence of stem rot (18.46 %) was recorded during *kharif*2021. Among the three districts (Dharwad, Gadag and Haveri), Dharwad district recorded the highest disease incidence in both *kharif* 2021 and *rabi/*summer 2021-22. In loss assessment trial, protection of eight genotypes with fungicides recorded the least stem rot incidence (27.99%) as compared to unprotected condition (33.85%). Among the eight genotypes, highest per cent yield loss was recorded in TAG 24 (24.79 %) followed by G 2-52 (23.20 %). Both TAG 24 and G 2-52 are highly susceptible for stem rot. Dh256 recorded the minimum (11.54 %) per cent yield loss followed by ICGV 06189(11.72 %). Among the eight genotypes, TAG 24 recorded the highest per cent haulm yield loss of 13.65 per cent. Under integrated management trial, the results revealed that, seed treatment with carboxin 37.5 per cent + thiram 37.5 per cent (@ 3.0 g/kg seeds) followed by soil drenching with tebuconazole 25.9 EC (@ 2.0 ml/l) at 60 days after sowing recorded the lowest mean per cent disease incidence (16.44%), lowest per cent colonization (40.57%), highest per cent germination (69.87%) and higher pod yield (21.76 q/ha) and haulm yield (4.86 t/ha). All the screened forty two advance breeding lines of groundnut were found susceptible and highly susceptible to stem rot.

Keywords: *Integrated disease management, Stem rot, Disease incidence, Soil drenching*

RAFVAL:ES-2025/72

Clinical Assessment Of Schanz Pin And Plate Combination For Repairing Comminuted Diaphyseal Femoral Fractures in A Dog

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A eighteen-month-old male German Shepherd dog having weight 25kg was presented to the VCC, Department of Veterinary Surgery and Radiology, PGIVER, Jaipur with a history of accidental injury one day prior, exhibiting severe pain, swelling, and non-weight-bearing lameness in the right hind limb. On physical examination, crepitus and oedematous swelling were observed. Radiographic evaluation confirmed a comminuted fracture in the proximal third of the femur. An appropriate fixation technique was determined following a thorough assessment. The limb was initially immobilized using Robert Jones bandaging. The dog was premedicated with atropine sulphate (0.02 mg/kg i/m) and xylazine (1 mg/kg i/m), followed by induction with ketamine hydrochloride (5 mg/kg i/m). General anaesthesia was maintained with oxygen and 2-3% isoflurane. A cranio-lateral skin incision was made along the femur up to the stifle region. A 3.5mm Schanz pin was inserted retrogradely, supplemented with two cortical screws for stabilization. A dynamic compression plate (DCP) was applied with three screws on each fragment. The surgical wound was closed in three layers. Postoperatively, antiseptic dressings and supportive Robert Jones bandaging were applied and changed every 10-15 days. The dog was administered ceftriaxone sodium (20 mg/kg i/m) for 5 days and meloxicam (0.2 mg/kg i/m) for 3 days. Oral calcium supplementation was advised for three weeks. Radiographs taken on the 25th postoperative day showed good periosteal response and soft callus formation. By the 60th postoperative day, the animal achieved a normal gait without any abnormalities. The Schanz pin plate combination with cortical screws proved to be an effective and stable fixation method for managing comminuted distal third femur fractures in dogs.

RAFVAL:ES-2025/73

Integrating Livestock, Agroforestry and Traditional Ecological Knowledge: Pathways to Climate-Resilient and Sustainable Livelihoods in India

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Transformation of India's agriculture towards an integrated agricultural economy and a zero-carbon farm would address the immediate danger from several rapid climate changes threatening agricultural systems. Integrating livestock systems, agroforestry practices, and Traditional Ecological Knowledge (TEK) systems must create synergies in fighting against such threats. The study shows how silvopastoral systems can enhance soil fertility, water retention, and carbon sequestration while providing farmers with additional income sources. Traditional ecological knowledge possessed by Indigenous communities, such as those from Northeast India, offers a wide range of adaptive strategies that can be used along with scientific methods. According to the findings, these integrated systems mitigate greenhouse gas emissions, add to economic returns, and create climate resilience. Support comes from the National Agroforestry Policy and other institutional frameworks, but there still are difficulties in scaling up. Experiences of success across different regions have confirmed that these integrated approaches are viable pathways to climate resilience, environmental sustainability, and enhanced rural livelihood across the diverse ago-ecological zones of India.

Keywords- *Traditional Ecological Knowledge (TEK); Agroforestry Systems in Climate Adaptation; Silvopastoral Livestock Integration; Sustainable Natural Resource Management (NRM); Climate-Resilient Agricultural Livelihoods; Carbon Sequestration in Agroecological Systems; Indigenous Knowledge for Environmental Sustainability; Nature-Based Solutions (NbS) and Rural Development.*

RAFVAL:ES-2025/74

Effect of Pruning and Fertilizer Application on Yield and Quality of Guava (*Psidium guajava* L.) cv. Sardar in Maharashtra

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This study was conducted to evaluate the impact of pruning techniques and fertilizer application on the quality and yield of guava (*Psidium guajava* L.) cv. Sardar under the climatic conditions of Chatrapati Sambhajinagar (Aurangabad), Maharashtra. Guava, known for its high nutritional value, is a major tropical fruit cultivated worldwide. The experiment involved four pruning levels (no pruning, 30 cm, 60 cm, and 90 cm) combined with various fertilizer treatments applied to four-year-old guava plants. The focus was on assessing key quality parameters such as acidity, vitamin C (ascorbic acid), pectin content, and total soluble solids (TSS), along with yield attributes. Results indicated that pruning at 90 cm, in combination with the highest fertilizer level (1000:400:400 NPK g/plant), significantly enhanced both fruit quality and yield. This treatment produced the highest values for ascorbic acid, pectin content, and TSS, along with maximum yield per plant and per hectare. These findings suggest that an optimal combination of deep pruning and adequate fertilization can substantially improve guava production and fruit quality. The study underscores the importance of integrated management practices in enhancing guava cultivation outcomes.

***Keywords**: Pruning, Fertilizer, Guava, Yield, Total Soluble Solids (TSS).*

RAFVAL:ES-2025/75

Farm Producer Organization as Engine of Rural Development: Insight from Saahaj Milk Producer Company

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Farm Producer Organisations (FPOs) have become pivotal in shaping the future of rural India by strengthening the socio-economic fabric of farming communities. This research paper explores the role of FPOs as engines of rural development, focusing on the case of **"Saahaj Milk Producers Company"**—a successful milk producer organisation operating in northern India. The study examines the multidimensional impact of such organisations on **"farmer growth, women's empowerment, youth employment"**, and broader **"socio-economic development".**

Through a qualitative case study approach, supported by field visits, stakeholder interviews, and analysis of company reports, this research investigates how Saahaj Milk has enabled rural communities—especially small and marginal farmers—to achieve sustainable livelihoods. The company's farmer-centric model has enhanced access to reliable markets, ensured fair pricing, improved productivity through veterinary support and training, and fostered collective bargaining power. Farmers reported

increased income stability, improved confidence, and greater resilience to market fluctuations. A key aspect of the study is the **empowerment of rural women**, who have become active income contributors through dairy activities. Saahaj Milk fosters gender inclusion by involving women in milk collection centers, training programs, and leadership roles, leading to greater financial independence, improved decision-making, and boosted self-esteem. The FPO model also creates **employment opportunities for rural youth**, such as milk collection agents, veterinary assistants, and logistics staff, reducing urban migration while promoting dignity and purpose. Socio-economic benefits include better nutrition, education, housing, financial inclusion, and community development through infrastructure, awareness, and digital initiatives by Saahaj Milk Producers Company.

Keywords: *Farm Producer Organization, Saahaj Milk Producer Company, Women Empowerment, Rural Development, Socio-economic Development*

Title- Succession of major insect pests in rice and effectiveness of some combination and sole insecticides against yellow stem borer and earhead bug”

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The present investigation entitled “Succession of major insect pests in rice and effectiveness of some combination and sole insecticides against yellow stem borer and earhead bug” were carried out at Students’ Instructional Farm, A. N. D. U. A. & T., Kumarganj, Ayodhya (U.P.) during Kharif 2021-22 and 2022-23. The population of yellow stem borer, leaf folder, ear head bug, brown plant hopper, white backed plant hopper and green leaf hopper initiated after sowing till harvesting. The maximum damage of yellow stem borer was observed on rice crop at 36th SMW (12.20 per cent dead heart) and minimum in 29th SMW (0.50 & 0.60 per cent dead heart), whereas maximum white ear in 40th SMW (16.80 & 17.20 per cent) and minimum 36th SMW (0.70 & 2.00 per cent), leaf folder 35th SMW (16.35 & 15.55 per cent) and 29th& 43th SMW (1.10 & 0.25 per cent), ear head bug 38th SMW (10.90 & 11.70 ear head bug/hill) and 43th SMW (1.50 & 1.10 ear head bug/hill), BPH 37th SMW (11.25 & 12.45 BPH/hill) and 29th& 40th SMW (0.20 BPH/hill), WBPH 38th SMW (12.80 & 13.70 WBPH/hill) and 30th& 41th SMW (0.50 & 0.25 WBPH/hill). The maximum GLH was found in 37th SMW (20.80 & 20.60 GLH/hill) and minimum 41th&30thSMW (0.20 & 1.10 GLH/hill). The dead heart per cent was non-significant positively correlation with minimum & maximum temperature and RH% whereas, significant positive correlation was observed with sunshine hours during Kharif 2021. The leaf folder damage percent showed non-significant positive correlation with minimum temperature and RH% and non-significant negative correlation with maximum temperature, rainfall and sunshine. During Kharif 2022, the leaf folder damage percent had non-significant positive correlated with minimum & maximum temperature, RH%, rainfall and sunshine hours. Ear head bug population had non-significant correlation

with weather parameters. Sun shine hours had significant negative impact on BPH population during Kharif 2021. During Kharif 2022, brown plant hopper had non-significant positive correlation with all weather factors viz., minimum and maximum temperature, RH%, rainfall and sunshine hours. The incidence of WBPH had non-significant positive correlation with minimum temperature, RH, rainfall and non-significant negative correlation with maximum temperature & sunshine during Kharif 2021 and 2022. GLH population showed significant negative correlation with sunshine hours during Kharif 2021. During Kharif 2022, the infestation of green leaf hopper had non-significant positive correlation with minimum and maximum temperature, RH%, rainfall and sunshine hours. Among the various treatments evaluated for the management of rice yellow stem borer and ear head bug, T2-Chlorpyriphos 50% + Cypermethrin 5% EC 750 ml/ha treated plots found most effective and gave maximum yield of 31.69 q/ha followed by T3-Novaluron 5.25% + Indoxacarb 4.5% SC 750 ml/ha treated plot with 30.09 q/ha. The maximum net return and cost: benefit ratio of Rs. 14964.17 and 1:5.16 was found in T2-Chlorpyriphos 50% + Cypermethrin 5% EC 750 ml/ha followed by T8-Thiamethoxam 25% WG 100 g/ha i.e., Rs. 8715.73/ha and 1:3.96. The efficacy of remaining treatments in order to their superiority wereT1-Profenofos 40% + Cypermethrin 4% EC 1250 ml/ha (1:3.17), T5-Acephate 70% SP 500 g/ha (1:2.85), T3-Novaluron 5.25% + Indoxacarb 4.5% SC 750 ml/ha (2:1.59), T7-Imidacloprid 70% WG 150 g/ha (1:1.20), T4-Imidacloprid 40%+ Ethiprol 40% WG 400 g/ha (1:0.82) and T6-Emamectine Benzoate 5% SG 250 g/ha (1:0.21).

RAFVAL:ES-2025/77

Germplasm screening and evaluation of bio-rational insecticides againstpod borer complex of Mungbean (*Vigna radiata* L.)Wilczek”

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The experiments were carried out at GPB Farm and Students Instructional Farm of Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya during *Kharif* 2019. A total of 42 mungbean germplasm including two checks (one susceptible and one resistant) were sown in augmented block design for evaluation against major insect pests under field condition. The weekly observation on major insect pests of mungbean starting from 7 days after sowing to till harvesting was recorded. Minimum population of white fly was recorded in KMP-4 (1.4 white fly/cage) followed by KMP-21 (1.6 white fly/cage) and KMP-23 (1.7 white fly/cage). Minimum jassid population was observed in NDM 1 (resistant check) (1.8 jassid/cage) followed by KMP-36 (1.9 jassid/cage) and KMP-29 (2.0 jassid/cage). Minimum thrips population recorded in KMP-4, KMP-6, KMP-13, KMP -19-36-2, KMP-20, KMP-21 and KMP-33 (0.0 thrips/plant) followed by NDM 1 (resistant check) (1.6 thrips/plant), KMP-19-31-2 (1.7 thrips/plant) and KMP-12 (1.8 thrips/plant) and minimum population of pod borers was observed in KMP-27 (0.0%) followed by KMP-7 (0.9%), KMP-19-7-11 (1.0%) and KMP-16 (1.2%). Among the various insecticides evaluated against pod borer complex of mungbean, the overall mean of pod borer damage per cent was lowest in Indoxacarb 14.5 SC at 60 g a.i./ha (1.2%) followed by Rynaxypyr 20 SC at 40 g a.i./ha (1.7%) and Cow urine 5% (2.5%) treated plot. Neem oil, Garlic extract and Kaner powder were next best treatments which were significantly superior to control (5.4%). Overall damage reduction over control was maximum in Indoxacarb 14.5 SC treated plot (78.1%) followed by Rynaxypyr 20 SC (68.2%) and Cow urine (53.4%) treated plot. Indoxacarb 14.5 SC @ 60 g a.i./ha treated plot gave 12.9 q/h grain yield which was significantly superior with all the treatments followed by Rynaxypyr 20 SC @ 40 g. a.i./ha (11.4 q/h). The maximum Cost: Benefit ratio was obtained in plot treated with cow urine (1:86.40) and maximum monetary gain (Rs.37160) obtained with Indoxacarb 14.5 SC followed by Rynaxypyr 20 SC (Rs. 26695).

RAFVAL:ES-2025/78

Studies on the Impact of cadmium on Growth, Yield Attributes , Yield and Biochemistry of Mung Bean (*Vigna radiata* L Wilczek) Under Natural Field Condition, Burdwan, West Bengal.

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Vigna radiata L. Wilczek is a staple food crop in terms of its high protein value. In our study we investigated in realistic field conditions the effect of six different concentration of cadmium (0,0.05,0.5,1,,10 and 20mM) on various growth attributes (root length, shoot length), yield attributes(pod length and diameter, number of grains per pod) , biochemical constituents (total chlorophyll, sugar, protein, leg hemoglobin, relative water content, leaf pH) and scanning electron microscope(SEM) study of different parts of *Vigna radiata* L Wilczek . A higher dose of cadmium produced 61.87% of reduction in yield . The cadmium treatment imparted its negative impact on chlorophyll , protein, leg haemoglobin and relative water content while an increment was induced for sugar and leaf pH . The SEM observation revealed gradual distortion of structural arrangement of tissues of root and shoot and reduction in the stomatal frequency. This study clearly indicates that cadmium showed toxic effects at higher concentrations of 20mM but promotery at lower concentrations of 0.05mM with reference to growth , yield and biochemical set up of crop plant.

Key words : *Cadmium , Vigna radiata L. Wilczek, Growth, Yield, SEM*

RAFVAL:ES-2025/79

Foliar application of *Kappaphycus alvarezii* extract enhances drought tolerance in wheat by improving physiological and biochemical traits

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Drought stress is a major environmental constraint limiting wheat productivity. This study investigated the efficacy of *Kappaphycus alvarezii* extract (KE), applied as the commercial product Sagarika concentrate liquid, in enhancing drought tolerance in wheat during the vegetative stage. Wheat plants were primed with foliar KE applications at concentrations of 2.5%, 7.5%, and 10% (v/v), and subjected to drought stress between 34 to 45 days after sowing (DAS). KE application significantly improved physiological and morphological traits under drought. The highest soil moisture retention was recorded in T5 (IR + 10% KE) at 29.17%, while the lowest was in T2 (Dr + H_2O). Shoot biomass was highest in T5 (1.858 g DW/plant) and lowest in T2 (1.076 g DW/plant), highlighting the growth-promoting potential of KE under both irrigated and stress conditions. KE-treated plants exhibited higher relative water content (RWC), enhanced membrane stability index (MSI), and increased chlorophyll content compared to drought-stressed controls. Notably, electrolyte leakage (EL) and hydrogen peroxide (H_2O_2) accumulation, key indicators of oxidative damage were significantly reduced in KE-treated plants, as shown by DAB staining and EL measurements. These findings demonstrate that KE foliar application effectively mitigates drought-induced oxidative stress, preserves physiological integrity, and promotes growth, offering a promising eco-friendly strategy for improving crop resilience under water-limited conditions.

Keywords: *Abiotic stress, Kappaphycus, Drought, Priming, Reactive oxygen species,* H_2O_2

RAFVAL:ES-2025/80

Ethnobotanical Practices and Plant Diversity Patterns in Alaniya Village: Indigenous Knowledge and Conservation Implications

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In this research the ethnobotanical practice and the patterns of plant diversity in the Alaniya Village in the Ladpura tehsil of the Kota district in the Rajasthan, India has been investigated. The objective was to document the use of plants by indigenous knowledge, identify patterns of diversity, and relate to conservation in this rural community. Through the use of mixed methods, from field survey to semi-structured interview to quantitative ecological assessment, 78 plant species were identified to be used by villagers for medicinal, food, religious and economic purposes. The results show that Alaniya has an extensive ethnobotanical knowledge that is, however, threatened by modernisation, environmental degradation and change in socioeconomic dynamics. High conservation value biodiversity patches were identified with medium species richness, though they were under threat of agricultural expansion and unsustainable harvesting practices. The study proposes a number of possible approaches to enhance conservation within the community-based management systems, which augment indigenous knowledge with ecological conservation measures. The contribution of this research to the broader understanding of ethnobotanical knowledge transmission is that it demonstrates the critical role of traditional ecological knowledge in conservation of biodiversity in India's semi-arid regions.

Keywords: *Indigenous knowledge, Conservation, Semi-arid ecosystems, Rajasthan, Sustainable resource management.*

RAFVAL:ES-2025/81

Advances in irrigation technology for water conservation

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Water is very important to agriculture. But nowadays, water is becoming more scarce and is a limited resource to agriculture as a reason of changes in climatic conditions, increases in population, and inefficient farming practices. Performing traditional irrigation methods also leads to the waste of water due to over-irrigation, evaporation, and runoff. In recent times, irrigation technology has been a game-changer for farmers to efficiently use water for irrigation. Without compromising crop productivity, and also technology advances in irrigation like smart irrigation controllers, AI-powered water scheduling, IoT-based monitoring, soil moisture sensors, and satellite-guided irrigation planning. These tools focus on working together to make exact use of every water droplet where it's needed and when it's needed, and controlling the waste usage of water with smart irrigation controllers. This type of technology is not only used to save water but also helps to improve the crop yield, cut down on labor, and reduce the energy cost. The combination of traditional agricultural knowledge with modern tools helps to create a good, sustainable agriculture in the future. In the end all these types of ideas will improve precision agriculture, making every drop count and helping to ensure food security and protecting our future generations to come.

Keywords: *Agriculture, irrigation, crop, productivity, smart irrigation controllers, AI, IoT, soil moisture sensors, satellite, precision agriculture.*

RAFVAL:ES-2025/82

Non-native flora of Duldula forest region in Jashpur

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The ecological invasion of the species in any landscapes becomes the matter of serious concern across the globe. This needs to scientific exploration of various ecosystems for database generation, understanding the mechanism and ecology, distribution, invasiveness, compatibility with site quality, etc. However, various tree species that have been introduced from other regions or countries contribute significantly to the structure, biodiversity, and function of many forests worldwide. The identified strengths and opportunities highlight the high growth potential of certain tree species, their suitability for reforesting degraded areas, and their role in restoring ecological balance by filling gaps left by the decline of native trees. The impact of non-native plants can be both positive and negative, depending on the context and management and their influence over time. In this context, present investigation was carried out in northern part of Chhattisgarh which includes various forest stands to explore the status and distribution of native and non-native species over the sites. The stratified random sampling techniques within a permanent plot were carried out the record the data on various aspects. Overall, total of 129 plant species, including trees, saplings, seedlings, shrubs, climbers, and herbs, belonging to 40 families were recorded. Total 21 tree species were identified, with 52.38% being native and 47.61% non-native, and the family Combretaceae emerged as dominant. The sapling layer comprised 25 species, with 44% native and 31.36% non-native, again showing dominance of Combretaceae. Among seedlings, 23 species were recorded, consisting of 43.47% native and 56.52% non-native species, with Leguminosae and Combretaceae as the dominant families. The shrub layer included 14 species, 46.15% native and 53.84% non-native, with Leguminosae as the leading family. A total of 17 climber species were observed, comprising 52.94% native and 47.05% non-native species. In the herb layer, 30 species were recorded, with 33.33% native and 66.66% non-native species. These findings reflect a considerable presence of non-native species across all vegetation layers in the Duldula region, highlighting their influence on local plant diversity.

Keywords: *Forest stand, native, non-native, ecology, invasion*

RAFVAL:ES-2025/83

A micropropagation protocol for medicinally important *Piper macropiper* Pennant – an endemic plant of India

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The study presents an efficient micropropagation protocol for *Piper macropiper* Pennant (syn. *P. miniatum* Blume), a medicinally important plant endemic to the Andaman and Nicobar Islands of India. This plant is used by local tribes for several medicinal purposes and it is known to possess potent antibacterial, mucolytic and strong α-glucosidase inhibition activity. Using nodal segments as explants, sterile cultures were established on MS medium. A rapid clonal propagation protocol was developed by testing the effect of different cytokinins, namely, 6-benzylaminopurine (BAP), Kinetin (Kn) and *meta*-Topolin (*m*T), on *in vitro* shoot multiplication. Medium containing 6.66µM BAP along with 4.65µM Kn was found to be the best for shoot multiplication as well as elongation. Multiplied shoots were rooted on basal MS medium. Plantlets were hardened with a survival rate of 80%. This is the first report on micropropagation of this species. The developed protocol can be used for clonal multiplication of plants which can be used for phytomedicine studies and commercial production purposes.

RAFVAL:ES-2025/84

The Role of Agroforestry in Mitigating Deforestation: A Sustainable Land-Use Strategy

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Deforestation is a major environmental concern globally, contributing to biodiversity loss, climate change, and the degradation of vital ecosystem services. Agroforestry, the deliberate integration of trees with crops and/or livestock systems, has emerged as a sustainable land-use practice with significant potential to reduce deforestation. By incorporating tree cover into agricultural landscapes, agroforestry helps decrease the dependence of communities on natural forests for fuelwood, timber, fodder, and other forest products. This reduces pressure on existing forests and supports their long-term conservation.Agroforestry systems offer multiple ecological and socio-economic benefits. They enhance carbon sequestration, conserve soil and water, improve biodiversity, and create microclimates that support resilient farming. Additionally, they provide farmers with diversified income sources and increased food security, making rural livelihoods more sustainable. In many parts of the world, including South Asia, Africa, and Latin America, agroforestry has been successfully implemented to restore degraded lands, improve agricultural productivity, and curb deforestation trends.Despite its benefits, widespread adoption of agroforestry faces challenges such as inadequate policy support, land tenure insecurity, and limited access to technical knowledge and resources. To maximize its impact, there is a need for integrated policies, institutional frameworks, research investment, and community participation. Promoting agroforestry at the grassroots and policy levels can play a pivotal role in forest conservation while supporting sustainable rural development. This paper highlights agroforestry as a nature-based solution that bridges environmental sustainability with socio-economic resilience in the fight against deforestation.

Keywords- *Agroforestry, Deforestation, Sustainable Land Use, Climate Resilience, Forest Conservation*

RAFVAL:ES-2025/85

Exploring The Sacred Groves Of Sarguja: A Study Of Tradition And Conservation

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The sacred groves of Sarguja, located in Chhattisgarh, represent a unique intersection between cultural practices and biodiversity conservation. These tracts of virgin forest, traditionally protected by local communities, serve as vital ecosystems for a diverse range of species, some of which are rare and endangered. This study, conducted at various sacred sites in Ambikapur, Sarguja, explored six distinct sacred groves, documenting the flora and cultural practices associated with these areas. Sixteen species were recorded, including *Tanacetum sanguineum*, an endangered species in Chhattisgarh. This research highlights the intricate relationship between local religious beliefs, taboos, and biodiversity preservation. Furthermore, certain sacred groves were found to be linked to temples and sacrificial rituals, underscoring their spiritual significance. Despite their ecological importance, these sacred groves face increasing threats from human encroachment, pollution, and resource extraction. This study emphasizes the need for active community participation in conservation efforts, although it also acknowledges that the involvement of external agencies, such as the Forest Department and environmental organizations, is essential for the sustainable management of these vital ecosystems. Ultimately, the sacred groves of Sarguja represent a critical blend of tradition and conservation, providing significant ecological, cultural, and tourism value that requires urgent protection and management.

***Keywords**: Sacred Groves, Conservation, BiodiversityEnvironment,Cultural, Communities.*

RAFVAL:ES-2025/86

Evaluation of cucumber genotypes for various horticultural traits under subtropical conditions of Jammu region

Raman Thappa, Sanjeev Kumar

A field experiment was conducted during the spring-summer season of the year 2023-2024 at the Experimental Farm, SKUAST-Jammu, Chatha, to evaluate the performance of 37 cucumber genotypes for growth and yield parameters under subtropical conditions of Jammu & Kashmir. The experiment was laid in randomized complete block design (RCBD), replicated thrice. On the basis of overall findings of the present research study, the cross combination namely CS2 x CS8 was observed the earliest with the minimum days to first female flowering. Node number at which first female flower appears was recorded earliest in cross namely CS3 x CS4. Maximum number of female flowers per plant was recorded in parent namely CS1. For days to first harvest, earliest harvesting was observed in case of crosses namely CS5 x CS6 and CS7 x CS8. Maximum fruit length was observed in case of cross combination namely CS2 x CS7 and for fruit diameter was observed in case of cross CS3 x CS8. Higher average fruit weight was found in cross CS3 x CS7. For number of fruits per vine, maximum number of fruits was observed in case of cross combination CS2 x CS5. For fruit yield per vine and fruit yield/ha were found maximum in case of cross combination namely CS1 x CS3 and CS1 x CS3 respectively.

Keywords: *Cucumber, genotype, performance, traits, yield*

RAFVAL:ES-2025/87

Eco-resilient Strategies for Pest and Disease Management

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Integrated Pest and Disease Management (IPDM) is a holistic and sustainable approach aimed at controlling plant pests and diseases while minimizing dependence on synthetic pesticides. With a rising global population, sustainable agriculture is essential to achieving the Zero Hunger goal. However, increasing insecticide resistance and Modern Environmental Health Hazards (MEHHs) resulting from pesticide exposure pose significant risks to both human and environmental health. IPDM offers an eco-smart solution that maintains agricultural productivity while preserving ecological integrity. This strategy integrates multiple methods - biological control, cultural practices, mechanical techniques, and the judicious use of chemicals guided by scientific monitoring and threshold-based decision-making. A cornerstone of modern IPDM is the incorporation of microbial biocontrol agents and plant growth-promoting microorganisms (PGPM), which naturally suppress pests and enhance plant immunity without leaving harmful residues.

Despite their promise, eco-friendly alternatives such as microbial bio-stimulants and biocontrol agents often show inconsistent results under field conditions, highlighting the need for deeper ecological understanding and practical validation. Moreover, over-reliance on chemical controls continues to dominate many crop protection programs, compromising the core principles of IPDM. To address these challenges, Agroecological Crop Protection is emerging as a complementary framework. It combines ecological science, farmer engagement, and landscape-level strategies to create a sustainable, socially inclusive, and environmentally resilient agricultural system.

As the urgency for sustainable farming grows, reinforcing IPDM through agroecological principles and advanced biocontrol technologies is critical to securing long-term food security and ecosystem health.

Key words: *Integrated Pest Management, Biocontrol Agents, Sustainable Agriculture, Agroecology, Plant Disease Management.*

RAFVAL:ES-2025/88

Evaluation of pumpkin cultivars in relation to the incidence of cucumber mosaic virus disease in Assam under field condition

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Pumpkin (*Cucurbita moschata* Duch.) belongs to the family *Cucurbitaceae*, is one of the important vegetable crops grown in India and abroad. Numerous biotic and abiotic factors hinder pumpkin production, and one of the main threats to its cultivation is the cucumber mosaic virus disease, which is caused on by the Cucumber Mosaic Virus (CMV). Given the significance of the disease, in 2022-2023, an experiment was conducted in the experimental field of the Department of Plant Pathology, BNCA, AAU, to investigate the varietal reactivity of various pumpkin cultivars against the cucumber mosaic virus disease in Assam. Of the eighteen pumpkin cultivars that were assessed for their susceptibility to the cucumber mosaic virus disease, six showed moderate susceptibility, eleven showed susceptibility, and one showed strong resistance against the cucumber mosaic virus disease under field condition.

Key words: *Cucumber mosaic virus, disease resistance, pumpkin cultivars*

RAFVAL:ES-2025/89

Effect of *Nigella sativa* (black cumin) on blood-biochemistry of Kadaknath birds

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The present study was aimed to determine the effects *Nigella sativa* (black cumin) on blood-biochemistry of Kadaknath birds under deep litter system. Experiment was carried out on kadaknath birds aged 6 weeks at poultry unit, College of Veterinary and Animal Science, Navania, Udaipur, India. Each of the five treatment groups consisted of four replicates, containing ten chicks per replicate. During a period of six weeks, *Nigella sativa* seeds were added to the birds' diets in amounts of 0% (T1) control, 1% (T2), 2% (T3), 3% (T4), and 4% (T5). Treatment effects on packed cell volume (PVC), hemoglobin (Hb) and red blood cells (RBC) were significantly higher (p <0.05) in T5 than control group. While, WBC count and lymphocyte percentages were significantly lower (p <0.05) in T5 group compared to T1 control group. H/L ratio was significantly higher (p <0.05) in T5 group in the present study. Serum biochemical markers significantly (p <0.05) varied; T5 birds had the lowest levels for triglycerides and cholesterol but higher amount of glucose than T1 group

Keywords: *Kadaknath, black cumin, blood biochemistry*

RAFVAL:ES-2025/90

Ecological Plasticity And Metabolic Diversity In *Eichhornia Crassipes* (Mart.) Solms

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The study investigates the ecotypic variations of the invasive weed *Eichhornia crassipes* across three locations in the Tiruchirappalli district: Srinivasa Nagar North (S1), South Ramalinga Nagar (S2), and Raja Colony (S3). Morphological differences were evident as S1 exhibited ovate leaves with long petioles (22 cm), while S2 and S3 had reniform leaves with bulbous petioles (8 cm and 6 cm, respectively). Anatomically, S1 had more vascular bundles, whereas S3 showed prominent sclereids. Phytochemical screening of ethanolic leaf extracts confirmed the presence of saponins, steroids, and tannins. UV–Visible spectroscopy revealed strong absorbance between 200–300 nm, and FT-IR analysis identified carbonyl, hydroxyl, and alkene functional groups. GC-MS analysis detected 18 bioactive compounds in S1, 10 in S2, and 12 in S3. Cyclohexasiloxane dodecamethyl and N(-T-Butyl)-2-Benzoyl Benzamide, with antifungal and antimicrobial properties, were common to all sites. Elementome analysis showed the highest phosphorus content in S1 (35.37 mg/kg) and nitrogen in S2 (0.16%). Water quality assessment indicated that S3 is the most degraded site with high turbidity and the lowest dissolved oxygen (6.93 mg/L). S1 showed signs of organic pollution with elevated BOD (10.49 mg/L) and COD (3 mg/L). Despite its invasive nature, findings suggest that *E. crassipes* holds phytoremediation potential by absorbing pollutants like phosphorus and nitrogen. Furthermore, its bioactive compounds with antimicrobial properties may offer pharmaceutical applications.

Keywords: *Eichhornia crassipes, ecotype, phytochemical analysis, elementome*

RAFVAL:ES-2025/91

The Role of climate change on Global food Security

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Climate change is a significant and growing challenge to global food security. The sources highlight that climate extremes and variability are major drivers of food insecurity worldwide. Higher temperatures and unreliable rainfall make farming difficult, impacting not only crops but also livestock, forestry, fisheries, and aquaculture, with potential for severe social and economic consequences.Climate change is projected to have varying impacts on crop yields across the globe. Some studies suggest potential yield increases at high and mid-latitudes, while lower latitudes are expected to experience decreases. However, these patterns can become more pronounced over time, and intensified warming, as seen in some climate models, can even lead to decreased yields in some higher latitude regions.The impact of climate change on food production can lead to decreases in overall cereal production and agricultural GDP, particularly in the developing world. This can result in increased world food prices and a rise in the number of people at risk of hunger. One study estimate that by the 2080s, climate change could lead to an additional 80 to 90 million people at risk of hunger globally under certain climate scenarios..Furthermore, food loss and waste contribute to greenhouse gas emissions, which in turn exacerbate climate change and further threaten food security. Addressing climate change is therefore crucial for achieving and maintaining food security in the long term. However, there are uncertainties surrounding the regional impacts of climate change, the potential for technological advancements in agriculture, the realisation of benefits from CO_2 fertilisation, and future water availability, which add complexity to these projections

Keyword: *Climate change, Global food security, Hunger, World food price.*

RAFVAL:ES-2025/92

Detection of Humanin-like Mitochondria Derived Peptide, its Quantification and Effects of Humanin Supplementation on Freezability of Vrindavani Bulls' Semen

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The mitochondrial derived peptide (MDP) known as humanin (HN) has potent cytoprotective, anti-apoptotic, and antioxidant qualities. The peptide has 21 or 24 amino acids and is encoded by the mitochondrial genome's MT-RNR2 gene. The current investigation was undertaken to establish the presence/absence of Humanin in the spermatozoa, seminal plasma and testicular tissue of Vrindavani. Using commercially available anti-Humanin antibody, immunohistochemical and immunocytochemical analyses were carried out on male reproductive organs removed from slaughterhouses and on ejaculated and epididymal spermatozoa, respectively. Humanin was detected by the indirect immunofluorescence assay in the testicular tissue section's spermatids, Leydig cells, ejaculated and epididymal spermatozoa, and interstitial space. The peptide was found to be localized in the neck and upper midpiece area of spermatozoa as a pin-pointed fluorescence. There was no Humanin-specific fluorescence visible in the seminal vesicles. Using a commercially available ELISA kit, humanin levels were also measured in the seminal plasma. The results showed a strong and positive connection between sperm concentration and progressive motility in good-quality ejaculates and poor-quality ejaculates . Humanin levels in good quality ejaculates were significantly higher than poor quality ejaculates. Cryopreserved high-quality ejaculates showed a favorable and substantial correlation between their post-thaw motility and initial Humanin levels in both non-freezable and freeze-dried semen. Freezable ejaculates had much greater Humanin levels than non-freezable ones. For the first time, the study demonstrated the presence of Humanin in seminal plasma, testicular tissue, and cross-bred Vrindavani spermatozoa.

***Key words**: Humanin (HN), Mitochondria Derived Peptide (MDP), Semen freezability, Vrindavani bulls*

RAFVAL:ES-2025/93

Optimization of Green Synthesis of *Azadirachta indica* Leaf Extract based Silver Nanoparticles using Response Surface Methodology

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Green synthesis of silver nanoparticles (AgNPs) using plant-based bio-reduction methods offers an eco-friendly and sustainable alternative to conventional chemical synthesis. In the present study, *Azadirachta indica* (neem) leaf extract was employed as a biogenic reducing and stabilizing agent for the synthesis of AgNPs. Optimization of silver nitrate concentration, temperature, pH, and extract volume for synthesis was carried out using Response Surface Methodology (RSM) with a Box-Behnken Design. A total of 29 experimental trials were conducted to evaluate individual and interaction effects of parameters on nanoparticle characteristics. Characterization was performed using UV–Visible spectroscopy and dynamic light scattering (DLS) to assess absorbance, particle size, and polydispersity index (PDI). The analysis of variance (ANOVA) confirmed the significance of the quadratic model for all three responses, with p-values < 0.05. Optimal conditions identified for minimal particle size and enhanced stability included 3.167 mM $AgNO_3$, 79 °C, pH 9, and 7.55 ml of leaf extract. The synthesized nanoparticles exhibited a strong surface plasmon resonance peak at 419 nm and favorable stability parameters, validating the efficacy of the optimized protocol. This study demonstrates the potential of neem-mediated synthesis under controlled conditions, contributing to scalable and reproducible green nanotechnology practices.

***Keywords**: Azadirachta indica, Silver nanoparticles, Response Surface Methodology, Box-Behnken Design*

RAFVAL:ES-2025/94

Assessment and Control of Bacterial Endotoxin in Ketoprofen Injection: A Strategic Approach Toward Patient Safety and Regulatory Compliance

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Ketoprofen, a widely used non-steroidal anti-inflammatory drug (NSAID), is commonly administered by injection for pain and inflammation. Because of its parenteral route, strict control of bacterial endotoxins is critical to ensure product safety and meet international regulatory standards such as USP <85>, EP 2.6.14, and JP 4.01. This study aimed to develop a strategic approach for detecting, quantifying, and controlling endotoxins in Ketoprofen injection. The bacterial endotoxin limit was determined based on the maximum recommended dose and a pyrogenic threshold of 5 EU/kg body weight. The Limulus Amebocyte Lysate (LAL) gel clot method was used for qualitative detection, with method suitability tests confirming no interference from the product. In-process controls were applied to critical points such as water for injection (WFI), equipment rinses, and the final product. A comprehensive contamination control strategy was implemented following EU GMP Annex 1 and PIC/S guidelines. All tested batches complied with the endotoxin limit (<0.5 EU/mL). No endotoxins were detected in WFI or equipment rinse samples, and environmental monitoring supported contamination control efforts. The findings emphasize the importance of a proactive, validated, and science-based approach for endotoxin control in injectable formulations. Consistent monitoring and adherence to regulatory guidelines play a vital role in ensuring patient safety and product quality.

Keywords: *Ketoprofen Injection, Bacterial Endotoxin, LAL Test, Gel Clot Method, Pyrogen Control, Regulatory Compliance*

RAFVAL:ES-2025/95

Impact of Varying Stocking Densities on the behaviour of Broiler Chickens

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The objective of this study was to examine how stocking density influences the performance of broiler chickens raised in intensive rearing systems. The research was carried out on six-week-old broilers at the poultry unit of the Livestock Farm Complex, College of Veterinary and Animal Science, Navania, Udaipur, affiliated with the Rajasthan University of Veterinary and Animal Sciences in India. The study included three treatment groups, each with four replicates, consisting of eight, ten, and twelve chicks, designated as D1 (8 birds/m²), D2 (10 birds/m²) control, and D3 (12 birds/m²). Each treatment group exhibited statistically significant effects ($p < 0.05$) on drinking and locomotory behavior, while cannibalism and leg deformities were not influenced by the different stocking densities. The D3 treatment group demonstrated the highest drinking frequency, followed by the D2 and D1 groups at 42 days of age. In contrast, the highest levels of movement were observed in the D1 group, with D2 control group showing moderate movement and D3 exhibiting the least. The study concluded that lower stocking densities did not adversely impact the welfare of the birds.

Keywords : *stocking density, behaviour, chickens, intensive system*

RAFVAL:ES-2025/96

Effect on Growth and Yield of Mungbean [*Vigna radiata* (L.) Wilczek] through Foliar Nutrition under Guava [*Psidium guajava* (L.)] based Agri-horti System in Vindhyan region of Mirzapur

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A field experiment was carried out during the *kharif* season 2022 at Agroforestry Research farm, Rajiv Gandhi South Campus, Banaras Hindu University, Varanasi (Uttar Pradesh). The trial included 10 treatments, each reproduces three times in a Randomized Block Design. The study evaluated the effects of Recommended dose of fertilizers (RDF) N_{18} P_{48} K_{24}, 2% neem coated urea, and foliar application of nano urea (4 ml/l), 0.5% zinc ($ZnSO_4$) and 0.2 % boron, on Mungbean growth and yield parameters during pre-flowering and pod development stages,. The data was recorded at 20 DAS, 40 DAS and at harvest stage and revealed the outcomes with growth characteristics *i.e*., plant height (46.4 cm), number of branches (5.3), number of trifoliate leaves (6.9), number of root nodules (4.7), dry matter accumulation (42.3 g) and also significant increase in yield characteristics *i.e.*, number of nodules/plant (21.9), number of pods/plant (27.33), number of grains/pod (8.13), 1000 seed weight (40.2 g), biological yield (4402 kg/ha), and grain yield (1550 kg/ha) was highest in RDF + nano urea 4 ml/l + 0.5 % Zn + 0.2 % B twice at pre-flowering and pod development stage in treatment T10 over control. Guava a 10 year old tree with an average height (5.85 m), canopy diameter (5.60 m), stem girth (0.97 cm), and crown length (4.93 m). The study sought to determine how these foliar nutrients affect the overall growth and development of Mungbean plants under the specified conditions.

Keywords:*Mungbean, Nano urea, Zinc, Boron, Yield, Agroforestry*

RAFVAL:ES-2025/97

Productivity and carbon sequestration potential of high intensity food fodder strip cropping sequence in Jammu

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Carbon sequestration in agriculture presents a promising strategy for mitigating climate change by capturing atmospheric carbon dioxide (CO_2) and storing it in soils and biomass. Agricultural practices play a dual role, being both a source and a sink for greenhouse gas emissions. By adopting specific land management techniques, agriculture can significantly enhance carbon storage while promoting soil health and productivity. The study investigates the productivity and carbon sequestration potential of a high-intensity food-fodder strip cropping sequence under the agro-climatic conditions of Jammu. In regions like Jammu, where land resources are limited and the demand for both food and fodder is increasing, integrating strip cropping systems offers a sustainable solution. The experiment was conducted to evaluate various combinations of cereal, legume and fodder crops arranged in alternating strips to maximize resource use efficiency, yield and carbon capture. Results indicated that specific sequences, particularly those involving maize+cowpea and oat +fababean combinations, significantly improved both biomass production and soil organic carbon content. The system promoted year-round ground cover, reduced soil erosion and enhanced microbial activity, contributing to increased carbon sequestration in the topsoil. Additionally, the inclusion of legumes improved nitrogen availability, thereby reducing the need for synthetic fertilizers.

Overall, the high-intensity strip cropping model proved effective in improving land productivity and ecological sustainability. This approach holds promise for replication in similar agro-ecological zones, providing a dual benefit of meeting food and fodder needs while contributing to climate change mitigation through enhanced carbon sequestration. Further research is recommended to optimize crop combinations and assess long-term impacts on soil health and carbon dynamics. Conservation tillage minimizes soil disturbance, thereby reducing CO_2 release, while cover crops and crop rotation improve organic matter inputs and microbial activity.

Keywords: *Carbon sequestration, Strip cropping, Food, Fodder Conservation agriculture*

RAFVAL:ES-2025/98

Foraging Behavior of Purple Heron (Ardea purpurea)in the Rice Fields of Kota: Implications for Urban Agricultural Landscape and Natural Pest Control

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Many studies showed that irrigated rice fields are alternative habitats for several wetland species. This study investigates the foraging behavior of the Purple Heron(Ardea purpurea) in rice fields within urban -agricultural matrix of Kota, Rajasthan. Observation indicate that Purple Herons primarily employ a stand -and- wait hunting strategy, with slow walking approach in shallow flooded rice fields. Prey capture is achieved via grasp capture technique using bill. Additionally Purple Herons serve as a natural pest controllers, preying on small vertebrates and invertebrates reducing reliance on chemical pesticides. This study highlights the need for the conservation -friendly agricultural practices to sustain avian biodiversity while enhancing ecosystem services in urbanizing landscapes.

Keywords : *Foraging behavior, Grasp capture, Pest controllers, Purple Herons, Rice fields.*

RAFVAL:ES-2025/99

Economics of poplar-onion agroforestry systems

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The present study was conducted at the research area of the Department of Forestry, CCS Haryana Agricultural University, Hisar, during the 2022–23 and 2023–24 *Rabi* seasons. The research was undertaken in a pre-established poplar plantation (established in February 2017), with four different spacings: 4×3 m, 5×3 m, 6×3 m, and 7×3 m. Within the interspaces of these spacings as well as in a control plot (without trees) three onion varieties *viz.*, HO 4, PRO 7, and Red 4 were cultivated. Under 6-year-old poplar plantation, 7×3 m and 6×3 m, poplar spacings provided maximum returns 2,04,433 and 1,97,932 rupees/ha, respectively with respective B:C ratio of 1.96 and 1.91, over control having net return of 1,61,807 rupees/ha with B:C ratio of 1.91. Under 6-year-old poplar plantation mean values of B:C ratio of onion varieties in 4×3 m and 5×3 m spacings were found 0.83 and 1.02 respectively whereas, under 7-year-old poplar plantations *viz.*, 4×3 m, 5×3 m 6×3 m and 7×3 m, the ratio was found 0.65, 0.85, 1.02 and 1.12 respectively. Without including poplar economics, under 6-year-old poplar plantation onion variety HO 4 recorded highest B:C ratio *i.e.*, 1.33 in 7×3 m and 1.21 in 6×3 m poplar spacings, PRO 7 recorded second highest B:C ratio i.e., 1.27 in 7×3 m & 1.17 in 6×3 m poplar spacings and Red 4 recorded lowest B:C ratio i.e., 1.24 in 7×3 m and 1.13 in 6×3 m poplar spacings without including poplar economics.

Keywords: *Economic, agroforestry, poplar spacings, onion varieties and B:C ratio*

RAFVAL:ES-2025/100

Role of Traditional knowledge in climate adaptation

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Sustainable Solutions from the Past: Traditional Knowledge in Modern Climate Adaptation

Traditional knowledge, developed through generations of interaction with the natural environment by Indigenous and local communities, plays a critical role in climate adaptation. This knowledge system encompasses sustainable practices in agriculture, water management, biodiversity conservation and disaster preparedness, offering practical, low-cost and culturally appropriate solutions to climate-related challenges. It provides context-specific, low-cost and culturally appropriate solutions to climate challenges, particularly in vulnerable regions. Traditional practices such as agroforestry, rainwater harvesting and controlled burning have proven effective in increasing community resilience and ecological sustainability Techniques such as agroforestry, rainwater harvesting and controlled burning have demonstrated effectiveness in enhancing ecosystem resilience and supporting livelihoods in vulnerable regions. Traditional knowledge is particularly valuable for its localized insights and adaptability, often filling gaps left by scientific data, especially in remote or under-resourced areas. Integrating this knowledge with modern scientific approaches can lead to more comprehensive and inclusive adaptation strategies. However, traditional knowledge systems face increasing threats from globalization, cultural erosion and lack of formal recognition. Preserving and respecting these systems—through documentation, education and supportive policy frameworks—is essential for strengthening community resilience and achieving equitable, sustainable climate adaptation. Recognizing the value of traditional knowledge not only enriches scientific understanding but also empowers communities to lead in the face of environmental change.

Keywords: *Traditional knowledge, climate adaptation, Indigenous communities, sustainable practices, agroforestry*

RAFVAL:ES-2025/101

Forest Management Through Sustainable Harvesting of NTFPs with Special Reference to Chhattisgarh

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Non-Timber Forest Products (NTFPs) are essential to the economy and livelihoods of forest-dependent communities in Chhattisgarh, India. The state boasts a rich diversity of NTFPs, including tendu leaves (*Diospyros melanoxylon*), mahua flowers (*Madhuca longifolia*), sal seeds (*Shorea robusta*), bamboo (*Bambusoideae* spp.), chironji (*Buchanania lanzan*), gums, resins, and various medicinal plants. These products significantly contribute to the income and sustenance of rural populations. Sustainable harvesting of NTFPs is crucial for balancing economic benefits with ecological conservation. Overexploitation can lead to resource depletion and biodiversity loss. Therefore, implementing sustainable management practices is vital. Strategies include regulating extraction rates, protecting young regenerations, and promoting diverse uses of medicinal plants. These measures ensure that harvesting does not exceed the forest's regenerative capacity, maintaining the production of goods and services for future generations. Agroforestry presents a promising model for sustainable development in Chhattisgarh. Agroforestry combines trees with crops or livestock on the same land, enhancing biodiversity, improving soil health, and providing additional income sources through NTFPs. This approach aligns with the state's objectives of promoting green and sustainable development. Community-based resource management is also essential for the sustainable harvesting of NTFPs. Involving local communities in decision-making processes ensures that harvesting practices are ecologically sound and economically beneficial. Recognizing indigenous rights to traditional land and resources strengthens local decision-making and resource management, leading to more effective conservation outcomes. These strategies not only conserve forest ecosystems but also enhance the livelihoods of forest-dependent communities, ensuring the long-term sustainability of both the environment and the economy.

Keywords: *NTFPs, Agroforestry, Biodiversity, Conservation, Sustainable management.*

RAFVAL:ES-2025/102

Sustainable Aquaculture: The Future Of Fish Farming

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Fisheries sector play an important role in developing the socioeconomic condition of country. Fish farming is a rapidly growing industry providing great source of protein for millions of people worldwide. It is the cultivation of aquatic organisms, with human involvement in the breeding process to increase production in operations, such as reproduction, storage, feeding, and protection against predators. The greatest prominence in aquaculture includes freshwater fish, followed by seaweed, showing the great importance of fish farming in food production worldwide. It has undergone significant diversification and intensification in recent decades, driven by the adoption of cutting edge technologies. This growth has substantially enhanced global food security and alleviated poverty. However the fish farming also faces challenges such as environmental concerns, disease management and market competition. To address these issues, the industry is shifting towards integrate multi-trophic aquaculture and recirculating aquaculture systems. The focus of future research and development will be on improving the efficiency, sustainability and social responsibility of fish farming practices.

Keywords: *Fish, Farming, Aquaculture, Fisheries*

RAFVAL:ES-2025/103

Theme 1: Suistainable Crop Production and Food Security

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The study was conducted at the Research Field of the Department of Soil Science and Agricultural Chemistry, Naini Agricultural Institute, SHUATS, during the *Zaid* season of 2021 to assess the effect of different levels of Phosphorus and Zinc on growth and yield. Soil reaction was almost neutral (pH 6.8), organic carbon was medium (0.562%), available nitrogen was low (220 kg/ha), potassium was medium (240.7 kg/ha), and accessible phosphorus was extremely high (28.2 kg/ha) in the sandy loam soil that was used for the experiment. The electrical conductivity was also 0.409 ds/m. The experiment was set up using a Randomized Block Design, which consisted of nine treatment combinations that were replicated three times and had three levels of zinc (0, 10, and 20 kg/ha) and phosphorus (0, 25, and 50 kg/ha). The result shows that significantly highest growth attributes of Cluster bean at 80 DAS viz., Plant height/plant (95.16 cm), dry weight/plant (34.87 g), number of nodules/plant (32.83), and crop growth rate (20.20 g/g/day). And yield attributes viz., number of pods/plant (42.12), grains/pods (9.41), test weight (37.12 g), grain yield (1484.15 kg/ha), Stover yield (2675.00 kg/ha) and Gross return (INR 1,24,639.00), Net return (INR 86,275.00) and Benefit-cost ratio (2.25) were found higher in treatment T9 (100% Zinc + 100% Phosphorus).

Keywords: *Phosphorus, Zinc, benefit-cost, net returns*

RAFVAL:ES-2025/104

Applications Of Essential Oils In Fruit And Vegetables Preservation

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The production of safe foods with little or no artificial preservatives is one of the foremost leading challenges for food manufacturing industries because synthetic antimicrobial agents and chemical food additives can cause severe negative effects on human health. However, there is an ever-increasing interest by consumers towards natural sources that have been aroused recently, and this increased consumer demand for safe food products has forced the food industries to use natural herbal and plant origins preservatives instead of synthetic preservatives for the production of safe foods. Traditionally, essential oils (EOs) obtained from numerous plant sources have been extensively encouraged for their putative health-promoting biological activities. The complex combinations that make up the essential oils contain numerous distinct chemicals that have been isolated by several techniques. Through various processes, these varied chemicals exhibit important biological functions as antimicrobial and antioxidant properties. However, their application is restricted by their volatility, oxidation susceptibility, and poor water solubility. The use of these essential oil food systems has been thoroughly explained here. The significance of EOs is discussed in this review along with their primary constituents, chemical and biological characteristics, such as their method of action, efficacy, synergistic effects as antimicrobials, and possible uses as preservatives in the food chain.

Keywords: *Keywords food safety; antibacterial; antifungal; phenolic compounds, Essential Oils.*

RAFVAL:ES-2025/105

A Sustainable Approach to Food Waste Management

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The disposal of fruit and vegetable by-products, particularly peels and seeds, presents a growing challenge for global food systems and environmental sustainability. In many developing countries such as India, food insecurity persists in part due to limited processing infrastructure and underutilization of agricultural residues. Notably, peels and seeds can account for 10–35% of the total fruit mass and are typically discarded despite being rich in valuable nutrients, antioxidants, dietary fibers, and bioactive compounds. This study investigates the potential of transforming these often-overlooked materials into value-added products. By leveraging cost-effective and environmentally friendly technologies, fruit and vegetable peels can be repurposed into functional materials such as natural preservatives, dietary supplements, animal feed, biofuels, cosmetics, and biodegradable packaging. Such innovations not only contribute to waste reduction but also create economic opportunities and support the principles of a circular economy. The paper emphasizes the importance of research, awareness, and policy frameworks to fully harness the potential of agro-industrial waste, thereby promoting food security and advancing sustainable development goals. Embracing such approaches can redefine waste as a valuable resource and pave the way for a greener, more resilient future.

Keywords: *sustainability, biodegradable packaging, biofuel, peels, agro-waste.*

RAFVAL:ES-2025/106

A Comprehensive Review on Eco-friendly Silver Nanoparticles Synthesized from plant extracts as Bio pesticides.

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Silver nanoparticles are among the most studied two-dimensional materials due to their high stability and low chemical vulnerability compared to other metals. These nanoparticles are typically prepared using toxic reducing agents that convert alloy ions into neutral nanoparticles. The overuse of environmentally friendly synthesis methods for the preparation of Silver Nanomaterial from plant extracts has attracted considerable attention due to their environmental friendliness and potential application in agriculture. This review provides an overview of the current literature on the sustainable synthesis of Silver Nanoparticles using various plant concentrated and their effectiveness as natural pesticides. Furthermore, the pesticide activity of these nanoparticles against a variety of agricultural pests, including insects, fungi and bacteria is highlighted. The possible mechanisms of the pesticides activity of AgNPs, including disruption of cell membranes, disruption of metabolic processes and the generation of oxidative stress are also explored. Furthermore, the challenges and prospects of using plant-mediated AgNPs as natural pesticides for renewable crop protection are addressed. We are examine the current use of various plants to produce highly effective antibacterial green AgNPs and systematically and in detail investigate the likely effects of photo catalysis and its density in plant extracts, solvents and extraction temperatures, as well as the influence of reaction temperature, pH, reaction time and precursor density on the size, shape and strength of the produced silver nanoparticles. The aim of this study is to provide a deeper understanding for the development of environmentally friendly and effective alternatives to synthetic pesticides by leveraging the inherent properties of plant extracts and Silver Nanoparticles.

Keywords *- Silver Nanoparticles, Green Synthesized, Plants Extracts, Natural Pesticides, Eco-friendly.*

RAFVAL:ES-2025/107

Assessment of Biofilm Formation and Shiga Toxin genes in ESBL-Producing E. coli Recovered from Retail Salad Vegetables in Mirzapur District, Uttar Pradesh, India

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The study aimed to assess the microbiological quality of raw salad vegetables from retail markets in Mirzapur, Uttar Pradesh, focusing on their role as a source of antibiotic-resistant bacteria and Shiga toxin producing ability, particularly ESBL-producing E. coli. A total of 224 samples from seven types of salad vegetables (tomato, cucumber, carrot, green chilli, radish, coriander, beetroot) were collected from 32 shops across 7 markets. Cefotaxime-resistant E. coli were detected in 94 samples, yielding 276 isolates. Of these, 274 (99.27%) were phenotypically confirmed as ESBL producers. The highest prevalence was found in radish (65.62%), followed by coriander (53.12%), carrot (46.87%), green chilli and beetroot (43.75% each), tomato (28.17%), and cucumber (25%). Biofilm formation was assessed using Congo Red Agar (CRA) and microtiter plate assay (MPA). CRA showed 70.80% BDAR and 29.19% RDAR morphotypes. MPA revealed 74.81% weak, 16.05% moderate, 3.2% strong, and 5.79% non-biofilm producers. PCR-based genotypic analysis found Fim-H gene in 77% of isolates, Sfa in 11.31%, and Pap-C in 4.01%. Further, all the ESBL-producing E. coli isolates were explored for a potential presence of Shiga-toxin gene employing PCR assay targeted at amplification of stxl and stx2 genes of E. coli, which revealed the presence of stx1 and stx2 genes in 1 and 2 isolates (1.09%), respectively. The findings highlight that raw salad vegetables can act as reservoirs of ESBL-producing E. coli with biofilm-forming abilities, posing significant public health risks.

Keywords *-Antibiotic resistance, Salad vegetables, Extended spectrum B-lactamase-producing Escherichia coli (ESBL-E. coli), Biofilm formation, Shiga-toxin production.*

RAFVAL:ES-2025/108

Assessing the Water Quality Parameters for Determining Fisheries Potential of Surwal dam reservoir, Sawai Madhopur

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The sustainable development of fisheries is closely related to the quality of water in aquatic ecosystems. Surwal dam reservoir is located near the city of Sawai Madhopur and is being used as a site of commercial fish production. The physico-chemical parameters of water, including temperature, pH, dissolved oxygen, COD, BOD, TDS, hardness and nutrient levels, play a crucial role in determining the suitability of water for supporting healthy fish populations. Water samples were collected from 2 different sites from the dam reservoir for the period of 6 months (October 2024-March 2025), and the key water parameters were analysed to established standards for aquatic life and fish production. The results reveal water of dam reservoir exhibiting optimal conditions for fish growth and reproduction, concluding water of dam to be suitable for fish production. This assessment provides valuable insights into the suitability of dam for fisheries potential.

Keywords- *Limnology, Fish production, Aquatic ecosystem, Ecological assessment*

RAFVAL:ES-2025/109

Investigating Biofilm formation in Methicillin-Resistant *Staphylococcus aureus* recovered from fresh retail salad vegetables in Mirzapur District, Uttar Pradesh

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This study investigates the occurrence of Methicillin-resistant *Staphylococcus aureus* (MRSA) in fresh salad vegetables including cucumber, carrot, coriander, chilli, radish, tomato, and beetroot collected from retail vegetable shops. Among the collected samples, *S. aureus* was detected with the highest number of isolates recovered from cucumber. Phenotypic methicillin resistance was confirmed using the disc diffusion assay, identifying the isolates as MRSA. All phenotypically confirmed MRSA isolates were further subjected to genotypic confirmation through PCR assays targeting the *mecA*, *mecB*, and *mecC* genes. The biofilm-forming ability of the MRSA isolates was examined both phenotypically and genotypically. Phenotypic assessment was performed using Congo Red Agar (CRA) and microtiter plate assay (MPA), which revealed three distinct colony morphotypes: pink dry and rough (PDAR), brown dry and rough (BDAR), and red dry and rough (RDAR). Genotypic analysis through PCR targeted the *icaA* and *icaD* genes involved in biofilm formation. The *icaD* gene was detected in 29% of the MRSA isolates, while the *icaA* gene was not amplified in any of the tested samples.

The findings demonstrate the presence of MRSA with biofilm-forming potential in raw salad vegetables commonly consumed without cooking. This underscores a potential public health concern, highlighting the need for improved hygiene practices during cultivation, handling, and retail to reduce the risk of contamination and subsequent transmission to consumers.

Keywords: *Antimicrobial resistance, Biofilm formation, MRSA, Salad vegetables, S. aureus.*

RAFVAL:ES-2025/110

Prevalence Of Bovine Trypanosomosis And Anaplasmosis In And Around Bhubaneswar

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The agro ecological and geo-climatic conditions of India are highly favorable for growth and multiplication of vectors like ticks and flies which act as natural vectors of anaplasmosis and trypanosomosis. These diseases are of zoonotic importance. Blood parasites have a detrimental impact on the global bovine population, significantly hindering livestock productivity and health. This study focused on assessing the prevalence of certain bovine hemoparasites, their molecular characterization, and associated risk factors in and around Bhubaneswar, Eastern India. A total of 106 bovine blood samples from varying breeds, ages, and sexes presented to the Veterinary Clinical Complex were examined using microscopy (Giemsa-stained thin blood smears) and polymerase chain reaction (PCR). DNA was extracted through conventional methods, with primers targeting the msp5 gene (382 bp) for *Anaplasma marginale* and VSG RoTat 1.2 gene (110 bp) for *Trypanosoma evansi*. Sequencing and phylogenetic analyses were performed on representative PCR products. Blood smear analysis revealed an overall prevalence of 21.7% (23/106), with *A. marginale*, *T. evansi*, and mixed infections showing rates of 10.38%, 3.77%, and 7.55%, respectively. All microscopy-positive samples were also confirmed by PCR, which indicated an overall prevalence of 35.8% (*A. marginale*: 17.92%, *T. evansi*: 5.66%, and concurrent infections: 12.26%). Higher prevalence was observed in cattle aged 2–4 years (16.9%), females (29.2%), and crossbred Jersey cattle (20.75%). Representative PCR products were sequenced and assigned to GenBank (OL550058: *A. marginale*; OL550059: *T. evansi*). Disease mapping for these parasites is limited in many regions of India. This study is likely the first to report molecular characterization of *T. evansi* and *A. marginale* from this area, shedding light on potential genetic diversity among local isolates.

RAFVAL:ES-2025/111

Exogenous ascorbic acid mediated drought tolerance in jute (*Corchorus olitorius* L.)

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Drought is known to alter the physiological responses in plants affecting their growth and development. Jute (*Corchorus olitorius* L.), an important lignocellulosic fibre crop, is susceptible to drought stress at the early growth stage. Here, the early drought response in contrasting jute genotypes and drought mitigation through different plant growth regulators to identify the best growth regulator and genotypic combination was investigated. Comparative effect of these plant growth regulators showed that 10 mM ascorbic acid aided in maximum drought recovery. Drought arrested biomass yield, plant height, chlorophyll content, affected nutrient (N, P, K, Fe and Ca) uptake and modified the cell wall composition reducing fibre productivity and quality. Drought enhanced biosynthesis of proline, ascorbic acid, flavonoids and antioxidants coupled with an increase in endogenous ascorbic acid. Exogenous ascorbic acid resulted in recovery of plant height, biomass, fibre quality, total chlorophyll, N, P, K, Fe, Ca and membrane stability whereas proline content was reduced. With exogenous ascorbic acid application, the endogenous ascorbic acid increased by 14.4 % exhibiting a significant positive correlation with 22 traits. The drought tolerance of genotypes, particularly cv. JRO 204, is attributed to higher endogenous ascorbic acid, proline, nutrient content and anti-oxidants which ultimately contributed to higher cellulose in fibre and biomass. Hence, the cultivation of drought tolerant genotype supplemented with exogenous ascorbic acid can be a robust mitigation strategy for early drought management in jute.

Keywords: *Antioxidants, Ascorbic acid, Drought, Jute*

RAFVAL:ES-2025/112

Season wise survey of mosquito fauna of District Yamuna Nagar

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Mosquitoes are one of the most important menaces affecting human populations worldwide. So far, over 3,500 species of mosquitoes have been reported of which 88 are known to transmit diseases to humans and another 243 are suspected to be disease vectors. Mosquitoes belong to the order Diptera and the family Culicidae, while humans are part of the class Mammalia and the order Primates.Important vectors of disease(s) include various species of genera,*Anopheles*, *Aedes*, and *Culex*. The most common diseases that are transmitted by these vectors include malaria, dengue, chikungunya, filaria, etc.Surveillance of mosquito-borne diseases, such as malaria and dengue fever, can provide valuable information on the presence and spread of these diseases. Unfortunately, mosquitoes also play a significant role as vectors for various diseases. Some species transmit pathogens such as malaria, dengue fever, Zika virus, and West Nile virus, posing significant health risks to human populations. This relationship has had a profound impact on human health and has driven research into mosquito control and disease prevention. The study was thus, designed to study theseasonal prevalence of mosquitoes in the Yamuna Nagar district of Haryana. Adult mosquitoes were collected using total catch method via UV light-based mosquito traps of CDC (Kenea et al.,2017) installed in the city houses.The adult mosquitoes were identified and the *Anopheles*, *Aedes* and *Culex* were recorded. The data was analysed and the results of the six-month analysis indicatedthat theCulexgenuswas the most dominant. The maximum number of mosquitoes were found in the August. The dominance of the mosquitoes in the area was primarily due to the prevalence of the Culex genera. The monthly distributions of the mosquitoes appeared to be influenced by high monsoon levels in the region.

RAFVAL:ES-2025/113

Sustainable crop production and food security

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Sustainable agriculture is a practical approach to achieving global food security while minimizing environmental degradation. It can be achieved through precision farming, organic farming, post-harvest management, INM, and climate smart farming. Precision agriculture technologies (PATs) are revolutionizing crop production by enabling sustainable and efficient practices. They use advanced tools like GPS, IoT, drones, and data analytics to monitor and manage crop production with precision. PATs not only increase crop yields but also contribute to environmental health by preserving natural resources and reducing pollution. Globally, PATs are accelerating adoption to address challenges like climate change, resource scarcity, and food security. The integrated pest and disease management strategy is a globally recognized approach to sustainable agricultural production. It combines biological, cultural, physical, and chemical tools to identify, manage, and reduce pest risks while minimizing economic, health, and environmental risks. Climate-resilient crops are being developed to mitigate the effects of climate change on agriculture. These crops are designed to maintain high yield potential and nutritional quality while abiotic stresses are reduced. Conventional breeding techniques, such as selection have improved stress tolerance in crops. Genetic resources, including wild crop relatives and landraces, have expanded genetic diversity for breeding programs. Molecular breeding techniques have revolutionized conventional breeding, enhancing trait selection precision and efficiency. Breeding climate-resilient crops is crucial for food security. Another approach to sustainability is Organic farming promotes sustainable crop production by focusing on ecological balance, soil health, and biodiversity. It reduces environmental degradation, preserves water resources, supports healthier ecosystems, and offers resilience. Post-harvest management systems aim to reduce agricultural waste and secure food security, particularly in the face of increasing population and diminishing resources.

Keywords : *precision agriculture, sustainability, climate-resilient crop varieties, food security*

RAFVAL:ES-2025/114

Distribution of soil aggregates organic carbon in rice under effect of tillage and fertilization in dry land ecosystem

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Soil aggregation increased by increasing organic carbon in soil. Organic manure is considered as an effective way to increase organic carbon in croplands. The aim of this experiment was to evaluate the effects of tillage i.e. conventional tillage (T1), reduced tillage (T2) and minimum tillage (T3) and fertilization i.e. 100% inorganic (F1), 50% organic (F2) and 100% organic (F3) on the soil aggregate carbon of an Inseptisol in the Indo-Gangatic plain in dry land condition. Aggregate organic carbon was much higher in macro aggregates and decreased in micro aggregates, after rice at the soil depths (0-5 cm). However, the silt + clay associated carbon did not change as much as in aggregates because of stronger bonding between clay and organic matter. The silt + clay associated carbon increased with increase in manuring indicating that they were far from carbon saturation. In all the aggregate classes, higher carbon content was observed in plots receiving 100% organic manure and decreased with decrease in manuring. Similarly, higher carbon content was observed in all the aggregate size classes in minimum tillage plots and decreased with increase in tillage intensity.

***Key words**: Tillage; Fertilizer; Aggregates; Organic carbon*

RAFVAL:ES-2025/115

Integrated Management of *Alternaria brassicae* in Mustard (*Brassica juncea* L.): A Comparative Research of Biological Treatments using the Standard Blotter Technique

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Alternaria brassicae is a major seed-borne pathogen of mustard (*Brassica juncea* L.), causing significant reductions in seed germination and crop yield. The experiment was conducted in the Department of plant pathology, SHUATS, Prayagraj, U.P. during 2022-2023, to evaluates the efficacy of biological agents (*Trichoderma viride, Pseudomonas fluorescens*), plant-based extracts (neem, eucalyptus), elicitors (salicylic acid, seaweed extract) and chemical fungicide (Mancozeb), for managing *A. brassicae* infection. The Standard Blotter Technique (SBT) was employed to assess seed germination, seedling vigour, and pathogen suppression. Results revealed that *Trichoderma viride* significantly enhanced seed germination (84.80%) and seedling vigour, demonstrating efficacy comparable to Mancozeb (85%). Among plant extracts, neem exhibited moderate antifungal activity, while salicylic acid contributed to induced systemic resistance. Eucalyptus extract showed limited pathogen suppression. The combination of biocontrol agents and elicitors presented a promising alternative to synthetic fungicides, aligning with sustainable agricultural practices. This study underscores the potential of integrating biological control strategies to reduce chemical dependency while ensuring seed health and vigour. Future research should focus on field validation, molecular characterization of seed-borne infections, and advanced disease management approaches.

Keywords: *Alternaria brassicae, Brassica juncea, biocontrol, seed pathology, blotter technique, eco-friendly disease management*

RAFVAL:ES-2025/116

Morphological characterization of Dalbegia sisso in Chakarbhatha, Bilaspur, Chhattisgarh

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Dalbergia sissoo, known commonly as North Indian rosewood or shisham is a fast-growing, hardy, deciduous rosewood tree native to the Indian subcontinent and southern Iran. *D. sissoo* is a large, crooked tree with long, leathery leaves and whitish or pink flowers. *Dalbergia sissoo* is a medium to large deciduous tree with a light crown, which reproduces by seeds and suckers. It can grow up to 25 m (82 ft) in height and 2 to 3 m (6 ft 7 in to 9 ft 10 in) in diameter, but is usually smaller. Trunks are often crooked when grown in the open. Leaves are leathery, alternate, pinnately compound, and about 15 cm (5.9 in) long. Flowers are whitish to pink, fragrant, nearly sessile, up to 1.5 cm (0.59 in) long, and in dense clusters 5 to 10 cm (2.0 to 3.9 in) in length. Pods are oblong, flat, thin, strap-like, 4 to 8 cm (1.6 to 3.1 in) long, 1 cm (0.39 in) wide, and light brown. They contain one to five flat, bean-shaped seeds, 8 to 10 mm (0.31 to 0.39 in) long. They have a long taproot and numerous surface roots that produce suckers. Young shoots are downy and drooping; established stems have light brown to dark gray bark, up to 2.5 cm (0.98 in) thick, shed in narrow strips; large upper branches support a spreading crown. However, no agronomic or morphological research has been conducted on this species. Twenty four trees were selected and collected for further statistical analysis of data. The morphological characters were considered using samples from 24 trees representing different populations in Chakarbhatha, Bilaspur, Chhattisgarh. Height. Girth, Leaf shape, structure, colour, pattern.

Keywords : *Dalbergia sissoo Morphological characters, Morphological research*

RAFVAL:ES-2025/117

Exploring the morphological diversity in rice accessions (*Oryza sativa* f. *spontanea*) for early seedling vigour

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Weedy rice (*Oryza sativa* f. *spontanea*) in view of red pericarp's color, commonly referred to as "red rice" and which recognized as a crop wild relative (CWR) of cultivated rice Oryza sativa, possessing the same genome type AA (2n=24). Weedy rice (*Oryza* spp.), a relative of cultivated rice, is a well-known troublesome weed that significantly threatens rice production in the world due to its exceptional competitive ability, viz., profuse tillering, high nutrient uptake, seed shattering, seed dormancy allowing for longer persistence in the soil, and so forth. However, certain desirable traits in this weed, such as high tillering capacity, tolerance to deep sowing, increased photosynthetic and nitrogen use efficiency, and resistance to various stresses, which could be utilized in rice improvement. A study was conducted to find the early vigour of 82 red rice accessions. The quality characters like hull and pericarp showed differences in colour. Out of these, 67 accessions were awned and 15 were awnless. Among the 67 awned accessions, the awn length ranged from 0.1 cm to 2.15 cm with an average awn length of 0.74 cm. The hull colour varied from black (57 accessions) to brown (24 accessions), grey (3 accession) and straw (4 accessions). The pericarp colour varied from light green (1 accession), red (77 accessions) and white (3 accessions). The shoot length or plant height as a measure of early vigour ranged from 10.00 cm to 24.38 cm at 30 DAS with an average plant height of 16.45 cm. The genetic and morphological diversity will provide further insight to bring out an accession with high seedling vigour as an important trait for rice improvement.

Keywords: *seedling vigour, weedy rice, plant height*

RAFVAL:ES-2025/118

Study On Feed Management And Growth Performance Of *Clarias Batrachus.*

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Clarias batrachus, widely known as the Asian walking catfish, is a commercially valuable freshwater species in Asia. In Purba Medinipur district of West Bengal, the market value of its seed is approximately ₹5 per piece. With appropriate breeding and rearing techniques, this species offers considerable profitability to small-scale farmers. However, the success of such ventures depends largely on the application of proper culture and management practices. The present study aimed to evaluate the effects of different protein levels in feed on the growth performance of *C. batrachus* seed over a 21-day experimental period. Locally available ingredients—including fish meal, yeast, egg yolk, wheat bran, along with added vitamins and minerals—were used to formulate three experimental diets. The Pearson Square method was applied to ensure balanced feed compositions, resulting in Diet A (30% crude protein), Diet B (35% crude protein), and Diet C (40% crude protein). Growth results demonstrated a clear trend: higher dietary protein levels contributed to increased growth. Seeds fed with Diet A exhibited an average growth of 25.4 mm in length and 125.6 mg in weight. Those fed with Diet B reached 27.21 mm in length and 137.7 mg in weight, while Diet C showed the most significant growth at 34.66 mm and 174.1 mg. Statistical analysis using ANOVA revealed that the calculated F-values exceeded the critical values, indicating a significant difference in growth performance among the three diets. These results suggest that Diet C, with 40% crude protein, had the most pronounced positive effect on seed growth and can be recommended for improved production outcomes.

Keywords: *Feed ingredients, Pearson Square method, Growth performance, Length-Weight, ANOVA*

RAFVAL:ES-2025/119

Carbon Farming towards Sustainable Agroecosystem

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The mounting climate change and environmental degradation emerged as serious concerns and pressing issues in front of human civilization. This alteration in the ecosystem and environment has caused negative consequences on food production, its quality, and soil-water-plant health. This scenario has led to finding and integrating the mechanisms of climate-smart, climate resilient environmentally friendly having the ecological orientation. In this context, carbon farming appears to be a tool or component within agroecosystems across the globe. This approach enhances the carbon sink both in soil and plant systems through the carbon sequestration process and leads to sustainable agriculture. This strategic approach would facilitate a climate action plan and transform the agroecosystems towards a more resilient, efficient, and ecology-based productive ecosystem. Thus, carbon farming is explicitly recognized as a step towards climate change mitigation, management of soil health and biodiversity, and economic opportunities. As per a report, in India, carbon farming has the economic potential of 63 billion dollars from the cultivated lands of 170 million hectares. Techniques involved in carbon farming are conservation agriculture, forest management, agroforestry, regenerative agriculture, grassland conservation, grazing management, utilization of renewable energy, etc. Implementing carbon farming involves vigilant planning, adaptation to site conditions, monitoring, and evaluation to enhance effectiveness under changing climate. Further strategic approaches such as supportive policy formulation, legal context, direct and indirect incentives to the farming community, empowering farmers, carbon credits, etc. need to be promoted and strengthened to encourage carbon farming. This will lead to food security with eco-environmental consciousness to move forward to sustainable development goals.

Keywords: *Agroforestry, Carbon farming, climate change, carbon sequestration, sustainability.*

RAFVAL:ES-2025/120

Rural Goldmine: Unlocking the Hidden Value in Cow and Goat Dung

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Livestock farming generates significant quantities of organic waste, often considered a disposal challenge. A transformative approach has been adopted to convert cow and goat dung into valuable eco-products at Institutional Livestock Farm Complex, Madhavaram – TANUVAS. This study demonstrates a model of waste-to-wealth innovation, where dried dung powder is skillfully repurposed into high-demand items such as eco-friendly statues, lamps, sambrani (natural incense) and flower pots. From just 1 kg of dung powder, sambrani yields a profit of ₹664, followed by statues (₹509.85), flower pots (₹90.75), and lamps (₹87). On a larger scale, converting 10,256.5 kg of dung could generate over ₹68 lakhs through sambrani alone. Similarly, goat farming waste (4.1 tonnes/year from 60 goats) can be processed into 1.2 tonnes of dung powder, offering annual profits exceeding ₹5 lakhs when diversified across products.This model not only adds a new revenue stream to livestock farming but also promotes environmental sustainability, women empowerment and rural entrepreneurship. The successful implementation at TANUVAS highlights the replicable potential of this zero-waste model across similar livestock institutions and farming communities. By reimagining waste as a resource, this work redefines the role of livestock in economic and environmental resilience—proving that the future of farming lies not just in production, but in transformation.

***Keywords** : Livestock farming, Organic waste, Eco-products, Rural entrepreneurship, Environmental sustainability.*

RAFVAL:ES-2025/121

A case of chronic nephropathy in Asiatic elephant – Postmortem and histopathology findings

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A post-mortem examination was conducted at Polyclinic, AHD, Dungarpur on a female Asian elephant (*Elephas maximus*, breed *indicus*) Apprx 50 yrs age to investigate the cause of death. The carcass was in good condition, although the hair coat appeared rough, and the tongue was protruded. The primary incision revealed unclotted blood in the subcutaneous vessels, and no abnormalities were noted in the peritoneum or lymphatic system. Notably, the lungs exhibited hypostatic congestion, emphysema, and frothy exudate, with clotted blood in the pulmonary veins. The trachea was congested, while other respiratory structures appeared normal. Cardiovascular examination revealed dark red blood, and pinpoint to ecchymotic epicardial hemorrhages. The spleen and mesentery displayed similar hemorrhagic lesions. The kidneys showed petechial hemorrhages, while the liver and gastrointestinal tract were markedly hemorrhagic. Other organs, including the genital system, brain, and musculoskeletal system, showed no gross abnormalities. The samples were received at Department of veterinary Pathology for histopathological confirmation. On histopathological examination showed severe renal tubular degeneration, necrosis of proximal convoluted tubules and glomerular congestion, with interstitial fibrosis and Bowman's space expansion. Liver sections revealed engorged sinusoids and central veins, swollen hepatocytes, hemosiderin-laden Kupffer cells and periportal fibrosis. The lungs had emphysematous changes and the spleen showed hemosiderin deposition with increased trabeculae. The heart displayed degeneration of cardiomyocytes and increased connective tissue. These findings collectively indicate chronic nephropathy, suggestive of age- related renal failure as the underlying cause of death.

RAFVAL:ES-2025/122

Survey of Seed-Borne Mycoflora of Pisum sativum Seeds

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Seed-borne fungal pathogens represent a significant constraint to the successful cultivation of Pisum sativum (pea), affecting seed quality, germination potential, and overall crop productivity. This study aimed to investigate the diversity, prevalence, and impact of fungal contaminants associated with pea seeds sourced from various agro- climatic regions. Seed samples were collected from agricultural markets and farmers' fields and analyzed using three standard seed health testing techniques: the blotter method, agar plate method, and deep-freezing method. These methods facilitated the isolation and identification of fungal species based on their morphological and microscopic characteristics. The analysis revealed a wide range of seed-borne mycoflora, with dominant genera including Aspergillus (particularly A. flavus and A. niger), Fusarium (F. oxysporum and F. solani), Penicillium, Alternaria, and Rhizopus. The frequency and intensity of fungal infestation varied depending on the geographic source of the seeds and the storage conditions. Among the identified fungi, Fusarium and Aspergillus species were the most prevalent and pathogenic, leading to significant reductions in germination rates and seedling vigor. Fusarium species caused pre- and post-emergence damping-off, while Aspergillus species posed additional risks through the potential production of harmful mycotoxins. Management strategies evaluated in this study included chemical seed treatments using fungicides such as carbendazim and thiram, as well as biological control methods involving antagonistic fungi like Trichoderma spp. Proper seed storage practices, especially those maintaining low moisture and optimal temperature, were also found to be effective in minimizing fungal contamination. Overall, the study underscores the critical importance of detecting and managing seed- borne fungi in Pisum sativum for sustainable agriculture. The findings advocate for integrated seed health management practices that combine chemical, biological, and cultural methods. Furthermore, continued research into biocontrol agents and the development of resistant seed varieties is essential for ensuring healthy seed stocks and stable pea production in the long term.

RAFVAL:ES-2025/123

Proteomic analysis of sperm reveals changes in fertility-related protein levels after FMD vaccination in Sahiwal bulls

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Backround: Breeding bulls used for artificial insemination require immunoprotection against bacterial and viral diseases. However, mandatory vaccinations can temporarily reduce semen quality for one to two months, significant stressor affecting production at semen stations. The etiology of this decline remains unclear, despite documented post-vaccination phenotypic alterations in spermatozoa. The molecular alterations induced by vaccination are insufficiently characterized. Therefore, the study was designed with the objective of elucidating the sperm protein alterations to clarify the mechanisms behind the temporary reduction in semen quality post-immunization. **Methods:** This study, conducted at the Artificial Breeding Research Centre, ICAR-NDRI, Karnal, Haryana. Five Sahiwal bulls were received single dose of Raksha OVAC trivalent FMD vaccine @ 2 ml via deep I/m. Sperm samples were collected in two phases: before vaccination (14 days prior) and after vaccination (on the 5th, 12th, 21st, 35th, 50th, and 62nd days post-vaccination), with two ejaculates taken from each bull on each sampling day. LC-MS/MS technique was used to study the protein profile of spermatozoa to determine their differential abundance before and after FMD vaccination. **Results:** Following vaccination, alterations in fertility-related proteins were observed: energy metabolism-related proteins (PGPM, BPGM, MRI), motility-related proteins (SLC25A41), and sperm membrane integrity-related proteins (AGPAT3, CHDH, GBA2) showed significant downregulation up to 35 days post-

vaccination. Conversely, proteins involved in acrosome reaction and sperm-egg fusion (NT5E, P4H8, EZR, CLIC1, CFL1) were notably upregulated during this period. Functional annotation revealed that oxidative phosphorylation and mitochondrial electron transport, crucial processes involving mitochondrial proteins, were downregulated, while glycolytic and pyruvate metabolic processes, key pathways involving cytoplasmic proteins, were upregulated. **Conclusion:** These changes suggest that vaccination induces stress responses in spermatozoa, prompting significant adaptations in metabolic pathways. Such alterations may adversely affect sperm function, motility, and overall fertility by altering ATP production pathways and compromising mitochondrial function under vaccination stress conditions.

Keywords: *Breeding bulls, Sperm proteins, Semen quality, Vaccination*

Recent Advances In Agriculture, Food Security, Veterinary & Allied Sciences For Livelihood And Environmental Sustainability

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Theme2: Livestock Production and Health Management

Sub -theme: Sustainable livestock feed and nutrition

"Strengthening Rural Livelihoods through Efficient Milk Marketing: A Channel-wise Economic Assessment"

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Dairy farming holds a pivotal place in the agricultural sector, significantly contributing to food security and supporting rural livelihoods. However, the economic viability of this sector largely depends on the efficiency of its marketing systems. This study explores the financial dynamics of milk production by assessing various marketing channels. Key parameters including production costs, revenue streams, and pricing margins were evaluated to determine the most advantageous and sustainable distribution approaches. The marketing analysis in the study area indicated that producers received the highest share of the consumer's payment through Channel-I (Milk producer→consumers), followed sequentially by Channel II (Milk producers→milkvendor→consumer),III(Milkproducers→milkvendor→retailers→consumer) and IV (Milk producers → COMFED → retailers → consumers).Therefore, Channel-I characterized by direct interaction between producers and consumers emerged as the most beneficial from the producers' perspective. Despite its advantages in ensuring higher returns, this model demands enhanced infrastructure and improved market access. The study recommends focusing policy efforts on strengthening cooperative frameworks, enhancing cold chain infrastructure, and establishing transparent and fair pricing systems. Higher fodder cost was one of the major issues faced by dairy farmers in the study area. Total feed cost per day was computed maximum (Rs.154.38) in small farmers, followed by medium farmers (Rs.151.93) and (Rs. 149.00) for large farmers. The notable point in this study was that the "Concentrate" followed by "Dry Fodder" and then "Green fodder" played a major role in increasing the total feed cost in all the cases. Apart from this, low procurement price, lack of sufficient veterinary facilities and non-availability of loan facilities in time were also identified as the major problems related to milk production in the study area.

Keywords: *Animal feed and fodder, Consumers, Dairy farmers, Milk producer, Milk production, Marketing channels, Producer's share, Sustainability, Vendors*

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Management of powdery mildew of mango with bio-control agents under konkan condition.

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The field experiment has been conducted in 2020-21 to 2022-23 for three consecutive years to study the effects of biocontrol agents under konkan condition. In the present study, six biocontrol agents (BCAs*) viz., Bacillus subtilis*, *Pseudomonas fluorescens*, *Lecanicillum lecanii*, *Ampelomyces quisqualis*, *Trichoderma viride* and *Trichoderma harzianum* were evaluated for their bio-efficacy against powdery mildew of mango each at 0.5% concentration levels under field conditions at Regional Fruit Research Station,Vengurla.All the biocontrol agents tested were non-significantly effective against powdery mildew of mango under field in konkan condition at 0.5% concentration.

Keywords:-*Bioefficacy , Biocontrol Agents, Powdery Mildew, Konkan Condition.*

RAFVAL:ES-2025/126

A study on the Socio-Economic Conditions and Livelihood Status of Junput Mangrove, East Midnapore, West Bengal

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This abstract summarizes the livelihood status and socio-economic baseline study undertaken in the Junput mangrove coastal area under East Midnapore District. The primary emphasis of the study was the cause of their substandard living conditions and destitution. Data gathered through a physical survey in the planted mangrove area is one of the key sources. In order to assess the socio-economic standing of the fishermen in the Junput mangrove area of four villages in the East Midnapore-Biramput, Haripur, Kamarput and Shyam Rai Bar Jalpai-a recent study was conducted from Jan, 2024 to Dec, 2024. Using a well-structured questionnaire total 350 household was surveyed in four villages to access the primary data. The percentage ratio was used to analyze the collected data. Average data of four villages shows that the majority of the residents belong to that area were Hindu 79.07 % and Muslim 20.92 %. Family size reveals that about 78.68 % people lived in nuclear family. Their educational status represents -6 % were college passed, 15.6 % were higher secondary level, 20.16 % had passed secondary level, 20.78 % were primary level and 39.28 % were illiterate. Their occupational data suggests about 39.63 % involved in fulltime fishing, 15.80 % were parttime fishermen, 10.33 % were agriculture farmer, 6.19 % were private tutor and 28 % were other occupation. Housing condition of fishermen was katcha 29.26 %, semi-pucca 53.73 %, pucca 14.57 %, tiled 0.44 % and free house 1.53 %. The number of people belonging to back ward class were 24.86 %, most backward community were 56.12 % and sc/st community were 19 %. In order to support their families, the women were compelled to work in dry fish khuties and earn a daily pay due to the depletion of marine resources.

Keywords: *Livelihood status, socio-economic condition, junput mangrove and fishing activities*

RAFVAL:ES-2025/127

Dietary Pattern Transformation and Agro-Nutritional Transition in Uttarakhand

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The resurgence of millet cultivation under the Shri Anna Programme highlights its relevance in promoting sustainable agriculture and ensuring nutritional security. This study examines the trends in millet consumption patterns in Uttarakhand, focusing on cultural preferences, dietary shifts, and production challenges within the Agro-Ecological Region (AER) 14. The study analyzes consumption trends, assesses factors influencing millet preferences, and identifies strategies to strengthen millet integration into regional food systems. Using a Knowledge, Attitude, and Practice (KAP) framework, the popularity of barnyard millet *(Echinochloa frumentacea)* and finger millet *(Eleusine coracana)* among local communities, shaped by cultural traditions, agro-climatic adaptability, and nutritional value, has been observed.

Preliminary findings reveal a gradual decline in millet consumption due to modernization, lack of processing infrastructure, limited market linkages, low economic incentives, and gaps in post-harvest technologies. To reverse this trend, the research provides interventions for decentralized processing units, millet-based product development, and targeted awareness campaigns to revive millet’s role in diets. Nutritional assessment details from NFHS-5 data also emphasize millet's potential in combating malnutrition and anemia, especially among women and children.

The study highlights the role of government programs, Self-Help Groups (SHGs), and capacity-building initiatives in enhancing millet production and consumption. Policy suggestions include promoting millet recipes, strengthening supply chains, and creating localized marketing strategies. Overall, this research shows the importance of revitalizing millet consumption trends to improve dietary diversity, promote sustainable agriculture, and empower rural women while addressing regional nutritional challenges.

Keywords: *KAP, NFHS-5, Dietary Diversity, Millet Consumption, Nutritional Security*

RAFVAL:ES-2025/128

Cultivating Change: Empowering Women and Engaging Youth in Agricultural Development

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Agriculture remains a vital sector for economic development and food security, particularly in developing regions. However, its potential is constrained by the underrepresentation of women and youth, who face systemic barriers to participation. The convergence of gender empowerment and youth involvement plays a pivotal role in advancing sustainable agricultural systems. Despite women contributing significantly to agricultural labor, they often lack access to essential resources such as land, credit, training, and leadership opportunities. Addressing these gender disparities can lead to increased productivity, improved household welfare, and enhanced community resilience. Similarly, youth represent a growing demographic with immense potential to transform agriculture through innovation, technology adoption, and entrepreneurship. Yet, young people frequently perceive agriculture as unappealing due to limited access to land, finance, and markets, coupled with traditional, labor-intensive practices. By implementing inclusive policies, providing targeted training, leveraging digital tools, and promoting agribusiness opportunities, agriculture can be repositioned as a viable and attractive career path for young people. Strategies to promote gender equity and youth participation include legal reforms, support for cooperatives, investment in education and agri-tech, and the development of climate-smart agricultural practices. Empowering women and engaging youth in agriculture is not only a matter of social justice but also a strategic move toward resilient, productive, and future-ready food systems. By unlocking the potential of these marginalized groups, the agricultural sector can become a dynamic force for inclusive economic growth and sustainable development.

Keywords: *Gender Empowerment, Youth involvement, Sustainable Agriculture, Inclusive development*

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Oceanlux: *Sargassum Wightii* for Sustainable Fashion

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As the global demand for sustainable materials continues to rise, the fashion industry is seeking eco-friendly alternatives to traditional raw materials. With concerns over resource scarcity, environmental impact, and the growing population, renewable materials are becoming a necessity rather than an option. Among these, marine algae stand out as a promising, climate-resilient resource. One such marine algae, *Sargassum wightii*, a brown seaweed abundant in the Gulf of Mannar, is rich in alginate, cellulose, fibers, and polyphenols. Notably, it has excellent film-forming properties, making it a strong candidate for bio-based fashion accessory sheets. This study explores the integration of Sargassum wightii (at concentrations of 10–50%) into sheet production and evaluates its mechanical and physical performance against conventional PVA-based sheets. The biochemical analysis of Sargassum wightii revealed a high fiber content (33.11%) and significant alginate levels (38.53%), both of which contribute to its durability and flexibility. The sheets developed from this seaweed had thicknesses ranging from 0.67 mm to 2.16 mm. Testing results indicated that sheets with 20–30% *Sargassum wightii* content exhibited tensile strengths between 15.13 MPa and 26.69 MPa, making them suitable for applications in footwear, leather goods, and saddlery. Additionally, these bio-based sheets demonstrated improved fire resistance and reduced water absorption compared to conventional materials. Notably, a *Sargassum wightii* sheet with 30% incorporation achieved 55.07% of the tensile strength and 100% of the maximum load-bearing capacity of the control PVA sheet, highlighting its potential as a viable sustainable alternative. This research underscores the immense possibilities of marine algae in industrial applications, paving the way for the integration of *Sargassum wightii* into the fashion sector. By leveraging nature’s resources, the industry can move towards a more sustainable and environmentally conscious future.

Keywords: *Sargassum wightii, PVA, Fashion sheets, bio-based*

RAFVAL:ES-2025/130

Extraction and Encapsulation of Black Cardamom (*Amomum subulatum*) Oleoresin: A comprehensive study on stability, thermal and morphological properties

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The study encompasses various microencapsulation methods of spray drying to encapsulate black cardamom oleoresin. Optimization of process parameters such as encapsulation material, core-to-wall ratio, and processing conditions is carried out to achieve high encapsulation efficiency and desirable product characteristics. The encapsulated black cardamom oleoresin is characterized through analytical techniques such as scanning electron microscopy (SEM), Fourier-transform infrared spectroscopy (FTIR), and X-ray diffraction (XRD) to evaluate the morphology, structure, and crystalline properties of the microcapsules. These findings provide critical insights into the physical and chemical properties of the encapsulated oleoresin. Furthermore, the applications of microencapsulated black cardamom oleoresin are explored, including its incorporation in food products for flavor enhancement, pharmaceutical formulations for controlled drug delivery, and cosmetic products for fragrance and therapeutic purposes. The enhanced stability and controlled release properties of the microcapsules make them suitable for a wide range of applications. The research findings highlight the potential of microencapsulated black cardamom oleoresin in various industries, offering a versatile and innovative approach to harness the benefits of this natural product. Additionally, the optimized process parameters contribute to the scalability and commercial viability of microencapsulation technology, making it a valuable asset for developing new products in the market.

Keywords: *Microencapsulation, Oleoresin, Spray Drying, Encapsulation Efficiency, Stability*

RAFVAL:ES-2025/131

Bastar Tribal Women Empowerment and Sustainable Livelihood through Secondary Horticulture

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This study explores the empowerment of tribal women in the Bastar region through sustainable livelihood initiatives centred on secondary horticulture. Bastar, a predominantly tribal district in Chhattisgarh, India, is rich in biodiversity and traditional knowledge but faces socio-economic challenges, especially among women. This study focused on secondary horticulture—the processing and value addition of horticultural and forest produce as a sustainable livelihood. Mahatma Gandhi had the vision to develop rural India and emphasized village-based agro-industries during India's independence movement; he started the All India Village Industries Association and experimented to reconstruct the rural economy by trained to groups for making Jaggery and Neera from palm trees. To follow the Vision of Mahatma Gandhi the KDCHRS has taken the initiative to establish a spices and pickles and tamarind Sauces processing unit under RIPA with the financial support of district administration where ten members of the tribal women's self-help group trained in the processing and marketing of Turmeric, Chili, Coriander of ground powder, Jackfruits pickles, Jimikand pickles, Kewkand pickles, Mango pickles, mix vegetables picklesand Tamarind sauces etc. Hence procuring and marketing backward linkages and forward linkage was established. Raw products received from local FPO, value-added processed products are sold out and supplied at C-Mart, Bastar Harihar Bajar, school Mid-day meals, Anganbadi, Hostels, Ashrams and Different Camps. The initiation plays a significant role in developing rural livelihood opportunities for tribal women SHG.

Keywords: *Secondary Horticulture, Livelihood, Women empowerment and Kewkand*

RAFVAL:ES-2025/132

India's Seaweed Sector Spatial Trends and Prospects

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Seaweed cultivation has emerged as a promising component of India's blue economy. The spatial distribution and trade dynamics of seaweed cultivation across India's coastal belt, with a focus on identifying regional production hubs, trade flows and sectoral bottlenecks. Using a mixed-methods approach, both primary and secondary data were collected from key seaweed-growing states including Tamil Nadu, Gujarat, Kerala, and Andhra Pradesh. Primary data were obtained through structured surveys and stakeholder interviews with seaweed farmers, traders and processors, while secondary data were sourced from government reports, MPEDA, NFDB and FAO databases. Geospatial mapping tools (QGIS) were used to visualize cultivation zones, and trade data were analysed to assess domestic market integration and export potential. The findings reveal that seaweed cultivation in India is largely concentrated in Tamil Nadu and Gujarat, dominated by species such as *Kappaphycus alvarezii* and *Gracilaria edulis*. While the production potential is high, the sector faces challenges including seasonal fluctuations, lack of organized market channels, poor post-harvest infrastructure and limited access to export markets. Trade analysis indicates a significant gap between production capacity and market realization, with most of the seaweed being sold in raw form with minimal value addition. The study concludes that strategic interventions, such as localized seed banks, processing hubs, improved logistics and market linkages are essential to strengthen India's seaweed value chain, enhance farmer income and promote sustainable use of marine resources in alignment with the goals of the Blue Economy.

Keywords: *Seaweed Cultivation, Blue Economy, Spatial Distribution, Trade Dynamics, Value Chain*

RAFVAL:ES-2025/133

Exploring phytochemical, antioxidant properties and neuroprotective potential of *Saraca asoca* leaf and bark

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Saraca asoca is a medicinal plant whose all plant parts has been preferred as a tonic and medicinal supplement for the women health, but because of the huge variety of bioactive compounds, *Saraca asoca* need to be explored for its neuroprotective properties. *The present study focuses on exploring the role of Saraca asoca* as an Angiotensin Converting Enzyme inhibitor using an *in vitro* assay which can act as a neuroprotective agent. The methanolic extracts of *both saraca asoca* bark and leaves extract were investigated for their neuroprotective properties, utilizing the angiotensin converting enzyme assay. ACE inhibitory activity was determined by spectrophotometer and absorbance was read at 410 nm. The extract of *Saraca asoca* leaf inhibited Angiotensin Converting Enzyme activity in-vitro with IC_{50} value of 146.2 µg/ml and bark extract has IC_{50} value of 155.9 µg/ml. The phytochemical analysis were also assessed by spectrophotometric method. The characterizations of the bioactive compounds were analyzed by LC-MS technique. The flavonoid and phenolic content of *saraca asoca* bark extract was found to be 11.1mg/ml and 104.0mg/ml respectively while the flavonoid and phenolic content of *saraca asoca* leaf extract was12.6mg/mland112.3mg/ml respectively. The activities of bark extract against DPPH, Superoxide, Nitric Oxide was concentration dependent with IC_{50} value of 126.32, 165.63, 134.76 µg/ml respectively while the activities of leaf extract against DPPH, Superoxide, Nitric Oxide was concentration dependent with IC_{50} value of 121.32, 163.74, 130.41 µg/ml respectively. The LC-MS analysis of leaf extract exhibited cardio protective compounds such as Dihydroquercetin, Quercetin, and austricine while bark extract exhibited Xanthohumol, Ursolic acid, Puerarin and Daidzein. The findings of the study suggest that both *Saraca asoca* leaf and bark extract prevents the conversion of ACE-I to ACE-II. The phytochemical analysis and the presence of several bioactive compounds found in it supports the findings of the study. Thus, it indicates excellent ACE inhibition properties thus playing as an effective neuroprotective agent.

Keywords: *Saraca asoca*, *Angiotensin Converting Enzyme*, LC-MS, *cardioprotective, bioactive compounds.*

RAFVAL:ES-2025/134

Engineering Plant Microbiomes Using Synthetic Communities (SynComs) for Sustainable Disease Suppression

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Synthetic microbial communities (SynComs) are a new technique to designing inoculants that combine microbial ecology and genetics concepts. The plant microbiome, once considered a passive companion, is now recognized as a dynamic, co-evolving system critical to plant health and resilience. Recent progress in microbial ecology, synthetic biology, and systems biology has made it possible to engineer plant microbiomes to dampen disease on an unprecedented scale. Amongst these, strategic design and implementation of Synthetic Microbial Communities (SynComs) presents a revolutionary, green alternative to tackle plant pathogens and reduce chemical pesticides. SynComs are specially designed consortia of beneficial microorganisms, screened for complementarity in antagonism against pathogens, competitive exclusion, modulation of host immunity, and environmental plasticity. In contrast to natural microbiomes, SynComs can be rationally constructed using high-throughput genomic, transcriptomic, metabolomic, and culturomic data, enabling construction of functionally optimized and host-adapted microbial communities. Combination of AI-assisted modeling and microfluidic screening platforms has enhanced SynCom predictability and stability in response to fluctuating environments. This presentation explains the mechanistic foundations and engineering principles of SynComs in plant pathology. Areas of interest include microbial interactions (synergistic, antagonistic, and signaling-mediated), host immune response regulation, disruption of quorum sensing, and colonization dynamics. As agriculture transitions toward ecological intensification, SynCom-based microbiome engineering emerges as a frontier paradigm for next-generation plant disease management.

Keywords: *Synthetic microbial community (SynCom), Plant-microbiomes, Plant-microbe interactions, Sustainable Disease Suppression, Omics*

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Agricultural Mechanization and Smart Farming

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Drone technology is rapidly transforming modern agriculture by offering precise, efficient, and cost-effective solutions for crop monitoring and spraying. Unmanned Aerial Vehicles (UAVs), commonly known as drones, are equipped with high-resolution cameras, multispectral sensors, and GPS-based navigation systems to capture real-time data on crop health, soil variability, and pest infestations. This data facilitates early detection of issues, enabling timely interventions that improve crop yield and reduce input costs. In spraying applications, drones ensure uniform distribution of fertilizers and pesticides with minimal human exposure and environmental impact. Their ability to access hard-to-reach areas and cover large fields quickly enhances operational efficiency, especially in fragmented or hilly terrains. The integration of Internet of Things (IoT) technology and machine learning algorithms further refines decision-making by providing actionable insights and enabling automated responses. Despite the promising potential, challenges such as regulatory compliance, limited payload capacity, and initial investment costs must be addressed. Future research should focus on enhancing drone endurance, payload efficiency, and AI-driven analytics to support widespread adoption in precision agriculture.

Keywords: *Drone Technology; Crop Monitoring; UAV Spraying; Precision Agriculture; Internet of Things*

RAFVAL:ES-2025/136

Mortality of *Eisenia fetida* earthworms in response to a broad-spectrum herbicide 2,4-D

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Sub-lethal toxicity of 2,4-D (2,4-dichlorophenoxy acetic acid), a broad spectrum herbicide was investigated to unravel the detrimental effects on body weight and survival of *Eisenia fetida* (Savigny) earthworms. Two sets of six mature adults replicated thrice were kept in vermibeds. The untreated set served as control. Another set of *E. fetida* adults exposed to 2,4-D @ 350 mg/kg for 24, 48, 72 and 96 hrs. served as treatment. Observations recorded on body weight changes and mortality revealed significant negative impact of 2,4-D on earthworms. The mean body weight of earthworms in the untreated control increased by 4.08, 8.16, 10.20 and 12.24 % over initial mean body weight (0.49 g) after 24, 48, 72 and 96 hrs. However, when exposed to 2,4-D @ 350 mg/kg, the mean body weight declined by 9.09, 10.61, 12.12 and 15.15 % after 24, 48, 72 and 96 hrs., respectively. All the adults survived in the control group whereas a mortality of 16.67, 33.33 and 50.00%, respectively was recorded after 48, 72 and 96 hrs. of exposure to 2,4-D.

Keywords: *Eisenia fetida, 2,4-D, concentration, body weight, mortality*

RAFVAL:ES-2025/137

Eco-Friendly Pest Management in Vegetable Farming: IPDM Practices and Adoption Constraints

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Integrated Pest and Disease Management (IPDM) is a sustainable and ecologically sound approach that combines multiple control strategies to manage pests and diseases below economic threshold levels. In vegetable crops, which are highly susceptible to a range of pests and pathogens due to their tender foliage, short lifecycle, and intensive cultivation, IPDM plays a crucial role in ensuring yield stability and food safety. Traditional reliance on chemical pesticides has led to problems such as pest resistance, environmental pollution, and residues in produce. IPDM addresses these challenges by integrating biological control agents, cultural practices, resistant varieties, mechanical tools, and need-based chemical applications.

Implementation of IPDM in vegetable farming has shown promising results in managing pests like fruit borers, aphids, whiteflies, and diseases such as blights, wilts, and mildews. However, adoption remains limited due to inadequate farmer training, lack of awareness, and insufficient availability of eco-friendly inputs. The situation is further complicated by climate change, which alters pest dynamics and disease epidemiology, requiring adaptive and location-specific IPDM strategies. Recent innovations, including pheromone traps, neem-based biopesticides, and mobile-based advisory systems, have improved accessibility and effectiveness of IPDM in vegetable crops. To maximize impact, capacity-building programs, policy incentives, and farmer-friendly technologies must be promoted. With proper implementation, IPDM offers a pathway to sustainable vegetable production, minimizing environmental impact while safeguarding human health.

Keywords: *Vegetable Crops, Integrated Pest and Disease Management (IPDM), Sustainable Agriculture, Climate-Smart Practices*

RAFVAL:ES-2025/138

Effect Of Amf On Growth Performance Of *Zea Mays* Plant

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Arbuscular mycorrhizal fungi (AMF) play a crucial role in enhancing plant growth and productivity through their symbiotic associations with plant roots, especially in nutrient- deficient and stress-prone conditions. This study investigates the effects of AMF on the growth, nutrient uptake, and overall physiological development of *Zea mays* (maize) plants. The present study evaluates the effect of Arbuscular Mycorrhizal Fungi (AMF) on the growth performance of *Zea mays* under nursery conditions .An experiment was conducted using nine seed pot trays, each tray containing 60 seeds. In total, 540 seeds were sown, with three trays serving as untreated controls and six trays inoculated with AMF. After 21 days, significant differences were observed between the control and treated groups. The control group, which did not receive any AMF treatment, exhibited a germination rate of 68%, an average plant height of 24.08 cm, a stem diameter of 2.89 cm, and three leaves per plant. In contrast, the AMF-treated plants showed improved performance. The first treatment (Glomus mosseae) recorded a 95% germination rate, an average height of 27.13 cm, a stem diameter of 2.92 cm, and three leaves per plant, along with 80% root colonization. The second treatment (Glomus etunicatum) resulted in an 82% germination rate, an average height of 25.16 cm, a stem diameter of 2.95 cm, and 70% root colonization. Additionally ,Chlorophyll concentrations were significantly higher in AMF-inoculated plants as compared to the control group, indicating an increase in photosynthetic efficiency. The results show that Glomus mosseae performed better than both Glomus etunicatum and the control group, promoting early seedling growth and enhancing physiological traits. These findings highlight the potential of arbuscular mycorrhizal fungi (AMF), particularly G. mosseae, as an effective biofertilizer for sustainable agriculture. It can improve plant growth and contribute to long-term food security and ecosystem resilience.

***Keywords**: AMF, Zea Mays, Ecosystem, Symbiotic Association, Sustainablity*

RAFVAL:ES-2025/139

Integrated Farming System for Enhanced Farm Productivity: A Case Study from South Goa, India

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Integrated Farming System (IFS) offer a holistic approach to improving farm productivity, resource-use efficiency and ecological sustainability. This study presents a comprehensive evaluation of a 1.5-hectare IFS model established in Nuvem town of South Goa district of Goa, integrating goatery, poultry, aquaculture, horticulture, spices, plantation crops and vermicomposting unit. Data were collected using a semi-structured personal interview schedule, supplemented with direct field observations. The system demonstrated strong economic performance, supported by effective integration of components. Synergistic practices such as recycling poultry droppings into aquaculture, utilizing nutrient-rich pond silt for horticultural crops and applying farm-derived organic manure reduced external input dependency and enhanced sustainability. Economic analysis revealed a total gross income of ₹14.4 lakhs and operational costs of ₹9.22 lakhs, resulting in a net income of ₹5.18 lakhs and a Benefit-Cost Ratio (BCR) of 1.56. The findings highlight integrated farming system significantly enhances the overall profitability of the farm, delivering positive outcomes in terms of income generation, efficient resource utilization and ecological viability, especially in coastal agroecological zones.

***Keywords**: Integra-ted Farming System, resource-use efficiency, ecological sustainability, Goa.*

RAFVAL:ES-2025/140

Integrated Nutrient Management in Fruit Crops

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Integrated Nutrient Management (INM) in fruit crops represents a holistic approach to optimizing nutrient availability, enhancing productivity, and minimizing environmental degradation. By synergistically combining organic, inorganic, and biological nutrient sources, INM ensures balanced fertilization tailored to the specific needs of fruit crops while preserving soil health and ecosystem sustainability . Fruit crops, such as mango, citrus, grapes, and berries, require precise nutrient management due to their perennial nature and sensitivity to micronutrient imbalances . Traditional reliance on chemical fertilizers has led to soil acidification, nutrient leaching, and greenhouse gas emissions, requiring sustainable alternatives . INM addresses these challenges by integrating organic amendments (e.g., farmyard manure, vermicompost, green manure), biofertilizers (e.g., Azotobacter,PSB), and judicious use of mineral fertilizers. For instance, legumes in intercropping systems fix atmospheric nitrogen, reducing dependency on synthetic N inputs. Integrated nutrient management, also known as INM, refers to the practice of applying all possible sources of nutrients, both organic and inorganic, to crop production at the same time. As a result, the INM assists the plants in satisfying their nutritional requirements while also restoring the fertility of the soil. Moreover, INM practices offer economic benefits by lowering the overall dependence on costly chemical inputs and reducing the risks associated with excessive fertilizer use, thereby increasing the profitability and sustainability of fruit production. The approach also supports environmental conservation by reducing nutrient runoff, curbing greenhouse gas emissions, and promoting the recycling of agricultural waste.

In summary, integrated nutrient management in fruit crops is a multifaceted strategy that balances the immediate nutrient requirements with the long-term preservation of soil fertility. Through the synergistic use of chemical and organic fertilizers along with bio-fertilizers, INM not only improves fruit yield and quality but also contributes to sustainable agricultural practices that are economically viable and environmentally responsible. This integrated approach is essential for overcoming the challenges posed by intensive fruit production systems and for ensuring the sustainability of fruit cultivation in changing climatic and socio-economic conditions.

Keywords: *INM, Organic Fertilizers, Sustainable, Environmental, Fruit crops.*

RAFVAL:ES-2025/141

The enzyme activity of endophytic bacteria isolated from *Lavandula*

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Since ancient times, natural biological products, especially medicinal plants, have been widely used in folk medicine and the pharmaceutical industry to protect humans from various diseases. One of the most valuable medicinal and aromatic plants is *Lavandula*, which has been used for treating various ailments, including wound infections, over generations. *Lavandula* is a green shrub and a prominent member of the *Lamiaceae* family. While numerous studies have examined endophytic bacteria and their properties from many medicinal plants, research on plants like *Lavandula* remains insufficient. *Lavandula* is known for its antioxidant, anti-inflammatory, and antimicrobial properties. In this study, we present a description of the endophytic bacteria of *Lavandula*, a plant that has been used for its therapeutic properties since ancient times, as bacterial endophytes can directly produce bioactive metabolites, induce plant growth-promoting rhizobacteria (PGPR) activity, and/or stimulate plant metabolism. This study aimed to explore the lipase and protease activities of endophytic bacteria to determine their effects on plants and their biological activity. Lipases break down fats, and proteases degrade proteins, playing a vital role in protecting plants from pathogenic damage. Studying these bacteria helps improve their antibacterial and antifungal properties, thus enhancing their potential as biological control agents. Moreover, their ability to produce lipases and proteases may contribute to the discovery of new biotechnological and pharmaceutical compounds. This research paves the way for the creation of ecologically safe and effective medicinal products.

In this study, a quantitative analysis of lipase and protease exoenzymes produced by bacterial isolates from *Lavandula* was performed. The highest lipase activity was observed in the GLP-5 isolate, producing 496 U/mL, followed by the GLB-27 isolate with 485 U/mL and the GLI-1 isolate with 498 U/mL. In protease activity testing, GLP-5 showed 2.643 U/mL, GLB-27 2.348 U/mL, GLI-1 2.136 U/mL, and GLB-13 1.861 U/mL.
The results of the study indicate that endophytic bacteria isolated from *Lavandula*, particularly GLP-5, GLB-27, and GLI-1 isolates, demonstrate significant lipase and protease activities. These bacteria exhibit strong antibacterial and antifungal properties, confirming their potential for use as biological control agents. These findings also suggest that they can be valuable resources for the development of new biotechnological and pharmaceutical compounds, contributing to the creation of environmentally safe and effective medicinal products.

Keywords: *Lavandula; endophyte bacteria; lipase; protease; pharmaceutical compounds*

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Antifungal Potential of Endophytic Bacteria Isolated from *Stevia rebaudiana*

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Stevia rebaudiana is a plant species belonging to the genus *Stevia* within the family Asteraceae. Among the species in this genus, *S. rebaudiana* is unique for containing sweetening compounds. *Stevia rebaudiana* Bertoni is known for producing sweet steviol glycosides in its leaves. Stevia extract is considered a promising natural alternative to synthetic sweeteners, with a sweetness intensity approximately 200–300 times greater than that of sucrose. Studies conducted by Carrera-Lanestosa et al. have demonstrated that stevia leaves, a natural, calorie-free sugar substitute, are not only safe for individuals with diabetes, hypertension, and obesity. Still, they may also aid in treating these conditions or preventing their complications. In addition to sweetening compounds, stevia leaves contain a wide range of biologically active substances beneficial to human health. In particular, this plant has been reported to possess antidiabetic, antihypertensive, anticancer, anti-cariogenic, anti-inflammatory, and bactericidal effects, which are discussed in more detail below. Furthermore, stevia has been found to exert beneficial effects on the digestive system and skin disorders, and may provide protective effects against general complications associated with metabolic syndrome. At present, *Stevia rebaudiana* is recognized as an important plant species widely studied by researchers across various scientific fields. Despite its extensive investigation, the microbiological aspects of this plant remain underexplored, and data are still limited. Therefore, our objective was to isolate and characterize the endophytic bacteria associated with this plant.

During the study, endophytic bacteria were isolated from *Stevia rebaudiana* and their antifungal activities were determined and analyzed. Plant samples were collected and transported to the laboratory for the isolation of endophytic bacteria. Initially, samples were cleaned of foreign particles and surface-sterilized using ethanol and sodium hypochlorite according to standard protocols. The plant organs (roots, stems, and leaves) were then dried, chopped into small pieces, and inoculated onto TSA and MPA media supplemented with 10 µg/ml nystatin to inhibit fungal growth. To assess the antifungal potential of pure bacterial isolates, dual culture assays were performed against several phytopathogenic and opportunistic human/animal fungal pathogens, including *Candida albicans*, *Aspergillus brasilensis*, *Aspergillus terreus*, and *Fusarium solani*. Active isolates were identified based on the formation of clear inhibition zones between the bacterial colony and the fungus. According to the results, isolates SR 7, SR 23, SR 24, and SR 31 exhibited antifungal activity against all tested fungi and generated the most pronounced inhibition zones. These findings indicate that the identified isolates may serve as potential candidates for future applications in medical biotechnology.

Keywords: *Stevia rebaudiana; endophytic bacteria; antifungal activity; Candida albicans; Aspergillius terreus; Aspergillus brasilensis, Fusarium solani*

RAFVAL:ES-2025/143

Antibacterial Potential of Endophytic Bacteria Isolated from *Stevia rebaudiana*

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The global population is steadily increasing, leading to various diseases and other factors contributing to the growing demand for natural food sources, medicinal agents, raw materials, and agricultural products. In recent years, significant attention has been focused on the study of endophytic microorganisms in medicinal plants, with numerous successful scientific investigations yielding promising results. Bacterial endophytes isolated from traditional medicinal plants have been found to possess several bioactive compounds with antibacterial and antifungal properties. Due to their ability to produce antibiotics, these endophytic bacteria are considered significant sources of antibiotic potential. Various bacterial species exhibit substantial potential as biological control agents (BCAs) against plant pathogens. Additionally, the vital role of fungi in preventing severe diseases in major crops has been well established. One of the plants that has attracted considerable interest among researchers is *Stevia rebaudiana*. Numerous sources are confirming its medicinal properties.

In this study, we evaluated and analyzed the antibacterial activity of endophytic bacteria isolated from *Stevia rebaudiana*. To determine the antibacterial properties of the isolates, we used the "agar well diffusion" method. For antibacterial activity assessment, two Gram-positive (*Listeria*

monocytogenes and *Staphylococcus aureus*) and two Gram-negative (*Escherichia coli* and *Salmonella enterica*) pathogenic bacteria were used.
The research results showed that the endophytic bacteria isolated from *Stevia rebaudiana*, particularly the SR 7, SR 14, SR 22, SR 23, SR 24, and SR 31 isolates, were active in inhibiting pathogenic bacteria, confirming that their antibacterial properties are significantly strong. Due to their antibacterial activity, these isolates may be used as biological control agents in the fields of medicine and agriculture in the future. The ability of endophytic bacteria to produce antibiotics and biologically active compounds highlights their potential as a vital resource for the development of new pharmaceutical agents and natural protection systems in the future.

Keywords: *Stevia rebaudiana; endophyte bacteria; antibacterial activity; antibiotics; Listeria monocytogenes; Staphylococcus; Escherichia coli; Salmonella enterica*

RAFVAL:ES-2025/144

The enzyme activity of endophytic bacteria isolated from *Lavandula*

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Since ancient times, natural biological products, especially medicinal plants, have been widely used in folk medicine and the pharmaceutical industry to protect humans from various diseases. One of the most valuable medicinal and aromatic plants is *Lavandula*, which has been used for treating various ailments, including wound infections, over generations. *Lavandula* is a green shrub and a prominent member of the *Lamiaceae* family. While numerous studies have examined endophytic bacteria and their properties from many medicinal plants, research on plants like *Lavandula* remains insufficient. *Lavandula* is known for its antioxidant, anti-inflammatory, and antimicrobial properties. In this study, we present a description of the endophytic bacteria of *Lavandula*, a plant that has been used for its therapeutic properties since ancient times, as bacterial endophytes can directly produce bioactive metabolites, induce plant growth-promoting rhizobacteria (PGPR) activity, and/or stimulate plant metabolism. This study aimed to explore the lipase and protease activities of endophytic bacteria to determine their effects on plants and their biological activity. Lipases break down fats, and proteases degrade proteins, playing a vital role in protecting plants from pathogenic damage. Studying these bacteria helps improve their antibacterial and antifungal properties, thus enhancing their potential as biological control agents. Moreover, their ability to produce lipases and proteases may contribute to the discovery of new biotechnological and pharmaceutical compounds. This research paves the way for the creation of ecologically safe and effective medicinal products.

In this study, a quantitative analysis of lipase and protease exoenzymes produced by bacterial isolates from *Lavandula* was performed. The highest lipase activity was observed in the GLP-5 isolate, producing 496 U/mL, followed by the GLB-27 isolate with 485 U/mL and the GLI-1 isolate with 498 U/mL. In protease activity testing, GLP-5 showed 2.643 U/mL, GLB-27 2.348 U/mL, GLI-1 2.136 U/mL, and GLB-13 1.861 U/mL. The results of the study indicate that endophytic bacteria isolated from *Lavandula*, particularly GLP-5, GLB-27, and GLI-1 isolates, demonstrate significant lipase and protease activities. These bacteria exhibit strong antibacterial and antifungal properties, confirming their potential for use as biological control agents. These findings also suggest that they can be valuable resources for the development of new biotechnological and pharmaceutical compounds, contributing to the creation of environmentally safe and effective medicinal products.

Keywords: *Lavandula; endophyte bacteria; lipase; protease; pharmaceutical compounds*

RAFVAL:ES-2025/145

Harnessing Organic Amendments to Restore Soil Fertility and Ensure Sustainable Crop Production in Contaminated Agroecosystems

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Soil contamination with heavy metals has posed a challenge ever since for sustainable agriculture, food security, and environmental health. In this regard, organic amendments such as biochar, compost, poultry manure, and farmyard manure have shown tremendous ability in ameliorating heavy metal toxicity, enhancing soil fertility, and boosting crop productivity in contaminated agroecosystems. This study investigates and compares these organic amendments regarding their ability to restore soil physicochemical properties, immobilize lead (Pb) bioavailability, and enhance maize (*Zea mays* L.) growth on polluted soils. The study results showed that simultaneous application of biochar and organic manures much improved the pH, organic matter, and cation exchange capacity (CEC) of the soil along with the reduction of metal mobility. The increase in plant physiological parameters like chlorophyll content and root-shoot biomass indicates better stress tolerance and nutrient uptake. These observations justify the use of organic amendments as eco-friendly and economically feasible options for soil reclaiming and sustainable crop production under contaminated conditions. The proposed method thus enhances food safety, environmental sustainability, and rural livelihood.

Keywords: *Organic amendments, heavy metals, soil fertility, biochar, maize, sustainability, food security, remediation.*

Integrated Use of Poultry Manure and Biochar for Enhancing Maize Yield in Heavy Metal Stressed Soils

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Heavy metal contamination in agricultural soils poses a serious threat to food security, soil health, and environmental sustainability. Among various metals, lead (Pb) is particularly toxic due to its non-degradable nature and potential to accumulate in the food chain. This study investigates the integrated application of poultry manure (PM) and biochar (BC) as a sustainable strategy to mitigate lead toxicity and enhance maize (Zea mays L.) yield in contaminated soils. A pot experiment was conducted to evaluate the effects of individual and combined applications of PM and BC on soil physicochemical properties, lead immobilization, and maize growth parameters. The results revealed that the combined use of poultry manure and biochar significantly improved soil pH, organic matter content, and cation exchange capacity (CEC), while reducing the bioavailable fraction of lead in the soil. This reduction in lead mobility decreased its uptake by maize plants, thus ensuring safer food production. Furthermore, notable improvements in maize growth traits including plant height, leaf area, chlorophyll content, root and shoot biomass were recorded under integrated treatments compared to control and sole applications. The synergistic effect of poultry manure and biochar not only enhanced nutrient availability but also played a vital role in buffering soil acidity and stabilizing toxic elements. This approach offers an eco-friendly, cost-effective, and sustainable remediation technique for the rehabilitation of polluted agricultural land. Adoption of such integrated organic amendment strategies can contribute significantly towards safe crop production, restoration of soil fertility, and protection of human health and the environment.

Keywords: *Poultry manure, Biochar, Lead (Pb), Soil remediation, Maize, Heavy metal stress, Sustainable agriculture, Soil fertility*

RAFVAL:ES-2025/147

Assess the Impact of Kisan Credit Card Scheme on Crop Productivity and Income of the Sample Farmers in Deoria District of Uttar Pradesh

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Kishan Credit Card (KCC) is one the many innovative products designed by NABARD with an objective to enable farmers to meet their credit requirements, preferably production credit ,from financial institutions in a timely an hassle - free manner. The KCC scheme which was introduced in14th August 1998. The present study deals with assess the impact of kisan credit card scheme on crop productivity and income of the sample farmers in Baitalpur block in Deoria district was selected purposively. 3 villages were selected on the basis of the important crops grown in the study area under Wheat and Rice cultivation. The present investigation is a comparative study between KCC holders and non-KCC holders. Therefore, two types of respondents were required.30 KCC and 30 non- KCC. In study area selection of respondents is done by random sampling method. The results show that the Overall Gross income of paddy per hectare was Rs.117784.16 in KCC beneficiaries and Rs. 104580.09 in non KCC beneficiaries per hectare. Net income was Rs.52028.23 in KCC beneficiaries and Rs.42741.66 in non KCC beneficiaries per hectare. Overall Gross income of wheat per hectare was Rs.82920.79 in KCC beneficiaries more compared to Rs.77409.10 in non KCC beneficiaries per hectare.Net income was Rs.29070.58 in KCC beneficiaries more compared to Rs. 25688.13 in non KCC beneficiaries per hectare. Impact of the KCC scheme on production, productivity and income increased under all the categories after availing credit under KCC scheme. It can also be seen that productivity of the paddy and wheat crop was found increased with increase in farm size. The overall, gross returns, net returns of paddy and wheat crops was higher in KCC beneficiary compared to non-KCC beneficiary farmers.

Keywords: *Wheat and Rice, Kisan Credit Card, Gross Income, Net Income and Productivity.*

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Integrated Nutrient Management in Fruit Crops

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Integrated Nutrient Management (INM) in fruit crops represents a holistic approach to optimizing nutrient availability, enhancing productivity, and minimizing environmental degradation. By synergistically combining organic, inorganic, and biological nutrient sources, INM ensures balanced fertilization tailored to the specific needs of fruit crops while preserving soil health and ecosystem sustainability . Fruit crops, such as mango, citrus, grapes, and berries, require precise nutrient management due to their perennial nature and sensitivity to micronutrient imbalances . Traditional reliance on chemical fertilizers has led to soil acidification, nutrient leaching, and greenhouse gas emissions, requiring sustainable alternatives . INM addresses these challenges by integrating organic amendments (e.g., farmyard manure, vermicompost, green manure), biofertilizers (e.g., Azotobacter,PSB), and judicious use of mineral fertilizers. For instance, legumes in intercropping systems fix atmospheric nitrogen, reducing dependency on synthetic N inputs. Integrated nutrient management, also known as INM, refers to the practice of applying all possible sources of nutrients, both organic and inorganic, to crop production at the same time. As a result, the INM assists the plants in satisfying their nutritional requirements while also restoring the fertility of the soil. Moreover, INM practices offer economic benefits by lowering the overall dependence on costly chemical inputs and reducing the risks associated with excessive fertilizer use, thereby increasing the profitability and sustainability of fruit production. The approach also supports environmental conservation by reducing nutrient

runoff, curbing greenhouse gas emissions, and promoting the recycling of agricultural waste. In summary, integrated nutrient management in fruit crops is a multifaceted strategy that balances the immediate nutrient requirements with the long-term preservation of soil fertility. Through the synergistic use of chemical and organic fertilizers along with bio-fertilizers, INM not only improves fruit yield and quality but also contributes to sustainable agricultural practices that are economically viable and environmentally responsible. This integrated approach is essential for overcoming the challenges posed by intensive fruit production systems and for ensuring the sustainability of fruit cultivation in changing climatic and socio-economic conditions.

Keywords: *INM, Organic Fertilizers, Sustainable, Environmental, Fruit crops.*

RAFVAL:ES-2025/149

Obtaining an Antimicrobial Biopreparation Based on Flavonoids from *Ammothamnus lehmannii*

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This study investigates the extraction, characterization, and evaluation of the antimicrobial activity of flavonoids isolated from Ammothamnus lehmannii in order to develop a plant-based biopreparation against pathogenic microorganisms. Ammothamnus lehmannii, a member of the Fabaceae family, is a promising source of bioactive flavonoids with potential applications in biotechnology. Plant flavonoids with significant antimicrobial activity are capable of disrupting the membranes of bacterial and fungal cells.

RAFVAL:ES-2025/150

Isolation of rhizosphere fungi from saline plants and evaluation of their halotolerance

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Soil salinity is currently one of the biggest global problems in agriculture worldwide, especially in the Central Asian steppes. High salt concentrations in saline soils cause osmotic stress and disrupt normal physiological processes in plants. This blocks the absorption of water by the roots, resulting in increased osmotic pressure, impaired photosynthesis, and the accumulation of excess Na^+ and Cl^- ions, which negatively affect mitochondria and chloroplasts. Soil salinity can be reduced by chemical and biological methods. Salt-tolerant plants, such as halophytes, grow in such conditions, helping to strengthen the soil and maintain ecological balance. Fungi and other microorganisms living in the rhizosphere of halophyte plants synthesize substances that stimulate plant growth, improve soil structure, and increase plant tolerance to salt. In addition, these microorganisms can improve soil quality and increase productivity. By studying the rhizosphere microflora of halophytes, new methods can be developed to protect the soil from degradation and solve bioecological problems. Soil samples were taken

from different regions of Uzbekistan and the Aral Sea coast to isolate rhizosphere fungi from halophyte plants. The study aimed to identify fungi adapted to high salinity conditions and assess their biotechnological potential. Soil solutions were prepared by the serial dilution method and inoculated onto PDA (Potato Dextrose Agar) medium containing 5% NaCl and incubated in a thermostat at 25 ℃ for 7 days. Morphologically different fungi were recultured, and 30 pure fungal isolates were obtained. To determine the salt tolerance of the isolated isolates, they were cultured on PDA medium containing 10 and 15% NaCl, and their growth was monitored for a week. As a result of the study, out of a total of 30 isolates obtained from the rhizosphere of halophytic plants, 18 (AN13, AB11-2, AO21-1, AO21-2, AB23, AN32, AB21-1, AB21-3, AT21-2, AT12) were able to grow in PDA medium with 10% NaCl, and 12 (AB31-1, AB31-2, AB31-3, AB32, AB33, AB34, AN3, AB35) were able to grow in PDA medium with 15% NaCl. These results confirm that they have halotolerant properties.

Keywords: *soil salinity; rhizosphere fungi; saline plants; halotolerance*

RAFVAL:ES-2025/151

Bioherbicidal Activity of Mycelial Fungi

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One of the primary objectives of modern science and agricultural practice is to increase productivity and ensure sustainability. Among the most pressing challenges in this field is weed control, particularly given the widespread use of chemical herbicides in global agriculture, which has raised serious environmental and human health concerns. Research conducted by the World Health Organization (WHO) and the International Agency for Research on Cancer (IARC) has shown that certain herbicides possess carcinogenic properties. Consequently, there is a growing need to develop effective and environmentally safe alternatives for weed management. Although conventional herbicides demonstrate high efficacy against unwanted vegetation, their prolonged use results in the contamination of soil and water bodies, a reduction in biodiversity within ecosystems, and, in some cases, the development of herbicide resistance in weeds. For this reason, bioherbicides—especially those derived from mycelial fungi—are emerging as promising alternatives to synthetic chemicals. Secondary metabolites produced by such fungi exhibit various phytotoxic effects, making them potential natural agents for weed control. In this study, the aim was to isolate fungi with potential bioherbicidal activity and to evaluate their herbicidal effects. Diseased plant samples were collected, and pathogenic fungi were isolated from their root, stem, and leaf tissues. A total of 16 fungal isolates were obtained from the endophytic, epiphytic, and rhizospheric regions of infected plants. These fungi were cultured in liquid nutrient media, and the resulting culture filtrates were collected. To assess the bioherbicidal activity of the fungal culture filtrates, seeds of Amaranthus retroflexus and Chenopodium album—two common weed species—were selected. In vitro

experiments were conducted to evaluate seed germination in the presence of fungal filtrates. The results revealed that the culture filtrates exhibited varying degrees of inhibitory effects on seed germination. While some isolates drastically reduced germination rates, others showed little to no effect. Notably, isolates 5, 7, and 10 demonstrated the highest phytotoxic activity. These isolates were identified as *Alternaria* sp., *Fusarium* sp., and *Aspergillus* sp., respectively. The secondary metabolites present in their culture filtrates significantly inhibited the germination of *Amaranthus retroflexus* and *Chenopodium album* seeds. These findings highlight the potential of certain mycelial fungi as effective bioherbicidal agents and warrant further investigation into their active compounds and modes of action.

Keywords: *bioherbicidal activity; mycelial fungi; Amaranthus retroflexus; Chenopodium album; Alternaria; Fusarium; Aspergillus*

RAFVAL:ES-2025/152

Certain hydrolytic enzyme activities of mycelial fungi with bioherbicidal potential

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Secondary metabolites produced by mycelial fungi have various phytotoxic effects and can serve as effective natural agents against weeds. Such biologically active compounds directly affect seed germination, root and stem growth, as well as physiological processes of plants, suppressing or destroying their growth. This mechanism not only provides an effective alternative to traditional chemical herbicides, but also causes minimal harm to the ecosystem. One of the mechanisms of the bioherbicidal effect of fungi on weeds is directly related to their ability to produce hydrolytic enzymes. In particular, the presence of enzymes capable of degrading the main components of the plant cell wall – cellulose, pectin, proteins, lipids, and phenolic compounds – is considered an important factor determining the bioherbicidal potential of these microorganisms. These enzymes can directly damage the cellular structure of weeds, slowing down their growth rate or causing complete destruction. At this stage, the enzymatic activity of 16 fungal isolates was studied in terms of key hydrolytic enzymes – cellulase, pectinase, protease, lipase, and laccase. In the evaluation process, special selective nutrient media were selected for each enzyme, and the activity of the isolates was conducted in vitro in Petri dishes. The activity of each enzyme was determined based on the diameter (mm) of the enzymatic clearing zone, and the obtained results showed significant differences in the level of enzyme production among the isolates. During the study, the exoenzyme activities of fungal isolates such as cellulase, pectinase, protease, lipase, and laccase were investigated. Based on the results of the conducted research, isolates 5, 7, 9, and 10 were identified as the most active samples in terms of hydrolytic enzyme production. These isolates showed high levels of enzymatic activity for all analyzed enzymes: cellulase, pectinase, protease, lipase, and laccase. Their broad-spectrum enzyme production potential enables them to exert a complex effect on various cellular components of weeds. Therefore, these isolates deserve special attention as promising bioherbicidal agents.

Keywords: *mycelial fungi; bioherbicidal potential; hydrolytic enzyme activities; cellulose; pectinase; protease; lipase*

RAFVAL:ES-2025/153

Dairy Plant Management system- Milk Procurement from rural milk areas, processing and product manufacturing

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Dairy plant management is a critical aspect of the dairy industry, encompassing a wide range of activities from milk procurement to product distribution. This chapter delves into the key components of a well-functioning dairy plant management system. The chapter explores the intricate process of milk procurement from rural producers, the meticulous techniques involved in milk processing, and the diverse range of dairy products manufactured. A well-connected system integrating these various aspects is indispensable for streamlining operations, minimizing costs, and guaranteeing the consistent delivery of premium-quality products. Dairy plant management provides key insights into the industry's impact on food security, rural livelihoods, and economic growth. Milk is primarily sourced from rural milk-producing areas where farmers supply raw milk daily. The system includes collection centers equipped with milk analyzers to test quality (fat content, SNF, etc.) and ensure fair pricing for farmers. Data is digitally recorded for transparency and traceability. Once the milk reaches the plant, it undergoes several processes such as chilling, pasteurization, homogenization, and separation. These steps are essential to ensure safety, hygiene, and quality compliance with industry standards. Processed milk is then used to produce various dairy products like curd, butter, cheese, paneer, ghee, and flavored milk. Automation and quality control systems are used to maintain consistency and shelf-life standards. Packaging and labeling are also integrated into the manufacturing system before the products are distributed to markets. Overall, a well-managed dairy plant system enhances operational efficiency, reduces wastage, ensures quality, and improves income for rural farmers.

Keywords: *Milk, Dairy, Processing, Dairy product*

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The Intertwined Fate of Soil Aggregates and Organic Carbon: Implications for Soil Health and Carbon Sequestration

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Soil aggregates, the fundamental structural units of soil, exert a profound influence on the storage and stability of soil organic carbon (SOC). This study explores the critical relationship between soil aggregation and SOC dynamics, highlighting that aggregate formation physically protects organic matter from microbial decomposition, a key mechanism for long-term carbon sequestration. The distribution and stability of SOC vary across different aggregate size fractions, with microaggregates often housing older, more recalcitrant carbon, while macroaggregates contain labile particulate organic matter that can be stabilized within newly formed microaggregates. Organic matter itself acts as a vital binding agent for aggregate formation, with different fractions contributing through transient, temporary, and persistent mechanisms. Land management practices significantly impact both aggregation and SOC stocks; strategies that enhance aggregate stability, such as reduced tillage and organic matter additions, are crucial for maximizing SOC sequestration and improving overall soil health. developing and adopting sustainable land management strategies is essential for mitigating climate change and ensuring long-term soil fertility.

Keywords: *carbon sequestration, soil fertility, SOC dynamics, Land management practices*

RAFVAL:ES-2025/155

Balancing Profits and Conservation in Agriculture, Agroforestry, and Plantation Land Use Systems

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Agriculture, agroforestry, and plantation forestry are interconnected systems, each contributes uniquely to economic profit and environmental conservation. Agriculture primarily aims to gain maximum profits on crop yields, but it can lead to resource depletion and ecological damage. Sustainable practices like organic farming and crop diversification help counter challenges while reducing costs and improving soil health. Agroforestry integrates trees into farming systems, offering dual benefits: income from agriculture components as well as timber, fruits, or medicinal products, and ecological advantages such as carbon sequestration and biodiversity enhancement. Plantation forestry is focused on commercial timber and fuelwood production, can yield significant profits but risks biodiversity loss and soil degradation through monoculture practices. .Based on primary data collected by questionnaire survey method and interviews of 10 farmers in each of Dhamtari, Kurud, Magarlod and Nagri Tehsils of Dhamtari District of Chhattisgarh with farmers of sole agriculture, agroforestry, and woodlot plantation area owning farmer respondents, It is observed that small farms had a higher cost of cultivation compared to medium and large farms, they also achieve a better benefit-cost (B:C) ratio and earn higher gross income compared to larger farms across various tree-based land-use systems. In Agroforestry systems, tree species such as *Gmelina arborea* and *Tectona grandis* are combined with crop *Oryza sativa* (rice), generating greater net incomes, family labour incomes, and overall profitability when compared to pure rice farming. In certain fields, large farms achieve maximum gross profit due to the availability of Traditional Bund-Based Agroforestry practices which significantly boost farmers' income during the 7th to 15th year, depending on the type of trees planted and their harvesting cycles. This practice has proven to be a financially rewarding approach that enhances livelihoods while contributing to environmental conservation and sustainability. Transitioning to mixed-species plantations and adopting sustainable models, such as community forestry programs, can make the view towards balancing economic objectives with conservation goals. Profitability and conservation across these systems is key to achieving sustainable land use, climate resilience, and securing long-term benefits for both economies and ecosystems.

Keywords: *Agroforestry, Agriculture, Plantation, Sustainable Land Use.*

RAFVAL:ES-2025/156

Infestation of red spider mites (*Tetranychus urticae* Koch) on okra crops and its management

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Okra, *Abelmoschus esculentus* (L.) Moench, also called Lady's finger, is one of the most important vegetable crops that is commercially cultivated in almost all of our country's states and in many other parts of the world. The okra crop's vulnerability to a variety of insect pests, including vectors, is a major issue in reducing its productivity. Over 37 insect pest species have damaged okra crops. Crops are attacked by many insects and mites, one of which is *Tetranychus urticae Koch*, the red spider mite। Thus, an investigation into its occurrence and a sustainable management was conducted. *T. urticae* attacks approximately 1200 species of plants, of which over 150 are economically significant. In severe infestation, direct feeding causes defoliation, chlorophyll loss, leaf bronzing, and even plant death। When severe infestation occurs, tetranychid mites web abundantly, forming a thick webbing sheath that covers the entire plant. Spider mite damage alone causes 10–15 percent loss in yield in vegetable crops. According to crop stage, conventional insecticides and synthetic pyrethroids have been found to be the most effective methods for controlling okra pests (Krishnakumar and Srinivasan, 1987). Kumar *et al*. (2007) found that under laboratory conditions, neem methanolic extract at 1% concentration controlled *Tetranychus* sp. at 78.6 percent and 71.9 percent. Avermectin is a natural acaricide made by Actinomycetes and Streptomyces avermitilis, which are found in the soil.

Keywords: *Okra, Abelmoschus esculentus, Tetranychus urticae, acaricide, management.*

RAFVAL:ES-2025/157

Impact Of E-Nam On Market Efficiency: A Case Study Review

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The Electronic National Agricultural Market (e-NAM), launched by the Government of India in 2016, is a transformative initiative aiming to unify agricultural markets across the country. This review evaluates the impact of e-NAM on market efficiency using insights from selected case studies and empirical research. e-NAM has enhanced transparency, price discovery, and inter-state trade while reducing transaction costs and information asymmetry. Case studies of APMCs such as Nizamabad (Telangana) and Kawardha (Chhattisgarh) illustrate substantial improvements in trade volumes, income levels, and digital transaction adoption post-e- NAM integration. Statistical analysis by Swain et al. (2022) revealed significant gains in modal prices and commodity arrivals, especially during the pandemic when market access was constrained. Similarly, data from Bachaspati et al. (2022) indicate a noteworthy shift in market arrivals and income trends in post-e-NAM years. Despite its success, challenges such as inadequate grading infrastructure, poor digital literacy among farmers, and lack of support facilities continue to hamper optimal utilization. As of December 2024, over 1410 mandis across 23 states and 4 UTs have been integrated, supporting 221 commodities with trade exceeding ₹3.19 lakh crore (eNAM, 2024). The study concludes that e-NAM holds immense potential in catalyzing the agricultural marketing ecosystem, provided existing infrastructural and institutional challenges are addressed through policy support and capacity building.

***Keywords**: e-NAM, agricultural markets, APMC, digital trading, price discovery, market efficiency*

RAFVAL:ES-2025/158

Soil Fertility Improvement through Regenerative Practices

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Soil fertility is a critical determinant of agricultural productivity and environmental sustainability. However, intensive conventional farming practices have led to widespread soil degradation, loss of organic matter, and nutrient depletion. Regenerative agriculture, a holistic land management approach, seeks to restore and enhance soil health by working in harmony with natural systems. Practices such as cover cropping, crop rotation, compost application, minimal tillage, agroforestry, and integrated livestock management significantly contribute to improved soil structure, increased organic matter, enhanced microbial diversity, and balanced nutrient cycling. These interventions not only rebuild soil fertility but also support carbon sequestration, water retention, and ecosystem resilience. The role of regenerative practices in restoring soil fertility, offering a sustainable pathway for future food security and climate change mitigation.

Keywords: *Soil fertility, organic matter, practices, management, climate change.*

RAFVAL:ES-2025/159

Arsenic contamination in groundwater: A broad review of NCR districts in Haryana. Sonam Thalod [Research Scholar]

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Arsenic contamination in groundwater is memorable problem for environment and public health. This paper is basically focused on sources, affected areas, health impacts, and controlling ways of arsenic contamination in groundwater around districts of Haryana, India. This paper coordinate finding from several studies of arsenic contamination in NCR regions of Haryana and the health risks in impacted areas. Also some mitigation ways are analysed for enhancing water quality which contributes to arsenic safe water for future use. Both anthropogenic and natural sources of arsenic in environment are considered due to which levels of arsenic in groundwater are increasing above permissible limits in NCR regions of Haryana. Contamination of groundwater with arsenic in it, can cause serious health problem such as cardiovascular diseases, skin problems like hyperpigmentation, keratosis, skin lesions, neurological disorders, developmental delay in children's and risk of cancer in liver, bladder, skin, lungs, and highly and longer intake of arsenic will lead to arsenic poisoning which may lead to death mostly among rural population of the impacted areas. If arsenicosis patients were provided arsenic safe drinking water and nutritious food, they will show the sign of recovery overtime. This paper also includes many ways for controlling and treating arsenic contamination in groundwater in every possible way with the help of government and locals by informing them about the risk to there health in present time as well as for the future. The different mitigation strategies talked about in this paper helps to mitigate arsenic from contaminated groundwater and enhance water quality in impacted areas where arsenic concentration has crossed the permissible limits or going to cross the permissible limits. This paper also provides support for future researches and improve human health.

Keywords: *Arsenic contamination, Haryana, Groundwater, Heavy metal, Human health.*

RAFVAL:ES-2025/160

Agricultural Resilience and Food Security in Northeast India

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Northeast India, with its diverse agro-climatic conditions, rich biodiversity, and traditional farming practices, holds immense potential for achieving regional food security. However, the region also faces unique challenges that threaten agricultural resilience and food availability. These include fragmented landholdings, limited access to modern technology, inadequate infrastructure, shifting cultivation practices, climate variability, and frequent natural disasters such as floods and landslides. Despite these constraints, the region is known for its rich repository of indigenous crops and organic farming practices, which, if harnessed effectively, can play a pivotal role in promoting sustainable agriculture and food security.

Agricultural resilience the ability of farming systems to adapt to and recover from shocks is critical for ensuring consistent food supply and livelihoods in the region. Strengthening resilience involves diversifying crop production, improving irrigation facilities, adopting climate-smart agricultural techniques, and integrating traditional knowledge with scientific innovations. Enhancing storage, transportation, and market linkages is equally vital to reduce post-harvest losses and improve food access.

Moreover, addressing food security in Northeast India requires a multidimensional approach that includes nutrition-sensitive agriculture, targeted policy interventions, and community-driven initiatives. Government schemes, research institutions, and non- governmental organizations must collaborate to build capacity, ensure inclusive growth, and empower local farmers, especially women and tribal communities.

Key word: *Northeast India, food security, agricultural resilience, sustainable agriculture, indigenous practices, climate-smart agriculture*

RAFVAL:ES-2025/161

Sustainable Livestock Feed and Nutrition

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Livestock nutrition plays a crucial role in ensuring animal health, productivity, and sustainability of livestock production systems. With growing concerns over environmental degradation, feed resource scarcity, and rising input costs, the focus on sustainable feed strategies has become more important than ever. This abstract explores the potential of alternative and locally available feed resources, efficient ration formulation, and nutrient recycling techniques as sustainable approaches to livestock feeding. Emphasis is laid on the integration of agro-industrial by-products, use of crop residues, and adoption of precision feeding technologies to optimize nutrient utilization while minimizing environmental footprints. In addition, the role of feed additives, probiotics, and natural growth promoters in improving feed efficiency and reducing dependency on antibiotics is also discussed. These strategies contribute to climate-smart livestock production and align with global goals of food security and sustainable agriculture. Effective policy support, capacity building of farmers, and continuous research are essential to mainstream these practices in diverse livestock systems across India.

Keywords: *sustainable feed, livestock nutrition, alternative feed resources, feed efficiency, climate-smart agriculture.*

RAFVAL:ES-2025/162

Analyzing the Grazing Behavior of Small Ruminants on Natural Pasture during the Summer Season

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A comparison was made between the grazing patterns of Jalauni sheep (n=10) and Bundelkhandi goats (n=10) on natural pastures during the summer season. To maintain a separation between the sheep and goats, two 0.5-hectare grazing areas were chosen. Stocking was conducted at a rate of twenty animals per hectare. Ten goats (Bundelkhandi) and ten sheep (Jalauni) participated in the experiment. Researchers observed each species of animal for fifteen days during the summer. Three hours of video footage were captured for each grazing parameter in the morning, afternoon, and evening, for a daily observation period of nine hours. Goats exhibited a considerably longer average grazing time (32.79 min/h) than sheep (22.30 min/h) during summer season. In contrast, sheep exhibited substantially longer walking time (5.43 min/h versus 3.65 min/h), standing time (13.44 min/h versus 11.73 min/h), and sitting time (18.92 min/h versus 11.82 min/h) than goats. Furthermore, sheep favored grasses throughout the majority of the day, including the morning, afternoon, and evening. Goats, on the other hand, exhibited a preference for a wider variety of plant species, including grasses during the morning and thorny vegetation followed by shrubs during afternoon and evening. Moreover, grazing time and grazing intake were negatively correlated with the ambient temperature during summer season in both the species.

Keywords: *Grazing, Behavior, Sheep, Goats, Summer, Natural Pasture*

RAFVAL:ES-2025/163

Empowering Youth and Women in Agriculture: Pathways to Sustainable Livelihoods and Inclusive Growth

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Agriculture remains the backbone of rural livelihoods in India, yet the sector faces significant socio-economic challenges, including youth (age 15–35 years) disengagement and persistent gender disparities. While the number of agricultural workers rose from 234.1 million in 2001 to 263.1 million in 2011, the sector's share in total employment declined from 58.2% to 54.6%, reflecting rural-to-urban migration driven by search for stable livelihoods. The National Sample Survey Office (2003) revealed that 40% of farmers expressed a desire to quit farming. Recognizing the vital role of youth in revitalizing agriculture and ensuring food security, ICAR launched the *Attracting and Retaining Youth in Agriculture (ARYA)* project in 2015–16. ARYA promotes entrepreneurship in agriculture and allied sectors through KVKs. These efforts, combined with regular follow-up meetings and exposure to Kisan Melas, are helping youth stay rooted in rural areas and contribute to innovation and local economies. Simultaneously, agriculture is undergoing feminization, with 80% of financially independent women engaged in farm-related work—33% as laborers and 48% as self-employed farmers. Despite this, gender inequities remain, with women facing restricted access to land, credit, and decision-making, embedded in patriarchal systems. Increased female-headed households due to male migration underscore the need for gender-responsive frameworks enhancing women’s skills and access to resources. With a projected 22% global labour market churn by 2030, this is a pivotal moment to transform agriculture into a field of opportunity, equality, and innovation—empowering youth and women as pillars of sustainable rural development.

Keywords: *Agriculture; Entrepreneurship; Gender; Innovation; Youth.*

RAFVAL:ES-2025/164

Smart Harvesting: Real-Time Fruit Detection and Robotic Picking for Modern Agriculture

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The integration of advanced computer vision and robotic technologies in agriculture has significantly transformed traditional farming practices, leading to increased productivity and efficiency. This paper presents a comprehensive study on image-based fruit detection and robotic harvesting, focusing on the development and implementation of intelligent systems capable of identifying, localizing, and picking fruits with high accuracy and minimal human intervention. Leveraging deep learning algorithms, particularly convolutional neural networks (CNNs), the system processes real-time image data to detect ripe fruits under varying lighting conditions and amidst complex backgrounds. Key challenges addressed include occlusions, variations in fruit size, shape, and color, as well as dynamic environmental factors such as wind and shadows. To enhance detection precision, data augmentation techniques and transfer learning from pre-trained models are employed, significantly improving performance in diverse agricultural settings. Once fruits are detected, a robotic arm equipped with a precision gripper navigates toward the target using sensor fusion techniques combining visual and depth data. Motion planning algorithms ensure efficient and safe fruit harvesting without causing damage to the plant or fruit. The proposed system was tested on various fruit types, demonstrating promising results in terms of detection accuracy, harvesting speed, and overall operational reliability. The findings suggest that image-based robotic harvesting systems hold great potential for large-scale agricultural applications, offering a sustainable solution to labor shortages and reducing post-harvest losses. Future work will focus on enhancing system adaptability across different crop types and integrating real-time feedback mechanisms for continuous learning and optimization.

Keywords: *Agricultural Robotics, Convolutional Neural Networks, Fruit Detection, Image Processing, Robotic Harvesting.*

RAFVAL:ES-2025/165

Comparative Analysis of Millets Consumption in Rural and Urban Area of Middle Gujarat

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Millets are ancient grains known for their resilience and nutritional benefits. The global millet production was 30.79 million tonnes, with India contributing nearly 40 per cent (2023). Gujarat ranked 7th in cultivated area and 5th in terms of production. This study, conducted in the middle Gujarat region, aimed to analyze the growth rate of millets area, production, and yield, to examine rural-urban consumption patterns, identify consumption behaviour factors, and assess nutrient intake through millets.

A multistage sampling method was used to select 200 households from Anand and Kheda districts—100 rural and 100 urban. Primary data were collected through interviews, and secondary data from CMIE. Exponential functions estimated growth rates; tabular analysis measured consumption and nutrient intake; and logistic regression and PLS-SEM analyzed consumption behaviour. The findings indicated a decline in millet area and production, while yield improved due to crop shifts, better technology, and policy changes. Rural households consumed more millets (4.16 kg/month) than urban ones (1.29 kg/month), with pearl millet being the most consumed. Rural households also spent a larger share of their budget on millets.

Also study identified that key factors influencing consumption are residence, price, taste, education, and age. Health benefits and affordability drove rural consumption, while urban consumers were influenced by environmental concerns, health, and marketing. Nutritional intake was higher from pearl millet and sorghum, especially among adults aged 26–61. To boost millet consumption, especially in urban areas, awareness campaigns, product innovation, market support, and targeted subsidies are essential. Engaging youth through modern millet-based foods can also enhance acceptance and demand.

Keywords: *Consumption pattern, Consumption behaviour, PLS-SEM, Nutrient intake*

RAFVAL:ES-2025/166

Seasonal incidence and succession of rice horned caterpillar in different rice ecosystem

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This experiment was conducted at College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur Chhattisgarh. In the pest succession study, population of horned caterpillar, *Melantis leda isemene* larvae/adult was first appeared during 32 SMW in month of August with 0.50, 1.25, 1.25, 1.00 and 0.75 larvae/adult/25 sweeps respectively in upland direct seeded rice ecosystem (UDS), MNT = Midland normal transplanted rice ecosystem, MSR = Midland SRI (System of rice intensification) rice ecosystem, LLO = Lowland organic rice ecosystem while 0.25 and 1.00 larvae/adult/25 sweeps in 33 SMW UTP = Upland transplanted rice ecosystem and in 34 SMW LLC = Lowland conventional rice ecosystem. The peak population of pest was recorded during 35, 37, 38 and 39 SMW with 2.25, 3.75, 4.50, 2.00, 3.25 and 7.00 in UTP, UDS, LLC, MSR, MNT and LLO respectively. The pest was disappeared in varied time interval in different rice ecosystem during *Kharif* season 2013-14. Similarly the seasonal incidence study showed that the highest per cent leaf damage/ hill was recorded at 33, 34, 36 and 37 SMW with 3.50, 5.20, 3.00, 3.44, 2.17 and 9.81 per cent leaf damage/hill respectively in MNT, LLC, MSR, UDS, UTP and LLO in different month of season. Relative abundance of this pest revealed that in among the ecosystem both population and damage per cent of pest was maximum in LLO followed by LLC and UDS.

Keywords: *Rice, Ecosystem and Rice horned caterpillar*

RAFVAL:ES-2025/167

Evaluation of Reproductive Performance in Crossbred Holstein Friesian and Jersey Cattle Under the Tropical Climate of Paralakhemundi, Odisha

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Crossbred cattle (Holstein Friesian × nondescript and Jersey × nondescript) contribute substantially to milk production in Odisha, India. However, data on their reproductive performance remains scarce. This study aimed to assess the reproductive performance of crossbred Holstein Friesian and Jersey cattle managed at the Livestock Farm Complex, School of Veterinary and Animal Sciences, Centurion University of Technology and Management, Paralakhemundi, Odisha. Reproductive parameters evaluated included service period (days), calving interval (days), services per conception, and conception rate (%). The mean values for Holstein Friesian crossbreds were 170.83 ± 52.03, 454.83 ± 52.14, 3.83 ± 4.17, and 52.78 ± 15.91, respectively, while Jersey crossbreds recorded values were 124.17 ± 43.55, 408.00 ± 106.25, 2.83 ± 3.55, and 68.33 ± 15.37, respectively. Statistical analysis revealed no significant differences ($P>0.05$) between the two groups for any of the parameters studied. These findings indicate that both Jersey and Holstein Friesian crossbred cows revealed comparable and satisfactory reproductive performance under the existing tropical conditions of Paralakhemundi, Odisha.

Keywords: *calving interval, conception rate, crossbred cows, service period, services per conception*

RAFVAL:ES-2025/168

Tolerance to heat stress in peas (Pisum sativum L.) : Present status and future prospects

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In the era of climate change, pea (Pisum sativum L.) productivity is increasingly compromised by abiotic stresses, notably heat stress (HS). Elevated temperatures, particularly during the reproductive phase (30.5–33°C), significantly reduce seed yield and germination, while early-stage HS impairs emergence, growth, and physiological functions. Yield losses of 11.1% to 17.5% have been observed with temperature rises of 1.4 to 2.2°C. Pea plants adopt various strategies to mitigate HS, including escape, avoidance, and tolerance mechanisms, although their specific temperature thresholds remain unclear. Traditional breeding has identified adaptive traits such as semi-leaflessness, upright growth, lodging resistance, lower canopy temperature, and smaller seed size as beneficial under HS conditions. Targeted screening of landraces and germplasm collections enables identification of HS-tolerant genotypes, while advanced phenotyping enhances breeding precision. Integrating next-generation sequencing (NGS) with genomic tools like genome-wide association studies (GWAS), marker-assisted selection (MAS), and genomic selection accelerates the identification of key genes associated with HS tolerance. Furthermore, transgenic approaches offer alternative avenues for developing thermotolerant cultivars. This study helps to understand the HS responses in pea, highlights breeding and biotechnological interventions, and outlines future challenges in developing heat-resilient varieties.

Keywords: *Heat Stress,Breeding, Pea, MAS, Climate resilient*

RAFVAL:ES-2025/169

Artificial Intelligence and Machine Learning in Weed Management in Field Crops: A Review

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Weed management is a critical challenge in modern agriculture, significantly affecting crop yields and farm profitability. Traditional weed control methods, such as manual weeding and chemical herbicides, have limitations, including high labour costs, environmental concerns, and the evolution of herbicide-resistant weed species. Recent advancements in artificial intelligence (AI) and machine learning (ML) offer innovative solutions for efficient and sustainable weed management. This review explores the applications of AI and ML in weed identification, classification, herbicide optimization, autonomous weeding systems, and decision support tools. The paper also discusses the challenges and future prospects of integrating these technologies into field crop management.

Keywords: *Artificial intelligence, machine learning, weed management, field crops, precision agriculture, herbicide optimization, autonomous weeding systems.*

RAFVAL:ES-2025/170

Foliar application of *Kappaphycus alvarezii* extract enhances drought tolerance in wheat by improving physiological and biochemical traits

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Drought stress is a major environmental constraint limiting wheat productivity. This study investigated the efficacy of *Kappaphycus alvarezii* extract (KE), applied as the commercial product Sagarika concentrate liquid, in enhancing drought tolerance in wheat during the vegetative stage. Wheat plants were primed with foliar KE applications at concentrations of 2.5%, 7.5%, and 10% (v/v), and subjected to drought stress between 34 to 45 days after sowing (DAS). KE application significantly improved physiological and morphological traits under drought. The highest soil moisture retention was recorded in T5 (IR + 10% KE) at 29.17%, while the lowest was in T2 (Dr + H_2O). Shoot biomass was highest in T5 (1.858 g DW/plant) and lowest in T2 (1.076 g DW/plant), highlighting the growth-promoting potential of KE under both irrigated and stress conditions. KE-treated plants exhibited higher relative water content (RWC), enhanced membrane stability index (MSI), and increased chlorophyll content compared to drought-stressed controls. Notably, electrolyte leakage (EL) and hydrogen peroxide (H_2O_2) accumulation, key indicators of oxidative damage were significantly reduced in KE-treated plants, as shown by DAB staining and EL measurements. These findings demonstrate that KE foliar application effectively mitigates drought-induced oxidative stress, preserves physiological integrity, and promotes growth, offering a promising eco-friendly strategy for improving crop resilience under water-limited conditions.

Keywords: *Abiotic stress, Kappaphycus, Drought, Priming, Reactive oxygen species,* H_2O_2

RAFVAL:ES-2025/171

Pathology And Diagnosis Of Squamous Cell Carcinoma In Bovines

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An investigation was carried out on twenty tissue samples collected from neeoplastic growth at horn, eye, skin and vulva in bovines suspected of squamous cell carcinoma (SCC) on the basis of gross pathology were collected from Durg, Dhamtari and Rajnandgaon districts of Chhattisgarh and processed in the Department of Veterinary Pathology, College of Veterinary Science and A.H., DSVCKV, Anjora, Durg (C.G.). Investigation was conducted to describe the pathological and immunohistochemical alterations including scoring and grading of squamous cell carcinoma in bovines. Histopathological examination as per standard H&E method of staining and immunohistochemistry was performed through Benchmark automated staining system. Twelve cases were diagnosed as SCC on the basis of histopathological and eleven on the basis of immunohistochemical analysis. Grossly neoplasms of horn revealed large, cauliflower like unilateral irregular masses at the base of horn and they were friable and soft in consistency. Small, unilateral growths observed in eye varied from soft to hard in consistency. Histopathological findings in SCC of horn revealed keratinization of horn epithelium forming concentric cell nests. Distinctive keratin pearls with more keratin deposition towards the center, numerous mitotic figures with anaplasia and neovascularization were evident in OSCC. Immunohistochemistry revealed strong immunohistochemical expression of Pan-Cytokeratin (Pan-CK), p53 and EGFR and negative to p16. Immunohistochemical scoring (IHS) was done in Pan-CK, EGFR and p53, ranged from 1-4. Well differentiated SCC of horn revealed strong immunoexpression against EGFR, varied from mild to intense. SCC of horn exhibited strong immunoexpression for Pan-CK, p53 and EGFR whereas, immunoexpression in OSCC specifically p53 was less as compared to SCC of horn. Grading and differentiation of SCC (horn & eye) was also done on basis of histopathological and immunohistochemical scoring.

Keywords: *Cell nests, EGFR, Histopathology, Immunohistochemical scoring, p53, p16, Pancytokeratin, Papaniculoau.*

RAFVAL:ES-2025/172

The role of root exudation in Nutrient scarcity and soil stress conditions in Forest Ecosystems

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The dynamics of root exudation in plants, particularly in forest ecosystems, are significantly influenced by nutrient scarcity and soil quality. As adaptive responses to environmental constraints, root exudates, which include sugars, amino acids, organic acids, and secondary metabolites, assist plants in acquiring nutrients and ensuring their survival. Plants increase the secretion of particular root exudates that release inaccessible nutrients from the soil matrix when nutrients are scarce. The soil's pH, texture, and moisture content also influence the quantity and composition of root exudates. Plants can enhance the release of chemicals that improve soil structure and microbial activity in acidic or tightly packed soils, making the environment more favourable for nutrient uptake. Conversely, exudate production tends to be lower in nutrient-rich and well-drained soils, indicating a reduced need for nutrient mobilization. Nutrient scarcity and soil health interact to produce a dynamic chain reaction where root exudates actively alter the chemical composition and microbiota of the soil while also adapting to environmental stresses. This mechanism significantly impacts biogeochemical cycles, affecting carbon sequestration, nitrogen mineralization, and organic matter decomposition in forest soils. To ensure sustainable management and restoration of forests, it is essential to understand these relationships. In areas that have been degraded or have low nutrient levels, managers can enhance soil fertility and nutrient cycling by selecting species with strong exudation potential. Future studies should focus on investigating the molecular mechanism driving root exudation response to the combined challenges of nutrient scarcity and unfavourable soil conditions. This will help maximize ecosystem output and resilience in the face of changing climate conditions.

Keywords: *Nutrients, Exudates, Soil restoration, Mineralization*

Impact Of *Lactobacillus Acidophilus* Derived Postbiotics On The Performance Of Broiler Chicken Under Induced Coccidiosis Condition

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Chickens are the world's leading source of high-quality animal protein, but production faces challenges from biotic and abiotic stressors, including parasitic pathogens named *hidden enemies*. Coccidiosis is a major disease affecting broilers aged 3-18 weeks. This study aimed to evaluate the effectiveness of *Lactobacillus acidophilus* postbiotics (*LA*P) in preventing coccidiosis by establishing a chick infection model and assessing *ngPro's* impact on broilers. A total of 320-day-old VENCOBB 430Y broiler chicks were randomly divided into 10 groups (4 replicates, 8 chicks each) and reared in cages for 6 weeks under 10 dietary treatments, including various *LA*P concentrations (0.2-0.6%, v/w) with and without *Eimeria* infection. On day 26, birds were orally inoculated with 1×10^4 sporulated *Eimeria* mixed oocysts. During the experimental period the birds were provided with *ad libitum* feed (ICAR-2013) and water. A novel method was used to prepare postbiotics, LCMS (Lauryl hydrogen sulfate). The inclusion of 0.6% *LA*P significantly improved BWG, ADG, and economic indices ($p<0.05$). Lower oocyst counts were observed in *LA*P (0.6%) and diclazuril-treated groups from 6–11 dpi. Improved INF-γ (T9), spleen weight (T8), and albumin (T9) levels were observed ($p<0.05$). However, certain parameters like FI, FCR, glucose, and intestinal histomorphology remained unaffected. The postbiotics-fed groups showed better production, economic indices, serum biochemical, HI and OPG compared to coccidiostat-treated and control groups. *Eimeria* oocysts gradually decreased with lower counts in diclazuril followed by 0.6% postbiotic, antibiotic, 0.2%, 0.4% and control. The results suggested that, inclusion of 0.6% postbiotic improved performance and reduced the severity of infection. The potential of postbiotics (*Lactobacillus acidophilus* 0.6% v/w) usage as an alternative to antibiotics growth promoter, can augment the coccidiostat in mitigating *Eimeria* mixed infection. The metabolite product has been officially registered as CARI GUTHEAL, but further validation is recommended.

Key words: *Postbiotics, Lactobacillus, Eimeria, hidden enemies*

RAFVAL:ES-2025/174

Organic Manures for Production of Quality Seedlings of Kamala [*Mallotus philippinensis* (Lam.) Mull. Arg.]: An LKT Multipurpose Species

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Mallotus philippinensis (Kamala), a medicinally and economically valuable tree of the Euphorbiaceae family, is widely distributed across tropical and subtropical regions, particularly in India, Sri Lanka, Southeast Asia, and Australia. Despite its broad ecological adaptability and diverse uses- ranging from traditional medicine to natural dyes and timber; this species faces propagation challenges due to low natural seed germination rates (5-22%), dormancy issues, and slow seedling growth. Effective nursery practices are crucial to conserve and utilize this underexplored lesser known and threatened (LKT) multipurpose species. In a seedling growth trial, various organic manure based growing media were evaluated for their influence on

the different growth attributes of *M. philippinensis*, focusing on shoot length, collar diameter, and number of leaves after five months of transplanting. Among the ten treatments, maximum shoot length (27.01 cm) was obtained in T_9 (Soil + Biocompost in 4:1), followed by 26.38 cm in T_4 (Soil + Poultry manure in 2:1) and 25.01 cm in T_7 (Soil + Vermicompost in 4:1). The highest collar diameter (3.81 mm) was found in T_4, followed by T_9 (3.78 mm) and T_7 (3.75 mm). Furthermore, the maximum number of leaves (7.73) was obtained in T_9, then in T_7 (7.47) and T_4 (7.19). However, the lowest sturdiness quotient was found in T_1 (Control: soil), followed by 6.05 in T_8 (Soil + Biocompost in 2:1) and 6.19 in T_3 (Soil + FYM in 2:1). Thus, the composition of organic manure based growing media consisting of biocompost, poultry manure and vermicompost can be used to produce quality planting material of *M. philippinensis* for afforestation and reforestation programmes.

Keywords: *Afforestation, Dormancy, Mallotus philippinensis, Organic manure, Seedling growth*

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Post-Harvest Management and Value Addition

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Post-harvest management is a critical component of the horticulture value chain that ensures the quality, safety, and shelf-life of produce from farm to consumer. In India, significant post-harvest losses occur due to inadequate handling, poor infrastructure, and lack of awareness among stakeholders. These losses can be minimized through efficient post-harvest practices such as proper harvesting time, sorting, grading, packaging, storage, and transportation. Value addition involves enhancing the value of raw horticultural produce through processing, branding, and diversification into new products. It plays a pivotal role in increasing farmers' income, reducing waste, and ensuring food security. Technologies like dehydration, canning, freezing, pickling, and the use of controlled atmosphere storage are crucial for both preservation and value enhancement. Adoption of modern techniques and capacity building of farmers and entrepreneurs can create new avenues for rural development and employment. Strengthening post-harvest infrastructure, cold chains, and processing units at the local level is essential for the sustainable growth of the horticulture sector. This paper emphasizes the importance of integrated approaches in post-harvest management and value addition to meet the increasing demands of both domestic and international markets.

Keywords: *post-harvest management, value addition, storage, processing, food security*

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Influence Of Biostimulants And Organic Mulch On Soil Microbial Population In Strawberry (F. × Ananassa Duch.)

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To investigate the influence of biostimulants and organic mulch on the soil microbial population of strawberry cv. Katrain Sweet, an experiment was carried out in the Department of Fruit Science and in the Biocontrol lab, Department of Plant Pathology, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, during two subsequent years i.e., 2022-2023 and 2023-2024. The results showed substantial enhancements in microbial growth of both fungi and bacteria with the use of Azotobacter, *Trichoderma harzianum* and PSB, applied in combination with organic mulch, particularly in treatment (T12) Azotobacter (8g/plant) + PSB (8g/plant) + *Trichoderma harzianum* (6g/plant) + dried leaves. This treatment resulted in the highest bacterial population count of 8.97×10^6 cfu g^{-1} of soil and a fungal population of 5.93×10^4 cfu g^{-1} of soil, significantly outperforming over the control. The findings underscore the potential for using biostimulants and organic mulches to enhance soil microbial growth in strawberry production, offering a sustainable approach for improving yield and plant health.

Keywords: *Biostimulants, Azotobacter, Trichoderma harzianum, dried leaves, strawberry, microbial population*

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Breeding for colour development in vegetable crops

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Vegetables with diverse colours attract consumers and offer significant health benefits. Their pigments contain bioactive compounds that help to manage health. Four major plant pigment groups contribute to colour variation. Carotenoids, including carotenes, lycopene, and xanthophylls, produce orange, red and yellow hues and support eye health. Flavonoids, such as flavonols and anthocyanins, give purple, blue and red colours, offering antimicrobial and cardiovascular benefits. Betalains, unique to the Caryophyllales order, serve as anthocyanin substitutes, producing red, orange and yellow shades. Chlorophyll gives plants their green colour. Breeding for colourful vegetables is gaining importance. Selection, hybridization and mutation breeding have developed pigment-rich varieties. Pusa Kulfi (cream-coloured, high in lutein) and Pusa Asita (black, rich in anthocyanins) are notable examples developed through selection. Wild species are valuable sources of bioactive compounds. Caro Red, a pro-vitamin A-rich tomato, was developed using *L. hirsutum*. ‘Indigo Rose’ was the first popular purple tomato cultivar obtained by crossing *Aft* × *atv* (*atroviolaceae*) released using conventional breeding approaches by Oregan State University. Pusa Betakesari is an indigenously developed orange coloured cauliflower (rich in beta-carotene) to tackle vitamin A deficiency in India using ‘Or’ gene following marker assisted selection. Many biofortified varieties of sweet potato like BHU Krishna (rich in anthocyanin), BHU Sona and BHU Kanti (β-carotene rich) were developed. In okra, Kashi Lalima and Pusa Lal Bhindi were developed, which are uniquely red in colour and have a higher anthocyanin content. By using different breeding tactics, there is ample scope for developing colourful vegetables.

Keywords: *Biofortified varieties, Colour, Deficiency, Pigments*

RAFVAL:ES-2025/177/A

Recent advances in breeding of bitter gourd (*Momordica charantia* L.)

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Bitter gourd (*Momordica charantia* L.) is an economically important cucurbitaceous vegetable crop known for its rich nutritional and medicinal properties, particularly its strong antidiabetic potential. The fruit contains bioactive compounds such as charantin which helps to regulate blood glucose levels, making it a valuable component in diabetes management. Despite its widespread cultivation, production constraints include low genetic potential, biotic and abiotic stresses. Recent breeding advances have focused on improving yield, earliness, fruit quality and disease resistance. A breakthrough has been the development of stable gynoecious lines such as DBGy-201, DBGy-202, IIHRBTGy-491, IIHRBTGy-492 and PreGy-1. These lines, governed by recessive or partially dominant genes, have enabled the development of high-yielding hybrids. Pusa Aushadi, a new variety developed through hybridization followed by single plant selection from a cross between gynoecious line DBGy-201 and Pusa Do Mousami has higher female: male ratio (7:1). The nutrient content and antioxidant activities are better than other existing varieties. Rootstock breeding has successfully utilized *Luffa* and *Cucurbita* species to enhance resistance to fusarium wilt and abiotic stresses. Molecular breeding tools, including marker-assisted selection (MAS) and QTL mapping, have identified key genetic loci associated with gynoecy, yield and fruit traits. Advances in whole-genome sequencing and transcriptome analysis have further accelerated breeding efficiency. Additionally, interspecific hybridization has been explored for disease resistance, while tissue culture techniques aid in germplasm conservation and rapid propagation of elite lines. These advancements collectively contribute to the development of superior bitter gourd varieties with enhanced productivity, resilience and antidiabetic benefits.

Keywords: *Bitter gourd, Charantin, Diabetes, Gynoecious lines*

RAFVAL:ES-2025/178

Isolation of multidrug-resistant (MDR) bacteria from wastewater: Focus on β-lactamase production and biofilm formation

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Antimicrobial resistance (AMR) is an escalating global concern, primarily driven by the excessive and inappropriate use of antibiotics in human healthcare, veterinary practices, and agriculture. Wastewater environments serve as significant reservoirs for multidrug-resistant (MDR) gram-negative bacteria. A key resistance mechanism among these pathogens is the production of β-lactamase enzymes, including extended-spectrum β-lactamases (ESBLs), which hydrolyze β-lactam antibiotics. Additionally, biofilm formation further enhances their resistance and persistence. In this study, seventy (70) bacterial isolates were recovered from four wastewater sites in Aligarh. Based on morphological, cultural, and biochemical characteristics, the isolates were tentatively identified as species of Enterobacter, Escherichia coli, Citrobacter, Proteus, Pseudomonas, Salmonella, Shigella, Klebsiella, and Serratia. Antibiotic susceptibility testing against 15 antibiotics revealed 100% resistance to ampicillin and amoxicillin, followed by resistance to rifampicin (82%), erythromycin (73%), nalidixic acid (58%), and co-trimoxazole (45%). Lower resistance rates were observed for chloramphenicol (18%), nitrofurantoin (10%), and aminoglycosides such as kanamycin (7%), streptomycin (6%), norfloxacin (1.5%), and gentamicin (1.5%). β-lactamase activity was assessed using ampicillin and penicillin as substrates. Among the 44 test isolates, 29 hydrolyzed ampicillin, 20 hydrolyzed penicillin, and 17 hydrolyzed both, indicating potential β-lactamase production. Minimum inhibitory concentration (MIC) results revealed that chloramphenicol was the most effective antibiotic, even at low concentrations. Among the 17 dual β-lactamase producers, three isolates (JSD-13, JSD-17, and TCS-11) were confirmed as ESBL producers based on a ≥5 mm difference in inhibition zone in the phenotypic disc confirmation test (PDCT). Furthermore, biofilm assays demonstrated that isolates tentatively identified as *Escherichia coli* were strong biofilm formers, followed by *Pseudomonas* and *Proteus* species. This study highlights the prevalence of MDR, β- lactamase, and ESBL-producing bacteria in wastewater and underscores the need for monitoring and alternative therapeutic strategies.

Keywords: *β-lactamase, Biofilm formation, ESBL production, Multi-drug resistance bacteria, Waste water*

RAFVAL:ES-2025/179

Host Reaction Of Popular Turmeric Varieties To Wilt Complex Caused By *Meloidogyne* And *Fusarium* Spp. Under Greenhouse Condition

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Turmeric (*Curcuma longa* L.) known as the "Golden spice of India," is a vital spice and medicinal crop. Its production is significantly constrained by the wilt complex caused by *Meloidogyne* spp. and *Fusarium* spp., which act synergistically to intensify disease severity. A greenhouse experiment was conducted during Kharif 2022 at the College of Agriculture, V.C. Farm, Mandya, Karnataka, to evaluate the response of six popular turmeric varieties- IISR Pragathi, Prathibha, IISR Alleppey Supreme, Lakhadong, Rajendra Sonia, and Pithambari-against the wilt complex. The treatments included individual and combined inoculations of *Meloidogyne* spp. and *Fusarium* spp., with uninoculated plants as control. The observations were recorded on wilt incidence, number of galls, root-knot index, and nematode population in soil and roots. Maximum galling and root-knot index (RKI) were observed in Rajendra Sonia (110.20 galls; RKI- 5.00), while IISR Pragathi recorded the lowest (28.80 galls; RKI- 3.10). Wilt incidence peaked when *Meloidogyne* spp. was inoculated 15 days prior to *Fusarium* spp., underscoring the nematode's role in predisposing the host to fungal infection. The highest wilt incidence was observed in Rajendra Sonia (68.33%), followed by IISR Alleppey Supreme, while IISR Pragathi exhibited the least (48.88%), followed by Prathibha. Based on the findings, Rajendra Sonia was categorized as highly susceptible, IISR Alleppey Supreme, Prathibha, Lakhadong, and Pithambari as susceptible, and IISR Pragathi as moderately resistant to the wilt complex. These results suggest IISR Pragathi as a promising variety for cultivation in wilt complex -prone areas and highlight the importance of integrated management for *Meloidogyne* and *Fusarium* complexes in turmeric.

Keywords: *Turmeric, Meloidogyne sp., Fusarium sp., Wilt complex, Karnataka.*

RAFVAL:ES-2025/180

Tissue culture in mulberry (*Morus* spp.) for in-vitro shoot development

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A study was undertaken in the department of Sericulture, with an objective to study the genotypic variations for the regeneration potential and to standardize the culture media for regenerates from nodal explant of different varieties of mulberry. The maximum bud sprouting (72.57%) was noticed in M-5 when MS medium with different concentrations of NAA and BAP. Among the different concentrations and combinations highest auxillary bud sprouting percentage of 71.50 was recorded when MS medium supplemented with 1.5 and 1.0 per cent NAA and BAP respectively in M5. In another combination of IAA and BAP, Significantly maximum response of sporting percentage (77.52%) was recorded in S13 when compared to V1, M5 and Mysore local. On the other hand among the different concentrations and combinations used the highest sprouting percentage of 81.91 was recorded when MS medium is supplemented with different concentrations of 1.5 and 1.0 mg/l IAA and BAP respectively.

Keywords: *Regeneration, MS Media, Nodal explants, Growth Hormones*

RAFVAL:ES-2025/181

Biofilm formation genes assessment in ESBL-producing *E. coli* isolates procured from salad vegetables in Mirzapur district, Uttar Pradesh, India.

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The present study assessed the occurrence of ESBL-producing *E. coli* in raw salad vegetables collected from 32 retail vegetable shops of Mirzapur Uttar Pradesh, (n=224). Altogether, 276 cefotaxime-resistant *E. coli* isolates were recovered, of which, 99.27% (274/276) were observed to be phenotypically positive for ESBL production. Subsequently, all the phenotypically positive ESBL-producing *E. coli* isolates were subjected to determine their biofilm-producing ability by Congo red agar (CRA) assay and microtiter plate assay (MPA) followed by genotypic confirmation by PCR assay targeted at *fim-H*, *Sfa* and *papC* genes. Biofilm formation was evident by both CRA and MPA methods. The *fimH* gene was found to be the predominant genetic determinant of biofilm formation which was detected in 77% (211/274) of the tested isolates followed by Sfa gene (11.31%), and *papC* gene (4.01%). A significant difference ($p<0.05$) was evident between CRA and MPA methods as well as phenotypic and genotypic methods for detection of biofilm formation among the recovered isolates. In addition, significant differences ($p<0.05$) were also observed upon vegetable-wise comparison of ESBL-producing *E. coli* isolates and the presence of biofilm-producing genes. These findings suggested that, the raw salad vegetables sold in the retail market harboured a high magnitude of ESBL-producing *E. coli* with a biofilm forming potential. This is highly concerning from the public health point which requires an improved hygiene practices, awareness and regulatory measure at various stages of the supply chain.

Keywords: *ESBL-producing E. coli, Raw salad vegetables, Biofilm formation, Congo red agar assay, Microtitre plate assay.*

RAFVAL:ES-2025/182

Agricultural and Biomedical Significance of Rustican Pepper (Armoracia rusticana)

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Earth pepper (*Armoracia rusticana*), popularly known as horseradish, is a perennial plant with bitter roots, widely used for food and medicinal purposes. Scientific research confirmed its richness in active substances such as glucosinolates, isothiocyanates, and flavonoids. Chren is of global interest for its antibacterial, antioxidant, and anti-inflammatory properties.

Studies have revealed the antibacterial, anti-inflammatory, and antioxidant effects of horseradish root. Its use against gastrointestinal and respiratory infections, as well as its effect on diabetes and aging, is also being studied. Its use as a spice is widespread in the USA and European countries.

In Uzbekistan, Armoracia rusticana is cultivated on a small scale and primarily used in households as a traditional remedy and spice. However, comprehensive scientific studies on its chemical composition, ecological adaptation, and pharmacological properties within the local context remain limited. As interest in natural and plant-based medicines grows globally, investigating its potential within Uzbekistan's agro-climatic conditions is of increasing relevance.

Recent studies have mainly focused on the pharmacological effects of horseradish, especially its main active compounds (allyl isothiocyanate) and glucosinolates. However, the following aspects have not been sufficiently studied:

1. Genetic diversity and gene expression.
2. Interaction with endophytic microorganisms.
3. Pharmacokinetics and toxicological profile.
4. Anti-aging and neuroprotective properties.

Our research specifically aims to investigate the antibacterial properties of endophytic microorganisms found in Armoracia rusticana. These endophytes, which naturally reside within the plant, are believed to produce bioactive compounds that may significantly contribute to the plant's overall pharmacological profile. Exploring these endophytes can provide new insights into the development of treatments for bacterial infections.

This allows for in-depth research on these aspects, the development of new biomedical preparations, functional food products, and innovative medicines. Earth pepper (Armoracia rusticana) is a promising plant in modern medicine and agriculture due to its rich phytochemical composition and multifaceted pharmacological activity. Research conducted on insufficiently studied aspects will serve not only the development of new medicines and food products, but also the sustainable development of agriculture.

RAFVAL:ES-2025/183

Storage Methods Of Pigment-Producing Microorganisms

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This paper discusses microbiology, the vital activities of microorganisms, pigments and pigment-producing microorganisms, xenobiotics, actinomycetes, and colorant materials. It emphasizes the ecological and industrial significance of microbial pigments, their biodegradability, and their applications in various fields.

Keywords: *Microbiology, microorganisms, pigments, xenobiotics, actinomycetes, organic dyes, inorganic materials*

Optimization Of Indole-3-Acetic Acid Production By Microorganisms

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Indole-3-acetic acid (IAA) is a plant growth hormone that plays an important role in cell elongation, root development, and overall plant physiology. The growing demand for environmentally friendly and economically efficient production methods has increased interest in the microbial synthesis of IAA. Unlike chemical synthesis, microbial production is less harmful to the environment and reduces production costs. However, optimizing IAA synthesis via microorganisms remains a challenge, as factors such as bacterial strains, growth conditions, and substrate availability affect the outcome. This study focuses on increasing IAA yield by optimizing fermentation conditions, which is of significant importance for agriculture and biotechnology. Improving IAA production using microorganisms could lead to the development of biofertilizers, contributing to sustainable agriculture and reducing dependence on chemical agrochemicals.

Materials and Methods

The studies on the production of Indole-3-acetic acid (IAA) were based on previous scientific research. Various studies have isolated IAA-producing bacterial strains from rhizospheric soil and purified them using standard microbiological techniques. The production of IAA was evaluated in media supplemented with L-tryptophan in numerous studies. For example, 0.1% L-tryptophan was added to LB broth, and the culture was incubated at 30°C with a shaking speed of 150 rpm for 72 hours. The resulting IAA concentration was determined using the Salkowski reagent method, where the formation of a pink color indicates the presence of IAA. The absorbance was measured spectrophotometrically at 530 nm.

Results and Discussion

According to the results of various studies, IAA synthesis by bacterial strains is influenced by several factors, particularly growth medium, L-tryptophan concentration, incubation time, and temperature. For example, the *Azospirillum brasilense* strain, when incubated in a medium containing 0.1% L-tryptophan for 72 hours, produced a significant amount of IAA (Patten & Glick, 2002). Additionally, bacteria such as *Pseudomonas fluorescens* and *Bacillus subtilis* have also been reported to synthesize IAA in sufficient quantities to stimulate plant root systems as rhizobacteria. Some studies have indicated that the pH level and carbon source also influence IAA yield. These results emphasize the importance of carefully selecting bacterial strains and their growth conditions to optimize IAA production. Microbial IAA synthesis presents a promising approach for the development of environmentally friendly biofertilizers in agriculture.

RAFVAL:ES-2025/185

Determination Of Optimal Nutrient Media For Microcloning Of *Ginkgo Biloba L.*

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Abstract: Abstract: Ginkgo biloba, a tree belonging to the Ginkgoaceae family, produces bioactive compounds - flavonoids and phenols - known for their high antioxidant activity.

Introduction. Ginkgo (Ginkgo biloba L.), a dioecious, deciduous, gymnosperm tree belonging to the Ginkgoaceae family, is known in English as the "maidenhair tree". This plant is known worldwide for its high medicinal value and is considered one of the oldest living trees on Earth. The ginkgo plant contains a variety of bioactive phytomolecules, including amino acids, organic acids, polyphenols and terpenoids. The main phytoconstituents found in G. biloba leaves are flavonoids, flavonoid glycosides, phenolic acids and terpene trilactones (diterpene ginkgolides and sesquiterpene bilobalide). These components contribute significantly to the pharmacological effects of ginkgo extract.

Plant biotechnology approaches, particularly tissue culture techniques using callus, cell suspensions, and root cultures, offer a more attractive and efficient alternative to traditional cultivation methods. Such methods offer the potential to produce biologically active products from medicinal plants. These strategies allow for the rapid and easy processing of plant materials in large quantities, regardless of the season, under controlled and stable conditions, and reduce the dependence on field-grown mother plants. Providing optimal conditions for the production of pharmaceutical components of G. biloba through bioreactor systems, ensuring maximum production of bioactive metabolites, is an area of increasing scientific research. Research in this area focuses on studying how factors such as nutrients, chemical, physical, and biotic factors, as well as plant growth regulators (PGRs), affect the biosynthesis and accumulation of bioactive metabolites of G. biloba.

Conclusion. Flavonoids and phenols are known to be valuable bioactive compounds found in Ginkgo biloba leaves. These compounds demonstrate the effectiveness of in vitro cultures to improve the production of high-value compounds from rare and endangered plants. For the industrial production of Ginkgo biloba medicinal components, it is necessary to establish stable and promising in vitro cultures using tissue culture systems. Such systems allow for the stabilization of phytochemical production using appropriate elicitors. Studies have shown that flavonoids and phenols can be produced from G. biloba using chitosan elicitation, which will optimize the use of this endangered plant in Uzbekistan. Light irradiation is recognized as an important physical factor that stimulates cell growth and phytomolecule biosynthesis. It has been observed that the antioxidant activity of callus extracts grown under light exposure to chitosan increases, which expands their applications in the pharmaceutical and nutraceutical fields. However, in this study, unique active components such as ginkgolides and bilobalide were not investigated under chitosan elicitation. Future studies should take this point into account and further investigate the expression of genes regulating the biosynthetic pathways of ginkgolides, bilobalide, and flavonoids.

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Study of some valuable and economic characteristics of *Arachis Hypogaea* L. cultivars.

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Meeting the population's needs for food and oil products is one of the pressing problems that motivates our scientists to conduct extensive research today [1]. Taking this into account, today we can mention the peanut plant as a plant rich in protein, minerals, vitamins and oil. Peanut (Arachis hypogaea L.) is included in the list of legumes with high nutritional value and among the most important oilseed crops in terms of high-quality oil storage. Peanuts are among the valuable and high-quality oilseed crops, and their seeds are among the most consumed due to their high content of protein, easily digestible minerals, and essential amino acid substitutes necessary for the human body [2].

Based on the above information, research is being conducted to study the valuable economic characteristics of foreign and local varietal samples of the peanut (Arachis hypogaea L.) collection. The research was conducted at the Dormon Scientific and Experimental Station of the Institute of Genetics and Plant Breeding of the Academy of Sciences of the Republic of Uzbekistan. The experiment used 10 samples of varieties introduced from various foreign countries and 10 local samples in the laboratory "Laboratory of Genetics, Selection and Seed Production of Legumes, Oilseeds and Medicinal Plants". Samples studied: Local varieties such as Polvon (conditionally named), Qibray, Lider, Mumtaz, Salomat, 1-mahalliy, 2-mahalliy, 4-mahalliy, 6-mahalliy, 7-mahalliy were used, while samples of varieties introduced from abroad were: The following varieties were used: Uganda Errect (Uganda), Virginia Improved (Israel), Zac Trang (Vietnam), Philippine Pink (Portugal), Namuno (Portugal), R-30 (Israel), Var Cubo (Japan), Dessertnыy (Russia), PL#1 (India), and Hippagi 2-20 (India).

As a result of the conducted research, a large number of morphological characters of foreign and local varieties of peanut (Arachis hypogaea L.) were observed. Virginia Improved 7.20±0.20, Uganda Errect

6.60±0.10, Dessert 6.60±0.10, R-30 up to 5.60±0.10, 7th local variety in the sample 6.80±0.10, Leader 6.20±0.10, in terms of pod weight (with pod) on one plant with high economic value, PL# 79.9±3.80, R-30 77.1±2.60, Dessert 67.4±4.30, 2nd local 66.5±4.10, Leader 96.2±4.10, Polvon 101.3±2.90 grams. These variety samples will serve as a valuable initial source for the future creation of new varieties of peanuts with high economic value.

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Research Rationale And Experimental Framework For Studying Endophytes In *Pimpinella Anisum*

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The study of endophytic microorganisms within medicinal plants offers promising pathways toward sustainable agriculture and enhanced phytochemical production. *Pimpinella anisum*, widely recognized for its essential oils and pharmacological value, presents a unique model for endophyte-plant interaction research. This study aims to systematically isolate, identify, and functionally characterize bacterial and fungal endophytes inhabiting the roots of *P. anisum*, under varying cultivation conditions: field, greenhouse, and hydroponic systems.

Introduction

Endophytes are symbiotic microorganisms residing inside plant tissues without causing harm. They often promote plant growth, enhance resistance to biotic/abiotic stress, and contribute to secondary metabolite biosynthesis. The root microbiome is especially critical, influencing nutrient acquisition and plant immunity. Despite the increasing interest, endophyte studies in *Pimpinella anisum* remain scarce, thus underscoring the novelty and importance of this research.

Objectives

This thesis addresses four key research questions:

1. What bacterial and fungal endophytes colonize *Pimpinella anisum* roots?
2. How do these endophytes contribute to plant growth and defense?
3. Which cultivation conditions best support beneficial plant-microbe interactions?
4. Can isolated endophytes be developed into biofertilizers or biocontrol agents?

Experimental Design Overview

The research follows a two-phase strategy:

Microbiological Phase: Isolation, culturing, and molecular identification (via 16S rRNA and ITS sequencing) of endophytic microbes from sterilized root samples.

Cultivation Phase: Evaluating the influence of selected endophytes on plant physiology and essential oil yield under three growth systems.

Each cultivation setup involves treatment groups (control, bacterial, fungal, and mixed inoculation) replicated thrice for statistical robustness. Data collection spans plant growth metrics (height, biomass), physiological indicators (chlorophyll content, photosynthetic rate), and microbial community structure.

Expected Contribution

This thesis establishes a foundational framework for all subsequent investigations in the project. It hypothesizes that targeted endophytic inoculation will enhance *P. anisum* productivity and biochemical richness. Through integrative microbiological and agronomic approaches, it also aspires to uncover microbial solutions for eco-friendly cultivation practices.

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Isolation Of Endophytic Bacteria From Strawberry (Fragaria) Plant

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Relevance. Nowadays, one of the priority directions in the field of microbiology is the identification, isolation, and application of highly active microbial producers for use in the food industry, agriculture, and animal husbandry. Therefore, many microbiologists are conducting research in a relatively new direction - isolating endophytic microorganisms from internal plant tissues and intercellular fluids and studying their beneficial properties for the plant and its ecology. These properties are being applied in biotechnology. Accordingly, isolating valuable microbial producers from the strawberry plant that can be used in the food industry, agriculture, and livestock breeding, as well as for plant growth stimulation and control of plant pathogens, is of great importance.

Research objective. To isolate endophytic bacterial isolates from the strawberry (Fragaria) plant.

Materials and Methods: To isolate endophytic bacteria, healthy and undamaged parts of the strawberry plant (*Fragaria ananassa)*—including leaves, stems, flowers, and fruits were selected. The selected plant parts were first thoroughly washed with distilled water to remove soil particles and surface microbes.Next, surface sterilization was carried out using the following sequence to eliminate external microbial contamination: The samples were immersed in 70% ethanol for 60 seconds,Followed by immersion in 10% sodium hypochlorite solution for 3–5 minutes**,** then rinsed 3–5 times with sterile distilled water to remove any residual sterilizing agents. After surface sterilization, the plant materials were aseptically cut into small pieces using sterilized scissors and placed onto nutrient agar (NA) medium (in gr/l . Peptone – 5, Sodium chloride (NaCl)-5, Hm peptone – 1,5, Yeast extract – 1.5, Agar – 15, pH – 7.4 ± 0.2).

The inoculated Petri dishes were incubated aerobically at 25–28°C for 72 hours. After incubation, the grown colonies were selected as potential endophytic bacterial isolates for further identification.

Results and analysis. Two endophytic bacterial isolates were obtained from the fruits and four from the stems of the strawberry (Fragaria) plant. Sterilized fruits and stems of Fragaria were inoculated onto Petri dishes and incubated aerobically at 25-28°C for 72 hours. During incubation, bacterial colonies were visually monitored, and their preliminary morphological characteristics were recorded.

Keywords: *Strawberry (Fragaria), endophytic bacteria, nutrient agar (NA), incubation, producer.*

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Effects Of Physical Mutagens On The Fertility Of Soybean Samples Learning.

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It is known that mutational selection is an important and effective method for increasing the economic characteristics of agricultural crops, including the quality and quantity of yield. Geehan Mohsen (2023) and others have conducted studies on increasing the protein and oil content and yield of soybeans using this effective method [1]. Mudasir Hafiz Khan and Sunil Dutt Tyagi (2013) published a review article on induced mutagenesis in soybean. This article states that mutations detected by induced mutagenesis in soybean have been widely reported in the literature [2].

From the above data, it is clear that the experimental mutagenesis method is of great importance in creating new varieties of agricultural crops with positive characteristics. Based on this, we conducted scientific research to obtain mutant forms by treating seeds of some soybean varieties from the botanical and genetic collection (Nafis, Genetic-1, Selecta-302, Sochilams, Khotira, Gen-8, Gen-9, Gen-25, BK-6 and Kol-17) with Ɣ-gamma radiation doses of 50, 100, 200, 300 and 400 gray before planting.

The germination of M1 plants treated with different doses of Ɣ-gamma radiation before sowing was studied in comparison with the control and experimental variants. In the control version of the experiment, the number of germinated plants ranged from 75% to 97%. The highest rate was observed in the Genetic-1 variety, which amounted to 97%, while the lowest rate was observed in the Khotira variety, which amounted to 75%. 50 gr before planting seeds. in the dose-treated experimental variant, the number of germinated plants was slightly lower than the control variant and was found to be from 55% to 72%. In the variant treated with a dose of 100 Gy of gamma rays, the highest percentage of sprouted plants was observed in the Ekhtiyoj variety, which amounted to 58%. In the Collection-17 soybean sample, this indicator was 47%.

We can observe that fertility decreases as the treatment dose of physical mutagens increases. Under the influence of the dose of Ɣ-200 gray, the fertility of different varieties of soybeans was observed to decrease by up to 50% in some samples, while in some samples, the decrease of fertility was observed in low percentages. The highest reduction in germination in the studied soybean varieties was observed in the samples exposed to a dose of Ɣ-400 gray, with a reduction in germination of up to 67%. However, the fact that M1 plants retained their viability even at high doses of gamma radiation allowed us to isolate genotypes that could be used as a source for further research. Among such genotypes are the varieties Genetic-1 and Selecta-302.

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Comparative Study Of Chlorophyll In The Leaves Of Soybean Varieties.

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Chlorophyll in soybean leaves is an important pigment for plant life and plays a key role in photosynthesis. Due to the fact that chlorophylls play a large role in the growth and development of plants, as well as in the process of photosynthesis, it is important to have enough pigments. Based on this, a number of local and foreign scientists have conducted scientific research on soybean crops.

In our previous studies, the amount of chlorophyll in the leaves of several samples of soybean genetic collection (Gen-1 to Gen-20) at different stages of development was analyzed [1]. V.V. Kotlyarov and E.S. Bagryantsev (2013) studied the effect of exogenous amino acids on the photosynthetic activity of soybean plants [2].

The amount of chlorophyll a in the tillering phase of soybean plant development ranged from 1.643±0.41 mg/g to 1.998±0.56 mg/g. The highest value was observed in the Tomaris MAN-60 soybean variety, while the lowest value was observed in the Marjon soybean variety, which was 1.643±0.41. In other varieties studied, average indicators were noted. The amount of chlorophyll b was also analyzed at this stage of plant development. According to the results of the analysis, the amount of chlorophyll b ranged from 0.859±0.17 mg/g to 0.955±0.49 mg/g. The highest chlorophyll b content was observed in the Ehtiyozh soybean variety, which amounted to 0.955±0.49 mg/g. Among the varieties studied, the highest total chlorophyll (a+b) values were observed in the Tomaris MAN-60 (2.900 mg/g), Genetic-1 (2.864 mg/g), and Khosildor (2.842 mg/g) soybean varieties. The amount of carotenoids in the combing phase of soybean varieties was also analyzed. We know from the literature that carotenoids are important pigments for plants, which play an important role in the photosynthesis process and in protecting cells. In addition, carotenoids have been found to protect cells from oxidative stress, neutralize free radicals, and increase the plant's resistance to stress. In our studies, the amount of carotenoids in soybeans at the stage of ripening ranged from 0.141±0.034 mg/g to 0.257±0.121 mg/g. The high index of this physiological sign was observed in the Genetic-1 soybean variety and was found to be 0.257±0.121 mg/g. This result suggests that Genetic-1 soybean variety is more resistant to various stresses than other varieties. In addition to these, the Genetic-1 variety of soybean is suitable for early, repeated cropping and photoneutrality, which allows cultivation in different regions of the Republic.

Thus, the amount of chlorophyll a and b, total chlorophyll (a+b), and carotenoids in the leaves of soybean varieties used for research at different stages of development was analyzed in field experiments. According to the results of the analysis, it was found that the amount of photosynthetic pigments in the studied soybean varieties varies at different phases.

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RAFVAL:ES-2025/191

Beneficial Properties of Chlorella Algae

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This thesis focuses on the biological activity, health benefits, and biotechnological applications of chlorella algae. Chlorella is a unicellular green microalga rich in proteins, chlorophyll, vitamins, and minerals, which are essential for human health. The study confirms its detoxifying, antioxidant, immune-boosting, and anti-inflammatory properties.

Introduction

Chlorella is a type of unicellular green algae known for its high biological activity and rich nutritional content, including proteins, chlorophyll, vitamins, and minerals. In the field of biotechnology, chlorella is widely utilized as a dietary supplement, pharmaceutical ingredient, and a natural agent for environmental purification.

Research Methods

The research involved a comprehensive review of scientific literature, analysis of chlorella's nutritional composition, and evaluation of its biological activities. Laboratory experiments were conducted to measure the bioactivity parameters of chlorella under controlled conditions.

Research Results

The study demonstrated that chlorella effectively detoxifies the human body, strengthens the immune system, and exhibits anti-inflammatory effects. Additionally, its applications in environmental purification and biofuel production were scientifically validated, highlighting its multifunctional potential in modern biotechnology

Keywords: *Chlorella, algae, biotechnology, chlorophyll, bioactive compounds.*

RAFVAL:ES-2025/192

Airborne Transmission & Antimicrobial Resistance Genes of *E. coli* in Zoos of Chhattisgarh

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This study aimed to isolate and characterize *Escherichia coli* from air and dust samples collected from three zoos in Chhattisgarh: Maitri Bagh Zoo (MBZ), Kanan Pendari Zoo (KPZ), and Nandan Van Zoo and Jungle Safari (NVZ). A total of 180 samples were processed using MacConkey Lactose agar, Eosin Methylene Blue agar, and biochemical tests, resulting in 102 presumptive *E. coli* isolates. Molecular confirmation via PCR targeting the 16S rRNA gene verified all isolates as *E. coli*. Antibiotic susceptibility testing was performed against 14 commonly used antibiotics. Aztreonam showed the highest efficacy (100% sensitivity), followed by imipenem (96.07%). The highest resistance was observed against amoxyclav (93.13%) and tetracycline (83.30%). Resistance patterns varied by location: MBZ showed 97.56% resistance to amoxyclav; KPZ and NVZ displayed 88.23% and 92.59% resistance to tetracycline and amoxyclav, respectively. Moderate sensitivity to cefoxitin was noted in KPZ (26.47%) and NVZ (25.92%). Phenotypic screening revealed that 35.29% (36/102) of isolates were extended-spectrum beta-lactamase (ESBL) producers. Prevalence rates of ESBL-producing *E. coli* were 29.26% in MBZ, 32.35% in KPZ, and 48.14% in NVZ. Molecular characterization identified ESBL genes in 22.54% (23/102) of isolates. Among these, 3.92% harboured both bla_{TEM} and $bla_{\mathrm{CTX\text{-}M}}$, 0.98% carried bla_{TEM} and bla_{SHV}, and 1.96% harboured all three bla_{TEM}, $bla_{\mathrm{CTX\text{-}M}}$ and bla_{SHV} gene. Zoo-wise, ESBL gene presence was observed in 24.39% of MBZ isolates, 23.52% of KPZ isolates, and 18.51% of NVZ isolates. Overall, the findings reveal a notable presence of multidrug-resistant and ESBL-producing *E. coli* in environmental samples from all three zoos. These results underscore the potential of zoos as reservoirs for antimicrobial-resistant bacteria and highlight the urgent need for enhanced biosecurity measures and judicious antibiotic usage to curb the spread of resistance among wildlife and human populations.

RAFVAL:ES-2025/193

Assess the Impact of Kisan Credit Card Scheme on Crop Productivity and Income of the Sample Farmers in Deoria District of Uttar Pradesh

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Kishan Credit Card (KCC) is one the many innovative products designed by NABARD with an objective to enable farmers to meet their credit requirements, preferably production credit ,from financial institutions in a timely an hassle - free manner. The KCC scheme which was introduced in14th August 1998. The present study deals with assess the impact of kisan credit card scheme on crop productivity and income of the sample farmers in Baitalpur block in Deoria district was selected purposively. 3 villages were selected on the basis of the important crops grown in the study area under Wheat and Rice cultivation. The present investigation is a comparative study between KCC holders and non-KCC holders. Therefore, two types of respondents were required.30 KCC and 30 non- KCC. In study area selection of respondents is done by random sampling method. The results show that the Overall Gross income of paddy per hectare was Rs.117784.16 in KCC beneficiaries and Rs. 104580.09 in non KCC beneficiaries per hectare. Net income was Rs.52028.23 in KCC beneficiaries and Rs.42741.66 in non KCC beneficiaries per hectare. Overall Gross income of wheat per hectare was Rs.82920.79 in KCC beneficiaries more compared to Rs.77409.10 in non KCC beneficiaries per hectare.Net income was Rs.29070.58 in KCC beneficiaries more compared to Rs. 25688.13 in non KCC beneficiaries per hectare. Impact of the KCC scheme on production, productivity and income increased under all the categories after availing credit under KCC scheme. It can also be seen that productivity of the paddy and wheat crop was found increased with increase in farm size. The overall, gross returns, net returns of paddy and wheat crops was higher in KCC beneficiary compared to non-KCC beneficiary farmers.

Keywords: *Wheat and Rice, Kisan Credit Card, Gross Income, Net Income and Productivity.*

RAFVAL:ES-2025/194

Zero budget natural farming: A boon in Integrated Pest Management in Cucurbits

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In recent past injudicious application of pesticides have posed an adverse impact on the environment. Chemical dependence to manage insect pests have resulted in problems such as pest resurgence, secondary pest outbreak, pesticide resistance and ultimately affected the well- being of human beings. To combat the ill impacts, the need of the hour is to utilize long term conservation of natural resources. Zero budget natural farming (ZBNF) is an agricultural farming model that aims to promote sustainable and organic farming practices. It is one of the emerging practices which minimizes the impacts of conventional resource-exhaustive and energy-intensive agriculture. The utilization of such conservational technologies not only manages the pest population at low levels but also promotes the diversity of various fauna and flora which assist in insect pest management. The adoption of ZBNF and Integrated Pest Management in pest management systems can lead to income diversification and crop intensification with minimal external input to develop sustainable opportunities for small holder farmer. IPM is an ecosystem based strategy through incorporation of biological control, habitat manipulation, modification of cultural practices and use of resistant varieties. However, recent developments in various pest management programmes such as precision agriculture, bio-intensive IPM, use of different biotechnological tools can manage the pest population in various crop - ecosystem. Hence the losses occurred due to pest attack can be reduced to a larger extent by combining various technologies in pest management.

Keywords: *Pest, IPM, Precision Farming, Zero budget Natural Farming*

Bridging the Gap: Gender Empowerment, Youth Involvement, and the Future of Community Extension

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Gender empowerment and youth involvement in agriculture are essential for achieving sustainable food systems, poverty reduction, and rural development. However, both women and youth often face systemic challenges—such as limited access to land, credit, and training—that hinder their full participation in agricultural activities. Extension services, which serve as a bridge between research institutions and farming communities, play a critical role in addressing these disparities. By promoting inclusive and participatory approaches, extension systems can empower women and youth with the knowledge, skills, and resources needed to thrive in the sector. Research explores the intersection of gender empowerment, youth engagement, and community extension, emphasizing the need for reform in extension services to ensure inclusivity and relevance. Traditional extension models have largely focused on male-dominated farmer groups, often overlooking the unique needs and contributions of women and young people.

However, gender-responsive and youth-friendly extension services—characterized by participatory methods, ICT integration, and decentralized delivery—have shown promise in enhancing access, adoption of innovation, and productivity among these groups, when extension programs are intentionally designed to include women and youth, they not only improve agricultural outcomes but also foster leadership, entrepreneurship, and social equity. Empowering gender and youth through responsive extension systems is not only a pathway to improved livelihoods but also a strategic imperative for transforming agriculture into a more inclusive, dynamic, and sustainable sector.

Keywords: *Community Extension, Gender Empowerment, ICT, Training, Youth Involvement*

RAFVAL:ES-2025/196

Genetic Advances And Innovations For Climate-Smart Maize Breeding

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Maize is a globally important cereal crop for food and livelihood security. In recent years, it remains highly sensitive to climate-induced stresses such as drought, heat and erratic rainfall. Breeding climate-smart maize has thus become an imperative task. Recent innovations have transformed maize improvement through both conventional and molecular approaches. Notably, genomic selection (GS) and marker-assisted selection (MAS) have accelerated trait introgression and selection efficiency for complex traits such as drought tolerance and yield stability. Gene-editing tools like CRISPR-Cas9 offer targeted modification for resilience traits. Doubled haploid (DH) technology is reducing breeding cycles, while high-throughput phenotyping (HTP) enables precise screening of physiological traits under field stress. Genome-wide association studies (GWAS) and the use of landraces and wild relatives are broadening the genetic base, especially for traits like root architecture and nutrient efficiency. Multi-omics tools like transcriptomics, metabolomics and epigenomics are unraveling key regulatory pathways for stress adaptation. Furthermore, climate-resilient gene identification and stacking through QTG and RNA Seq and participatory breeding ensure field-level relevance. Together, these advancements mark a paradigm shift in maize breeding, aligning genetic potential with climate resilience goals. Thus, integrated and efficient employment of all these strategies can play a significant role in enhancing genetic gain, environmental adaptability and sustainable maize production systems.

Keywords: *Maize, Climate resilience, Genetic improvement, Genomic tools, Abiotic stress tolerance*

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Reviving Indigenous Wisdom for Strengthening Climate-Resilient Agroecosystems

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Climate change continues to perform profound impacts on agriculture, food security and rural livelihood, especially in areas sensitive to the world's climate. According to IPCC (2023), the overall surface temperature has increased by about 1.1° C from the pre-industrial period, strengthened harsh weather events and stabilized agricultural ecosystems. Traditional knowledge systems that accumulate ecological knowledge agencies based on this place have developed in generations that provide invaluable resources for climate recovery. Experimental studies show that indigenous agricultural activities, such as rainwater harvesting, sacred forests improving local biodiversity from 20 to 30% and multi-cropping systems to improve food safety of households by 25%. The integration of traditional knowledge into modern scientific methods helps improve adaptability, reduce damage and promote adaptation based on the ecosystem. The assessments of participation in vulnerability and the map of indigenous knowledge based on GIS have proven the improvement from 30 to 40% of adaptive results when traditional and scientific knowledge systems are combined. This paper underscores the need for climate-resilient agricultural frameworks that institutionalize traditional knowledge, supported by policy reforms recognizing indigenous rights and local governance systems. Leveraging traditional knowledge within modern climate action offers a culturally sensitive, scientifically validated and environmentally sustainable pathway for achieving livelihood security in the face of climatic uncertainties.

Keywords: *Climate Change, Traditional Knowledge, Climate Adaptation and Food Security*

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Regeneration techniques for enhancement of seed germination, seedling vigour and production of quality planting materials for conservation of LKT species *Bauhinia malabarica* Roxb.

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A small to moderate sized deciduous, Lesser Known and Threatened tree (LKT) species, *Bauhinia malabarica* Roxb. is belonging to Fabaceae family. The wood of *B. malabarica* is largely used as a fuel whereas leaves are used as fodder and rated as a good fodder. Parts of tree are used as traditional medicines for curing various diseases *viz*. young shoots is being commonly prescribed to treat cough, gout, glandular swellings and goiter, hemorrhage, leprosy, menorrhagia, scrofula, urinary disorders, wasting diseases, worm infestations and wounds, for liver disorders. Leaves are good source of calcium and iron. Decoction of this plant root bark used for liver problems. Root and stem of this plant used for the treatment of cholera would heal diuretic and dysentery. Seed coat of this tree species is very hard, easily does not germinate in natural habitats and hardly germinate up to 2-3 per cent without any treatment. Furthermore, the seedling growth in initial stage is slow. Thus, the present experiment was conducted to standardize the regeneration technique by adopting presowing treatments on seed germination and further early seedling vigour in *B. malabarica.* For the trial, Completely Randomized Design with four repetitions and six different presowing treatments *viz.*, soaking of seeds in hot water for 24 hrs, soaking of seeds in conc. H_2SO_4 for 30 minutes, soaking of seeds in conc. H_2SO_4 for 60 minutes, soaking of seeds in conc. H_2SO_4 for 90 minutes, soaking of seeds in conc. H_2SO_4 for 120 minutes and soaking of seeds in cow dung slurry for 24 hrs were adopted for assessment of seed germination whereas for seedling growth and vigour study, due to very low germination in soaking of seeds in cow dung slurry for 24 hrs was not considered. For germination trial, treated seeds (100 seeds/ treatment/ repetition) were sown in the tray containing soil: sand: farm yard manure (2:1:1 ratio) and after 30 days of sowing, seedlings were transferred into polythene bags having same media of

germination for growth and vigour study. Results showed that significantly maximum germination, mean daily germination, germination value and germination rate index recorded in soaking of seeds in conc. H_2SO_4 for 60 minutes treatment. However, maximum peak value of germination was recorded in soaking of seeds in conc. H_2SO_4 for 90 minutes whereas minimum mean germination time was recorded in soaking of seeds in conc. H_2SO_4 for 30 minutes. The growth and vigour parameters of *B. malabarica* seedlings at 180 days after transplanting showed maximum shoot height, collar diameter, total fresh weight of plant, total dry weight of plant, total leaf area and seedling quality index in soaking of seeds in conc. H_2SO_4 for 60 minutes treatment. However, maximum root: shoot ratio noticed in soaking of seeds in conc. H_2SO_4 for 120 minutes and minimum sturdiness quotient (4.410) recorded in soaking of seeds in hot water for 24 hrs. Overall result showed that soaking of seeds in conc. H_2SO_4 for 60 minutes was found best treatment for seed germination as well as seedling growth and vigour of *B. malabarica.*

Keywords*: Bauhinia malabarica, conservation, regeneration technique, seed treatment, seedling vigour*

RAFVAL:ES-2025/199

Effect of Vitamin C on Arsenic Induced Oxidative Stress in Buffalo Erythrocytes *In Vitro*

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Exposure to arsenic, a highly toxic trace metalloid causes disturbances in cellular redox status leading to serious health hazards in dairy animals including buffaloes, subsequently affecting human through consumption of milk. Exposure of buffalo erythrocytes to varying concentration of sodium arsenite (0.01-0.5µg for 2hrs.) decreased the activities of superoxide dismutase, catalase, glutathione peroxidase; and increased the malondialdehyde generation and fragility of erythrocytes in a concentration dependent manner compared to the corresponding controls. Vitamin C treatment @10mg/ml to sodium arsenite (0.5µg) challenged buffalo erythrocytes *in vitro* for 2hrs. effectively modulated the oxidative stress as evidenced from the improved membrane lipid peroxidation, erythrocytic fragility and enhanced activities of superoxide dismutase, catalase and glutathione peroxidase compared to the corresponding controls which can be attributed to the antioxidant characteristics of Vitamin C against arsenic. This study demonstrated that acute exposure of sodium arsenite, trivalent arsenic to the buffalo erythrocytes produces oxidative stress through enhanced membrane lipid peroxidation and depletion of intracellular enzymatic antioxidant defense, which was modulated by vitamin C.

Keywords: *Arsenic, Oxidative stress, Buffalo erythrocytes, Vitamin C*

RAFVAL:ES-2025/200

Unlocking the Nutritional Potential of Onion Leaves: Impact of Sowing Dates on Bioactive Compounds

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Allium cepa L., commonly known as onion, is a primary species within the Allium genus of the monocotyledonous family Alliaceae. The edible part of an onion is the bulb, consisting of fleshy, enlarged leaf bases or scales. As the bulb develops, the outer leaf bases dry out and become scaly, while the inner leaves thicken. During vegetative growth, the stem remains small and inconspicuous. However, after exposure to temperatures below 10°C (vernalization), the stem rapidly elongates, producing seed-bearing umbels. Onions are rich in calories, vitamin C and minerals. Quercetin, a powerful antioxidant, is also present. They possess medicinal properties, helping prevent and treat heart disease, cancer and asthma. The volatile compound, Allyl-propyl disulphide lowers blood sugar, while raw onions boost HDL cholesterol and blood- clot dissolving activity. However, heat destroys sulfur compounds and cooked onions lose blood-thinning properties. Onion green leaves are harvested and sold in local markets, offering farmers an extra income source. These leaves are nutritionally similar to onion bulbs, enhancing their value. To determine the onion bulb and leaf nutritional quality through year- round cultivation, including kharif and late kharif seasons. A study was conducted at Bhawanipatna (2023) to optimize late

Kharif onion sowing dates. Using a RBD with four replications, five sowing dates (15th June to 15th August, at 15-day intervals) were tested for growth and quality of onion leaves and bulbs. The onion cultivar Bhima Dark Red performed best all parameter, when sown on 15th August, outperforming other dates and confirming its potential for successful late Kharif production. The 15th June sown crop had 38.81% mortality and 61.19% survival, while the 15th August sown crop had 14.50% mortality and 85.50% survival, showing better survivability. The August-sown onion crop showed significant growth improvements, including increased, the plant height (51.2cm), leaves plant-1(6.18), leaf length (42.5cm), leaf diameter (0.68cm), LFW (3.05g) and DLW (0.30g) at 60 DAP. The August-sown crop showed improved yield attributes, with TBY 12.29 kg/plot, MBY 10.63 kg/plot and lowest UMBY (1.44 kg/plot). However, the early sown crop had higher ascorbic acid content in leaves (25.19 mg/100g) and protein content (5.40%). Notably, the late sown crop had a more desirable lower TSS: acidity ratio (17.17).

Key words: *Sowing dates, Kharif onion and Nutritional quality attributes.*

RAFVAL:ES-2025/201

Isolation of Zn solubilizing bacteria and development of consortium based Zn biofertilizer to enhance grain Zn and protein content in wheat in combination with ZnO nanoparticles

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Zinc (Zn) malnutrition, also known as “hidden hunger,” affects over two billion people worldwide. Inadequate dietary intake, poor bioavailability, and associated health risks necessitate sustainable and cost-effective strategies to combat Zn deficiency. Zn biofortification of staple crops through agronomic approaches is a widely accepted and feasible solution with broad outreach potential. In this study, 1075 isolates were screened for Zn solubilization, among them 280 isolates were found to effectively solubilize Zn on basal agar medium containing Zn oxide (ZnO). The Zn-biofertilizer was prepared using strains of *Streptomyces venezuelae, Streptomyces laurentii, Streptomyces fimbriatus,* and *Pseudomonas* sp. having Zn solubilization efficiency (ZSE) of more than 200%, and plant growth promoting (PGP) traits such as siderophore production, organic acids production, and additional traits like stress tolerance, antifungal activity, and ability to colonize root. Along with biofertilizer, we have used ZnO nanoparticles (ZnO-NPs) (5 mg/kg) as nano-fertilizer; it is functionalized with alizarin red S dye. This dye helps in visualizing the passage and accumulation of nanoparticles in wheat plant tissues. The application of biofertilizer in combination with ZnO (*Zn_nano_biof)* shows the significant increase in total length, photosynthetic pigments, and grain protein content was observed compared to control. The AAS analysis found that *Zn_nano_biof* treatment, show 87.1% increase in zinc content in the wheat grains compared to control. The SEM-EDX also confirms the maximum Zn of about 1.39% in *Zn_nano_biof*. This strategy can be used in Zn deficient alkaline soil and supports the Sustainable Development Goal 2 (SDG2) of United Nations. Large-scale distribution of this biofertilizer among farmers is recommended to address Zn deficiency.

Keywords: *ZSB, Micronutrient**,** Malnutrition, PGP traits, Zinc deficiency, Biofertilizer, Biofortification, ZnO nanoparticles, wheat*

RAFVAL:ES-2025/202

Biochemical and Growth Responses of Plants Under Different Bioagents and Organic Treatment

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This study evaluates the impact of various organic and microbial treatments on plant biochemical and growth parameters at two intervals: 0 and 60 days after transplanting. Treatments included untreated and inoculated controls, vermicompost (VC) and neem cake (NC) at 200g, and their combinations with microbial consortia (T3+T14 and T3+T17). Key parameters analyzed were Total Phenolic Content (TPC), Total Soluble Protein (TSP), Total Soluble Sugars (TSS), and the activities of enzymes including Phenylalanine Ammonia Lyase (PAL), Tyrosine Ammonia Lyase (TAL), Catalase (CAT), Peroxidase (POX), Superoxide Dismutase (SOD), Glutathione Peroxidase (GTP), and Glutathione Reductase (GTR). Results demonstrated that combined applications of composts with microbial inoculants significantly enhanced biochemical and enzymatic responses compared to controls. Notably, NC T3+T14 showed the highest values for most parameters. TPC reached 204.00 under NC T3+T14, compared to 189.00 in the control, while TSP peaked at 10.670. TSS also improved, with NC T3+T14 recording 1.451 over the control's 1.298. Enzymatic activities followed a similar trend: PAL activity increased to 0.358 (control: 0.267), and CAT reached 0.823 (control: 0.158), indicating enhanced stress defense mechanisms. SOD and GTP activities under NC T3+T14 were also notably elevated, peaking at 2.123 and 0.672, respectively. These findings underscore the synergistic benefits of integrating microbial consortia with organic amendments, especially neem and vermicompost. Such combinations effectively promote plant physiological resilience, suggesting a viable, sustainable approach for improving crop productivity and stress tolerance through enhanced biochemical and antioxidant profiles.

Keywords: *biochemical, plant, growth, antioxidant, physiological*

Cutting edge Techniques in Agriculture and its Potential in Soil microbes

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Cutting-edge agriculture technology, known as AgriTech, is revolutionizing the agricultural industry by integrating innovative solutions to address pressing challenges in food production, resource optimization, and sustainability. The adoption of precision farming techniques, such as data analytics, IoT devices, and remote sensing, enables farmers to optimize resource allocation, improve crop yields, and reduce environmental impact (Ahmad *et al.,* 2021). Advanced technologies like vertical farming, hydroponics, and robotics maximize productivity while conserving land, water, and energy. Biotechnology and genetic engineering offer opportunities to develop crops with enhanced traits, promoting resilience to pests, diseases, and climate change. The cutting-edge agriculture technology holds immense promise for transforming farming practices and achieving a sustainable future. The future agricultural environment may physically change as a result of the new technology. Both on a small-scale and large scale, emerging technologies, ranging from robots to machine language, have totally changed modern agriculture. They'll advance agriculture to entirely new levels (Achilles *et al.,* 2020).

The study of the whole of the genetic material contained within the microbial populations found in a certain environment is made possible by metagenomics. This technique enables a thorough knowledge of the variety, function, and interactions of microbial communities that are notoriously difficult to research. Due to the limitations of conventional techniques such as culturing and PCR-based methodologies, soil microbiology is a particularly challenging field. Metagenomics has emerged as an effective technique for overcoming these obstacles and shedding light on the dynamic nature of the microbial communities in soil (Riesenfeld *et al.,* 2004). The effectiveness of target-based metagenomics in determining the function of individual genes and microorganisms in soil ecosystems is also highlighted. Targeted metagenomics, including high-throughput sequencing and stable-isotope probing, is essential for studying microbial taxa and genes in complex ecosystems. Shotgun metagenomics may reveal the diversity of soil bacteria, composition, and function impacted by land use and soil management (Suenaga, 2012).

Keywords: *Cutting-edge agriculture technology, metagenomics, vertical farming.*

RAFVAL:ES-2025/204

Effect Of Different Substrates And Seed Treatments (Ga_3 And Kno_3) On Germination Of *Solanum Torvum* When Soaked At Different Time Intervals

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Solanum torvum is used as a rootstock for tomato as well as brinjal in vegetable grafting. Grafted plants are very vigorous and tolerate diseases affecting the root system, thus allowing the crop to continue for a second year. But the seeds didn‘t germinate uniformly and studies on improvement of germination are very meagre and scanty. In view of this a lab experiment was conducted at SKLTGHU, COH, Rajendranagar, Hyderabad with the aim of improving the germination. Seeds of *Solanum torvum* collected from COE, Jeedimetla formed the base material for this study. The experiment was carried out with two replications in three Factorial Completely Randomised Design (FCRD) during 2019-20. The Seed treatment with GA3 @ 2000 ppm with Blotter paper for 24 hours and Hand Scrubbing followed by GA3 @ 2000 ppm with Blotter paper for 24 hours showed best results in terms of germination per centage *i.e.* (100%). How ever the results are on par with Hand Scrubbing followed by GA3 @ 2000 ppm with Vermicompost for 24 hours (99.50%), Hand Scrubbing followed by GA3 @ 2000 ppm with Blotter paper for 36 hours (99.50%), GA3 @ 2000 ppm with Vermicompost for 24 hours (99.50%), GA3 @ 2000 ppm with Blotter paper for 36 hours (99.50%) and Hand Scrubbing followed by GA3 @ 2000 ppm with Vermicompost for 36 hours (98.50%) combinations were followed to get uniform seed germination.

Keywords: *Solanum torvum, seed germination, seed treatment, germination per centage*

RAFVAL:ES-2025/205

Effect of antioxidant enriched *Aloe vera* gel based edible coatings and Low Density Polyethylene on quality characteristics of Ber (*Ziziphus mauritiana* Lamk.) cv. Umran

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Indian jujube (*Ziziphus mauritiana* Lamk.), commonly known as ber, is a popular fruit consumed primarily in its fresh form and is especially significant in arid regions. Often referred to as the poor man's apple due to its rich nutritional value. Freshly harvested ber fruits were treated with *Aloe vera* gel (AVG) coatings enriched with natural antioxidants such as ascorbic acid and citric acid, followed by packaging in LDPE bags. The fruits were analyzed at regular intervals for physiological loss in weight (PLW), firmness, total soluble solids (TSS), titratable acidity, ascorbic acid content, over a 16 days storage period. Results demonstrated that fruits coated with antioxidant-enriched *Aloe vera* gel with 1% ascorbic acid and packed in LDPE exhibited significantly lower PLW and maintained higher firmness compared to untreated control fruits. This treatment also effectively delayed the increase in TSS and decline in titratable acidity and ascorbic acid content, thereby preserving the nutritional quality of the fruit. Among the treatments, AVG enriched with 1% ascorbic acid with LDPE packaging showed the best performance in maintaining overall fruit quality and shelf life of the ber fruit. This combination effectively extended the shelf life of ber fruits up to 16 days under ambient conditions. The study concludes that antioxidant enriched *Aloe vera* gel coatings, particularly when used alongside LDPE packaging offer a promising, eco-friendly strategy to enhance the postharvest life and marketability of ber fruits. This integrated approach can serve as a sustainable alternative to synthetic preservatives in the fresh fruit industry.

***Keywords**: Aloe vera gel, LDPE packaging, postharvest quality, shelf life, edible coating ascorbic acid.*

RAFVAL:ES-2025/206

Herbal Medicine Used To Improve Fertility In Male Animals

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Reproductive ability of male animals is impacted by different components such as neurohormonal impabalne, reproductive organ tissue changes, seminal properties, libido, sexual behavior, environment, genotype which may result imperfect spermatogenesis. It is more often than not said that male is the half the group. Inspite of recognizing the part of male in making the breed, male infertility has gotten lesser consideration. The spermatogenesis is a exceedingly complex synchronized process. In later period of restorative treatment, different drugs are accessible to treat the male infertility cases; be that as it may, analysts are giving more accentuation on conventional medication which having less unfavorable impacts and toxicity. Many researcher studied on medicinal plants viz. Citrullus vulgaris or watermelon (seed extract), Cinnamomum zeylanicumon, Cardiospermum halicacabum (balloon vine), Chlorophytum borivilianum (Safed Musli), Asparagus racemosus (Shatavari), Danae racemose, Eurycoma longifolia, Mucuna pruriens, Nigella sativa, Ocimum basilicum, Phaleria macrocarpa, Phoenix dactylifera L., Phyllanthus emblica (Amla), Piper longum (Pippali), Punica granatum, Sida cordifolia (Bala), Turnera diffusa (Damiana), Zingiber officinale and had found its positive effect to improve male fertility as per its property. Alpinia galanga plant extract had a direct affect on the testes that help to amplify the number of spermatozoa and the increased the level of testosterone production. Apium graveolens (Celery) contains phytoestrogens, it can increase in the number of sperms, sertoli cells, primary spermatocyte and also increased spermatogenesis. Aloe vera increased the number of stem cells and primary spermatocytes by preventing apoptosis of germinal cells, enhancing cell division and stimulating the leydig cells to increase testosterone production.

RAFVAL:ES-2025/207

Short-term forecasting of Ginger price in Kalimpong district of West Bengal

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Kalimpong is one of the major high-quality ginger-producing districts in West Bengal. Together with the state of Sikkim, it contributes approximately 15% of India's total ginger production. Ginger prices in Kalimpong fluctuate based on supply, demand, and transportation factors. This study aims to create a short-term forecast of the weekly price (Rs./Quintal) in Kalimpong district. The data was modelled using three techniques, namely-Autoregressive Integrated Moving Average (ARIMA), Time Delay Neural Network (TDNN) and the hybrid ARIMA-TDNN models. The ARIMA model is a traditional statistical model, while the TDNN is a modern machine learning model, and the hybrid ARIMA TDNN is a combination of the two, where the TDNN model is built on the residuals of the ARIMA model. Weekly data from August 2023 to March 2025 was taken for this study. The model was built on 80% training data and validated with 20 % testing data. Following standard model building architecture, ARIMA (0,1,1), TDNN (3,3), and ARIMA(0,1,1)-TDNN(2,1) were identified as good fit models. These models were evaluated to find the best fit based on the lowest values of RMSE, MAPE and MAE. Results reveal that the hybrid ARIMA-TDNN was the best fitted model among the three Short-term forecasts for the next five weeks are generated i.e., from April 2025 to 1st week of May 2025, which is an off-season period for ginger crop. Forecast values do not show any evident change and suggest that prices are more likely to remain the same.

Keywords: *ginger price, ARIMA, TDNN, ARIMA-TDNN hybrid*

RAFVAL:ES-2025/208

Title: "Development of Litchi-based *Yoghurt* Enriched with Sweet Potato by using Response Surface Methodology"

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About 10-14% of the total annual milk production is being used for fermented dairy products. *Yoghurt* is one of the most widely consumed fermented dairy products globally and is acidified by the addition of a starter culture containing fermenting bacteria such as *Streptococcus thermophiles* and *Lactobacillus delbrueckii ssp. bulgaricus.* The present study is focused on the development of litchi-based *yoghurt* enriched with sweet potato powder (LBYSPP) using response surface methodology (RSM). The sweet potato is used due to its nutraceutical importance, thickening, gelling and bulking properties and litchi juice is used to improve the nutritional value and palatability of the final product. In this study, the Central Composite Rotatable Design (CCRD) of the RSM technique was employed to optimise the level of process variables of litchi juice, sweet potato powder (SPP) and sugar (at a constant rate of 6% by weight/volume of milk in each treatment combination), based on sensory evaluation, physico-chemical and textural & rheological characteristics of LBYSPP. The sensory characteristics (flavour, body & texture, colour & appearance, and overall acceptability) were evaluated and compared with the control sample. The results reveal that milk having 3.0% fat level, 15% litchi juice and 6.14% SPP having the highest desirability (0.963), hence selected as the optimized solution. Hence, it was confirmed that the selected addition level is most suitable for preparing a sensorially-acceptable product with optimum sensory attributes.

Keywords: *Litchi juice, sweet potato powder (SPP), Litchi-based yoghurt, sensory attributes, RSM, CCRD*

RAFVAL:ES-2025/209

Assessment and mitigation of natural regeneration potential of *Butea monosperma* (Lam.) in dominated forest sites of the Malwa plateau region of the India

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Enumeration of natural regeneration status of forest is an authentic tool to know the actual condition of forest ecosystem. Four dominated forest sites of palash viz., Bagdar, Equawasa, Poli and Baser of the Malwa plateau region of India were selected for the study during October 2023 to May 2024. Twenty quadrates of 2 x 2 m were laid out from each dominated forest sites using stratified random sampling method. The pattern of natural regeneration (recruits, unestablished and established individual/ha) of forest sites was recorded 11125,1250 & 1375 in Equawasa followed by 8875,750 & 1125 in Bagdar, 7375,500 &750 in Poli and 5000,375 & 625 in Baser. However, the Baser and Poli forest sites fail to convert its recruits into unestablished and established individuals/ha due to poor soil depth and posed threat of uncontrolled grazing of animals. The highest percent of establishment stocking (59.01) and regeneration success (67.50) was found in Equawasa forest site due to higher un-established individuals, protection and topographical features than other forest sites under the study. The study suggests that artificial regeneration of this species could be promoted in nurseries and use of biotechnological interventions specially tissue culture technique to produce healthy planting material on a large scale. Besides in-situ conservation and management, large-scale afforestation with the participation of local communities in protected forest areas, particularly in religious forests, is necessary.

Keywords: *Establishment stocking, Forest ecosystem, Palash, Regeneration success and Stocking index*

RAFVAL:ES-2025/210

Impact of Phytobiotics and Organic Acids on the Broiler's Performance

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Excessive use of antibiotics in broiler production has significantly contributed to the emergence of antimicrobial-resistant bacteria, raising major concerns for both animal and public health. Research has demonstrated that antibiotic use in poultry plays a pivotal role in escalating the global challenge of antimicrobial resistance. Therefore, this study was planned to evaluate the impact of phytobiotics, both individually and in combination with organic acids, on the growth performance of broilers. A total of 300-day-old Vencobb chicks were randomly divided into six groups: NC (control), PC (antibiotics), PH-1 (1% phytobiotic), PH-2 (2% phytobiotic), PHO-1 (1% phytobiotic + 0.1% organic acid), and PHO-2 (2% phytobiotic + 0.1% organic acid), with five replicates of 10 birds each for a 35-day trial. Feed intake was numerically lower in the PHO-1 and PHO-2 groups compared to the NC group. Final body weight gain was significantly higher in the PHO-2 group compared to the NC group, and was comparable to the PC group. The PHO-2 group exhibited the best feed conversion efficiency (FCR = 1.82), followed closely by the PHO-1 group, both demonstrating improved feed efficiency compared to the NC group. The European Production Efficiency Factor (EPEF) was significantly higher in the PHO-2 group compared to the NC group, and was also comparable to or higher than the PC group, indicating enhanced production efficiency with the combined phytobiotic and organic acid supplementation. Furthermore, the European Broiler Index (EBI) was significantly higher in the PHO-2 group compared to the NC group, highlighting its potential to effectively enhance broiler performance. In conclusion, supplementation with phytobiotics and organic acids particularly in the PHO-2 group significantly improved broiler performance and offers a promising alternative to antibiotic growth promoters, contributing to more sustainable, profitable, and antibiotic-free poultry production.

Keywords: *Phytobiotics, Organic acids, Broiler performance, Antibiotic-free poultry*

RAFVAL:ES-2025/211

Effect of Integrated nutrient management on yield of sorghum (Sorghum bicolor L.)

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Mobile Number : 7800G22650 Abstract

Sorghum (Sorghum bicolour L.) plant is grown for food and fodder purpose throughout the world. Integrated nutrient management plays an important role in growth as well as quality of fodder crop production. Nutrient interactions have a role to play in determining the course and outcome of two major issues of interest in fertilizer management-namely, balanced fertilizer input and efficient fertilizer use. Application of 100-40 (N-P kg ha-1) + Azospirillum recorded significantly higher green forage yield (394 q ha- 1) and higher dry matter content (38.9%) was recorded by T6 (100-40 N-P kg ha-1+ Azospirillum) (Bhuriya et al. 2024). Seogokar et al. (2024) found that the application of 75% RDF combined with vermicompost (2.5 t ha-1) and AMF (5 kg ha-1) significantly enhanced sorghum yield and total nutrient uptake. This treatment demonstrated a marked improvement in yield, achieving a 116.5% increase in grain yield and a 120.2% increase in fodder yield over the control. These results indicate combining refused fertilizer inputs with organic amendments and arbuscular mycorrhizal fungi (AMF) can effectively enhance sorghum productivity while potentially reducing dependence on chemical fertilizers.

Keywords: *Azospirillum, AMF, sorghum, balanced fertilizer, refused fertilizer.*

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Effect of Different Levels of Nitrogen and Sulphur on Growth, Yield, and Quality of Indian Mustard (*Brassica juncea* L.)

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Indian mustard (Brassica juncea L.) is a critical oilseed crop whose productivity and seed quality are constrained by deficiencies of essential macronutrients, notably nitrogen (N) and sulphur (S). This study evaluated the effects of five nitrogen levels (0, 30, 60, 90, and 120 kg ha^{-1}) and four sulphur levels (0, 20, 40, and 60 kg ha^{-1}) arranged in a factorial randomized block design with three replications. Growth parameters—including plant height, branching, leaf area index, and dry matter accumulation—were recorded at key phenophases. Yield attributes (siliquae per plant, seeds per siliqua, 1000-seed weight, seed and stover yields) and quality metrics (oil and protein content, oil yield) were assessed at maturity. Statistical analysis via ANOVA at the 5% significance level revealed that both N and S significantly influenced vegetative growth, yield, and seed quality, with their interaction exhibiting synergistic benefits. Optimal results for biomass accumulation and seed yield were observed at 90 kg N ha^{-1} combined with 40 kg S ha^{-1}, whereas maximum oil content (38.5%) and protein content (23.7%) were attained at 60 kg N ha^{-1} + 60 kg S ha^{-1}. Economic analysis indicated that the 90 kg N + 40 kg S treatment provided the highest net returns and benefit–cost ratio. These findings suggest that balanced application of N and S can substantially enhance mustard productivity and seed quality under Eastern Uttar Pradesh agro-climatic conditions, there by informing location-specific nutrient management recommendations for sustainable oilseed production.

Keywords: *Indian mustard; nitrogen; sulphur; growth; yield; oil content; protein content; nutrient interaction.*

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Predicting India's Potato Production using Autoregressive Integrated Moving Average (ARIMA) Time Series Modeling

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After maize, rice, and wheat, potatoes rank as the fourth most important food crop in the world and are a staple meal for more than a billion people. It is essential to world food security because of its yearly output, which exceeds 300 million tons. During the 2020–21 growing season, India produced 56.17 million tons of potatoes from 2.20 million hectares, making it one of the world's leading producers. Significant contributions to the national output are made by major potato-producing states including Uttar Pradesh, West Bengal, Bihar, Gujarat, Madhya Pradesh, and Punjab. Ensuring the stability of the food supply, allocating resources as efficiently as possible, and influencing policy choices all depend on accurate potato production predictions. The Autoregressive Integrated Moving Average (ARIMA) model is used in this study to forecast time series data on Indian potato production. The research focuses on determining production trends at the national level and across the major contributing states using historical data. In order to ensure the model's robustness and forecast accuracy, the best ARIMA model is chosen by minimizing important performance metrics, particularly the Bayesian Information Criterion (BIC) and Akaike Information Criterion (AIC). The ARIMA(1,2,1) model was found to be the most appropriate for predicting potato production in India after a number of candidate models were evaluated. Based on the country's improved agricultural practices and technological advancements, the model predicts a robust upward trend in production. If continued, this upward trend will have a big impact on market planning, policymaking, and food security. The study highlights the value of time series models, like ARIMA, in agricultural forecasting and offers decision- makers insightful information. To improve forecasting accuracy and create hybrid models for even higher precision, future research may incorporate exogenous variables like temperature, rainfall, or fertilizer use.

Keywords: *ARIMA, Forecasting, Potato, Production, Time Series Analysis.*

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Protected cultivation of parthenocarpic cucumber: a step toward year-round production

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Protected cultivation has emerged as a viable solution for ensuring sustainable and high-quality vegetable production throughout the year, particularly in regions affected by adverse climatic conditions. Among the various vegetable crops, parthenocarpic cucumber (*Cucumis sativus* L.) known for its ability to set fruit without pollination, is exceptionally well-suited for cultivation under protected environments. The absence of pollination dependency allows for consistent fruiting, making it an ideal choice for year-round production. The use of controlled environmental parameters such as temperature, humidity and light combined with precision irrigation and fertigation systems has led to significant improvements in yield, fruit uniformity and marketability. Controlled environmental conditions such as temperature (25-30°C), relative humidity (60-70%) and light regulation significantly enhance crop performance. Some of the commercial hybrids like 'Pant Parthenocarpic Cucumber-2', 'Kian' and 'Multistar' have demonstrated early maturity (35-40 days after sowing), high yield potential (100-110 t/ha) and superior fruit quality. The use of drip fertigation has been reported to increase water-use efficiency by up to 40% and fertilizer-use efficiency by 30-50%. Protected structures also significantly lower the risk of pest and disease infestation, thereby minimizing the dependency on chemical pesticides and promoting safer produce. The productivity of parthenocarpic cucumbers under protected cultivation can be two to three times higher than in open field conditions, with enhanced fruit quality attributes such as length, firmness, skin colour and shelf life. Moreover, parthenocarpic cucumber cultivation provides opportunities for continuous harvesting across seasons, catering to urban and peri-urban markets that demand consistent supply of fresh, residue-free vegetables. The ability to produce throughout the year also improves farmers' income stability and employment generation.

Keywords: *Protected cultivation, Parthenocarpic, Relative humidity, Temperature and Light*

RAFVAL:ES-2025/214/A

Advancing crop resilience: the shift from conventional breeding to precision gene editing

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Climate change poses significant challenges to global agriculture, necessitating the development of crops that can withstand abiotic stresses such as drought, heat and salinity. Traditional breeding methods, while instrumental in past agricultural advancements, often involve lengthy processes and limited precision. The advent of precision gene editing technologies, particularly CRISPR/Cas systems, has revolutionized crop improvement strategies. These tools allow for targeted modifications in plant genomes, facilitating the development of varieties with enhanced stress tolerance, disease resistance and yield stability. The successful application of CRISPR/Cas9 in various crops leading to improved traits without the introduction of foreign DNA, thereby addressing regulatory and public acceptance concerns. For instance, gene-edited wheat trials in Australia aim to increase yields by 10% through precise genome modifications. Similarly, comprehensive mapping of the wheat genome has provided valuable insights for targeted breeding efforts. As regulatory frameworks evolve to accommodate these technologies, precision gene editing stands as a promising approach to developing climate-resilient crops ensuring food security and promoting sustainable agriculture in the face of environmental challenges.

Keywords: *Climate, CRISPR/Cas, DNA, Drought, Heat and Salinity*

RAFVAL:ES-2025/214/B

Eco-conscious crop protection: the role of integrated pest and disease management in minimizing chemical use

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The growing concerns over environmental degradation and human health risks associated with excessive pesticide use have highlighted the need for sustainable crop protection strategies. Integrated Pest and Disease Management (IPDM) offers a holistic and eco-conscious approach to managing pests and diseases by combining cultural, biological, mechanical and chemical methods in a judicious and synergistic manner. This study aims to explore the effectiveness of IPDM in minimizing the reliance on synthetic agrochemicals while maintaining crop productivity and health. The impact of various IPDM modules implemented across different cropping systems, focusing on the reduction of chemical inputs, pest and disease incidence, yield performance and environmental outcomes were predicted with the various research methods and implementations. The integration of biocontrol agents, trap crops, resistant cultivars and need-based pesticide applications resulted in significant declines in pest populations and disease severity, while preserving beneficial organisms and soil health. Furthermore, economic analysis revealed favourable benefit-cost ratios under IPDM systems compared to conventional pesticide-intensive practices. The findings underscore the potential of IPDM as a key strategy for achieving sustainable agriculture, supporting both environmental integrity and food security. Adoption of IPDM not only reduces the chemical load in agroecosystems but also fosters biodiversity, improves soil and water quality, and enhances the resilience of crops to biotic stress. Scaling up IPDM adoption through farmer training, policy support and participatory research is essential to transition toward more sustainable and eco-friendly agricultural systems. This research advocates for a paradigm shift in pest and disease management aligned with ecological principles and sustainable development goals.

Keywords: *IPDM, Trap crops, Yield, Soil and Biodiversity*

RAFVAL:ES-2025/215

Study on marketing practices of kachai lemon growers in Manipur

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Kachai Lemon (Citrus jambhiri), recognized for its distinctive aroma and high ascorbic acid content, is a region-specific horticultural crop cultivated predominantly in Kachai village of Ukhrul district, Manipur. Despite its Geographical Indication (GI) tag, the marketing of Kachai Lemon remains largely unorganized and constrained by various structural and institutional limitations. The study is an attempt to assess the prevailing marketing practices followed by kachai lemon growers and employed both descriptive and analytical methodologies. The primary data was collected from 60 kachai lemon growers through structured schedule. The findings reveal that majority of the growers harvest their produce between the month of November-March and used gunny bags & carton box for packing. However, majority of the growers are not employing the grading practices. The study identified inadequate storage and transportation infrastructure, lack of market information and limited bargaining power as the major challenges faced by the growers. Therefore, the study suggests urgent need for strategic policy interventions, improved market linkages, promotion of farmer-producer organizations (FPOs) and capacity building to enhance the marketing efficiency and economic viability of Kachai Lemon cultivation.

Keywords: *Marketing practice, Market information, Kachai lemon growers, Manipur*

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Formulation of Cholestrol-Free Low-Fat Vegan Eggs as an Alternative to Animal Eggs

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Vegan dietary choices have a direct impact on agricultural demand, production techniques, and sustainability practices, veganism and agriculture are closely related. By emphasizing plant-based diets and opposing animal husbandry, veganism promotes a shift in agriculture towards use of moral, environmentally responsible, and resource-efficient practices.Veganism includes the use of plant-based foods and excludes the use of animal products .This increases the need for agriculture as the ingredients used in making of vegan eggs are plant-based.The sole purpose of the study was to design cholesterol- free,low-fat vegan eggs as an alternative to animal eggs. Innovative plant-based substitutes known as vegan eggs mimic the flavor, consistency, and culinary adaptability of conventional poultry eggs. The current study involves development of vegan eggs using oat milk as egg white for all the three variants.The egg yolk for the Variation-A,B and C was moong dal,tofu and potato respectively. A statistical analysis was performed in terms of sensory evaluation where (p= 0.12) which is greater than los(p=0.05),depicting no significant difference between standard and variation-A(most acceptable variant).In terms of nutrient analysis,statistical data revealed that (p=0.03) which is smaller than los(p=0.05),depicting there is significant difference between standard and variation-A(most acceptable variant). According to ANOVA,(p=0.14) which is greater than los(p=0.05)which revealed that there is no statistical difference between standard and variation-A(most acceptable variant).The eggs also contain turmeric which has curcumin which has antioxidants.The use of black pepper(piperin) enhanced the flavor and increased the absorption of curcumin. The product also contains probiotics due to addition of nutritional yeast in the egg yolks of all variants.The protein composition of the vegan egg came to 12.9g for the most acceptable variant(moong dal).This is equivalent to the protein content in animal eggs.The fat composition came to 2.3g which is much lesser than animal egg making it a low-calorie product.

Keywords: *Veganism,Agriculture,Sustainable,VegaEggs,Cholesterol free,Low-fat,Nutritional yeast.*

RAFVAL:ES-2025/217

Stem Bark in Indian Traditional Medicine and its potential Therapeutic Properties: A Review

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The growing awareness of the harmful effects of synthetic drugs made people to explore the time-tested remedies from traditional alternative medicine. Tree bark has an ancient history about its medicinal values and has been used in the Indian Ayurvedic and Unani system of medicines. Their formulations are widely used in traditional and indigenous healing practices for centuries by different ethnic groups in the world and is now being used in the manufacture of modern day medicine, cosmetics, and pharmaceuticals. Ethno-medicinal and traditional applications of bark derived drugs received significant attention as they are well tested for their efficacy and believed to be safe and effective for human health. As the world is reversing towards the herbal drug it is the need of the hour to re-analyze the knowledge of traditional medicine. Thus there is increasing interest in the validation of traditional plant based medicine in India and other countries for treatment of various metabolic disorders. India being a tropical country is blessed with wide variety of tree species and traditional knowledge for their wise and sensible utilization. Bark of different tree species of Rajasthan have been investigated by different workers. They were documented for their traditional and pharmacological activity. It was reported that barks are generally used in the form of dried powder, potions or decoctions. Preliminary phytochemical screening showed the barks to be rich in phenolics, flavonoids, tannins, and other secondary metabolites. Phenolic compounds are the main active ingredients of bark. A range of benefits have been reported from the use of polyphenol-rich bark extracts such as cardio-protective, neuro-protective, hepato- protective, anti-tumor, anti-diabetic, antiviral, anti-inflammatory,

wound healing, and other oxidative stress related diseases. Properties like biodegradability, UV-shielding and free radical scavenging activity make them suitable for medical, pharmaceutical and beauty applications. Both in vitro and in vivo studies have shown that they have rich array of active phyto-constituents, remarkable antioxidant potential, pharmacological activities, and health benefits, thus validated their traditional uses.

However, several traditional uses have yet to be scientifically explored. The findings highlighted the relevance of tree bark in traditional medicine and its potential therapeutic properties. They promote the integration of traditional and medicinal practices for holistic healthcare solutions. Awareness of traditional healing practices by ancient Indian medicinal practitioners and indigenous communities contribute significantly in the preservation of cultural backgrounds, biodiversity and a potential resource for pharmaceuticals. Therefore, further studies are proposed to explore tree bark to identify and isolate novel active compounds for new bio-based medicines.

Keywords: *Tree bark, Traditional knowledge, Therapeutic properties, Indigenous healing practices, Ethno-medicine.*

RAFVAL:ES-2025/218

Breeding for Beauty: Trends and Technologies in Ornamental Crop Improvement

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Ornamental plants are widely used around the world for their distinctive floral traits such as fragrance, color, shape, early blooming, plant architecture, stress tolerance and extended shelf-life. Techniques such as haploidy, polyploidy, cryopreservation, somaclonal variation and genetic modification have proven useful in conserving genetic resources and creating elite plant clones. Additionally, methods like in vitro mutagenesis, selection of doubled haploids, molecular markers and molecular breeding provide plant breeders with tools to explore and utilize genetic diversity effectively. Ornamental plants have become central to the bioeconomy, with progress in floricultural biotechnology and genomics accelerating plant improvement efforts. Cutting-edge technologies such as genomics, nanotechnology, and gene editing now allow for the customization of floral traits, benefiting both ornamental and cosmetic sectors. Genetic modification strategies have enabled the production of flowers with diverse colors and enhanced post-harvest traits, paving the way for elite plant varieties. These genetically

modified plants offer considerable advantages for both growers and consumer. However, despite their commercial promise, only a limited number of genetically modified ornamental varieties have undergone field trials and reached the market. Since the initial development of color-modified carnations and roses decades ago, progress in transforming and commercializing other ornamental varieties has been relatively slow. Thanks to modern genomics and precise genome editing tools, it is now possible to tailor specific traits such as flower color, early flowering, plant form, scent and longevity by manipulating biosynthetic pathways through gene insertion, overexpression or silencing. Still, economic and regulatory barriers have hindered the widespread commercialization of genetically modified and gene-edited crops in many countries. To overcome these challenges, there is a need for more relaxed regulatory frameworks, particularly for ornamental and other non-food plants.

Keywords: *Plant Breeding, Mutagenesis, Ornamental Plants, Genetic Modification*

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Nutritional status of Two Economically Important Food Fishes, from Punjab, India

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During the present study, two food fishes, *Cyprinus carpio* and *Hypophthalmichthys molitrix* were analyzed for proximate composition and mineral elements. The samples were purchased in fresh condition from local market of Kharar, Punjab. *C. carpio* was found to contain high amount of protein, fat and carbohydrates (18.20, 4.10 and 2.64%). Among the macroelements, Ca, Mg and Na levels were observed more in *C. carpio* whereas K in *H. molitrix* respectively. A significant variation was found between both the fish species with respect to proximate composition, macroelements and microelements. The levels of microelements detected in both species, essential for human health, were within the permissible limits established by international standards such as those set by the World Health Organization (WHO) and the Food and Agriculture Organization (FAO). Overall, the findings of this study underscore the nutritional richness of both *C. carpio* and *H. molitrix*, affirming their value as wholesome food sources. Their substantial protein content and favorable mineral profile make them suitable food source for inclusion in a balanced diet, particularly in regions where fish forms a significant part of the daily nutritional intake. Thus, both the food fishes are considered as nutritionally rich sources of food.

Keywords: *Fish, Minerals, Muscle, Protein, Punjab*

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Smart Shield: Sustainable Strategies Through Integrated Pest Management

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Sustainable agriculture emphasizes the necessity of producing food in environmentally sound, economically viable and socially responsible ways. Endemic and invasive pests threaten food crop productivity and food security worldwide. The use of synthetic pesticides is the most common pest management method, often leading to resistance, harm to beneficial organisms, residue accumulation, increased yield losses and higher production costs. Integrated Pest Management (IPM) offers a comprehensive solution to these challenges in an economically viable, environmentally sustainable and socially acceptable manner. IPM is an ecosystem-based approach to crop protection that incorporates various sustainable strategies, emphasizing preventive, cultural, mechanical, biological and chemical tactics, guided by regular monitoring and economic thresholds to minimize pest damage while reducing reliance on chemical pesticides. Cultural strategies like crop rotation and resistant varieties disrupt pest life cycles and

enhance crop resilience. Mechanical methods, including traps, provide immediate pest suppression. Biological control conserves and augments natural enemies, supported by biopesticides. Behavioural tactics, such as pheromone traps, enhance pest regulation. Chemical control is a last resort, using selective pesticides aligned with resistance management. The success of IPM depends on legislative support, pest surveillance and farmer education through initiatives like Farmer Field Schools. IPM is crucial for achieving climate-resilient, productive and eco-friendly farming systems, optimizing crop production while minimizing environmental impacts and enhancing resilience to challenges like climate change and biodiversity loss. Ultimately, IPM is characterized by the intelligent selection and application of pest control measures that ensure favourable economic, ecological and social outcomes.

Keywords: *IPM, Sustainable agriculture, Biopesticides, Pest surveillance*

RAFVAL:ES-2025/221

Superfruit Spotlight: The Amazing Health Benefits of Grapefruit

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Grapefruit (*Citrus* × *paradisi*) is a nutrient-rich citrus fruit recognized for its unique flavor and numerous health benefits. It is an excellent source of vitamin C, antioxidants, dietary fiber, and phytochemicals such as flavonoids and limonoids, all of which contribute to its functional food status. Uniquely among citrus fruits, grapefruit contains a notably high level of vitamin A, providing over 50% of the recommended daily intake per whole fruit, compared to only 4% from an orange. This makes it especially beneficial for eye health, immune function, and inflammation control. Regular consumption of grapefruit has been linked to reduced oxidative stress, enhanced immune response, and a lower risk of chronic diseases such as cardiovascular disorders, obesity, and type 2 diabetes. Its low glycaemic index and high-water content support healthy weight management and hydration. Additionally, grapefruit contains bioactive compounds like naringin, which demonstrate anti-inflammatory, anti-cancer, and lipid-lowering properties. These compounds further enhance grapefruit's therapeutic potential in preventing metabolic and degenerative conditions. With its dense nutritional profile and wide range of health-promoting properties, grapefruit is a valuable addition to a balanced diet and may serve as a potent dietary component in disease prevention and overall wellness strategies.

***Keywords**: Grapefruit, Limonoids, Oxidative Stress, Naringin*

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Innovative Strategies In Vegetable Breeding: Ensuring Food Security Amidst Climate Challenges

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Climate change is increasingly affecting agriculture, with unpredictable weather patterns such as droughts, floods, and temperature fluctuations threatening food security. Vegetable crops, being particularly sensitive to environmental stressors, face significant risks in this changing climate. To address this, the development of climate-resilient vegetables has become a crucial strategy to maintain agricultural productivity and safeguard farmer livelihoods.

Recent scientific advancements focus on breeding vegetables that can withstand extreme weather conditions. These include crops with drought and heat tolerance, flooding resistance, and enhanced photosynthesis capabilities. Notable examples are "super tomatoes" developed for drought and heat resilience, flood-tolerant rice, and other crops designed to thrive in unpredictable climates. Institutions like the University of Florida and the International Rice Research Institute are leading these efforts, using biotechnological tools to enhance resilience.

Beyond genetics, the successful adoption of these crops also requires increased consumer awareness and policy support. Ensuring that scientific innovations reach farmers is essential to mitigate the effects of climate change and reduce crop failure risks. Climate-resilient vegetables not only promise food security but also offer economic stability for farming communities and reduce the environmental impact of crop loss.

In conclusion, developing climate-resilient vegetables is vital for securing future food supplies and protecting farmers' livelihoods. By combining scientific advancements with public awareness and supportive policies, agriculture can adapt to and thrive amidst climate challenges.

Keywords: *Climate Resilience, Vegetable Breeding, Drought Tolerance, Flood Resistance, Biotechnology*

BURANSH: Red Gold of Himalayas for Women's Economic Empowerment Through Value Addition

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Buransh or Red Rhododendron (*Rhododendron arboreum*) is a spring blooming shrub with vibrant red blooms, widely known as the "Red Gold of the Himalayas". It produces flowers during the months of March-April in the North Western Himalayas and has immense potential not only as a natural resource but as a driver of sustainable, women-led economic development in the Himalayan region. Buransh flowers are a source of valuable nutrients and bioactive compounds such as flavonoids, saponins, tannins, and other phenolic compounds, which are known for their health-promoting properties viz. anti-inflammatory, antioxidant, anticancer, cardioprotective, hepatoprotective activities etc. The flowers are edible and enjoyed for its sour taste. During spring buransh flowers are found abundantly in the mid to high altitudes of Himachal Pradesh, particularly in districts like Kangra, Mandi, Shimla, Chamba, Sirmaur and Solan, at elevations ranging from 1500 to 3600 meters. This makes it an excellent source of livelihood for the rural women in Himachal Pradesh. Through its processing and value addition women's economy can be empowered by engaging women in harvesting, collection, processing, packaging and marketing these products. The flowers can be consumed fresh as well as processed into various value-added products viz. squash, juice, teas, herbal remedies, flower pickle, chutney, jam, jelly and other food products, adding natural color and flavor. Additionally, these blooms can be dried, packed and sold in cities with high profitability. Value addition of buransh not only generate income but also promote self-reliance and entrepreneurship among women. Furthermore, by creating self-help groups, cooperatives & government schemes like NRLM (National Rural Livelihood Mission), PMFME (Pradhan Mantri Formalization of Micro Food Processing Enterprises) and MSME support offers capacity building, market linkages and seed funding to rural women entrepreneurs to scale up their business. With proper training in hygiene, food safety, branding and packaging, women can transform this traditional floral resource into commercially viable products catering to both local and urban markets. As a result, the value addition of buransh is emerging as a promising model for women's economic empowerment.

Keywords*: Buransh, Rhododendron, Value Addition, Processing, Economic Empowerment*

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A Pioneer Study of Bird Diversity of Tonk District, Rajasthan, India

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The present study is carried out in district, Tonk which is one of the most important district of Rajasthan. It is situated 100 kms from state capital Jaipur on National Highway 52. From geographical point of view it is present on 25°41’ to 26°34' latitude and 75°07’ to 76°19' longitude covering area of 7,190.5 sq kms. The main motive of this study is to make a checklist of bird species in the Tonk district that are under varying degrees of strain from human activities. During the study a total of 127 bird species belonging to 55 families were recorded here across 13 major water bodies and their surrounding areas. Among these, 94 species were identified as local/resident, 19 species as summer and winter migratory, and 14 species as resident migratory. Additionally, 28 families comprised only a single species, whereas there was a single family which had 7 species. The current study might be able to assist in the compilation of an accurate database describing the bird diversity at the study region, including its presence, distribution, habitat classification and habitat preferences. This study provides a baseline of information on birds that live in wetland environments. In the future, periodic species and habitat surveys have the potential to provide significant information that may be used to detect trends in wetland bird populations as well as trends in the characteristics of the habitat.

Keywords: *Bird diversity, Habitat, Endothermic, Wetland, Population.*

RAFVAL:ES-2025/225

Formulation of Cholestrol-Free Low-Fat Vegan Eggs as an Alternative to Animal Eggs

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Vegan dietary choices have a direct impact on agricultural demand, production techniques, and sustainability practices, veganism and agriculture are closely related. By emphasizing plant-based diets and opposing animal husbandry, veganism promotes a shift in agriculture towards use of moral, environmentally responsible, and resource-efficient practices.Veganism includes the use of plant-based foods and excludes the use of animal products .This increases the need for agriculture as the ingredients used in making of vegan eggs are plant-based.The sole purpose of the study was to design cholesterol- free,low-fat vegan eggs as an alternative to animal eggs. Innovative plant-based substitutes known as vegan eggs mimic the flavor, consistency, and culinary adaptability of conventional poultry eggs. The current study involves development of vegan eggs using oat milk as egg white for all the three variants.The egg yolk for the Variation-A,B and C was moong dal,tofu and potato respectively. A statistical analysis was performed in terms of sensory evaluation where ($p= 0.12$) which is greater than los($p=0.05$),depicting no significant difference between standard and variation-A(most acceptable variant).In terms of nutrient analysis,statistical data revealed that ($p=0.03$) which is smaller than los($p=0.05$),depicting there is significant difference between standard and variation-A(most acceptable variant). According to ANOVA,($p=0.14$) which is greater than los($p=0.05$)which revealed that there is no statistical difference between standard and variation-A(most acceptable variant).The eggs also contain turmeric which has curcumin which has antioxidants.The use of black pepper(piperin) enhanced the flavor and increased the absorption of curcumin. The product also contains probiotics due to addition of nutritional yeast in the egg yolks of all variants.The protein composition of the vegan egg came to 12.9g for the most acceptable variant(moong dal).This is equivalent to the protein content in animal eggs.The fat composition came to 2.3g which is much lesser than animal egg making it a low-calorie product.

Keywords: *Veganism,Agriculture,Sustainable, Vega Eggs,Cholesterol-free,Low-fat,Nutritional yeast.*

RAFVAL:ES-2025/226

Contribution of Dairy Industry in Indian Economy and its Challenges

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Dairy industry plays a key role in economy of a country. India has around 20% contribution in total global milk production and its dairy sector contributes about 5% in the national annual income. More than 80 million farmers are directly or indirectly employed in the dairy industries and around 198 million metric tonnes of milk is produced per year. Verghese Kurien, 'Father of White Revolution' in India lead the Operation Flood which boosted the dairy sector productivity many folds by applying cooperative model. Uttar Pradesh, Maharashtra, Punjab and Haryana are major contributing states in milk production. Dairy export of India has reached 108711 metric tonnes in the recent years and growth in this sector is continuing while India imports milk powder and few dairy derivatives also. National Dairy Development Board (NDDB) has been fostering the dairy sector for enhancement of its productivity. Amul, Mother Dairy, Omfed and Hatsun Agro have successfully emerged as private sector in dairy industry and have significant contribution in annual national income. Despite its growth and globalization, Indian dairy sector faces many challenges which have adversely affected its productivity, supply chain, infrastructure and economic viability. Low milk productivity in Indian dairy cattle, disease outbreaks, low cross breeding rates and insufficient cooling as well as testing facilities at collection centres have compromised with safety and quality of milk. Though, technological advancements have brought the things better, there is intense need of further research and implementation of its outcome for the best utilization of available resources to promote innovation in dairy sector. Value added dairy products such as flavoured milk, yogurt and cheese should be encouraged to increase the income of dairy farmers. India can become the global leader in dairy industry by implementing quality research, technological advancements, promoting diversification of marketing and empowering dairy farmers.

Keywords: *Dairy sector, productivity, income, quality research, farmers.*

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Isolation of rhizobacteria from *Medicago sativa L.* grown in the dried Aral Seabed and assessment of their halotolerance

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Medicago sativa L. a perennial legume of the Fabaceae family, is widely utilized as a nutritious fodder in animal husbandry and other agricultural applications. Rich in protein, vitamins, and various micro and macroelements, *Medicago Sativa* L. plays a crucial role in crop rotation systems. It improves soil structure and facilitates soil mineralization by fixing atmospheric nitrogen through symbiosis with rhizobacteria. These rhizobacteria residing in the *Medicago Sativa* L. rhizosphere contribute significantly to plant growth, yield, and adaptation to abiotic stress factors.

This research focuses on rhizobacteria for sustainable productivity development in the arid regions of Uzbekistan, specifically addressing the challenges posed by high salinity levels in the dried Aral Seabed. Soil samples were collected from the roots and rhizosphere of alfalfa plants growing in this harsh environment and transported to the laboratory for bacterial isolation. The samples were cultured on TSA, NA, and MPA media to obtain pure cultures.A total of 102 bacterial isolates were obtained and subsequently screened for salt tolerance. Each isolate was inoculated onto media containing varying concentrations of NaCl (5%, 10%, 15%, and 20%). The results revealed that almost all isolates exhibited robust growth at 5% NaCl. Under 10% salt stress, 73 isolates displayed active growth, while 18 showed moderate activity. At 15% NaCl, 32 isolates remained active, with 11 exhibiting moderate activity. Finally, under the most severe salt stress of 20% NaCl, 14 isolates maintained moderate activity.

Further investigation into the mechanisms by which these salt-tolerant isolates promote plant growth under saline conditions will pave the way for enhancing Medicago Sativa L's resilience to salt stress and improving its overall productivity in this ecologically challenged region. This knowledge can be instrumental in developing sustainable agricultural practices in arid and saline environments like the dried Aral Seabed.

Keywords*: Salt-tolerant bacteria, salt concentration, Medicago Sativa L.*

RAFVAL:ES-2025/228

Application of Solid-State Fermentation for the Sustainable Production of Bioactive Compounds from Fruit Waste

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Fruit waste products, produced in significant volumes by the food sector, are a great resource for sustainable bioprocessing. This review looks at solid-state fermentation (SSF) as a long-term way to turn fruit waste into something useful, focusing on making bioactive molecules that could be used in medicine or as food supplements. Solid substrates, including peels and pulp from fruits such as oranges, apples, and bananas, which are abundant in fiber and important nutrients, provide optimal conditions for microbial proliferation in solid-state fermentation processes. Using microorganisms like *Aspergillus niger* and *Trichoderma reesei* in solid-state fermentation (SSF) can help get more secondary metabolites out of plants, such as flavonoids, phenolics, and alkaloids. The fermentation process was refined by adjusting variables like temperature, moisture content, and duration of fermentation. The results indicated a substantial increase in the yield of bioactive chemicals relative to conventional extraction techniques. Moreover, using fruit waste mitigates environmental contamination and presents a novel method for generating high-value goods from agricultural byproducts. This study emphasizes the viability of SSF as an economic and ecological approach for bioconversion, promoting circular economy principles and aiding the advancement of green technology in the pharmaceutical and food sectors.

Keywords: *Solid-state fermentation, fruit waste, bioactive compounds, sustainable bioprocessing, circular economy*

RAFVAL:ES-2025/229

Potential of Fish Protein as Sustainable Source of Nutrition

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This review examines the nutritional importance of fish protein as an optimal and environmentally sustainable nutrient source. Fish-derived protein demonstrates exceptional biological value due to its comprehensive amino acid profile, containing all essential amino acids including leucine, isoleucine, valine, and taurine, in highly bioavailable forms. The superior digestibility coefficients of fish protein (90-98% for finfish tissue and approximately 85% for crustaceans and mollusks) render it particularly beneficial for vulnerable populations including pediatric patients, geriatric individuals, and those with compromised gastrointestinal function. Fish protein consumption demonstrates cardio protective effects through mechanisms including triglyceride reduction and improved lipoprotein profiles. Additionally, it enhances muscular anabolism and recovery through up regulation of the mechanistic target of rapamycin (mTOR) pathway and optimization of protein synthesis efficiency. The review provides detailed characterization of protein composition across various aquatic species categories fatty fish, lean fish varieties, and shellfish clarifying their distinctive nutritional attributes and amino acid configurations. Fish-derived bioactive compounds exhibit anti-inflammatory properties and immunomodulatory effects, while epidemiological and intervention studies suggest associations with enhanced neurocognitive function and potential mitigation of age-related cognitive deterioration. As global protein requirements escalate concomitantly with population growth, responsibly harvested fish protein represents a nutritionally superior alternative. Future investigative priorities should address sustainable aquaculture methodologies, innovative processing technologies to maximize protein extraction efficiency, and further elucidation of bioactive peptides in fish protein that may confer functional benefits beyond fundamental nutritional requirements. This comprehensive assessment underscores the significant potential of fish protein in addressing both individual nutritional requirements and broader global food security challenges.

Keywords: *Omega 3 fatty acid, Peptides, Protein hydrolysates, EPA, DHA and C-reactive protein (CRP).*

RAFVAL:ES-2025/230

Evaluation Of High Value And Climate Smart Crops Under Custard Apple Based Agri-Horti System In The Vindhyan

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A field experiment was conducted on a sandy clay loam soil at Rajiv Gandhi South Campus, Banaras Hindu University, Mirzapur, UP during monsoon 2024 to study the (a) productivity, profitability and resource-use efficiency of diversified custard-apple-based agroforestry systems; (b) identifying the most profitable agri-hoti system; and (c) analysing the economic aspects of the treatments. The experiment was laid out in randomised block design replicated thrice, the treatments comprised of 5 crops: T1-vegetable cowpea, T2- okra , T3- fingermillet , T4- ashwagandha , T5- clusterbean. The experiment was laid below 17 year old custard apple based agri-horti system. The results indicated that the mean crop equivalent yield was recorded highest for T2- custard apple+okra 2,191.42 kg/ha followed by T3-custard apple+cluster bean 1,880.00kg/ha , T1- custard apple+cowpea 1,743.57 kg/ha, T5-1,478.57 kg/ha and lowest for T3- 1,437.85kg/ha. The cost of cultivation was recorded highest for T2- custard apple+okra Rs 71560, and lowest for custard apple+ finger millet Rs 28510. The gross return was highest for custard apple+ okra Rs 153400 followed by custard apple+ cluster bean Rs 131600 and lowest for custard apple+ finger millet Rs 100650. The net return was recorded highest for custard apple+okra Rs 81840 and lowest for custard apple+ cowpea Rs 59790. The B:C ratio was recorded highest for custard apple+ finger millet 3.53 followed by custard apple+ ashwagandha 2.92 and lowest for custard apple + cowpea 1.96.

RAFVAL:ES-2025/231

Mapping the Green Invaders: Diversity and Dominance of Weed Flora in Okra Agroecosystem

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A comprehensive survey of weed flora in an experimental okra field during the Kharif season unveiled a diverse and dynamic weed spectrum, comprising grasses, sedges, and broad-leaved weeds (BLWs). A total of 24 weed species were documented, reflecting the ecological complexity of the field environment. Among these, five were grass species, one was a sedge, and a significant majority 18 species belonged to the broad-leaved category. The sedge *Cyperus rotundus* L. emerged as the most dominant and persistent weed across all treatments, known for its deep rhizome system and high regenerative capacity. Among the grasses, *Cynodon dactylon* (L.) and *Dactyloctenium aegyptium* (L.) Beauv. exhibited widespread presence and aggressive growth habits. The broad-leaved weed flora was largely dominated by problematic and invasive species such as *Parthenium hysterophorus, Digera arvensis* Forsk., *Euphorbia hirta* L., *Amaranthus viridis* L., and *Commelina benghalensis* L., all of which are known to compete vigorously with crops for nutrients, light, and space. The dominance of these species highlights the urgent need for strategic, species-specific, and eco-friendly weed management approaches. Integration of precision weed mapping, bioherbicide development, and predictive weed emergence modeling could offer a futuristic edge in managing such complex weed assemblages in vegetable cropping systems.

Keywords: *Okra, Weed flora, Cyperus rotundus, Parthenium hysterophorus, Grasses, Broad-leaved weeds, Sedge, Agroecosystem, Weed diversity, Integrated weed management*

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Climate Change and Food Security: A vulnerability Assessment for South-Asia

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Food insecurity remains a pressing challenge to global development, with more than 800 million people currently undernourished. Climate change is expected to intensify this crisis, placing an additional 10 to 20 percent of the global population at risk of hunger. When combined with rapid population growth and increasing pressure on natural resources, climate change significantly threatens both food and livelihood security. South Asia has been selected for this study because it is among the most climate-vulnerable regions in the world. The region heavily relies on agriculture as a source of income and sustenance, making it highly sensitive to climatic fluctuations, particularly shifts in rainfall and rising temperatures. Countries in this region already grapple with widespread poverty, malnutrition, and limited institutional capacity to adapt to changing environmental conditions. This research evaluates food security vulnerability in South Asia by applying a Composite Vulnerability Index (CVI) across eight countries: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. The results indicate that Afghanistan (Exposure Index: 0.57) and Pakistan (Sensitivity Index: 0.59) are particularly vulnerable due to high exposure to climate hazards and low resilience. In contrast, the Maldives (Adaptive Capacity Index: 0.72) demonstrates a relatively higher capacity to adapt. The findings underline the urgency of implementing region-specific strategies focused on climate resilience, agricultural sustainability, and institutional capacity building. Strengthening adaptive capacity and ensuring inclusive food systems are essential to safeguarding livelihoods and achieving long-term food security in South Asia.

***Key words**: Climate Change, Vulnerability and South Asia*

RAFVAL:ES-2025/233

Molecular Detection of Begomovirus solanumdelhiense Virus in Tomato Crops.

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Leaf curl viral disease is a serious viral disease that primarily affects solanaceous crops, most notably tomatoes. It is caused by a group of viruses known as begomoviruses, which belong to the Geminiviridae family and are transmitted in persistent, circulative manner mainly by the whitefly (*Bemisia tabaci*), which acts as the main vector and spreads the virus from infected to healthy plants. The infected plant shows typical symptoms such as upward curling and mosaic, foliar deformation, crinkling appearance and stunted growth. To diagnose the virus, collected leaf samples were processed for genomic DNA isolation, followed by a PCR assay. The isolated DNA was confirmed for the association of Begomovirus using universal primer as well as begomovirus-specific primers. Upon confirmation of the virus with universal primer, the DNA samples were checked with begomovirus virus species, e.g., ToLCNDV, ToLCJV, ToLCPV, ToLCKV, ToLCGV, and PEPLVB. In the PCR assay, the maximum samples were found positive for the ToLCNDV. The remaining other virus species-specific primer was not amplified in PCR. The CP gene of ToLCNDV was cloned and sequenced. The virus sequences showed >95% similarity with available sequences of respective viruses in the NCBI database. This study highlights the prevalence of a major leaf curl variance in tomato, and therefore, further research could also help in the sustainable management of the disease.

Keywords: *Whitefly, begomovirus, ToLCNDV, leaf curl*

RAFVAL:ES-2025/234

Standardized The Compost Bag Size And Calculating The Yield Parameters For Button Mushroom (*Agaricus Bisporus*) Production

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The experiment was conducted at Mushroom Production unit at Sant Kabir College of agriculture and research station, Kawardha (Kabirdham), C.G. during November 2018 to February 2019 and November 2019 to February 2020 under controlled condition. Fresh culture of *Agaricus bisporus* S-11 were obtained from S.G. College of Agriculture and Research Station, Indira Gandhi Krishi Vishwavidyalaya, Jagdalpur (C.G.). Culture was multiply and maintained on potato dextrose agar. The substrates which were used in the experiment were prepared according to standard formulations and procedure as suggested by DMR, Solan. Experiments was layout un Complete Randomized Design (CRD) with eight treatments viz., T_1 – Bag size of 3.0kg compost, T_2 – Bag size of 4.0kg compost, T_3 – Bag size of 5.0kg compost, T_4 – Bag size of 6.0kg compost, T_5 – Bag size of 7.0kg compost, T_6 – Bag size of 8.0kg compost, T_7 – Bag size of 9.0kg compost, T_8 – Bag size of 10.0kg compost and three replications. Experimental trials were carried out in a closed room provided with air conditioner as source of cooling. The relative humidity inside the cropping rooms was maintained to 60-70%. Observations were recorded on days taken to spawn run, days taken to pin head initiation, average stalk height, average diameter of mushroom cap, average weight of fruiting bodies, total number of fruiting bodies per bag, average weight of fruit body, total mushroom yield and biological efficiency. Results indicated that the faster spawn was run in treatment T_1 – Bag size of 3.0kg compost, T_2 – Bag size of 4.0kg compost (13 days) and maximum time taken for

spawn running in treatment T_8 – Bag size of 10.0kg compost (22 days). Minimum days to initiation of pin head was observed in T_1 – Bag size of 3.0kg compost (28 days) and delayed pin head initiation was noticed in T_8 – Bag size of 10.0kg compost (37 days). Maximum stalk height was recorded in treatment T_8 – Bag size of 10.0kg compost (3.79 cm) and shortest stalk was noticed in T_4 – Bag size of 6.0kg compost (2.74cm). Maximum average diameter of mushroom cap and maximum average weight of fruiting bodies was recorded in T_6 – bag size of 8.0kg compost 4.67cm and 33.92g, respectively. In case of Total Yield per bag was obtained in T_8 – Bag size of 10.0kg compost 1144g whereas, highest biological efficiency was observed in (17.54%) T_3 – Bag size of 5.0kg compost.

RAFVAL:ES-2025/235

Bio-Efficacy Of Native Isolates Of *Beauveria Bassiana, Bacillus Thuringiensis, Aspergillus Flavus* And *Metarhizium Anisopliae* Against Pod Borer Of Chickpea

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A field experiments was carried out at Sant Kabir College of Agriculture and Research Station (Indira Gandhi Krishi Vishwavidyalaya), Kawardha, Kabirdham, Chhattisgarh to evaluate the bio-efficacy of native isolates of *Beauveria bassiana, Bacillus thuringiensis, Aspergillus flavus* and *Metarhizium anisopliae* against pod borer of Chickpea under Randomized Block Design with seven treatments viz., T_1 – *Beauveria bassiana* Bilaspur isolate 10%, T_2 – *Beauveria bassiana* Kawardha isolate 10%, T_3 – *Bacillus thuringiensi* Kawardha isolate 10%, T_4 – *Aspergillus flavus* Kawardha isolate 10%, T_5 – *Metarhizium anisopliae* Kawardha isolate 10%, T_6 – *Metarhizium anisopliae* Bilaspur isolate 10% and T_7 – Untreated control (Water only) and three replications. Seeds of variety Jaki-9218 were sown with distance of 30cmrow-to-rowand 10 cm plant to plant in the plot size 6.9m x 5m. All the recommended cultural and agronomical practices were followed to raise healthy crop as per the package recommended for Chhattisgarh region. The first spraying of respective treatments was done at ETL of 1 larva/5 plants and second spray was taken at 15 days intervals of first spray by using knapsack sprayer. Five liters of formulation of each bio-pesticide was used for one hectare along with 500 liters water. The observations on the larval population of *H. armigera* were recorded from per meter row at before, 5, 10 and 15 days after 1st spray and 5, 10 and 15 days after 2nd spray. Pod damage

was recorded on ten tagged plants in each replication at before, 5, 10 and 15 days after 1st spray and 5, 10 and 15 days after 2nd spray. Experimental data indicated that the most effective treatment was found T_3 – *Bacillus thuringiensis* Kawardha isolate 10% which exhibited maximum percent reduction in larval population (81.82%) of followed by T_4 – *Aspergillus flavus* Kawardha isolate 10% (75.82%), T_1 – *Beauveria bassiana* Bilaspur isolate 10% (69.73%), T_2 – *Beauveria bassiana* Kawardha isolate 10% (63.64%), T_5 – *Metarhizium anisopliae* Kawardha isolate 10% (60.64%) and T_6 – *Metarhizium anisopliae* Bilaspur isolate 10% (57.64%). In case of damage pod, minimum damage pods (5.30%) were observed in plot treated with T_3 – *Bacillus thuringiensis* Kawardha isolate 10% followed by T_4 – *Aspergillus flavus* Kawardha isolate 10% (7.77%), T_1 – *Beauveria bassiana* Bilaspur isolate 10% (9.29%), T_2 – *Beauveria bassiana* Kawardha isolate 10% (11.11%), T_5 – *Metarhizium anisopliae* Kawardha isolate 10% (11.73%), and T_6 – *Metarhizium anisopliae* Bilaspur isolate 10% (11.93) at maturity. Maximum seed yield (1748.32Kg) were observed in plot treated with T_3 – *Bacillus thuringiensis* Kawardha isolate 10% followed by T_4 – *Aspergillus flavus* Kawardha isolate 10% (1680.53Kgha^{-1}), T_1 – *Beauveria bassiana* Bilaspur isolate 10% (1523.87Kgha^{-1}), T_2 – *Beauveria bassiana* Kawardha isolate 10% (1452.25Kgha^{-1}), T_5 – *Metarhizium anisopliae* Kawardha isolate 10% (1418.55Kgha^{-1}), and T_6 – *Metarhizium anisopliae* Bilaspur isolate 10% (1390.50Kgha^{-1}) whereas in control plot seed yield was obtained 1089.85Kg ha^{-1}.

RAFVAL:ES-2025/236

Seed quality behavior of stored soybean seeds as influenced by different packaging materials and storage conditions

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A lab experiment was conducted at Vacuum Packaging Laboratory to study Seed quality behavior of stored soybean seeds as influenced by different packaging materials and storage conditions. Soybean seeds (JS-335) were stored in different packaging materials viz., gunny bags , high density polythene bags and vacuum packed bags stored at room temperature (25 ± 2º C) and cold storage (4 ± 1º C) for a period of 16 months during 2023-24. The treatments having eight combinations and consisting of different packaging materials viz., gunny bags , high density polythene bags and vacuum packed bags were replicated four times in both cold and ambient storage conditions in completely randomized design (CRD). The results of the study revealed that the seed quality viz., moisture content (10.5), seed germination (79.8%), At the end of storage period, significantly higher values of hydrolytic enzymes activity (α-amylase (4.21mg maltose released/min), lipase (16.32 milliequivalent free fatty acid /min/g) and protease(24.82 mg amino acid released /min/ml)) were recorded in vacuum packed seeds stored under cold storageand it was on par with those stored under room temperature (α-amylase (4.16 mg maltose released/min), lipase(16.27 milliequivalent free fatty acid /min/g) and protease(24.77 mg amino acid released /min/ml)) and followed by aluminium packed bag α-amylase (4.06 and 4.12mg maltose released/min), lipase(16.21 and 16.23 milliequivalent free fatty acid /min/g) and protease(24.51 and 24.58 mg amino acid released /min/ml)values were higher in vacuum packed seeds than gunny bags, HDPE bags , Aluminium bag for soybean seeds stored under cold storage compared to room temperature throughout the storage period. Among the packaging materials, the seeds stored in vacuum packed bags maintained the seed quality and seed germination with least deterioration compared to seeds stored in gunny bags and high density polythene bags.

Keywords: *Seed quality, Moisture content, enzyme activities, vacuum packaging and cold storage.*

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Seed quality behavior of stored groundnut seeds as influenced by different packaging materials and storage conditions

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A lab experiment was conducted at Vacuum Packaging Laboratory to study Seed quality behavior of stored groundnut seeds as influenced by different packaging materials and storage conditions. Seed kernel of groundnut (TMV-2) were stored in different packaging materials viz., gunny bags , high density polythene bags, aluminium and vacuum packed bags stored at room temperature (25 ± 2º C) and cold storage (4 ± 1º C) for a period of 14 months during 2023-24. The treatments having eight combinations and consisting of different packaging materials viz., gunny bags, high density polythene bags and vacuum packed bags were replicated four times in both cold and ambient storage conditions in completely randomized design (CRD). The results of the study revealed that the seed quality parameters *viz.,* moisture content (7.50), seed germination (75.2%) and At the end of storage period, significantly higher values of hydrolytic enzymes activity (α-amylase (2.08mg maltose released/min), lipase (14.80 milliequivalent free fatty acid /min/g) and protease(28.95 mg amino acid released /min/ml)) were recorded in vacuum packed seeds stored under cold storage and it was on par with those stored under room

temperature (α-amylase (2.06 mg maltose released/min), lipase(13.17 milliequivalent free fatty acid /min/g) and protease(26.79 mg amino acid released /min/ml)) and followed by aluminium packed bag α-amylase (3.06 and 4.02mg maltose released/min), lipase(15.22 and 15.63 milliequivalent free fatty acid /min/g) and protease(25.52 and 25.18 mg amino acid released /min/ml)values were higher in vacuum packed seeds than gunny bags, HDPE bags , Aluminium bag for groundnut seeds stored under cold storage compared to room temperature throughout the storage period. Among the packaging materials, the groundnut seeds stored in vacuum packed bags maintained the seed quality and seed germination with least deterioration compared to seeds stored in Aluminium bag , gunny bags and high density polythene bags.

Keywords: *Seed quality, Moisture content, enzyme activities, vacuum packaging and cold storage.*

RAFVAL:ES-2025/238

Comparative Analysis of Thermoadaptability Among Indigenous and Crossbred Cattle Through Biochemical and Gene Expression Markers

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Climate change caused by global warming has heightened the vulnerability of livestock worldwide to heat stress (HS), leading to reduced animal productivity and posing a serious threat to the livelihood and sustainability of small-scale or marginal farmers. The neuroendocrine, cellular and molecular systems, along with behavioral and metabolic networks, play a crucial role in the body's adaptive response to stress. In animals, adaptation and the maintenance of homeostasis occur through hormonal and molecular mechanisms. To evaluate the effects of heat stress on the expression of heat stress-responsive genes, an experiment was conducted using six native (Hariana) and six crossbred (Vrindavani) cattle. These animals were exposed to a temperature of 38°C in a psychrometric chamber for 49 days, followed by a 7-day recovery period, with daily exposure lasting 6 hours. Blood samples were collected every seven days up to day 49 for the isolation of peripheral blood mononuclear cells (PBMCs). PBMCs were isolated from heparinized blood, RNA was extracted, and gene-specific primers were used for qPCR analysis to assess the expression of genes including HSP70, HSP90, IL-2, IL-6, eNOS, and iNOS. These variations in hormone and gene expression of the Hariana breed indicate their potential roles in reducing the harmful effects of heat stress, helping maintain cellular balance, and supporting the animal’s defense mechanisms during prolonged thermal stress.

***Keywords**: Hariana, Heat stress, Thermoadaptability, Psychrometric chamber, Crossbred*

RAFVAL:ES-2025/239

Effect of tannin supplementation on enteric methane emission and rumen fermentation parameters of Sahiwal heifers

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Climate change is exacerbating heat stress in livestock, negatively impacting animal health, productivity, and welfare. Furthermore, livestock are significant contributors to greenhouse gas emissions, particularly methane, which is a potent contributor to global warming. Therefore, it is essential to develop strategies to mitigate heat stress and reduce methane emission in livestock. This study aimed to investigate the effects of tannin supplementation on enteric methane emission, rumen fermentation parameters, and physiological responses in Sahiwal heifers under different seasonal conditions. Sixteen Sahiwal heifers were selected and divided into two groups: a control group and a treatment group. The control group was fed with normal farm feeding, while the treatment group received a diet with 50% fodder replacement with ramie grass and supplementation with mango seed kernel powder 3% of dry matter intake (DMI). The study was conducted across three seasons: hot dry, hot humid, and thermoneutral. Rumen fermentation parameters and enteric methane emission were measured once in each season. The results of this study showed that mean values of methane emission significantly ($p \leq 0.05$) decrease in treatment group as compare control group in all season. Rumen ammonia nitrogen levels were significantly ($p \leq 0.05$) decrease in the treatment group suggesting improved nitrogen utilization. A significant ($p \leq 0.05$) increase in total rumen volatile fatty acid (VFA) production in all seasons. These findings highlight the potential of tannin supplementation as a sustainable strategy to mitigate methane emissions and improve rumen fermentation in different seasons.

Keywords: *Methane, Tannin, Ammonia, Fermentation*

RAFVAL:ES-2025/240

Infrared Thermography and Hematological Profiling for Early Detection of Laminitis in Cattle

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Laminitis is a painful inflammatory disorder of the bovine hoof, frequently leading to lameness and significant economic losses in the livestock sector. Early diagnosis is essential for effective management and to minimize long-term complications. This study assessed the utility of infrared thermography (IRT) as a non-invasive method for early detection of laminitis, in conjunction with hematological stress markers. Twenty lactating cattle from the Livestock Research Centre (LRC), ICAR-NDRI including both healthy and laminitis individuals were evaluated. High-resolution thermal images were obtained using a FLIR camera, targeting the coronary band and hoof regions, and temperature gradients between limbs were analyzed. Simultaneously, blood samples were collected to measure total leukocyte count (TLC), neutrophil-to-lymphocyte ratio (NLR), and cortisol concentrations, which are indicative of systemic inflammation and stress. IRT effectively detected increased surface temperatures in the hooves of laminitis-affected cattle, reflecting localized inflammation. Statistically significant elevations ($p < 0.05$) in TLC, NLR, and cortisol were observed in affected animals compared to healthy controls. Moreover, there was a strong positive correlation between regional hoof temperature and both TLC ($r = 0.852$, $p < 0.01$) and cortisol levels ($r = 0.608$, $p < 0.05$). Laminitis limbs and coronary bands exhibited temperature increases of 4.28°C and 3.72°C, respectively, relative to healthy cattle. These results demonstrate that integrating infrared thermography with hematological profiling provides a rapid, non-invasive, and animal-friendly approach for early laminitis detection. This combined diagnostic strategy facilitates prompt intervention, thereby improving animal welfare and reducing economic losses associated with lameness in cattle.

***Keywords**: Infrared Thermography, Laminitis, Hematological parameters, dairy cattle.*

Data to the Annadata – Agronomic Intelligence (AI) for Sustainable Farming Transformation

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While Agriculture is a highly localized field and the most important one for feeding the populace of the world and as global agriculture strives to meet the dual challenges of food security and environmental sustainability, it is imperative that the integration of Artificial Intelligence (AI) into precision farming offers a transformative pathway. There are field level challenges that the farmers face and a detailed study through collection, collation, consolidation and correlation of data and information to the challenges faced would yield a better understanding of solutions that can solve problems.

Our study presents a data-driven analysis of farmer behavior, challenges, and readiness for the much-needed digital adoption based on our multi-dimensional survey wherein the data collected across diverse agricultural districts in the state of Maharashtra would throw some light on the way forward. Using correlation analysis and heatmapping techniques, we examine relationships between different crop types and systemic constraints such as rising input costs, lack of modern machinery, and knowledge access.

Our findings reveal strong positive correlations among pesticide, fertilizer, and herbicide costs, suggesting systemic inefficiencies in agri-input availability. Most operational challenges (input cost, availability, lack of machinery) are highly correlated ($r > 0.95$) and the rising cost of fertilizers vs. pesticides ($r = 0.99$) suggests these issues co- occur, indicating systemic constraints in agri-input supply chains. We have also observed Strong Positive Correlations between the information about government schemes with Market volatility ($r = 0.99$) and lack of proper advice ($r = 0.99$), which implies that knowledge access is a major bottleneck. We have observed Weak or Negative Correlations of Climate change and uncertainty of water which have low or near-zero correlations with most other factors, possibly indicating a lack of awareness or recognition of climate risks among farmers and also lack of manpower is negatively correlated with climate concerns (r ≈ -0.67) and other major issues suggesting that where climate or market risks are acknowledged, labor issues are deprioritized. The study further explores the high digital readiness among farmers—98% own smartphones and 95% express willingness to adopt agricultural applications—highlighting a receptive ecosystem for location-based, crop-specific decision support systems and agri-tech tools underscore the need for contextual, multilingual interfaces and integrated advisory platforms.

Keywords: *Precision Agriculture, Artificial Intelligence, Generative AI in Agriculture, Farming Challenges, Sustainable Farming, Hyperlocal Decision Support*

Algal Diversity and Ecotourism Aspects of Badbela Talab Wetland Jhalawar

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Wetlands are among the most productive ecosystems, offering crucial ecological services and supporting diverse biological communities. The Badbela Talab Wetland (BBTW) in Jhalawar (Rajasthan) is an ecotourism significant area for its ecosystem services and biodiversity values including algae and waterbirds. Algae are autotrophic microorganisms group which crucial aquatic ecosystem also indicates changes in water quality. This study investigates the algal diversity in BBTW and explores its potential contribution to ecotourism. Water and algae samples were collected monthly from selected four sample sites using standard plankton nets and preserved with 4% formalin and 2% Lugol's iodine solution(two step methods) for laboratory analysis. Identification and microphotography was performed using compound microscope with digital camera and standard taxonomic keys. Algal species composition, abundance and seasonal variation assessed using diversity indices. Environmental parameters such as water temperature, pH, dissolved oxygen, and nutrient concentrations were measured on-site using portable multimeter other than in laboratory to understand their influence on algal growth. Findings revealed a rich diversity of algae, including Chlorophyceae, Cyanophyceae, Bacillariophyceae, Chrysophyceae and Euglenophyceae reflecting the ecological health and productivity of BBTW. Ecotourism plays a vital role in promoting sustainable development while conserving natural ecosystems. This study explores the ecotourism potential of BBTW and an adjacent Lov Kush Vatika, focusing on their ecological, educational, and recreational values. Through field observations, visitor surveys, highlights the aesthetic and cultural significance of BBTW .The findings indicate that this natural sites offer unique opportunities for environmental education, bird watching, and nature-based tourism. However, challenges such as waste management, habitat disturbance, anthropogenic activities, and lack of infrastructure were also identified. There is an urgent need to better management. The study provides a scientific basis for sustainable ecotourism planning while ensuring environmental sustainability and local livelihoods.

Keywords: *Algal diversity, physicochemical parameters, Badbela Talab Wetland, Ecotourism.*

RAFVAL:ES-2025/243

Recent Advances in Veterinary Sciences for Livelihood and Environmental Sustainability

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Recent advancements in veterinary sciences have played a pivotal role in enhancing livestock productivity, ensuring livelihood security, and promoting environmental sustainability. Breakthroughs in disease diagnostics, such as portable PCR devices, CRISPR-based detection tools, and AI-powered imaging systems, have revolutionized early disease detection, minimizing zoonotic risks and economic losses for farmers. Novel vaccine technologies, including mRNA vaccines and nanoparticle-based delivery systems, provide enhanced protection against emerging and endemic livestock diseases while reducing antibiotic dependency.

Precision livestock farming (PLF) has emerged as a game-changer, integrating IoT-enabled wearables, automated milking systems, and drone-based herd monitoring to optimize animal health, welfare, and resource efficiency. Sustainable feed innovations—such as insect-derived proteins, single-cell proteins, and agro-industrial byproduct utilization—are reducing the environmental footprint of livestock production by lowering methane emissions and deforestation linked to conventional feed crops.

Genomic advancements, including CRISPR-Cas9 gene editing and genomic selection, are accelerating the development of disease-resistant, heat-tolerant, and high-yielding livestock breeds, crucial for climate adaptation. Furthermore, the One Health approach has gained momentum, fostering interdisciplinary collaboration to combat antimicrobial resistance (AMR), prevent pandemics, and balance ecosystem health.

These innovations not only bolster farm incomes and food security but also align with global sustainability goals by promoting eco-efficient practices. However, challenges remain in scaling these technologies for smallholder farmers and ensuring equitable access. Future research should focus on policy frameworks, cost-effective solutions, and capacity-building to maximize the societal and environmental benefits of modern veterinary sciences.

Keywords: *Veterinary sciences, precision livestock farming, sustainable feed, One Health,*

RAFVAL:ES-2025/244

Human-Wildlife Conflict: Veterinary Solutions For Coexistence

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Human-wildlife conflict (HWC) is a growing global challenge, threatening biodiversity, agricultural livelihoods, and public health. As natural habitats shrink and human populations expand, interactions between wildlife and domestic animals intensify, leading to economic losses, zoonotic disease transmission, and retaliatory killings of endangered species. Veterinary science plays a crucial role in mitigating these conflicts by promoting coexistence through innovative and sustainable interventions.

This paper explores veterinary strategies to reduce HWC, focusing on disease prevention, livestock protection, and wildlife conservation. One key approach involves improving livestock health through vaccination programs, parasite control, and fortified husbandry practices, reducing the need for farmers to encroach on wildlife territories. Another solution is the use of non-lethal deterrents, such as guardian animals (e.g., dogs or donkeys), bio-fencing, and predator-proof enclosures, which minimize livestock predation while preserving carnivore populations. Additionally, veterinary professionals contribute to wildlife health monitoring, identifying zoonotic disease risks (e.g., rabies, bovine tuberculosis) at the human- livestock-wildlife interface. Early detection and One Health collaborations help prevent outbreaks that could devastate both wildlife and farming communities. Community engagement is equally vital; training farmers in wildlife-friendly practices and conflict resolution fosters long-term coexistence.Ultimately, reducing HWC requires multidisciplinary efforts, with veterinarians at the forefront. Their expertise in animal health, disease management, and sustainable farming can bridge the gap between humans and wildlife.

Keywords: *Human-wildlife conflict, veterinary interventions, livestock protection, zoonotic diseases, One Health, sustainable coexistence.*

Effect of tannin supplementation on enteric methane emission and rumen fermentation parameters of Sahiwal heifers

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Climate change is exacerbating heat stress in livestock, negatively impacting animal health, productivity, and welfare. Furthermore, livestock are significant contributors to greenhouse gas emissions, particularly methane, which is a potent contributor to global warming. Therefore, it is essential to develop strategies to mitigate heat stress and reduce methane emission in livestock. This study aimed to investigate the effects of tannin supplementation on enteric methane emission, rumen fermentation parameters, and physiological responses in Sahiwal heifers under different seasonal conditions. Sixteen Sahiwal heifers were selected and divided into two groups: a control group and a treatment group. The control group was fed with normal farm feeding, while the treatment group received a diet with 50% fodder replacement with ramie grass and supplementation with mango seed kernel powder 3% of dry matter intake (DMI). The study was conducted across three seasons: hot dry, hot humid, and thermoneutral. Rumen fermentation parameters and enteric methane emission were measured once in each season. The results of this study showed that mean values of methane emission significantly ($p \leq 0.05$) decrease in treatment group as compare control group in all season. Rumen ammonia nitrogen levels were significantly ($p \leq 0.05$) decrease in the treatment group suggesting improved nitrogen utilization. A significant ($p \leq 0.05$) increase in total rumen volatile fatty acid (VFA) production in all seasons. These findings highlight the potential of tannin supplementation as a sustainable strategy to mitigate methane emissions and improve rumen fermentation in different seasons.

Keywords: *Methane, Tannin, Ammonia, Fermentation*

RAFVAL:ES-2025/246

Anthelmintic Resistance of Gastrointestinal Nematodes of Small Ruminants

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Anthelmintic resistance among gastrointestinal nematodes (GINs) in small ruminants has emerged as a significant threat to sustainable livestock production worldwide. GINs, particularly Haemonchus contortus, Trichostrongylus spp., and Teladorsagia circumcincta, are responsible for substantial economic losses due to decreased productivity, increased morbidity, and mortality in sheep and goats. The widespread and often indiscriminate use of anthelmintic drugs—especially benzimidazoles, macrocyclic lactones, and imidazothiazoles—has accelerated the development of resistance. Current evidence reveals alarming levels of multidrug resistance across various regions, particularly in intensive and semi-intensive production systems. This resistance threatens the efficacy of conventional control measures and necessitates an urgent shift toward integrated parasite management (IPM) strategies. These include targeted selective treatment (TST), pasture rotation, nutritional supplementation, genetic selection for parasite-resistant breeds, and the use of novel or alternative therapeutics such as bioactive forages and vaccines. Understanding the genetic and epidemiological dynamics of anthelmintic resistance is crucial for developing sustainable parasite control programs and preserving the health and productivity of small ruminant populations.

***Keywords**: Goat, Sheep, Drugs, Effective management, Parasite.*

RAFVAL:ES-2025/247

Infrared Thermography and Hematological Profiling for Early Detection of Laminitis in Cattle

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Laminitis is a painful inflammatory disorder of the bovine hoof, frequently leading to lameness and significant economic losses in the livestock sector. Early diagnosis is essential for effective management and to minimize long-term complications. This study assessed the utility of infrared thermography (IRT) as a non-invasive method for early detection of laminitis, in conjunction with hematological stress markers. Twenty lactating cattle from the Livestock Research Centre (LRC), ICAR-NDRI including both healthy and laminitis individuals were evaluated. High-resolution thermal images were obtained using a FLIR camera, targeting the coronary band and hoof regions, and temperature gradients between limbs were analyzed. Simultaneously, blood samples were collected to measure total leukocyte count (TLC), neutrophil-to-lymphocyte ratio (NLR), and cortisol concentrations, which are indicative of systemic inflammation and stress. IRT effectively detected increased surface temperatures in the hooves of laminitis-affected cattle, reflecting localized inflammation. Statistically significant elevations ($p < 0.05$) in TLC, NLR, and cortisol were observed in affected animals compared to healthy controls. Moreover, there was a strong positive correlation between regional hoof temperature and both TLC ($r = 0.852$, $p < 0.01$) and cortisol levels ($r = 0.608$, $p < 0.05$). Laminitis limbs and coronary bands exhibited temperature increases of 4.28°C and 3.72°C, respectively, relative to healthy cattle. These results demonstrate that integrating infrared thermography with hematological profiling provides a rapid, non-invasive, and animal-friendly approach for early laminitis detection. This combined diagnostic strategy facilitates prompt intervention, thereby improving animal welfare and reducing economic losses associated with lameness in cattle.

Keywords: *Infrared Thermography, Laminitis, Hematological parameters, dairy cattle.*

RAFVAL:ES-2025/248

Trade Competitiveness and Evolving Export Patterns of Indian Marine Products: A Decadal Analysis

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The present study evaluates the export competitiveness and trade direction of India's marine products over the decade spanning from 2013 to 2022. The research employed Revealed Comparative Advantage (RCA) and Relative Symmetric Comparative Advantage (RSCA) to assess export competitiveness and the Markov chain analysis to assess the trade direction of marine product exports. The results indicated that the India holds a strong comparative advantage in exporting crustaceans, evidenced by the highest average RCA and RSCA value of 9.05 and 0.80 respectively, affirming its dominance in global crustacean markets. Molluscs and frozen fish also exhibit comparative advantage with moderate RCA values of 3.33 and 1.50, respectively. However, other categories such as live fish, fresh/chilled fish and aquatic invertebrates revealed RCA values below unity and negative RSCA values, indicating comparative disadvantage in exporting of these marine products. The transitional probability matrices for both quantity and value of exports underscore the stability of frozen shrimp as India's most consistent export segment, with over 82 per cent retention in quantity and 91 per cent in value. In contrast, marine products like frozen squid, dried items and live items showed high volatility with minimal retention. Gains and losses across categories highlight shifts due to changing international demand, policy impacts and product diversification. Overall, the findings emphasize the need to strengthen areas of disadvantage while consolidating India's leadership in crustaceans and frozen marine products.

Keywords: *Marine exports, Revealed Comparative Advantage, Export competitiveness, Crustaceans, Indian seafood trade.*

RAFVAL:ES-2025/249

Optimizing Irrigation Regimes and Sowing methods to Improve Yield and Quality of European Carrot in the Mid-Hill Region of the North-Western Himalayas

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Efficient irrigation and appropriate sowing methods are essential for optimizing carrot production. Inadequate water supply during critical growth stages limits nutrient uptake and disrupts physiological processes, while excessive irrigation leads to nutrient leaching and reduced productivity. Similarly, the method of sowing is another critical agro-technique that significantly influences seed germination, plant establishment and directly influencing nutrient availability and crop response. To address these agronomic considerations, a field experiment was conducted during the 2021–22 and 2022–23 growing seasons at Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India. In this study, 2 sowing methods (S_1- flat-bed and S_2- ridge) and 4 irrigation schedules *viz.* I_1 (IW/CPE 0.6), I_2 (IW/CPE 0.8), I_3 (IW/CPE 1.0) and I_4 (IW/CPE 1.2) at 3 cm depth of irrigation were evaluated and replicated thrice in RBD (factorial). The results revealed that carrot yield significantly increased under higher irrigation levels, particularly when combined with ridge sowing. Among the irrigation regimes, IW/CPE 1.0 emerged as the most efficient, achieving the highest water productivity and economic returns per unit of water used. Notably, this regime also resulted in a 15% water saving compared to the highest irrigation level (IW/CPE 1.2), demonstrating its superior efficiency in water utilization while sustaining high productivity.

Keywords: *Irrigation regimes, sowing methods, productivity, nutrients.*

RAFVAL:ES-2025/250

Integrated and Conservation Agriculture-Based Strategies for Sustainable Chilli Thrips Management

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Chilli thrips **(*Scirtothrips dorsalis* Hood)** are a major pest affecting crops like chilli and other crops like cotton, strawberries, and ornamentals. While insects are abundant globally, only about 1 per cent directly compete with humans—chilli thrips being among them by reducing crop yields and quality. Although chemical pesticides are widely used for thrips control, they pose risks to human health, the environment, and contribute to pest resistance. This highlights the need for sustainable pest management strategies. Conservation agriculture (CA) offers a viable solution by promoting soil health, biodiversity, and reduced chemical input. Increased biodiversity in CA systems can naturally suppress chilli thrips through enhanced populations of beneficial organisms. However, CA adoption can face challenges such as inconsistent yields, increased labor, and the potential buildup of pests if not managed properly. Integrated Pest Management (IPM) complements CA by using a mix of methods: Cultural: crop rotation, intercropping, and timely planting Biological: natural enemies like predatory mites and fungi Mechanical: sticky traps and reflective mulches Chemical: selective use only when pest thresholds are reached Biotechnological: resistant varieties and RNAi-based methods. Innovations like bio-intensive IPM, precision agriculture (PA), and biotech tools further enhance chilli thrips control by enabling early detection and targeted action. Combining CA, IPM, PA, and biotechnology enables effective, eco-friendly, and sustainable chilli thrips management, supporting long-term agricultural productivity and environmental health.

Keywords: *Chilli thrips, IPM, Conservation Agriculture, Precision Agriculture, Biodiversity*

RAFVAL:ES-2025/251

Influence Of Storage Conditions, Packing Materials And Storage Months On Seed Longevity Of Onion (Allium Cepa L.) Seeds

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The seeds of onions (Allium cepa L.) have a very limited lifespan and lose viability in one year. To determine the influence of storage conditions, packing materials and storage months on seed longevity of onion seeds cultivar Arka Kalyan have been uesd in this experiment. Onion seeds were kept for 18 months in different of containers, including cloth bags, high density polythene bags, purdue improved crop storage bags, aluminium foil and vacuum packed bags, at ambient and in cold conditions (5-7 ºC and 65-70 % RH). The studies findings showed that while seed quality parameters such as germination percentage, total seedling length, seedling vigour index, and seedling dry weight decreased with increasing storage period but lipase activity increased. While moisture content levels fluctuated considerably over the course of storage, they remained constant for vacuum packaging. In comparison to seeds stored in cloth bags, high density polythene bags, purdue improved crop storage bags and aluminium foil seeds, seeds stored in vacuum packed bags had the best quality preservation among the containers. Additionally, it was discovered that seeds stored in vacuum-packed bags retained their seed quality with the least deterioration in comparison to other packaging materials.

Key words: *Storage conditions, vacuum packaging, lipase activity*

RAFVAL:ES-2025/251/A

Reducing Post-Harvest Losses Through Integrated Management Systems

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Post-harvest losses represent one of the most critical challenges to global food security, particularly in developing countries where up to 30–40% of harvested crops are lost before reaching consumers. These losses not only diminish the economic returns for farmers but also contribute to unnecessary pressure on natural resources and greenhouse gas emissions. This paper explores innovative and scalable post-harvest management strategies aimed at reducing losses across the agricultural value chain. The study assesses the causes of post-harvest losses including improper handling, lack of storage infrastructure, poor transportation, and inadequate processing facilities and provides evidence-based solutions tailored to various crop types and climatic regions. Emphasis is placed on low-cost, energy-efficient storage systems (e.g., solar- powered cold storage), hermetic grain storage, improved packaging materials, and farmer training in handling practices. Furthermore, the paper evaluates the role of ICT tools and mobile- based platforms in improving logistics, traceability, and market access. Policy interventions, such as investment incentives for rural infrastructure and the integration of post-harvest planning into national agricultural strategies, are discussed as essential enablers. By adopting holistic post- harvest systems and empowering smallholder farmers with tools and knowledge, countries can significantly reduce food loss, enhance food availability, and create new economic opportunities.

RAFVAL:ES-2025/251/B

Value Addition In Agriculture: Unlocking Economic Potential Through Agro-Processing

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As global demand shifts toward convenience, quality, and sustainability in food products, value addition in agriculture has emerged as a transformative strategy to increase farmers' income, generate employment, and reduce post-harvest losses. This paper explores the economic and social potential of value addition through agro-processing, branding, and market diversification, particularly in the context of smallholder and rural agricultural systems. The research examines various forms of value addition ranging from primary processing (drying, cleaning, grading) to secondary processing (packaging, preservation, manufacturing) and how they impact profitability, shelf-life, and market competitiveness. Case studies from India, Kenya, and Latin America illustrate successful models of farmer cooperatives, women-led agribusinesses, and public-private partnerships that have leveraged agro-processing to access premium markets, both domestic and international. Special focus is given to policy and financial frameworks that support micro and small enterprises in agri-value chains, including training, access to credit, start-up incubation, and digital market platforms. The paper also delves into challenges such as food safety regulations, infrastructure gaps, and the need for quality certification and traceability mechanisms. Ultimately, value addition serves not only to improve product quality and consumer appeal but also to catalyze rural industrialization and empower farming communities.

RAFVAL:ES-2025/252

Climate Adaptation Strategies For A Warming World

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With climate change intensifying the frequency and severity of droughts, floods, wildfires, and heatwaves, the world is confronting an urgent need to adapt to new environmental realities. While mitigation remains critical, adaptation strategies have become equally essential particularly for vulnerable populations in developing nations already facing the brunt of climate impacts. This paper explores a range of adaptation strategies across critical sectors such as agriculture, water resources, public health, and urban development. Focusing on locally-driven, context-specific solutions, the study highlights success stories from diverse regions including South Asia, Sub-Saharan Africa, and Latin America. Case studies demonstrate how communities are employing nature-based solutions such as mangrove restoration and agro ecology alongside modern tools like climate-smart agriculture, early warning systems, and mobile-based weather forecasting. The integration of indigenous knowledge with scientific research is also shown to enhance adaptive capacity in culturally and ecologically relevant ways. Policy-level interventions are analyzed, emphasizing the need for multi-scalar governance structures, inclusive decision-making, and climate finance mechanisms such as risk insurance and adaptation funds. The research underscores the importance of mainstreaming adaptation into national development agendas to ensure long- term resilience and sustainability. Ultimately, the study argues for a paradigm shift from viewing adaptation as a reactive response to disasters, to proactively building climate-resilient systems and societies. Achieving this requires coordinated global support, innovation, and empowerment of local communities to lead adaptation efforts tailored to their unique challenges.

RAFVAL:ES-2025/252/A

Climate-Smart Agriculture For Sustainable Crop Production And Food Security

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The escalating impacts of climate change rising temperatures, erratic rainfall, and frequent extreme weather events pose significant threats to global food security, especially in vulnerable regions of Africa, South Asia, and small island developing states. In response, climate-smart agriculture (CSA) has emerged as a crucial strategy to enhance crop productivity while building resilience and reducing agricultural emissions. This paper explores the adoption of CSA practices as a scalable solution to secure sustainable crop production in the face of environmental stressors. The study synthesizes field-level data and policy case studies on the implementation of CSA techniques, including drought-tolerant crop varieties, precision irrigation, conservation tillage, agroforestry, and integrated pest management. It further evaluates the role of digital agriculture, such as AI-powered advisory systems and satellite- driven crop monitoring, in optimizing resource use and decision-making. The economic and social benefits of CSA are also examined, including improved livelihoods, soil regeneration, and gender-inclusive farming practices. Barriers to large-scale adoption such as limited access to finance, knowledge gaps, and policy fragmentation are analyzed, with recommendations for multi stakeholder partnerships, capacity-building initiatives, and integration into national climate action plans. The abstract concludes that CSA is not just an adaptive approach but a transformative one. With appropriate investments and enabling environments, it can serve as a cornerstone for achieving food security under the pressures of climate change, population growth, and resource scarcity.

RAFVAL:ES-2025/252/B

Soil Health And Agro Ecology In Ensuring Long -Term Food Security

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Degraded soils, driven by intensive monoculture farming, chemical overuse, and poor land management, are undermining the foundations of global food systems. With nearly one- third of the planet's arable land degraded, the crisis of soil health is becoming a critical bottleneck in achieving sustainable crop production and long-term food security. This paper focuses on the urgent need to restore soil ecosystems through agro ecological principles that prioritize biodiversity, ecological balance, and farmer-led innovation. The research draws from global case studies where agro ecology has successfully reversed land degradation and enhanced food productivity particularly in regions such as the Sahel, Central America, and parts of Southeast Asia. It highlights the role of cover cropping, crop rotation, composting, intercropping, and the use of bio fertilizers in enhancing soil organic matter and nutrient cycling. The intersection of agro ecology and indigenous knowledge systems is also explored as a means to empower smallholder farmers and strengthen local food sovereignty. Furthermore, the study critically examines the political and economic barriers to scaling agro ecology, including market incentives that favour industrial agriculture and the lack of policy support for regenerative practices. It calls for integrated soil health frameworks, investment in agro ecological research, and reforms in agricultural subsidy systems to prioritize ecological sustainability over yield maximization alone. In conclusion, restoring soil health through agro ecology is essential not only for crop productivity but also for climate mitigation, biodiversity conservation, and rural resilience. This transition must be central to future food security strategies amid growing ecological and demographic pressures.

RAFVAL:ES-2025/253

DSR - a promising alternative to traditional transplanting methods in paddy

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Rice is one of the world's most important food crops and it is a staple food for more than half of the world's population. South East Asia, is presently known to be the centre of origin of rice. Direct seeded rice (DSR) is a method of rice cultivation in which the paddy seeds are sown directly into the field, instead of the traditional method of growing seedlings first in a nursery followed by transplanting them into the main field. DSR has now emerged as a promising alternative to the traditional transplanting methods, offering several benefits that contribute to sustainable and resourceful rice cultivation. Looking into advantages of DSR method over conventional paddy cultivation, firstly, direct seeding significantly reduces water consumption compared to flooded transplanting methods, sponsoring water conservation in paddy cultivation. Secondly, the labour input required for DSR method is significantly lower than that required for the traditional transplanting method. The elimination of the labour-intensive steps of conventional paddy cultivation such as seedbed preparation, seedling transplantation into the field, results in reduced labour costs, cost of cultivation and increased operational efficiency for farmers. Furthermore, DSR method allows for timely planting, enabling the farmers to adjust their cultivation schedules with the optimal weather conditions. This adaptability reduces the risk of crop loss due to unfavourable environmental conditions, increasing overall crop resilience. The improved flexibility in planting also aids in taking up multiple cropping patterns, contributing to the improved productivity and higher income generation. In conclusion, global agriculture is currently facing the challenges of climate change, resource scarcity, and a growing population, the advancement of sustainable and efficient methods like DSR can become a crucial step towards ensuring food security to the population and economic fortune in paddy cultivating regions.

Key words: *Direct seeded rice (DSR), sustainability, transplantation, climate change and food security*

RAFVAL:ES-2025/254

Response of paddy (*Oryza sativa* L.) genotypes to direct seeding: A study on physiology and yield

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A field study was conducted during the *Kharif* seasons of 2022 and 2023 to examine the performance of 35 rice genotypes under the Direct Seeded Rice (DSR) cultivation method, along with six check varieties. The experiment was laid out in a randomized block design with two replications. The objective was to assess key physiological parameters that influence plant growth and grain yield in DSR conditions. The analysis showed that successful genotypes in DSR systems typically demonstrate superior physiological efficiency. Vital indicators such as a high Normalized Difference Vegetation Index (NDVI), increased photosynthetic rate, and suitable stomatal conductance were found to be crucial during early growth stages. Notably, genotypes IET 28746 (18.4 μmol CO_2 m^{-2} s^{-1} photosynthetic rate, 46.2 SPAD, 0.83 NDVI, 5450 kg/ha), IET 29965 (17.9 μmol CO_2 m^{-2} s^{-1} photosynthetic rate, 45.8 SPAD, 0.81 NDVI, 5320 kg/ha), and IET 29511 (18.7 μmol CO_2 m^{-2} s^{-1} photosynthetic rate, 47.1 SPAD, 0.85 NDVI, 5580 kg/ha) demonstrated superior physiological characteristics, contributing to their better yield performance. These findings suggest that selecting genotypes based on advantageous physiological traits can effectively improve grain yield under DSR practices.

Keywords: *DSR, Genotypes, checks, physiological attributes, selection.*

RAFVAL:ES-2025/255

Automation of Waste water treatment through Machine Learning

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Abstract: Waste water treatment is an insurmountable issue of present times. Waste water though generates intentionally and unintentionally by various industrial and anthropogenic activities exerts influential impact on all our natural resources. Traditionally, waste water treatment involves physical, chemical and biological methods and their amalgam at primary, secondary and tertiary stages of treatment with the sole objective of reduction in biological oxygen demand and improving waste water quality. Disposal of waste water has been stringently monitored but the associated cost in treatment demands application of machine learning. It helps in predicting effluent concentration, micropollutant behaviour, energy consumption and enhances performance of biological waste water treatment plants. Machine learning is computation based algorthim where input data is trained to achieve desired outcome. It is an emerging technique for real-time and cost-effective methods for simulating system performance. This paper highlights a review of different machine learning models applicable for waste water treatment viz., artificial neural network, support vector machines, data-driven adaptive control, Gaussian process regression, Long Short-Term Memory networks and ensembles of trees etc. The review will help in understanding reliable methods for management and operation of a Wastewater Treatment Plant (WWTP).

Keywords*: waste water, machine learning, reinforcement learning, forecasting*

RAFVAL:ES-2025/256

Impact of Biochar on Carbon Sequestration and Soil Physico-chemical properties

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Society currently faces global environmental challenges of the burning of waste plants reside which demand innovative, interdisciplinary and complex solutions. In India about 500 million tons agricultural and agro-industrial residues are being generated annually in the country. The major quantities of these wastes generated from agricultural sources are sugarcane bagasse, aromatic crop residue, paddy, wheat straw, and husk, etc. (Quispe *et al.* 2017). A major amount of this agricultural residue farmers treats as waste, are burn in field itself. Hence, there is need to combat these problems through a sustainable management system, which will revive depletion of waste generated from agriculture itself. Conversion of this agricultural waste into biochar through pyrolysis could be a positive solution for minimizing agricultural waste. Production of biochar also offers many opportunities for enhancing soil Physico-chemical characteristics and carbon sequestration.

Biochar is the by-product of pyrolysis that has been produced for the amendment of soil profile as well as soil biota. At present waste is generated in agriculture, forests and related agro-industries is in tremendous amount. Biochar could provide a key solution by converting these wastes (biomass) into biochar for soil amendment. Biochar, the solid product of biomass carbonization intended as a soil amendment, has attracted attention due to its ability for long term improvements in soil physical and chemical properties with potentially important effects on soil biota. Biochar offers multitude of benefits in terms of agronomical and environmental management. With the high levels of carbon in atmosphere, mainly in the form of CO_2 gas, atmosphere acts as a potential source of carbon. Soil carbon sequestration is a feasible strategy for reducing the concentration of CO_2 in the atmosphere. Recently, interest has grown to sequester atmospheric carbon into biochar followed by its application to the soil. Soil application of biochar is being frequently reported as a potential option for climate change mitigation through carbon sequestration and other agricultural and environmental benefits. Application of biochar into the soil not only sequester carbon but also reduce emission of N_2O and CH_4 from soil, provide suitable option for management of agricultural and forestry wastes, enhancement of soil sustainability, reduction in fertilizer requirements, production of renewable energy and several other environmental benefits (Lehmann and Joseph 2015; Wang *et al.* 2018; Majumder *et al*. 2019). Biochar chemical and physical properties, including its resistance to microbial utilization, change with aging (Mukherjee *et al.,* 2014) which has profound implications for the estimation of the long-term capacity of biochar-amended soils to sequester carbon (Spokas, 2013). The biochar application in agriculture is attracting significant attention globally as a way to increase characteristics of the soil. Soil amendment with biochar has been considered as an suitable option for several purposes such as improving soil nutrient availability (Prasad *et al.,* 2017), biological activity i.e. soil enzyme activity (Awad *et al.,* 2018) and microbial activity (Pressler *et al.,* 2017).

Dume *et al.* (2016) studied that the addition of biochar improved, pH, electric conductivity (EC), cation exchange capacity (CEC), organic carbon (OC), organic matter (OM), total nitrogen (TN), exchangeable cations and available phosphorous of the soil and had no significant effect on soil texture. According to the recent research, the application of carbonization products may effectively enhance the physico-chemical characteristics of soils and improve the fertility of poor soils (Saletnik *et al.,* 2019**)**. Han *et al.* (2017) stated that the biochar application has a significant impact on the soil bacterial community, which may improve the microbial diversity of continuous cropping systems in cotton soils. Adekiya *et al.* (2020) reported that biochar application significantly in both years improved yield of cocoyam and soil physical (bulk density, porosity, moisture content, mean weight diameter (MWD) of soil aggregates, dispersion ratio, and infiltration rate) and chemical (soil organic matter, pH, N, P, K, Ca, Mg, and CEC) properties and erosion resistance.

Singh Mavi *et al.* 2018 reported that electrical conductivity (EC) and pH, oxidisable organic carbon (OC), microbial biomass carbon (MBC), dissolved organic carbon (DOC) and available nutrients (NPK) increased with increasing rates of biochar addition in both loamy sand and sandy clay loam soils. Singh and Mavi (2018) stated that rate of C mineralization (mg CO_2-C g^{-1} SOC day^{-1}) was greater in treatments receiving higher rate of biochar application and also found that MBC and DOC concentration increased with increasing rate of biochar addition as compared to control. Bhullar *et al.* (2019) reported that irrespective of the SAR levels, addition of rice straw biochar enhanced cumulative respiration (CR) and microbial biomass carbon (MBC), more so at higher rate of application. Both pH and SAR significantly decreased in the biochar amended sodic soils, whereas opposite trend was noticed in the amended control. Rice straw biochar significantly increased electrical conductivity, dehydrogenase activity, and P and K contents when compared to control (no amendment) up to 7.5 cm soil depth (Gupta *et al.,* 2019).

Studies have showed that biochar application improved the physical, chemical, and biological properties and therefore crop yield. Biochar has been shown to improve soil structure (Jien and Wang 2013), soil aggregate stability, tensile strength and penetration resistance and porosity (Kimetu and Lehmann 2010), water-holding capacity and nutrient cycling (Harvey *et al.* 2012), and soil infiltration and reduce runoff and decrease erosion (Asai *et al.,* 2009). On the basis of recent studies, it is quite evident that effects of biochar feedstock and production process (pyrolysis conditions) on the physical, chemical and biological properties of soil must be better understood to devise effective management strategies for achieving agricultural benefit. Thus Biochar application is a unique sustainable approach, which has a significant potential to address number of environmental issues and good way to sequestrate atmospheric carbon. Under field condition the biochar is a suitable candidate for the improvement of soil physio-chemical properties, microbial abundance and composition.

RAFVAL:ES-2025/257

Agricultural Finance and the Ground Realities of Bihar's Small Farmers

Atul Kriti[1]

Agricultural finance continues to play a pivotal role in shaping the livelihood security and economic productivity of small and marginal farmers (SMFs) in India. In Bihar, where over 90% of agricultural households fall under the SMF category, their dependence on seasonal credit is not just a financial matter, but a question of survival. This study evaluates the effectiveness of both Union and State-level government initiatives aimed at providing institutional credit to SMFs in Bihar. The analysis draws on a combination of government reports, policy documents, and field-level survey responses gathered from SMFs and key administrative stakeholders in selected districts of Bihar.

Despite the growing scale of credit disbursements under schemes like the Kisan Credit Card (KCC), PM-KISAN, and NABARD-backed cooperative credit systems, the ground realities reflect a mismatch between institutional intent and impact. The study reveals that while targets under the Annual Credit Plan have seen a consistent rise, SMFs continue to struggle with procedural hurdles, limited awareness, lack of collateral, and dependence on informal sources. Findings show that credit access is often influenced by landholding size, literacy levels, and administrative support systems.

The paper argues for a more inclusive financial architecture—one that simplifies procedures, integrates doorstep banking solutions, and promotes participatory credit literacy models. Strengthening cooperative institutions and regional rural banks, while leveraging digital platforms, is also recommended. This research adds to ongoing discussions on rural financial inclusion and seeks to inform policy shifts that genuinely empower the SMF community.

Keywords: *Agricultural finance, Small and Marginal Farmers, Bihar, Institutional credit, Rural livelihoods*

Efficacy of post-emergence herbicides on growth and yield of mungbean [*Vigna radiata* (L). Wilczek]

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A field experiment entitled "**Efficacy of post-emergence herbicides on growth and yield of mungbean [*Vigna radiata* (L). Wilczek]**" was conducted at Instructional Farm, College of Agriculture. Jodhpur (Rajasthan) during *kharif* season of 2022. Field experiment was laid out in randomized block design (RBD) with ten treatment combinations and replicated thrice. The treatments taken in the investigation were W_1- Weedy check, W_2- Weed free, W_3- Imazethapyr 55g/ha, W_4- Fluazifop-p-butyl 250g/ha, W_5- Pendimethalin + imazethapyr 800g/ha, W_6- Imazethapyr + imazamox 70g/ha, W_7- Propaquizafop + imazethapyr 83.3g/ha, W_8- Aciflourfen sodium + clodinafop- propargyl 210g/ha, W_9- Fomesafen + fluazifop-p-butyl 220g/ha, W_{10}-Quizalofop ethyl 60g/ha. Results indicated that post-emergence application of fomesafen + fluazifop-p-butyl 220g/ha (W_9) significantly reduced weed density and dry weight of *Digera arvensis* L., *Phyllanthus niruri* L., *Dactyloctenium aegyptium* L. results in achieving higher weed control efficiency at all growth stages of crop that improved weed index and also lesser nutrient removals (N, P, K) recorded at 30, 45 DAS and at harvest. Owing to reduction in weed infestation which improved growth attributes *viz.* final plant population (311 '000 plants/ha) at harvest, plant height (11.10, 36.21 and 58.3 cm), dry matter accumulation (2.75, 11.84 and 21.26 g/plant), number of trifoliate leaves (8.80, 14.36 and 12.06/plant) at 30, 45 DAS and at harvest, respectively, while total number of branches (6.21 and 7.09/plant), root length (12.58 and 13.49 cm) and root

volume (7.08 and 10.08 cm^3) was significantly recorded at 45 DAS and at harvest, respectively due to application of said treatment (W_9) during field experimentation.

Similarly, significantly higher number of pods/plant (35.79), number of grains/pod (9.74) and 1000-grain weight (42.26 g) were recorded under post-emergence application of fomesafen + fluazifop-p-butyl 220g/ha (W_9) resulted in production of higher grain yield (1253 kg/ha), stover yield (2093 kg/ha) and biological yield (3346 kg/ha) and also showed their efficacy in recording higher protein yield (309 kg/ha) and contents of N, P and K in grains and stover as well as their uptakes by mungbean.

Improvement in grain yield that resulted in higher monetary advantages in terms of gross return (₹ 109,728/ha), net return (82,148) and B C ratio (3.97) by application of most effective treatment (W_9) as compared to weedy check (W_1). However, among all the treatments weed free (W_2) recorded significantly highest growth and yield attributing characters and yield over rest of the treatments tested during field trial.

Keywords: *- Dry matter; efficacy; fomesafen; growth attributes; imazethapyr; post-emergence; weedy check; weed free*

RAFVAL:ES-2025/259

Multivariate analysis for grain yield and its contributing traits in wheat (*Triticum aestivum* L.) under Southeastern humid plain of Rajasthan

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At present scenario, it is an urgent need to develop wheat varieties which is an economical, viable, climate resilience and sustainable option via plant breeding approaches. Therefore, the study was focused on to assessing the genetic diversity among the wheat cultivar. Forty-two cultivars were evaluated in RBD with four replications during *rabi* season 2023-24 at AICRP on Seed (Crops), AU, Kota, Rajasthan. The recorded data of 12 traits were subjected to assessment of multivariate analysis. The significant differences were observed among the cultivars for all the traits under studied. Among the cultivars, a wide range of variation was noted for most of the traits. In Principal component analysis (PCA), Out of 12 PCA, the first six PCA were contribute 83.23 % of the total variation while only first two components contributed for 44.62 % variation. It revelled those days to 50 percent flowering, number of tillers in one-meter^2 area, number of grains per spikelet and test weight were major contribute to the total variability. Five clusters were formed from 42 cultivars studied. Cluster IV has highest number of 14 cultivars followed by cluster III (12 cultivars). Cluster I was solitary with one cultivar. The cluster I and IV had the greatest inter cluster distance of 113.42 %. Based on their overall appearance and per se performance from a diverse cluster, the wheat cultivar Raj-42.38, Raj-3765, Raj-4037, UP-2338, GW-366, HD-2278, GW-190, Sujata, HD-2967, HD-2781, UP-319, PBW-226, HD-2189 and DBW-16 and GW- 503 were found desirable. This study suggests that these identified wheat cultivars can be employed in hybridization programmes and to produce better transgressive segregants, offering a high potential for yield in subsequent generations.

Keywords: *Cultivar, Genetic diversity, Grain yield, PCA, and Wheat*

RAFVAL:ES-2025/260

Development and Evaluation of Value-Added Products from Dragon Fruit *(Hylocereus undatus)* for Enhanced Nutritional Benefits and Waste Utilization

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Hylocereus undatus is the most abundant variety of dragon fruit known for its superfood powers and high nutritional properties. This study was intended to increase knowledge about its functional and nutritional properties to benefit the population through value added products of dragon fruit. Preserved products using different ratios of pulp and peel were developed and standardized through organoleptic evaluation. By-products were also utilized to develop value added products. Dragon fruit jelly obtained the highest mean value (8.3) for colour of T1 which means “liked very much” and the lowest (6.9) for texture of T2 which came in category of “liked moderately”. The highest score for overall acceptability (8.0) found in T1 which also “liked very much” and selected for further research on storage study. The colour difference in mean scores found significant at 5 per cent level. However that of other sensory attributes including appearance, flavour, texture, taste and overall acceptability found non-significant at 5 per cent level. Candy and spread developed as a by-product for utilizing the filtrate of fruit discarded while making dragon fruit jelly. This helped maximum utilization of fruit parts and minimizing the waste as well. The study highlights the therapeutic significance of dragon fruit, development of value-added products to generate employment in food sector and utilization of by-products for efficient management of waste resulting into increased productivity, low cost and high profitability.

Keywords: *Dragon fruit, value addition, jelly, by-products*

RAFVAL:ES-2025/261

Assessment of Genetic Variability, Heritability and Genetic Advance among different characters in tomato [*Solanum lycopersicum* (Mill.)]

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The field experiment was carried out at Horticulture Research Farm-1, Babasaheb Bhimrao Ambedkar University (A Central University), Lucknow, during the Rabi season 2021-22. In this, 20 genotypes, including check cultivars, were evaluated to estimate different characters' genetic variability, heritability, and genetic advance. The experiment was laid out in a Randomized Block Design (RBD) with three replications. Characters viz., days to 50% flowering, plant height, number of primary branches per plant, polar diameter of fruit, equatorial diameter of fruit, total soluble solids, number of fruits per cluster, average fruit weight, number of fruits per plant, marketable fruit yield per plant, unmarketable fruit yield per plant and total fruit yield per plant were studied during the experiment. Analysis of variance showed significant differences among genotypes for all the characters under study during the investigation. The Phenotypic coefficient of variance (PCV) was higher than the genotypic coefficient of variation (GCV) for the characters studied. The highest genotypic coefficient of variation (GCV) was observed for unmarketable fruit yield per plant (30.23). The moderate GCV was reported for total fruit yield per plant (29.52), followed by plant height (29.18) and average fruit weight (26.22), whereas it was least for TSS (7.76), followed by days to 50% flowering (8.46) and number of fruits per cluster (13.11). Except for TSS (72.89), all characteristics had high heritability coupled with genetic advance, thus showing some scope for improvement through selection, and may successfully improve the attributes to increase tomato yield.

***Keywords**: Tomato, RBD, Traits, Genotypes, Heritability, PCV, GCV.*

RAFVAL:ES-2025/262

Management of Fruit rots disease of Ash Gourd (Petha)

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Ash gourd / White gourd, *Benincasa hispida* (Thumb.) Cogn is a favorite palatable cucurbitaceous vegetable crop grown throughout the tropical and subtropical regions. It is grown in Kharif as well as summer season vegetables in Jalaun District of Uttar Pradesh. Ash gourd is a moisture enriched vegetable containing nearly 96% water and is a great source of vitamin B1, B3 and vitamin C and also possesses carbohydrates and various minerals such as calcium, sodium, zinc, iron, and phosphorus. Fruit of Ash gourd is eaten as a vegetable and also candied with sugar in the preparation of ‘Petha’. Its seeds are edible and used in the preparation of different types of sweets. Decaying of fruits is a major problem during storage. Sometimes rotting starts from the lower fruit portion that has been in contact with soil. White fungal growth, which later on turned into brown circular scelerotia, is observed on the fruit surface. The infected fruits contain completely rotten seeds, which turn white, become hollow, and fail to germinate. The main symptom appears on the upper surface of fruits as black dry rotting, which is localized, and does not affect the entire fruit. Small circular black numerous conidia present over infected fruits. The Fruit Rot disease is caused by *Fusarium Solani*, *Fusarium Moniliforme*, *Verticillium Dahliae*, *Sclerotium rolfsii* and *Phomopsis Cucurbitacearum* in the field as well as during storage. To combat losses caused by this disease, an On Farm Trial on “Management of Fruit rots disease of Ash Gourd (Petha)” was accomplished at the village of Gadhgua and Kurepure Kanar of Jalaun district of Uttar Pradesh. The four treatments, namely, T2 Soil application of Trichoderma harzianum @5 kg/ ha, T3 seed treatment with carbendazim + mancozeb @3 g/kg seed, T4 Foliar application of metalaxyl 4% + mancozeb 64 % @ 3 g /kg seed and T1 Farmers’ practices as control were evaluated against ash gourd fruit rot. The data obtained from OFT revealed that the minimum disease incidence 10.00%, the highest yield 250 Q/ha and cost benefit ratio 1:3.07 were recorded in T4 (Foliar application of metalaxyl 4% + mancozeb 64 % @ 3 g /kg seed) followed by T3 (Seed treatment with Carbendazim + mancozeb @ 3g/kg seed), T2 and T1, respectively.

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Economic Viability And Agribusiness Perspectives Of Climate-Resilient Technologies In Cotton Cultivation: Evidence From Maharashtra

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Cotton cultivation in Maharashtra, a major contributor to the rural economy, is increasingly vulnerable to climatic variability, rising input costs, and market inefficiencies. This research investigates the economic feasibility and agribusiness implications of climate-resilient agricultural technologies in cotton farming. Data was collected through structured surveys and field trials focusing on high-density planting systems (HDPS), precision nutrient management using soil health cards, and micro-irrigation practices like drip systems. A cost-benefit analysis and partial budgeting approach were employed to assess the profitability of these interventions. Integrated pest management (IPM) techniques using bio-inputs and pheromone traps were evaluated for their cost-effectiveness in reducing pesticide expenditure. The study also explores the role of Farmer Producer Organizations (FPOs) and digital marketing platforms such as e-NAM in enhancing price realization and reducing marketing inefficiencies. Findings indicate a significant improvement in gross returns, input use efficiency, and risk mitigation for adopters of these technologies. Policy suggestions emphasize strengthening agri-infrastructure, farmer capacity building, and market linkages to promote sustainable and economically viable cotton production systems under the lens of agribusiness management.

Keywords: *Climate-resilient agriculture, HDPS, e-NAM, IPM, cost-benefit analysis, partial budgeting, FPO*

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Advancing Sustainable Tea Cultivation: Empowering Small Tea Growers Of Assam For Livelihood Security And Environmental Sustainability

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Sustainable development in agriculture has become a global imperative, particularly in regions where small-holder farmers form the backbone of the economy. In Assam, Small Tea Growers (STGs) play a pivotal role in the tea industry, contributing significantly to both local livelihoods and the state's overall production and economy. Representing over half of Assam's tea production, these growers are increasingly adopting innovative, sustainable practices to combat challenges related to soil degradation, climate variability, and fluctuating market access. The paper tries to explore the recent advances in small-scale tea cultivation emphasizing on organic farming, integrated nutrient -pest management and eco-certification as tools for promoting sustainability. These practices would not only improve yield quality and farm incomes but also reduce ecological footprints, restore biodiversity, and promote carbon sequestration. Additionally, support through policy frameworks, training, and certification initiatives has further strengthened the capacity of STGs to adopt climate-smart agriculture. By integrating traditional knowledge with scientific innovations, STGs of Assam are shaping a resilient, green agricultural model that reinforces food and livelihood security without compromising environmental integrity.

Keywords: *Small Tea Growers, Sustainable Agriculture, Organic Tea, Environmental Sustainability, Climate-Resilient Farming, Eco-Certification.*

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Rapid Decomposition Of Solid Waste By Actinomycete

The rapid decomposition of solid waste is a critical challenge for modern waste management systems, especially in urbanized areas with large volumes of organic waste. Actinomycetes, a group of bacteria known for their ability to degrade complex organic compounds, have shown significant potential in accelerating the decomposition process. This study explores the role of actinomycetes in the rapid breakdown of solid waste, focusing on their ability to degrade cellulose, lignin, and other complex materials commonly found in organic waste. The research investigates the isolation and characterization of actinomycetes strains from various environmental sources, their enzymatic activities, and their efficiency in composting systems. Results demonstrate that certain strains of actinomycetes exhibit enhanced decomposition rates, reducing the volume of waste and contributing to the production of high-quality compost. The potential applications of actinomycetes in solid waste management, including their integration into bioreactors and composting processes, are discussed. This study highlights the promise of actinomycetes as a sustainable and efficient solution for improving waste disposal and reducing the environmental impact of solid waste accumulation.

Keywords: *Actinomycetes; antibiotic; bioremediation enzymes; metabolic.*

Assessment of Genetic Variability, Heritability and Genetic Advance among different characters in tomato [*Solanum lycopersicum* (Mill.)]

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The field experiment was carried out at Horticulture Research Farm-1, Babasaheb Bhimrao Ambedkar University (A Central University), Lucknow, during the Rabi season 2021-22. In this, 20 genotypes, including check cultivars, were evaluated to estimate different characters' genetic variability, heritability, and genetic advance. The experiment was laid out in a Randomized Block Design (RBD) with three replications. Characters viz., days to 50% flowering, plant height, number of primary branches per plant, polar diameter of fruit, equatorial diameter of fruit, total soluble solids, number of fruits per cluster, average fruit weight, number of fruits per plant, marketable fruit yield per plant, unmarketable fruit yield per plant and total fruit yield per plant were studied during the experiment. Analysis of variance showed significant differences among genotypes for all the characters under study during the investigation. The Phenotypic coefficient of variance (PCV) was higher than the genotypic coefficient of variation (GCV) for the characters studied. The highest genotypic coefficient of variation (GCV) was observed for unmarketable fruit yield per plant (30.23). The moderate GCV was reported for total fruit yield per plant (29.52), followed by plant height (29.18) and average fruit weight (26.22), whereas it was least for TSS (7.76), followed by days to 50% flowering (8.46) and number of fruits per cluster (13.11). Except for TSS (72.89), all characteristics had high heritability coupled with genetic advance, thus showing some scope for improvement through selection, and may successfully improve the attributes to increase tomato yield.

***Keywords**: Tomato, RBD, Traits, Genotypes, Heritability, PCV, GCV.*

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Integrated Nutrient Management for Sustainable Spinach Beet Production

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The growing demand for sustainable agricultural practices necessitates the integration of eco-friendly inputs that enhance crop productivity while preserving environmental integrity. This study investigates the synergistic effect of inorganic nutrients and biofertilizers on the growth, yield, and quality of spinach beet (*Beta vulgaris* var. *bengalensis*), a leafy vegetable of high nutritional and economic value. A field experiment was conducted using a randomized block design with Ten treatment combinations of recommended doses of inorganic fertilizers (NPK @ 100%, 75%, 50%, 25%) and Biofertilizers, including *Azotobacter*, Phosphate-solubilizing bacteria (PSB), Potassium solubilizing Bacteria (KSB) and Arka Microbial Consortium (AMC) along with Micronutrient spray *i.e.* Arka Vegetable special at 15 days interval. Results demonstrated that 50% inorganic nutrients and 50% Biofertilizers nutrient combination has significantly enhanced plant growth and yield and quality attributes. The combined application of 50% inorganic nutrients and 50% Biofertilizers emerged as an optimal strategy, promoting sustainable yield without compromising soil health. This integrated approach reduces reliance on chemical fertilizers and enhances microbial activity in the rhizosphere, improving long-term soil fertility. Promoting biofertilizer-based nutrient management in spinach beet supports sustainable agriculture and eco-friendly food production, aligning with global efforts toward environmental sustainability, soil health preservation, and improved food security.

Key words: *Inorganic nutrients, Biofertilizers, Sustainable, Spinach Beet.*

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Infestation of red spider mites (*Tetranychus urticae* Koch) on okra crops and its management

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Okra, *Abelmoschus esculentus* (L.) Moench, also called Lady's finger, is one of the most important vegetable crops that is commercially cultivated in almost all of our country's states and in many other parts of the world. The okra crop's vulnerability to a variety of insect pests, including vectors, is a major issue in reducing its productivity. Over 37 insect pest species have damaged okra crops. Crops are attacked by many insects and mites, one of which is *Tetranychus urticae Koch*, the red spider mite। Thus, an investigation into its occurrence and a sustainable management was conducted. *T. urticae* attacks approximately 1200 species of plants, of which over 150 are economically significant. In severe infestation, direct feeding causes defoliation, chlorophyll loss, leaf bronzing, and even plant death। When severe infestation occurs, tetranychid mites web abundantly, forming a thick webbing sheath that covers the entire plant. Spider mite damage alone causes 10–15 percent loss in yield in vegetable crops. According to crop stage, conventional insecticides and synthetic pyrethroids have been found to be the most effective methods for controlling okra pests (Krishnakumar and Srinivasan, 1987). Kumar *et al*. (2007) found that under laboratory conditions, neem methanolic extract at 1% concentration controlled *Tetranychus* sp. at 78.6 percent and 71.9 percent. Avermectin is a natural acaricide made by Actinomycetes and Streptomyces avermitilis, which are found in the soil.

Keywords: *Okra, Abelmoschus esculentus, Tetranychus urticae, acaricide, management.*

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Extraction And Characterization Of Starch Isolated From Different Oats Varieties Grown In Kashmir

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The present investigation "*Extraction and characterization of starch isolated from different oat varieties grown in Kashmir*" was conducted at the Division of Food Science and Technology, SKUAST-Kashmir during the year 2020-21. In the first experiment, starches were isolated from different Kashmir grown oat varieties-SFO-1, SFO-3, Sabzar, SKO-20 and SKO-96 using alkaline steeping method. In the 2nd experiment, the isolated starches were characterized for various physicochemical parameters which include chemical composition, functional characteristics, amylose, amylopectin and extract of amylose leaching. Besides, iodine absorption spectra, acid hydrolysis, degree of synerisis and freeze-thaw stability were determined. The results of chemical composition show that the moisture content of starches ranged from 9.25±0.009% to 13.21±0.115% indicating the shelf-stability of the isolated starches. Ash content of starches varied from 0.66±0.007% to 1.03±0.17% with Sabzar having the highest ash content. While as the nitrogen content was significantly ($p \leq 0.05$) lower for SKO-96 (3.03±0.067%) and highest for SKO-20 with nitrogen content of 3.63±0.088%. Starch damage and starch lipids were found to range from 4.62±0.06% to 6.42±014% and 3.44±0.038% to 5.80±0.063%, respectively. The results indicate that the purity of starches was more than 90%. The functional characteristics showed that amongst all starch samples, SKO-20 had significantly ($p \leq 0.05$) higher water absorption index of 2.86±0.009 g/g where as it had the <lowest oil absorption index (1.71±0.017 mL/g) and swelling factor (5.633±0.176). Swelling factor and swelling capacity were however, found higher for Sabzar. Highest amylose content was observed in SKO-20 (24.28±0.041%) and lowest in Sabzar (19.50±0.041) indicating that all starches fall within the category of intermediate-amylose starches. The extract of amylose leaching also exhibited the similar trend as that of amylose. λ_{max}, blue value and $OD_{620/550}$ were found significantly ($p \leq 0.05$) higher in SKO-20 and the lowest was observed in Sabzar. Starches were subjected to acid hydrolysis, the results of which indicated the highest

percentage of starch hydrolysis in Sabzar (85.16%) and lowest in SKO-20 (78.12%). This is attributed to the lowest amylose content and thus crystallinity in Sabzar than SKO-20. Degree of synersis and freeze-thaw stability was determined for all starch samples and it was observed that SKO-20 had significantly ($p<0.05$) higher degree of synerisis as 67.28±0.009% however, it had the lowest freeze-thaw stability of 68.19±1.75. The FT-IR spectra peaks appeared at apparently 3320, 2920, 2645, 1426, 1331, 1156, 1079, 120, 923, 915-757 cm^{-1} confirming the polysaccharide nature of starches. The wide peak appeared at around 3320 cm^{-1} indicating the nature of the starches. Thermal analysis results showed that endothermic peak appeared in all starch types revealing to starch gelatinization. SKO-20 exhibited ($p\leq0.05$) higher onset gelatinization temperature (T_o) of 76.12±0.06^{o}C while as the lowest was shown by Sabzar with T_o of 69.86±1.31 o C. This suggests that SKO-20 is more resistant to particle degradation when heated in water, which is considered to be important for food ingredients experiencing high temperature during processing. Enthalpy was higher in SKO-20 (15.78±0.09 J/g) indicating the requirement of more energy for gelatinization. In contrast, energy required for gelatinization of Sabzar would be significantly ($p\leq0.05$) lower owing to its lowest ΔH value of 12.60±0.92J/g. The percent transmittance was found to be significantly ($p\leq0.05$) higher in SKO-20 (6.21±0.048%) having higher amylose content, while as the least was observed in Sabzar (4.91±0.034%) owing to its lower amylose content. Gel hardness was significantly ($p\leq0.05$) higher in SKO-20 (21.61±0.007 N) and lowest in Sabzar (18.02±0.011 N). Color profile of starch samples suggested that all types of starches were pure as was evident from their higher values of lightness (L*) more than 90. Pasting characteristics results showed that final viscosity was lowest in SKO-20 (341.30±1.56 mPas) and highest in SKO-96 (1470±1.43 mPas). It was further observed that SFO-1 has the ability to form the most stable hot paste than other varieties owing to its lowest breakdown viscosity. The lowest setback viscosity of 314.62±1.56 mPas was exhibited by SKO-20 and the highest was observed in SKO-96 (1416.05±1.41 mPas).

Key words. *Oats, starch, varieties, pasting properties, thermal properties*

Management of Major Insect Pests of Soybean *Glycine max* (L.) under Field Conditions

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The field experiment on "Management of Major Insect Pests of Soybean, *Glycine max* (L.) under Field Conditions " was conducted at SKUAST-Kashmir Wadura Campus Sopore during *Kharif* 2020 to study the incidence of major insect pests of soybean and to evaluate different insecticides against pod borer on soybean. The incidence of flea beetle, *Altica hemensis* commenced from 27th Standard meteorological week (SMW) with an average population level of 0.48 beetles per three leaves per plant reached its peak level of 1.75 beetles in 32nd SMW and then decreased and reached 0.24 beetles in 40th SMW. The percentage of flea beetle, *A. hemensis* infestation ranged from 8-40%, with highest infestation recorded in 33rd and 34th SMW respectively. The incidence of pod borer, *Helicoverpa armigera* commenced from 29th SMW with an average population level of 0.40 larvae per three leaves per plant reached its peak level of 2.67 larvae in 33rd SMW and then decreased and reached 0.60 larvae in 40th SMW. The percentage of pod borer, *H. armigera* infestation ranged from 4-48%, with highest infestation recorded in 35th SMW. The percentage of pod damage by *H. armigera* ranged from 4-40%, with highest pod damage recorded in 35th SMW. The incidence of flea beetle revealed positive correlation with maximum temperature (r = 0.45), minimum temperature (r = 0.87), morning relative humidity (r = 0.39), evening relative humidity (r = 0.68) and negative correlation with rainfall (r = - 0.41) and sunshine hours (r = - 0.19). The regression analysis revealed that 88 per cent of flea beetle, *A. hemensis* population was influenced by weather parameters. The incidence of pod borer revealed positive correlation with maximum termperature (r = 0.22), minimum temperature (r = 0.33), morning relative humidity (r = 0.59), evening relative humidity (r = 0.31) and negative correlation with rainfall (r = - 0.42) and sunshine hours (r = - 0.06). The regression analysis revealed that 61 per cent of pod borer, *H. armigera* population was influenced by

weather parameters. The results on the effect of various treatments, *viz*., cypermethrin 10EC (0.006%), indoxacarb 14.5EC (0.007%), profenofos 50EC (0.05%), neem oil (0.3%), imidacloprid 17.8 SL (0.005%), quinolphos 25 EC (0.025) and control (water) on the larval population of pod borer, *H. armigera* revealed that all the treatments were found superior over control. The highest mean per cent reduction of pod borer population was observed in indoxacarb 14.5EC (69.44%) followed by imidacloprid 17.8 SL (62.65%), cypermethrin 10EC (58.06%), profenofos 50EC (54.05),), quinolphos 25 EC (48.83%) and neem oil (40.59%). The results on yield of soybean, *G. max* at different treatments revealed that the highest yield percentage of 19.19 was observed in indoxacarb 14.5EC (19.19) followed by imidacloprid 17.8 SL (18.07), cypermethrin 10EC (14.58), profenophos 50 EC (09.91), quinolfos 25 EC (08.72) and neem oil (6.98). Hence, amongst the treatments, indoxacarb 14.5EC or imidacloprid 17.8 SL may be recommended for the management of pod borer, *H. armigera* on soybean, *G. max* (L.).

Keywords*: Soybean, Altica hemensis, Helicoverpa armigera, Mortality, Yield.*

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Climate-Driven Transformation in Grapevine Physiology and Fruit Quality

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Climate change is exerting growing pressure on viticulture through rising temperatures, fluctuating humidity levels and shifting precipitation patterns. These environmental changes have a direct impact on grapevine physiology, particularly on key phenological stages such as bud burst, flowering, fruit set, veraison and ripening. Elevated temperatures often result in earlier bud burst, increasing the risk of frost damage and disrupting the vine's developmental rhythm. Accelerated phenology shortens the growing season, leading to an imbalance between sugar accumulation and phenolic maturity. Concurrently, changes in humidity influence disease pressure, especially fungal infections, and affect stomatal behavior, thereby altering transpiration rates and photosynthetic efficiency. These physiological disruptions contribute to reduced berry size, higher sugar concentrations and diminished acid content, ultimately affecting fruit composition and wine quality.

Moreover, climate variability alters the biosynthesis of key secondary metabolites such as anthocyanins, flavonols and aromatic compounds, threatening regional wine typicity and consumer expectations. The degree of impact varies depending on cultivar, terroir, and vineyard management practices. In response, viticulturists are adapting by refining canopy architecture, implementing regulated deficit irrigation, shifting planting dates, and selecting climate-resilient cultivars, rootstocks and use of new generation growth regulators. Precision viticulture technologies and climate-smart practices are also gaining traction to enhance vineyard resilience. This

review synthesizes current knowledge on the influence of temperature and humidity on grapevine physiology and fruit quality, highlighting the importance of proactive and adaptive strategies to ensure sustainable grape and wine production under changing climatic conditions. Climate change is reshaping grapevine physiology and fruit quality through variations in temperature and humidity, affecting developmental stages, berry composition, and overall wine typicity. These impacts highlight the urgency for adaptive strategies to maintain vine health and fruit standards. Integrating climate-resilient practices is essential to sustain productivity. A forward-looking approach is key to ensuring the long-term stability of viticulture under changing environmental conditions.

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Shatavari: A Multifunctional Medicinal Herb

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Shatavari (*Asparagus racemosus*), a renowned medicinal herb in Ayurveda, is widely recognized for its therapeutic potential in managing reproductive health, immune modulation, and metabolic disorders. The roots of shatavari contain a diverse array of bioactive compounds, including steroidal saponins (shatvarin I-VI), flavonoids (kaempferol, quercetin, rutin), polyphenols, alkaloids, and oligospirostanosides, which contribute to its pharmacological effects. High-Performance Liquid Chromatography (HPLC) analysis has confirmed the presence of sarsasapogenins, racemosol, asparagamine A, and furan derivatives like racemofuran, which play a key role in its antioxidant, anti-inflammatory, and estrogenic activities. Medicinally, *A. racemosus* is extensively used for its estrogenic and galactagogue properties, making it a preferred choice for treating hormonal imbalances, menstrual irregularities, menopausal symptoms, and infertility. It also possesses adaptogenic, anti-diabetic, gastroprotective, antimicrobial, and neuroprotective properties, supporting its application in modern herbal formulations. Research suggests that its immunomodulatory effects enhance resistance against infections, while its gastroprotective activity provides relief from ulcers and acid-related disorders. The increasing demand for shatavari in pharmaceuticals and nutraceuticals necessitates sustainable cultivation strategies to prevent overharvesting. Biotechnological interventions, including *in vitro* propagation and metabolite profiling via HPLC, offer promising solutions for its large-scale production. This abstract highlights the phytochemical composition, medicinal applications, and biotechnological prospects of *Asparagus racemosus*, emphasizing the need for further clinical trials to validate its traditional uses and expand its integration into modern medicine.

Keywords: *Asparagus racemosus*, Shatavari, HPLC analysis, phytochemicals, steroidal saponins, reproductive health, medicinal plants

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Rapid Decomposition Of Solid Waste By Actinomycete

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The rapid decomposition of solid waste is a critical challenge for modern waste management systems, especially in urbanized areas with large volumes of organic waste. Actinomycetes, a group of bacteria known for their ability to degrade complex organic compounds, have shown significant potential in accelerating the decomposition process. This study explores the role of actinomycetes in the rapid breakdown of solid waste, focusing on their ability to degrade cellulose, lignin, and other complex materials commonly found in organic waste. The research investigates the isolation and characterization of actinomycetes strains from various environmental sources, their enzymatic activities, and their efficiency in composting systems. Results demonstrate that certain strains of actinomycetes exhibit enhanced decomposition rates, reducing the volume of waste and contributing to the production of high-quality compost. The potential applications of actinomycetes in solid waste management, including their integration into bioreactors and composting processes, are discussed. This study highlights the promise of actinomycetes as a sustainable and efficient solution for improving waste disposal and reducing the environmental impact of solid waste accumulation.

Keywords: *Actinomycetes; antibiotic; bioremediation enzymes; metabolic.*

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Entrepreneurial Marketing Approaches Among Agripreneurs in the Kumaon Region of Uttarakhand

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This study explores the dynamics of entrepreneurial marketing practices among agripreneurs in the Kumaon region of Uttarakhand, India. With the growing emphasis on rural entrepreneurship and the agribusiness sector, understanding how agripreneurs market their products and services is crucial for sustainable development and economic resilience. The research investigates key dimensions of entrepreneurial marketing, including innovation, customer focus, risk-taking, resource leveraging, and value creation. Through a combination of qualitative interviews and quantitative surveys with local agripreneurs, the study identifies the marketing strategies adopted, the challenges faced, and the impact of regional factors such as geography, infrastructure, and policy support. Findings suggest that while Kumaon agripreneurs exhibit strong entrepreneurial traits, their marketing efforts are often constrained by limited access to digital tools, market information, and financial resources. The study concludes with recommendations for enhancing marketing capabilities through training, government support, and the integration of digital technologies to boost agribusiness growth in the region.

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Enhancing Dairy Processing with Ozone Technology: Efficiency, Safety, & Sustainability

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Ozone (O_3) is a powerful oxidizing agent with promising applications in dairy processing. Due to the high nutritional content of milk and dairy products, microbial contamination and spoilage are significant challenges. Ozone technology enhances efficiency, safety, and sustainability by preventing mold growth on cheese, controlling airborne molds in ripening/storage areas, and mitigating mite infestations that cause product loss. The use of ozone in cheese ripening rooms, particularly for sanitizing wooden racks, has been recommended for decades. Ozone is easily generated and eco-friendly, decomposing quickly without leaving residues, In industrial practice, ozone is produced using corona discharge, electrochemical, or UV radiation methods, with corona discharge being the most commonly used due to its efficiency. Its ability to improve hygiene without leaving harmful residues makes it a valuable tool for modern dairy processing. Ozonation is a cost-effective, eco-friendly technology for dairy processing, enhancing food safety and sustainability. It removes milk residues, eliminates biofilm-forming bacteria, and effectively sanitizes air, water, and food-contact surfaces. Ozone decontaminates *Cronobacter sakazakii* in dried milk, treats bovine mastitis with a 60% recovery rate, and degrades antibiotics and aflatoxins in dairy products. Its rapid decomposition leaves no harmful residues, extends shelf life, and reduces water and energy consumption. This paper explores ozone's applications in dairy processing, its impact on product quality, and its role in sustainable dairy operations.

Keywords. *Biofilm, Cheese, Corona discharge, Dairy powder, Ozonation, Ozone*

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Genotypic Evaluation of Wheat for Seedling Resistance to Leaf Rust Pathotype 12-7

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Wheat (*Triticum aestivum* L) is one of the oldest and most widely cultivated cereal crop. It provides approximately 20% of the calories and 20% of the protein required for the human diet. The most important biotic limitations in its production are fungi, bacteria, nematodes and virus. Among the fungal diseases rusts are the most destructive. Amid all the wheat rusts, Leaf rust caused by *P. triticina* Eriks. is a highly devastating and more prevalent globally. Rust fungus has an inherent ability to rapidly evolve continuously into new pathotypes and spread by air over long distances. The rapid emergence of new virulent pathotypes often leads to the ineffectiveness of rust resistance. So, regular and continuous monitoring of the virulence profiles of *P. triticina* pathotypes and the identification of new sources of resistance is crucial for developing high-yielding resistant cultivars and in formulating effective disease management strategies. In this study seedling resistant test was performed on one hundred wheat genotypes against the pathotype 12-7 and it was observed that among all the germplasm lines fifty-two genotypes were found very resistant, eighteen were resistant, five were moderately resistant, three were moderately susceptible, twenty were susceptible and two were heterogeneous. The genetic resistance is considered the most economical, practical and eco-friendly approach to managing wheat rusts over other alternatives.

Keywords: *Wheat, Leaf rust, Pathotypes, Genotypes, Seedling resistance*

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Efficacy of Botanical Extracts against *Klebsiella aerogenes* causing Stem Rot in Pearl Millet

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Pearl millet [*Pennisetum glaucum* (L.) R. Br.] commonly known as bajra, is an important cereal and forage crop of arid and subtropical regions of Indian subcontinent. Pearl millet plays an imperative role in the food and energy security to the rural people especially in the rainfed areas. The pearl millet crop succumbs to various biotic and abiotic stresses at various stages of growth, which causes low yield and high economic losses in terms of quantity and quality, thus limiting its role in income generation, nutrition and health. Recently, a new bacterial disease, stem rot of pearl millet (*Klebsiella aerogenes*) was reported from Haryana, which is devastating for pearl millet. It is a very destructive and novel disease in major pearl millet growing regions. Aquous extracts of five botanicals *viz*., Neem leaves, eucalyptus leaves, ginger rhizome, turmeric powder and karanj leaves were tested at three different concentrations *viz*., 10, 25 and 50 per cent against *Klebsiella aerogenes* under *in vitro* conditions using disc diffusion method. The highest concentration *i.e*., 50 per cent showed the maximum diameter of inhibition zone in all the plant extracts. The maximum inhibition zone was observed in neem leaves extract followed by eucalyptus leaves and ginger rhizome. An increasing consciousness about environmental pollution due to pesticides has challenged the plant pathologist to search for eco-friendly tools for the disease management. Plant extracts are an eco-friendly alternative to chemical pesticides as they not only suppresses pathogens but also promote the healthy crop stand.

Keywords: *Pearl millet, Stem rot, Plant extracts, Disc diffusion method and Inhibition zone.*

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Gross Anatomical Characterization of Mesenteric Lymph Nodes in Buffaloes (Bubalus bubalis)

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The mesenteric lymph nodes in buffaloes were identifed along the mesentery, primarily adjacent to the jejunum and ileum. Morphologically, these lymph nodes appeared as oval, elongated or small button shaped structures. They were encapsulated and firm in consistency, with coloration ranging from pale pink to Grayish-white. Variations in size allowed for differentiation between large and small mesenteric lymph nodes. These characteristics reflect the typical structural organization of lymphatic tissues and provide essential morphological insights relevant to anatomical and pathological studies in buffloes (Bubalus bubalis).

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Hydrochemical Characterization and Seasonal Suitability Assessment of Groundwater for Drinking Use in the Mahi Upper Basin

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Groundwater is a critical resource for drinking and agricultural needs worldwide, yet its quality is increasingly threatened by both natural processes and human activities. The presence of geogenic contaminants such as fluoride or salinity, along with pollution from industrial, agricultural, and domestic sources, can render groundwater unsafe for human consumption and ecosystem health. Assessing groundwater quality is therefore essential to ensure public health and sustainable water management. In this study, the groundwater quality of the Mahi Upper Basin was evaluated using physicochemical data from 99 monitoring wells, sampled during pre-monsoon (2022) and post-monsoon (2023) periods. The analysis revealed notable spatial and seasonal variations: pH values ranged from 6.82 to 9.05 (mean 7.8±0.4), electrical conductivity (EC) reached up to 3160 µS/cm, and total dissolved solids (TDS) peaked at 2054 ppm. Major ion concentrations showed substantial fluctuations, with calcium ranging from 12–292 meq/L, magnesium from 4–92 meq/L, and chloride from 21–445 meq/L. Fluoride concentrations exceeded the WHO limit (1.5 ppm) in 23% of samples, reaching as high as 3.54 ppm. Post-monsoon samples indicated reduced mineralization (mean TDS: 657 vs. 923 ppm pre-monsoon) but elevated sodium (up to 376 meq/L) and bicarbonate (857 meq/L) levels. Water Quality Index (WQI) assessment classified 68% of samples as poor to unsuitable for drinking, primarily due to high salinity and ion toxicity. These findings underscore the urgent need for targeted groundwater management strategies to address both geogenic contamination and seasonal hydrochemical changes in the basin.

Keywords: *Groundwater, Water Assessment, Hydrochemical Analysis, Seasonal Variation, Water Quality Index, Mahi Upper Basin*

RAFVAL:ES-2025/280

Nutrients dynamics under long term block plantations of different tree species

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The physico-chemical properties viz. texture, soil pH, EC, OC, CaCO3, available nitrogen, phosphorus, potassium and DTPA-extractable micronutrients (Mn, Fe, Cu and Zn) of soil have been anaylzed under block plantations of different tree species viz. Pongamia pinnata, Prosopis cineraria and Ailanthus excelsa in Regional Research Station, Bawal, Rewari (Haryana). For this, soil samples from 0-15, 15-30, 30-60, 60-90, 90-120, 120-150 and 150-180 cm soil depths under tree canopies including site without plantations of these tree species (control) have been collected. Leaves samples of different tree species were also collected to analyze plant nutrient status. The soil was found loamy sand. In general, soil pH and EC decreased significantly under plantations as compared to control and increased with soil depth along profile under tree plantations as well as under control. Highest reduction in pH was recorded under Prosopis cineraria followed by Pongamia pinnata and Ailanthus excelsa. CaCO3 content decreased under tree plantations as compared to control and increased with soil profile. Available NPK and micronutrient content increased under tree plantations as compared to control. Maximum increase in nutrient content was recorded under Prosopis cineraria followed by Ailanthus excelsa and Pongamia pinnata. However, nutrient status decreased with increasing soil depth. The organic carbon content increased significantly under different tree species as compared to control and decreased with soil depth. It was recorded that percent N, P and K content was highest in leaves of Prosopis cineraria followed by Ailanthus excelsa and Pongamia pinnata. Micronutrients viz. Mn, Fe, Zn and Cu content were also found highest in leaves of Prosopis cineraria followed by Ailanthus excelsa and Pongamia pinnata. It was concluded that tree plantations helped in overall improvement of soil nutrient status and maintained its fertility.

Keywords: *Micronutrients, soil fertility, soil texture, block plantations*

RAFVAL:ES-2025/281

Comprehensive Study of Agricultural Accidents in Rajasthan

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Agricultural operations is a vital component of the national economy. However, the use of hazardous machinery and the nature of fieldwork often lead to accidents, which are typically categorized as either fatal or non-fatal. A comprehensive survey was conducted to assess agricultural accidents in three selected districts of Rajasthan Banswara, Pali, and Bharatpur. In each district, 20 villages were randomly selected, and data was collected through personal interviews with victims or their families. The survey employed an IoT-based application and structured questionnaires to capture detailed information. For the year 2021-22, the survey recorded a total of 101 accidents. Among these, 43 were fatal and 58 were non-fatal. Analysis revealed that the highest incidence of accidents occurred among individuals with lower education levels, particularly in the illiterate category, and within the age group of 30-44 years. In terms of causation, accidents involving machinery especially threshers and snakebites were significant contributors, with 5 and 16 reported cases, respectively. The economic impact of these accidents was considerable. The primary objectives of this study were to enhance worker safety, promote awareness, and identify the key factors contributing to these incidents. Implementing adequate safety measures is essential for preventing accidents, improving workforce morale, and fostering higher levels of productivity and job satisfaction among agricultural workers.

Keywords: *agricultural accident, tools and equipment, farm injury, safety.*

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Integrated Analysis of Hydrodynamics and Reactions in Biomass Gasifiers: Drag and Turbulence

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Biomass gasification is a promising technology for converting renewable biomass into valuable syngas, offering a sustainable energy solution. This comprehensive review delves into the intricate interplay between hydrodynamic parameters and chemical reactions within biomass gasification reactors, with a particular focus on drag and turbulence phenomena. We explore the fundamental mechanisms of heat and mass transfer, the role of various drag models, and the application of turbulence models such as DNS, LES, and RANS. By integrating experimental findings, theoretical frameworks, and case studies, we aim to provide a holistic understanding of the complex dynamics governing biomass gasification. This review not only highlights the advancements and challenges in the field but also identifies key areas for future research, contributing to the optimization and design of more efficient and sustainable biomass gasification systems.

Keywords: *Biomass, Gasification, Simulation, Sustainable energy, Waste conversion, CFD*

RAFVAL:ES-2025/283

Smart Metering mechanism in planter for sustainable development

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Sustainable development in Precision agriculture is a farming technique that uses agricultural technology to increase farm production while minimizing environmental impact with enhanced crop performance. Precision agriculture's success is determined by how well it can be used to measure, manage, and evaluate crop production's space-time continuum. The precision planting of crops is progressing in the country, however there is no indigenous precision planting machines available in the country. Some imported substitutes are available but being too costly are beyond the reach of common farmers. There are various types of planters which have different types of seed metering mechanisms which are working by attached with ground wheel; these mechanisms are of mechanical type and they use drive through gears, chains or belts from the ground wheel and while transmitting power, there exists some transmission losses. Due to continuous friction between moving parts, these components are subjected to wear and tear. The sensor system in the machine helps in proper metering of seeds and thus further reduces the losses. Therefore, this review article aiming to provide knowledge about electronic metering of seeds that would be an indigenous and cost-effective substitute for imported planters. The metering unit would be synchronized with the D.C motor with the help of proximity sensor and micro controller. Thus, the precision farming can be achieved with the help of smart metering mechanism by avoiding multiple seed dropping and missing voids, keeping row to row and seed to seed distance constant. By keeping the above points in view, an effort is made to develop a battery-operated corn planter based on electronic sensor metering mechanism. This will share major workload of operator for providing ease in planting operation. The developed planter will ensure precise planting, less drudgery, timeliness, economic viability and eco-friendly machine with scope to be adopted by the small to marginal farmers of the country.

Keywords: *Metering mechanism, Electronic unit, sensor, Precision agriculture, D.C motor*

RAFVAL:ES-2025/284

A Review of Principal Component Analysis Applications in Zero Energy Piped Irrigation Network Design and Evaluation

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The design and optimization of sustainable irrigation systems are critical for enhancing water use efficiency in agriculture, especially under increasing water scarcity and energy constraints. Zero Energy Piped Irrigation Network (ZEPIN) systems, which operate without external energy inputs by leveraging natural gravitational flow, offer a promising solution for low-cost and energy-efficient water distribution. This review synthesizes current research and design approaches related to various ZEPIN configurations, focusing on their hydraulic performance, operational feasibility, and spatial layout strategies. Principal Component Analysis (PCA) is employed as a multivariate statistical tool to identify key parameters influencing system performance across different designs. By reducing dimensionality and highlighting dominant design factors—such as pipe diameter, slope, head loss, discharge efficiency, and topographical alignment—PCA enables objective comparison and classification of ZEPIN alternatives. The findings emphasize the potential of PCA in supporting data-driven decision-making for sustainable irrigation planning. This paper also discusses the limitations of existing studies, proposes an integrated PCA-based framework for ZEPIN optimization, and identifies future research directions for improving system reliability under varied agro-climatic and terrain conditions.

Keywords: *Zero Energy Irrigation, Piped Irrigation Network, PCA, Hydraulic Efficiency, Sustainable Water Management*

RAFVAL:ES-2025/285

Studies on Bioactive Compounds of Mulberry Genotype Lchinose (*Morus alba*)

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The present investigation was conducted to assess the bioactive compounds and antioxidant activity from fresh different parts of mulberry genotype (Ichinose) viz. fruit, leaf, shoot and root. The compounds studied were total soluble solids, total sugars, total chlorophyll, total ascorbic acid, total phenols, total flavonoids, total anthocyanins and total carotenoids. Individual flavonoids and anthocyanins were identified and quantified via high performance liquid chromatography (HPLC). Antioxidant activities were determined by, (1,1-diphenyl-2-picrylhydrazine) radical scavenging assay (DPPH), ferrous reducing antioxidant power (FRAP), hydroxyl radical scavenging assay (HRSA) and beta carotene bleaching assay (BCBA). The content of total soluble solids were recorded highest (20%) in fruit and lowest (4%) in shoot. Similarly, total sugars were recorded highest (16.40%) and lowest (2.90%), in shoot. Total chlorophyll was recorded highest (312 mg/100g) and lowest (10.7 mg/100g) in fruit. Total ascorbic acid was recorded highest (70.9 mg/100g) in leaf and lowest (12.4mg/100g) in root. Highest (533.77 mg GAE/100g) content of total phenols were recorded in fruit and lowest (250.96 mg GAE/100g) in leaf. Also, highest (232.34mg/100g) content of total flavonoids were recorded in fruit and lowest in leaf (110.20mg/100g). Anthocyanin content in fruit was recorded (142 mg/100g) and a negligible amount i.e., (0.01 mg/100g) was recorded in leaf. Content of individual and total carotenoids via high performance liquid chromatography (HPLC) and spectrophotometer were recorded highest (0.21-2.1mg/100g), (4.4mg/100g) and (5.8mg/100g), in leaf and lowest (0.02-0.0.07mg /100g), (0.21mg/100g) and (0.38mg/100g,) in root, respectively. Individual flavonoids viz. quercetin and isoquercetin via HPLC were recorded highest (11.6mg/100g), (6.5 mg/100g) in leaf and lowest (5.3mg/100g) and (2.1 mg/100g) in fruit, respectively. Individual anthocyanins viz cyanadin-3-O glucoside and cyanadin-3-O rutinoside were

only recorded in fruit with a value of (7.2 mg/100g) and (11.6 mg/100g), respectively. Antioxidant activities via DPPH, FRAP, and HRSA were recorded highest (85.06%), (0.711 as O.D) and (73.35%) in fruit and lowest (70.28%), (0.187 as O.D) and (36.67%), in leaf respectively. Highest (24.09%) antioxidant activity via BCBA was recorded in root and lowest (18.06%) in leaf. A significant ($p \leq 0.05$) difference in total was observed amongst the four parts for bioactive compounds and antioxidant activities. The study concluded that due to the presence of high phenolic content and high antioxidant activity there are ample chances for using mulberry plant as an important antioxidant health promoting agent in food and pharmaceutical industries. There is further possibility of using it as neutraceutical agent for value addition in sericulture.

Keywords: *Mulberry, Morus alba, Ichinose, Bioactive compounds and Antioxidant activity.*

RAFVAL:ES-2025/286

Current status of insecticide resistance in cotton leafhopper of northern India

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Amrasca biguttula is one of the most destructive sucking pests of cotton, causing substantial yield losses, and its management in India still relies predominantly on chemical control. However, the indiscriminate and injudicious use of insecticides in the cotton-growing regions of Punjab, Haryana, and Rajasthan has accelerated the development of resistance, posing a major challenge to sustainable pest management. To address this issue, the present study evaluated the current status of insecticide resistance in *A. biguttula* conducting bioassay on field populations collected from key cotton-growing districts—Faridkot, Ludhiana, Bathinda, Mansa, Muktsar, Fazilka, Sirsa, and Ganganagar—against a susceptible reference population from Solan. Among the tested insecticides, tolfenpyrad demonstrated the highest efficacy across all populations, with LC_{50} values ranging from 0.04 to 0.21 ppm, followed by fenpyroximate (0.02–0.32 ppm), flonicamid (2.31–7.48 ppm), dinotefuran (1.71–15.13 ppm), thiamethoxam (15.67–103.17 ppm), imidacloprid (13.95–112.12 ppm), and acetamiprid (73.05–260.43 ppm). Neonicotinoid insecticides were the least effective overall, with the highest LC_{50} values observed in Ganganagar (8.13–260.43 ppm), Mansa (5.02–249 ppm), and Sirsa (15.13–191.33 ppm), though dinotefuran remained comparatively more potent than other members of this group. Reduced susceptibility to flonicamid was evident in Faridkot (7.48 ppm), Ganganagar (7.25 ppm), and Muktsar (7.22 ppm), while resistance to fenpyroximate was pronounced in Ludhiana (0.32 ppm), Ganganagar (0.29 ppm), and Mansa (0.21 ppm). Likewise, tolfenpyrad exhibited slightly elevated LC_{50} values in Fazilka (0.21 ppm), Mansa (0.17 ppm), and Bathinda (0.17

ppm), though it remained the most effective molecule overall. The findings highlight that although resistance to neonicotinoids is widespread and increasing, molecules such as tolfenpyrad, fenpyroximate, and flonicamid continue to exhibit strong efficacy against *A. biguttula*. Their rotation under integrated pest management (IPM) strategies is strongly recommended to delay resistance development, preserve long-term effectiveness, and ensure sustainable management of the cotton leafhopper in northwestern India.

Keywords: *Bioassay, Cotton leaf hopper, Amrasca biguttula, Insecticide resistance, Tolfenpyrad*

RAFVAL:ES-2025/287

Edible Coatings and Biodegradable Packaging for Extending Fruit Shelf Life

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The increasing demand for residue-free, environmentally safe postharvest technologies has accelerated research on edible coatings and biodegradable packaging for perishable fruit crops. Polysaccharide-, protein-, and lipid-based edible coatings enriched with functional bioactive compounds significantly slow down physiological deterioration by forming semi-permeable barriers that regulate moisture loss and gas exchange. Controlled experiments summarized in the Food and Bioprocess Technology review show that chitosan-based coatings can reduce microbial growth on strawberries and tomatoes by 1.2–2.5 log CFU and delay weight loss by 22–40%, effectively extending shelf life by 5–10 days under ambient storage. Similarly, aloe-vera-gel coatings applied on citrus and mango have shown 18–32% lower respiration rates and 25–45% reduced firmness loss, contributing to a 30–50% improvement in marketable fruit percentage after two weeks of storage. Trials on biodegradable packaging materials—particularly PLA (polylactic acid) films, cellulose-nanofiber composites, and starch-based bioplastics—demonstrate equivalent or superior barrier properties compared to conventional plastics. For example, mangoes packed in PLA films exhibited 35% lower moisture loss and 28% reduction in chilling injury symptoms when stored at 10°C for 21 days. Advanced Nano-emulsion coatings containing essential oils (thyme, lemongrass, and clove) or natural antimicrobials have further enhanced antifungal performance, reducing postharvest decay in table grapes and bananas by 40–70%, while maintaining sensory quality. Integration of biodegradable packaging with modified-atmosphere features has produced shelf-life extensions of up to 200–250% in certain berry crops. Despite these successes, challenges remain including cost of coating application at commercial scale, variability in coating uniformity, potential changes in flavor perception, and region-specific biodegradation constraints. Future research must focus on low-cost, farm-level application methods, multifunctional coatings with controlled release of volatiles, and comparative lifecycle assessments to validate environmental benefits. Edible coatings and biodegradable packaging are among the most promising eco-friendly interventions for reducing postharvest fruit losses and enhancing quality.

RAFVAL:ES-2025/288

Impact of different organic fertilizers and AMC on growth and development of *Dieffenbachia* and *Philodendron*

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Ornamental foliage plants improve indoor climate by removing harmful chemicals, absorb noise *etc*. Keeping in mind the importance of foliage plants, the investigation entitled "Impact of different organic fertilizers and AMC on growth and development of *Dieffenbachia* and *Philodendron*" was undertaken. The experiment was carried out at College of Horticulture, Sri Konda Laxman Telangana Horticultural University, Rajendranagar, Hyderabad, during *Kharif*, 2019 and *Rabi* in Completely Randomized Design with seven treatments and replicated thrice. Application of Castor cake 100 g/poly bag (T_2) recorded maximum plant height (79.56 cm), plant spread, number of leaves per plant (7.00), leaf length (53.30 cm), leaf area (3779.02 cm^2), lower specific leaf area (150.00 cm^2/g) , which was followed by the treatment of T_6 - AMC 5 g + Castor cake 100 g/poly bag in *Dieffenbachia* plants. *Philodendron* plants recorded, maximum plant height (40.17 cm), plant spread, number of leaves per plant (52.89), leaf length (20.42 cm), leaf area (5471.55 cm^2), lower specific leaf area (240.85 cm^2/g) in Castor cake 100 g/poly bag (T_2), which was followed by the treatment of T_6 -AMC 5 g + Castor cake 100 g/poly bag.

RAFVAL:ES-2025/289

Polyploidy and Its Applications in Floriculture

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Polyploidy breeding holds immense prospects in developing desirable varieties in flower crops. With the help of polyploidy, changes in morphology and cytology of plant are observed. Tetraploids are more vigorous and larger in size and produce thick and dark green leaves. Mostly seen consequences of induced polyploidy are increase in size and shape of plants, leaves, branches, flower parts, fruits and seeds. Intensification of flower colour and fragrance is observed in marigold plants following chromosome number doubling.

Although colchicine remained the most used for induction of polyploidy Chemicals like colchicine, oryzalin, trixuralin and amiprophosmethyl (APM) etc. are also used in induction of polyploids. Chromosome doubling using various chemicals was observed in flower crops *viz*., marigold, aster, orchid, jasmine, lillium, chrysanthemum, alstromeria, anthurium, rose and gerbera.

Polyploidy breeding holds immense prospects in developing desirable varieties in flower crops. Polyploidy breeding is desirable when a desirable trait is not available in existing genotypes. Colchicine was found to be most used in inducing polyploidy in various crops successfully. With increasing concentration of colchicine solution and soaking duration, per cent germination and survival rate of seedling decreased and stomata size was increased. Plant height was lower, produce more number of branches, flower diameter, longer flower stalks, darker and thickened broad leaves, longer stalks and long storage life compared to diploids.

RAFVAL:ES-2025/290

Efficient Irrigation Management Strategies for Sustainable Rose Cultivation

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Irrigation management plays a critical role in optimizing growth, flower quality, and resource-use efficiency in rose cultivation. Roses are highly sensitive to both moisture stress and excessive water application, making precise irrigation scheduling essential for sustainable production. Proper irrigation management ensures adequate soil moisture for root development, nutrient uptake, and continuous flowering while minimizing water losses through evaporation, runoff, and deep percolation. Modern irrigation techniques such as drip and micro-sprinkler systems have gained prominence due to their ability to deliver water directly to the root zone with high efficiency. These methods not only conserve water but also reduce disease incidence by limiting excess moisture on foliage. The integration of soil moisture sensors, climate-based scheduling, and evapotranspiration models further enhances irrigation precision by aligning water application with crop demand and environmental conditions. Additionally, irrigation practices influence fertilizer use efficiency, as controlled water delivery supports effective fertigation and reduces nutrient leaching. In protected cultivation and greenhouse-grown roses, automated irrigation systems have shown significant potential in improving uniformity, yield, and flower stem quality. Sustainable irrigation management in rose cultivation contributes to higher productivity, improved flower aesthetics, and reduced environmental impact. Therefore, adopting scientifically guided irrigation strategies is essential for meeting the increasing demand for high-quality roses while conserving water resources under changing climatic conditions.

Keywords: *Rose cultivation, irrigation scheduling, drip irrigation, water-use efficiency, sustainable horticulture*

RAFVAL:ES-2025/291

Trap Crops in Horticulture: An Eco-friendly Strategy for Sustainable Pest Management

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Trap cropping is an ecologically sound pest management technique widely adopted in horticultural systems to reduce crop losses caused by insect pests. It involves the strategic cultivation of specific plant species that are more attractive to pests than the main crop, thereby diverting pest populations away from economically important plants. In horticulture, trap crops play a significant role in minimizing reliance on chemical pesticides, promoting environmental safety, and enhancing biodiversity. These crops may function by attracting pests for oviposition, feeding, or shelter, after which the pests can be mechanically removed, biologically controlled, or selectively treated. Trap crops can be classified as perimeter trap crops, sequential trap crops, or sacrificial trap crops depending on their spatial and temporal arrangement. Common examples in horticulture include mustard used to manage aphids in cole crops, marigold for nematode suppression, and sunflower for managing fruit borers. Beyond pest suppression, trap crops contribute to improved crop quality, reduced pesticide residues, and conservation of beneficial insects such as pollinators and natural enemies. When integrated with other components of Integrated Pest Management (IPM), trap cropping enhances system resilience and economic sustainability. However, successful implementation requires proper selection of trap crop species, timing, and management practices. Overall, trap crops represent a cost-effective and environmentally friendly approach that supports sustainable horticultural production while addressing growing concerns over pesticide overuse and ecological imbalance.

Keywords: *Trap cropping, horticulture, pest management, sustainable agriculture, integrated pest management*

RAFVAL:ES-2025/292

Strategies for Mitigating Post-Harvest Losses in Vegetable Crops

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Post-harvest losses in vegetable crops pose a major challenge to food security, farmers' income, and supply chain efficiency, particularly in developing countries. These losses occur due to improper harvesting practices, mechanical injury, physiological deterioration, microbial spoilage, and inadequate storage, transportation, and marketing infrastructure. Vegetables, being highly perishable and metabolically active, are especially vulnerable to quality and quantity losses after harvest. Effective mitigation of post-harvest losses requires an integrated approach involving pre-harvest management, appropriate harvest timing, and adoption of improved post-harvest technologies. Harvesting vegetables at optimum maturity using proper tools reduces physical damage and respiration losses. Immediate pre-cooling, washing, grading, and packaging help maintain freshness and minimize microbial contamination. The use of improved storage methods such as cold storage, controlled and modified atmosphere storage, and evaporative cooling systems significantly extends shelf life. Adoption of suitable packaging materials reduces moisture loss and mechanical injury during transportation. Post-harvest treatments like curing, waxing, use of ethylene inhibitors, and application of safe preservatives further enhance storage life and marketability. Strengthening cold chain infrastructure, improving rural storage facilities, and promoting value addition through processing can substantially reduce wastage. Capacity building of farmers, traders, and stakeholders on post-harvest handling practices, along with policy support and technological interventions, plays a crucial role in loss reduction. Mitigating post-harvest losses not only enhances vegetable availability and quality but also improves profitability, sustainability, and overall efficiency of the horticultural value chain.

Key words: *Pre-cooling, Cold storage, Modified atmospheric storage, Waxing*

RAFVAL:ES-2025/293

An Econometric Analysis of Black Gram Price Forecasting in India

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Black gram (*Vigna mungo*) is a high-value pulse crop of major nutritional and economic significance, valued for its richness in phosphoric acid, protein, calcium, iron, and other essential minerals, and therefore plays an important role in balanced diets. Cultivated widely across diverse agro-climatic regions, particularly under rainfed conditions and in rice fallows, the crop integrates well into multiple cropping systems and also contributes to soil fertility through biological nitrogen fixation, enhancing the sustainability of production systems. India dominates global black gram production, accounting for more than 70 per cent of total output, while Myanmar and Pakistan follow as major producers; among them, Myanmar is a crucial supplier to the Indian market during periods of domestic supply tightness. Strong domestic consumption combined with a narrow global production base results in relatively firm price behavior compared to many other pulses. Price forecasts were generated using an eight-year time series of black gram prices, analyzed through advanced econometric techniques including ARIMA, ARCH, and GARCH models implemented in the R statistical environment. Model adequacy and forecasting efficiency were rigorously evaluated using standard goodness-of-fit criteria such as Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and Mean Absolute Percentage Error (MAPE), and further validated through comparison with futures market trends, national and international trade reports, and state-level trade surveys. Among the competing specifications, the ARIMA (0, 1, 2) model emerged as the most robust and parsimonious for price forecasting. Based on this model, black gram prices are projected to range between approximately Rs. 7,290 and Rs. 7,600 per quintal during the period from January to April 2026, assuming no major policy interventions or external supply shocks. Despite lower domestic arrivals, comfortable carry-over stocks and steady imports at lower international prices will continue to outweigh demand recovery, keeping Black gram prices range-bound to weak over the next 3–4 months.

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Time Series Modeling and Price Forecasting of Maize in India

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Maize (*Zea mays* L.) is one of the most versatile and economically important cereal crops, widely recognized for its remarkable adaptability to a broad range of agro-climatic conditions. It is often referred to as the *queen of cereals* owing to its superior genetic yield potential and high responsiveness to improved inputs and management practices. Globally, maize is cultivated in nearly 164 countries, encompassing diverse soil types, climatic regimes, biodiversity zones, and farming systems, which underscores its resilience and flexibility as a crop. Maize plays a multifaceted role as a source of food, feed, fodder, and raw material for several industrial products, including starch, ethanol, and bio-based chemicals. During 2023–24, maize was cultivated worldwide on approximately 2,082.72 lakh hectares (5,146.51 lakh acres), producing about 12,379 lakh tonnes with an average productivity of 5,962 kg per hectare (2,412 kg per acre). China recorded the largest maize area with 442.57 lakh hectares, followed by the United States of America (350.11 lakh ha), Brazil (223.16 lakh ha) and India (107.44 lakh ha). The United States of America stands as the largest producer of maize, contributing approximately 29.96 per cent of total global production, driven by advanced production technologies and high productivity levels. Other major maize-growing countries include China, Brazil, Argentina, India, Mexico, Ukraine, Indonesia, and South Africa, collectively accounting for a substantial share of world output. Owing to its high productivity, diverse end uses, and growing demand from feed and industrial sectors, maize has emerged as a strategic crop for ensuring food security, supporting livestock industries, and promoting agri-industrial development worldwide. Price forecasts for maize were developed using a 15-year time series of prices analyzed through ARIMA, ARCH, and GARCH models, with parameters estimated in the R statistical software. Model performance was evaluated using Akaike Information Criterion, Bayesian Information Criterion, and Mean Absolute Percentage Error, and the results were cross-validated with futures market trends, trade reports, and state-level surveys. Market fundamentals indicate a mixed year-on-year trend in arrivals, with heavy inflows from Madhya Pradesh keeping overall availability comfortable despite easing arrivals elsewhere. Domestic prices have remained mixed to slightly weak due to ample supply and uneven demand from the feed, poultry, and ethanol sectors, while policy support has provided only limited localized relief. Rabi maize sowing has increased significantly to 15.60 lakh hectares, up 11.5 per cent year-on-year, strengthening expectations of higher production. Globally, abundant supplies and higher export projections from major origins have kept sentiment cautious and prices largely range-bound. Based on the econometric analysis, the ARIMA (1, 1, 2) model was found to be the most suitable for forecasting. Accordingly, maize prices are projected to range between Rs. 2,300 and Rs. 2,540 per quintal during January to April 2026, assuming normal market conditions.

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Field-level assessment of Integrated Pest Management Module for Pink Bollworm in Cotton Agro-ecosystems of Warangal Telangana

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Pink bollworm (*Pectinophora gossypiella* Saunders) is a major pest of cotton (*Gossypium hirsutum* L.) in Warangal district, India, causing serious yield and economic losses. A three-year, multi-location on-farm study (2022–2024) was conducted to evaluate seasonal pest dynamics, weather influence, and economic performance of Integrated Pest Management (IPM) compared with conventional Farmer Practice (FP). The IPM module, consisting of pheromone traps, cultural practices, biological agents (*Trichogramma chilonis*, *Beauveria bassiana*, neem-based products), and need-based insecticide applications, significantly suppressed pink bollworm populations. Peak larval density under IPM ranged from 5.2 to 6.4 larvae per 50 bolls, with seasonal mean population of 8.1–15.3 larvae per 50 bolls, whereas FP plots recorded 16.8–27.6 larvae per 50 bolls. IPM fields exhibited markedly lower rosette flower incidence (3.5–9.2%) and green boll damage (3.1–8.6%) compared with FP (9.8–31.4% and 18.2–25.7%, respectively). Pest incidence peaked during September and declined thereafter. Correlation and regression analyses identified rainfall as the strongest suppressive weather factor ($r = -0.63$), while temperature and sunshine hours favored pest buildup; the regression model explained 68% of the variability in IPM plots. IPM adoption increased seed cotton yield by 36.8–49.6% (28.2–33.7 q ha^{-1}), enhanced net returns (₹108,450–₹158,920 ha^{-1}), and resulted in higher benefit–cost ratios (2.45–2.78) over FP. The results demonstrate that climate-responsive IPM is an effective and sustainable strategy for pink bollworm management in cotton.

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Assessment of yield gains and profitability under IPM-based groundnut cultivation in Warangal district

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Groundnut is an important legume oilseed crop in India; however, a wide gap between potential and realized yield continues due to severe insect pest incidence, erratic rainfall, moisture stress, escalating labour costs, and market price instability, with insect pests posing the major constraint to productivity in Warangal district of Telangana. To address this problem, Integrated Pest Management (IPM) modules were evaluated through large-scale Front Line Demonstrations (FLDs) conducted at twelve farmer locations during the *rabi* 2021, 2022 and 2023, with adjacent farmer practice plots serving as controls. Pest populations in both IPM and control plots were assessed using standard sampling procedures to determine the impact of IPM interventions. The IPM demonstrations resulted in significant suppression of major insect pests, recording 61.5% reduction in thrips, 68.2% in leafhoppers, 74.6% in leaf miner, and 54.3% in tobacco caterpillar throughout the cropping period. Adoption of IPM practices led to an average yield increase of 39.8%, producing a mean pod yield of 2895.6 kg ha^{-1} and an avoidable yield loss of 825.4 kg ha^{-1}. Correlation analysis revealed a strong positive association between yield, net income, and benefit–cost ratio (r = 0.9826 and 0.9769), indicating that enhanced economic returns were primarily driven by IPM-induced yield improvement. The technology gap ranged from 3.2 to 4.3 q ha^{-1}, the technology index from 9.4 to 12.7%, and the extension gap from 8.6 to 9.3 q ha^{-1}, demonstrating the effectiveness of scientific interventions and farmer awareness in improving groundnut productivity through IPM while reducing the cost of cultivation.

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Blending Indigenous and Scientific Knowledge for Sustainable Farming Systems

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Sustainable farming systems are increasingly challenged by climate change, environmental degradation, declining soil fertility, and overdependence on external inputs. In this context, blending Indigenous Technical Knowledge (ITK) with scientific agricultural knowledge offers a viable pathway toward ecologically balanced, resilient, and sustainable agriculture. Indigenous knowledge systems, developed through generations of close interaction with local ecosystems, emphasize biodiversity conservation, efficient use of natural resources, and location-specific farming practices. Scientific knowledge contributes to systematic experimentation, technological innovation, and improved efficiency, creating scope for complementary integration. Indigenous practices related to soil fertility management, traditional seed preservation, mixed and intercropping systems, natural pest and disease control, water conservation, and climate adaptation provide low-cost and environmentally sound solutions, particularly suited to small and marginal farming systems. When combined with scientific approaches such as improved crop varieties, precision nutrient management, climate information services, and strengthened agricultural extension, these practices enhance productivity while reducing ecological risks. Such integration supports sustainable intensification without undermining traditional ecological balance. Blending indigenous and scientific knowledge systems also strengthens farmers' adaptive capacity by recognizing local wisdom, promoting participatory decision-making, and encouraging community-based innovation. However, effective integration is constrained by inadequate documentation of indigenous practices, erosion of traditional knowledge transmission, limited institutional recognition, and weak linkages between formal research institutions and farming communities. Addressing these constraints requires inclusive extension mechanisms, participatory research frameworks, supportive policy environments, and capacity-building initiatives that value indigenous knowledge alongside scientific expertise.

Keywords: *Indigenous Technical Knowledge; Scientific knowledge; Sustainable farming systems; Climate resilience; Agricultural sustainability*

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Multivariate Analysis of Phenotypic Trait Variation in Sweet Corn (*Zea mays* L. *saccharata*)

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Sweet corn (*Zea mays* L. *saccharata*) is an important specialty maize crop valued for its high sugar content, tender kernels, and wide range of uses in fresh consumption, processing industries, and livestock feed. With the increasing demand for sweet corn in urban and peri-urban areas, the development of high-yielding and quality hybrids has become a major breeding objective. Since sweet corn is a cross-pollinated crop, the success of hybrid breeding largely depends on the availability of genetically diverse and superior parental lines. Therefore, assessment of genetic diversity among inbred lines using reliable statistical tools is a prerequisite for effective crop improvement programmes. Our present study was undertaken to evaluate the extent of genetic diversity among 25 sweet corn inbred lines using multivariate techniques. The experiment was conducted during *rabi* 2019–20 at the Maize Research Centre, Hyderabad, following a randomized block design with two replications. Data were recorded for twelve yield and yield-attributing traits, including days to flowering, plant and ear height, ear length and diameter, kernel traits, cob yield (with and without husk), total soluble sugars, and green fodder yield. Principal component analysis (PCA) identified four principal components with eigenvalues greater than one, together explaining 84.64% of the total phenotypic variation. The first principal component contributed the maximum variation and was predominantly influenced by yield-related traits such as cob weight, ear length, ear diameter, number of kernels per row, and plant height. Biplot analysis revealed strong positive associations among these yield-contributing traits. Hierarchical cluster analysis using Ward’s method grouped the inbred lines into six distinct clusters, indicating substantial genetic divergence among the genotypes. Highly divergent inbred lines were identified as promising parents for hybridization. The study demonstrates that multivariate analysis is an effective approach for identifying key traits and diverse parental lines, thereby facilitating the development of superior sweet corn hybrids with enhanced yield and quality.

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Morpho-Physiological and Molecular Divergence Study For Terminal Heat Stress in Bread Wheat (*Triticum Aestivum* L.)

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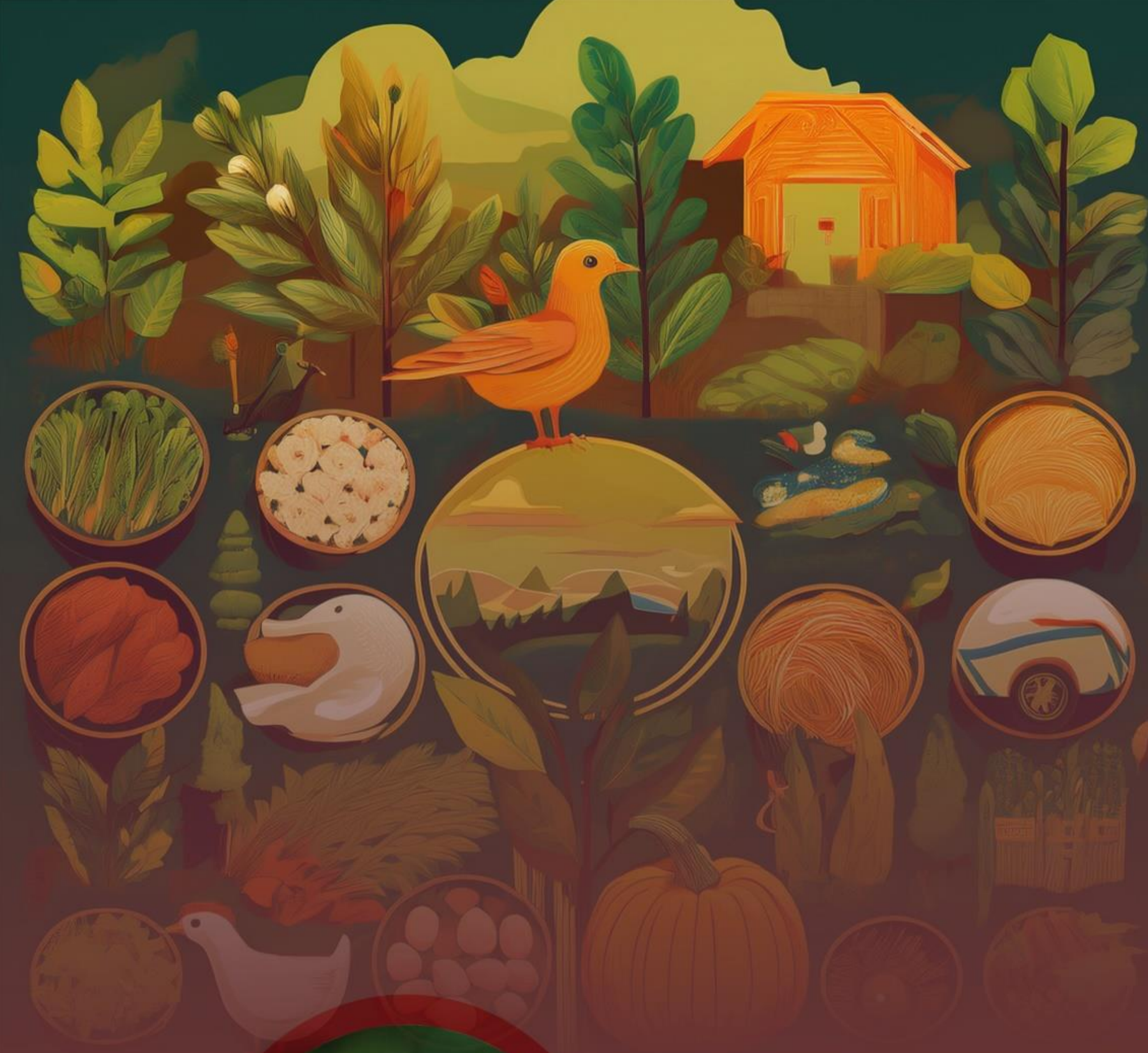
The study was conducted during the *rabi* 2020–21 to evaluate bread wheat (*Triticum aestivum* L.) genotypes for terminal heat stress tolerance under late-sown conditions. Twenty-nine genotypes were assessed under timely and late-sown environments using a Randomized Block Design with three replications. Variability parameters, genetic advance, correlation and path analysis, cluster analysis and molecular diversity were investigated.

Analysis of variance revealed significant genetic variability among genotypes for most traits under both environments. Traits such as tillers per plant, grains per spike and grain yield per plant exhibited high heritability coupled with high genetic advance. Grain yield showed positive associations with tillers per plant, grains per spike, canopy cover and thousand grain weight, while it was negatively associated with canopy temperature and heat susceptibility index under both conditions. Path analysis indicated grains per spike and harvest index as major contributors to grain yield.

Cluster analysis grouped genotypes into nine and six clusters under timely and late-sown conditions, respectively, indicating substantial genetic divergence. Grain yield contributed most to total divergence. Genotypes RAUW401 and RAUW419 were identified as promising donor parents under timely and late-sown conditions, respectively. Molecular diversity analysis using 11 SSR markers classified the genotypes into four groups, supporting the phenotypic diversity observed. The study highlights the potential of identified genotypes and traits for developing heat-tolerant wheat varieties.



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