Two Day National Seminar
on

SUSTAINABLE MANAGEMENT OF NATURAL RESOURCES FOR FOOD SECURITY AND LIVELIHOOD PROMOTION UNDER CLIMATE CHANGE SCENARIO

29th to 30th March, 2024

Organised by:

Department of Biological Sciences (Agriculture)

MIDNAPORE CITY COLLEGE

Venue:

Dr. A.P.J. Abdul Kalam Memorial Hall

MIDNAPORE CITY COLLEGE

Bhadutala, Midnapore, Paschim Medinipur, Pin- 721129, West Bengal, India

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"Sustainable Management of Natural Resources for Food Security And Livelihood Promotion Under Climate Change Scenario"

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SOUVENIR

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MIDNAPORE CITY COLLEGE

(Recognised by UGC, Govt. of India & Affiliated to Vidyasagar University and West Bengal University of Health Sciences)

Midnapore, Paschim Medinipur, Pin- 721129, West Bengal, India

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	Mr. Kamalendu De (Assistant Professor of Botany) Dept. of Biological Sciences.
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	Mr. Suman Dey (Office Attendant) Administrative Dept.

Programme Schedule

Two Day National Seminar
on
"Sustainable Management of Natural Resources for Food Security and Livelihood Promotion under Climate Change Scenario"
Date:
29th to 30th March, 2024.
Venue:

Midnapore City College
Dr. A. P. J. Abdul Kalam Memorial Hall

29th March, 2024 (Friday)		
10.00 am	:	Welcoming dignitaries
10.05 am	:	Opening song
10.10 am	:	Lighting the lamp of inauguration
10.15 am	:	**Welcome address** by Dr. Sudipta Chakraborti, Principal, School of Biological Sciences, Midnapore City College
10.25 am	:	**Address of Guest of Honour**
10.40 am	:	**Presidential Address** by Dr. Pradip Ghosh, Founder Director
10.50 am	:	**Key Note Address by Prof. D. D. Patra, Former VC, BCKV** on "Agricultural productivity and food security in changing climate scenario: Indian perspective".
11.50 am	:	**Vote of Thanks** by Dr. Anulina Manna, Convenor
11.50 am	:	Closing song
12.00 pm	:	Tea Break
12.15 pm	:	**Technical Session – I (Invited Lectures by Resource Persons)** **Chairman: Prof. Arup Chattopadhyay, BCKV** **Rapporteur:** Dr. Kartic Bera
12.15 pm	:	**<u>Invited Lecture – I</u> (12.15 pm to 1.00 pm)** **Prof. Ivi Chakraborty,** Department of Postharvest Technology, F/Horticulture, BCKV, Nadia, West Bengal On "Irradiation technology in food research with special emphasis on fruits and vegetables"

1.00 pm	:	**<u>Invited Lecture – II</u> (1.00 pm to 1.30 pm)** **Dr. Joydeep Banerjee,** Assistant Professor, Department of Agricultural and Food Engineering, Indian Institute of Technology Kharagpur, West Bengal on "Calcium signaling in plants under abiotic stress conditions".
LUNCH BREAK		
2.30 pm	:	**<u>Invited Lecture – III</u> (2.30 pm to 3.00 pm)** **Dr. Pinaki Acharyya,** Institute of Agricultural Science, University of Calcutta, Ballyganj Circular Road, Kolkata on "Nano Fertilizers - A Global Review"
3.00 pm	:	**<u>Invited Lecture – IV</u> (3.00 pm to 3.30 pm)** **Dr. Prahlad Deb,** Department of Horticulture & Postharvest Technology Institute of Agriculture, Visva-Bharati, Sriniketan on "Traditional Processing and Value Addition o f Horticultural Crops Can Play A Crucial Role in Enhancing the Livelihoods of Rural People".
3.30 pm	:	**Technical Session – II** **ORAL PRESENTATIONS (3.30 pm to 5.30 pm)** **Chairman:** Dr. Pratap Kumar Mukhopadhyay **Co-chairman:** Dr. Pinaki Acharya **Rapporteur:** Sudip Bhattacharya
3.30 pm	:	**Technical Session - III** **POSTER PRESENTATIONS (3.30 pm to 5.30 pm)** **Chairman:** Prof. Ivi Chakraborty **Rapporteur:** Pratonu Bandopadhyay
5.30 pm	:	**Hi-Tea**
6.30 pm	:	**Cultural Programme**
8.00 pm	:	**Dinner**

Technical Session – II
ORAL PRESENTATIONS (3.30 pm to 5.30 pm)

Sl. No.	Presenter (s)	Topic
1.	Monjit Paul and Pratap Mukhopadhyay	Deep Water Rice Fish Farming Minimizing Climate Change Effects & Maximizing Resource Use Efficiency
2.	Agniva Halder	Insect Pollinators of Litchi and Foraging Behaviour of Honey Bees
3.	Arnab Das, Subhadip Roy Dibya Maity, Subhas Patar, Pratonu Bandyopadhyay,Shreyosi Roy, Tapan Das	Screening of Different Potato Varieties for Resistance Against Late Blight Diseaseunder Lateritic Zone of West Bengal
4.	Augustina Saha and Shirshendu Samanta	Conservation Agriculture- A New Paradigm in Agricultural Research

5.	Bidipta Roy and Monjit Paul	The Effluents Released in East Kolkata Wetland, West Bengal, India, Impending Threat to Cultured Fish
6.	Chinmoy Mandal, Prerna Baraily, Yegireddy Ashok	Effect of Papaya Plant Extract on Microbial Contamination of Fruits And Vegetables
7.	Dharmadas Kalindi	The Effect of Management of Rice Residue on Yield Parameters, Soil And Weed Flora in Rice-Mustard Cropping System in West Bengal
8.	Kamalendu De	Wastewater Treatment by Algae – A Sustainable Approach
9.	Manas Das and Basudev Mandal	Induced Breeding and Embryonic Development of *Macrognathus Aral* (Bloch And Schneider, 1801) under the Captive Condition
10	Monirul Haque and S K Acharya	Comparative Study on Climate Risks and their Impact on Indian Farming: A Case Study From West Bengal

Technical Session – III
POSTER PRESENTATIONS (3.30 pm to 5.30 pm)

Sl. No.	Presenter (s)	Topic
1.	Aditya Kumar Verma and Goutam Mondal	Production of Papaya (*Carica Papaya* L.) for Papain Extraction
2.	Animesh Chowdhury, Subhajit Barat, Subhajit Pal, Agniva Halder, Subhajit Dutta	Lentils: The Nutritional Powerhouses Ensuring Food Security
3.	Animesh Ghosh	Protected Cultivation of Fruit Crops – A Way Forward for Fruit Growers
4.	Animesh Jana, Debashrita Giri, Smritilekha Maiti	Golden Rice: A Potential Solution to Vitamin A Deficiency
5.	Ankan Das, Sandip Debnath	The Convergence of Big Data and Bioinformatics: Transforming Biological Research
6.	Ankita Majumdar	Micronutrient Deficiency in Fruit Crops And Their Management
7.	Anukriti Moktan	Isolation & Identification of Ectoparasites in Freshwater Ornamental Fish (*Carassius Auratus*) And Its Treatment with *Calotropis Gigantea* Extract
8.	Arnab Mandal, Sudip Bhattacharya	Integration of Advanced Molecular Approaches and Speed Breeding Methods for Development of Climate-Resilient Crops
9.	Asmita Ray, Shreyosi Roy, Pratonu Bandyopadhyay	Nutritional Backup By *Rabi* Leafy Vegetables Under Conservation: A Review
10.	Bidipta Roy and Monjit Paul	Nutritional Backup by *Rabi* Leafy Vegetables under Conservation: A Review
12.	Bikram Jana	A Review on Crop Residue Burning: Impact and Its Management

13.	Debasmita Mandal, Pratonu Bandyopadhyay, Shreyosi Roy	Pasture Based Livestock Farming in Association with Compost: A Sustainable Approach Towards Livelihood
14.	Gangaram Rana, Prahlad Deb and Roshan Lal Sahu	Impact of Temperature on Seed Germination of Papaya (*Carica Papaya* L.) under the Laboratory Condition
15.	Himansu Yadav and Basabadatta Sahu	Role of Plantation Crop in Mitigating Climate Change
16.	Jharna Khatun	Cultivating Harmony– Nurturing the Land Through Natural Farming in Horticultural Crops
17.	Kumar Abhishek and Prahlad Deb	Effect of Foliar Application with Micronutrients on Seedling Growth of Papaya (*Carica Papaya* L.)
18.	Kunal Patra, Pratonu Bandyopadhyay and Shreyosi Roy	*Eucalyptus* Plantation: Political and Environmental Issues And Background
19.	Madhurima Das Sarkar, Prahlad Deb, Payel Das and Pradipto Kumar Mukherjee	Abiotic Stress in Citrus Plants: Challenges and Management Strategies
20.	Manisha Hembram	Biofortified Vegetable Crops: an Option for Mitigating Hidden Hunger
21.	Moumita Roy, Krishnendu Raj, Mahua Banerjee and Kalipada Pramanik	Effect of Integrated Nutrient Management on Yield of Sweet Corn (*Zea Mays* L. *Saccharata* Sturt.) In Coastal Saline Zone of West Bengal
22.	Moupriya Pal, Soumitra Pal and Subrata Mondal	Insights into Pollination, Reproduction and Breeding Systems of *Justicia Gendarussa* Burm.F.
23.	Nayan Kumar Dey, Pratonu Bandyopadhyay and Shreyosi Roy	Efficiency of Using Drones in Crop Production
24.	NityanandaLayek, Anmol Giri, S.C. Sarkar and Gobinda Mula	Estimation of Capital Investment in Installing Different Irrigation Sources - A Study in Northern Districts Of West Bengal
25.	Chaudhuri, P.S., Dhar, S., Giri,U., Paul,N., Lodh, P. and Bandopadhay, P	Effects of Integrated Nutrient Management Through Application of Vermicompost on Soil Physico-Chemical Properties, Paddy Growth, Yield and Earthworm Population Structure
26.	Patatri Mali, Anu Priya and Arka Maji	Transgenic Male Sterility - *Barnase-Barstar* Gene System

30th March, 2024 (Saturday)	
10.00 am	**Technical Session – IV (Invited Lectures by Resource Persons)** **Chairman:** Prof. Tapas Dasgupta **Rapporteur:** Shreyosi Roy
10.00 am	**Invited Lecture – V (10.00 am to 10.30 am)** **Prof. Gopal Shukla,** Department of Forestry, North Eastern Hill University, Tura, Meghalaya on "Climate-Resilient Farming System: Strategies for Managing Challenges and Embracing Opportunities in Tree Outside Forest Environments".

10.30 am	**<u>Invited Lecture – VI</u> (10.30 am to 11.00 am)** **Dr. Ranjit Paul** Assistant Professor, Rani LAxmi Bai Central Agricultural University, Jhansi, UP on "Sustainable Fruit Production Technology and Enhancing Farmers' Income".
11.00 am	**<u>Invited Lecture – VII</u> (11.00 am to 11.30 am)** **Dr. Ranjan Kumar Tarai** College of Horticulture, Odisha University of Agriculture and Technology, Chiplima, Sambalpur, Odisha on "Influence of Micronutrients on Growth, Yield and Physico-Chemical Attributes of Lemon (*Citrus Limon*)".
11.30 am	**Technical Session – V** **ORAL PRESENTATIONS (11.30 am to 1.30 pm)** **Chairman:** Prof. Gopal Shukla **Co-chairman:** Dr. Ranjan Tarai **Rapporteur:** Subhas Patar
11.30 am	**Technical Session – VI** **POSTER PRESENTATIONS (11.30 am to 1.30 pm)** **Chairman:** Dr. Prahlad Deb **Co-chairman:** Dr. Ranjit Paul **Rapporteur:** Pratonu Bandopadhyay
1.30 pm	**LUNCH BREAK**
2.30 pm	**VALEDICTORY PROGRAMME**

Technical Session – V
ORAL PRESENTATIONS (11.30 am to 1.30 pm)

Sl. No.	Presenter (s)	Topic
1.	Patralika Mukhopadhyay and Shibu A.V.	Presence of Microplastics in Gastrointestinal Tract of A Commercially Important Fish Species from Kerala, India
2.	Pradipto Kumar Mukherjee, Payel Das, Madhurima Das Sarkar and Avisek Mondal	Stock-Scion Relationship in Fruit Crops
3.	Ratan Das, Prahlad Deb and Abhijit Debnath	Identification and Utilization of Ethno-Medicinal Plants in Unakoti District of Tripura, India
4.	Rimi Nama	Determination of Lethal Concentration for Imidacloprid to *Anabas Testudineus* of Their Impact on its Behaviour Pattern
5.	Md Imtiazzaman and Sahar Murmu	Efficacy of Different *Trichoderma* Isolates against Collar Rot Disease of Lentil
6.	SandipKumar De, KalipadaPramanik, Sarbajoya Goswami and Subhajit Barat	Biofortification of Nano Zinc on Summer Maize (*Zea Mays* L.) under Drip Fertigation in Lateritic Soil of West Bengal

7.	S. Patar, S.K. Ray, R. Das, K. Sen and U. Bouri	Biofortification of Nano Zinc on Summer Maize (*Zea Mays* L.) under Drip Fertigation in Lateritic Soil of West Bengal
8.	Shirshendu Samanta, Augustina Saha and Asok Saha	Response of Planting Geometry on Production of Potato (*Solanum tuberosum* L.) Seed Under Late Planted Condition
9.	Surendra Patra and Sudipta Chakrabarti	Botanical Sources of Phytoestrogens Serve as Alternative Sources of Food, Offering a Plethora of Health Benefits
10	Bikash Jana	Alpine Sedges (Cyperaceae) and its Effect on Global Warming

Technical Session – VI
POSTER PRESENTATIONS (11.30 am to 1.30 pm)

Sl. No.	Presenter (s)	Topic
1.	Pathik Sutradhar	'Mahua' (*Madhuca Longifolia*) and Its Application For Food and Livelihood Promotion
2.	Payel Das, Prahlad Deb, Pradipto Kumar Mukherjee and Madhurima Das Sarkar	Sustainable Citrus Farming under Climate Change Scenario
3.	Piyali Giri, Pratonu Bandyopadhyay and Shreyosi Roy	Advances in Remote Sensing of Agriculture
4.	Prabhat Kumar and Snehasish Chakravorty	Container Gardening: A New Alternative Towards Gardening
5.	Prakriti Dey	Vertical Gardening Of Horticultural Crops – A Profitable Pathway For Modern Horticulture
6.	Priyanka kumari and Goutam Mandal	Nano Urea - Roles in Agricultural Innovation and Environmental Impact in Banana
7.	Rajarshi Guchhait, Rupam Samadder , Kingshuk Adak, Saikat Pal, Ayantika Dawn	A Review of Kitchen Gardens
8.	Rohit Das, Pratonu Bandyopadhyay and Shreyosi Roy	A Study on: AI Based Plant Disease Detection System
9.	Rounak Mukherjee	Interconnected Life: The Symbiotic Dance of Flora, Fauna, and the Environment in Ecological Conservation
10.	Sanchita Mondal and Ruma Mahata	Signalling Pathways And Downstream Effectors of Plant Innate Immunity: An Updated Insight
12.	Saikat Samanta, Pratonu Bandyopadhyay, Shreyosi Roy and Sudip Bhattacharya	Integrated Farming System: An Approach Towards Agricultural Sustainability, Food security and Livelihood Promotion of Red Lateritic Zone in West Bengal
13.	Santanu Nandi, Jyoti Sankar Padhi, Atanu Majumder, Wanmei M Konyak, Debashis Saren	Response to *Rhizobium* Isolates Interms of Seed Yield and Compatibility of *Rhizobium* in the Case of Green Gram Genotypes

14.	Sarbajoya Goswami,Ganesh Chandra Malik, Mahua Banerjee, Kalipada Pramanik and Sandip Kumar De	Effect of Organic Management On Indigenous Aromatic Rice Cultivars In New Alluvial Zone Of West Bengal
15.	Saurav Kumar and Goutam Mandal	Speed Breeding for Crop Improvement
16.	Shah Ariful Haque, Shreya Pal and Abir Choudhury	Nanotechnology A Potential Tools for Abiotic Stress Management
17.	Soumyadeep Mandal	The Impact of Modern Agriculture on Food Safety
18.	Subhajit Pal, Swarnali Bhattacharya, Agniva Halder, Animesh Chowdhury[4], Buddhisatya Dowara	Relevance of Bee Fauna in Horticultural Products and Strategies for Preserving These Endangered Bee Species
19.	S. Das, F. H. Rahman, R. Roy, P. Bhowmik	Effect of Arka Mango Special Application on Inflorescence Development, Fruit Setting and Fruit Quality of Mango in Malda District, West Bengal
20.	Sudhanshu Yadav	Application of Nanofertilizers in Fruit Production
21.	Debanshu Pradhan, Sukhendu Jana, Sritanu Banerjee and Abhranta Mahata	Organic Farming – Current Status and Future Opportunities
22.	Suranjana Manna and Dr. Kartic Bera	Application of Precision Farming for Climate Resilient Crop Cultivation to Achieve Food Security in India
23.	Sutanu Bhattacharya	Soilless Cultivation: An Advance Approach For Agricultural Development
24.	Swagata Patra, S. K. Acharya, Darshan.N. P.	An Interpretation on Farming Uncertainty in Agriculture Of West Bengal
25.	Swati Rajput	Parthenocarpic Vegetables: Importance and Approaches
26.	Tanmoy Mondal, Soustav Datta and Fatik Kumar Bauri	Genetic Resources Management of Jackfruit
28.	Tanmay Santra Arundhuti Singha, Soumitra Pal and Subrata Mondal	Pollinaria Diversity of Orchidacea from West Bengal: A Systematic Approach
29.	Tanushri Manna and Tapan Das	A Review on Microgreens
30.	Urmila Tudu	Wild Relative of Fruit Crops and Their Uses
31.	Abhijit Debnath	Interaction Between Tomato (*Solanum Lycopersicum* L.) Genotypes and Sowing Windows as Assessed By Diversity Analysis, P.C.A., and Correlation, with Particular Attention to Yield, Quality Attributes, and The Intensity of Disease Outbreak
32.	Pinky Maity	Future Prospects and Post-Harvest Quality Attributes of Tomato and Cherry Tomato Genotypes for Puree Production
33.	Tanushree Guria	Impact of Soil Erosion on Agriculture: A Review
34.	Rahul Sur	Gamma Irradiation; An Emerging Technology to Improve the Shelf Life of Chilli (*C.Annum* L*)*
35	Subhadip Chowdhury and Surajit Mitra	Post-Harvest Assessment of Physiochemical Properties of Arrowroot and Preparation of Gulal

ABOUT THE COLLEGE

MIDNAPORE CITY COLLEGE, the first self-financing General Degree College in the South Bengal region within the state of West Bengal, has been established by MORAINE HUMAN RESOURCE DEVELOPMENT ORGANISATION, a registered society bearing registration S/1L/31682 on dated 02.09.2005 having its office at Aparnapalli, Satbankura, Paschim Medinipur with the sole aim to help the people as per notification of Higher Education Department, Govt. of West Bengal bearing No: W.B (Part-I)/2015/SAR-458 dated 23rd day of September, 2015 published in Kolkata Gazette and subsequent No Objection was issued to this college through the order No.197-ILC/OM-58L/2017 dated 18.07.2017 on the basis of which Vidyasagar University also extended the affiliation by its memo No: VU/R/ Circular /8EC-10 / C0383/ 2017 dated 05.09.2017 and VU/IC/BMLT/MCC/017/2019 dated 29.01.2019. The college is also recognized under section 2(f) by UGC, Govt. of India bearing File No: 8-1/2018(CPP-I/C) dated 18.01.2018 for conducting different Under Graduate and Post Graduate programmes in the faculty of Arts and Science and Allied Health Science from the academic session 2017-18. The college is located at educationally backward and rural area in the district of Paschim Medinipur within the state of West Bengal and most of our students belong to socially and economically backward sections of society. The sole aim of MORAINE HUMAN RESOURCE DEVELOPMENT ORGANISATION is to serve people by imparting quality education and research to the society. The institution has received recognition from Department of Scientific Industrial Research (DSIR) Govt. of India as Scientific and Industrial Research Organisation (SIRO) bearing F. No.11/762/2018-TU-V dated 26th November,2018. The institute is recognised under The Directorate of Medical Education, Government of West Bengal (ME/MISC-85-2020/M/1720/1(2) dated 13.11.2020, ME/MISC-85-2020/M/2018/1(2) dated 30.12.2020, ME/MISC-85-2020/M/167/1(2) dated 20.01.2021, ME/MISC-85-2020/M/168/1(2) dated 20.01.2021, ME/MISC-85-2020/M/169/1(2) dated 20.01.2021, ME/MISC-85-2020/M/170/1(2) dated 20.01.2021) and it is affiliated to The West Bengal University of Health Sciences, West Bengal (OG/WBUHS/2020-21/1328 dated 25.01.2021, OG/WBUHS/2020-21/1672, OG/WBUHS/2020-21/1673, OG/WBUHS/2020-21/1674, OG/WBUHS/2020-21/1675 dated 23.03.2021). The institute believes that excellent teaching can produce better students and thereby helping the institute to emerge as a centre of excellence.

भाकृअनुप
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डा. एस. एन. झा
Dr. S.N. Jha, ARS
FNAAS, FIE, FISAE, FNADSI, FJSPS, Japan
उपमहानिदेशक (कृषि अभियांत्रिकी)
Deputy Director General (Agricultural Engineering)

MESSAGE

I am happy to learn that Department of Biological Sciences (Agriculture), Midnapore City College, Paschim Medinipur, West Bengal is going to organize a National Seminar on "Sustainable Management of Natural Resources for Food Security and Livelihood Promotion under Climate Change Scenario" on 29 – 30th March, 2024. In the context of climate-resilient agriculture in India, sustainable resource management is paramount for ensuring both food security and livelihood promotion. Water, soil, and biodiversity are key resources that demand judicious management to mitigate the impacts of a changing climate. Implementing efficient water management practices, such as rainwater harvesting, drip irrigation, and water-use efficiency technologies, helps farmers adapt to erratic precipitation patterns and water scarcity. Conservation tillage and organic farming techniques enhances soil health, moisture retention, and fertility, contributing to sustainable agricultural productivity. Promoting climate-resilient crop varieties and agroforestry systems ensures robust food production amid evolving climatic conditions. Diversification of crops not only enhances resilience but also offers farmers alternative income sources. Mechanization of pre and post production agricultural systems has also played a pivotal role in resource conservation with increased productivity. Community-based initiatives for watershed management and afforestation contribute to sustainable resource use, reducing vulnerability to climate-related risks. Government policies that incentivize climate-smart practices and support sustainable agriculture provide a framework for livelihood enhancement.

Considering the above aspects, the seminar topic is much relevant and I hope the deliberations in this seminar will result into straight way forward to overcome this condition. I wish a grand success of this National Seminar.

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भारतीय कृषि अनुसंधान परिषद
कक्ष क्र. 101, कृषि अनुसंधान भवन-II, नई दिल्ली-110 012, भारत
INDIAN COUNCIL OF AGRICULTURAL RESEARCH
Room No. 101, Krishi Anusandhan Bhavan-II, Pusa, New Delhi-110012, India

डॉ. सुरेश कुमार चौधरी
उप महानिदेशक (प्राकृतिक संसाधन प्रबंधन)
Dr. Suresh Kumar Chaudhari
Deputy Director General (Natural Resources Management)

MESSAGE

I am happy to hear that a National Seminar on "Sustainable Management of Natural Resources for Food Security and Livelihood Promotion under Climate Change Scenario" to be organized by Department of Biological Sciences (Agriculture), Midnapore City College, Paschim Medinipur, West Bengal from 29th to 30th March, 2024. Natural resource management for ensuring food security and promoting sustainable livelihoods, particularly in regions reliant on agriculture and natural ecosystems is key for sustainability. Effective management involves the responsible stewardship of resources such as water, soil, forests, and biodiversity to ensure their availability and productivity for current and future generations. Sustainable practices, including conservation, reforestation, soil conservation, and efficient water management, are essential for mitigating environmental degradation and maintaining ecosystem resilience. By adopting sustainable agricultural techniques such as agroforestry, organic farming, and crop rotation, communities can enhance soil fertility, conserve water, and reduce reliance on chemical inputs, thereby safeguarding long-term food production. Moreover, promoting biodiversity conservation and sustainable harvesting practices in forests and fisheries preserves crucial ecosystems, supports local economies, and provides alternative livelihood opportunities. Empowering local communities through participatory approaches, knowledge sharing, and capacity building fosters ownership of natural resources and encourages the adoption of sustainable practices tailored to local contexts.

Through concerted efforts to conserve and sustainably utilize natural resources, societies can enhance food security, alleviate poverty, and promote resilient livelihoods, contributing to the overall well-being of both people and the planet. Considering the perspectives, this seminar is much relevant and timely approach. I hope the deliberations in this seminar will result into convergent way forward to overcome the changing climate conditions for resilience crop production technology. I wish this National Seminar all success.

(S.K. Chaudhari)

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Message from the President

MIDNAPORE CITY COLLEGE

Being the founder president of Moraine Human Resource Development Organisation, the idea of opening the first self-financing general degree college in south Bengal first came to my mind. The college is an epitome of our noble thoughts. "Midnapore City College is more than just a college; we are a COMMUNITY. From your first day at Midnapore City College, you will meet people who will support, inspire, and challenge you to be the best person. Because of our uniqueness, we can promise that when you will leave, you will experience tremendous growth. You will be developed into a new, more advanced and self-assured version of yourself.

At MCC, we feel proud of ourselves of our reputation for being a "caring college". Our faculty and staff are dedicated to help students to achieve their goals. They will work with you daily to ensure a successful educational experience. Our student body is equally as welcoming and warm-hearted. They offer an environment of support, encouragement and friendship like no other.

As an accredited institution, uniquely aligned with business and industry, we also feel proud of ourselves for being a center for academic excellence. Once you begin at Great Bay, you will be exposed to a rigorous learning experience both in and out of the classroom. We will make you face challenge like never before, but the award will be a presentation of better you. Get inspired and control your destiny.

Midnapore City College is uniquely capable of answering this call, of speaking to this world. As an institution of higher education, Midnapore City College is committed to the discovery and transmission of knowledge. It also seeks to integrate excellence and distinctive commitment among the students.

As a President of Midnapore City College, I am conveying the message to all of my delegates, students and all the academic personalities. I am assuring you that by this **Two Day National Seminar** on **"Sustainable Management of Natural Resources for Food Security and Livelihood Promotion under Climate Change Scenario"** on **29th** to **30th March, 2024** at **MIDNAPORE CITY COLLEGE**, we will understand the value of the ecological justice that we need to fulfil. Ecocriticism is a field of literary and cultural studies that examines the relationship between literature, culture, and the natural environment. It emerged in the late 20th century as a response to environmental crises and concerns about humanity's impact on the planet.

Thank you. All the best.

Smt. Sukrita Ghosh
President
Midnapore City College

Message from the Vice-President

MIDNAPORE CITY COLLEGE

The starting of college life from school life is a very big step in life. Students have put in so much hard work in public exams, spent sleepless nights, earned a rewarding score, and with the blessings of parent/guardian, students have joined the chosen stream of education to realize life-ambition and set the foundation for future. By choosing to create a future for themselves from our institution means that we, the teachers and management at Midnapore City College are also responsible for their successful graduation and growth.

It is their career path that have now embarked upon, which will be a remarkable journey in itself that will prepare them for a life beyond college. We hope to make students journey with us, engaging, encouraging and enlivening as ever, for them to grow as a thorough individual, ready to take on life as an adult. We pray and will work with all the students to see them become one with the society where their contribution will make a definitive difference to our world. As I mentioned earlier, the learned staff and the ever-accessible management is there to guide them through and help for nurture their dreams and fulfil them - by empowering to realize true potential.

This is a great occasion to show our care for the **Two Day National Seminar** on **"Sustainable Management of Natural Resources for Food Security and Livelihood Promotion under Climate Change Scenario"** on **29th** to **30th March, 2024** at **MIDNAPORE CITY COLLEGE**. This national seminar is an extraordinary gathering of students, researchers, scientists and professors. By this seminar the students will be benefitted by the scientists and academicians from their source of knowledge.

Best wishes.

Mrs. Anindita Ghosh
Vice-President
Midnapore City College

Message from the Chairman

MIDNAPORE CITY COLLEGE

The **Two Days National Seminar** on "**Sustainable Management of Natural Resources for Food Security and Livelihood Promotion under Climate Change Scenario"** is a very important event for all the academic fraternity, as it will provide us with key insights and in-depth information on such a topic that will show a way forward for sustainable development goals in midst of changing climate scenario. We shall hear from some of the most eminent and knowledgeable professionals in the field to enrich ourselves.

I would also like to welcome all of the faculties, researchers, students and other participants to remain actively attached to the knowledge and experience sharing sessions of this national seminar.

As a Chairman of this College, I assure you that college will provide and assist all the students to achieve their goals. In Midnapore City College (MCC), students will have a quality of life that's very high and different, in academic pursuits for seeking professional excellence that will enrich and make efficient, confident and successful person in life. It will be more glorified by this national seminar.

I can foresee that the seminar will definitely stimulate new thoughts in the young minds. Academic and research fraternities will definitely be benefitted by the healthy exchange of scientific thoughts from the scholarly deliberations. I am confident enough that this seminar will be a platform of knowledge gathering and sharing the ideas with respect to sustainable natural resource management for food security and livelihood promotion in climate change scenario.

Wish you all the best. Thank you again.

Prof. Pravas Ghosh
Founder Chairman
Midnapore City College

Message from the Director

MIDNAPORE CITY COLLEGE

On behalf of Midnapore City College, I extend a warm welcome to all participants of the **Two Days National Seminar** on "**Sustainable Management of Natural Resources for Food Security and Livelihood Promotion under Climate Change Scenario"** on 29th to 30th March, 2024. It is indeed a privilege to convene experts, researchers, practitioners, and policymakers to deliberate on one of the most pressing issues of our time.

As we gather to discuss sustainable resource management in the context of ensuring food security and promoting livelihoods amidst a changing climate, we recognize the urgency and complexity of the challenges ahead. Climate change poses unprecedented threats to agricultural productivity, natural resource availability, and the livelihoods of millions of people around the globe. However, it also presents us with an opportunity to rethink our approaches and embrace innovative solutions.

Throughout this seminar, we aim to foster dialogue, share knowledge, and explore strategies that can contribute to building resilience and sustainability in the face of climate change. We will delve into topics such as water management, soil conservation, biodiversity conservation, climate-smart agriculture, and diversified livelihood options. Through insightful discussions, case studies, and best practices, we hope to generate actionable recommendations and pathways for achieving our collective goals.

I encourage all participants to actively engage in the sessions, share your experiences, and contribute your expertise towards identifying practical solutions that can be implemented at various levels. Let us seize this opportunity to learn from each other, inspire positive change, and forge meaningful collaborations that will pave the way for a more resilient and prosperous future.

I extend my sincere gratitude to the organizing committee, sponsors, and partners for their invaluable support in making this seminar possible. Together, let us embark on this journey towards sustainable resource management for food security and livelihood promotion, knowing that our collective efforts today will shape the well-being of generations to come.

Thank you, and I look forward to fruitful discussions and outcomes.

I wish for the grand success of the seminar.

Warm regards,

Dr. Pradip Ghosh
Director
Midnapore City College

Message from the Principal

MIDNAPORE CITY COLLEGE

A very warm welcome to the **Two Days National Seminar** on "**Sustainable Management of Natural Resources for Food Security and Livelihood Promotion under Climate Change Scenario"** on 29th to 30th March, 2024 at MIDNAPORE CITY COLLEGE. The college has been functioning with a noble vision and mission clearly reflecting its social responsibility and commitment to nation building. The institution provides effective and efficient support and facilities to academic mission and maintains a supportive environment for all the stakeholders of this institute by this national seminar held in the rural area of Midnapore (Junglemahal).

This seminar will provide a platform for scholars, researchers, students, and practitioners to come together and exchange their ideas, sharing knowledges, and findings related to sustainable natural resource management and livelihood security. This exchange fosters intellectual growth and contributes to the advancement of knowledge in the field of agrarian, environmental as well as biological sciences. Sustainable resource management and livelihood promotion are essential pillars for fostering resilience and prosperity in communities. Effective resource management involves responsibly utilizing natural resources to meet present needs without compromising the ability of future generations to meet their own needs. This entails practices such as conservation, renewable energy adoption, and efficient resource use. Concurrently, livelihood promotion focuses on enhancing economic opportunities and quality of life for individuals and communities. By creating sustainable livelihood options through initiatives like eco-tourism, agroforestry, and small-scale enterprises, communities can diversify income sources while preserving their environment. Together, these approaches not only protect ecosystems but also empower communities to thrive economically, socially, and environmentally, ensuring a more sustainable future for all.

It is my hope that the seminar will stimulate a thoughtful dialogue. We will all be benefitted with the healthy exchange of ideas. I hope the deliberations during the national seminar will definitely bring the key for sustainable development goal issues and targeted recommendations for policy makers.

Thank you. Best wishes.

Dr. Sudipta Chakrabarti
Principal
Midnapore City College

Message from Vice-Principal

MIDNAPORE CITY COLLEGE

It is a matter of great pleasure for me to welcome you all to the **Two Days National Seminar** on "**Sustainable Management of Natural Resources for Food Security and Livelihood Promotion under Climate Change Scenario"** on 29th to 30th March, 2024 at MIDNAPORE CITY COLLEGE. This seminar will help build a sense of community among the academicians, researchers and scholars. They provide opportunities for exchange of ideas, sharing knowledge, collaboration, and mentorship, which are essential for fostering a supportive academic environment and for the development of emerging scholars. Sustainable resource management and livelihood promotion are integral components of fostering long-term environmental and socioeconomic well-being. Sustainable resource management involves the responsible utilization of natural resources to ensure their longevity for future generations. This entails practices such as renewable energy adoption, efficient water usage, and regenerative agriculture to minimize waste and environmental degradation. Simultaneously, livelihood promotion focuses on enhancing economic opportunities and quality of life for communities. By creating sustainable livelihoods through initiatives like eco-tourism, agroforestry, and green entrepreneurship, communities can diversify their income sources while preserving ecosystems. Integrating these approaches fosters a balance between environmental conservation and economic development, empowering communities to thrive while safeguarding their natural resources. Through this synergy, societies can achieve sustainable development that sustains both people and the planet.

I welcome you all to Midnapore City College and hope that this seminar will act as a medium for all of us present here to ponder upon the topic of discussion, challenge us to strive towards it and inspire us at the same time. Thank you!

Dr. Kuntal Ghosh

Vice-Principal

MIDNAPORE CITY COLLEGE

Message from Convenor

I express m sincere gratitude to the august gathering of all the participants and want to grab the opportunity to welcome you all in the **Two Days National Seminar** on "**Sustainable Management of Natural Resources for Food Security and Livelihood Promotion under Climate Change Scenario"** on 29th to 30th March, 2024 at MIDNAPORE CITY COLLEGE. The objective of organizing this natonal level academic event is to share and enhance the knowledge of each and every individual attached in the field of agrarian ecosystem, environmental science, biological science and other allied sectors.

In the face of a changing climate, sustainable resource management stands as a fundamental pillar for ensuring both food and livelihood security. With climate change exacerbating weather variability, increasing the frequency and intensity of extreme events, and altering ecosystems, the need for sustainable resource management practices becomes even more pressing. These practices aim to optimize resource use while minimizing negative impacts on the environment, thus building resilience against climate-related risks.

One crucial aspect of sustainable resource management involves efficient water management. With changing precipitation patterns and increased drought occurrences in some regions, water scarcity becomes a significant threat to agriculture and livelihoods. Implementing water-saving techniques such as drip irrigation, rainwater harvesting, and efficient water distribution systems can help conserve this precious resource, ensuring its availability for agricultural production and other essential needs.

Similarly, soil conservation is paramount in mitigating the impacts of climate change on food and livelihood security. Soil degradation, exacerbated by factors like erosion, nutrient depletion, and salinization, reduces agricultural productivity and threatens food supplies. Sustainable land management practices, including conservation tillage, agroforestry, and cover cropping, help preserve soil health, enhance fertility, and improve water retention capacity, thus supporting crop growth and livelihood sustainability.

Furthermore, biodiversity conservation plays a crucial role in sustaining food production and livelihoods in a changing climate. Healthy ecosystems provide essential services such as pollination, pest control, and nutrient cycling, which are vital for agricultural productivity. Protecting natural habitats, promoting agrobiodiversity through crop diversification, and adopting ecological farming practices contribute to ecosystem resilience, ensuring continued food production and livelihood opportunities.

Moreover, sustainable agriculture practices contribute to reducing greenhouse gas emissions and mitigating climate change. Agroecological approaches, such as organic farming, agroforestry, and integrated crop-livestock systems, sequester carbon in soils, thus helping mitigate climate change while enhancing agricultural productivity and resilience.

In addition to sustainable resource management in agriculture, promoting diversified livelihood options is crucial for enhancing resilience to climate change impacts. Climate-sensitive sectors like agriculture may become increasingly vulnerable in a changing climate. Therefore, creating alternative income sources beyond agriculture, such as eco-tourism, renewable energy projects, and sustainable forestry, can help diversify livelihoods and reduce dependence on climate-sensitive activities.

Investing in climate-resilient infrastructure, such as irrigation systems, storage facilities, and rural roads, also contributes to enhancing food and livelihood security in the face of climate change. Furthermore, strengthening local institutions, providing access to finance, and empowering communities to participate in decision-making processes are essential for building adaptive capacity and fostering resilience to climate change impacts on food and livelihood security.

Overall, sustainable resource management practices play a crucial role in ensuring food and livelihood security in a changing climate scenario. By implementing water-efficient irrigation, soil conservation measures, biodiversity conservation efforts, and promoting diversified livelihood options, societies can enhance resilience, mitigate climate risks, and secure sustainable futures for all.

Dr. Anulina Manna
Assistant Professor & Convenor of National Seminar
Department of Biological Sciences (Agriculture), Midnapore City College

Message from Organizing Secretary

It is my great pleasure that I can extend a heartfelt welcome to all participants of the **Two Days National Seminar** on "**Sustainable Management of Natural Resources for Food Security and Livelihood Promotion under Climate Change Scenario"** on 29th to 30th March, 2024 at MIDNAPORE CITY COLLEGE. As the Organizing Secretary, I am thrilled to see the culmination of our collective efforts in bringing together the experts, scholars, and practitioners to address one of the most pressing challenges of our time.

The theme of this seminar, focusing on sustainable resource management amidst a changing climate, underscores the urgency and importance of finding innovative solutions to ensure food security and promote resilient livelihoods. Climate change presents formidable challenges to our agricultural systems, natural resource management practices, and socio-economic well-being. However, it also offers an opportunity for collaboration, innovation, and collective action.

Over the course of this seminar, we will delve into various dimensions of sustainable resource management, including water conservation, soil health, biodiversity conservation, and climate-smart agriculture. Through engaging presentations, panel discussions, and interactive sessions, we aim to foster knowledge exchange, stimulate critical thinking, and catalyze actionable strategies for addressing the impacts of climate change on food security and livelihoods.

I urge all participants to actively participate in the sessions, share your insights, and engage in fruitful discussions. Your contributions are invaluable in shaping the discourse and charting a course towards sustainable and resilient futures for all. Let us leverage this platform to build networks, forge collaborations, and inspire transformative change in our respective spheres of influence.

I extend my sincere appreciation to all the organizing committee members, sponsors, and partners for their unwavering support and dedication in making this seminar a reality. Together, let us embark on this journey of exploration, learning, and collaboration, with the shared vision of creating a more sustainable and equitable world for present and future generations.

Thank you for your participation, and I look forward to meaningful interactions and outcomes.

Warm regards,

Dr. Tapan Das
Organizing Secretary and Assistant Professor
Department of Biological Sciences (Agriculture), Midnapore City College

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AGRICULTURAL PRODUCTIVITY AND FOOD SECURITY IN CHANGING CLIMATE SCENARIO: INDIAN PERSPECTIVE

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EXECUTIVE SUMMARY

Population is increasing at an alarming rate making India the most populus country in the world. World population will touch 10 billion by 2050 asking doubling the food production. India's population is expected to swell up to 1.67 billion by 2050, in contrast, China's population would shrink to 1.32 billion.

The Green Revolution in the 1970s followed by the liberalization of the Indian economy in the 1990s has credited with shepherding India onto a path of high growth. Over the last decade, increase in per capita incomes, greater urbanization rates, increase literacy rates, population growth and poverty reduction have characterized this high growth process. It has often been criticized that Green Revolution was confined to two crops viz. rice and wheat, and beneficiaries were the resource-rich farmers of north-west and south India.

Agriculture is the foundation of the civilization, culture and heritage of India. More than 80% of the people in rural India have Agriculture as their livelihood, whereas nearly 58% people are employed directly or indirectly with agriculture and allied activities.It is one of the oldest systems of the world, characterized by its diversity and heterogeneity, unorganized and stressed on account of natural and anthropogenic vagaries from 'seed to market'. Indian agriculture is as diverse as the country itself. It encompasses different agroecosystems based on commonality of climatic, soil, geological, vegetational and other natural features, which decide the diversity of habitats, variety of crops and livestock that has been developed over the years. This gives an opportunity to grow varying crops, vegetables and fruits under different agroclimatic conditions.

Challenges of meeting food demand to increasing population could only be attained by sustainable agricultural production). Although India has achieved 'self-sufficiency' in food grain production, it brought a host of environmental challenges viz. loss of soil fertility and biodiversity, resulted in water logging, surface and ground water pollution, intensified pests and diseases and varying socio-logical problems. Aside from tackling these challenges, looking ahead to 2050 and beyond, we see important trends of unequal growth and climate change challenges threating India's ability to sustainability and equitably manage an economic and nutrition transformation. Boosting agricultural production is critical for economic growth and development in India. Agricultural production, however, affects and is affected by climate change. Productivity growth influenced by increasing demand for high

value agricultural produce will lead to increased greenhouse gas emissions and soil and water degradation accentuating production risk in agriculture.

India needs higher production of food grains and associated food materials for sustaining food as ell as nutrition security. With higher disposable income, the choice of the people will be a nutritious food. To add to this concern is decrease in cultivable area due to urbanization, land degradation, soil pollution, salinization, indiscriminate use of inorganic fertilizers and agrichemicals etc. It will be a herculean task to produce more from less area of land, for more people. There has been a considerable decline in soil fertility and environmental resilience. It calls for a different approach which should educate the farmers to utilise their traditional knowledge to produce more grains using fewer external inputs. Sustainable agricultural practices are supposed to be resource-conservative and resilient to the present climate change scenario.

Indian agriculture is to be reimagined and prioritized for enhancing doubling farmers' income, reducing fertilizer use (25%) and water use (20%), increasing use renewable energy (50%), reducing greenhouse gas emission intensity (45%) and rehabilitating degraded lands. India, being a signatory and prominent member of the United Nations, has several international commitments such as *Panchamrit* and carbon neutrality, land degradation neutrality, biodiversity conservation, regional agricultural development and Sustainable Development Goals (SDGs) (Pathak, 2023) Fortunately, advances in science have opened new avenues for addressing the challenges and fulfilling the priorities and commitments. A multi-pronged strategy encompassing integration of crops and livestock, diversification of cropping systems, intensification, customisation, farm mechanization, introduction of Artificial Intelligence, value addition and market access are the way forward to realise the full potentials of Indian farming with focus on profitable commercialization and export.

Advanced technology will be needed to increase the input use efficiency to reduce the cost of production and enhanced value addition to make Indian agriculture profitable, competitive and attractive to rural youth. In addition, value addition through processing will help in reducing colossal losses on one hand and increase the income of the farmers on the other. Agricultural scientists and policy-makers should take up the challenges with focused research programs keeping in mind the recent developments in science and technology, changed economic environment and opportunities at national and international arenas for higher productivity, profitability, sustainability and climate resilience to meet the aspirations of Indian agriculture.

Recent advances in sustainability data analytics and development of multiple indicators of sustainability has enabled scientists to design region-specific sustainable and optimized diets that are nutritious, affordable, culturally acceptable, and whose footprints are within environmental planetary boundaries .For India, such optimization research has suggested the percentage by which the consumption of different food items in different states need to increase or decrease such that individual diets meet the nutritional needs staying under environmental planetary boundaries. On average, across the country, the daily per

capita intake of vegetables, fruits, pulses, nuts, and coarse grains (e.g., millets, sorghum, barley, maize) need to increase by more than double the current intake amounts while the intake of sugar, rice, wheat, and oils needs to decrease substantially for meeting the national nutrition and environmental goals. This also entails huge reductions in intake of junk food and discretionary items high in bad nutrients. Individuals and government can also leverage the ongoing research on ranking, profiling and prioritizing food items that are nutrient dense and have lower impact on the environment than traditionally consumed items.

Food insecurity arises when all people, at all times, lack physical and economic access to enough, safe, and nutritious food to fulfil their dietary needs and food choices for an active and healthy life. One of the greatest concerns facing the globe today is food and human security. One of the most important aspects of the Millennium Development Goals, along with poverty eradication and environmental protection, is food security. 'Food security' is defined as a concept that considers both physical and economic access to food while also taking into consideration people's dietary demands and preferences. Food security is "ensuring that all people have access to sufficient, safe, and nutritious food at all times in order to live a healthy and active life." Food security is built on three pillars: constant food supply, access to a balanced diet, and food usage for basic nutrition and care, as well as access to safe drinking water and sanitation.

Climate change is adversely affecting the Indian agricultural sector. Farmers' perceptions of an adaptation to the rapidly changing climatic conditions are considered crucial policy measures to combat these adversities. Studies have shown that majority of the Indian farmers have perceived a rise in temperature, erratic and decreased rainfall which is consistent with the meteorological data. Indian farmers seem to have adopted a wide range of adaptation measures that are mostly incremental and systemic. Transformational adaptations in the form of substantial changes in land use, resource and labour allocations, occupational pattern, and cropping systems are also increasingly found to be adopted by farmers. However, the studies do not substantially confirm that farmers' adaptation measures result from their perception of climate change. Lack of access to sufficient information and adequate credit at the right time, household income, farm size, gender, and resource endowment, among others, frequently influences the adoption of adaptation measures. To avoid maladaptive outcomes and achieve long-term sustainability, it has been a need for large-scale investments in the Indian farming sector in general and building farmers' capacity in particular. In addition, adopting an integrated approach for assessing farmers' perception of an adaptation to changing climatic conditions and their outcomes is essential for effective policymaking towards achieving food security and farmers' wellbeing.

Climate change has added to the enormity of India's food security challenges. While the relationship between climate change and food security is complex, most studies focus on one dimension of food security, i.e., food availability. This paper provides an overview of the impact of climate change on India's food security, keeping in mind three dimensions — availability, access, and absorption. It finds that ensuring food security in the face of climate

change will be a formidable challenge and recommends, among others, the adoption of sustainable agricultural practices, greater emphasis on urban food security and public health, provision of livelihood security, and long-term relief measures in the event of natural disasters.

To develop climate-resilient strategies and make adequate policy interventions, there is a need for an integrated assessment of the impact of climate change on India's food security. So far, there are fewer studies on the impact of climate change on other dimensions of food security besides production. Research efforts should be directed towards assessing and quantifying where possible the impact of climate change on undernutrition and food absorption. Climate change and food and nutrition insecurity pose two of the greatest development challenges of our time and yet a more sustainable food system can heal the planet but ensure food security to all. Agriculture is the primary cause of deforestation, threatening pristine ecosystems. Without action, emissions from food systems will rise even further, with an increase in food production.

The global agrifood system must therefore deliver on multiple fronts. It must feed the world, adapt to climate change, and drastically reduce its greenhouse gas emissions. In response to these challenges, the concept of Climate-smart Agriculture (CSA) has emerged as a holistic approach to end food insecurity and promote sustainable development while addressing climate change issues.

In this paper, a brief insight has been given on the concept of sustainable agriculture, its need in the present scenario and a critical assessment in terms of challenges and opportunities for overall sustainability in developing nations by considering India as a model country. How the integration of traditional knowledge and modern agriculture practices will improve the agricultural productivity, soil quality and health as well as socio-economic balance, has also been discussed in terms of research opportunities. Several issues related to sustainable agriculture practices for higher production, maintaining soil health and attaining food security have been discussed.

CLIMATE-RESILIENT FARMING SYSTEM: STRATEGIES FOR MANAGING CHALLENGES AND EMBRACING OPPORTUNITIES IN TREE OUTSIDE FOREST ENVIRONMENTS

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ABSTRACT

Climate change and its effects on agriculture and forestry have made developing climate-resilient farming systems are critically required for long-term and sustainable food production while preserving ecosystem health. Trees grown outside of traditional forest settings, such as agroforestry systems, orchards, and urban green spaces, are examples of trees outside forest (TOF) environments. TOF are dynamic due to floral diversity, these TOF environments present unique challenges, but they also provide opportunities for innovative and adaptive practices. Several strategies can be implemented to manage these challenges and embrace opportunities in different TOF environments. To begin, increasing the diversity of tree species and suitable crop species is critical for climate resilience. This contributes to the reduction of risks associated with climate change, such as pests and diseases, and extreme weather events. Furthermore, incorporating appropriate tree management techniques and conservation practices can boost tree resilience outside of forest environments. Mulching, irrigation management, and soil conservation methods are examples of practices that can be used to optimize water use efficiency and reduce erosion. This includes practices such as mulching, irrigation management, and soil conservation methods to optimize water use efficiency and reduce erosion. Incorporating climate-smart agricultural practices, such as precision farming and integrated pest management, can also help trees survive outside of forests. Climate change is posing serious challenges to agriculture around the world. At the same time, it presents certain opportunities for farmers to capitalize on through appropriate adaptations. Integrating trees into farmlands is emerging as an important climate-smart strategy with broad resilience, mitigation, and livelihood benefits. Outside of forests, also known as trees on farms, a significant portion of landscape tree cover in tropical countries provides ecosystem services. However, climate change will have an impact on these on-farm trees and their services, necessitating immediate management intervention. Improving nursery production of quality tree seedlings adapted to predicted future conditions; targeted assisted natural regeneration to boost tree densities using resilient native species; incorporating climate-ready multipurpose trees into evolving agroforestry systems to provide goods while enhancing microclimate and adaptive management of pests, diseases, invasive species, fires, etc., aided by early warning information are key strategies for enhancing climate-resilience. Addressing uncertainties in climatic and socioeconomic conditions requires adaptable approaches. Government, institutional, and need

based policy support is critical to motivate farming communities across different agro-ecological zones in contexts to adopt targeted climate-smart interventions for trees outside of forests. Overall, we should strive to create multifunctional, climate-adaptive landscapes by combining technological, biophysical, and management options, while also maximizing the potential of genetically resilient tree resources on farms.

Keywords: Climate-Resilient farming, livelihood support, tree outside forest environment

IRRADIATION TECHNOLOGY IN FOOD RESEARCH WITH SPECIAL EMPHASIS ON FRUITS AND VEGETABLES

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EXTENDED ABSTRACT

Irradiation technology proved to be effective in combating post-harvest food losses by controlling the harmful insects and a microorganism attacking on stored products, helps in curtailing food-borne diseases and overcoming quarantine barriers. Application of ionizing radiation is considered as a reliable treatment by exposing the packed or bulked food (both fresh and processed) to the source of irradiation. The benefits of Gamma irradiation technology in addressing post-harvest food problems are, in some cases, unique and can improve the quality of a number of food products by not only eliminating the risk of pathogenic contaminants and destroying harmful pests/microbes in grains, but also be employed to restrain the sprouting of roots, tubers, bulbs etc. and, proved to be considerably beneficial in terms of delaying the ring and senescence of horticultural perishables. There is a misconception of harmful health impact of consuming irradiated food, but it has been approved by almost all the regulatory agencies (IAEA, WHO etc.) regarding the fact that Irradiated foods do not become radioactive as they never give off radiation. Consuming irradiated foods does not expose or contaminate a person with radiation or radioactive materials. Of course, alike other technologies, a specific recommendations and regulations are to follow to obtain the maximum benefit. The present paper highlights the application of gamma irradiation for shelf life extension of some important fresh perishable crops and their processed products under West Bengal condition.

Methodology and applications: Cobalt-60 (60Co) as a source of gamma irradiation of food, fresh and processed products of fruits and vegetables, packaging materials etc. Irradiation of food is the process of exposing it to a carefully controlled amount of energy in the form of high-speed particles or rays. Applications of food irradiation are usually organized into three categories according to the range of delivered dose:

A. Low-Dose (<1KGy) i. Sprouting inhibition

Sprouting of foods, such as potatoes, yams, garlic and onions can be inhibited by refrigeration and the application of various chemicals such as malic hydrazide (preharvest) and CIPC (postharvest). Refrigeration is expensive and the chemical treatments are relatively cheap and efficient, but they do leave residues and many countries have banned their usage for health reasons. In such instances, irradiation can be recommended as a reasonable hazard free alternative. Sprouting prevention and reduced rotting and weight loss have been observed in potatoes, garlic, onions and yams in the range of 50 -150 Gy.

The shelf life extension for strawberries, carrots, mushrooms, papayas and packaged leafy vegetables also appears to be promising at dose levels of a few kGy or less.

ii. Insect disinfestations: The best control of stored grain pests can be achieved by using fumigants such as ethylene dibromide or ethylene oxide. Until 1984, fruits and vegetables were fumigated with chemicals to meet the quarantine regulations. Use of these chemicals has been banned or strictly restricted in most countries for health and environmental reasons. Although a few heat and cold treatments are capable of insect disinfestations, they can also acutely degrade the taste and appearance of the produce. Radiation processing (@dose range of 150 - 700 Gy) has therefore been suggested as an alternative to fumigation. A dose level of 250 Gy can be effective on quarantine treatment of fruit flies, & @ 500 Gy can control all stages of most of the pests.

iii. Delay in ripening of fruits and vegetables: Ripening in bananas, mangoes and papayas can be delayed by irradiation at 0.25 - 1 kGy. It is important to irradiate them prior the onset of ripening. The same dose levels can also significantly extend the shelf life of many food products by reducing populations of spoilage bacteria, moulds and yeasts. For example- The shelf life of various cheeses can be extended significantly by eliminating molds at doses of less than 0.5 kGy

B. Medium-Dose (1 - 10 KGy)

Treatment of strawberries with irradiation dose of 2 - 3 kGy, followed by storage at 10°C, prevents spoilage caused by *Botrytis* sp. can result in a shelf life extension of up to 14 days. Irradiation of mushrooms at 2 - 3 kGy inhibits cap opening and stem elongation and can be increased shelf life for at least by two-fold at 10°C storage temperature. Commercial irradiation of spices has been approved and practiced satisfactorily in many countries @5-10 kGy without negative impact on chemical or sensory properties for most of the processed food items.

C. High-Dose (>10 kGy)

Some foods such as fresh fruits and vegetables, betel leaf deteriorate when subjected to high radiation doses. However, other foods, including meat, poultry and certain sea foods is possible to effectively sterilize with retention of quality even @ 25-45 kGy dose range, provided that certain precautions are taken.

Constraints: Initial cost of installation, once the facility being commercially generated, there is ample scope of income generation through irradiation of crop produces, especially it will be extremely helpful for exporting foods.

Conclusion: Irradiation is a non-thermal food processing technology helps in combating post-harvest losses, controlling food-borne diseases and overcoming quarantine barriers. Irradiated foods neither become radioactive, nor do they give off radiation. Eating irradiated foods does not expose or contaminate a person with radiation or radioactive materials. Although, a misconception of using irradiated foods persists among many people, till today, assuming its deleterious health impact. European countries generally made it mandatory to accept an import of any agricultural produce only those are irradiated on locating the Radura symbol on the produce.

NANO FERTILIZERS - A GLOBAL REVIEW

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ABSTRACT

Outburst of world population has forced the agricultural sector to extend crop productivity to satisfy the needs of billions of people. The present agriculture system is based on application of excessive amounts of chemical fertilizers to have a satisfactory yield leading to health hazards and ground water contamination. Nanotechnology has improved ways for large-scale production of nanoparticles, which are now used to improve fertilizer formulations for enhanced uptake in plant cells by minimizing nutrient loss. Nano fertilizers can be classified based on their composition, structure, and mode of action. In terms of composition, nano fertilizers can consist of nanoparticles made from various materials such as metals, metal oxides, carbon-based materials or polymers. Furthermore, nano fertilizers can be categorized based on their mode of application. Some are designed for soil application; some for foliar application. The present market value of nano fertilizer is about 500 million USD. The market value is likely to be 1250 million USD by 2030.Despite the numerous benefits, challenges such as high production cost of nano-fertilizers is a major constraint as compared to traditional fertilizers. Nano fertilizers, despite their potential benefits have several notable drawbacks. One major concern revolves around their environmental impact. Furthermore, the regulatory landscape for nano fertilizers is currently inadequate. The absence of specific regulations tailored to these innovative products raises concerns about their responsible use. Robust regulatory frameworks are essential to ensure that nano fertilizers adhere to safety standards and environmental sustainability underlining the importance of addressing these regulatory gaps before widespread adoption occurs. While the potential advantages of nano fertilizers are apparent, it is imperative to maintain a cautious stance in their widespread adoption.

INFLUENCE OF MICRONUTRIENTS ON GROWTH, YIELD AND PHYSICO-CHEMICAL ATTRIBUTES OF LEMON (*Citrus limon*)

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EXTENDED ABSTRACT

Citrus is considered as one of the most important fruits widely cultivated in different parts of the world. It is one of the major fruit crops with global availability and popularity that contribute largely to human diet. Global citrus production reaches to 144 million metric tons in 2020 with China ranked as the biggest producer followed by Brazil, India, Mexico, Spain, Egypt, Iran, and South Africa (FAO,2020).According to the data released from the department of Agriculture and Farmers Welfare, the total horticulture production in 2021-22 was estimated to be 341.63 million tonnes from a total area of 27.73 million ha. The total area under fruits was estimated to be 7.019 m ha with a production of 107.102 million tonnes, whereas the total area under limes/lemons was estimated to be 3,22,000 ha with a production of 37, 42,000 tonnes. Lemon (*C.limon* Burma.) belongs to the family Rutaceae which comes under the category of acid fruits, is principally used as fresh fruit (Bhatt *et al*,. 2016). Lemons are gaining popularity in India because of (i) its multiple utility, (ii) production all the year round and (iii) tolerance against citrus decline and other citrus disorders. Besides their consumption as fresh fruit, a large number of products and by-products like pickles, squash, jam, jelly, candies and marmalades are prepared and marketed at a premium price.

Citrus requires 17 essential elements for the normal growth and production. Deficiency of' micronutrients occur at various stages of growth and developments of citrus plants. Micronutrients are required in very small quantities, yet they are very effective in regulating plant growth. Application of these mineral nutrients in deficiency condition improves the growth and development of citrus tree and also physico-chemical composition of fruits. Micronutrients deficiency in soil and plants is a worldwide nutritional problem and very severe in many countries (Alloway, 2008). Lemon being a heavy and regular bearing crop that bears throughout the year has to be supplemented with adequate nutrients to ensure the yield and quality of the harvest. Foliar application of micronutrient like Zn, Cu, Mn and Fe has advantages over soil application because of high effectiveness, rapid plant response, convenience and elimination of toxicity symptoms brought about by excessive soil accumulation of such nutrients. Foliar feeding gives quick response as the application is directly on leaves. The information of nutrient management in general and micronutrient role in particular so as to enhance growth, yield and quality fruit production in lemon under western Odisha condition is meagre. In view of the above mentioned facts, the experiment on the topic entitled “Influence of micronutrients on growth, yield and physico-chemical attributes of lemon (*Citrus limon*)” was carried out at College of Horticulture, OUAT,

Chiplima, Sambalpur during the year 2022-23 by using Randomized Block Design with ten treatments replicated thrice. The treatment details were T1:foliar spray of @ 0.2 % B through Borax, T2:foliar spray of @ 0.3 % Zn through ZnSO4, T3: foliar spray of @ 0.15 % Fe through FeSO4, T4: foliar spray of @ 0.15 % Cu through CuSO4,T5: foliar spray of 0.2 % B through Borax + 0.3 % Zn through ZnSO4+ 0.15 % Fe through FeSO4,T6: Foliar spray of 0.2 % B through Borax + @ 0.15 % Fe through FeSO4 + @ 0.15 % Cu through CuSO4,T7: Foliar spray of 0.2 % B through Borax + 0.3 % Zn through ZnSO4 + 0.15 % Cu through CuSO4,T8: Foliar spray of 0.3 % Zn through ZnSO4+ 0.15 % Fe through FeSO4+ 0.15 % Cu through CuSO4,T9: Foliar spray of 0.2 % B through Borax + 0.3 % Zn through ZnSO4+ 0.15 % Fe through FeSO4 + 0.15 % Cu through CuSO4,T10: Control (Water spray).The observations on growth, yield and yield attributing characters, physico-chemical attributes, nutrient content in both leaves & fruit juice and phytochemical parameters of the fruit juice due to application of different treatments were recorded.

The plant height and stem diameter did not vary due to application of micronutrients singly or in combination. However, significant variation with respect to average plant spread in East-West and North-South directions and canopy volume in lemon was obtained due to application of the micronutrients. The net enhancement in canopy volume was observed maximum (2.33 m3) in T9 i.e. in plants sprayed with 0.2% B through Borax + 0.3% Zn through ZnSO4 + 0.15% Fe through FeSO4 + 0.15% Cu through CuSO4 followed by T8 (2.20 m3) and T7 (1.89 m3) while minimum enhancement in canopy volume (0.84 m3) was recorded in T2.. The treatment T9 also recorded highest fresh weight (29.00g) and dry weight (8.00g of), chlorophyll content in leaves (0.783mg/g of fresh leaves and 1.620 mg/g of fresh leaves).The highest fruit weight (55.82 g) was recorded in T5 which were found to be statistically at par with T8 (55.71 g), T9 (53.71 g) and T6 (51.37 g) whereas the highest number of fruits per plant (179.3) and yield (9.63 kg/plant) was registered by treatment T9. The untreated control plants (T10) had produced the lowest yield of 5.64 kg/plant. Highest TSS content (8.72 0 Brix) , lowest acidity (2.35%),highest TSS: acid ratio (3.71) and ascorbic acid (46.50 mg/100 ml) was obtained plants under treatment T9. The control had recorded lowest values for the above parameters studied.

With respect to nutrient contents in the leaves, the treatment T7 recorded the maximum Ca (83.74 mg/l) whereas T1 had recorded highest Mg (22.789 mg/L) in the leaves. The treatment T9 recorded highest boron (0.988 mg/l) and iron (9.554 mg/l) whereas T4 had recorded maximum Cu (0.562 mg/l), zinc (0.354 mg/l) and manganese (0.732 mg/l) in the leaves. When applied singly, highest Ca and Mg was found in T3; Cu and Mn in T4: Zn in T2 ; Fe in T3 while B in T1 in the leaves.

With respect to nutrient contents in the fruit juice of the lemon, the treatment T9 had recorded the maximum Ca (41.931 mg/l), Zn (0.453 mg/L) and Mn (0.277 mg/L). Highest Mg (22.789 mg/l) and B (8.568 mg/L) was found in T1 whereas T3 recorded highest Fe content (1.026mg/L).The highest Cu content (0.078 mg/l) in the fruit juice was registered in T4. When applied singly, Ca, Mg and B was found maximum in T1; Cu &Mn in T4 ; Zn in T2 while maximum Fe content was obtained in treatment T3.

Highest protein (9.91 mg/L), carbohydrate (19.38 mg/L), amino acid (32.78 mg/L), phenols(315.98 mg/L) and flavonoids (30.44 mg/L) contents were observed in treatments T9,T4,T7,T6 and T1 respectively. From the present study ,it may be concluded that foliar spray of 0.2 % B through Borax + 0.3 % Zn through ZnSO4+ 0.15 % Fe through FeSO4 + 0.15 % Cu through CuSO4 is superior than the other treatments with respect to improvement in growth, yield, nutrient content, nutritional and phytochemical attributes and physico-chemical parameters contributing towards the better yield in Lemon.

From the present study, it may be concluded that foliar spray of 0.2% B through Borax+0.3% Zn through $ZnSO_4$+0.15% Fe through $FeSO_4$+0.15% Cu through $CuSO_4$ i.e. T_9 wasfound to be superior to other treatments for improving growth, yield, fruit quality, foliar and fruit juice nutrient content and important nutritional and phytochemical attributes contributing towards the better yield in Lemon cv. Konkan Seedless under West Central Table Land Zone of Odisha. Moreover, this research has been done only in one year. Hence, to confirm the result, further study is needed.

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CALCIUM SIGNALING IN PLANTS UNDER ABIOTIC STRESS CONDITIONS

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ABSTRACT

Salt stress is one of the most prevalent abiotic stresses affecting agricultural lands. Research indicates that approximately 10% more land becoming salinized every year, with estimates suggesting that by 2050 about half of the world's arable land will be impacted by salt stress. Rice, a staple crop for many, suffers significantly in terms of grain quality and yield under salt stress, particularly during the vegetative and reproductive stages. This study investigates physiological, biochemical, and molecular responses of local landraces and modern cultivars to differential salt stresses. Different rice genotypes were subjected to salt stress at 100 mM and 200 mM NaCl concentrations during the early seedling stage. Potentially tolerant genotypes depicted enhanced superoxide dismutase (SOD) and catalase (CAT) activities upon exposure to stresses. Conversely, the salt-sensitive genotypes displayeda significant increase in the levels of hydrogen peroxide (H_2O_2) and malondialdehyde (MDA) content in response to salt stress. DAB and NBT staining techniques were employed in salt-sensitive and tolerant varieties to detect hydrogen peroxide accumulation and superoxide accumulation, respectively. The relative gene expression of several calcium signaling genes, salt-stress signaling genes, and calmodulin-binding transcription activator (CAMTA) genes were studied between the salt-sensitive and tolerant varieties. Based on our data and previous literature, we have proposed a plausible model of the salt stress signaling cascades between the tolerant and sensitive rice genotypes to explain the stress tolerance mechanisms.

Keywords: Calcium signaling, Catalase, Rice, Salt stress, Superoxide dismutase.

SUSTAINABLE FRUIT PRODUCTION TECHNOLOGY AND ENHANCING FARMERS' INCOME

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Abstract

In India, sustainable fruit production technology is crucial for increasing farmers' income, promoting eco-friendly methods, and boosting crop yields. The diverse climatic and soil conditions of India allow for the cultivation of a vast variety of fruits across tropical, subtropical, and temperate zones. Horticulture is a vital component of agriculture, playing a key role in poverty reduction, nutritional improvement, and creating income and employment opportunities for farmers and related industries. The transition of this sector into a commercialized entity has attracted private investments aimed at improving production systems. Adoption of technologies such as GIS-based cultivation, micro-irrigation, precision farming, greenhouse cultivation, and enhanced post-harvest management has driven growth but also introduced new challenges. Despite advancements in research, there remains a considerable yield gap in many horticultural crops due to factors affecting productivity and quality. Consequently, Indian farmers are now better positioned to fulfill both local and global demands for high-quality fruits, contributing to a more thriving agricultural sector.

Key words: Fruits, production technology

DEEPWATER RICE FISH FARMING MINIMIZING CLIMATE CHANGE EFFECTS & MAXIMIZING RESOURCE USE EFFICIENCY

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ABSTRACT

Deep Water Rice (DWR) which constitutes traditional cultivars (plant height more than 140 cm) are usually grown under low lying waterlogged areas which remain inundated by monsoon rains for a period of 5-6 months a year, with water depth ranging 0.5-2.0m. India has the largest area under deep-water rice (DWR) in the world, major areas of which are located in the states of Assam, Bihar, Orissa, eastern Uttar Pradesh, and West Bengal (Dutta, 1981). These states altogether comprise 78.7% (21.1 million hectare) of rice farming areas coming under rain fed are out of which 16% (4.3 mha) of the area is upland, 48% (12.9 mha) low land (0-50cm water depth), and the remaining 14.7% (3.7mha) is deep water areas. Significantly, West Bengal tops among five states, having 24.32% (0.9mha) of deep-water rice farming area (Kar et al., 2005). Such DWR areas, by and large, have low productivity of rice probably due to the immense variability of the area's hydrologic conditions governed under several factors like variation in the flood timing, depth and duration of submergence depending on rainfall, topography, and flood overflows from the different sources. On the contrary, these areas, however, are potentially capable of supporting the production of other yields like fish and prawns. In waterlogged DWR areas, fish migrate from the nearby perennial water bodies and pass their significant part of life cycle: usually mature fish prefer those areas as their suitable niche for breeding, spawning, and rearing of progenies - a scenario of common occurrence in DWR areas. Farmers of DWR areas collect traditionally those indigenous fish for their livelihood. Different observations have reported that the production of those traditionally growing fish might range up to 100 kg/ha/season recorded in different DWR areas in West Bengal. That DWR areas are to be flooded during monsoon is a natural phenomenon, which cannot perhaps be averted. Hence, such a vast area should be accepted as a nature's gift rather than adversity, and may be utilized for cultivation of – at least one crop of fish along with rice. In this connection, the suitable technology, which can be widely accepted by the farming communities, should be implemented in those areas to culture fish so as to make them viable for production of two different crops viz., rice and fish at the same time from the same area.

Keywords: Deep water rice, Rice-Fish Culture, Livelihood

TRADITIONAL PROCESSING AND VALUE ADDITION OF HORTICULTURAL CROPS CAN PLAY A CRUCIAL ROLE IN ENHANCING THE LIVELIHOODS OF RURAL PEOPLE

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ABSTRACT

Rural communities often engage in traditional methods of processing and preserving horticultural crops such as drying, fermentation, pickling, and canning. These techniques extend the shelf life of perishable produce, allowing farmers to sell their products beyond the harvest season and fetch higher prices in the market. Value addition transforms raw horticultural crops into a variety of food products such as jams, jellies, sauces, juices, and snacks. These products cater to diverse consumer preferences and have a higher market value compared to fresh produce, providing farmers with additional income streams. Mahua flowers are traditionally processed by collecting them, sun-drying to remove moisture, then manually separating the petals from the seed. It is used to prepare syrups, jams, or fermented to produce alcoholic beverages. Date palm jaggery is prepared traditionally by extracting sap from date palm trees, boiling it until it thickens, then pouring it into molds to cool and solidify. Palmyrah palm toddy is traditionally prepared by tapping the inflorescence of the palmyrah palm tree to collect sap. The sap is then fermented naturally by ambient yeasts, resulting in a mildly alcoholic beverage. Some horticultural crops lend themselves to artisanal craftsmanship, where rural communities use traditional skills to create value-added products such as woven baskets, decorative items, natural dyes, and herbal cosmetics. These products contribute to cultural heritage preservation and offer unique selling propositions in niche markets. Many horticultural crops have medicinal or therapeutic properties, and rural communities often utilize traditional knowledge to extract oils, essences, and extracts for use in traditional medicine, aromatherapy, and herbal remedies. Value addition in this sector not only generates income but also promotes health and well-being. Value addition activities often involve collective efforts within rural communities, leading to the establishment of community-based enterprises such as cooperatives, self-help groups, and women's associations. These enterprises promote social cohesion, empower marginalized groups, and foster local entrepreneurship. Traditional value-added products and agro-horti-tourism experiences attract tourists interested in authentic cultural experiences and locally sourced goods. Rural communities can leverage their horticultural heritage to develop tourism infrastructure, accommodation facilities, and agri-tourism activities, thereby generating income from tourism-related services.

Key words: Traditional processing, food, medicinal plants, horti-tourism, livelihood security.

PRODUCTION OF PAPAYA (*Carica papaya* L.) FOR PAPAIN EXTRACTION

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ABSTRACT

Papaya (*Carica papaya* L.), belong to the family caricaceae is eaten as fresh fruit. It is also known as papaw or paw paw. It is one of the most nutritious and medicinally important fruit. It is a tropical fruit and can be grow in wide range of climate. It provides highest income per unit area next to bananas. Recently, is industrial value has also increased due to the enzyme papain which has numerous uses. Papain is abundantly found in the leaves and the skin of the green fruits that are used in food leather and pharmaceutical industries. Papain is also helpful in to reducing pain inflammation, infection, swelling, diarrhea and allergies in addition to improving digestion. Papain has been extensively used as a common ingredient in the brewery and in the meat and meat processing. Therefore, its cultivation has become profitable. Farmers can easily generate good income source either by papain extraction or by marketing unripe and ripe fruits. Papaya farming needs to be redefined under subtropical conditions. Since Papaya grows in a wide range of climate papaya production for extraction of papain can be a high source of income even for small scale farmers.

Key words : Papain, tropical, income, farmer, enzyme.

INSECT POLLINATORS OF LITCHI AND FORAGING BEHAVIOUR OF HONEY BEES

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ABSTRACT

An experiment was conducted in litchi orchard (Bombai variety) of Horticultural Research Station (latitude 22°56′39″N and longitude 88°30′56″E) of Bidhan Chandra Krishi Viswavidyalaya at Mandouri in Nadia district of West Bengal during February to March, 2019to record the different insect pollinators with special reference to foraging behaviour of honey bees visiting litchi flowers. A total of 13 insect pollinators belonging to order Hymenoptera (comprising of 7 species viz., *Apis dorsata*, *Apis mellifera*,*Apis cerana indica, Apis florea, Lassioglossum* sp.*, Vespa tropica* and *Camponotus compressus)*, Diptera (comprising of 5 species viz., *Episyrphus balteatus*, *Eristalis* sp., *Syrphus* sp., *Sacrcophaga sp.* and *Lucilia sericata*) and Coleoptera (comprising of single species viz., *Coccinellaseptum punctata)* were found to visit litchi flowers during the period of study. The abundance (percentage of insect fauna/inflorescence/5 min.) of Hymenopterans (77.71%) was maximum followed by Dipterans (22.27%).Among Hymenopterans, *A. dorsata*(50.11%) was predominant visitor followed by *A. cerana indica* (11.80%), *A. florea* (8.68%) and *A. mellifera* (7.12%). The foraging speed (time spent in sec. per flower per forager) was recorded maximum during 9-11 am while, minimum during 3-5 pm for all the honey bees. The mean foraging speed was found to be maximum in *A. dorsata* (4.64 sec) while *A. florea* (3.32 sec) showed lowest. On the contrary, the foraging rate (number of flowers visited per min. per forager) was found to be highest during 3-5 pm for all the honey bees and the maximum and minimum mean foraging rate was recorded in *A. florea* (12.29) and *A. dorsata* (10.54) respectively.

Key words: Litchi insect pollinators, Honeybees, Abundance, Foraging behaviour.

LENTILS: THE NUTRITIONAL POWERHOUSES ENSURING FOOD SECURITY

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ABSTRACT

India, a nation with significant numbers of impoverished and undernourished individuals, has historically advocated for a diet centred around cereals. This diet mostly consists of subsidised basic commodities like rice and wheat, which are used to sustain its population of over one billion people. Presently, food patterns are transforming. Policy officials, experts, and health campaigners are seeking strategies to combat hunger and malnutrition in the nation. As individuals transition their attention from calorie consumption to nutritional value, overlooked food items like pulses are receiving increased recognition. Lentils have a huge impact on food and nutrition security for millions of people in India. They are a crucial component of the diet for the large vegetarian population and provide an economical protein source in impoverished communities. Lentils have significant agricultural value and are also highly nutritious, containing ample amounts of protein, carbs, fibre, vitamins, and minerals. Plant proteins are crucial for human nutrition as they provide a viable substitute for animal proteins, hence reducing the need for meat consumption. In addition to being used for phytoremediation and prevention against a variety of human ailments, lentils have also been used as environmental bio-indicators to detect cytotoxicity. This review explores the nutritional and economic potential of lentils in attaining the goal of food security and enhancing livelihoods for millions of Indians.

Keywords: Pulse, Nutritional security, Foods security.

PROTECTED CULTIVATION OF FRUIT CROPS – A WAY FORWARD FOR FRUIT GROWERS

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ABSTRACT

Protected cultivation of fruit crops involves growing them within controlled environments such as greenhouses, high tunnels, shade houses, and net houses. These structures provide protection from adverse environmental conditions, pests, and diseases, allowing for optimized growing conditions and extended growing seasons. Greenhouses, made of materials like glass or plastic, offer precise control over factors like temperature, humidity, and light, making them ideal for cultivating fruit crops that require specific climates. High tunnels, simpler in design with metal or plastic hoops covered by polyethylene film, are suitable for small fruit crops like strawberries and blueberries, offering protection while allowing ventilation. Shade houses, equipped with shading materials, protect fruits from excessive sunlight and heat, benefiting crops sensitive to high temperatures. Net houses, utilizing nets to shield against pests and birds, are especially useful for crops susceptible to damage, such as grapes and berries. Additionally, hydroponic and aeroponic systems provide soilless cultivation methods, allowing for precise nutrient delivery and maximizing growth potential. Climate control systems, including heating, cooling, and ventilation, are integrated to maintain optimal growing conditions. Automated systems equipped with sensors ensure monitoring and regulation of environmental parameters. Overall, protected cultivation of fruit crops enhances productivity, quality, and flexibility, enabling growers to produce high-quality fruits year-round in a controlled environment.

Key words: Green house, fruits, soilless culture, vertical farming.

GOLDEN RICE: A POTENTIAL SOLUTION TO VITAMIN A DEFICIENCY

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ABSTRACT

Abstract: Genetically engineered "Golden Rice" contains up to 35 μg β-carotene per gram of rice. It is important to determine the vitamin A equivalency of Golden Rice β-carotene to project the potential effect of this biofortified grain in rice-consuming populations that commonly exhibit low vitamin A status. Through genetic modification, scientists introduced beta-carotene, a precursor to vitamin A, into the rice. This gives golden rice its characteristic golden colour. The primary goal of golden rice is to provide a fortified food source for populations at risk of vitamin A deficiency, particularly women and children. Vitamin A deficiency can lead to serious health problems, like- xerophthalmia (eye conditions), increased risk of infections and even blindness. Regulatory bodies in several countries, including the United States and Philippines, have deemed it safe for consumption Golden rice offers a safe, sustainable and cost-effective approach to improving nutrition, particularly in areas with limited access to other sources of vitamin A . Golden rice remains a work in progress, with ongoing research to improve its β carotene content and agronomic traits. The first commercial cultivation of golden rice was approved by International Rice Research Institute (IRRI) in the Philippines in 2021.

Keywords: Golden rice, vitamin A, β-carotene, GE- regulation, GMO crop, xeropthalmia.

THE CONVERGENCE OF BIG DATA AND BIOINFORMATICS: TRANSFORMING BIOLOGICAL RESEARCH

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ABSTRACT

The advent of big data has revolutionized various scientific disciplines, with bioinformatics emerging as a pivotal field benefiting from this data deluge. This article explores the synergistic convergence of big data and bioinformatics, illuminating how this integration is catalyzing transformative advances in biological research. We delve into the methodologies and technologies at the intersection of these domains, highlighting key areas such as genomic sequencing, proteomics, and complex biological systems modeling. We examine case studies where big data analytics have enabled breakthroughs in understanding biological processes, agro-ecosystem, disease mechanisms, and therapeutic targets. The article also addresses the challenges and opportunities presented by the vast volume, velocity, and variety of biological data, discussing strategies for data management, analysis, and interpretation in the context of bioinformatics. Furthermore, we explore the implications of this convergence for personalized medicine, environmental conservation, and agriculture, underscoring the potential for big data and bioinformatics to drive innovation and solve pressing global challenges. The article concludes by projecting future trends in the field, emphasizing the need for interdisciplinary collaboration, advanced computational infrastructures, and ethical considerations in harnessing the power of big data in bioinformatics. Through this exploration, we aim to provide a comprehensive overview of how the integration of big data and bioinformatics is setting a new paradigm in biological research for a sustainable future, offering unprecedented opportunities for discovery and innovation.

Keywords: Big data, Bioinformatics, Data integration, AI/ ML, High-performance computing, Multi-omics integration, Cloud computing.

MICRONUTRIENT DEFICIENCY IN FRUIT CROPS AND THEIR MANAGEMENT

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ABSTRACT

Micronutrient deficiency in fruit crops can significantly impact yield, quality, and overall plant health. Common micronutrient deficiencies include those of iron (Fe), zinc (Zn), manganese (Mn), boron (B), copper (Cu), and molybdenum (Mo). Symptoms vary depending on the nutrient lacking but may include yellowing of leaves, stunted growth, poor fruit development, and overall reduced vigor. To manage micronutrient deficiencies, several strategies can be employed. Soil testing is essential to assess nutrient levels and determine deficiencies accurately. Based on soil test results, corrective measures such as soil amendments or foliar applications can be implemented. Soil amendments, including micronutrient fertilizers or organic materials rich in the deficient nutrient, can be incorporated into the soil to replenish nutrient levels over time. Foliar sprays containing micronutrients are applied directly to the leaves, providing a quick remedy for deficiencies and ensuring rapid uptake by the plant. However, it's crucial to follow recommended application rates to avoid toxicity. Additionally, maintaining proper soil pH is essential for micronutrient availability; adjusting pH levels through liming or acidification can improve nutrient uptake by plants. Furthermore, crop rotation and intercropping with legumes can help enhance soil fertility and nutrient availability. Regular monitoring of plants for symptoms of deficiency, coupled with proactive management practices, is key to preventing and addressing micronutrient deficiencies effectively. Overall, a comprehensive approach that integrates soil testing, appropriate fertilization, and cultural practices is essential for managing micronutrient deficiencies in fruit crops and ensuring optimal growth and productivity.

Key words: Micronutrients, fruit crops, deficiency, corrective measures.

ISOLATION & IDENTIFICATION OF ECTOPARASITES IN FRESHWATER ORNAMENTAL FISH (*Carassius auratus*) AND ITS TREATMENT WITH *CALOTROPIS GIGANTEA* EXTRACT

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ABSTRACT

In the midst of high demand of ornamental fishes all over the world, this beneficial business in India is facing loses due to the invasion of parasites. The current study shows that the ornamental fish (*Carassiusauratus*, commonly known as Gold Fish) are mostly infected by the ecto-parasites such as, *Ichthyophthirius* sp., *Dactylogyrus* sp., *Gyrodactylus* sp. and *Argulus* sp. The intensity of infection is usually high during summer season and low during cooler months. Nowadays, a large portion of the world population, especially in developing countries depends on the traditional system of medicine for a variety of diseases. Several studies show that *Calotropis gigantea* is used conventionally to treat many diseases such as cancer, diabetes and intestinal disease in African and Asian countries. Many research provides evidence of their antioxidant, analgesic, anti-inflammatory, anti-diarrheal, anti-convulsant, anti-malarial, antitumor, antimicrobial and hepatoprotective proterties. The objective of this paper is to find out the anti-parasitic effect of *Calotropisgigantea* on the common Gold Fish (*Carassius auratus*) wich could contribute and important insight for the ornamental fish farmers.

Keywords: Ornamental fish, invasion of parasites, intensity of infection, *Carassius auratus*, herbal medicine, treatment of fish disease, *Calotropis gigantea*

SCREENING OF DIFFERENT POTATO VARIETIES FOR RESISTANCE AGAINST LATE BLIGHT DISEASEUNDER LATERITIC ZONE OF WEST BENGAL

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ABSTRACT

Potato (*Solanum tuberosum*) is an important vegetable cash cropbelongs to the Solanaceae family. The cultivation of Potato increasing steadily inthe lateritic region of West Bengal. The main problem to cultivation of potato in this region **is** Late Blight disease caused by *Phytopthora infestans*. The present study highlights that the field experiments were conducted to screen out six potato varieties against late blight disease during the year 2023-24. We observed that *K. Ashoka*is highly susceptibility to *P. infestans* among the six-variety. *K. Himalini* were found most resistantto *P. infestans* among the six-variety. Another rest variety were found moderately resistant respectively K. Jyoti, K. Chandramukhi, K. Pukhrajand K. Khyati. Resistant source can be incorporated in breeding program to develop high yielding resistant variety of potato in future.

Key words: Late Blight of potato, Resistance. lateritic region.

INTEGRATION OF ADVANCED MOLECULAR APPROACHES AND SPEED BREEDING METHODS FOR DEVELOPMENT OF CLIMATE-RESILIENT CROPS

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ABSTRACT

Climate change and population growth are becoming the alarming issue of modern agriculture. Climate change induced by global warming can trigger higher abiotic stress, insect pest pressures, and plant diseases, thus affecting crop production. Plant breeding using conventional methods has greatly helped to enhance economic features for the production and release of suitable cultivars. Hybrid development using conventional breeding methods takes a long time to stabilize the variability within the population before it is released for commercial cultivation. Current developments in genomes and molecular tools have accelerated the process of developing breeding techniques that can more accurately and efficiently handle large population. These techniques include gene stacking for multiple trait introgression into an elite background, marker-assisted selection, and gene pyramiding for multiple stress tolerances. A comprehensive breeding strategy is needed, that incorporates modern techniques for rapid generation advancement and assessment. Speed breeding, a method of advancing generations rapidly by minimize the generation cycle. Genetic selection along with speed breeding can speed up the breeding cycle, even allowing more genetic improvement. Climate resilient crop genetically improved through genomic selection, advance genome tools and speed breeding method helps to get efficient result, earlier than the conventional breeding approaches.

Keywords: Climate-Resilient, Genomic selection, Genetic advancement, Smart Breeding.

NUTRITIONAL BACKUP BY *RABI* LEAFY VEGETABLES UNDER CONSERVATION: A REVIEW

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ABSTRACT

In today's agriculture, sustainable intensification in cropping systems based on cereals has gained significant importance. Therefore, a key area of research in the near future will be developing sustainable cropping systems from a techno-economic and environmental standpoint. Over half of the world's population depends on rice as a staple meal; it is the second most extensively grown crop after maize.Over 90% of the world's rice is produced and consumed in the Asia-Pacific area.Rice fields are frequently left fallow during the rabi season, which can be used to produce short-duration crops like green vegetables with the goal of increasing cropping intensity and maximizing nutrient and water use efficiency under conservation practice.Leafy vegetables plays a vital role in human nutrition, offering a plethora of essential vitamins, minerals, and phytonutrients. Among them, rabi leafy vegetables hold significant importance due to their availability during the winter season, ensuring a steady supply of nutrients when other crops may be scarce. This review aims to explore the nutritional backup provided by *rabi* leafy vegetables in the conservation of human health. It synthesizes existing literature on the nutritional composition, health benefits, and conservation strategies of *rabi* leafy vegetables. By examining various aspects such as their nutrient content, antioxidant properties, and culinary versatility, this review highlights the importance of incorporating rabi leafy vegetables into diets for optimal health. Understanding the nutritional significance and conservation methods of rabi leafy vegetables can aid in promoting their consumption, thereby contributing to improved public health outcomes.

Keywords: *Rabi* leafy vegetables, nutritional composition, conservation.

CONSERVATION AGRICULTURE- A NEW PARADIGM IN AGRICULTURAL RESEARCH

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A B S T R A C T

To meet the global food demand, agricultural production will need to boost by 70% using scientifically sound, eco-friendly, and socially acceptable technologies by 2050. Areas with high levels of food unavailability due to the degraded environment and inadequate options for coping with extreme weather events will face a rapid decline in productivity and leads to greater instability in agricultural communities and production systems. Conservation agriculture (CA) has emerged as an alternative to an inefficient tillage-based conventional agriculture. Crop establishment methods which promote healthier soils are emerging, including dry direct seeded rice (DSR) and unpuddled transplanted rice (UPTR). Several studies reported that DSR can be an economically feasible alternative to puddled transplanted rice (PTR) as it helped in reductions of production cost by 11–17% with 25–30% less irrigation water at similar yield levels and saved INR 5000/- on fuel and labour. Seedlings are mechanically transplanted into untilled, saturated soil in UPTR where rice yields are not compromised and where less energy is used in rice production than in PTR.UPTR is well suited to agricultural environments where the onset of wet-season rains is abrupt and heavy, as occurs across many regions in Asia. In these regions, DSR may result in poor or even complete crop establishment failure. Considerable weed pressure in both DSR and UPTR at early growth stages, leads to significant reduced yields if weeds were not effectively checked. Integration of CA-based No-till mechanized-transplanter at proper sowing window, nutrient & water management and selecting the right crop at right time can effectively increase the yield levels. CA-based systems are found more adapted to extreme climatic conditions and can mitigate the negative effects of climatic stresses like terminal heat, water stress and thereby helps in increasing crop yields over the conventional system. Despite some challenges associated with CA, when done correctly, CA could ensure current food security and nutrition for all without compromising the economic, social, and environmental bases for future generations.

THE EFFLUENTS RELEASED IN EAST KOLKATA WETLAND, WEST BENGAL, INDIA, IMPENDING THREAT TO CULTURED FISH

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ABSTRACT

The East Kolkata Wetlands (EKW) in West Bengal, India, is a vital ecosystem that has long supported fish farming and wastewater treatment. However, rapid urbanization and industrialization have led to an increased discharge of effluents into the wetlands, posing a significant threat to the cultured fish. The effluents from East Kolkata Wetlands are composed of domestic kitchen wastes, sanitation wastes, agricultural wastes, biomedical wastes containing human anatomical waste, animal waste, microbiology & biotechnology waste, discarded medicines &cytotoxic drugs, heavy metals from different industries. These wastes are very perilous because of the potentially infectious in nature as it may pose a serious threat to human health, if its management is indiscriminate and unscientific. The toxicity test in this study identifies the reason of the maximum fish mortality in EKW was due to the toxic chemicals present in sewage effluents, which can accumulate in the water and sediments, adversely affecting fish health. Heavy metals can induce physiological stress, reduce growth, and impair reproduction in fish, while organic compounds can degrade water quality and lead to oxygen depletion. Nutrient pollution can trigger algal blooms, further deteriorating water quality and causing fish mortality. Due to the effect of those effluents, considerable fish mortality happens during pre and post monsoon months when the dilutions of those toxic nutrients are less. Fishes are the primary bio needle as they are very sensitive towards the contamination. The current study was based on the bioassay test on fresh water fish *Tilapia* cultured in East Kolkata Wetlands and measurable mortality can be seen every year especially during summer and winter months without any traces of pathogenic infections. To mitigate these threats, it is imperative to implement measures to minimize effluent discharge into the wetlands. This includes enhancing industrial wastewater treatment, promoting sustainable agricultural practices, and raising public awareness. Regular monitoring of water quality and fish health is also crucial for assessing the impact of effluents and ensuring the sustainability of fish farming in the EKW.

Keywords: Effluents, East Kolkata Wet Lands, Bioassay, Toxicity Test, Wastes.

CHALLENGES AND CONSERVATION OF THE EAST KOLKATA WETLANDS: A CRITICAL ANALYSIS

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ABSTRACT

The East Kolkata Wetlands (EKW), designated as a 'Ramsar Site' due to its environmental significance, serves as the lungs of Kolkata, the metropolitan city. However, rapid urbanization, population growth, illegal land acquisition, and conversion of wetlands, along with the dumping of untreated industrial and domestic sewage, pose significant threats to this ecosystem. Despite these challenges, the wetlands are crucial for agriculture and fishery, providing livelihoods to thousands of fishers and contributing to the economy of the city. The current study aims to assess the current status of the EKW and provide insights for future conservation efforts.One of the unique aspects of EKW is the utilization of city sewage for agricultural and aquaculture production, which is vital for the livelihoods of the local population, particularly the poor. Cooperative societies play a key role in the development of aquaculture businesses and the socio-economic well-being of the community. However, the fishers face various challenges, including illiteracy, health issues, and social problems, with females being more affected than males. Poverty, malnutrition, alcoholism, domestic violence, and other issues plague the community, exacerbated by rapid industrialization and illegal industries in the area. Water quality analysis of the wetlands reveals that while certain parameters such as temperature, pH, and dissolved oxygen are within optimal levels, others like total hardness, nitrate-nitrogen, phosphorus content, BOD, COD, and chlorides are above average, signalling potential problems in the future. Chromium contamination from industries is a particularly concerning issue. Despite these challenges, fishers continue to utilize waste products for fish production, but there is a trend of shifting away from aquaculture due to low production rates and increasing population among fisher families. Immediate attention is needed to address the education and health needs of the people living in EKW, as their livelihoods are at risk due to deteriorating water quality and changing economic conditions.

Keywords: East Kolkata Wetlands (EKWs), water quality parameters, socio-economic condition, cooperatives, chromium (Cr.).

A REVIEW ON CROP RESIDUE BURNING: IMPACT AND ITS MANAGEMENT

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ABSTRACT

Numerous agricultural harvests produce a significant amount of residues both on and off the farm. Every year, crop wastes of over 500 Mt are produced in India. The largest amount of agricultural leftovers (352 Mt) is produced by cereals, with fibres (66 Mt), oilseeds (29 Mt), pulses (13 Mt), and sugarcane (12 Mt) following in order. While rice alone accounts for 34% of crop leftovers, cereal crops (rice, wheat, maize, and millets) provide 70% of the residues. The mechanised rice-wheat system in northwest India, which includes Punjab, Haryana, Uttarakhand plains, and Western Uttar Pradesh, is severely affected by the problem in the irrigated Indo-Gangetic plains. A lack of labour and a shorter time span between rice harvest and wheat seeding are the main obstacles to the rice-wheat cropping method. This pushes farmers towards automated harvesting, which causes enormous amounts of crop wastes to be burned in the field. Burning crop residue results in the loss of plant nutrients like N, P, K, and S. It also raises soil temperature, which affects the physicochemical, biological, and microbiological characteristics of the soil and releases greenhouse gases (GHGs) including CO_2, CH_4, and N_2O that contribute to global warming. Incorporating crop residue into soils through the use of conservation agriculture practices, encouraging the use of crop residue for the preparation of bio-enriched compost or vermicomposting, using crop residue for mushroom cultivation, diversifying the uses of crop residue as fuel for power plants, producing cellulosic ethanol, offering incentives for the purchase of good quality seeds, turbo seeders, shredders, or baling machines, and providing farmers with subsidies for renting resource-saving machinery from custom hiring centres or agriculture service centres, etc.

Keywords: residue, global crop worming, greenhouse gases, technological intervention.

EFFECT OF PAPAYA PLANT EXTRACT ON MICROBIAL CONTAMINATION OF FRUITS AND VEGETABLES

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ABSTRACT

Many of the agricultural commodities are highly perishable in nature and among which horticultural produce contributes for the maximum percentage. Nearly 10% of the production is being loosed in terms of post-harvest losses out of 74 million tonnes of production and there is a necessity to overcome this bottle neck. Many of the shelf extending chemicals and other plant based extracts are available to extend the shelf-life by reducing the microbial growth on the produce. Among the different plant based extracts papaya extract is one of the potential plant based product that have the ability to reduce the microbial contamination by acting as antimicrobial, anti-fungal and anti-oxidant activity due to presence of constituents like phenol, vitamins and enzymes. The enzymes present in the extract of papaya have the ability to breakdown the proteins present in the cell wall of the bacteria and thereby effects the structure and functionality of the organism and even the extract contains acidic pH which is not a prevailing condition for microbial growth and hence the application of papaya extract on the horticultural commodities like fruits and vegetables may help in extending their shelf-life by reducing the microbial contamination.

Key Words: Anti-fungal, Anti-microbial, papaya.

PASTURE BASED LIVESTOCK FARMING IN ASSOCIATION WITH COMPOST: A SUSTAINABLE APPROACH TOWARDS LIVELIHOOD

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ABSTRACT

As global demand for livestock products is expected to double by 2050, necessary increases to future production. Integration of pasture or legumes along with livestock rearing can restore degraded land reduce drought occurrence. Non-arable or degraded land can be utilizing by adapting this approach. Managed forage increases amount of carbon, nitrogen into soil and inhibit nitrification. A good quality pasture or grass not only maintains the growth of animal also maintain their productivity. Livestock waste is the main organic nutritious resource to plants. Composting is ideal approach to convert farm waste into useful resource materials. Conversion of livestock waste into biogas compost and vermicompost are very useful to resource Sustainability and increase crop yield by their application. India is most prominent country using biogas technology (BT) as CNG cylinders in vehicular and another appliance. Microalgae is a renewable and energy feedstock that are cultivated by livestock waste and produce by product like biogas, biodiesel etc. Thus, livestock production along with compost unit makes the farm industry profitable and sustainable towards livelihood.

Keywords: Pasture, Composting, Biogas technology (BT), Livelihood security.

THE EFFECT OF MANAGEMENT OF RICE RESIDUE ON YIELD PARAMETERS, SOIL AND WEED FLORA IN RICE-MUSTARD CROPPING SYSTEM IN WEST BENGAL

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ABSTRACT

Experiment entitled "The effect of management of rice residue on yield parameters, soil and weed flora in rice-mustard cropping system in West Bengal" was conducted during rabi season 2020-22 at "Teaching Farm, Bidhan Chandra Krishi Viswavidyalaya, College of Agriculture, Burdwan. The field experiment was conducted in split-split-plot design with 3 replications, comprising 2 main plot treatments E_1: Traditional sowing and E_2: Mustard transplanting and 4 sub-plot treatmentsPr_0: Traditional paddy + No residue, Pr_1: Mechanized paddy +Residue Burning, Pr_2: Mechanized paddy + In-situ residue incorporation, Pr_3: Mechanized paddy + In-situ compost by Waste Decomposer and 3 sub-subplot treatments W_1: Farmer Practice, W_2: Pendimethalin 30EC@1kg a.i. ha-1 + HW, W_3: Aqueous extract of *Tectona grandis*, *Calotropis procera* and *Parthenium hysterophorus* (10%v/v) @ 100ml L-1 +HW to study the effect of yield, yield attributes of mustard and to find out the changes in soil properties and weed flora. Among the treatments Pr_3(Mechanized paddy + In-situ compost by Waste Decomposer) showed highest result in Number of pod/plants, Seeds/pod, Test weight and final yield of Mustard followed byPr_2 (Mechanized paddy + In-situ residue incorporation). A superior soil physical condition and normal NPK ratio was found by applying waste decomposer for managing crop residue in the treatment Pr_3which was followed by Pr_2. Some common weed flora identified in the field are *Grangea maderaspatana*,*Polygonum plebeium*,*Chenopodium album*,*Cyperus rotundus*,*Digitaria sanguinalis*.Among the weed management treatments W_2(Pendimethalin 30EC@1kg a.i. ha^{-1} + HW) showed better result for controlling of weeds over the farmers practices.

Key words: Residue, Yield, Yield parameters, Weed.

IMPACT OF TEMPERATURE ON SEED GERMINATION OF PAPAYA (*Carica papaya* L.) UNDER THE LABORATORY CONDITION

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ABSTRACT

Seed germination is one of the most important stages in the life cycle of papaya and is strongly influenced by temperature conditions. The purpose of this study is that we have tried to know the stage of seed germination of papaya (*Carica papaya* L.) under the BOD incubator condition. Temperature three levels (20, 25 & 30 °C) were used. The objective of this study is to see how germination is accelerated at different temperatures by treating seeds with growth regulators, chemicals, and organic supplements. Since the seed coat contains sarcotesta, which inhibits germination, seed treatment is necessary. For seed treatment in papaya, soak the seeds in a solution of Coconut water @ 50%, Tomato juice @ 20%, cow urine @ 10%, GA_3 @ 200 ppm, NAA @ 200 ppm, KNO_3 @ 0.5% and normal water (control) twenty four hours. For this study place in petri plates with moist filter paper, 20 seeds were placed in each petri plate, after that data observation was taken by placing the petri plate on BOD incubator. The T_2 GA_3 @ 200 ppm (92.66%) recorded the highest number of seed germination at temperature range 30 ^{0}C followed by T_1 (Coconut water), T_3 (NAA @ 200 ppm), followed by while seedling length, root length and shoot length were maximum at T_1 (Coconut water @ 50%) recorded 6.5, 3.35 and 9.423 and lowest at T_6 KNO_3 (Potassium Nitrate @ 0.5%) was found in variety "Ranchi" under incubator control condition.

Kew word: Seed treatment, germination, sacrotesta, temperature, BOD incubator.

ROLE OF PLANTATION CROP IN MITIGATING CLIMATE CHANGE

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ABSTRACT

Climate change is the most significant challenges of 21st century. As the global climate crisis intensifies, the imperative to identify sustainable solutions becomes increasingly urgent. Plantation crop have emerged as significant players in climate change mitigation strategies. They have the unique property of carbon sequestration and ecosystem services. Several crops such as coconut, oil palm, rubber, cocoa and tea possess inherent characteristics that make them valuable assets in climate change mitigation efforts. These crops have extensive root systems and dense canopies, enabling them to sequester substantial amounts of atmospheric carbon dioxide through photosynthesis and soil carbon storage. Moreover, their perennial nature ensures long-term carbon sequestration and resilience to climate variability. They help to mitigate soil erosion, regulate water cycles, and promote biodiversity conservation by providing habitats for diverse flora and fauna. Plantation agriculture can enhance local livelihoods by generating employment opportunities and supporting rural economies, thereby fostering resilience to climate change impacts. The sustainability of plantation crop cultivation hinges on responsible management practices that prioritize environmental conservation and social equity. Sustainable land-use planning, agroforestry techniques, and certification schemes can help minimize deforestation, biodiversity loss, and social conflicts associated with plantation expansion. By adopting sustainable management practices, plantation agriculture can play a pivotal role in transitioning towards a more resilient and sustainable future in the face of climate change.

Key words: climate, plantation crop, mitigation.

CULTIVATING HARMONY– NURTURING THE LAND THROUGH NATURAL FARMING IN HORTICULTURAL CROPS

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ABSTRACT

Natural farming, rooted in traditional wisdom and ecological harmony, presents a compelling alternative to conventional agricultural practices by prioritizing sustainability and eschewing chemical inputs. Originating from the pioneering work of Masanobu Fukuoka, this methodology seeks to restore ecological balance while fostering agricultural productivity through the prudent utilization of natural resources. Central to its ethos are four foundational pillars: Beejamrutha, Jeevamrutha, Achhadana, and Waaphasa, each contributing to the resilience and fertility of agro-ecosystems. Beejamrutha employs microbial seed treatments derived from cow urine and dung-based formulations to enhance seed vitality and disease resistance. Jeevamrutha nurtures soil microbiota diversity through organic inoculums, promoting soil health and nutrient availability. Achhadana advocates for ground cover with crop residues, mitigating soil erosion and enhancing moisture retention. Waaphasa, fosters soil humus buildup, improving soil structure and water retention capacity. Implementing various production practices such as crop rotation, residue management, and intercropping further enhances the resilience and productivity of natural farming systems. Pest management strategies, including Agniastra, Brahmastra, and Neemastra, harness the potency of natural ingredients to mitigate pest pressures sustainably. Despite some inherent limitations, such as restrictions on hybrid varieties and slower initial results, empirical evidence underscores the effectiveness of natural farming practices. Notable outcomes include prolific flowering in Bougainvillea post-application of 3% Panchyagavya and significant reductions in thrips infestation at the Rose Garden following the application of Brahmastra and Neemastra (5% + 5%). These findings underscore the promising potential of natural farming as a sustainable solution to contemporary agricultural challenges.

WASTEWATER TREATMENT BY ALGAE – A SUSTAINABLE APPROACH

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ABSTRACT

Anthropogenic activities, including industry, urbanization, and agriculture, contribute to global wastewater production, causing eutrophication that leads to algal blooms, oxygen loss, and species extinction. Tertiary treatment, which eliminates nonbiodegradable pollutants, has disadvantages such as toxic metabolites and high operational expenses. Microalgae consortia, or polycultures of algal species that are more stable than the cultures of single microalgal cultures and less susceptible to the external environment, can be used as biological remedies to address these issues by effectively removing heavy metals, phosphate, and nitrogen from wastewater. This approach has advantages such as recycling phosphate and nitrogen, using algal biomass in biorefinery systems to generate single cell protein (SCP), and discharging wastewater into natural water bodies with less pollution and oxygenation. Malnutrition is the result of a decrease in the production of protein-enriched foods due to population growth, water scarcity, climate change, and shrinking agricultural regions. The Agenda for Sustainable Development calls for national cooperation to end hunger and prevent malnutrition by 2030. Wastewater clean-up and a paradigm shift from conventional to nonconventional protein sources are urgently needed. A number of scholarly publications have shown that dried microbial biomass is a rich source of protein. The SCP process can be applied to realize circular green economy and reduce environmental harm by using easily accessible feed stocks such as wastewater for algal cultivation.

Keywords: Microalgae consortia, Wastewater, Sustainable development**,** Malnutrition, Single cell protein (SCP)

EFFECT OF FOLIAR APPLICATION WITH MICRONUTRIENTS ON SEEDLING GROWTH OF PAPAYA (*Carica Papaya* L.)

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ABSTRACT

Papaya (*Carica papaya*), belongs to the family Caricaceae is known to be originated from Tropical America and is grown in tropical to subtropical areas all over the world. It is mainly propagated by seeds which show wide variability in germination and seedling growth. Micronutrients play a significant role in disease resistance, tremendously increase crop yield and can improve shelf life of produce. Foliar application can meet the expense of nutrients as it is a well-established operation to complete and enrich plant nutrition. The present investigation, "Effect of foliar application with micronutrients on Seedling Growth of Papaya (*Carica Papaya* L.)" was conducted at Horticulture farm of the Department of Horticulture and Post-Harvest Technology, Institute of Agriculture, Palli Siksha Bhavana, Sriniketan, Visva-Bharati University. The study involved nine treatments viz., T_1 (Zinc sulphate @ 0.2%), T_2 (Zinc sulphate @ 0.4%), T_3 (Borax @ 0.2%), T_4 (Borax @ 0.4%), T_5 (Zinc sulphate @ 0.2% + Borax @ 0.2%), T_6 (Zinc sulphate @ 0.2% + Borax @ 0.4%), T_7 (Zinc sulphate @ 0.4% + Borax @ 0.2%), T_8 (Zinc sulphate @ 0.4% + Borax @ 0.4%), T_9 (Control) with three replications in CRD. The seedlings were raised in polythene bags filled with growing media (soil: sand: FYM @ 1:1:1). Plant growth parameters like plant height, number of leaves, leaf size, stem girth, root length, root primary and secondary branches, root and shoot fresh, dry weight were recorded at 15 days interval. The obtained results showed that Zinc sulphate @ 0.4% + Borax @ 0.4% was found to be effective for the recorded growth parameters.

Key words: Papaya, germination, seedling growth, zinc, boron.

EUCALYPTUS PLANTATION: POLITICAL AND ENVIRONMENTAL ISSUES AND BACKGROUND

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ABSTRACT

Eucalyptus (*Eucalyptus teriticornis*) is a controversial tree among the agricultural community globally. It is a native tree of Australia and introduced in India later through Tipu Sultan on Nandi Hills in Southern India. *Eucalyptus* meets requirement of people and industries to reduce the pressure of natural forests with the production of fuel, timber, pulpwood. *Eucalyptus* has a vast potential for rapid and fast growth and became the most widely planted and economically important tree worldwide, but it also has some negative impact on agricultural production system. The ecological, social and economic aspects of the species receiving roper attention to understand its impact to avoid the indiscriminate Planting of *Eucalyptus*. Here the studies about the concerns behind the planning of the plantation of *Eucalyptus* in India. Political and environmental concerns are studied in detail.

Keywords: *Eucalyptus* cultivation, Background, Social and Political impact

ABIOTIC STRESS IN CITRUS PLANTS: CHALLENGES AND MANAGEMENT STRATEGIES

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ABSTRACT

Citrus is one of the most important fruit crop grown in India and it is comprising of mandarins, sweet oranges, grape fruit, lime and lemons etc. They are rich in vitamins, minerals and many other substances. Abiotic stress poses significant challenges to fruit crop production worldwide. Citrus crops face numerous abiotic stresses, including temperature extremes, water scarcity, salinity, and nutrient deficiencies, which significantly impact their growth, yield, and quality. Temperature stress, characterized by frost damage or heat waves, disrupts citrus metabolism, leading to reduced photosynthesis, flower and fruit drop, and even plant mortality. Water scarcity, exacerbated by climate change and erratic rainfall patterns, results in osmotic stress, compromising water uptake and nutrient transport in citrus plants. Salinity stress, prevalent in arid and coastal regions, hinders citrus growth by altering soil osmotic potential and ion balance, causing ion toxicity and nutrient imbalances. Additionally, nutrient deficiencies, such as nitrogen, phosphorus, and potassium, impair citrus growth and development, reducing yield and fruit quality. To manage abiotic stresses effectively, integrated approaches are essential. These include employing cultural practices like mulching and irrigation scheduling to conserve soil moisture and mitigate temperature extremes. Furthermore, selecting stress-tolerant citrus cultivars and rootstocks, coupled with precision farming techniques and soil amendments, can enhance citrus resilience to abiotic stresses. With all the understanding the complexities of abiotic stressors in citrus plants and implementing holistic management strategies are crucial for sustainable citrus production in the face of changing environmental conditions.

Key words: Citrus, fruit crop, abiotic stress, deficiency, toxicity.

BIOFORTIFIED VEGETABLE CROPS: AN OPTION FOR MITIGATING HIDDEN HUNGER

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ABSTRACT

Hidden hunger, characterized by micronutrient deficiencies, persists as a global health challenge, particularly in vulnerable populations. Biofortified vegetable crops offer a promising avenue for addressing this issue by enhancing the nutritional content of staple foods. By enriching staple foods with essential vitamins and minerals, biofortified vegetables gives a practical means to improve dietary diversity and nutritional intake, thereby enhancing public health outcomes.This review explores the latest advancements and technical aspects of biofortification techniques, including conventional breeding, transgenic approaches, and agronomic practices. Furthermore, it examines the impact of biofortified vegetable crops on alleviating hidden hunger, considering factors such as nutrient bioavailability, consumer acceptance, and agronomic feasibility. The integration of multidisciplinary efforts, including plant breeding, nutrition science, and agricultural extension, is crucial for the successful implementation and uptake of biofortified vegetable crops as a sustainable solution to mitigate hidden hunger and improve public health outcomes globally.Theimportance of biofortification as a viable solution to combat hidden hunger and underscores the need for further research and implementation efforts to maximize its impact on public health and well-being.By enhancing the nutritional content of commonly consumed vegetables through conventional breeding or genetic engineering, biofortification offers a sustainable and cost-effective approach to improving dietary quality. Key nutrients such as iron, zinc, vitamin A, and folate can be substantially increased in biofortified varieties, thereby addressing deficiencies that contribute to various health complications..In conclusion, biofortified vegetable crops offer a promising solution for addressing hidden hunger and improving nutritional outcomes, particularly in resource-constrained settings. By harnessing the power of agriculture to deliver essential nutrients, biofortification holds the potential to transform food systems and promote health equity on a global scale.

Keywords: Hidden hunger, Biofortification, Vegetable crops, Nutrient deficiency, Agriculture.

INDUCED BREEDING AND EMBRYONIC DEVELOPMENT OF *Macrognathus aral* (Bloch and Schneider, 1801) UNDER THE CAPTIVE CONDITION

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ABSTRACT

The current investigation aimed to assess induced breeding techniques and embryonic development of *Macrognathus aral* within a captive condition. Mature brooders were subjected to three different doses of synthetic hormone (T_1, T_2, and T_3), each replicated three times, to standardize breeding performance for this species. Of all experimental trials, the highest fertilization and hatching rate was recorded in T_2 of 2^{nd} experiment i.e. 93.79±0.64 and 89.75±0.77 respectively. The perivitelline space of the fertilized eggs was observed 13-18 minutes post-fertilization. The first cleavage, resulting in two equal blastomeres, occurred 51-57 minutes after fertilization. Cell division was completed within 4.17- 4.35 hrs. Subsequently, the fertilized egg progressed to the morula stage in 6.27- 6.39 hrs, the blastula stage in 10.24- 11.14 hrs, and finally, the gastrula stage in 14.02-14.42 hrs. The eggs hatched 32.20 hrs after fertilization, under a water temperature ranging between 31-33°C. This study underscores the viability of seed production of *M. aral* under controlled conditions, offering valuable implications for both aquaculture and conservation efforts.

Keywords: *Macrognathus aral*, Fertilization, Perivitelline space, Blastomere, Hatching.

COMPARATIVE STUDY ON CLIMATE RISKS AND THEIR IMPACT ON INDIAN FARMING: A CASE STUDY FROM WEST BENGAL

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ABSTRACT

The Indian agricultural sector establishes a central role in the country's economy, supporting directly or indirectly more than half of the population's livelihoods. However, despite its strong ability to adequately address national food needs, it is highly susceptible to increasing climate risks. The Tarai Alluvial Zone (TAZ) region of West Bengal, due to its geographical location, experiences diverse climate conditions, resulting in acidic soil and relatively lower crop productivity while the southern New Alluvial Zone (NAZ) represents higher productivity and high cropping intensity. The present study covers the Alipurduar and Cooch Behar districts in the TAZ and the North 24 Parganas and Nadia districts of NAZ. It aims to identify the current situation of farmers regarding their perception of climate change risks, their impact, and the mitigation strategies they employ to adapt. Three hundred respondents primarily engaged in farming activities are selected using simple random sampling from the chosen study locations. The data is collected through a structured interview schedule conducted between 2020 and 2023. The study indicates that farmers with more extensive farming experience, knowledge of improved agricultural practices, greater exposure to mass media, economic incentives, and interactions with extension agents demonstrate a higher perception of climate change risks. In contrast, the adaptation of farmers to climate change presents a negative correlation with land fragmentation and dependency ratios. The study emphasizes the need for capacity-building initiatives to promote climate resilience techniques, countering the adverse impacts of climate change and promoting sustainable agricultural growth.

Keywords: Climate change risks, adaptation, farmers' perception, livelihood, mitigation, resilience.

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON YIELD OF SWEET CORN (*Zea mays* L. *saccharata* Sturt.) IN COASTAL SALINE ZONE OF WEST BENGAL

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ABSTRACT

Maize is an important staple food having higher yield potential worldwide. Among different types of corn, sweet maize (*Zea mays* L. *saccharata* Strut) kernel is considered as vegetable and it is mainly used as fresh, frozen or canned. Sweet corn is a good natural source of iron which might help form blood cells due to presence of folic acid and niacin. Organic source of nutrients also enhanced the concentration of sugars and glutathione in maize kernel. In this back ground, a field experiment was conducted during *rabi* season of 2022-2023 at farmers field, Rangabelia, Gosaba, West Bengal to study the "effect of integrated nutrient management on yield of sweet corn (*Zea mays* L. *saccharata* Sturt.) in coastal saline zone of West Bengal"**.** The experiment was laid out in randomized block design (RBD) with 10 treatments viz., T_1-Zero-N and 100% PK through chemical fertilizer (CF); T_2-100% NPK through CF; T_3-75% N and 100% PK from CF and 25% N from poultry manure (PM); T_4-50% N and 100% PK from CF and 50% N from PM; T_5-75% N and 100% PK from CF and 25% N from turkey manure (TM); T_6-50% N and 100% PK from CF and 50% N from TM; T_7-75% N and 100% PK from CF and 25% N from goat manure (GM); T_8-50% N and 100% PK from CF and 50% N from GM; T_9-75% N and 100% PK from CF and 25% N from biogas slurry (BS); T_{10}-50% N and 100% PK from CF and 50% N from BS, replicated thrice with an individual plot size of 20 m^2. Results indicated that treatment receiving 100% NPK produced highest number of grains per cob. TM and BS with 25% fertilizer N supplementation resulted in more numbers of grains per cob among different manures. 100% NPK plots resulted in highest green cob yield followed by TM with25% fertilizer N supplementation and BS with 25% fertilizer N supplementation.

Key words: Integrated nutrient management, sweet corn, turkey manure, biogas slurry.

INSIGHTS INTO POLLINATION, REPRODUCTION AND BREEDING SYSTEMS OF *Justicia gendarussa* Burm.f.

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ABSTRACT

Justicia gendarussa Burm.f. (Acanthaceae) isan important and widely used medicinal plant distributed throughout south west Bengal. The protandrous flowers last for 3-4 days. Flowers pass through three distinct phases: male, bisexual and female. Two species of bees *Apis dorsata* and *Apis ceranaindica* are the most effective pollinators. Pollen grains are deposited on the dorsal surface of the thorax during *Apis* spp. visit to the flowers in the male phase and the stigma rubs the pollen-deposited thorax and is pollinated when the bees visit the flowers in bisexual and female phases. Fruit-set in natural conditions was 15% and no fruit set was observed through bagging while 2% was observed in netting condition. But in case of controlled pollinations 0%, 46% and 5% fruit set were noticed through autogamy, xenogamy and geitonogamy, respectively. Results from the breeding experiment suggested that, *J. gendarussa* exhibits mixed breeding system with selfing and outcrossing. The results indicate that protandry does not prevent self-pollination, but reduces interference in export and import of pollen. Although the flowers have adapted well to achieve a high level of pollination, reproductive success in terms of fruit set is low, largely due to the limitation of compatible pollen.

Keywords: *Justicia gendarussa,* breeding system, pollination biology, protandry.

EFFICIENCY OF USING DRONES IN CROP PRODUCTION

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ABSTRACT

Currently India faces increasing the food demand due to population blast. The traditional methods which were used by the farmers were not sufficient enough to fulfil these requirements. Manual pesticide spraying causes many harmful side effects to the personnel involved in the spraying process. The WHO estimated as one million cases of ill affected when spraying the pesticides in the crop field manually (Karan & Vimalkumar, 2020). Modernization of agriculture technology through drone is becoming popular, as it has higher efficiency compare to conventional. Uses of agricultural drones allows to reducing losses during cultivation and decrease in the spraying rate and losses from trampling and also help to Improved crop health, enhanced production, soil mapping, better resource utilization. A drone or UAV (Unmanned aerial vehicles) helps in precision agriculture by capturing site-specific information and analyzing field crops. Hence, this study has done to estimate the efficiency of drones in agriculture.

Keywords: Modern agriculture, Drone technology, Unmanned Aerial Vehicle (UAV).

ESTIMATION OF CAPITAL INVESTMENT IN INSTALLING DIFFERENT IRRIGATION SOURCES - A STUDY IN NORTHERN DISTRICTS OF WEST BENGAL

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ABSTRACT

The study investigated diverse irrigation sources in the districts of Cooch Behar and Jalpaiguri in West Bengal, focusing on their significance in both agricultural and aquacultural operations. The research selected 50 electrical shallow tube-well farmers, 50 diesel shallow tube-well farmers, 50 solar shallow tube-well farmers, 25 electrical deep tube-well farmers, 25 diesel deep tube-well farmers, 25 electrical river lift farmers, and 25 diesel river lift irrigation farmers using a multistage sampling technique. It analyzed the average depths of the sample shallow tube wells in the chosen regions, revealing depths of 66.26 feet, 67.10 feet, and 62.77 feet for electrical, diesel, and solar shallow tube wells, respectively. The findings revealed the total fixed cost and total operation and maintenance costs for electrical shallow tube wells to be ₹ 36,797.20 and ₹ 42,416.74 respectively, for diesel shallow tube wells to be ₹ 36,082.20 and ₹ 53,498.88 respectively, and for solar shallow tube wells to be ₹ 3,000 and ₹ 15,050 respectively. Calculating the average area watered by a shallow tube-well unit demonstrated that, considering the irrigated area through water sales, electrical, diesel, and solar pump units irrigated on average 3.72 hectares, 3.31 hectares, and 1.50 hectares of land respectively. For deep tube wells, the average irrigated areas by diesel and electrical units were 20.50 hectares and 16.42 hectares respectively, while for river lift irrigation, the average areas watered by diesel and electrical engines were 38.54 hectares and 20 hectares respectively. The study also estimated the cost of irrigation for main crops including rice (Kharif and Roro), potatoes, maize, and vegetables, employing river lift irrigation, deep tube wells powered by electricity, diesel, and solar energy, as well as solar-powered and electric shallow tube wells.

Keywords: Capital investment of different sources of irrigation.

EFFECTS OF INTEGRATED NUTRIENT MANAGEMENT THROUGH APPLICATION OF VERMICOMPOST ON SOIL PHYSICO-CHEMICAL PROPERTIES, PADDY GROWTH, YIELD AND EARTHWORM POPULATION STRUCTURE

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Abstract

The paddy (*Oryza sativa* L.) belonging to the family of grasses, Gramineae (Poaceae) is one of the major crop of the world and forms the staple food of about half of the world's population. India stands first in rice producing areas in the world and second in rice production following China. Agricultural productivity has been declining due to indiscriminate application of agrochemicals and reduced application of organic manure, overgrazing, burning of crop residues which ultimately causes a decline in available plant nutrients and pH in soils. Presently there is an urgent need to switch from inorganic farming to organic farming so as to improve and protect soil health and achieve sustainable agriculture. A study was conducted on paddy during two consecutive seasons (March to June, pre-kharif; August to November, *Kharif*) of 2018 at lowland experimental farm of College of Agriculture, Tripura, Lembucherra, West Tripura (23°54′41.3″N, 91°18′58.9″E, elevation 39 m). There was eleven treatments replicated thrice viz. T_1 = 0.5 t ha^{-1} vermicompost, T_2=1.5 t ha^{-1} vermicompost, T_3 = 2.5 t ha^{-1} vermicompost, T_4=3.5 t ha^{-1} vermicompost, T_5 = 4.5 t ha^{-1} vermicompost , $T_6 = T_1$+ RDF, $T_7 = T_2$+ RDF , $T_8 = T_3$+ RDF, $T_9 = T_4$+ RDF, $T_{10} = T_5$+ RDF, T_{11} = RDF (N: P_2O_5: K_2O = 100:50:50) [RDF: Recommended dose of fertilizers; Control plot].Application of vermicompost and its combination with recommended doses of NPK in the paddy crop led to significant increase ($p<0.05$) in growth parameters (Canopy height (cm), Root length(cm), No. of tillers, Root biomass (g), Straw biomass(g)) and yield attributing parameters (No. of Panicles/tiller, Total no. of filled Grains, Total no. of unfilled grains, Length of Panicle (cm)) and yield (Test weight (g) (1000 grains), Grain yields (t ha^{-1}), Straw yields (t ha^{-1}))of paddy along with earthworm population in the T_9 plot [3.5 t ha^{-1} vermicompost + recommended dose of fertilizer (RDF)]. Gradual increase in soil pH, organic C, total N (%), av. P (Kg ha^{-1}), av. P (Kg ha^{-1}) and plant uptake of N (%), P (%) and K (%) were recorded up to T_{11} (only RDF). Thus present experiment indicates that in the tropical soils of lowland paddy agro-ecosystemintegrated nutrient management (INM) through vermicompost increase the growth and yiel d parametersof paddy plant.

Keywords: *Glyphidrilus* sp., INM, Paddy productivity, Vermicompost, Yield.

TRANSGENIC MALE STERILITY - *barnase-barstar* GENE SYSTEM

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ABSTRACT

Transgenic crops have revolutionized agriculture by offering solutions to various challenges such as pests, diseases, and environmental stress as well as male sterility sources of hybridization. Among the innovative genetic constructs employed in these crops is barnase-barstar gene system, renowned for its effectiveness in conferring resistance against herbicides and male sterility. *Barnase*, an RNase enzyme, destroy tapetal cell layer with in the anther that surrounds the pollen sac, prevents pollen formation and results to male sterility. A chimeric tapetal cell-specific ribonuclease inhibitor gene (*barstar*) used in male fertile plants to restore male fertility in F_1 progeny. Cytotoxic ribonuclease activity in the anther was supressed to restore male fertility in in F_1 hybrid by the formation of cell-specific RNase/Rnase inhibitor complex. On the other hand, *barstar* confer herbicide resistance helps to identify male sterile line as well male fertile line.

Key word: Barnase-barstar, Herbicide resistance, Male sterility, Transgenic crops.

'MAHUA' (*Madhuca longifolia*) AND ITS APPLICATION FOR FOOD AND LIVELIHOOD PROMOTION

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ABSTRACT

Madhuca longifolia, commonly known as Mahua, belonging to the Sapotaceae family also known as 'Butter nut tree'. Mahua comes under the Minor Forest Produce (MFP), Mahua greatly found in the districts of Purulia, Bankura, Birbhum, West Midnapore, South 24 Parganas in West Bengal states. Mahua holds profound significance for socio-economic development, particularly within tribal communities in the Indian subcontinent. Mahua serves as a cornerstone of sustenance and economic prosperity. Its various parts, including flowers, seeds, and leaves, are rich sources of nutrition, providing vital dietary supplements particularly during lean periods. Moreover, Mahua-derived products such as Mahua oil and Mahua-based alcoholic beverages are integral to local economies, offering avenues for income generation and livelihood diversification. Mahua's significance extends beyond immediate consumption and economic gain, Mahua trees play a crucial role in soil conservation, watershed management, and biodiversity conservation. Mahua harvesting and processing activities often coincide with agricultural off seasons, providing seasonal employment opportunities. This seasonal employment can help mitigate income fluctuations and alleviate poverty during lean periods. Mahua emerges as a versatile and sustainable resource with significant implications for food security, livelihood promotion, and natural resource management. Leveraging its potential while addressing existing challenges can contribute to fostering resilient communities and ecosystems, thereby promoting socio-economic development and environmental sustainability in Mahua-growing regions.

Keywords: *Madhuc alongifolia,* Food, Beverages, Livelihood Security.

PRESENCE OF MICROPLASTICS IN GASTROINTESTINAL TRACT OF A COMMERCIALLY IMPORTANT FISH SPECIES FROM KERALA, INDIA

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ABSTRACT

The presence of microplastics (≤5mm) in seafood has become a growing concern due to their potential adverse effects on both the environment and human health. The present study focused on the examination of microplastics present in the gastrointestinal tract of *Anabas testudineus* (n=55), a commercially significant fish species that is extensively consumed by individuals. The specimens were acquired from the Periyar River, which is widely acknowledged as the "Lifeline of Kerala" owing to its significant influence on the social and economic aspects of the state. The gastrointestinal tracts exhibited an average abundance of 0.65±0.67 MPs/individual. The predominant morphotype observed was fibres, with polyethylene being the primary polymer documented. Multiple studies have documented the adverse effects of microplastics on fish health, such as decreased survival rate, impaired reproduction and growth, heightened oxidative stress, alterations in behaviour and metabolism. The findings of the study suggest that the existence of microplastics within the *A. testudineus* presents a possible pathway for human exposure. Due to a growing number of reports regarding the existence of microplastics in the human body (such as blood, placenta, and urine), it is now recognized that microplastics are transported through the body after being consumed. Hence, the existence of microplastics in fish species gives rise to substantial apprehensions regarding public health and food security. Stringent management policies must be established to effectively control and monitor plastic pollution in order to preserve these pristine waters.

SUSTAINABLE CITRUS FARMING UNDER CLIMATE CHANGE SCENARIO

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ABSTRACT

Climate change poses a significant threat to global agriculture, impacting the growth and productivity of crops, with citrus fruits, such as oranges and lemons, particularly vulnerable due to their specific growth requirements. Factors like extreme heat, drought, and frost, compounded by rising carbon dioxide levels, exacerbate challenges for citrus farming. This paper explores the impact of climate change on citrus farming and proposes strategies for sustainable cultivation. Citrus cultivation spans diverse climates, but optimal growth occurs within a temperature range of 55°F to 98°F (13°C to 37°C). However, temperature fluctuations can impair fruit quality and growth. Despite the nutritional importance and popularity of citrus fruits, farmers often face unpredictable harvests and financial losses due to climate variability. To address these challenges, collaborative efforts between farmers and scientists are crucial. Implementing effective orchard management practices, including tailored nutrition, irrigation techniques, and mulching, can mitigate heat and drought stress on citrus crops. Additionally, selecting resilient cultivars and rootstocks, such as Volkamer lemon and Rangpur lime, enhances productivity and resilience to water stress. Strategic fertilizer application, utilizing plant growth regulators like cytokinins and abscisic acid, and adopting mulching practices aid in managing abiotic stresses. Breeding programs focusing on developing resilient citrus rootstocks and biotechnological interventions, such as in vitro mutagenesis and genetic transformation, offer promising avenues for developing stress-tolerant varieties. Also soil micro biomes provide insights into improving plant resilience to abiotic stressors. By integrating agronomic practices, breeding strategies, and biotechnological interventions, sustainable citrus farming can be fostered amidst climate change. These efforts aim to enhance water-use efficiency, develop climate-resilient varieties, and ensure food security in a changing world.

Key words: citrus, climate change, rootstock, abiotic stress, sustainable cultivation.

ADVANCES IN REMOTE SENSING OF AGRICULTURE

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ABSTRACT

Remote sensing has several advantages in the field of agronomical research purpose. The assessment of agricultural crop canopies has provided valuable insights in the agronomic parameters. Remote sensing play a significant role in crop classification, crop monitoring and yield assessment. The use of remote sensing is necessary in the field of variation in soil, climate and other physico-chemical changes. Representative case studies are presented in the special issue "Advances in Remote Sensing of Agriculture". To complement the examples published within the special issue, a few main applications with regional to global focus were selected for this review, where remote sensing contributions are traditionally strong. The selected applications are put in the context of the global challenges the agricultural sector is facing: minimizing the environmental impact, while increasing production and productivity. Five different applications have been selected, which are illustrated and described: biomass and yield estimation, vegetation vigor and drought stress monitoring, assessment of crop phenological development, crop acreage estimation and cropland mapping and mapping of disturbances and land use/land cover (LULC) changes. The remote sensing along with the other advanced techniques such as global positioning systems and geographical information systems are playing a major role in the assessment and management of the agricultural activities.

Keywords: Agriculture, Advance technology, productivity, Remote sensing.

CONTAINER GARDENING: A NEW ALTERNATIVE TOWARDS GARDENING

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ABSTRACT

Now a day flat and terrace culture are increasing day by day and it leads to decreasing land for gardening. There are hardly space in the city houses for growing fruits and vegetables especially in multistoried buildings. Though India is one of the leading countries in fruit production in world, despite this, malnutrition is a big problem in India. Further, excessive applications of chemical fertilizers and pesticides have contaminated our food chain leading to various serious diseases. Rapid urbanization and limited land area for planting felt the need for growing fruit in containers on the roof tops. Containers are used now a day as a great alternative for the production of fruits and vegetables such as green leafy vegetables. It also helps in the availability of chemical free products and helps the livelihood to get a better health too.

Keywords : Container gardening, Chemical fertilizers, Livelihood.

STOCK-SCION RELATIONSHIP IN FRUIT CROPS

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ABSTRACT

The interactions and relationships between the two or more partners of a grafted plant is called stock-scion relationship. Rootstocks are widely used in fruit crop cultivation as they impart various desirable characters to the scion like fruit quality, yield, vigour and stress tolerance. In the case of Citrus, Alemow (*Citrus macrophylla*) is designated as an ideal rootstock for quality fruit production of acid lime and mandarin (Sonkar*et al*., 2010). The scion too can affect the characters of the rootstock. Grafting of a vigorous cultivar as scion to a weak rootstock stimulates the growth of the rootstock. In many grafting procedures, interstocks are used which can also affect the characters of stock and scion. Citrus greening disease tolerant accessions when used as an interstock may enhance plant defense and provide increased HLB tolerance to susceptible scions (Dutt*et al*., 2023). The interaction between stock and scion is mediated by several molecules (small RNAs, DNA, proteins, hormones, and phenols) which as transferred across the graft junction (Rasool*et al*., 2020). The success of grafting and development of stable graft union depends on the taxonomic proximity of the stock and scion. Secondary metabolites like phenols are important determinants of graft incompatibility. Compounds like coumaric acid, catechin and prunasin have been reported in incompatible stock-scion combination. Phytohormones like auxins are the principal regulatory factor governing vascular differentiation and play a crucial role in graft union formation. However, the identification and development of rootstocksis a time-consuming process and use of molecular markers aid this process in future.

Keyword: Scion, Stock, Graft junction, Phytohormones, Vigorous

VERTICAL GARDENING OF HORTICULTURAL CROPS – A PROFITABLE PATHWAY FOR MODERN HORTICULTURE

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ABSTRACT

Vertical gardening of horticultural crops is a sustainable and space-efficient method that maximizes growing areas in urban and small-scale settings. Utilizing various vertical structures such as trellises, walls, and hanging containers, this approach enables the cultivation of a wide range of crops including vegetables, herbs, fruits, and ornamental plants. By going vertical, gardeners can make the most of limited space, transforming balconies, patios, rooftops, and even indoor environments into productive green spaces. Trellises and arbors provide support for climbing crops like tomatoes, cucumbers, and beans, while wall-mounted planters and modular systems allow for the cultivation of herbs, lettuces, and strawberries. Vertical hydroponic systems offer an innovative solution for growing crops without soil, making efficient use of water and nutrients in a controlled environment. Beyond practicality, vertical gardening also offers aesthetic benefits, enhancing the visual appeal of urban landscapes and creating green oases in concrete jungles. Living walls and green facades not only beautify buildings but also contribute to air purification and urban biodiversity by providing habitat for beneficial insects and birds. Maintenance of vertical gardens involves regular watering, fertilization, and pruning to ensure healthy plant growth and productivity. Overall, vertical gardening of horticultural crops represents a creative and sustainable approach to urban agriculture, promoting food security, environmental sustainability, and community well-being in densely populated areas.

Key words: Vertical farming, horticultural crops, farm income, livelihood promotion

NANO UREA - ROLES IN AGRICULTURAL INNOVATION AND ENVIRONMENTAL IMPACT IN BANANA

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ABSTRACT

Banana (*Musa paradisiaca* L.) is the cheapest and most nourishing of all fruits.Apart from its use as a dessert fruit and for culinary purposes, the banana plant has multifaceted uses: the leaf is commonly used as a hygienic dining plate; the male flower as a favourite vegetable; the inner core of the pseudostem is a popular vegetable with many therapeutic uses; the sap is used as an indelible ink in industry and the underground rhizome is exploited as animal feed in a composite mixture with other feedstuffs. Banana takes more nutrients per unit area than almost any other crops due to which cost of cultivation is very high. Nano urea, characterized by its reduced particle size and enhanced solubility, offers a revolutionary approach to nutrient management in agriculture. The conventional use of urea, a widely utilized nitrogen fertilizer, has often resulted in nutrient losses due to volatilization and leaching, contributing to soil and water pollution. Nano urea, through its controlled nutrient release mechanisms, aims to enhance nutrient use efficiency, thereby minimizing environmental degradation. Agricultural innovation, encompassing advancements in farming practices, technology adoption, and sustainable resource management, is imperative to ensure global food security and meet the demands of a rapidly growing population. The integration of nano urea into these innovations presents a transformative opportunity for farmers to optimize nutrient utilization, increase crop productivity, and reduce the ecological footprint of agriculture. The significance of this interdisciplinary approach lies not only in its potential to reshape the agricultural landscape but also in its alignment with broader sustainability goals. As the world grapples with the challenge of producing more food with fewer resources, nano urea stands at the crossroads of scientific innovation and agricultural necessity.

Keywords: nano urea, agricultural innovation, nutrient management, sustainability, environmental impact.

A REVIEW OF KITCHEN GARDENS

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ABSTRACT

Kitchen gardens, also known as home gardens or vegetable gardens, are increasingly gaining attention as a sustainable and practical means of supplementing household food supply, promoting healthier eating habits, and fostering a deeper connection with nature. This review synthesizes the current literature on kitchen gardens, focusing on their significance, benefits, challenges, and future prospects. The significance of kitchen gardens lies in their ability to empower individuals and communities to take control of their food production, thereby reducing reliance on external food systems and enhancing food security. Moreover, kitchen gardens offer numerous environmental benefits, such as mitigating climate change through carbon sequestration, conserving biodiversity, and promoting sustainable land management practices. Despite their advantages, kitchen gardens face several challenges, including limited space, inadequate knowledge and skills, and potential pest and disease problems. Addressing these challenges requires comprehensive strategies encompassing education, community engagement, and policy support. Additionally, promoting diversity in garden design and plant selection can enhance resilience and sustainability. Looking ahead, the future of kitchen gardens appears promising, driven by growing interest in sustainable living, urban agriculture initiatives, and technological advancements. Leveraging emerging technologies such as vertical gardening systems, hydroponics, and smart gardening tools can further enhance the productivity and sustainability of kitchen gardens. In conclusion, kitchen gardens represent a valuable and versatile approach to sustainable food production, with far-reaching benefits for individuals, communities, and the environment. By addressing the challenges and harnessing the opportunities associated with kitchen gardening, we can foster a culture of self-reliance, resilience, and environmental stewardship.

Keywords: Kitchen gardens, home gardening, sustainable food production, food security, urban agriculture, community resilience.

IDENTIFICATION AND UTILIZATION OF ETHNO-MEDICINAL PLANTS IN UNAKOTI DISTRICT OF TRIPURA, INDIA

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ABSTRACT

A study was conducted to understand the availability and ethno-medicinal plants in Unakoti district of Tripura, India. The native population used 43 plant species, from 29 families, to treat a wide range of diseases. The plants comprise climbers, ferns, shrubs, trees, and members of the Asteraceae, Lamiaceae, and fabaceae families, among others. The plant species was used to treat fever, diabetes, constipation, irregular periods, cough, toothache, headaches, diarrhoea, and bone fractures. The current investigation came to the conclusion that the people living in the Unakoti district had extensive knowledge of medicinal plants and how to use them. Therefore, by documenting the traditional knowledge of these beneficial plants, the current study hopes to increase the potential of these therapeutic plants for elsewhere by highlighting their significance.

Key words: ethno-medicinal plant, diseases, fabaceae and dysentery.

DETERMINATION OF LETHAL CONCENTRATION FOR IMIDACLOPRID TO *Anabas testudineus* OF THEIR IMPACT ON ITS BEHAVIOUR PATTERN

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ABSTRACT

Imidacloprid is an effective insecticide agent commonly used to control sucking insects. In this study, median lethal concentration i.e., 96h-LC_{50} value, along with behavioral and histopathological modifications of imidacloprid were investigated in the native fish, *Anabas testudineus*. For determining LC_{50}-96h of, imidacloprid four different concentrations of the test chemical at a range from 2.5 to 3.5 mg/L in a geometric series were selected after a range-finding test. Control group without the test solution and the positive control containing the solubilizing agent (DMSO) as a vehicle was also maintained, comprising ten animals per group. The median lethal concentration of imidacloprid in *Anabas testudineus* estimated by using Probate analysis was 1.35 mg/L. Histopathological alterations observed in gill consist of uplifting and hyperplasia of epithelium, aneurysm, lamellar disorganization as shortened primary lamella, fusion or loss of secondary lamella and hyperplasia of gill arches. The intensity of morphological lesions increases when the concentration is increased and also substantiates the behavioral alterations exhibited by the fish during exposure. From the result of probate statistical method, it is evident that the acute toxic effect of imidacloprid is concentration-dependent, and therefore, imidacloprid contamination is a threat to aquatic organisms.

Keywords: Lethal concentration, Imidacloprid, *Anabas Testudineus*, Behaviour Pattern

A STUDY ON: AI BASED PLANT DISEASE DETECTION SYSTEM

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ABSTRACT

The world population is increasing at a very fast rate and with increase in population the need for food increases briskly. But agriculture production is not increasing at same rate. A large quantity of total agricultural production is lost due to disease and pest infestation. The traditional method of plant disease detection is time consuming and require experience. Up to 40% of food crop are lost due to plant pest and disease annually (FAO). The visible signs, such as affected leaf, help to identify disease. Therefore, automated leaf disease detection using artificial intelligence (AI) with Internet of Things (IOT) sensors are considered for analysis and detection. The problem becomes bigger for young farmers to determine the diseases by visualizing the plants. There are different steps and existing models to detect the plant disease with AI. There is various machine learning (ML) and deep learning (DL) based AI models are existing which used to detect the disease of different crops. Few of famous ML and DL based algorithms are KNN, CNN, RF, DT, SVM etc. CNN based models shows 100% accuracy in detection of leaf mold disease of tomato (Kumar et al, 2019) and 99.4% accuracy in bacterial spot and mosaic disease of tomato (Vadivel and Suguna, 2022). This paper surveys the work of different researchers to get a brief overview about implementation and efficiency of AI based disease detection system.

Keywords: Artificial intelligence, deep learning, internet of things, machine learning.

INTERCONNECTED LIFE: THE SYMBIOTIC DANCE OF FLORA, FAUNA, AND THE ENVIRONMENT IN ECOLOGICAL CONSERVATION

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ABSTRACT

The intricate relationship between flora, fauna, and the environment is a cornerstone of ecological stability. Flora, encompassing all plant life, serves as the primary producer within the ecological hierarchy, initiating the energy flow through food webs. Their role extends beyond mere sustenance; they are pivotal in carbon sequestration, influencing climatic patterns and fostering biodiversity. Fauna, the animal kingdom, not only contributes to the biodiversity but also plays a vital role in pollination, seed dispersal, and maintaining the ecological equilibrium. The interplay between flora and fauna through these processes is fundamental to the regeneration and resilience of ecosystems. Conservation efforts are paramount in safeguarding these natural resources. The use of Geographic Information Systems (GIS) has been instrumental in identifying conservation priorities by analyzing spatial data and complex multivariate scenarios (Hernandez et al., 2023)[2]. This approach enables a more nuanced understanding of the ecological dynamics and aids in the formulation of targeted conservation strategies. The burgeoning field of ecocriticism offers a profound understanding of the symbolic representation of flora and fauna in literature, reflecting the deep-seated connection humans share with nature. This bond underscores the ethical imperative to conserve our natural heritage, not only for its intrinsic value but also for its irreplaceable role in our survival and well-being. In conclusion, the conservation of flora and fauna is not a mere act of preservation but a complex, multifaceted endeavor that requires a concerted effort from various disciplines. It is through this holistic approach that we can hope to maintain the delicate balance of our environmental systems and ensure the continuity of life on Earth.

SIGNALLING PATHWAYS AND DOWNSTREAM EFFECTORS OF PLANT INNATE IMMUNITY: AN UPDATED INSIGHT

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Plants lack specialized immune cells, but they have evolved various strategies to respond against pathogens, environmental constraints and anthropogenic activities. Plant innate immunity is a vital regulatory system that enables plants to resist diseases and abiotic stresses and maintain their overall health and development. To enhance agriculturaloutput, it is necessary to safeguard them from environmental intruders. Though plants lack nervous system, they are surprisingly resilient to different biotic and abiotic stresses by protecting themselves using various signalling systems, includes receptor mediated detection of pathogens, Signal Transduction pathways, Systemic Signalling, Cross talk with hormonal pathways and downstream genetic regulation etc. Plants utilize reactive species (ROS, RNS, RHS, RSS etc.) as part of their innate immunity system to combat pathogens. These reactive species collectively contribute to the activation of defense mechanisms, such as the hypersensitive response (HR), production of antimicrobial compounds, strengthening of cell walls, and programmed cell death, ultimately enhancing the plant's ability to defend against pathogens. Small RNAs and transcription factors (TFs) play a crucial role in regulating various aspects of plant development and are involved in different levels of plant immunity, such as pathogen-triggered immunity (PTI) and effector-triggered immunity (ETI). This review examines the complex interplay signalling mechanism between different reactive species, and several transcription factors by which plants ultimately leading to different stress responses.

Keywords: Innate immunity, Defense mechanism, Signal transduction, ROS,TFs, Small RNAs.

EFFICACY OF DIFFERENT TRICHODERMA ISOLATES AGAINST COLLAR ROT DISEASE OF LENTIL

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ABSTRACTS

Collar rot is one of the most important diseases of lentil. It causes heavy damage to the crops every year leading to the drastically reduction in the yield. So, management of this disease is very essential with different approaches like, bio-pesticides, plant extracts and chemical fungicides. Chemical control is the most effective method to control the disease. But it has limitation. Its continuous application with same fungicides leads to development of resistance of the pathogen as well as chemical hazardous towards the environment. In contrary there is no such problems in other two approaches. Therefore, our experiment was conducted with different Trichoderma isolates to find out effective isolates against the disease under *in vitro* as well as *in vivo* condition. Eight Trichoderma isolates were used in this experiment isolated from lentil field and identified them on molecular basis. In the antagonistic test under *in vitro* condition, *Trichoderma harzianum* strain 1 and *Trichoderma asperellum* expressed the similar level of efficacy by 58.05% reducing of mycelium growth over control which was followed by *Trichoderma harzianum* strain 4 with 55.18% inhibition and remaining isolates displayed below 50% inhibitory effect. However, very less disease control was incurred by them under field condition. *Trichoderma harzianum* strain 1 only exhibited slightly higher disease control (34.42%) and yield (9.36q/ha) compared to other isolates which is not sufficient. Therefore, for field application the efficiency of this strain should be increased otherwise new isolates need to be find out.

Key words: Collar rot, Lentil, Management, Trichoderma isolates.

INTEGRATED FARMING SYSTEM: AN APPROACH TOWARDS AGRICULTURAL SUSTAINABILITY, FOODSECURITY AND LIVELIHOOD PROMOTION OF RED LATERITIC ZONE IN WEST BENGAL

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ABSTRACT

Due to the scarcity of per capita land holdings, farmers mainly focus on individual agricultural components, resulting in improper utilization of farm resources and exacerbating the problem of food scarcity. Integrated farming system seems to be the possible solution for food security as well as nutritional security, stability of income and efficient management of resources for the small and marginal farmers in India. IFS is an appropriate integration of crops, livestock, fishery, poultry, agroforestry, ducker, apiculture etc. with the objective of profitability and sustainability depends on the space and time. It based on the concept that 'there is no waste' which means waste from one component becomes an input for another part of the system which reduce the cost of production and improves productivity. It reduces the risk of cultivation, increase the total income and promote the living standard of society. Moreover, IFS contribute to environmental conservation by minimizing chemical inputs, reducing greenhouse gas emission and preserving biodiversity. Problematic soil and climate situation highly influence the adaptation of IFS and its components in red *lateritic* zone in West Bengal. Rice varieties having early maturing, drought tolerance and dwarfing nature and agroforestry trees having effective root system are suitable for cultivation in red *laterite* soil. The methodology is explained to realize better productivity, profitability and sustainable production system that would help to solve the food, fuel and energy crisis, create more employment opportunity and ensure continuous stabilize income.

Keywords: IFS, Red laterite, Sustainability, Profitability

BIOFORTIFICATION OF NANO ZINC ON SUMMER MAIZE (*Zea mays* L.) UNDER DRIP FERTIGATION IN LATERITIC SOIL OF WEST BENGAL

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ABSTRACT

Maize (*Zea mays* L.), the 'king of the grain' plays a significant role in worldwide maize production. Maize growth and yield is closely linked to availability of moisture. Scarcity of fresh water and micronutrient availability is now a common problem in agriculture production worldwide. Need to adopt the most efficient water management techniques along with fertilizer application i.e., drip fertigation that can enhance both water and nutrient use efficiency. Under this situation, a field experiment was carried out during *summer* season of 2022-2023 at Agricultural Farm of Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Sriniketan, West Bengal, to study "Biofortification of nano zinc on summer maize (*Zea mays* L.) under drip fertigation in lateritic soil of West Bengal". The soil of the experiment site was sandy-loam in texture with high percentage of sand and low percentage of clay. The soil was slightly acidic, low in soil organic carbon, available nitrogen, phosphorus and medium in potassium. The field experiment was conducted in Split-plot design with three replications in which four main plots consist of four Drip-fertigation practicesviz., DF_1: Farmers' practice with 100% RDF, DF_2: Drip irrigation with 50% RDF, DF_3: Drip irrigation with 75% RDF and DF_4:Drip irrigation with 100% RDF and sub plots consist of four Nano zinc applications viz., Zn_1: Control,Zn_2: Seed priming of ZnO NP at 50 ppm, Zn_3: Seed coating of ZnO NP at 50 ppm, Zn_4: Foliar application of ZnO NP at 50 ppm.The results showed that Drip-fertigation practices exerted significant influence on all the growth parameters and productivity of maize. TheDF_4recorded maximum dry matter accumulation and number of leaves and it was at par with DF_3. The higher number of grains cob^{-1} and highest grain yield was recorded with DF_4but it was at par with DF_3.The different method of Nano zinc applications also showed positive and favourable influence on improving almost all growth and yield parameters of maize under study.Zn_3 recorded maximum dry matter accumulation and number of leaves, yield attributes such as number of grains cob^{-1} and highest grain yield over other nano zinc applications and it was at par withZn_2.Therefore, efficient supply of irrigation water and micronutrient through drip fertigation is a vital option for getting higher yield in water scarcity tracts.

Keywords: Drip fertigation, maize, nano zinc oxide, yield.

RESPONSE TO *Rhizobium* ISOLATES INTERMS OF SEED YIELD AND COMPATIBILITY OF *Rhizobium* IN THE CASE OF GREEN GRAM GENOTYPES

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ABSTRACT

A field experiment was conducted to study the compatibility of indigenous *Rhizobium* isolates on green gram genotypes. 3 varieties of *Vigna radiata* and 4 isolates of *Rhizobium* including an uninoculated control (RG-1,2, 3 and uninoculated control) was included in this study. Split Plot Design was followed in this case. Characters contributing to N_2 fixation and yield were recorded. Highest average nodule dry weight was found with RG_3 isolates in dicating that has highest symbiotic efficiency than other isolates. Green gram variety Pusa 1431 gave 20% more yield/plant when compared to the control when inoculated with RG-1. Viratgave 27% more yield/plant when compared to the control when inoculated with RG-1. Chaiti gave 21% more yield/plant when compared to the control when inoculated with RG-3.

Keywords: Green gram, Rhizobium, Split Plot Design, N_2fixation, Symbiotic, compatibility, seed yield.

EFFECT OF ORGANIC MANAGEMENT ON INDIGENOUS AROMATIC RICE CULTIVARS IN NEW ALLUVIAL ZONE OF WEST BENGAL

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ABSTRACT

Aroma is avital trait that offers significant profits for growers who grow aromatic rice cultivars worldwide. Organically grown aromatic rice has great potential athome and abroad.In the context of aroma and consumer preference a field experiment was carried out to study the "**Effect of organic management on indigenous aromatic rice cultivars in new alluvial zone of West Bengal**"during *kharif* season of 2022 at Central Research Farm of Bidhan Chandra Krishi Viswavidyalaya, Gayeshpur, Nadia, West Bengal. The topography of land is medium and sandy clay loam in texture having pH value 7.4. The experiment was laid in a Randomized Block Design (RBD) having three replications with each plot dimension of 5 m X 2.3 m. The experiment comprised of 7 treatments of aromatic rice varieties (V) viz. V_1: Gobindabhog, V_2: Radhatilak, V_3: Radhunipagal, V_4: Kalojira, V_5: Harinakhuri, V_6: Lal Badshahbhog, V_7:Dudheswar. The recommended dose of NPK fertilizer was @ 50:25:25 kg ha^{-1} of which 50% RDN was applied through vermicompost and rest 50% through Mustard Oil Cake.The data showed that in the generalgrowth of plant continued with the advancement of crop agethough the increase in plant height, number of tillers $hill^{-1}$, leaf area, drymatter accumulation was rapid during earlier stages of crop growthand thereafter it increased slowly and reachedits maximum at harvest stage. It indicates that the growthattributes were significantly influenced by various treatmentsat different time intervals. Among the varieties, Kalojira recorded the highest grain yield of 2800 kg ha^{-1} followed byLal Badshahbhog (2367 kg ha^{-1}) and Gobindabhog (2333 kg ha^{-1}). The high yields of these varieties were attributed to higher number of panicles m^{-2}, more filled grains panicle and lower chaff %. All the varieties recorded medium aroma except Dudheswar. Results also showed positive influence on yield of different varieties under organic management.

Keywords: Aromatic rice, indigenous, organic, yield.

SPEED BREEDING FOR CROP IMPROVEMENT

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ABSTRACT

Horticulture crops typically have long breeding cycles, and breeders require longstanding breeding programs and years for the development of improved cultivars. This long breeding period is mainly due to the long juvenile phase of perennial trees. Using assisted breeding methods to shorten the breeding cycle and speed up crop research is an alternative strategy to overcome this obstacle. Speed breeding approaches and protocols are not well established and standardized for fruit crops. Efforts are underway to develop breeding resources and techniques to improve fruit crops. The standardization protocols are in progress for few crops including perennial fruit crop like apple and citrus. In apple (*Malus* × *domestica*) breeding, transgenic early flowering plants overexpressing a FRUITFULL- homolog (BpMADS4) were crossed with T1190 that had a fire blight-resistance gene (Fb-F7) from the wild species of Malus. The early flowering transgenic F_1 seedlings were backcrossed with 'Regia', with apple scab resistance genes (Rvi2 and RVi4), and 98/6–10 with powdery mildew resistance genes (Pl-1 and Pl-2), resulting in a plurally resistance gene pyramid, achieved by MAS, in transgenic BC_1 seedlings. Even citrus trees are suffering immense damage from serious diseases such as citrus canker (XCC), huanglongbing (HLB), and citrus tristeza virus (CTV). Therefore, disease resistant varieties has been developed using the integration of precocious transgenic trifoliate orange with the overexpression of CiFT and MAS that aimed at shortening the duration for disease resistance breeding representing a fast-track breeding system. As a result, one generation of backcrossed breeding, that would normally take at least 5 years, was achieved in a single year by fast-track breeding system. Speed breeding could serve as a basic platform for integrating high-throughput phenotyping and genotyping techniques, marker-assisted/genomic selections and gene editing for improvement of the traits in fruit crops.

Keywords: Speed breeding, Apple scab, Citrus canker.

NANOTECHNOLOGY A POTENTIAL TOOLS FOR ABIOTIC STRESS MANAGEMENT

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ABSTRACT

Nanotechnology has applications in sustainable agriculture. However, rather than acting as nanocarriers, some nanoparticles (NPs) with specific physiochemical features naturally enhance plant growth and stress tolerance. Reports on abiotic stresses imposing potential adverse effects on crop productivity worldwide are more than biotic stresses. The declining crop production leads to negative and inevitable effects on the livelihoods of the farmers and mankind for their survival. According to a report, the maximum yield associated with abiotic stress factors is estimated to vary between 54 and 82%. Not only these stresses adversely affect the sustainability of the agricultural industry, but it also threatens the national economy and food security. Therefore, the major challenge is to manage the abiotic stress to improve crop production under abiotic stress. The present chapter reviews the responses of the crop plants to different abiotic stresses and the potential roles of nanotechnology towards modulating the stress factors in order to secure the future of sustainable agriculture worldwide. Abiotic stresses mainly drought, salinity, flooding, metal toxicity, and rising temperature due to global warming disrupts the ionic and osmotic balance of the plant cell. As a result, there is restriction of diverse crop farming declining agricultural production over large areas. Nanotechnology offers promising applications in agriculture and horticulture. Specifically, nano fertilizers (NFs) have been investigated for enhancing growth, antioxidant defines, and productivity in fruit-bearing plants. These crops are vital for supplying essential nutrients and minerals to humans. However, their production and quality often face challenges from various stresses. Using nanoparticles (NPs) can potentially mitigate these challenges, thereby improving the productivity and quality of horticulture & vegetable crops. NPs possess unique chemical and physical properties that benefit plant growth, development, and stress tolerance, making them valuable for fruit crop enhancement.

Key words: Sustainable Agriculture, Abiotic stress, Biotic stress, Nanotechnology, Salinity, Drought, Metal toxicity, Osmotic Balance, NPs.

THE IMPACT OF MODERN AGRICULTURE ON FOOD SAFETY

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ABSTRACT

The rapid development of modern agriculture has had a profound impact on food safety. With the continuous advancement of technology and changes in agricultural production methods, modern agriculture can produce more food more efficiently, but it also brings a series of food safety issues. These issues include pesticide residues, veterinary drug residues, genetically modified foods, water and soil pollution, and problems in the breeding industry. These problems directly affect people's health and life safety. This article studies and analyzes the impact of modern agriculture on food safety, explores the problems and challenges existing in modern agriculture, and proposes some solutions to ensure food safety. These solutions include strengthening regulation, promoting green agriculture, adopting biotechnology, and enhancing consumer education. By taking these measures, we can better protect the rights and health of consumers and contribute to the realization of sustainable agricultural development.

RELEVANCE OF BEE FAUNA IN HORTICULTURAL PRODUCTS AND STRATEGIES FOR PRESERVING THESE ENDANGERED BEE SPECIES

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ABSTRACT

The significance of bee fauna in horticulture produce cannot be overstated, as these vital pollinators play a crucial role in the reproduction and yield of many crops worldwide. Bees contribute to the pollination of approximately 75% of leading global food crops, including fruits, vegetables, and nuts. However, the decline in bee populations poses a significant threat to agricultural productivity and biodiversity. Factors such as habitat loss, pesticide use, climate change, and disease have contributed to this decline, with certain bee species facing the risk of extinction. To address this pressing issue, effective preservation methods must be implemented. Conservation efforts should focus on preserving natural habitats, reducing pesticide usage through sustainable agricultural practices, and promoting bee-friendly landscaping initiatives. Additionally, the establishment of protected areas and the creation of nesting sites can provide safe havens for declining bee species. Furthermore, raising public awareness about the importance of bees and their conservation is essential for garnering support and fostering collective action. In conclusion, safeguarding bee fauna is imperative for ensuring the sustainability of horticulture produce and maintaining ecosystem health. By implementing preservation strategies and promoting coexistence with these essential pollinators, we can mitigate the decline of bee populations and secure the future of global food security.

Keywords: Bee Fauna, Conservation, Pollination, Sustainability, Global Food Security.

BIODIVERSITY OF WILD EDIBLE MUSHROOMS IN THE SAL FOREST OF THE LATERITIC REGION OF WEST BENGAL

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ABSTRACT

Mushrooms are heterotrophic organisms of very diverse forms, size, physiology and mode of reproduction. Mushroom fungi have fruiting bodies large enough to be seen with the naked eye and to be picked up by hand. There is a great number and variations in mushroom morphology. The big difference in mushrooms is that some are edible and some are poisonous (Smith & Weber 1996). Sal forest of West Bengal has a rich diversity of mushrooms. The present study highlights the diversity of wild edible mushrooms found in the Sal forest of Bankura and the West Midnapore districts of West Bengal. The survey was conducted in different months of the rainy season during July - September (2021). A total of 6 species of edible mushrooms were observed but only 3 of them could be identified by studying the variation in size, colour, texture and shape of the cap and stalk and these characteristics are important in identification and taxonomic studies of mushrooms (Chang & Miles 1987). The other rest of the species were not taxonomically identified but they were identified as edible by information recorded through personal interviews of local people during the rainy season for consumption and sale. Commonly edible wild mushrooms collected from this sal forest were: *Astraeus hygrometricus, Russula congoana,* and *Termitomyces sp*. (identified) and another 3 identified by local name Durga, Kend and Modhal chhatu (mushroom).

Key words: Wild edible mushroom, Sal forest.

EFFECT OF ARKA MANGO SPECIAL APPLICATION ON INFLORESCENCE DEVELOPMENT , FRUIT SETTING AND FRUIT QUALITY OF MANGO IN MALDA DISTRICT, WEST BENGAL

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ABSTRACT

The mango (*Mangifera indica*) is the most important fruit crop in India and is titled as the king of fruits. It is being cultivated for well over 4000 years in India. Mango is the third most important fruit in the tropics due to its nutritional properties and delicious flavor. Mango is cultivated throughout the tropics and warmer sub-tropics. An On Farm Trial was conducted at Malda Krishi Vigyan Kendra, Uttar Banga Krishi Viswavidlaya, Ratua Malda, India during 2020-21 to study the response of mango variety 'Fazli' through application of 'Arka Mango Special', a foliar micronutrient mixture which was developed by Indian Institute of Horticulture Research (IIHR), Bengaluru for higher fruit quality and yields in mango. The experiment was done in a randomized block design with three treatments, viz., T1: Farmers practice (sprayed with Boron and Zinc application), T2: Micro nutrient Grade V @2g/lit (Twice Before Flowering & Twice After Flowering), T3: Mango Special - 4 times application (Twice Before Flowering & Twice After Flowering) @ 5g/L with 7 replications and 4 nos trees/unit. Treatments were foliar sprayed twice at flower bud differentiation, flower initiation and marble stage of fruit growth. All the two micronutrient treatments significantly improved fruit retention, quality, yield parameters, over the control (T1). Among micronutrient treatments, the treatment Arka Mango Special (T3) recorded the maximum values for no. of fruits/panicle at mature stage (2.71), Fruit weight (262.92kg) and fruit yield (7.72q/ha) Increased yield over control is 3.64 %. The Incremental cost benefit ratio (ICBR) is 1.09 for Arka Mango Special over the Micro nutrient Grade V (T2) mixture which is 1.02. From the present study, it can be concluded that application of Mango special (T3) in mango orchard is very much effective for good mango production than normal farmer practice and application of micronutrient mixture grade V (T2).

Keywords: Mango, IIHR, Micro nutrient Grade V, Arka Mango Special

APPLICATION OF NANOFERTILIZERS IN FRUIT PRODUCTION

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ABSTRACT

Nanofertilizers offer promising avenues for enhancing fruit production through their precise nutrient delivery and efficient uptake mechanisms. By leveraging nanotechnology, these fertilizers can optimize nutrient utilization, leading to increased fruit yield, improved quality, and environmental sustainability. Engineered to release nutrients gradually and target them directly to plant cells, nanofertilizers minimize nutrient losses due to leaching, volatilization, or runoff, thereby reducing environmental pollution and conserving resources. Their customizable formulations cater to the specific nutrient requirements of different fruit crops and soil conditions, allowing growers to tailor nutrient management strategies for maximum efficiency. Moreover, nanofertilizers can enhance fruit tree resilience to pests, diseases, and environmental stresses, contributing to long-term crop health and productivity. Precision agriculture practices benefit from nanofertilizers, enabling growers to apply nutrients with precision and monitor soil nutrient levels accurately. This targeted approach not only optimizes resource utilization and minimizes input costs but also supports sustainable fruit production practices by promoting soil health and ecosystem balance. Furthermore, nanofertilizers may extend the post-harvest shelf life of fruits, reducing food waste and enhancing economic returns for growers. While further research is needed to fully understand their efficacy and long-term impacts, nanofertilizers hold significant promise in revolutionizing fruit production towards greater productivity, sustainability, and resilience.

Key words: Nanofertilizers, fruit crops, benefits, environment sustainability.

ORGANIC FARMING – CURRENT STATUS AND FUTURE OPPORTUNITIES

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ABSTRACT

Every technological advancement or disruption to the natural ecosystem has a negative impact. For the past 50 years, we have used pesticides and herbicides carelessly to increase crop yields, but the effects are now evident to us. The endosulfan disaster in Kerala and the story of the Malwa region of Punjab (the cancer belt) are prime examples of it. Having attained self-sufficiency in food grain production, our next mission is to provide people with wholesome meals. Organic farming is the alternative, chemical-free farming method that we are searching for. Additionally, it helps to obtain a premium price by exporting chemical-free agricultural products to industrialized nations, as the demand for wholesome, residue-free food grows daily on a global scale.The Indian government has promoted organic agriculture since 2015 through its pan-India scheme—ParamparagatKrishiVikasYojana (PKVY). Under this program, there were 13.9 million certified organic farmers in 29,859 organic clusters, covering 0.59 million hectares (about 0.4% of the cropped area in India). The implementation process of PKVY and the impact at the farmer level using the Difference-in-Difference approach. An economic surplus model was employed to observe the macro scale using data from an all-India representative sample from 576 clusters for the crop year 2017. The results identified that organic farmers experienced 14–19 percent less costs and 12–18 percent lower yields than conventional farmers. Growing awareness of food security and ecological safety has led to a dramatic overall improvement in practically every crop type through organic farming. Today's health-conscious consumer base will support the expansion of the organic agriculture industry in a number of ways.

Key words: Herbicides, Natural ecosystem, Organic farming, PKVY, Pesticides, Herbicides

APPLICATION OF PRECISION FARMING FOR CLIMATE RESILIENT CROP CULTIVATION TO ACHIEVE FOOD SECURITY IN INDIA

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ABSTRACT

Climate change is "directly or indirectly to human activity that alters the composition of the global atmosphere and which in addition to natural climate variability observed over comparable time periods'' as per the Intergovernmental Panel on Climate Change. From 1901to 2018 the average temperature of India increased by 0.7°C. Approximately an increase of 4.4°C in temperature within the end of 21st century is projected (Krishnan et al., 2020). Changes in global climate hamper the age old process of farming on global scale. Water scarcity, excessive heat, irregular rainfall, heat wave, advent of insects, loss of nutrition value are the various problem those the agricultural sector of India faces with changing climate. The population of India is growing faster (1,210,584,977 census 2011). As a result a big question mark on food security is appearing. It is important to use precision farming (mulching, relocation of crop, soil health monitoring etc.) and climate resilient crops to achieve food security. Fruit crops such as dragon fruit (dry tropical climate), Phalsa, Wood apple etc. which demand lower moisture and less affected by fluctuation of temperature should be introduced. It will help to increase productivity and restrain nutrient value of crops. Multidisciplinary research, collaboration with researcher, policy maker and farmer can reduce the devastating effect of climate change and secure food security.

Key words: Precision farming, Climate Resilience, Mulching, Food Security.

BOTANICAL SOURCES OF PHYTOESTROGENS SERVE AS ALTERNATIVE SOURCES OF FOOD, OFFERING A PLETHORA OF HEALTH BENEFITS

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ABSTRACT

Botanical sources of phytoestrogens present themselves as alternative sources of food, boasting a myriad of health benefits. These naturally occurring compounds are abundant in various plants, with primary classes including isoflavones, lignans, and coumestans. Isoflavones, such as genistein and daidzein, are notably rich in soybeans and soy products, while lignans like secoisolariciresinol and matairesinol are prevalent in flaxseeds, sesame seeds, and whole grains. Moreover, legumes, nuts, fruits, and vegetables offer varying levels of phytoestrogens, enhancing the diversity of dietary options. The consumption of phytoestrogen-rich botanicals has been linked to a range of health benefits. Epidemiological studies indicate that diets abundant in phytoestrogens may mitigate hormone-related conditions, including menopausal symptoms, osteoporosis, cardiovascular diseases, and certain cancers. Phytoestrogens exert their effects through diverse mechanisms, encompassing estrogen receptor modulation, antioxidant activity, and anti-inflammatory properties. Additionally, they may influence gut microbiota composition, thereby exerting indirect effects on health. Beyond their health advantages, botanical sources of phytoestrogens offer sustainability, affordability, and versatility as alternative food sources. Integrating these plant-based foods into dietary patterns can enrich nutrient intake and promote overall well-being. Furthermore, cultivating phytoestrogen-rich crops aligns with agroecological practices, fostering environmental sustainability. Nevertheless, considerations must be made regarding individual variability in phytoestrogen metabolism and potential interactions with medications or existing health conditions. Further research is imperative to determine optimal dietary intake levels and elucidate the specific health effects of different phytoestrogen sources.

Keywords: Phytoestrogens; Botanical sources; Health benefits; Dietary diversity; Sustainability.

SOILLESS CULTIVATION: AN ADVANCE APPROACH FOR AGRICULTURAL DEVELOPMENT

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Abstract

In many regions of the world, resources like clean water and good land are already scarce. Furthermore, the traditional utilisation of arable land is getting harder, which is made worse by climate change. Soilless culture is a method of growing plants in any medium other than soil. In soil less, culture all nutrient is supplied to the plants by sufficient nutrient solution to meet the plants demand. The delivery of this solution is through various types of distribution systems i.e. sprinkler or drip and various liquid culture systems. Generally soluble nutrients are mixed into the water and supplied to the plant (fertigation) using various type of technologies, including hydro agriculture (Hydroponics), aqua agriculture (Aquaponics), aerobic agriculture (Aeroponics). Benefits of soil less culture includes, space management for other crops. It saves >90 % of the irrigated water, provide maximum productivity and offers good extent of biotic stress management. The large amount of production in a short time, soilless culture is a new and advance methods of cultivation. This technique may describe a new era of agricultural development.

Keywords: Hydroponics, Aquaponics, Aeroponics, Fertigation, Soilless culture, Nutrient management.

AN INTERPRETATION ON FARMING UNCERTAINTY IN AGRICULTURE OF WEST BENGAL

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ABSTRACT

Uncertainty is an inherent characteristic of systems where unpredictable or incomprehensible factors play a significant role. The more complex a system becomes, the less resilient it tends to be. The agricultural production system in India, particularly in West Bengal, is highly susceptible to a wide range of uncertainties. Operating mostly under rain-fed conditions, it faces uncertainties related to weather patterns and resource availability, along with market volatility, limited access to technology, and a fragile input delivery mechanism. This study aimed to explore and illustrate the key issues and underlying causes of uncertainty in the agricultural sector. The research was conducted in the Nadia district of West Bengal, focusing on technology uncertainty and potential sustainable policy options. The study involved a sample of 100 respondents from three villages, primarily consisting of small and marginal farmers. The villages were selected using a simple random sampling method, while farmers who exhibited a faster adaptation to changing cropping systems and survival amidst uncertainties were chosen through snowball non-random sampling. The findings of the study highlighted the importance of reducing uncertainty in the lives of farmers. One approach involved was mobilizing farmers to create safety nets in the form of community enterprises, resilient ecological practices, and harmonizing social factors. The study showed that improving crop biodiversity leads to diverse and financially rewarding harvests. By consolidating fragmented enterprises, communities can establish a resource pool, enabling the sharing of water resources among multiple individuals and reducing risks in farming endeavors.

Keywords: Uncertainty, Unpredictability, Crop biodiversity,Risk,Decision-making.

PARTHENOCARPIC VEGETABLES: IMPORTANCE AND APPROACHES

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ABSTRACT

Parthenocarpy is the development of the ovary into a seedless fruit without the need of pollination and fertilization. parthenocarpy is essential as it enhance fruit quality, extends the harvest season. Vegetables have a significant part in the diversification of agriculture and are essential to the food and nutrition security of the world's expanding population. Vegetable consumption per capita in India is very low and that is only around 230.4 g per day against minimum about 300 g recommended by dietician. So, increase production of high – quality vegetables in greater quantities are highly desired, as is the reduction of postharvest loss through processing and longer storage life. And The absence of seed is usually appreciated by consumers and producers because it increases fruit quality and fruit shelf life. When seed is limiting factor during consumption, parthenocarpy increases the quality, storage life, and processing qualities of vegetable crops like, eggplant, tomato, and watermelon. Vegetable with Parthenocarpy characteristics boost processing firms' profitably. Two types of parthenocarpy occurs: genetic / natural and artificially parthenocarpy. it induced artificially by exogenous application of hormones or their enhanced endogenous level, trough Distant Hybridization, mutation, use of irradiation pollen, alternation in chromosome number, gene modification, and through genome editing tools. mainly used Auxin and gibberellins plant growth regulator for induced parthenocarpy. It is well known that phytohormones are crucial for fruit setting, and that genetic modification of these hormones can result in seedlessness. And negative effects of parthenocarpy is also occurs in fruit like fruit becomes misshapen, smaller and duller in appearance, softer in texture. Decrease biodiversity, which reduces plant species resistance to diseases.

GENETIC RESOURCES MANAGEMENT OF JACKFRUIT

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ABSTRACT

Jackfruit (*Artocarpus heterophyllus* Lam.) is one of the important fruit of the Moraceae family which is bears the largest fruit among the edible fruits. Now a days jackfruit also called as "Superfood" for its nutritional value and health benefits. Jackfruit is indigenous to the rain forests of Western Ghat, India and it is also widely distributed in particular in South and South East Asia, which aids in the selection of superior desirable types. In India, it is widely distributed in the states of West Bengal, Assam, Bihar, Tripura, Uttar Pradesh, the foothills of the Himalayas and South Indian states of Kerala, Tamil Nadu and Karnataka. Cross pollination and predomination of seed propagation over a long period of time have boosted species diversity and genetic diversity within species by influencing the evolutionary process of extinction, selection, gene drift, and mutation. Genetic resource management includes exploration, collection, evolution, characterization, conservation and exchange. Over the past few decades several jackfruit genotypes have been collected throughout the tropics for their conservation, study and improvement. In India, Indonesia, Nepal, Malaysia, Thailand, Philippines, Vietnam, Sri Lanka, and Bangladesh, jackfruit collections for evaluation and selection are limited and therefore, Mitra and Maity were initiated in 1990 the collection and evaluation of over 1460 jackfruit trees in West Bengal. Thirty-five types have been identified as superior clones and are being conserved at the Faculty of Horticulture Research Station. This is required for developing improved crop cultivars, which could contribute to national development.

Keyword: Jackfruit, genetic resource, genetic diversity and conservation.

POLLINARIA DIVERSITY OF ORCHIDACEA FROM WEST BENGAL: A SYSTEMATIC APPROACH

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ABSTRACT

Abstract Orchidaceae is one of the most widespread families of flowering plants. Almost 1300 species of orchids are reported from India, which represent about 5.98% of the world orchid flora. The unique flower structure attracted the human being. It has three sepals, three petals (one is modified and form the labellum), and a central column. Column bears the pollinia. The pollinaria are solid masses of pollen grains which represent the male reproductive unit. In present study it has been focused on orchid pollinaria. Various micro morphological characters of those pollinaria were observed. A similarity matrix is prepared using 9 binary state characters and 4 multistate characters by correlation of the coefficient method, with the help of this similarity matrix, dendrogram was constructed by UPGMA method. The result shows that, two major clades are recognized in this treatment. The first clade represents the subfamily Orchidoideae and the second clade represent another subfamily Epidendroideae. All the species of Epidendroideae came from a monophyletic group.

Keywords: Orchidaceae, Pollinaria, UPGMA, Clade, Dendrogram.

A REVIEW ON MICROGREENS

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ABSTRACT

Microgreens, the little unsung heroes of the food world, bring colour and nutrition to our meals. These little greens, picked when they are still young, have an amazing concentration of vitamins, minerals, and antioxidants. The cultivation of microgreens, their nutritional value, and their culinary variety. Grown from different vegetable and herb seeds, microgreens become fully grown shortly after their first true leaves appear. Though little in stature, they are bursting with flavor—from sweet to spicy and come in every shade of green and more. From radish to kale, every kind has a different flavour and textural profile. Microgreens provide an intense concentration of vital elements and are high in nutrients. The little greens frequently have higher quantities of vitamins and minerals. They also have a remarkable variety of antioxidants, which are substances that minimise oxidative stress and enhance general health. Microgreens are excellent for creativity in cooking, in addition to being nutritious. Sprinkled over salads, tucked into sandwiches, or mixed into smoothies, these little greens give a vibrant splash of colour and freshness to every meal. They are useful as a wholesome base for culinary experimentation as well as a tasty accent, which is something that both chefs and home cooks appreciate. Microgreens represent the essence of "small but mighty." Despite their small size, they are incredibly nutritious and delicious. Growing enthusiasm for these little greens with a big nutritional punch coincides with increased awareness of their advantages.

Key word: Microgreens, Variety, Nutrition, yield.

WILD RELATIVE OF FRUIT CROPS AND THEIR USES

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ABSTRACT

A crop wild relative is a wild plant closely related to a domesticated plant. It may be a wild ancestor of the domesticated plant. Crop wilt relatives have contributed many useful genes to crop plants, and modern varieties of the most major crops now contain genes from their wild relatives. wild relatives play a crucial role in fruit crop improvement work by providing a source of genetic diversity that can be used to develop new varieties with improved traits and adaptability.Wild relatives of fruit crops such as mango (*Mangifera indica*), banana (*Musa* spp.), jackfruit (*Artocarpus heterophyllus*), jamun (*Syzygium cumini*), and Indian gooseberry (*Phyllanthus emblica*) are found in various regions of India. These wild species exhibit genetic traits such as disease resistance, drought tolerance, and nutritional content that can be utilized to improve cultivated varieties through breeding programs. The conservation of wild related fruit crops is critical for preserving genetic diversity and ensuring the viability of fruit farming in India. Habitat loss caused by deforestation, urbanisation, and agricultural development endangers wild relatives' existence. Conservation measures such as protected area designation, habitat restoration, and ex-situ conservation are critical to protecting these precious genetic resources for future generations. wild relatives of fruit crops in India are of immense importance for crop improvement, biodiversity conservation, and ecosystem resilience. Conservation initiatives aimed at protecting these species are essential to ensure the continued availability of valuable traits for fruit breeding programs and the sustainable cultivation of fruit crops in India.

Key words: Wild relatives, fruit crops, origin, uses

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