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STAR NATIONAL CONFERENCE

"Current Trends in Agriculture Research and Extension Services: Shaping the Future of Sustainable Agriculture and Food Security"

BOOK OF ABSTRACTS

Jointly organized by

SCIENCE AND TECHNOLOGY APPLICATIONS REMODEL SOCIETY (STARS)
JAIPUR, RAJASTHAN

SRI KARAN NARENDRA AGRICULTURE UNIVERSITY (SKNAU)
JOBNER, RAJASTHAN

February 23-25, 2025

Editors

Vinod Kumar
Yonika Saini
Pratibha Singh
Narendra Kumar Gupta
Prashant Yadav
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starsociety2010@gmail.com
www.starsociety.org.in

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Compiled and edited by

Vinod Kumar, ICAR-IIRMR, Bharatpur
Prashant Yadav, ICAR-IIRMR, Bharatpur
Yonika Saini, ICAR-IIRMR, Bharatpur
Kailash Chandra Sharma, ICAR-NIBSM, Raipur
Pratibha Singh, RARI, Durgapura, Jaipur
Seema Sharma, RARI, Durgapura, Jaipur
Narendra Kumar Gupta, RARI, Durgapura, Jaipur
Ashok Kumar Sharma, ICAR-IIRMR, bharatpur

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Foreword

It gives us immense pleasure to present the Souvenir of Abstracts from the STAR National Conference on "Current Trends in Agricultural Research and Extension Services", held from February 23 to 25, 2025, at the Rajasthan Agricultural Research Institute (RARI), Jaipur. This esteemed event was jointly organized by the Science and Technology Applications Remodel Society (STAR Society) in collaboration with Sri Karan Narendra Agriculture University (SKNAU), Jobner.

Agriculture remains the foundation of India's economy, sustaining millions of livelihoods and ensuring national food security. However, the sector faces growing challenges, including climate change, soil degradation, declining productivity, and the need for sustainable intensification. To address these challenges, scientific research and effective extension services play a crucial role in bridging the gap between innovation and practical application.

The STAR National Conference served as a significant platform for bringing together leading scientists, academicians, policymakers, extension professionals, progressive farmers, agri-startups, industry leaders, NGOs, and Farmer Producer Organizations (FPOs). The conference fostered a dynamic exchange of knowledge, research findings, and practical experiences, with a strong focus on emerging technologies, sustainable farming practices, policy interventions, and innovative extension strategies.

One of the significant highlights of the event was the recognition of excellence in agricultural research, extension, and entrepreneurship through various awards, including the STAR Fellow Award, STAR Gold Medal, STAR Excellence Awards, Best Agri-Startup Award, and Community Empowerment Awards. These awards were designed to honor individuals and organizations making outstanding contributions toward agricultural development, rural empowerment, and sustainability.

This Souvenir of Abstracts is a comprehensive compilation of the research findings, innovations, and case studies presented during the conference. It reflects the dedication of researchers and professionals toward advancing agricultural science and creating impactful solutions for farmers and rural communities. We believe that this publication will serve as a valuable resource for students, researchers, policymakers, and agricultural practitioners in shaping the future of Indian agriculture.

We extend our sincere gratitude to Sri Karan Narendra Agriculture University (SKNAU), Jobner, for their collaboration and support in organizing this event. Our heartfelt appreciation goes to all the scientists, experts, participants, and sponsors whose contributions made this conference a grand success.

As we move forward, let us continue working collectively to enhance agricultural research, strengthen extension mechanisms, and empower farming communities with knowledge and technology.

General Secretary, STAR Society

सत्यमेव जयते

डॉ. हिमांशु पाठक
DR. HIMANSHU PATHAK
सचिव (डेयर) एवं महानिदेशक (आईसीएआर)
Secretary (DARE) &
Director General (ICAR)

भारत सरकार
कृषि अनुसंधान और शिक्षा विभाग एवं
भारतीय कृषि अनुसंधान परिषद
कृषि एवं किसान कल्याण मंत्रालय, कृषि भवन, नई दिल्ली–110 001

GOVERNMENT OF INDIA
DEPARTMENT OF AGRICULTURAL RESEARCH AND EDUCATION (DARE)
AND
INDIAN COUNCIL OF AGRICULTURAL RESEARCH (ICAR)
MINISTRY OF AGRICULTURE AND FARMERS WELFARE
Krishi Bhavan, New Delhi 110 001
Tel: 23382629 / 23386711 Fax: 91-11-23384773
E-mail: dg.icar@nic.in

MESSAGE

I am happy to know that the STAR Society and SKN Agriculture University, Jobner, Jaipur, Rajasthan are organizing the STAR National Conference on "Current Trends in Agriculture Research and Extension Service: Shaping the Future of Sustainable Agriculture and Food Security" during February23-25, 2025.The conference addresses of the most pressing challenges faced by the agriculture sector today, ensuring sustainability, enhancing productivity, adapting to climate change, and achieving food security for a growing global population. By bringing together researchers, academicians, policymakers, extension professionals, NGOs, FPOs, and private stakeholders, the event will serve as an excellent platform to deliberate on innovative solutions and collaborative approaches to achieve sustainable agricultural growth. The inclusion of discussions on funding opportunities, partnerships, and awards for outstanding contributions further enriches the scope and impact of this event.

I hope that the deliberations and outcomes of this conference will significantly contribute to the advancement of agricultural research, extension services, and stakeholder collaboration. I encourage all the participants to engage actively, share insights, and explore actionable strategies that can address the current and emerging challenges in agriculture.

I wish the National Conference a grand success.

(Himanshu Pathak)

Dated the 20th February, 2025
New Delhi

Prof. (Dr.) Arvind Kumar
Padma Shri Awardee
FNAAS, FISA, FISOR, FSEE, FCHAI, FISNS, FNESA

Formerly:
Founder Vice Chancellor, RLBCAU, Jhansi
DDG (Ag. Education), ICAR, New Delhi
Director, ICAR-DRMR, Bharatpur
Professor, GBPUA&T, Pantnagar

Date: 15/02/2025

Message

I am delighted to extend my heartfelt congratulations to the **Science and Technology Applications Remodel Society (STAR Society)** for successfully organizing the **STAR National Conference** on *"Current Trends in Agricultural Research and Extension Services: Shaping the Future of Sustainable Agriculture and Food Security"*, in collaboration with **Sri Karan Narendra Agriculture University (SKNAU), Jobner, Jaipur**, from **February 23–25, 2025**.

Agriculture remains the backbone of our nation's economy, and in the face of pressing challenges such as **climate change, resource depletion, and food security**, the role of **research, innovation, and extension services** has never been more crucial. This conference serves as a vital platform for **scientists, policymakers, industry leaders, NGOs, FPOs, and extension professionals** to exchange insights, share knowledge, and explore sustainable solutions for a more **resilient agricultural future**.

The inclusion of **NGOs, FPOs, and private institutions** in this dialogue is particularly commendable, as collaboration between **research institutions and grassroots organizations** is key to ensuring that scientific advancements effectively reach farmers. The initiative to **facilitate funding opportunities for NGOs** and strengthen partnerships between institutions and stakeholders reflects a forward-thinking approach that will significantly contribute to **rural development and agricultural growth**.

I deeply appreciate the efforts of **STAR Society and SKNAU** in bringing together experts and practitioners to deliberate on **emerging trends, innovations, and challenges** in agriculture. I am confident that the discussions at this conference will lead to **actionable recommendations** that will benefit farmers and the broader agricultural community.

I extend my **best wishes** for the grand success of this event and look forward to its **positive impact on the agricultural sector**.

(Arvind Kumar)

Address: Flat No. 515, Carnation Tower, Gaur City Saundaryam, Sector Techzone - 4, Greater Noida West, UP - 201 318
Tel. : +91 9711008862, Email: akrlbcau@gmail.com

भारतीय कृषि अनुसंधान परिषद
डॉ. राजेंद्र प्रसाद रोड,कृषि भवन,नई दिल्ली-10001
Indian Council of Agricultural Research
Dr. Rajendra Prasad Road, KrishiBhavan, New Delhi-110001
फोन कार्यालय/Tel (Off.): 011 23382545, 23046560; Fax: 011 23097003, E-mail: ddgcs.icar@nic.in

डॉ. देवेन्द्र कुमार यादव
उप महानिदेशक (फसल विज्ञान)
Dr. Devendra Kumar Yadava
Deputy Director General (Crop Science)

Dated: 14.02.2025

MESSAGE

Agriculture is the backbone of the national food and nutritional security. Seed is the foundation of agriculture, and ensuring the quality, availability and genetic potential of seed is of paramount importance for achieving higher productivity, sustainability, and food security. The role of research institutions, policymakers, seed industries, and farmer organizations is critical in strengthening the seed sector, promoting the adoption of high-yielding and climate-resilient varieties and ensuring that farmers have access to good quality seed.

I am happy to learn that the Science and Technology Applications Remodel (Star) Society is organizing a National Conference on Agriculture focusing on various regional and national issues related to agriculture in general and improved technological interventions including seed in particular. This conference serves as a crucial platform for knowledge exchange, collaboration and the promotion of innovative practices in agriculture, research, extension services and motivates researchers, extension professionals and industry partners contributing towards agricultural development. The discussions and deliberations during this conference will undoubtedly contribute to shaping strategies for enhancing seed systems and improving agricultural productivity.

The Indian Council of Agricultural Research (ICAR) has been at the forefront of developing and promoting scientific innovations in the seed sector. Through advanced breeding programs, biotechnology interventions, and policy support, we aim to enhance seed quality, improve varietal replacement rates and ensure the availability of improved seeds across diverse agro-climatic regions.

I extend my warm greetings to the organizers, distinguished speakers, researchers, policymakers, industry representatives, NGOs and all participants of the STAR National Conference and wish a great success.

देवेन्द्र कुमार यादव

(D.K. YADAVA)

VICE-CHANCELLOR SECRETARIAT
SRI KARAN NARENDRA AGRICULTURE UNIVERSITY
Jobner, District - Jaipur (Rajasthan) Pin303329
Phone: 01425-254039, 254555, Email : vc@sknau.ac.in

Prof. Balraj Singh
Vice-Chancellor

Message

It is a matter of great pride and privilege for SKN Agriculture University, Jobner, Jaipur, to collaborate with the STAR Society in organizing the National Conference on "Current Trends in Agriculture Research and Extension Service: Shaping the Future of Sustainable Agriculture and Food Security" to be held at RARI, Durgapura, Jaipur from 23rd to 25th February 2025.

Agriculture stands at the crossroads of rapid technological advancements, growing food demands, and pressing environmental challenges. This conference provides an invaluable platform to bring together eminent scientists, academicians, policymakers, extension workers, Farmer Producer Organizations (FPOs), NGOs, and private stakeholders to deliberate on the latest innovations, strategies, and solutions to achieve sustainable agricultural growth and ensure food security.

At SKN Agriculture University, we are deeply committed to advancing agricultural education, research, and extension services to benefit farmers and stakeholders across the nation. Collaborating on this event is a testament to our shared vision of promoting knowledge-sharing and fostering partnerships that can lead to impactful outcomes for rural development and sustainable livelihoods. The conference's emphasis on funding opportunities for NGOs, the role of FPOs, and the recognition of exceptional contributions through awards demonstrates a holistic approach to addressing the multifaceted challenges in agriculture. These initiatives will undoubtedly inspire innovation and motivate stakeholders to work collaboratively toward common goals.

I extend my heartfelt gratitude to the STAR Society for their exemplary efforts in organizing this conference. I also commend all the participants for their dedication and enthusiasm in contributing to this noble cause. I am confident that the discussions and outcomes of this conference will set the stage for transformative developments in agricultural research and extension services, paving the way for a more sustainable and food-secure future.

On behalf of SKN Agriculture University, I convey my best wishes for the grand success of this event. May the conference yield valuable insights, foster meaningful collaborations, and create lasting impacts for the betterment of agriculture and society.

15/2/25

(Balraj Singh)

Dr. Bidyut C. Deka
Vice Chancellor

ASSAM AGRICULTURAL UNIVERSITY
JORHAT-785013, ASSAM (INDIA)

(Recipient of Sardar Patel Outstanding Institution Award)

Message

I am happy to extend my best wishes to the Science and Technology Applications Remodel Society (STAR Society) for organizing the STAR National Conference on Current Trends in Agricultural Research and Extension Services: Shaping the Future of Sustainable Agriculture and Food Security". The national conference is organised in collaboration with Sri Karan Narendra Agriculture University (SKNAU), Jaipur, from February 23-25, 2025, at Rajasthan Agricultural Research Institute (RARI), Jaipur.

Agricultural research and extension activities play a significant role to meet the emerging challenges in food security, climate resilience, and rural development. This conference is expected to provide an excellent opportunity for scientists, academicians, policymakers, NGOs, FPOs, and industry leaders to strengthen the agricultural sector through meaningful dialogues.

I appreciate this noble initiative for bringing NGOs and FPOs to the plateform of scientific dialogue.

I am confident that this conference will lead to fruitful discussions, valuable networking, and actionable recommendations that will benefit farmers, researchers, and policymakers alike.

I wish the programme a grand success.

(Bidyut C. Deka)

Phone: (91) 376 2340013(O), 2340050(R) Fax: (91) 376 2340001 Website: www.aau.ac.in
Email: vc@aau.ac.in

मुख्य महाप्रबंधक
Chief General Manager

NABARD

Message

I am pleased to extend my heartfelt greetings to all the esteemed participants of the STAR National Conference on "Current Trends in Agriculture Research and Extension Service: Shaping the Future of Sustainable Agriculture and Food Security." This conference, organized at RARI, Durgapura, Jaipur, in collaboration with SKNAU, Jobner, Jaipur from February 23-25, 2025, is a commendable initiative to bring together stakeholders from diverse sectors to discuss innovative solutions for the future of Indian agriculture.

Agriculture remains the backbone of our economy and sustainable practices are key to ensuring food security and rural prosperity. In this dynamic era, research and extension services play a pivotal role in transforming traditional agricultural practices into more efficient, resilient and sustainable systems. The deliberations at this conference will undoubtedly foster meaningful discussions, promote innovative solutions and strengthen collaborations among key stakeholders, including scientists, policymakers, FPOs, agri-startups and private sector players.

NABARD has always been committed to supporting initiatives that enhance agricultural productivity, empower farming communities and promote sustainable rural development. The role of research institutions, Farmer Producer Organizations (FPOs), NGOs and private sector stakeholders in driving innovation, technology adoption and inclusive growth is crucial. This conference provides an excellent platform to deliberate on challenges, share best practices and explore collaborative opportunities for the benefit of the farming community.

I appreciate the efforts of the STAR Society for organizing this important event and fostering knowledge exchange in the agriculture sector. I am confident that the discussions and insights generated during this conference will contribute significantly to shaping policies and strategies for sustainable agriculture and rural development.

I extend my best wishes for the grand success of this conference and look forward to its valuable outcomes.

Dr. Rajiv Siwach
Chief General Manager
NABARD,
Jaipur

राष्ट्रीय कृषि और ग्रामीण विकास बैंक
National Bank for Agriculture and Rural Development
राजस्थान क्षेत्रीय कार्यालय
3, नेहरू प्लेस, टोंक रोड, जयपुर – 302 015 • फोन : +91 141 2740821 • फैक्स : +91 141 2742161 • ई मेल : jaipur@nabard.org
Rajasthan Regional Office
3, Nehru Place, Tonk Road, Jaipur - 302 015 • Tel. : +91 141 2740821 • Fax : +91 141 2742161 • E-mail : jaipur@nabard.org

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Prof. Parmendra Kumar Dashora
Vice - Chancellor

Mo. +91 9414162682, 9690275275
E-Mail : vc@mangalayatan.edu.in
pkdashora@gmail.com

Date : 14-02-25

Message

It is with immense pride and joy that I extend my heartiest greetings and best wishes for the National Conference on "Current Trends in Agriculture Research and Extension Service: Shaping the Future of Sustainable Agriculture and Food Security", being organized by the STAR Society in collaboration with SKN Agriculture University, Jaipur, from 23rd to 25th February 2025.

Agriculture remains the cornerstone of our nation's economy and the lifeline of rural communities. However, with rapid advancements in technology, growing environmental concerns, and the increasing demand for sustainable practices, the sector is facing unparalleled challenges and opportunities. This conference provides a unique platform to address these critical issues by bringing together a diverse group of stakeholders, including researchers, academicians, policymakers, FPOs, NGOs, and private organizations, to discuss, deliberate, and innovate for a sustainable agricultural future.

The theme of this conference resonates deeply with the vision of building a resilient agricultural system capable of ensuring food security while conserving natural resources. The collaborative approach of the STAR Society and SKN Agriculture University in hosting this event is a testament to the power of partnerships in fostering knowledge exchange, capacity building, and transformative action.

As the National Coordinator of the STAR Society, I am particularly encouraged by the emphasis on promoting research, extension services, and stakeholder collaborations. The conference's focus on funding opportunities, institutional linkages, and recognition of outstanding contributions through various awards will undoubtedly motivate participants to excel in their respective domains and contribute to the nation's agricultural development.

I take this opportunity to congratulate the organizing teams of STAR Society and SKN Agriculture University for their tireless efforts in planning and executing such a significant event. I am confident that the deliberations, discussions, and outcomes of this conference will lead to actionable strategies and innovative solutions, shaping the future of agriculture and rural development in our country.

On behalf of Mangalayatan University and the STAR Society, I convey my warmest regards to all the participants and stakeholders. May this conference be a resounding success and serve as a beacon of inspiration for everyone striving toward sustainable agriculture and food security.

With best wishes,

P. K. Dashora
Vice Chancellor, Mangalayatan University
National Coordinator, STAR Society

भाकृअनुप-भारतीय तिलहन अनुसंधान संस्थान
ICAR-Indian Institute of Oilseeds Research

राजेंद्रनगर, हैदराबाद-500030, तेलंगाना राज्य, भारत
Rajendranagar, Hyderabad-500030, Telangana State, India
Tel: +91-040-24015222; Fax: 040-24017969; e-mail: director.iior@icar.gov.in; Web: http://www.icar-iior.org.in
ISO 9001 : 2015 Certified Institute

डॉ. आर.के. माथुर
Dr. R.K. Mathur
निदेशक / Director

MESSAGE

It gives me immense pleasure in extending my warm greetings to the organizers and participants of the STAR National Conference being organized by STAR Society, Jaipur during February 23-25, 2025. This event serves as a valuable platform in bringing together the researchers, academicians, policy makers, Farmer Producer Organizations (FPOs), private industries, and NGOs to deliberate on the pressing challenges and emerging opportunities in the field of agriculture, more particularly in research, extension, and sustainable development.

The role of science and technology in agriculture has never been more critical than it is today. With the growing demand for food under changing climatic conditions and the need to have sustainable farming practices, it is essential to integrate innovative technologies and research-driven solutions. Conferences like this would foster collaboration among diverse stakeholders, pave the way for impactful interventions that benefit farmers and the agricultural community at large.

The oilseed sector plays a pivotal role in India's agricultural economy. Enhancing oilseed production and productivity, improving quality seed production and ensuring sustainability through advanced breeding techniques, precision farming, efficient resource management, farm mechanization and strong value chain establishment are some of the key areas that require focused efforts. I am confident that the deliberations emerged from the conference will definitely contribute to the development and dissemination of practical solutions for enhancing oilseed production and addressing the challenges faced by farmers.

I commend the STAR Society for its dedicated and unstinted efforts in organizing such a prestigious event by bringing together and emanating the rich experience, expertise and outstanding contributions of eminent scientists and subject-matter-specialists in the field of agriculture. Such initiatives would greatly inspire excellence and encourage innovation among stakeholders in general and young scientists and research scholars in particular resulting to strengthening of agricultural and the farmers which is the livelihood for more than 50% of Indian population.

I wish the Conference a great success and look forward to meaningful deliberations that would lead to constructive outcomes for the future Indian agriculture.

[R.K. MATHUR]
Director

Hyderabad
Dated February 13, 2025

Tel:7597004107, 7597004174(O),
Website :http://drmr.res.in
Email director.drmr@gmail.com,director.drmr@icar.gov.in

भाकृअनुप–भारतीय सरसों अनुसंधान संस्थान
ICAR-Indian Institute of Rapeseed-Mustard Research

सेवर, भरतपुर (राज.)/Sewar, Bharatpur - 321303 (Raj.)
(An ISO 9001-2008 Certified Organization)

डॉ. प्रमोद कुमार राय
DR. PRAMOD KUMAR RAI
निदेशक
Director

Dated : 18.02.2025

Message

It gives me immense pleasure to extend my heartfelt greetings and best wishes to the STAR Society and SKN Agriculture University, Jaipur, for organizing the National Conference on "Current Trends in Agriculture Research and Extension Service: Shaping the Future of Sustainable Agriculture and Food Security", scheduled from 23rd to 25th February 2025.

This conference comes at a critical juncture when the agriculture sector is facing multifaceted challenges, including climate change, resource constraints, and the need for sustainable intensification of production systems. The focus of this event on the latest trends in agricultural research and extension services is not only timely but also crucial for shaping innovative strategies that align with the goals of sustainable agriculture and food security.

As the Director of the Indian Institute of Rapeseed-Mustard Research, I am particularly encouraged by the emphasis on collaborative efforts among research institutions, universities, FPOs, NGOs, and private organizations. Through such partnerships we can effectively translate research outcomes into field-level solutions, ensuring accessibility and adoption by farmers across diverse agro-climatic regions.

The inclusion of discussions on funding opportunities, the role of Farmer Producer Organizations, and the recognition of exceptional contributions through various awards further highlights the comprehensive and inclusive nature of this conference. These initiatives will undoubtedly inspire participants to contribute meaningfully and work collectively towards addressing the challenges of agricultural sustainability and food security.

I commend the STAR Society and SKN Agriculture University for their vision and dedication in organizing this conference, which will provide a vibrant platform for knowledge sharing, innovation, and networking. I am confident that the deliberations and outcomes of this event will lead to transformative advancements in agriculture and pave the way for a more sustainable and resilient future.

On behalf of the Indian Institute of Rapeseed-Mustard Research, I wish the conference great success. May it serve as a catalyst for impactful research, effective extension services, and strengthened partnerships for the benefit farmers and stakeholders nationwide.

With best regards,

(P.K.RAI)

CONTENT

Natural Resource Management

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Horticulture and Floriculture

Plant Protection

Social Science, Trade and Policies

Climate Smart Agriculture in Dryland

Success Stories

Empowering Rural Prosperity

Agricultural Engineering and Technology

NATURAL RESOURCE MANAGEMENT

Optimization of Mineral Nutrient Management for Higher Productivity in Mustard

BS Meena*, Purshottam Bijarniya, Yonika Saini and PKP Meena
Agricultural Research Station, Kota
**Corresponding author: bhawanidamria@gmail.com*

Abstract
The field experiment was conducted during the rabi seasons of 2021-22, 2022-23 and 2023-24 at Agricultural Research Station, Kota to find out optimization of mineral nutrient management for higher productivity in mustard. Based on three years of study showed significant improvement in siliquae/plant, seed yield and net returns with increasing levels of fertility level from 100% NPK (100:50:30 kg/ha NP2O5K2O) to 150% NPK (150:75:45 kg/ha NP2O5K2O) over control. Further, application of 40 kg S + 5 kg Zn + 1 kg B/ha enriched with 500 kg FYM/ha significantly improved silique/plant, seed yield and economics over application of 20 kg S + 2.5 kg Zn + 0.5 kg B/ha and at par with 40 kg S + 5 kg Zn + 1 kg B/ha, 50 kg S + 5 kg Zn + 1 kg B/ha and 20 kg S + 2.5 kg Zn + 0.5 kg B/ha enriched with 500 kg FYM/ha.

Keywords: *Indian mustard, fertility level, nutrient management, productivity*

Introduction
Indian mustard (*Brassica juncea*), a vital rabi oilseed crop, plays a key role in India's edible oil supply. In 2023-24, total oilseeds production reached 39.59 million tonnes, with rapeseed-mustard leading at 13.16 million tonnes (33.24% of total production). Rajasthan, Haryana, and Uttar Pradesh dominate its cultivation, contributing significantly to the agricultural economy. Despite its importance, the productivity of mustard is often constrained by suboptimal nutrient management practices. However, achieving optimal yields remains a challenge, often hindered by inadequate nutrient management practices. To enhance productivity, it is essential to optimize the application of both primary (NPK) and secondary and micronutrients (S, Zn, and B). The study aimed to identify the most effective mineral nutrient management strategies for maximizing yield and economic returns. By evaluating different levels of NPK and the integration of secondary and micronutrients, this research seeks to enhance the productivity and profitability of Indian mustard cultivation.

Methodology
A field experiment was conducted at Agricultural Research Station, Kota during the rabi seasons of 2021-22,2022-23 and 2023-24 to study the optimization of mineral nutrient management for higher productivity in mustard in irrigated areas of south-east Rajasthan. The experiment comprised NPK level : 4viz., Control, 100% NPK, 125% NPK and 150% NPK, Secondary & Micro nutrients: 5 viz., 20 kg S + 2.5 kg Zn + 0.5 kg B/ha, 40 kg S +5 kg Zn +1 kg B/ha, 20 kg S+ 2.5 kg Zn+0.5 kg B/ha enriched with 500 kg FYM/ha, 40 kg S + 5 kg Zn +1 kg B/ha enriched with 500 kg FYM/ha and 50 kg S + 5 kg Zn +1 kg B/ha were laid out in spilt plot design with three replications. 5 kg/ha seed of variety 'DRMRIJ 31 (Giriraj)' was used, planted at crop geometry of 30 x10 cm in respective years. All the recommended agronomic practices were done throughout the crop season. Siliquae/plant, Seed yield and economics were workout as per standard statistical procedure and using formulae.

Results and Discussion
The application of various organic nutrient sources significantly enhanced growth and yield parameters of mungbean. The treatment with 50% N from FYM + 50% N from VC + VW @ 10% spray (T_5) resulted in the highest plant height, number of branches, and root nodulation, followed by treatments with FYM + PG and FYM + NPK biofertilizers. Yield attributes, including the number of pods per plant and seeds per pod, were also highest with T5, which reflected higher nutrient uptake and photosynthetic efficiency. The highest seed yield (1243 kg/ha), straw yield (2204 kg/ha), and biological yield (3447 kg/ha) were observed with T_5, which outperformed other treatments. The positive effect of organic manures, such as FYM, VC and VW, on nutrient release, soil health, and nitrogen fixation contributed to improved growth and higher yield, aligning with findings by Joshi *et al*. (2023) and Prakasham *et al*. (2019).

Conclusions
In conclusion, the two-year field experiment underscored the significant impact of organic sources on mungbean growth and yield within the mungbean-wheat cropping system of southeastern Rajasthan. Among the eight treatments tested, the application of 50% N by Farm yard manure + 50% N by vermicompost + vermiwash @ 10% spray intervals at 15, 30, and 45 DAS (T_5) exhibited the most favourable results. These findings highlight the potential of organic amendments for fostering sustainable mungbean cultivation practices in the region.

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Evaluating the Impact of Organic Nutrients on Mungbean Productivity in South-Eastern Rajasthan

Yonika Saini*
Department of Agronomy, Agriculture University, Kota, Rajasthan
**Corresponding author: yonikasaini66@gmail.com*

Abstract

A field experiment was conducted during the *Kharif* seasons of 2022 and 2023 at the organic farming block of the Agricultural Research Station, Ummedganj, Agriculture University, Kota (Rajasthan), to study the effects of organic sources of nutrient on mungbean growth and yield in the mungbean-wheat cropping system of south-eastern Rajasthan. The experiment included eight treatments arranged in a randomized block design with three replications. The two-year pooled results showed that the treatment T_5 produced significantly higher values for plant height (54.62 cm), number of branches/plant (9.65), total number of effective nodules/plant (31.65), fresh and dry weight of root nodules/plant (119.94 mg and 23.98 mg, respectively), number of pods/plant (26.28), number of seeds/pod (9.39), pod length (8.17 cm), test weight (34.99 g), seed yield (1242 kg/ha), and straw yield (2204 kg/ha) compared to the absolute control. These results were statistically on par with the T_3 and T_7 treatments, and the seed yield was found at par with T_3 in the pooled analysis. In conclusion, the application of 50% N by FYM and 50% N by vermicompost, along with vermiwash spray, is highly effective in improving mungbean growth and yield in the studied cropping system.

Keywords: *Organic sources, mungbean, growth parameters, FYM, vermicompost*

Introduction

Mungbean (*Vigna radiata* L.), the third most important pulse crop in India, is cultivated over 3.19 million hectares, yielding 3.0 million tonnes with an average productivity of 940 kg/ha (GOI, 2023-24). Rajasthan is a major producer, contributing 11.75 lakh tonnes from 23.32 lakh hectares, with an average productivity of 503 kg/ha.(GOI, 2023-24). Mungbean seeds are rich in protein (24%) and essential minerals, including calcium, iron, magnesium, phosphorus, and potassium, along with vitamins A, B, and C, making them a critical component of human nutrition. The excessive use of inorganic fertilizers and pesticides has led to environmental degradation, declining soil health, and pest outbreaks. This has fueled a shift toward organic farming, focusing on sustainable nutrient management and soil health preservation. Organic inputs such as farmyard manure (FYM), vermicompost, biofertilizers, and liquid organics (Panchagavya, vermiwash, Jeevamrut, and sasyagavya) play a crucial role in improving soil fertility, microbial activity, and nutrient availability. This study aims to evaluate the efficacy of various organic nutrient sources on the growth, yield, and quality of mungbean in the mungbean-wheat cropping system of south-eastern Rajasthan, addressing the challenges of low yields during the organic farming transition period.

Methodology

A field experiment was conducted during the Kharif seasons of 2022 and 2023 at the organic farming block (Field No. 14) of the Agricultural Research Station, Ummedganj, Kota (25°11' N latitude, 75°50' E longitude, 258 m MSL). The study evaluated the effects of organic nutrient sources on mungbean growth and yield in the mungbean-wheat cropping system of south-eastern Rajasthan. . The experimentwas laid out in randomized block design laid with allocation of treatments in three replications consisted of 8 treatments, *viz*. (T_1) Absolute control; (T_2) 100 % N by Farm Yard Manure (FYM) + cow urine @ 10% spray at 15, 30, and 45 days after sowing (DAS); (T_3) 100% N by FYM + panchagavya @ 5% spray at 15, 30, and 45 DAS; (T_4) 75% N by FYM + 25% N by vermicompost + vermiwash @ 10% spray at 15, 30, and 45 DAS; (T_5) 50% N by FYM + 50% N by vermicompost + vermiwash @ 10% spray at 15, 30, and 45 DAS; (T_6) 75% N by FYM + jeevamrut @ 500 liters/ha at sowing + vermiwash @ 5% spray @ 15, 30, and 45 DAS; (T_7) 100% N by FYM + NPK consortia of biofertilizers + Zinc solubilising bacteria (ZSB) each @ 62.5 ml/kg seed inoculation + amrita sanjeevani @ 500 liters/ha at sowing, 15 and 30 DAS and 75% N by FYM + NPK consortia of biofertilizers @ 62.5 ml/kg seed inoculation + sasyagavya @ 10% spray at 15, 30, and 45 DAS (T_8) The soil was medium black clay loam (pH 7.72) with medium organic carbon (0.55%), nitrogen (352.3 kg/ha), phosphorus (50.78 kg/ha), high potassium (432.25 kg/ha), and normal zinc (0.84 mg/kg). Mungbean variety IPM 410-03 (Shikha) was sown at 20 kg/ha. FYM and vermicompost were applied pre-sowing, and liquid organic manures were sprayed as per treatments. Growth parameters like plant height, branches, and nodules were recorded, while yield parameters included pods/plant, seeds/pod, test weight, and seed/straw yields. Data were statistically analyzed following Panse and Sukhatme (1985), with treatment effects assessed at a 5% significance level.

Results and Discussion

The application of various organic nutrient sources significantly enhanced growth and yield parameters of mungbean. The treatment with 50% N from FYM + 50% N from VC + VW @ 10% spray (T_5) resulted in the highest plant height, number of branches, and root nodulation, followed by treatments with FYM + PG and FYM + NPK biofertilizers. These improvements were attributed to enhanced nutrient availability, cytokinins from FYM promoting plant growth, and better soil structure facilitating nodulation. Yield attributes, including the number of pods per plant and seeds per pod, were also highest with T5, which reflected higher nutrient uptake and photosynthetic efficiency. The highest seed yield (1243 kg/ha), straw yield (2204 kg/ha), and biological yield (3447 kg/ha) were observed with T_5, which outperformed other treatments. The positive effect of organic manures, such as FYM, VC, and VW,

on nutrient release, soil health, and nitrogen fixation contributed to improved growth and higher yield, aligning with findings by Joshi *et al*. (2023) and Prakasham *et al*. (2019).

Conclusions

In conclusion, the two-year field experiment underscored the significant impact of organic sources on mungbean growth and yield within the mungbean-wheat cropping system of southeastern Rajasthan. Among the eight treatments tested, the application of 50% N by Farm yard manure + 50% N by vermicompost + vermiwash @ 10% spray intervals at 15, 30, and 45 DAS (T_5) exhibited the most favourable results. These findings highlight the potential of organic amendments for fostering sustainable mungbean cultivation practices in the region.

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Enhancing Yield and Water Use Efficiency in Indian Mustard Using Hydrogel and Salicylic Acid

Priyanka Kumawat*[1] and Pankaj Kumar[2]
Pulses Section, Department of G & PB, CCS Haryana Agricultural University, Hisar, Haryana, India[1]
Department of Soil Science, CCS Haryana Agricultural University, Hisar, Haryana, India[2]
**Corresponding author: pkumawat.agro@gmail.com*

Abstract
Water scarcity in Rajasthan's arid and semi-arid regions poses a major challenge to Indian mustard cultivation. A field experiment was conducted over three *rabi* seasons (2018-19 to 2020-21) at SKN Agriculture University, Jobner, to evaluate the effect of hydrogel and salicylic acid on mustard productivity and water use efficiency. The results revealed that the application of 5.0 kg/ha hydrogel with 200 ppm salicylic acid (foliar spray at flowering and siliqua formation) significantly improved seed yield (1840 kg/ha), stover yield (3847 kg/ha) and water use efficiency (8.53 kg/ha-mm) of mustard crop. These findings suggest that hydrogel and salicylic acid application is a promising strategy for improving mustard yield and profitability in water-limited areas.

Keywords: Hydrogel, mustard, salicylic acid, water use efficiency, yield

Introduction
Indian mustard is an important *rabi* oilseed crop, widely used for edible oil, especially in North India. Rajasthan leads in rapeseed and mustard cultivation, yet its productivity remains below potential due to water stress and other biotic and abiotic factors. Poor soil moisture conservation in Rajasthan's sandy soils causes severe moisture stress during mustard's active growth stages, limiting yield. Hydrogel, an insoluble, cross-linked polymer, can absorb over 400 times its weight in water and gradually release it, improving soil properties and enhancing water availability. Studies (Anupama & Parmar, 2012) confirm its positive impact on crop yield and water use efficiency. Salicylic acid, a phytohormone, regulates plant functions like growth, photosynthesis, and stress tolerance (Nasrin *et al*., 2014), aiding osmotic adjustment and reducing water loss. Considering these factors, this study was undertaken to assess the effects of hydrogel and salicylic acid on enhancing yield and water use efficiency in Indian mustard.

Methodology
A field experiment was conducted during the *rabi*seasons of 2018-19, 2019-20, and 2020-21 at the Agronomy Farm, S.K.N. College of Agriculture, Jobner, located at 26°05' N latitude, 75°28' E longitude, and 427 meters above sea level in agro-climatic zone III A. Nine treatment combinations were tested, including a control, hydrogel at 2.5 kg/ha and 5.0 kg/ha, and salicylic acid at 100 ppm and 200 ppm applied during flowering and siliqua formation stages. Combinations of hydrogel and salicylic acid at both concentrations were also evaluated. The treatments were arranged in a randomized block design (RBD) with three replications. Hydrogel was mixed into the soil, and foliar spray of salicylic acid was done as per the treatment plan.The experimental data were subjected to statistical analysis employing standard techniques of analysis of variance (ANOVA).

Results and Discussion
The application of hydrogel at 5.0 kg/ha, along with salicylic acid at a concentration of 200 ppm during the flowering and siliqua formation stages, resulted in the highest seed yield (1840 kg/ha), stover yield (3847 kg/ha) and water use efficiency (8.43 kg/ha-mm). However, it shared statistical similarity with the treatment of hydrogel at 5.0 kg/ha + salicylic acid at 100 ppm during the flowering and siliqua formation stages, as well as with the treatment of hydrogel at 2.5 kg/ha + salicylic acid at 200 ppm during the same stages in this respect.Notably, these three treatments collectively improved the seed yield by 46.14%, 43.84%, and 36.13% over the control, respectively. Bharat *et al.* (2019) also found that hydrogel application improved seed yield and water-use efficiency in Indian mustard, supporting its role in enhancing crop and water productivity.

Conclusions
The three-year study recommends using hydrogel at 5.0 kg/ha or 2.5 kg/ha, combined with salicylic acid at 200 ppm or 100 ppm during the flowering and siliqua formation stages, for optimal productivityand water use efficiency in Indian mustard in semi-arid Rajasthan. These findings offer crucial insights for sustainable agriculture in water-scarce regions, demonstrating that the strategic use of hydrogel and salicylic acid can enhance mustard yield even under challenging climatic conditions. This approach can significantly benefit farmers in Rajasthan's arid and semi-arid areas, improving both productivity and resource efficiency.

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Integrated Approach of Weed Management in Green Gram

Kumkum Meena*, Shweta Gupta, Seema Sharma, Pratibha Singh and SK Bishnoi
Rajasthan Agricultural Research Institute (SKNAU, Jobner), Durgapura, Jaipur, 302018
*Corresponding author : *kumkummeenakota2002@gmail.com*

Abstract

The field experiment was conducted at RARI, Durgapura during *kharif* 2024 and 2025.The experiment was laid out in Randomized block design (RBD) with three Replications with twelve different weed management treatments. To evaluate the integrated approach of weed management in green gram**.** Observation showed the most predominant weed species in green gram field were Digitaria sanguinalis, Cyperus rotundus, Boerhavia diffusa, Phyllanthus niruri etc. Among various methods of weed management minimum weed density and weed dry weight was observed in weed free After weed free minimum weed density and weed dry weight was found in (T_9) Propaquizafop 2.5% + Imazethapyr 3.75% W/W (Ready mix) @ 125g.a.i/ha at 15-20 DAS followed by the treatment Early post-emergence application of Sodium Acifluorfen 16.5% + Clodinofop-Propargyl 8% EC @ 245 g.a.i/ha at 15-20 DAS. Weedy check treatment produced least crop yield due to maximum crop weed competition.

Keywords: *Green gram, Hand Weeding,Propaquizafop, IWM*

Introduction

Mungbean (*Vigna radiata*L.) consisthigh content of protein (20-25%), minerals (4%) and carbohydrate (46-51%). India is the world's largest producer of pulses, and boosting their yield is key to meeting the growing demand and ensuring food security, particularly for our large vegetarian population. Among the various pulses, green gram (mungbean) is the third most produced and is highly valued for its rich protein, mineral, and carbohydrate content.Ready or tankmixes of compatible herbicideswithvarying modes of action may ensure effective management of diverse weed flora and check shifting of weed flora complex and herbicide resistance.Around 11 billion USD monetary lossduetoweeds from10majorcropsofIndiaWeeds compete with the crop for water, nutrients, light, and space, leading to yield losses of up to 90%.The first 30 days after sowing are critical, as the crop's slow growth makes it vulnerable to the rapid spread of weeds. Traditionally, hand weeding has been used to control weeds, but it is time-consuming and costly. With the rising shortage of labor, herbicides have emerged as an effective alternative for weed control. By managing weed competition and improving agricultural practices, we can enhance the yield of green gram and contribute to the food and nutritional security of our nation.

Methodology

The experimental site was located at 26°512 N latitude and 75°472E longitude and at an altitude of 390 m above mean sea level. The soil of the experimental site was well-drained loamy sand and coarse in texture. Twelve treatments of weed management were tested in randomized block design with three replications. The treatments consisted of T_1: Weedy check; T_2:1HandWeedingat20-25DAS;T_3:Weeding with manually operated mechanical weeder at 2025 DAS.; T_4: Pariedrow sowing+straw mulching between pairs @3.0tonnes/ha. T_5:Paired row sowing+weeding with manually operated Mechanical weeder at 20-25DAS; T_6:Paired row sowing + Earlypost-emergence application of propaquizafop 2.5% + Imazethapyr 3.75% W/W(Ready mix) @ 125ga.i/ha at 15-20 DAS; T_7: Pre-emergence application of pendimethalin 30%+ Imazethapyr 2%(Readymix) @750ga.i/ha *fb*H Wat30-35DAS; T_8:Pre-emergence application of pendimethalin 30 % + Imazethapyr 2% (Ready mix) 750g.a.i./ha *fb* Weeding with manually operated mechanical weeder at 30-35DAST$_9$: Earlypost-emergence application of propaquizafop 2.5%+ Imazethapyr 3.75% W/W (Ready mix) @ 125g.a.i/ha at 15-20 DAS T_{10} - Early post-emergence application of Sodium Acifluorfen 16.5% + Clodinofop-Propargyl 8% EC @ 245 g.a.i./ha at15-20DAS T_{11}:Earlypost-emergence application of Imazethapyr 35%+ Imazamox 35% (Readymix) @40g.a.i./ha at 15-20DAST$_{12:}$Weedfree. Weed density determine help of Quadrate sizes ranging from 0.25 m^2 to 1m^2 and weed oven dried at 65°C.

Results and Discussion

Minimum Weed Density and Weed Dry Weight was observed in weed free which was found at per with T_9 Propaquizafop 2.5% + Imazethapyr 3.75% W/W (Ready mix) @ 125g.a.i/ha at 15-20 DAS After Weed free, Minimum Weed Density and Weed Dry Weight was found in T_9 Propaquizafop 2.5% + Imazethapyr 3.75% W/W (Ready mix) @ 125g.a.i/ha at 15-20 DAS followed by T_{10} Sodium Acifluorfen 16.5% + Clodinofop-Propargyl 8% EC @ 245 g.a.i/ha at 15-20 DAS.Maximum Weed density and Weed Dry Weight was found in Weedy Check.

Conclusions

The get the effective weed management in green gramPropaquizafop 2.5% + Imazethapyr 3.75% W/W (Ready mix) @ 125g.a.i/ha at 15-20 DAS is recommended.

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Crop Intensification with Oilseed Crops by Replacingthe Rice Fallows in Red and Lateritic Belt of West Bengal

Shyamali Das[1] and Tapas Kumar Roychowdhuri[2]
[1]*All India Coordinated Wheat and Barley Improvement Project, Department of Agronomy*
[2]*All India Coordianated Research Project on Floriculture, Department of Floriculture and landscape architecture, Bidhan Chandra KrishiViswavidyalay, West Bengal, India*
**Corresponding author: shyamalisms@gmail.com*

Abstract
Field experiments were carried out at farmers' field to study the performance of different rice based crop sequences by introducing suitable varieties of rapeseed and mustard crops to fit under varied rice- fallow land situation under diverse topographical and irrigation condition of red and lateritic belt of west Bengal (23.3076^{0}N latitude, 87.4158^{0}E longitudes)with the objective of providing additional remuneration to the farmers through introducing low input and management requiring crops being profitable and having market demand with ultimate goal of increasing cropping intensity of the area and district as well.The result showed that Paddy (var Gontra Bidhan 1)-Mustard (var. Pusa Bahar)- Groundnut (TG 37A) showed highest REY of 10.1 t/ha with B:C ratio 2.3 against B:C ratio being 1.6 in Paddy-Fallow sequence.

Keywords : *Profitable Rice based crop sequence, alternative land use strategies, rice, mustard, cropping intensity*

Introduction
The Red and Lateritic zone comprises four district namely Bankura, Purulia, Birbhum and West Midnapur district of West Bengal. The problems regarding year round cultivation of crops and profitability from the system faced by the farmers are more or less similar residing inthese districts. The general practice of the farmers of this zone is to cultivate long duration paddy cultivar MTU 7029 that is harvested delayed from the end of November to middle of December creating the situation not possible to take anycrops during rabi season and onward, resultantly a large area of these districts remained fallow and become barren grazing land after kharif paddy, making the agricultural scenario a non-remunerative practice and farmers to be marginal ones.In search for good alternatives for the farmers, KVK Bankura conducted On Farm Trial (OFT) with the introduction short duration paddy to be harvested within end October to early November allowing the fields to be ready for cultivation of rapeseed and mustard and possibility of taking summer crops with advent of Norwester shower during early summer season in these area can be a viable cropping practice to provide good opportunity to increase cropping intensity, fertility and profitability from the system as a whole.

Methodology
With all the facts keeping in background, on farm trials were conducted in 3 homogeneous selected villages of Sonamukhi, Bishnupur and Ranibandh blocks for 10 consecutive years in the same pre-selected field of the farmers from 2007 to 2017. The sandy, sandy loam and red laterite soil and sub-tropical climate is true representation of the red and lateritic zone of West Bengal that represents four adjacent districts (Bankura, Purulia, Birbhum and West Midnapur district) of the state. The average monthly maximum temperature would range from 24.5-37.5^{0}C and the minimum varying from 8.5-24^{0}C, yearly average rainfall being 1200-1400 mm (Annual Report, Bankura KVK, WB). The selected villages facing identical

problems related to the less revenue generated from cultivating long duration paddy variety MTU 7029 (Swarnamasuri). The experiments were laid down in Randomized Block Design with three replications (treatment represents each cropping sequence followed in each farmer's field and replication represents the villages). The evaluation for system productivity was calculated as per Rice Equivalent Yield (REY) considering the average yield of respective crop in sequence. The value of the produce from each crop was taken by considering the average price (prevailing in local market) of the produce of respective crop from the experiment conducted in the aforesaid period was recorded for economic calculation for respective crop sequence under study. The Net Production Value (NPV) was calculated by dividing net profit by cost of cultivation of respective system.

Treatment details :

Treatment	Details
Cropping Sequence 1 (CS 1):	Paddy (MTU 7029)-Fallow
Cropping Sequence 2 (CS 2):	Paddy (Annada)- Yellow sarson (Binoy) –Sesame (Roma)
Cropping Sequence 3 (CS 3):	Paddy (Annada)- Yellow Sarson (NC-YS-05-02)- Groundnut (TAG 24)
Cropping Sequence 4 (CS 4):	Paddy (Annada)-Toria (Agrani)-Groundnut (TG 51)
Cropping Sequence 5 (CS 5):	Paddy (Annada)- Toria (PT-303)- Groundnut (TG 37A)
Cropping Sequence 6 (CS 6):	Paddy (GB 1)- Indian Mustard (Bhagirathi)- Groundnut (TAG 24)
Cropping Sequence 7 (CS 7):	Paddy (GB1)- Indian Mustard (Pusa Mehak)- Groundnut (TG 51)
Cropping Sequence 8 (CS 8):	Paddy (GB 1)- IndianMustard (Pusa Bahar)- Groundnut (TG 37A)

Results and Discussion
The results showed that highest system productivity in terms of REY from the system as well as highest gross return was recorded in crop sequence 8 comprising Paddy (Gontra Bidhan

1)-Indian Mustard (Pusa Bahar)-Groundnut (TG-37A) recording highest average REY of 10.1 over years and B:C ratio being 2.3 as against the control/ farmers practice of monocrop practice of Rice, i.e., Paddy-Fallow system recording average REY of 4.0 and B:C ratio being 1.6 over years.The CS 8 recording highest return may be due to high yielding capacity of GB 1 in the lateritic soil, bold seed character and high oil content of Pusa Bahar and higher numbers of pod/plant and bold seed type of TG 37 A variety. Crop Sequence 6 and Crop Sequence 7 also performed well. Crop Sequence 3, Crop Sequence 4 and Crop Sequence 5 having Paddy variety Annada also performed well by vacating the land much early for sowing toria and early mustard varieties but recorded low yield than other bold seed rice due to short duration in nature though gained popularity among farmers in terms of land use criteria or early vacation of land for preparation of rabi crops.

Conclusions

It may be concluded and simultaneously suggested that the substitution of age old rice variety MTU 7029 with the new short duration cultivars namely Annada and Gontra Bidhan 1 allowed the system possible to take two extra succeeding crops Rapeseed-Mustard and Groundnut in the sequence making the crop sequence profitable to provide higher economic return and sustainable one to the red lateritic soil to be readily adoptable by the resource poor farmers of the dry region of the state.The farmers can adopt other alternative crops having market demand of their produce.

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Effect of Different Doses of Nitrogen Fertilizers on Growth, Yield and Economics of Wheat

Rahul Singh Jantwal and Pratibha Singh
Rajasthan Agricultural Research Institute (SKNAU, Jobner), Durgapura, Jaipur, 302018
*Corresponding author:*jantwalrahul22@gmail.com*

Abstract
The field experiment conducted at Unchapul Haldwani, Nainital, Uttarakhand during 2023 and 2024. The experiment was laid out in Randomized block design (RBD) with three Replications. Nitrogen @ 0, 30, 60, 90,120,150 and 180 kg ha^{-1}was applied in respective plots in the form of urea applied in split doses 50% at basal application and remaining 50% through top dressing at flowering stage with RDF of P2O5 and K2O at basal application. Various growth, yield and economic parameters of the crop were influenced significantly by various nitrogen levels. Significantly maximum plant height were obtained under highest nitrogen level, 180 kg ha^{-1}. But higher number of tillers, dry matter accumulation, higher grain yield, biological yield, No. of grain per spike, test weight, harvest index of wheat, highest gross return and net return and highest benefit cost ratio was obtained with successive increase of dose upto 125% (150 kg N ha^{-1}) recommended dose of N. Therefore, application of 150 kg ha^{-1} is an option to improve the wheat yield, growth and economics.

Keywords*: Triticum aestivum, spikes, Grain, Biological yield, Harvest index ,Wheat*

Introduction
Nitrogen is a crucial nutrient for plant growth, playing a vital role in amino acid and protein synthesis, which are essential for the development of crops. The availability of nitrogen directly impacts growth, development, and yield (Hussain *et al*.2003). It is highly mobile in the soil and considered essential for increasing crop productivity, with agriculture consuming around 19.5 million tons of nitrogen fertilizer annually. Initially, a single nitrogen application was recommended, but due to its soil mobility, double split applications became common (Koch and Hussain 2020). However, nitrogen use contributes significantly to production costs and can negatively affect the environment (Ullah *et al.* 2019). In developing countries, high nitrogen costs are exacerbated by climate change. Increasing nitrogen use efficiency is key to reducing costs and improving crop yield. Adequate nitrogen application is particularly important for wheat, influencing growth, tillering, grain yield, and flour quality. Low nitrogen levels can hinder crop performance, highlighting the importance of managing nitrogen for optimal wheat production.

Methodology
Field experimental farm is located at Unchapul, Haldwani, Uttarakhand at an altitude of 443 m above sea level.29.227167æ%N,79.496001æ%E.The experiment was conducted November, 2023 to April, 2024. Wheat variety 'HD2967' was sown on 15th November, 2023.The experiment, arranged in a Randomized Complete Block Design, had Seven treatments and three replications. Wheat was planted at a seeding rate of 100 kg ha^{-1}, with a row spacing of 20 cm.Phosphate fertilizer was applied as DAP (46% P2O5, 18% N) at 85 kg P2O5 ha$^{-1,}$ with phosphorus incorporated at planting and nitrogen applied in split doses using granular urea. Urea was broadcasted at sowing, with top-dressing during flowering stage. Total three irrigations were applied to the crop at different stages. Harvesting took place in the Second week of April. Grain yield and yield components were measured from a one-meter square area, including spike count, 1000-grain weight, and average grains per spike.

Results and Discussion
Various growth, yield and economic parameters of the crop were influenced significantly by various nitrogen levels. Significantly maximum plant height were obtained under highest nitrogen level, 180 kg ha-1. But higher number of tillers, dry matter accumulation, higher grain yield, biological yield, No. of grain per spike, test weight, harvest index of wheat, highest gross return and net return and highest benefit cost ratio was obtained with successive increase of dose up to 125% (150 kg N ha-1) recommended dose of nitrogen.

Conclusions
The application of 125% recommended dose of N with 150 kg N ha^{-1} significantly the high values of growth, yield and economics. The application of nitrogen in split doses 50% at basal application and 50% at the time of flowering to improve nitrogen use efficiency. Thus 125% recommended dose of N with 150 kg N ha^{-1} recommended for obtaining maximum yield of wheat.

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Effect of Lantana Biochar on Yield of Organic Chickpea

Roshan Choudhary[1], SK Sharma[2], BL Dudwal[3], NK Gupta[4] and Monika Choudhary[5]
[1]*Deputy Director Research, SKN Agriculture University, Jobner*
[2]*Assistant Director General (HRM), ICAR, New Delhi*
[3]*Assistant Professor (Agronomy), SKN Agriculture University, Jobner*
[4]*Director Research, SKN Agriculture University, Jobner*
[5]*Senior Research Fellow, NRC on Seed Spices, Ajmer*
Corresponding author: roshan.agro@sknau.ac.in

Abstract
A field experiment was carried outat MPUAT, Udaipur. The experiment was laid out in factorial randomized block design with three replications and assigning sixteen treatment combinations consisting of two factors and both were at four levels first factor was different doses of *Lantana camara* biochar *i.e.* control and different levels of *Lantana camara* biochar with different time of application of *lantana camara* biochar Results revealed that application of 3.5 t ha^{-1} *Lantana camara* biochar gave higher seed yield haulm yield and biological yield as compared to control, 1.5 t ha^{-1}.Application of *Lantana camara* biochar in two split does i.e. 50% at sowing + 50% at branching resulted in higher seed yield, haulm yield and biological yield as compared to application of *Lantana camara* biochar at time of sowing, at branching and pod formation stage, respectively.

Keywords: *Lantana, biochar, split application, yield*

Introduction
Organic agriculture combines tradition, innovation, and science to benefit the shared environment and promote fair relationships and good quality of life for all involved. Organic farming is being practiced in 190 countries of the world. The harmful effects of chemicals used in agriculture are changing the mindset of consumers of different countries who are now buying organic produce with high premium for health. Lantana camara makes available huge nitrogen rich moist biomass, which has potential to be utilized as a substrate for organic recycling. Its biomass has potential for utilization as organic manure, has antimicrobial, insecticidal and medicinal properties. Biochar is a carbonaceous product of the pyrolysis of solid biomass formed after °C in the absence of oxygen. It is a dark colored heating at the temperature of 300-600 powdery product with several unique properties like high porosity, high cation exchange site which provides favorable conditions for living microbiota in the soil and increase the soil carbon pool. So, biochar application improves the overall properties of soil and act as a soil amendment to enhance soil fertility.

Methodology
The experiment was laid out at Organic Farming Unit (Agronomy), Rajasthan College of Agriculture, Udaipur which is located in Southern Eastern part of Rajasthan. *Lantana* biochar was used through slow pyrolysis in biochar production system (Pratap Kiln) which was prepared in the CTAE, Udaipur. Stalks of *Lantana camara* plant were fed to the pyrolysis reactor in oxygen limiting condition where the temperature goes up to 450° C for the period of four minutes.This process occurs in three stages, first where the moisture content of the biomass was reduced to <10 percent at the temperature of 180 °C, second where the biochar production starts with the breakdown of hemicellulose and cellulose at the temperature range of 180-360° C and last stage where lignin breaks down at the temperature of 450 °C. The lantana biochar was incorporated into the soil as per the treatments with help of the spade in 15 cm top soil layer.

Results and Discussion
Application of 3.5 t ha^{-1} lantana biochar recorded significantly higher seed yield (1436 kg ha^{-1}) with an increase of 34.51% over control (1067 kg ha^{-1}). This might be due to the vigorous vegetative growth resulting in higher photosynthate production and translocation from source to the sink which is apparent on reproductive growth *viz.* number of pods plant-1, and 100 seed weight which were the important yield attributes having significant positive effect on seed yield. Application of *Lantana camara* biochar in two split does i.e. 50% at sowing + 50% at branching resulted in higher seed yield, haulm yield and biological yield as compared to application of *Lantana camara* biochar at time of sowing, at branching and pod formation stage, respectively.

Conclusions
It is concluded that the maximum growth parameters, yields and nutritional value of chickpea seeds were obtained in response to application of 3.5 t ha^{-1} lantana biochar in two splits i.e. 50% at sowing + 50% at branching.

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Effect of Nano Nutrientson Performance of Groundnutunder Semi-arid conditions of Rajasthan

Pratibha Singh, R Sammauria, Shewta Gupta and Rahul Singh Jantwal
Rajasthan Agricultural Research Institute (SKN Agriculture University, Jobner), Durgapura, Jaipur, Rajasthan-302 018
**Corresponding author email: pratibha.soils@sknau.ac.in*

Abstract
A field experiment was conducted during *Kharif* 2021 and *Kharif* 2022 at Rajasthan Agricultural Research Institute, Durgapura, Jaipur (Sri Karan Narendra Agriculture University, Jobner) to study the effect of Nano DAP on growth, productivity, economics and soil health in groundnut (var. RG 510). The experiment was laid out in Randomized Block Design with 12 treatments comprised of three levels of recommended dose of DAP (i.e. 0, 25 & 50%) alongwith seed treatments and one foliar applications of nano DAP in three replications. Equal quantities of recommended dose of K, S and Zn were applied in all treatments. Results of experiment revealed that application of seed treatment with 2.5ml Nano DAP per kilogram seed and one foliar spray of 2 ml Nano DAPper litre water along with 50% recommended dose of DAP has highest growth, yield attributing parameters and yield of groundnut.

Material and Methods
The experiment was laid out in Randomized Block Design with 12 treatments comprised of three levels of recommended dose of DAP (i.e. 0, 25 & 50%) alongwith seed treatments and one foliar applications of nano DAP in three replications. Equal quantities of recommended dose of K, S and Zn were applied in all treatments. The crop was raised with recommended agronomic practices.

Results and Discussion
The highest pod, kernel and haulm yield were recorded with 50% DAP as basal + seed treatment with Nano DAP @ 2.5ml/kg seed and one foliar application of Nano DAP @ 2.0ml/litre of water (T_{11}) which were significantly higher than 50% DAP as soil application (T_4). Yields with treatment having 25% DAP as basal + seed treatment with Nano DAP @ 2.5ml/kg seed and one foliar application of Nano DAP @ 2.0ml/litre of water (T_9) had at par yield with 100% RDF of DAP. Yields with 0% DAP as soil application + seed treatment with Nano DAP @ 2.5ml/kg seed and one foliar application of Nano DAP @ 4.0ml/litre of water (T_7) were statistically at par with 25% DAP as soil application (T_3) and were significantly higher than yields in control i.e. 0% DAP as soil application (T_1).

Conclusion
On the basis of first year study, it may be concluded that application of Nano DAP as seed treatment and one foliar spray in groundnut crop may be an efficient method for maximizing yield under semi-arid conditions of Rajasthan. Application of seed treatment with 2.5ml per kilogram seed and one spray of 2ml Nano DAP per litre of water in combination with 25 to 50% of recommended dose of DAP may provide an effective solution to enhance crop growth and productivity.

Residual Effect of Fertility and Sulphur Levels on Growth and Yield Attributes of Zaid Mungbean under S-E Rajasthan

Satyanarayan Regar, Pratap Singh, MK Sharma, CK Jadon and Uditi dhakar
College of Agriculture, Ummedganj, Agriculture University, Kota
**Corresponding author: regarsatyanarayan@gmail.com*

Abstract
An experiment was conducted at Research Farm, Ummedganj, Kota during *Zaid* season 2022 and 2023. The experiment comprised of 28 treatment combinations. In this experiment application of different levels of fertility and sulphur were applied to the preceding crop (coriander) had significant effect by application of 125% RDF + foliar spray (19:19:19) @ 0.5% at pre flowering and umbellate formation along with sulphur 60 kg/ha on growth and yield attributes of mungbean**.** There are same results observed in net returns and B**:** C ratio which was at par with 125% RDF, 100% RDF + foliar spray and 100% RDF along with sulphur 40 kg/ha over control and rest of the treatments.

Keywords: *Mungbean, yield, net returns, residual effect*

Introduction
Mungbean (*Vigna radiata* L. Wilczek) is the third most important pulse crop of India after chickpea and pigeonpea.Therefore, exploring alternative cropping patterns is essential. Mungbean, an important legume in Asia, can play a significant role in various cropping systems. Its adaptability to environmental stresses such as drought and low soil fertility (Bourgault *et al.,* 2010) allows for its cultivation in diverse cropping arrangements. Additionally, integrating a grain legume like mungbean into cropping systems contributes substantial biomass and nitrogen to the soil, thereby enhancing soil fertility and promoting sustainable crop productivity (Ali *et al.,* 2012). The coriander-mungbean cropping system provides an effective rotation option for sustainable agriculture. The inclusion of mungbean in the quick rotation helps break pest and disease cycles, suppress weeds and diversify the cropping system, reducing the risk of yield losses due to continuous monoculture.

Methodology
A field experiment was conducted at College of Agriculture, Research Station, Ummedganj, Kota during *Zaid* season 2022 and 2023, was laid out in SPD with three replications comprised of seven fertility levels (Control, 75% RDF, 100% RDF, 125% RDF and 75% RDF + foliar spray (19:19:19) @ 0.5% at pre flowering and umbellate formation, 100% RDF + foliar spray (19:19:19) @ 0.5% at pre flowering and umbellate formation and 125% RDF + foliar spray (19:19:19) @ 0.5% at pre flowering and umbellate formation) and four levels of sulphur (Control. 20, 40 and 60 kg/ha). The soil of the experimental field was medium black clay loam with poor in organic carbon, low in available nitrogen (279 kg/ha), medium in available phosphorus (22.1 kg/ha), available sulphur (14.9 kg/ha) but high in available potassium (391 kg/ha). The soil was slightly alkaline in reaction with pH 7.62.and bulk density 1.43 respectively.

Results and Discussion
Result on pooled basis showed that 125% RDF + FS of NPK (19:19:19) 0.5% at pre flowering and umbellate formation in preceding crop had significant influence onplant height **(**47**.**61 cm**)**, DMA **(**91**.**22 g/m row length**)**, leaf area index at 45 DAS **(**3**.**39**)**, no**.** of pods/plant **(**18**.**51**)**, no**.** of grains/pod **(**8**.**72**)**, test weight **(**32**.**18 g**)**, grain yield **(**836 kg/ha **)**and straw yield **(**1433 kg/ha**)**, net returns **(**36852₹**/ha)** and B**:**C ratio **(**1**.**57**).** Increased nutrient availability under inorganic conditions may lead to enhanced conversion of carbohydrates into proteins. The resulted in a positive residual effect on the yield attributes of the subsequent mungbean cropBarkha *et al.* (2020).

Conclusions
It is concluded that, in Coriander-*zaid* mungbean cropping system, application of 100% RDF + foliar spray (19:19:19) @ 0.5% at pre flowering and umbellate formation along with sulphur 40 kg/ha applied in coriander, gave the highest seed yield and found remunerative.

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Effect of Nutrient Management on Growth, Yield Attributes and Yield of Soybean

S Ram Rundala*, Pratap Singh, TC Verma, YK Meena and Pradeep Kumar
Agriculture University, Kota (Rajasthan), Bharat, 324001
**Corresponding author: shiva.skn@gmail.com*

Abstract
The Krishi Vigyan Kendra, Jhalawar (Rajasthan) was conducted as On Farm Trial/Testing (OFT) at five selected farmers' field in the three consecutive Kharif 2020, 2021 and 2023 season to find out the effect of nutrient management on growth, yield attributes and yield of soybean under irrigated/rainfed conditions. Growth characters (Plant height, number of branches, number of nodules), yield attributes (pods per plant, No. of grains per pod and 100-seed weight in g) and yield (grains yield 19.20 q/ha) of soybean were observed and found significantly higher and improved due to application of100% RDF (NPKSB 20:40:40:30:1 kg/ha)+ FYM @ 10t/ha + Seed treatment with Rhizobium & P.S.B. + Fe @ 5 kg/ha ($FeSO_4$ @ 25 kg/ha) as soil application + Foliar application of 1% $FeSO_4$ at pre flowering and pod formation stages followed by 100% RDF (NPKSB 20:40:40:30:1 kg/ha) + FYM @ 10t/ha + Seed treatment with Rhizobium & P.S.B. culture and also found significantly higher growth, yield attributes and yield as compared to farmers practice.

Keywords: Soybean, on farm trial, Fe, sulphur and biofertilizer.

Introduction
Awonder crop soybean (*Glycine max.* (L.) Merill) is a leguminous crop and belongs to family leguminoaceae. Soybean crop is predominantly grown in India as a rainfed crop covering the states of Madhya Pradesh, Maharashtra and Rajasthan on black soil (Vertisol) and associated soils. It is the major growing oilseed crop of *Kharif* season in the Hadoti region of Rajasthan state. India is largest importer of edible oils in the world and the domestic availability is almost 50% of its production..The production and productivity is less due to wide gap between proper fertilization & application method and good agricultural practice. Another important reason behind this may the continuous use of imbalance fertilizer without proper soil sampling and recommendation of soil testing. Therefore, the deficiencies symptoms of nutrients appear on plants and in the soils of Jhalawar district. The balanced fertilization with proper application method is most accepted critical factor for qualitative yield and productivity of soybean.

Methodology
The On Farm Trial (OFT) conducted at five selected farmers' fieldatadoptedvillageofKVK,Jhalawarviz. Aktasa& Panwasa (Jhalrapatan block) in the three consecutive *Kharif* 2020, 2021 and 2023 season. The selection of thevillages was for the find out the reasons of wide technological gap between potential and local yield of soybean.. The experiment was laid out in strip plot and consisted of three treatments replicated five times i.e.**T_1**: *Farmers practice (Imbalanced use of fertilizer and no use of micronutrients);***T_2**: *100% RDF (NPKSB 20:40:40:30:1 kg/ha) + FYM @ 10t/ha + Seed treatment with Rhizobium& P.S.B. culture* and **T_3**: *T_2+Fe @ 5kg/ha ($FeSO_4$ @ 25 kg/ha) as soil application + Foliar application of 1% $FeSO_4$ at pre flowering and pod formation stages*.The areas of each treatment have 0.1 ha. The foliar application of $FeSO_4$ @ 1% at pre flowering and pod formation stages. Soybean variety JS 20-34 was taken as test crop. The crop was harvested at around 85-90 DAS. Observations included plant height, number of branches, nodules per plant, pods/plant, seeds/pod, 100-seedsweight (g), seed & straw yield (kg/ha) and economics of soybean cultivation. Economic analysis was done based on cost of cultivation, gross return, net return and B:C ratio.

Results and Discussion
After conduction of OFT the data were collected, summarized and analyzed. The plant height (45.80 cm), number of branches (3.80), number of nodules (56.37) per plant were observed and found significantly higher in T_3 compared to T_1 (Farmers practice) with plant height (37.03cm), number of branches (2.37), number of nodules (39.2) per plant of soybean. This increase in plant height, branches and leaves per plant might be due to greater availability of nutrients, form of organicand inorganic sources which helped in acceleration of various metabolic processes of N, P and K which help in better absorption of nutrients coupled with proper distribution, these results are in conformity with the reports of Dash *et al.* (2005) and Biswas*et al.* (2023).The pods per plant (40.90), No. of grains per pod (2.87), 100-seed weight (11.83), yield (18.23 q/ha), net return (0.64 lakh/ha) and economic profitability (B:C 2.79) of soybean were observed and found significantly higher due to the application of T_3 as compared to T_1 (Farmers practice) with pods per plant (29.53), no. of grains per pod (2.00), 100-seed weight (9.95), yield (12.12 q/ha), net return (0.30 lakh/ha) and economic profitability (B:C 1.95).

Conclusions
On the basis of pooled results of OFT, it is concluded that the conjoint application of 100% RDF (NPKSB 20:40:40:30:1 kg/ha) + FYM @ 10t/ha + Seed treatment with *Rhizobium*& P.S.B. culture + Fe @ 5kg/ha ($FeSO_4$ @ 25 kg/ha) as soil application + Foliar application of 1% $FeSO_4$ at pre flowering and pod formation stages of soybean had realized a net return of Rs. 0.64 lakh/ha as compared to farmers practice with net returns of Rs. 0.30 lakh/ha.

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Effect of Tillage and Nutrient Management Systems on Pearl Millet Yield and Soil Properties under Semi-Arid Condition of Rajasthan

Seema Sharma*, SK Jain, Shweta Gupta, Pratibha Singh, RN Choudhary, Bheem Pareek and Anju Kanwar
Rajasthan Agricultural Research Institute, Dutapura (SKNAU, Jobner), Jaipur
**Corresponding author: seemasharma.agro@sknau.ac.in*

Abstract
Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is the most widely grown staple food of majority of poor and small land holders in Asia and Africa. It is also consumed as feed and fodder for livestock. Pearl millet in India is being cultivated on an area of 7.55 million ha with a production of 9.22 million tonnes and the average productivity of 1374 Kg ha^{-1} (Anonymous 2023). In India, the major pearl millet growing states are Rajasthan, Maharashtra, Uttar Pradesh, Gujarat and Haryana contributing 90% of total national production. Pearl millet is gluten free and retains its alkaline properties even after being cooked which is ideal for people suffering from gluten allergy and acidity.

Keywords:Pearl millet, nutrition, nutri-cereals

Introduction
Pearl millet is the most widely grown staple food of majority of poor and small land holders in Asia and Africa. It is also consumed as feed and fodder for livestockIt is the world's sixth and India's fourth important cereal food crop after rice, wheat and maize. In India, the major pearl millet growing states are Rajasthan, Maharashtra, Uttar Pradesh, Gujarat and Haryana contributing 90% of total national production. In Rajasthan, pearl millet occupies 4.55 million ha area with the production of 5.89 million tonnes and average productivity of 1296 kg ha^{-1}. (Anonymous. 2023). Pearl millet is also called as the "Powerhouse of Nutrition" as it consists of most of the important nutrients in good quantity and quality which is required for maintaining healthy life. Pearl millet has special health benefiting properties for people suffering from life style diseases like diabetes, obesity etc. as it has high proportions of slowly digestible starch and resistant starch that contribute to low glycemic index.

Methodology
A field experiment was conducted during *Kharif* 2020 to *kharif*-2022 at RARI, Durgapura, Jaipur under rainfed coarse textured soil situation **"**to study effect of tillage and nutrient management systems on pearl millet yield and soil properties**"**. The experiment was laid out in Split plot design with three replications. The treatments consisted of a. Conventional tillage (Two harrow + one cultivator and planking + two inter culture operations at 15-20 & 30-35 DAS),b. Conventional tillage (Two harrow + one cultivator and planking + one Inter culture operations at 21-28 DAS), c. Minimum tillage (One harrow + one cultivator and planking + two inter culture operations at 15-20 & 30-35 DAS), d. Minimum tillage (One harrow + one cultivator and planking one inter culture operations between 21-28 DAS as main plot and a. 100% RDF of the zones b. 75 % N through RDF + 2.5 t/ha FYM c. 50 % N through RDF + 5.0 t/ha through FYM d. 100% N through FYM.

Results and Discussion
Results showed that minimum tillage practices recorded at par yields both of grain and straw with conventional tillage. Among the fertility levels significantly higher grain 3662 kg/ha and stover yield of 8900 kg/ha was found in 100% RDF over rest of the treatments. However, it was found at par with treatment T2 with respect to both grain and straw yields on pooled basis of three years.

Conclusions
From the results it is concluded that Minimum tillage (one harrow + one cultivator and planking + two interculturing at 15-20 & 30-35 DAS with the help of wheel hoe) with 100% RDF increased pearl millet productivity under rainfed condition with maximum net returns.

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Baree-The Home Garden: Inherent Natural Farming System of Assam

Bordoloi A*[1], Dutta P[1], Goswami A[1], Dihingia S[1], Medhi B[1], Neog RC[1], Bordoloi P[1] and Neog M[2]
Krishi Vigyan Kendra, Sivasagar, AAU, Jorhat[1], Director of Extension Education, DoEE, AAU Jorhat[2]
**Corresponding author: arundhatibordoloi@gmail.com*

Abstract
Baree – a traditional species–rich, diversified and well-structured agroforestry system of Assam. Like any other home garden of the tropical and sub - tropical world, *Baree* system also provides service to the socio economic functions with caring and protecting natural resources in a balanced manner. As Baree system involves low cost production system and year round maintenance, it is very much popular among the poor farming community of Assam. Product diversity is another attraction of the system which gives wholesome nutrient to a farm family.Because of it'sincredible nature of farming by harnessing natural resources in low cost manner through conserving biodiversity along with the soil health, *Baree* system is an unique example of Natural Farming in India.

Introduction
A *Baree* is the most dominant category and exists in almost every rural and semi-urban household of the state, and can be appropriately termed as 'homescape' of Assam.In *Baree* system, various agroforestry and fruit plants are planted to harvest the basic necessities of the household.The main objective of *Baree*system is household consumption. In a typical *Baree*system, space is utilized both horizontally and vertically. From the Ground stratum to the upper canopy of multipurpose trees the gradient of light and relative humidity creates different niches enabling various species groups to exploit them (Das & Das, 2005). *Baree*system contributes extensively to soil nutrient enrichment through leaf litter deposition and soil erosion control through cover crop, which highly supports the principle of Natural Farming.In Baree system the herbs/weeds are never completely removed from soil due their various utilities which support the concept of LIVING SOIL under Natural Farming.

Methodology
Sap or leaf extracts, stem, bark, roots or seeds of many plant species are utilized sometimes along with dung of livestocks, as the management measures against pests and disease of many economic plant species. Besides, several fern species, bamboo species, Moringa oleifera (Sajina), etc. are utilized in some localities as pesticides for crops grown in Baree. One of the most commonly utilized measure as insect repellant is the addition of ash to the leaves of Solanum melongana (Bengena), Capsicum sp. (Jalakia) etc. Similarly, water used after washing of fish is widely applied to the cucurbits as insect repellent. In *Baree* system only cowdungor FYM is used as nutrient management practice. In situ decomposition of grown weeds, herbs and leaf litter are major source of soil nutrition. Such crops also serve as cover crops by protecting erosion of soil especially during monsoon.

Results and Discussion
The traditional *Baree* system of Assam is a complete Natural Farming system with inherent age-old land use practice based on traditional knowledge. It contributes enormously towards income generation, improved livelihood, household economic welfare, promotion of entrepreneurship and rural development. The contribution towards household economic wellbeing may be in several ways: output can be sold in local market to earn additional income, activities can be upgraded into a small cottage industry or the savings from consuming home grown products can lead to more disposable income. As need of the hour, Baree should be structured to be more efficient commercial enterprise by growing high value crops or trees and animal husbandry. The traditional modes of agriculture as well as household industrial production which maintained a harmonic relation with nature are being increasingly replaced by the modern modes caring little for sustainability (Bhagabati *et al.* 2014).

Conclusions
Considering the importance of Baree in terms of nutritional security, preservation of biodiversity, ecology and economic upliftment of the farmers, due importance should be given for reorientation and reorganization of the system as Inherent Natural Farming system of Assam.

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Effect of Integrated Nutrient Management on Growth and Yield of Wheat

Ramakant Sharma*[1], DS Bhati[2] and Dinesh Arora[2]
[1]*Professor, Agri Research Sub-Station Ajmer,* [2]*SS & Head, KVK, Ajmer SKNAU, Jobner (Raj)*
**Corresponding author: .....*

Abstract

Jeevamrit, when combined with RDF and FYM, significantly improves wheat yield and soil health. The highest yield (41.94 q/ha) and net returns (¹ 58,598/ha) were recorded under T3 (RDF + FYM + Jeevamrit). Jeevamrit enhances microbial activity, leading to better nutrient cycling and improved crop performance. INM strategies involving organic and inorganic inputs can enhance economic and environmental sustainability in wheat production. This study provides strong evidence that integrated nutrient management using Jeevamrit can be an effective approach to improve productivity while maintaining ecological balance.

Introduction

Sustainable agricultural productivity is a major concern in India, particularly in the post-Green Revolution era, where excessive reliance on chemical fertilizers has led to environmental degradation and declining soil fertility. Integrated Nutrient Management (INM), which combines organic and inorganic inputs, is emerging as a promising approach to enhance crop productivity while maintaining soil health. Among organic inputs, Jeevamrit—a fermented liquid manure made from cow-based products is gaining attention for its ability to enhance soil microbial activity and nutrient availability.This study was conducted at the ARSS, Tabiji, Ajmer, to assess the impact of INM, specifically the integration of Jeevamrit with conventional fertilizers and farmyard manure (FYM), on the growth, yield, and economic returns of wheat. The study aimed to determine whether such an approach could improve crop performance while ensuring long-term soil sustainability

Methodology

A two-year field experiment (rabi 2021-22 and 2022-23) was conducted on sandy-loam soils characterized by low organic carbon, low phosphorus, and medium potash levels. The soil was alkaline with a pH of 8.6. A randomized block design (RBD) was used with five treatments, each replicated four times. The treatments included:T1: Absolute control (no inputs)T2: Recommended dose of fertilizers (RDF: 90 kg N + 35 kg P, O… /ha) + 4 t FYM/haT3: RDF + 4 t FYM/ha + Jeevamrit (500 liters/ha × 2 applications)T4: 75% RDF + 4 t FYM/ha + Jeevamrit (500 liters/ha × 2 applications)T5: 50% RDF + 4 t FYM/ha + Jeevamrit (500 liters/ha × 2 applications)The wheat variety Raj-3077 was sown in the second week of November and harvested in the third week of March. Nitrogen was applied in two splits, with half at sowing and the remainder after the first irrigation. Jeevamrit was applied during the first and second irrigations.

Results and Discussion

The combined application of Jeevamrit, RDF, and FYM (T3) resulted in the highest number of spikes per meter row length (80.50) and test weight (42.53 g). The improved yield attributes in T3 can be attributed to enhanced microbial activity and nutrient cycling facilitated by Jeevamrit. Increased soil enzymatic activities and microbial diversity under Jeevamrit-based systems have been reported in previous studies, supporting its effectiveness in improving plant growth and yield. The highest grain yield (41.94 q/ha) and biological yield (86.6 q/ha) were recorded in T3. Treatments with lower fertilizer application (T4 and T5) also performed better than control but showed a decline in yield compared to T3, indicating the importance of maintaining a balance between organic and inorganic inputs for optimal production. Economic analysis revealed that T3 was the most profitable, yielding the highest net returns (Rs 58,598/ha) and benefit-cost ratio (2.05). The economic advantage of T3 suggests that integrating Jeevamrit into nutrient management practices can enhance profitability while ensuring environmental sustainability.

Conclusions

The study highlights the positive impact of integrating Jeevamrit with RDF and FYM on wheat growth, yield, and economic viability. The findings suggest that Jeevamrit not only enhances yield attributes and grain production but also plays a crucial role in improving soil microbial activity, nutrient availability, and long-term soil health.Given its low cost and environmental benefits, Jeevamrit-based INM can be a viable option for resource-poor farmers looking to optimize wheat productivity sustainably. Further research is needed to assess the long-term effects of Jeevamrit on soil fertility and nutrient dynamics under different agro-climatic conditions.

Assessment of Soil Fertility Status in *Char* areas of Assam

Bibha Ozah*[1] and Prabal Saikia[2]
Scientist[1], Soil Science, AAU- ZRS, North Lakhimpur, Chief Scientist[2], AAU- ZRS, North Lakhimpur
**Corresponding Author: bibha.ozah@aau.ac.in*

Abstract

GPS based soil samples were collected from two depths of *char* areas of Lakhimpur and Dhemaji District under North Bank plain Zone of Brahmaputra Valley of Assam. The GPS based soil samples were collected from surface and sub- surface zone of the sampled points and analyzed for pH, OC (%), available N, P_2O_5 and K_2O. The study reveals that the nutrient content is varies from low to high in the *char* areas. The pH is neutral in range and organic carbon is low to high.

Key words: GPS based soil samples, *char* areas,pH and organic carbon

Introduction

Soil fertility is the inherent capacity of soil to supply essential nutrients for proper growth, development and enhancement of crop yield (Tisdale et al., 1993). Various physical, chemical and biological properties of soil affect the soil fertility and crop productivity. Fertile top soil erosion through run off and nutrient loss may cause reduction in soil fertility (Guimaraes et al., 2021). A char area is a riverine island or sandbar formed by silt deposits in a river. Chars are formed by the dynamics of erosion and accretion in rivers. The char areas of river Brahmaputra cover about 3.60 lakhs ha in Assam. These areas are vulnerable to several natural calamities like flood, drought, sand-casting, erosion etc. Many of such chars remain stable for long period of time allowing vegetation to grow up and settlement to establish. The soil nutrient statuses of these chars are needed to be analysed for proper nutrient management and to increase farmers' income.

Methodology

Lakhimpur and Dhemaji district is under the North Bank plain Zone of river Brahmaputra of Assam. A total of 234 nos. of soil samples were collected from surface (0- 15 cm) and sub- surface (15- 30 cm) layer of 117 locations of the two districts. The GPS based soil samples were collected air dried at room temperature, ground and passed through 2 mm sieve and analyzed for different soil parameters *viz.*, pH, organic carbon, available nitrogen, available phosphorus and available potassium by using standard analytical methods. Soil pH in 1:2.5 soils: water suspension of the processed samples was determined by using the calibrated glass electrode pH meter. Wet digestion method of Walkley and Black (1934) was used to determine organic carbon content of the soil samples. Available nitrogen and available phosphorus content of the study site soil samples were assessed using alkaline potassium permanganate method (Subbiah and Asija, 1956) and Bray's I method (Bray and Kurtz, 1945) respectively. Determination of available potassium was done by flame photometer using neutral normal ammonium acetate as an extracted (Hanway and Heidel, 1952).

Results and Discussion

The present study reveals that the pH of the soils of char areas of Lakhimpur and Dhemaji of Assam varies from 6.93- 7.85, may be due to siltation of the char areas after flooding in every year. The soils of char areas are also less disturbed by the anthropological actions. Soil organic matter is an important index of soil quality and best integrator of inherent soil productivity. The organic carbon percentage of the analyzed samples varies from 0.27 – 1.71 i. e. low to high. The available N content of the soil varies from 56- 134 kg/ ha which is low in range. It may be due to loss of N due to flood and erosion of the char areas. The available P2O5 content of the soil varies from 12.57 – 26.42 kg/ ha (low to medium). Available K2O content varies from 11.18- 648.74 kg/ ha i.e. low to high in range.

Conclusions

The char areas of Assam vary in nutrients content from low to high. There is numbers of fertile chars where cultivation of crops produce good yield. The study reveals that exploration of the char areas with proper ways may increase the profitability and improve the livelihood of the farmers of that area.

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Trends and Forecasting of Area, Production and Yield of Paddy and Rapeseed & Mustard in Assam: A Study Toward Sustainability

Krishnali Gogoi*[1], Dibyajyoti Shyam[2] and Ashok Kumar Sharma[3]
Senior Research Fellow[1], [3]Principal Scientist, ICAR-IIRMR, Sewar, Bharatpur, Rajasthan.
Department of Agricultural Economics and Farm Management[2], Assam Agricultural University.
**Corresponding Author: krishnaligogo96@gmail.com*

Abstract
In state like Assam, agriculture is essential to both sustainable development and food security. This study examines trends and projections in two important crops of Assam: Paddy and rapeseed-mustard. The yield improvement (6.47% CGR, R2 = 0.85) over area expansion (0.82% CGR, R2 = 0.53) was the primary driver of the moderate growth in paddy output from 1993 to 2023 (5.81% CGR, R2 = 0.77). The production of rapeseed-mustard increased by (3.58% CGR, R2 = 0.46), driven primarily by yield increases (3.15% CGR, R2 = 0.70) as opposed to area growth (0.42% CGR, R2 = 0.03). Forecasts found that paddy and mustard production rising steadily from 68,28,121 to 77,90,740 and 249,954 MT to 440,053 MT from 2023 to 2030, with wider confidence intervals showing variability.

Keywords*:* Agriculture, yield improvement, crop production, food security and projections

Introduction
Food security and sustainable growth are greatly aided by agriculture, which is essential to Assam's socioeconomic development. The two main crops in the state that are the subject of this study are rapeseed-mustard and paddy. Paddy output has increased steadily over the last three decades, primarily due to yield improvements (6.47% annual compound growth rate, or CGR) rather than an increase in the area under cultivation. In a similar vein, rapeseed-mustard output has grown moderately (3.58% CGR), with yield gains outpacing area expansion. According to the data, both crops' production increased moderately but steadily between 1993 and 2023, and projections indicate that this growth will continue until 2030. The study offers a thorough understanding of the variables affecting crop yields by highlighting projection unpredictability brought about by wider confidence intervals. This research is critical for understanding agricultural trends and informing future policy decisions in Assam's agricultural sector.

Methodology
The study used secondary data from different government reports and publication for trend analysis and forecasting. The exponential trend equation and the cubic trend equation are the two types of trend equations that are used to examine historical data and find growing trends. While non-linear growth patterns over time may be included in the cubic model, constant percentage increase was captured by the exponential model. Crop production, yield improvement, and area expansion was evaluated by fitting these equations to data from 1993 to 2022. In order to predict future production levels, ARIMA (Auto Regressive Integrated Moving Average) model, a time series forecasting technique was used toforecasts for the period 2023 to 2030, with confidence intervals to account for potential variability in future production trends. This comprehensive approach provides robust insights into the crop production dynamics in Assam.

Results and Discussion
The study revealed that paddy production in Assam has primarily been driven by yield improvements (6.47% CGR), with area expansion contributing modestly (0.82% CGR). The exponential and semi-log quadratic models showed significant growth, particularly between 2003-2012, for rapeseed and mustard yield improved, with a growth rate of 3.15% over the study period. Area expansion contributed minimally, with limited growth observed in recent years. Significant growth observed between 2003 and 2012 (10.73% CGR), but production and yield growth slowed afterwards. Forecasts for paddy production in Assam predict steady growth, with production increasing from 6,828,121 MT in 2023 to 7,790,740 MT in 2030. Confidence intervals showed variability, with production ranging between 5,853,338 MT and 7,802,904 MT. Mustard production is expected to rise from 249,954 MT in 2023 to 440,053 MT in 2030, with variability between 216,728 MT and 697,795 MT.

Conclusion
The study highlights the significant role of yield improvements of paddy and rapeseed-mustard production. Over the past three decades, both crops have shown steady increase in production and yield. Area expansion had a limited impact, particularly in recent years. Forecasts suggest continued moderate growth for both crops through 2030. These findings revealed that agricultural productivity can be achieved through sustainable practices and technological advancements. Future agricultural policies must focus on optimizing yield improvements and addressing potential challenges posed by land constraints and environmental factors for food security in Assam.

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Effect of Microbial Consortium and Nutrient Management on Growth & Yield of Clusterbean [*Cyamopsis tetragonoloba*(L.) taub.]

Ram Niwas Choudhary*, Shweta Gupta, KC Gupta, Seema Sharma, Bheem Pareek, Pratibha Singh, Anju Khangaroth, Kavita Bhadu and Rahul

Rajasthan Agricultural Research Institute (S.K.N. Agriculture University, Jobner,) Durgapura, Jaipur, Rajasthan-302018

**Corresponding author : rnchoudhary.agro@sknau.ac.in*

Introduction

Clusterbean (*Cyamopsis tetragonoloba* L.) is one of the important drought hardy and deep rooted and adapted to the harsh climatic conditions of arid and semi arid zone of India. Multi-purpose legume grown as feed, fodder, green manure, vegetable and recent year as an industrial crop, due to presence of galactomannan (30-35 %) in its endosperm. Its gum is used in food processing, paints, cosmetics, synthetic resins, water blocking agents and fire retardant etc (Gandhi *et a*l., 2005). The area under this crop in Rajasthan is about 28.41 Lac ha with production of 12.84 Lac tones and average productivity of 452 kg ha^{-1}, (GoR, 2019-20). The FYM improves the nutrient and water holding capacity of soils, increases nutrients availability, enhance the beneficial soil microorganism activity and improves the soil structure **(**Wendimu2017**).** The effective microbial consortia should be assessed using compatibility tests, pot experimentation techniques, generation time, a novel and quick plant bioassay, and sensitivity to external stimuli (temperature, pH). The mixture of two or more microbial strains found in the root microbiome stimulates plant growth and development. The present review deals with mechanism, formulation, inoculation process, commercialization, and applications of microbial consortia as plant bioinoculants for agricultural sustainability (Negi R *et al.,* 2024)

Materials and Methods

A field experiment was conducted under All India Coordinated Research Project on Kharif Pulses during *Kharif* -2023 at Research Farm, Rajasthan Agricultural Research Institute, Durgapura, Jaipur, Rajasthan to study the "Effect of microbial consortium and nutrient management on growth and yield of clusterbean" The experimental site was located at 26°512 N latitude and 75°472E longitude and at an altitude of 390 m above mean sea level.The soil of the experimental site was well-drained loamy sand and coarse in texture. Eight treatments of microbial consortium and nutrients were tested in randomized block design with three replications. Microbial consortium applied asseed treatment and soil application method, whereas in case of nutriment management RDF applied at the time of sowing as 100, 75 and 50 % .The treatments consisted of T_1:Control (100% RDF), T_2: 100% RDF + seed treatment with microbial consortium, T_3:100% RDF + soil application of microbial consortium, T_4:100% RDF + seed treatment with microbial consortium and soil application of microbial consortium, T_5:75% RDF + seed treatment with microbial consortium, T_6:75% RDF + soil application with microbial consortium, T_7 : 75% RDF + seed treatment with microbial consortium and soil application of microbial consortium and T_8: 50% RDF + seed treatment with microbial consortium and soil application of microbial consortium

Result

The results of the experiment revealed that T_4: (100% RDF + seed treatment with microbial consortium and soil application of microbial consortium) treatment gave significantly higher seed yield (1454 kg/ha), no. of branches, no. of pods plant and pod length over control and also found and at par with T_7 treatment. Stover yield statistically higher recorded with T_4 treatment. Similarresult reported by Sunar K, Das K, Rai AK, Gurung SA (2023)

Conclusion

On the basis of the experiment results, it concluded that 100% RDF + seed treatment with microbial consortium and soil application of microbial consortium gave significantly higher seed,No. of branches, No. of pods plant and pod length over control

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Effect of Different Weed Control Methods on Yield Attributing Characters and Yield of Clusterbean [*Cyamopsis tetragonoloba* (L.) Taub]

Rahul[1], BR Meena[2], Varsha Jeetarwal[3] and Manisha Kumawat[4]
[1,4] *Department of Agronomy, SKNAU, Jobner, Rajasthan, 303329*
[2] *Assistant Professor, Department of Agronomy, SKNAU, Jobner, Rajasthan, 303329*
[3] *Department of Agronomy, RARI, Durgapura, Rajasthan, 302018*
**Corresponding author : rahulpalsaniya99@gmail.com*

Abstract
A field investigation was carried out at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during *kharif,* 2022 on loamy sand soil. The experiment was laid out in randomized block design with ten treatments and three replications. The ten treatments were as follows Pendimethalin @ 0.75 kg a.i./ha PE (T_1), Imazethapyr @ 100 g a.i./ha PoE (T_2), Quizalofop-ethyl @ 40 g a.i./ha PoE (T_3), Pendimethalin @ 0.75 kg a.i./ha PE + Imazethapyr @ 100 g a.i./ha PoE (T_4), Pendimethalin @ 0.75 kg a.i./ha PE + Quizalofop-ethyl @ 40 g a.i./ha PoE (T_5), Pendimethalin @ 0.75 kg a.i./ha PE + one hand weeding (T_6), Pendimethalin @ 0.75 kg a.i./ha PE + straw mulch @ 3 t/ha (T_7), Pendimethalin @ 0.75 kg a.i./ha PE + straw mulch @ 5 t/ha (T_8), weed-free (T_9) and weedy-check (T_{10}).

Keywords*: Clusterbean, Pendimethalin, Imazethapyr, Kharif, Yield attributing characters, Yield*

Introduction
Clusterbean [*Cyamopsis tetrogonoloba* (L.) Taub.], commonly known as guar in the local language, belongs to family fabaceae. It is mainly grown in the arid and semi-arid regions of India. Due to frequent rains, weed populations drastically increase during the rainy season and start competing with the crop for natural resources like nutrients, moisture, light and space, resulting in significant yield reduction. Due to inconsistent rainfall and the difficulty of organizing enough labor to work on large areas at once, physical methods of weed control are often not used efficiently enough during the rainy season. Consequently, it has become necessary to use herbicides. Hand weeding is a traditional and effective form of weed control, however, it can be expensive, so it is beneficial to examine pre and post-emergence herbicides to compare their efficacy to traditional methods (Yadav *et al.,* 2011).

Methodology
A field trial was conducted at Agronomy farm of Sri Karan Narendra Agricultural University, Jobner during *Kharif*, 2022 to find out the effect of different weed control methods on Growth and Yield of Clusterbean(*Cyamopsis tetragonoloba* (L.) Taub.). The experiment was laid out in randomized block design with 10 treatments and 3 replications. The treatments were as follows Pendimethalin @ 0.75 kg a.i./ha PE (T_1), Imazethapyr @ 100 g a.i./ha PoE (T_2), Quizalofop-ethyl @ 40 g a.i./ha PoE (T_3), Pendimethalin @ 0.75 kg a.i./ha PE + Imazethapyr @ 100 g a.i./ha PoE (T_4), Pendimethalin @ 0.75 kg a.i./ha PE + Quizalofop-ethyl @ 40 g a.i./ha PoE (T_5), Pendimethalin @ 0.75 kg a.i./ha PE + one hand weeding (T_6), Pendimethalin @ 0.75 kg a.i./ha PE + straw mulch @ 3 t/ha (T_7), Pendimethalin @ 0.75 kg a.i./ha PE + straw mulch @ 5 t/ha (T_8), weed-free (T_9) and weedy-check (T_{10}).

Result and Discussion
The results showed that different weed control treatments have significantly increased the yield attributing characters *viz*. seeds per pod, pods per plant and pod length of clusterbean over the weedy-check except test weight which turns out to be non-significant. Maximum seeds per pod (9.9), pods per plant (62.1) and pod length (6.5 cm) were observed under treatment weed-free which was at par with Pendimethalin @ 0.75 kg a.i./ha PE + one hand weeding and significantly superior to the rest treatments. Highest seed yield (1417 kg/ha), stover and biological yield (4228.5 and 5645.5 kg/ha, respectively) were obtained under the treatment weed-free which was statistically at par with Pendimethalin @ 0.75 kg a.i./ha PE + One hand weeding. The results were in accordance with research findings of Yadav *et al.* (2011), Punia *et al.* (2011), Patel*et al.* (2018)

Conclusion
Based upon the results of one-year field experiment, it can be concluded that treatment Pendimethalin @ 0.75 kg a.i./ha PE + one hand weeding produced higher seed yield (1389 kg/ha). The treatment weed-free was also recorded to be equally effective with yield (1417 kg/ha). The results are only indicatives and for more consistent and final conclusion further experiments are required to be performed at more locations.

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Impact of National innovation on Climate Resilient Agriculture-Technology Demonstration Component (NICRA-TDC) in Jodhpur District of Rjasthan

SK Sharma[1*], PC Garhwal[2], BL Ola[3], Sunil Kumar[4] and PK Rai[5]
[1]*Senior Scientist & Head,* [2]*SMS (Horticulture),* [3]*SMS (Agronomy),* [4]*SMS (Plant Pathology),*
KVK (ICAR-IIRMR), Gunta, Bansur, Alwar-II, Rajasthan 301 402
[6]*Director, ICAR-IIRMR, Sewar, Bharatpur, Rajasthan 321 303*
**Corresponding Author: sushil4sharma@gmail.com*

Abstract
Demonstrations were organized covering an area of 1204 ha benefiting 551 farmers under NRM interventions viz., water harvesting and recycling, in-situ moisture conservation, ground water recharge and various resource conservation techniques. Under crop production module various interventions such as drought tolerant and short duration varieties, location specific intercropping systems, crop diversification, pest and disease management, nutrient management etc., were taken up on 535 ha area covering 1143farmers. Under livestock interventions, 1735 farmers were benefited on improved fodder production covering 197.6 ha, breed upgradation, vaccination, animal health camps, etc. where 3450 animals were benefited. Under institutional interventions like custom hiring centre, fodder bank and seed bank 499 farmers were benefited in terms of timely taking up of farm operations, enhanced access to quality seed and fodder .Through capacity building and extension activities, awareness on climate resilient technologies was brought about benefitting 7000 and 14510 farmers through 406 and 290 activities respectively. Some of the interventions under four different modules which were successfully demonstrated to farmers have been presented in the following sections.

Keywords: *Jodhpur, Rajasthan, NRM, Mustard, Green Gram, Floating sheet, Tank silt*

Introduction
National Innovations in Climate Resilient Agriculture (NICRA) is a multi-institutional and multi-disciplinary network project launched by ICAR in 2011 which aims to build resilience in Indian agriculture to climate change and climate variability through strategic research and technology demonstrations. Technology Demonstration Component (TDC) of NICRA which is implemented in 121 climatically vulnerable districts of the country focuses on enhancing the adaptive capacity of farmer in these districts to climatic change and to ensure security of livelihood in times of climatic aberrations. The objectives of NICRA are as

I. To enhance the resilience of Indian agriculture covering crops, livestock and fisheries to climatic variability and climate change through development and application of improved production and risk management technologies

II. To demonstrate site specific technology packages on farmers' fields for adapting to current climate risks.

III. To enhance the capacity of scientists and other stakeholders in climate resilient agricultural research and its application.

Methodology
The Technology Demonstration Component (TDC) of NICRA was implemented through Krishi Vigyan Kendras (KVKs) during 2013-18 in 2 villages viz., Purkhwas and Lunawas Khara of Luni Panchyat Samiti Jodhpur districts of Rajasthan, under ICAR-ATARI, Jodhpur. Under the project, KVK conducted demonstration of climate resilient technologies in four modules viz., NRM, crop production, livestock and institutional interventions besides conducting capacity building and extension activities related to these technologies.

Results and Discussion
TDC was actively involved to demonstrate the climate resilient technologies in the selected villages of Jodhpur district. Promotion of short duration, high yielding cultivars suitable for arid zone –In Kharif season-MPMH-17 of Bajra, IPM 02-3 of green gram, RGC -1017 of cluster bean and CZM-2 of moth bean. Theses interventions have perform better and increased the average yield from 14 to 35.7% in Kharif crops. During Rabi Season-. Giriraj, NRCDR-2, PM-26 of mustard varieties and GC-4 of cumin. The yield increased in Mustard 40.69%, 29.25% and 16.6% over local, respectively. In cumin GC-4 variety increase 41.16 % yield with 3.26 BC ratio.

NRM-Under the project 406 farmers were used compost pits for quality compost production, which were fully utilized by the farmer. Floating Sheet Demonstration: To protect water evaporation from irrigation tank which area was 160 sq. meters. With division one technical support a floating sheet was spread over open tank. The results showed that 9.75 litter water were saving from evaporation per square meter/day therefore it was saving of 1561 litre water/day in summer season. Summer deep ploughing -Conduct at 210 farmers' fields as moistures conservation tillage practice for proper rain water management. The farmers had sown Bajra in the fields and increased 29.41% productivity. Tank silt -It applied at 84 farmers' field for improving soil fertility and the interventions have found increased 23.52% productivity. Gum inducing treatment under the project 35 farmers gained average 500 g Gum/tree from in A. Senegal trees and found Rs. 390 as net return.

Breed improvement- During the reported period farmers gets 48 young stocks of Tharparkar cow, 62 murrah buffalo and 390 sirohi goat kids. The sirohi goat is preferred for its meat production and high price of buck. The productivity of sirohi buck was increase 49.48%.

Azolla production- It was observed that 12 % milk yield was increased by use of Azola.

Custom Hiring Center-5 sprayers, 5 dusters, 4 seed-cum–fertilizer drill, 1 water tanker and 1 small platform Weighing machine and disc harrow were also given at CHC centre.

Conclusion
It increased crop yields, improved soil fertility, and enhanced water conservation. Key interventions included high-yielding crop varieties, water-saving techniques, livestock breed improvement, and the promotion of Azola for milk yield enhancement. Additionally, a Custom Hiring Centre provided essential farming equipment to local farmers.

Effect of Foliar Nutrition in Cowpea [*Vigna unguiculata* (L.) Walp.] Under Rainfed Condition

Vaishali Haribhau Surve
Navsari Agricultural University, Navsari- 396450 (Gujarat)
•Corresponding Author: vaishusdream@gmail.com

Abstract

An investigation was carried out in plot No. 11 at College farm, College of Agriculture, Navsari Agricultural University, Campus Bharuch during *kharif* 2023. The experiment was arranged in a randomized block design (RBD) with nine treatments, which included: T1 (Control), T2 (RDF 20-40-00 NPK kg/ha), T3 (RDF + 2% Panchagavya), T4 (RDF + 2% Cow urine), T5 (RDF + 2% Vermi bed wash), T6 (RDF + 1% Novel), T7 (RDF + 2% Urea), T8 (RDF + 1% 19-19-19) and T9 (RDF + Nano urea 2 ml/lit), each with three replications. The soil of experimental plot was clayey with low in available nitrogen (240.42 kg/ha), available phosphorus (39.58 kg/ha) and high in available potassium (338.28 kg/ha). The soil reaction (pH) was slightly alkaline (7.68). The finding revealed that, significantly higher growth parameters *viz*. plant height at 60 DAS (71.33 cm) and at harvest (75.38 cm), number of branches per plant at 45 (8.65) and 60 DAS (9.64), dry matter accumulation per plant at 45 DAS (20.80 g) and at harvest (32.24 g) recorded with treatment T6 (RDF + 1% Novel) however, it was found statistically at par with T3 and T8 (RDF + 1%. While, number of root nodules per plant at 45 DAS did not show significant differences due to various foliar nutritions, but the highest number of root nodules (28.21) was observed under treatment T6 (RDF + 1% Novel). Yield attributes *viz*. number of pods per plant (25.55), number of seeds per pod (17.41) and length of pod (18.24 cm) as well as seed yield (1625 kg/ha) and stover (3004 kg/ha) yield were also recorded significantly higher with T6 and found statistically at par with T3 and T8. While, 100 seed weight was not significantly influenced by different treatments. Protein yield (354.61 kg/ha) was recorded significantly higher with T6, which was statistically at par with T3 and T8 (RDF + 1% 19-19-19). Significantly, P (0.640%) and K (1.247%) content in the seeds and N, P and K (0.867%, 0.320% and 1.095%, respectively) in stover were significantly influenced by treatment T6. These values were statistically comparable to those in T3 (RDF + 2% Panchagavya). Significantly, the highest total N, P and K uptake by cowpea (82.75, 19.93 and 53.18 kg/ha, respectively), were reported under T6, over rest of the treatments, but it was statistically at par with T3. Available nitrogen recorded significantly higher (277.20 kg/ha) in treatment T6, which was statistically comparable with T3 (RDF + 2% Panchagavya) and T8. Application of T6 noted that higher agronomic efficiency of nitrogen (21.43 kg/kg) and phosphorus (10.72 kg/kg) as compared to rest of the treatments. While, higher apparent recovery efficiency of nitrogen and phosphorus resulted in treatment T6 (RDF + 1% Novel) by registering the value of 144.27% and 15.87% respectively. Among the different foliar nutrition maximum net return (1,01,851 ¹ /ha) was achieved with foliar nutrition of T6 (RDF + 1% Novel) along with BCR of (3.31). While, lowest net return (71,324 ¹ /ha) was achieved with T1 (Control). Based on one year field experiment, it can be concluded that cowpea *cv*. GC 3 fetched appreciably higher yield and economic returns when fertilized with RDF (20-40-00 NPK kg/ha) along with foliar nutrition 1% Novel or 2% Panchagavya or 1% NPK (19-19-19) at branching and flowering stages.

Keywords: Cowpea, randomized block, Panchagavya

Characterization of Soil for Sustainable Management and Food Security in Sambhar Lake Area of Rajasthan

Suman Jat, SS Sharma* and KK Sharma
Department of Soil Science and Agricultural Chemistry, SKN College of Agriculture (SKNAU), Jobner 303329
**Corresponding author: ssharma.soils@sknau.ac.in*

Abstract

The present investigation involves morphological, physical and chemical charaterization, classification of soils for optimum land use planning for sustainable management of Sambhar Lake area in Jaipur district. The soils were very deep, yellowish brown to pale brown in colour, sandy loam to silty loam in texture and single grain to massive in structure.

The soils were moderately alkaline (pH 7.32 to 8.86) in reaction and non-saline (EC 0.25 to 1.67 dS m^{-1}). Organic carbon content was observed low in soils (0.09 to 0.22 percent). The soils were low in cation exchange capacity and the exchange surface was dominated by exchangeable calcium followed by magnesium, sodium and potassium. The soils of the study area were taxonomically classified in Inceptisols (P2, P4, P5 and P6) and Entisols (P1 and P3) soil order. Based on the soil properties, the soils of the Sambhar Lake area have been categorized into land capability class III. On the basis of major soil constraints and potential, suitable land use plan has been suggested.

Key words: *Characterization, entisols, inceptisols, soil suitability,sustainable management*

Performance of Cluster Bean (*Cyamopsis tetragonoloba*) Grown as Intercropping under Available Natural Nesources in not Arid Region of in Western Rajasthan

RC Balai*, SR Meena, Manpreet Kaur and Anita Meena
ICAR-Central Institute for Arid horticulture, Bikaner- 334 006, Rajasthan
**Corresponding author:* rcbsoni72@gmail.com

Abstract

In north-west part of Indian arid zone, importance of native crop-plants having agricultural and horticultural significance is well known. In hot arid region, native crop-plants of horticultural significance have enormous potential in providing nutrition rich food and social security to inhabitants of the desert area. Land productivity and life support system in hot arid region are seriously constraints by low and erratic rainfall, extreme temperature, high wind velocity, high evapo-transpiration, sandy soils with poor fertility, low water retention capacity etc. To develop rainfed and multi-purpose desert agri-horticulture under resource constraint environment. Traditional farming systems are adopted since time immemorial for security of food, fodder and fuel wood in drought-prone arid region.In arid parts, the trees and farming system provide fodder, fruit, vegetable, fuel wood, timber and fiber for sustaining rural livelihood and also provide food, nutrition and income security There is need to exploit genetic resources of native crop-plant species developing varieties or trait specific value added genotypes and viable farming systems suited to the prevailing agro-climate. As the soils of the region are coarse textured with very poor nutrient and water retention capacity imposes sever limitations on crop performance. Cluster bean (Cyamopsis tetragonoloba L.Taub.), is an important coarse, drought-tolerant legume that is primarily grown during the kharif season in arid and semi-arid regions of the country. Cluster bean improves soil fertility by fixing a significant amount of atmospheric nitrogen. It has ability to fix approximately 37-196 kg of atmospheric nitrogen per hectare per year in soil. It is also used to reclaim saline and alkaline soils. organic manures i.e farm yard manure, sheep manure, vermicompost play a key role in increasing cluster bean yield. There is significant increase in growth, yield attributes, and yield. Other organic sources like panchagavya and jeevamrit is used for foliar spraying, soil application with irrigation water and seed treatment which is enhancing crops in organic farming. It may be concluded that application of available natural resources using integrated nutrient management has positive effect on growth and yield of cluster bean, under normal rainfall.

Effect of Microbial Consortium and Nutrient Management on Growth & Yield of Clusterbean [*Cyamopsis tetragonoloba* (L.) taub.]

Ram Niwas Choudhary*, Shweta Gupta, KC Gupta, Seema Sharma, Bheem Pareek, Pratibha Singh, Anju Khangaroth and Kavita Bhadu
Rajasthan Agricultural Research Institute (S.K.N. Agriculture University, Jobner,)
Durgapura, Jaipur, Rajasthan-302018
**Corresponding author : rnchoudhary.agro@sknau.ac.in*

Abstract

A field experiment was conducted under All India Coordinated Research Project on Kharif Pulses during *Kharif* -2023 at Research Farm, Rajasthan Agricultural Research Institute, Durgapura, Jaipur, Rajasthan to study the "Effect of microbial consortium and nutrient management on growth and yield of clusterbean" The experimental site was located at 26°512 N latitude and 75°472E longitude and at an altitude of 390 m above mean sea level. The soil of the experimental site was well-drained loamy sand and coarse in texture. Eight treatments of microbial consortium and nutrients were tested in randomized block design with three replications. Microbial consortium applied asseed treatment and soil application method, whereas in case of nutriment management RDF applied at the time of sowing as 100, 75 and 50 % .The treatments consisted of T_1 :Control (100% RDF), T_2: 100% RDF + seed treatment with microbial consortium, T_3:100% RDF + soil application of microbial consortium, T_4:100% RDF + seed treatment with microbial consortium and soil application of microbial consortium, T_5:75% RDF + seed treatment with microbial consortium, T_6:75% RDF + soil application with microbial consortium, T_7: 75% RDF + seed treatment with microbial consortium and soil application of microbial consortium and T_8: 50% RDF + seed treatment with microbial consortium and soil application of microbial consortium.

The results of the experiment revealed that T_4: (100% RDF + seed treatment with microbial consortium and soil application of microbial consortium) treatment gave significantly higher seed yield (1454 kg/ha), no. of branches, no. of pods plant and pod length over control and also found and at par with T_7 treatment. Stover yield statistically higher recorded with T_4 treatment.

Keywords : *Clusterbean , Microbial consortium, Nutriment management*

Efficacy of New Herbicides on Weed Dynamics and Productivity of Groundnut

Shweta Gupta*, Seema Sharma, RN Choudhar, Pratibha Singh, Bheem Pareek, Anju Kanwar Khangarot and Kavita Bhadu

Rajasthan Agricultural Research Institute (S.K.N. Agriculture University, Jobner,)
Durgapura, Jaipur, Rajasthan-302018
**Corresponding author: shweta.agro@sknau.ac.in*

Abstract

A field experiment was conducted under All India Coordinated Research Project on Weed Management for three consecutive years during *Kharif* 2021 to *Kharif* 2023 at Research Farm, Rajasthan Agricultural Research Institute, Durgapura, Jaipur, Rajasthan to study the "Efficacy of new herbicides on weed dynamics and productivity of groundnut". The experimental site was located at 26°512 N latitude and 75°472E longitude and at an altitude of 390 m above mean sea level. The mean maximum temperature was 31.62°C, 33.42°C, 34. 12°C and minimum temperature was 22.5°C, 23.1°C, 22.4 °C and total rainfall was 718.2 mm, 489.4 mm 510.0 mm, during the crop period in the year 2019, 2020 and 2021, respectively. The soil of the experimental site was well-drained loamy sand and coarse in texture. Ten treatments of weed management were tested in randomized block design with three replications. The treatments consisted of T_1: Weedy check; T_2: Weed free; T_3: Pendimithalin 30% + Imazethaper 2% (PE) at 800 g a.i./ha.; T_4: Diclosulam 84% WDG (PE) at 24g a.i./ha T_5: Sulfentrazone 28% + Clomozone 30 % WP (PE) at 725g a.i./ha; T_6:Fluazifop-p-butyl 13.4 % + Fomesafen 11.1% EC (Ready mix) at 230 g a.i./ha at 2-3 leaf stage of weed; T_7: Propaquizafop 2.5% + Imazethapyr 3.75% w/w (Ready mix) at 125 g a.i./ha at 2-3 leaf stage of weed; T_8:Sodium Acifluorfen 16.5% + Clodinofop-propargyl 8% EC at 245 g a.i./ha at 2-3 leaf stage of weed;T_9: Fomesafen 12% + Quizalofop-ethyl 3% SC (Ready mix) at 230 g a.i./ha. at 2-3 leaf stage of weed and T_{10} - Imazethapyr 35% + Imazamox 35% WG (Ready mix) at 60 g a.i./ha at 2-3 leaf stage of weed.

Results in the pooled analysis showed that minimum weeds and maximum Weed Control Efficiency were recorded in Weed free which was found at par with T_8:Sodium Acifluorfen 16.5% + Clodinofop-propargyl 8% EC at 245 g a.i./ha at 2-3 leaf stage of weed (92.16%). Pod yield (3.40 t/ha) and haulm yield (4.90 t/ha) was recorded maximum in Weed free which was found at par with T_8:Sodium Acifluorfen 16.5% + Clodinofop-propargyl 8% EC at 245 g a.i./ha at 2-3 leaf stage of weed. (3.20 t/ha and 4.63 t/ha, respectively).

Keywords: *Groundnut, Sodium Acifluorfen, Clodinofop-propargyl, weed control efficiency*

Effect of Organic Manure and Inorganic Fertilizers on Growth, Yield and Nutrient Uptake of Rice (*Oryza Sativa* L.)

Ajay Kumar Yadav[1*] and SS Sharma[2]

Reasearch Scholar[1], Assistant Professor[2], Depatment of Soil Science & Agricultural Chemistry,
Sri Karan Narendra Agriculure University, Jobner-303329
**Corresponding author : yadavajay68626@gmail.com*

Abstract

Rice (Oryza sativa) is a vital staple crop that plays a crucial role in global food security. To meet the increasing demand for rice production, farmers often utilize a combination of organic manure and inorganic fertilizers. This research investigated that the field experiment was laid out in Randomized Block Design with eleven treatments and replicated thrice. The rice variety **PB-1509** was transplanted in puddle soil. The important findings are the plant height in (cm), Number of tillers, Dry matter accumulation of rice and leaf area index of rice30, 60, 90 DAT at harvest stage was investigated in Treatment T_{11} (100% NPK + FYM + S + Zn) given the highest. The yield attributes like panicle length (cm), panicle weight (g), number of grain per panicle, grain weight per panicle and 1000 seed weight (g) was investigated in T_{11} (100% NPK + FYM + S + Zn) given the highest. The grain yield varied from 23.49 - 43.38 q ha^{-1}, Straw yield varied from 32.42 - 57.24 q ha^{-1}, the biological yield varied from 55.91 - 100.62 q ha^{-1}, the harvest index varied from 42.01 - 43.95 % and the maximum protein content in rice grain was recorded in the treatment combination T_{11} (100% NPK + FYM + S + Zn) gave the highest. The nitrogen content in grain ranged from 1.13 – 1.22 %, P content from 0.22 - 0.26 %, K from 0.31 – 0.41 %, sulphur content varied from 0.07- 0.19 kg ha^{-1} and Zinc varied from 15.35 - 22.37 ppm. The minimum and maximum was observed in the T_1 [Control] and T_{11} (100% NPK + FYM + S + Zn), respectively. The uptake values of nutrients in grain and straw increased due to concentration of these nutrients and biological yield of grain and straw. It was recorded that N uptake 26.54 – 52.92 kg ha^{-1}, P from 5.17 – 11.28 kg ha^{-1}, K from 7.28 - 17.79 kg ha^{-1}, S from 1.64 – 8.24 kg ha^{-1} and Zn from 36.06 – 97.04 g ha^{-1} in T_{11} (100% NPK + FYM + S + Zn). Studies have shown that the combined application of organic manure and inorganic fertilizers produces synergistic effects on rice growth and yield. The organic manure enhances soil structure, moisture retention, and microbial activity, thereby promoting root development and nutrient uptake. Inorganic fertilizers supplement these benefits by providing immediate nutrient availability to support vigorous vegetative growth, improved tillering, and increased grain formation. The combined application of organic manure and inorganic fertilizers offers substantial benefits for rice cultivation.

Keyword: Organic manure, Inorganic fertilizer, Grain Yield, straw yield, puddle soil

Productivity Enhancement of Rapeseed-Mustard Through Innovative Transplanting Technique in Assam

Har Vir Singh, Ashok Kumar Sharma*, Arun Kumar, Vinod Kumar and Pramod Kumar Rai
ICAR- Indian Institute of Rapeseed-Mustard Research, Bharatpur, Rajasthan 321 303, India
**Corresponding author : ashok.drmr@gmail.com*

Abstract

Field experiments were carried-out during winter season of 2022-23 at Bongaigaon and Dhubri districts of Assam to evaluate the yield attributes and yield performance of transplanted toria and mustard with broadcasted toria and mustard under ICAR-DRMR APART project. The experiments were laid down in randomized block design with five replications and four treatments, viz. transplanted toria (T_1), toria broadcasting (T_2), transplanted mustard (T_3) and mustard broadcasting (T_4). Results showed that transplanted toria recorded highest average plant height (90 cm), number of silique/plant (205.3), primary branches (4.25) and secondary branches (14) as compared to broadcasted sowing method of toria. Results also revealed that; transplanted mustard recorded highest plant height (205 cm), number of silique/plant (256), primary branches (6.10) and secondary branches (17.3) over mustard broadcasting method. Further results revealed that; the highest average seed yield were recorded in transplanted mustard (19.3 q/ha) and transplanted toria (13.9 q/ha) which were recorded around 67% and 49% more yield as compared to broadcasted mustard and toria in Assam. The highest additional net monetary return (32060 ¹ /ha) and benefit cost ratio (3.2) were also higher in transplanted mustard. From this study it can be concluded that; transplanting of mustard and toria could be beneficial for getting higher yield as well as additional net monetary returns in the Assam.

Keywords*: broadcasting, B:C ratio, mustard, plant height, toria, transplanting, yield*

Efficacy of Different Weed Control Measures in Cumin (*Cuminum cyminum* L.) at Different Dates of Sowing in Sandy Soils of Western Rajasthan

Anju Kanwar Khangarot
Assistant Professor, Department of Agronomy, Rajasthan Agricultural Research Institute, Durgapura, Jaipur, SKNAU, Jobner
**Corresponding author : anju.agro@sknau.ac.in*

Abstract

A field experiment was carried out to study the efficacy of different weed control measures in cumin **(***Cuminum cyminum* L.**)** at different dates of sowing in Rajasthan at Agricultural Research Farm, SKRAU, Bikaner during *Rabi* season of 2021-22 to 2022-23**.** The experiment comprising 28 treatment combinations; four sowing dates ***(***01 November, 15 November, 30 November and 30 December***)*** and seven weed management treatments ***(***Weedy check, Weed free, (HW at 30 and 45 DAS)Pendimethalin 1.0 kg ha^{-1} PE, Pendimethalin – 24 + Oxyfluorfen 500 g ha^{-1}PE, Flumioxazin 100 g ha^{-1}PE, Oxyfluorfen 50 g ha^{-1}PoE and Oxadiargyl 50 g ha^{-1}PoE***)*** in split plot design with three replications**.**

The results revealed that second date of sowing 15 November reported significantly lowest weed density, weed dry matter as well as lowest nutrient depletion by weeds in comparison to remaining date of sowing**.** However, with the delay in sowing upto15 December the density, dry matter and nutrient uptake by weeds had increased significantly**.** Sowing on 01 November ***(***D_1***)*** recorded maximum value for growth and yield attributes which was closely followed by D_2**:** 15 November and showed statistical similarity with 01 November**.** However, yield of cumin remained at par under D_1, D_2 and D_3**.** Nitrogen and phosphorus content of seed and stover were also reported maximum in first date of sowing ***i.e.*** 01 November which was at par with 15 November**.** Wherein, D_2 was also found at par with ***i.e.*** 30 November**.**The sowing date 01 November recorded significantly higher seed yield ***(***5**.**77 q ha^{-1}***)*** with net return of ¹ 1,47,246 ha^{-1} and B**:**C ratio of 3.32**.** It was at par with 15 November and 30 November**.**

Among weed control measures HW twice at 30 and 45 DAS brought about the maximum reduction in weed density, weed biomass production and nutrient depletion by weeds at all the growth stages of crop ascompared to other treatments**.** On pooled basis dry matter accumulation and other growth parameters, yield attributes, quality parameters significantly improved and also fetched maximum net returns (¹ 156756 ha^{-1}) in completely weed free treatment and closely followed by oxyfluorfen @ 50 g ha^{-1} and oxadiargyl @ 50 g ha^{-1}. But B: C ratio was recorded maximum in oxadiargyl @ 50 g ha^{-1} (3.36) followed by oxyfluorfen @ 50 g ha^{-1} (3.32) and these remained at par with weed free (3.21).

It is also reported that combined effect of first date of sowing i.e. 01st November with oxadiargyl @ 50 g ha^{-1} reported maximum B: C ratio (3.66) followed by 15th November with oxadiargyl @ 50 g ha^{-1}. It can be concluded that the cumin crop can be grown with least crop-weed competition and higher yield, quality and profitability till 30 November along with post emergence application of either oxyfluorfen @ 50 g ha^{-1} or oxadiargyl @ 50 g ha^{-1}.

Effects of Exogenously Applied Nanoparticles on Terminal Heat Stress in Indian Mustard

Ashika Ansari*[1], P. Bhasker[1], Anita Kumari[1], Ramavatar[2] and Vinod Goyal[1]
Department of Botany and Plant Physiology[1], CCS Haryana Agriculture University, Hisar-125004.
Oilseed Section, Department of Genetics & Plant Breeding[2], CCS Haryana Agriculture University, Hisar-125004.
**Corresponding author : goyal2973@gmail.com*

Abstract
Brassica juncea, also known as Indian mustard, is an important oilseed crop. The present investigation was conducted to evaluate the impact of nanoparticles on the morphological, physiological, and yield attributes of *Brassica* crops under late sown terminal heat stress conditions. The crop was sown under late sown conditions on 15th November 2023.Nanoparticles (Zn-NP's, S-NP's, Si-NP's &nanonitrogen) were applied exogenously at vegetative state (30 DAS) and flowering stage (60 DAS), on two genotypes (RH 1706 and RH 1975).The application of Zn-NP, Si-NP's, and Nanonitrogen (2 ml/L) improved photosynthetic rates by 30.57% with 1 ml/L Zn-NP in RH 1706 and 33.14% with Nanonitrogen in RH 1975. Antioxidant enzyme activities increased with the highest SOD activity observed with (48.83%) 2 ml/L Nanonitrogen in RH 1706 and the highest CAT activity (30.16%) with 1 ml/L Nanonitrogen in RH 1975, which indicates enhanced oxidative stress tolerance and improved physiological efficiency. Yield attributes showed significant improvements with nanparticle application, enhancing seed yield by 17.57% (1 ml/L Nanonitrogen) in RH 1706 and 16.92% in RH 1975. Among all nanoparticle treatments, Nanonitrogen (1 ml/L) performed best followed by Si-NP's (1ml/L) and Zn-NP (2ml/l), that resulted into enhanced photosynthetic rates and better source to sink strength. These findings suggest that nanoparticles improve crop resilience to terminal heat stress by enhancing physiological and antioxidant enzymes activity, which ultimately contributed to better yield.

Keywords: *Brassica juncea*, Heat stress, Nanoparticles, Yield

Enhancing Bael (*Aegle marmelos* Corr.) Fruit Yield and Quality : Mitigation of Fruit Cracking through Organic and Inorganic Nutrient Application and Mulching in Arid Environments

Anita Meena*, MK Jatav, Roop Chand Balai and SR Meena
ICAR-CIAH, Bikaner
**Corresponding author: anumeena5@gmail.com*

Abstract
The present study evaluated the effects of organic manures, chemical fertilizers, and theircombinations with mulching using black polythene on bael fruit production. Results showed significant increases in both yield and average fruit weight across all treatments. Organic manures outperformed chemical fertilizers in enhancing fruit production. The highest fruit yield (41.65 kg/plant) was achieved with the application of the recommended dose of NPK, 60kg FYM, and black polythene mulching, followed by 35.26 kg/plant from NPK, 60 kg FYM and crop residue mulching. Fruit yield increased with the rate of FYM application, with the greatest yield variation observed in treatments using 60 kg FYM and black polythene mulching,which optimized nutrient and moisture supply while reducing evaporation. The highest fruitset, retention, and minimum fruit drop were recorded with NPK + 60 kg FYM + blackpolythene mulching, closely followed by NPK + 60 kg FYM + crop residue mulching, both significantly outperforming other treatments. Leaf nutrient analysis revealed the highest foliar nitrogen content (1.90%) in plants treated with NPK + 60 kg FYM + black polythene mulching, correlating with the highest fruit yield. The highest phosphorus content (0.73%) was alsorecorded in this treatment. In contrast, control plants exhibited the lowest N, P, and K values(1.47%, 0.41%, and 1.12%, respectively). The highest fruit weight (1.98 kg) was observed inplants receiving NPK + 60 kg FYM + black polythene mulching, followed by those treated with 60 kg FYM and crop residue mulching (1.62 kg). Total Soluble Solids (TSS) content inthe fruit pulp was significantly higher in treated plants (47.15° Brix) compared to control plants(38.00° Brix). The study emphasizes the importance of balanced nutrient management and moisture conservation through the combined use of organic manures, inorganic fertilizers, andmulching to enhance bael fruit yield, quality, and overall crop sustainability.

Keywords: *Bael, fruit cracking, organic, inorganic, mulching*

Effect of Weed Management Practices on Yield Attributing Characters and Yield of Green Gram [*Vigna radiata* (L.) Wilczek] under Western Arid Region of Rajasthan

Varsha Jeetarwal*[1], SP Singh[2], Rahul[3] and Manisha Kumawat[4]
[1] *Department of Agronomy, SKRAU, Bikaner, Rajasthan, 334006*
[2] *Associate Professor, Department of Agronomy, SKRAU, Bikaner, Rajasthan, 334006*
[3,4] *Department of Agronomy, RARI, Durgapura, Rajasthan, 302018*
**Corresponding author: vjeetarwal27091999@gmail.com*

Abstract
A field experiment was conducted during *Kharif*, 2022 at Agronomy Farm, College of Agriculture, Bikaner. The experiment comprising 10 treatment combinations with three replications and was laid out in randomized block design with combination of Weedy check (control), Weed free, Pendimethalin @ 750 g ha^{-1} PE, Diclosulam 20 g ha^{-1} PE, Flumioxazin 75 g ha^{-1} PE, Pendimethalin + Imazethapyr (30+2) @ 800 g ha^{-1} PE, Imazethapyr @ 50 g ha^{-1} PoE, Quizalofop + Imazethapyr (7.5+15) @ 65 g ha^{-1} PoE, Imazethapayr + Imazamox (35+35) @ 50 g ha^{-1} PoE, Sodium Aceflurofen 16.5 + Clodinafop 8 @ 240 g ha^{-1} PoE. Maximum number of growth attributes, yield attributes i.e. pod plant^{-1} and seed pod^{-1} and quality attributes i.e. protein content and protein yield were recorded under weed free and Pendimethalin + Imazethapyr @ 800 g ha^{-1} PE which was significantly higher than weedy check and diclosulam 20 g ha^{-1} PE. The highest seed, straw and biological yield recorded under weed free treatment which was statistically at par to Pendimethalin + Imazethapyr @ 800 g ha^{-1} PE and Pendimethalin @ 750 g ha^{-1} PE, while significantly superior to rest of the weed management practices.

Keyword: *Kharif, pendimethalin, weed free, yield attributes, yield, weed management*

Appraisal of some soil physical properties and available micronutrients under organic and conventional farming systems in an Inceptisol

Priyanka Meena*[1], Manoj Shrivastava[1] and YS Shivay[2]
[1]*Division of Environmental Sciences, ICAR-Indian Agricultural Research Institute,New Delhi 110012, India*
[2]*Division of Agronomy, ICAR-Indian Agricultural Research Institute,New Delhi 110012, India*
Present address: ICAR-National Institute of Biotic Stress Management, Raipur493225, Chhattisgarh
**Corresponding author: priyankameena28@gmail.com*

Abstract
Globally, 98.9 million hectares worldwide were managed organicallyas of the end of 2023, a 2.6 percent increase from 2022. India has 4.5 million hectares under organic farming. Trace elements have an important role in plant and animal nutrition and their deficiencies and toxicities cause adverse effects on plant growth and animal health. There is a need to maintain optimal concentrations of micronutrients in soil and plant to the attainment of optimum economic yields of crops and animal productivity and welfare. A field study has been conductedto investigate the available micronutrients in different aggregates under organic and conventional farming practices. The field experiment was, thus, conductedat the Research Farm of the ICAR-Indian Agricultural Research Institute, New Delhi on sandy clay-loam soil starting from *Kharif* 2006 under the rice-wheat cropping system. The experiment was laid out in a Randomized Block Design with three replications and eight treatments. The treatments consisted of control (T1), farmyard manure (FYM@ 10 t/ha) applied to only rice (T2); FYM @ 10 t/ha applied to only wheat (T3); FYM @ 10 t/ha applied to rice and wheat (T4); *Sesbania*green manure (SGM) to rice and LGLM to wheat (T5); SGM + Blue Green Algae (BGA) and LGLM+ *Azotobacter* to wheat (T6); SGM + FYM to rice and LGLM + FYM to wheat (T7); and SGM + FYM + BGA to rice and LGLM + FYM + *Azotobacter* to wheat (T8).In this study, the effect of organic amendments was evaluated on physical soil properties *i.e*., different size aggregates and yield of the respective system by sampling the soil from three depths (0-15, 15-30, and 30-60 cm) for two seasons in rice and wheat (2019-2020 and 2020-2021). The results were found to be improved in T8 in the case of the yield of rice and wheat. Although the soil aggregate was significantly affected by organic amendments,however,the maximum Mean Weight Diameter (MWD) was observed in T8 followed by T7, T6, and T4 at the soil depthsof 0-15 cm. A similar trend was observed in the other depths also. The concentration of Zn, Mn, Fe, and Cu was found significantly higher in 0-15 cm soil depthas compared to other depths. Our results clearly indicated that the cumulative effect of GM + FYM + BGA leads to increased productivity,improvedsoil physical properties, and as well as micronutrient availability.

Keywords*: Aggregate, Inceptisol, Micronutrients, Organic farming*

Effect of Potassium and Stress Mitigating Chemicals on Yield Attributing Characters and Yield of Mungbean [*Vigna radiata* (L.) Wilczek]

Manisha Kumawat[1], LR Yadav[2] and Naveen Kumar[1]
Department of Agronomy[1], SKNAU, Jobner, Rajasthan, 303329
Professor[2], Department of Agronomy, SKNAU, Jobner, Rajasthan, 303329
**Corresponding author: manishakumawat21339@gmail.com*

Abstract
A field experiment was conducted at Agronomy Farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during *kharif* season, 2022 on mungbean [*Vigna radiata* (L.) Wilczek] grown on loamy sand soil. The experiment was laid out in Factorial Randomized Block Design with three replications and sixteen treatment combinations consisting of four levels of potassium (control, 20, 30 and 40 kg K_2O/ha) and four stress mitigating chemicals (control, KNO_3 @ 100 ppm, TGA @ 100 ppm and kinetin @ 50 ppm). Results indicated that application of 40 kg K_2O/ha significantly increased number of pods per plant, number of seeds per pod and test weight and showed significant superiority to control and other preceding levels of potassium. The significantly highest seed, straw and biological yield were also recorded under 40 kg K_2O/ha. Foliar application of stress mitigating chemicals also had a remarkable impact on yield attributing characters. Two foliar sprays of 100 ppm TGA being at par with kinetin recorded significantly the highest yield attributes *viz*., number of pods per plant, number of seeds per pod and test weight. The maximum seed, straw and biological yield were also obtained under TGA being at par with kinetin. Correlation coefficients were worked out between seed yield and number of pods/plant, number of seeds/pod and test weight. Results showed that the seed yield was significantly and positively correlated with number of pods/plant (r = 0.984), number of seeds/pod (r = 0.981) and test weight (r = 0.982).

Keywords*: Stress mitigating chemicals, TGA, kinetin, KNO_3, potassium, yield*

Effect of Integrated Nutrient Management on Yield, Yield Attributes, and Economics of Hybrid Maize in South Eastern Region of Rajasthan

Urmila Choudhary[1], Rajendra Kumar Yadav[2] and Vinod Kumar Yadav[1]
[1]M.Sc. Scholar, Deartment of soil science and Agricultural Chemistry, College of Agriculture, Agricultural University, kota (Rajasthan)-324001
[2]Agriculture Research Station, Agricultural University, Kota (Rajasthan)-324001
**Corresponding Author : .....*

Abstract
A field experiment entitled "Effect of Integrated nutrient management on soil health and productivity of hybrid maize" was conducted during the *Kharif*, 2023 at the Research Farm, Agricultural Research Station, Ummedganj-Kota, Rajasthan. The soil of experimental site was clay loam in texture, slightly in reaction and low in nitrogen to medium in phosphorus and potassium. The experiment comprised 10 treatment combinations: T1 - Absolute control, T2 - 100% RDF, T3 - STCR, T4 - 50% RDF + 50% FYM, T5 - 100% FYM, T6 - 50% RDF + 50% poultry manure, T7 - 100% poultry manure, T8 - 100% RDF + Biofertilizer (*Azotobacter* + PSB), T9 - 50% RDF + 50% FYM + Biofertilizer (*Azotobacter* + PSB), and T10 - 50% RDF + 50% PM + Biofertilizer (*Azotobacter* + PSB). The dose of nutrient based on RDF 90:30 NP kg per ha. The field experiment, consisting of ten treatments replicated three times, was laid out in a randomized block design using the maize hybrid variety PHM-3 as the test crop. The results revealed that the maximum no. of cob per plant (1.87), cob length (23.17 cm), cob width (4.73 cm), no. of grain per cob (451), test weight (242 g), grain yield (5963 kg per ha), stover yield (8984 kg per ha), harvest index (39.90 %) and B:C ratio were registered under application of fertilizer through the STCR (T3).

Keywords: *Nutrient Management, Biofertilizer, maize*

Impact of Different Fertility and Zinc Levels on Yield attributes and Yield of Okra [*Abelmoschus esculentus* (L.) Moench]

KK Sharma*, Madan Lal Jat, SS Sharma, Gajanand Jat, Chiranjeev Kumawat, Prerna Dogra and Kiran Doodhwal
Department of Soil Science & Agricultural Chemistry, S.K.N. College of Agriculture
(S.K.N Agricultural University, Jobner), Campus-Jobner.
**Corresponding authoremail: kksharma.soils@sknau.ac.in.*

Abstract

A field experiment was conducted to study the "Impact of Different Fertility and Zinc Levels on Yield attributes and Yield of Okra [*Abelmoschus esculentus* (L.) Moench]"during *kharif*season 2017 at Horticulture farm, S.K.N. College of Agriculture, Jobner. The experiment consisted of 16 treatment combinations with four fertility levels (control, 75% RDF, 100% RDF and 125% RDF) and four zinc levels (control, 10 kg ZnSO$_4$.7 H$_2$O ha^{-1}, 20 kg ZnSO$_4$.7 H$_2$O ha^{-1} and30 kg ZnSO$_4$.7 H$_2$O ha^{-1}) in Randomized Block Design with three replications.

Result indicated that application 100% RDFsignificantly increased the number of fruits per plant, Fruit weight, Fruit length, fruit yield per plant, fruit yield per plot, fruit yield per hectare,Fruit yield per pickingand netreturns of okra crop as compared to control, and other treatments. Result further indicated that application of 30 kg ZnSO$_4$. 7 H$_2$O ha^{-1}significantly enhanced thenumber of fruit per plant, Fruit weight, Fruit length,fruit yield per plant, fruit yield per plot, fruit yield per hectare, Fruit yield per pickingand netreturns of okra crop as compared to control, and other treatments. Application of 100% RDF with 30 kg ZnSO$_4$.7 H$_2$O ha^{-1} proved the best treatment combination in terms of,fruit yield per plant, per plot, per hectare and net return in comparison to other treatment combinations. However, the treatment 125% RDF and 30 kg ZnSO$_4$.7 H$_2$O ha^{-1} found at par to this treatment.

***Keywords**:Okra, RDF, RBD, fertility levels*

Biostimulants: As Source of Alleviation of Terminal Heat Stress in Indian Mustard (*Brassica Juncea* L.)

Banita Gawaria[1*], Ashika Ansari[1], KD Sharma[1], P Bhasker[1], Ramavatar[2] and Vinod Goyal[1]
Department of Botany and Plant Physiology[1], CCS HAU, Hisar-125004.
Oilseed Section, Department of Genetics & Plant Breeding[2], CCS HAU, Hisar-125004.
**Corresponding author:banitagawaria@gmail.com*

Abstract

Global climate change and global warming are significantly elevating concerns for the sustainability of crop productivity. The impact of elevated temperature at the reproductive stage of a crop is one of the critical limitations that influence crop growth and productivity globally. Biostimulants improve plant growth and ameliorate high temperature stresse by modifying plant physiological processes, antioxidant system and water use efficiency. Present study was conducted to investigate the effect of different biostimulants (Seaweed extract, OSA, Micronutrients, and thiourea) on morpho-physiological, and yield traits in RH 1424 variety of Indian mustard under late sown conditions during *rabi* season of 2023-24.

Biostimulants treatment significantly enhanced fresh and dry biomass of leaves and siliqua under late sown conditions. The biostimulant treatments also enhanced photosynthetic rate and transpiration rate by 31.9% and 79.1%, the treatment seaweed extract (5ml/L) performed better followed by micronutrients and other biostimulants. The results further revealed that correlating positively with the leaf biomasss, demonstrating that improved physiological processes facilitated better growth and improved yield. Biological yield and seed yield increased significantly due to increased plant biomass and 1000 seed weight under terminal heat stress with the application of biostimulants. Seed yield increased by 27.8% with the application of 5ml/L seaweed extract at par with 2ml/L of micronutrients. The findings of this study revealed that the treatment foliar application of seaweed extract (5ml/L) performed better over control plants morpho-physiological, and yield components under late sown conditions.

***Keywords:** Biostimulants, brassica, gaseous exchange, terminal heat*

Assessing Terminal Heat Tolerance In Diverse Genotypes of Indian Mustard (*Brassica juncea* L, Czern & Coss.)

Kartikeya Srivastava*, Richa Kumari and Rohit Kumar Verma
Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221005
**Corresponding author : kartikeya@bhu.ac.in*

Abstract
In the northern and eastern regions of India, mustard is typically sown after the paddy harvest. However, the sowing is often delayed due to the late harvesting of the *kharif* crop. As a C_3 plant, mustard is sensitive to high temperatures, and exposure to terminal heat stress negatively impacts its physiological processes and yield. To address this challenge, a study was conducted to evaluate 14 mustard genotypes, including 12 advanced lines and 2 check varieties, under two distinct sowing conditions: timely sowing and late sowing. The trial aimed to assess the effects of terminal heat stress and was carried out during the *Rabi* season of 2023-24 at the Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh. The evaluation focused on fifteen yield and yield-attributing traits alongside four physiological traits to understand the impact of terminal heat stress on the crop and identify genotypes with potential resilience. Analysis of variance revealed significant treatment variation for all the traits under studied, HUJM-23-10 out yielded from check for yield per plant under late sown condition. The experiment suggested that four of the mustard advance lines expressed high value for indices likes yield stability index, relative heat index, heat resistance index and yield potential score index, highlighting their superior performance and adaptability to heat stress conditions.

Keywords: *Terminal Heat Stress, Yield Stability Index, Relative Heat Index, Heat Resistance Index, Yield Potential Score Index*

Evaluating the Potential of Nano-Bio Formulations in the Sustainable Control of Red Spider Mites in Tea Gardens

Supriya Sonowal[1*], Shyamal Kumar Phukon[2], Milon Jyoti Konwar[3], Sarat Sekhar Bora[4]
[1]Department of Tea Husbandry and Technology, AAU, Jorhat, Assam
[2]Advisory Department, Tocklai Tea Research Institute, Jorhat, Assam
[3,4] Directorate of Research (Agriculture),AAU, Jorhat, Assam
**Corresponding author: supriya.sonowal@aau.ac.in*

Abstract
The investigation and field experiment were conducted in the Department of Tea Husbandry and Technology, Assam Agricultural University (AAU), Jorhat, Assam. To study the effect of combined formulation of Chitosan Nano particle and bio agent *M. anisoplae* against red spider mite of tea in field condition was applied at different doses 5 %, 7% and 10 % respectively and, three sprays of formulated product were done at 21 days intervals and records were taken at an interval of 3 days after spraying. Results showed that the highest per cent of mortality of red spider mite at fifth day after third spray was recorded from the treatment of *M. anisopliae* + Chitosan Nano particle (76.02%) at 10 ml/lit dose.

Keywords: *Tea, chitosan nano particle, m. anisoplae, red spider mite*

Effect of Different Weed Control Methods on Yield Attributing Characters and Yield of Clusterbean [*Cyamopsis tetragonoloba* (L.) Taub]

Rahul[1*], BR Meena[2], Varsha Jeetarwal[3] and Manisha Kumawat[4]
[1,4]Department of Agronomy, [2]Assistant Professor, Department of Agronomy, SKNAU, Jobner, Rajasthan-303329
[3] Department of Agronomy, RARI, Durgapura, Rajasthan-302018
**Corresponding author: rahulpalsaniya99@gmail.com*

Abstract
A field investigation was carried out at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during *kharif,* 2022 on loamy sand soil. The experiment was laid out in randomized block design with ten treatments and three replications. The ten treatments were as follows Pendimethalin @ 0.75 kg a.i./ha PE (T_1), Imazethapyr @ 100 g a.i./ha PoE (T_2), Quizalofop-ethyl @ 40 g a.i./ha PoE (T_3), Pendimethalin @ 0.75 kg a.i./ha PE + Imazethapyr @ 100 g a.i./ha PoE (T_4), Pendimethalin @ 0.75 kg a.i./ha PE + Quizalofop-ethyl @ 40 g a.i./ha PoE (T_5), Pendimethalin @ 0.75 kg a.i./ha PE + one hand weeding (T_6), Pendimethalin @ 0.75 kg a.i./ha PE + straw mulch @ 3 t/ha (T_7), Pendimethalin @ 0.75 kg a.i./ha PE + straw mulch @ 5 t/ha (T_8), weed-free (T_9) and weedy-check (T_{10}).The results showed that different weed control methods markedly reduced crop-weed competition and treatment Pendimethalin @ 0.75 kg a.i./ha PE + one hand weeding and Pendimethalin @ 0.75 kg a.i./ha PE + Imazethapyr @ 100 g a.i./ha PoE recorded higher yield attributing characters *viz.* seeds per pod, pods per plant, pod length and test weight of clusterbean and yield in clusterbean.

Keywords*: Clusterbean, pendimethalin, imazethapyr, kharif, weed control, yield attributing characters, yield*

CROP IMPROVEMENT

Stability Analysis and Genotype × Environment Interaction Assessment of Mustard Genotypes in West Bengal Using AMMI, GGE Biplot, BLUP and WAASBY Model

Achyuta Basak[1*], Suvendu K Roy[1], Archana N Rai[2] and Moumita Chakraborty[1]

[1]*Department of Genetics and Plant Breeding, Uttar BangaKrishiViswavidyalaya, Pundibari, Cooch Behar, West Bengal, India-736165*[2] *Nuclear Agriculture and Biotechnology Division, Bhabha Atomic Research Centre, Mumbai, India-400085.*

**Corresponding author: achyutabasak51@gmail.com*

Abstract

Thirteen mustard genotypes were evaluated across five agro-ecological environments in North Bengal, India, to assess genotype × environment interaction (GEI) effects on yield and stability. Multiple analytical approaches including AMMI, GGE biplot, BLUP and WAASBY were employed. The analysis revealed significant variations in crop yields due to genotypic differences, environmental conditions, and GEI. Genotypes TM-309-2 (G6) and TM-308-1 (G5) consistently demonstrated superior performance, combining high yield potential with stability across environments. Environment 4 (Manikchak, Malda) emerged as the most suitable location for genotype screening. Based on these findings, TM-309-2 and TM-308-1 are recommended for cultivation in specific regions and as potential parental lines in mustard breeding programs, given their proven stability and yield performance.

Keywords : G × E interaction, stability analysis, mustard genotypes, multi-environment trials (METs), yield

Introduction

Rapeseed and mustard are the largest edible oil source in India contributing ~32% of domestic edible oil production. To increase the production and productivity in West Bengal, early maturing varieties are required to fit into the cropping system. Keeping this in view, the present investigationwas carried out using 10 early maturity Trombay Mustard (TM) genotypes along with 3 checks were tested to assess GEI effects on yield and adaptability, aiming to identify superior genotypes. Several methods are utilized to analyse data from multi-environment trials (METs), classified into univariate and multivariate approaches. Among the latter, the AMMI model is critical, combining analysis of variance and principal components analysis. Recently, the weighted average of absolute scores (WAAS) index was introduced, incorporating all interaction principal components for a comprehensive biplot assessment. The GGE biplot model further aids breeders in evaluating genotype stability and yield across environments. Additionally, BLUP estimation and the WAASB index merge AMMI and BLUP advantages.

Methodology

The experimental trials were conducted across five distinct agro-ecological environments (E1= Pundibari, E2= Chopra, E3= Kharibari, E4= Manikchak, E5= Majhian) in the North Bengal region of West Bengal, India. Thirteen mustard genotypes (TM-301-3, TM-303-1, TM-305-1, TM-306-1, TM-308-1, TM-309-2, TM- 310-3, TM-312-1, TM-313, TM-316, PM-25, JD-6, B9) were evaluated using RBCD with three replications. The plot size was 3 x 2 m², with plant spacing maintained at 30 x 10 cm. Recommended agronomic practices were uniformly implemented across all experimental locations. Grain yield was recorded at physiological maturity and expressed in quintals per hectare (q.ha{ [1]). Bartlett's test of homogeneity revealed non-homogeneous error variances across locations. Consequently, a weighted least squares analysis was implemented, utilizing the reciprocal of root mean square errors through Aitken transformation for the combined analysis of variance. Statistical analyses were performed using the 'metan' package in R statistical software (version 4.4.2). Graphical representations and data visualization were generated using the 'ggplot2' package in the same environment.

Results and Discussion

Multiple analytical models were employed to assess stability and adaptability. The AMMI-1 analysis identified Environment 4 (Manikchak) and Genotypes G5, G6, G11, and G2 as exhibiting minimal environmental influence, indicating their stability. This was further corroborated by AMMI-2 analysis, where G6 and G5 were positioned proximally to the biplot origin, demonstrating high stability across environments. In the Y vs WAAS model, G6 and G5 demonstrated superior stability, being positioned in the fourth quadrant. The GGE biplot analysis revealed E4 has high representativeness and discriminative ability as it exhibited acute angles relative to the Average Environment Coordination (AEC) abscissa. The mean versus stability model analysis positioned G5 and G6 along the AEC abscissa with high yield means, confirming their stability. Best Linear Unbiased Prediction (BLUP) analysis indicated G9, G5, and G6 had the highest predicted yield values while maintaining stability.

Conclusions

To increase the production and productivity of the mustard cultivar, in addition to high yield, consistent performance of the genotypes is required over several environments. This study revealed significant yield variability among 13 mustard genotypes. Analysis of G × E interaction and stability using different models, demonstrated significant GEI effects.

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Genetic Validation of Molecular Markers Associated with Quality Traits in Recombinant Inbred Line (RIL) Population of *Brassica juncea* (L.)

Sushma Yadav[1,2], Arun Kumar[1], Anjana Goel[2] and Prashant Yadav[1]*
[1]*ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur, Rajasthan (3213030)*
[2]*GLA University, Mathura, Uttar Pradesh (281406)*
**Corresponding author: prashantnduat@gmail.com*

Abstract
A recombinant inbred line (RIL) population comprising 320 lines of Indian mustard (*Brassica juncea*), developed from a cross between the elite cultivar 'Giriraj' and the East European line 'Heera,' was characterized to validate molecular markers associated with key quality traits—glucosinolate and erucic acid content. Phenotypic evaluation of parental lines and RILs was conducted using UV-Vis spectrophotometry for total seed glucosinolate content and gas chromatography for erucic acid content. The parental genotypes were initially validated with SSR markers linked to low glucosinolate content (*GER*1/Q1 and *GER*5/Q5) and low erucic acid content (*FAE*1.1 and *FAE*1.2), which successfully amplified expected fragment sizes. Specifically, the SSR markers for the *FAE1.1* gene produced 381 bp and 399 bp fragments for the *FAE1.1* and *FAE1.2* markers, respectively, while the polymorphic markers linked to low glucosinolate traits amplified 650 bp and 310 bp fragments for the *Q1* and *Q5* markers, respectively. Genotypic analysis of the RIL population revealed a heterozygous banding pattern for markers associated with low glucosinolate and erucic acid traits. The total glucosinolate content among RILs ranged from 21.2 to 140.3 ìmol/g of defatted seed meal, whereas erucic acid content varied between 0.5% and 34%. These validated markers provide a reliable tool for mustard breeders to facilitate genetic improvement of oil quality through marker-assisted selection.

Keywords: Indian mustard, molecular markers, breeding for quality traits, marker-assisted selection

Introduction
Indian mustard (*Brassica juncea*) is one of the most commonly cultivated oilseed crops in India as well as around the world. The oil quality in mustard is largely dependent on glucosinolates and erucic acid. Glucosinolates at high concentrations cause a bitter taste, contribute to antinutritional effects, and high amounts of erucic acid lead to health hazards from cardiovascular issues to others [1]. Hence, breeding programs must develop varieties with reduced glucosinolate and erucic acid content to improve oil quality and acceptance among consumers. Marker-assisted selection (MAS) is a powerful tool in plant breeding which permits the accurate identification and selection of desired traits at the molecular level. SSR markers have been widely applied in practice due to high polymorphism and high reproducibility [2]. The present study is focused on validating SSR markers linked to low glucosinolate and erucic acid content in the Indian mustard recombinant inbred line (RIL) population, thus allowing their potential utilization in MAS for oil quality improvement.

Methodology
A recombinant inbred line (RIL) population consisting of 320 lines was developed from a cross between the elite Indian mustard cultivar 'Giriraj' and the East European line 'Heera.' The parental lines were selected based on their contrasting glucosinolate and erucic acid content. Total seed glucosinolate content was quantified using UV-Vis spectrophotometry, following the protocol described by Pushpa et al. [3]. Erucic acid content was determined through gas chromatography, as outlined by Bharti et al. [4]. Genomic DNA was extracted from young leaves of the parental lines and RILs using the cetyltrimethylammonium bromide (CTAB) method [5]. SSR markers previously reported to be linked to low glucosinolate (*GER*1/Q1 and *GER*5/Q5) and low erucic acid (*FAE*1.1 and *FAE*1.2) traits were selected for validation [3,4]. Polymerase chain reaction (PCR) amplification was performed, and the products were resolved on agarose gels to determine fragment sizes.

Results and Discussion
The SSR markers Q1 and Q5, linked to low glucosinolate content, amplified fragments of 650 bp and 310 bp, respectively, in the low-glucosinolate parent 'Heera.' Markers *FAE*1.1 and *FAE*1.2, associated with low erucic acid content, produced fragments of 381 bp and 399 bp, respectively, in 'Heera.' These fragment sizes are consistent with previous reports [3,4]. Genotyping of the RIL population revealed segregation of the SSR markers associated with low glucosinolate and erucic acid traits. A heterozygous banding pattern was observed, indicating the presence of both parental alleles in the population. The total glucosinolate content among RILs ranged from 21.2 to 140.3 ìmol/g of defatted seed meal, while erucic acid content varied between 0.5% and 34%. This variation reflects the genetic diversity within the population and the potential for selecting lines with desirable oil quality traits.

Conclusions
The successful validation of SSR markers linked to low glucosinolate and erucic acid content in the RIL population underscores their utility in marker-assisted selection for oil quality improvement in Indian mustard. The phenotypic variation observed among the RILs provides a valuable resource for breeders to select lines with optimal oil quality traits. The use of validated molecular markers accelerates the breeding process by allowing early selection of desirable traits, reducing reliance on phenotypic screening, and increasing selection efficiency.

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Revolutionizing Rhizospheric Microbial Studies with Omics Approaches for Sustainable Agriculture

Prashant Yadav*, Sushma Yadav, Arun Kumar, NR Bhardwaj and PK Rai
ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur, Rajasthan, India (3213030)
Corresponding Author : prashantnduat@gmail.com

Abstract
Rhizospheric microbial communities enhance crop productivity, plant health, and carbon sequestration through dynamic root-microbe interactions mediated by root exudates. These interactions influence nutrient acquisition, water uptake, metabolism, and stress tolerance. Traditional culturing methods capture only ~1% of soil microbes, limiting our understanding. Advances in next-generation sequencing, proteomics, transcriptomics, and metabolomics have revolutionized microbiome research, enabling comprehensive analysis of microbial structure, function, and dynamics. Multi-omics approaches provide insights into plant-microbe interactions, fostering sustainable agriculture by improving stress resilience and nutrient cycling. This abstract underscore the transformative role of omics-based techniques in deciphering rhizospheric microbial ecosystems and promoting agro-ecosystem sustainability.

Keywords: Rhizospheric microbiome, plant-microbe interactions, omics approaches, sustainable agriculture.

Introduction
The rhizosphere, a dynamic soil region influenced by plant roots, hosts a diverse microbial community crucial for plant growth and soil health. These microbes contribute to nutrient cycling, disease suppression, and stress tolerance, ultimately enhancing crop productivity. Root exudates, rich in organic compounds, shape microbial composition by modifying soil chemistry and fostering beneficial interactions. However, traditional culturing methods capture only a small fraction of soil microbes, limiting our understanding of their roles. Recent advancements in high-throughput sequencing and multi-omics technologies, such as metagenomics, transcriptomics, proteomics, and metabolomics, have revolutionized microbial research. These approaches provide deeper insights into microbial diversity and plant-microbe interactions, enabling the development of microbiome-based strategies for improving nutrient use efficiency, stress resilience, and sustainable agriculture.

Methodology
This review explores rhizospheric microbial communities using a multi-omics approach to understand their interactions with plant roots. For this type of study, Soil and root samples from diverse agroecosystems are analysed to capture microbial diversity. DNA extraction and next-generation sequencing (NGS) identify microbial taxa and functional genes, while transcriptomics examines gene expression in plant-microbe interactions. Proteomics and metabolomics, utilizing mass spectrometry and chromatography, reveal microbial proteins and metabolites involved in nutrient cycling and stress response. Advanced bioinformatics tools integrate multi-omics data, uncovering microbial networks and functional pathways. Statistical analyses, including principal component analysis (PCA) and correlation studies, identify key microbial taxa influencing plant growth. This review highlights the significance of omics-based approaches in unravelling rhizospheric microbiomes and their potential for microbiome-based solutions in sustainable agriculture.

Results and Discussion
Rhizospheric microbial communities play a vital role in plant health, nutrient cycling, and stress resilience (Berendsen et al., 2012). Root exudates shape microbial composition, fostering beneficial interactions that enhance crop productivity. Traditional culturing methods capture only ~1% of soil microbes, but multi-omics approaches, including metagenomics, transcriptomics, proteomics, and metabolomics, provide deeper insights into microbial structure and function (Mendes et al., 2013). Next-generation sequencing and computational tools have revolutionized microbiome research, enabling precise identification of microbial networks. Leveraging these insights can advance microbiome-based strategies to improve soil fertility, enhance stress tolerance, and optimize nutrient cycling, fostering resilient and sustainable agroecosystems.

Conclusions
Understanding rhizospheric microbial communities through multi-omics approaches offers new opportunities to enhance crop productivity, stress resilience, and nutrient cycling. By integrating advanced sequencing and computational tools, we can unlock the full potential of plant-microbe interactions for sustainable agriculture. These insights pave the way for microbiome-based strategies to improve soil health and agroecosystem sustainability.

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Deciphering Molecular Insights into Moth Bean Accessions [*Vignaaconitifolia*(Jacq.) Marechal] Under Semi-Arid Region of Gujarat

Jaishree Tanwar[1*] and Yonika Saini[2]
[1]*Department of Genetics and Plant Breeding, Agriculture University, Jodhpur, Rajasthan*
[2]*Department of Agronomy, Agriculture University, Kota, Rajasthan*
**Corresponding author: jaishreetanwar13@gmail.com*

Abstract
Moth bean, a drought and heat tolerant pulse crop grown in arid and semi-arid regions of India. The extent of genetic variability, correlation for seed yield and nine other attributes and molecular diversity using thirty-eight moth bean accessions was studied during *kharif*-2019 in randomized complete block design in four replicates. Polymorphic information content value of the microsatellites ranged from 0.23 to 0.57, while the heterozygosity value ranged from 0.26 to 0.64. The cluster diagram revealed a similarity index value ranged from 0.08 to 1.00 and genotypes were clustered in two main groups. Based on the results it could be concluded that, microsatellites are efficient in discriminating among the moth bean accessions and it showed narrow gene base of the accessions.

Keywords: *Moth bean, molecular study and microsatellites*

Introduction
Moth bean botanically *Vigna aconitifolia(*Jacq.*)* Marechal belongs to family fabaceae and subfamily papilionaceae. It is self-pollinated crop with diploid chromosome number (2n = 22) (Bairiganjan and Patnaik, 1989). It is excellent source of easily digestible protein with low flatulence and is consumed as 'dal', bean sprouts, noodles, green beans and boiled dry beans. Besides edible uses, moth bean is known as soil binder. Its dense mat like spreading behaviour of the canopy, completely covers the ground, therefore, reducing soil movement, which shields soil from heat, prevent cracking and crust formations which reduces moisture loss. Higher yield and nutritional factors is the ultimate criteria of any crop breeding programme, but it is very complex trait and influence by many component traits which show positive and negative effects on its expressions. Therefore, it is desirable to know the mutual relationship between various component traits on which selection can be made for improvement in the yield of the crop.

Methodology
Investigation was carried out at Pulses Research Station Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar. Genomic DNA (Doyle and Doyle, 1987) of thirty-eight genotypes were extracted and purity was checked by agarose gel electrophoresis. Spectrophotometry was performed at absorbance ratio 260/280 nm and a portion of DNA samples were diluted. PCR reactions for SSR were carried out in a reaction volume of 15 ìl and the amplification was programmed. The amplified products along with standard 100 bp DNA marker were separated by electrophoresis and visualized under gel documentation system. The SSR reproducible bands of DNA fragments were scored and the data matrix was read by NTSYS-pc version 2.20 and analysed by SIMQUAL program with Jaccard's similarity coefficient. (Jaccard, 1908). The resulted similarity matrix was entered into SAHN clustering program, a tree matrix was produced and dendrogram constructed using UPGMA.

Results and Discussion
Out of twenty-four primers twelve primers gave polymorphism with a mean of 2.25 alleles per locus. The amplified fragments ranged from 104 bp to 270 bp indicating presence of considerable amount of variation in the number of repeats between the different alleles. The PIC values of these SSR markers varied from 0.23 to 0.57 with an average of 0.36. The heterozygosity (H) value for the polymorphic SSR markers was ranged from 0.26 to 0.64, indicated the presence of low genetic diversity. Similarity index value ranged from 0.08 to 1.00, which indicates the presence of moderate amount of variation among all the genotypes. The highest similarity index value of 1.00 suggested that genotypes may have similar parentage in their ancestors. While, the least similarity index value of 0.08 was suggesting that they were divergent. Clustering pattern of dendrogram generated by pooled SSR data of thirty-eight genotypes constructed using UPGMA showed two major clusters A and B formed at a similarity coefficient of 0.28. The similarity coefficient was ranged from 0.28 to 0.98 which is an indicative of presence of moderate variation among the genotypes. Cluster A was divided into two sub clusters A1 and A2 and Cluster B was also divided into two sub-clusters B1 and B2.

Conclusions
SSR marker are highly effective in detecting the genetic diversity in moth bean and could be useful for further genetic analysis of the crop. Cluster A was grouped into four genotypes and remaining genotypes was clustered into cluster B indicating narrow genetic base of the crop due to highly self-pollinated nature of crop. Clustering pattern based on SSR marker data suggesting the presence of low genetic variation in the moth bean genotypes clustered in 'B' cluster. The observed result showed the presence of narrow genetic diversity in moth bean genotypes, that lays the emphasis on need to explore and exploit more number of genotypes to study diverse nature of the crop for genetic improvement.

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Stability Studies for Yield and Related Traits in Castor (*Ricinuscommunis*L.)

Versha Sharma[1*], Sita Ram Kumhar[1] and Ramesh[2]
[1]*Department of Genetics and Plant Breeding, College of Agriculture, Jodhpur, Agriculture University, Jodhpur*
[2]*Department of Genetics and Plant Breeding, Agricultural Research Station, Mandor, Agriculture University, Jodhpur*
**Corresponding author: vershasharma500@gmail.com*

Abstract
Castor (*Ricinus communis*L.) is a non-edible oilseed crop and development of superior cross combinations with high seed yield remained a prime objective for breeders. The experiment was conducted to study G x E interactions and stability parameters using 3 lines and 10 testers, their resultant 30 hybrids and one check (GCH-8) for seed yield and related component traits under 3 different environments. Hybrid MCP-1-1 x MP-35- 17 showed average stability for seed yield at 120, 150, 180 and 210 days after sowing, whereas MCP-1-1 x MP-39-17 exhibited average stability for oil content, ricinoleic acid content, seed yield at 120 and 210 days after sowing. Based on overall analysis, MCP-1-1 x MP-35-17 and MCP-1-1 x MP-39-17 was found promising in arid regions of Rajasthan.

Keywords: Castor, stability, G x E interaction, seed yield..

Introduction
Castor (*Ricinuscommunis*L.) is a non-edible oilseed crop, contains 45- 60% oil, primarily used for the manufacturing of soaps, lubricants and cosmetics; furthermore it also possesses significant medicinal value. Warm climate with low relative humidity considered suitable for oil production and quality seed production. Optimum rainfall of 300 mm and soil pH of 6 - 7.3 is congenial for castor production. However environment exerts significant impact on seed yield and oil content in castor (Patel *et al.,* 2016) [1]. High temperature (>38^{o}C) during growing period exerts negative impact on seed yield (Chakrabarty *et al.,* 2021) [2]. Therefore, assessment of genotypes and genotype and environment (G x E) interaction on expression of seed yield and attributing traits is essential for breeding. Hence, present experiment was conducted to estimate the G x E interaction in castor for seed yield and attributing traits.

Methodology
The experiment was conducted using 44 entries comprising of 30 hybrids, developed from 3 lines and 10 testers using line x tester and one check, GCH-8. The experiments were planted in randomized block design (RBD) with three replications in environments at two locations *i.e.* in *Kharif,* 2020 at ARS, Mandor, Jodhpur (E1); *Kharif,* 2021 at ARS, Mandor, Jodhpur (E2) and Instructional Farm, College of Agriculture, Jodhpur (E3).The crop in E1 was sown on 1st week of August (*Kharif,* 2020) and E2 on 4th week of August and E3 on 2nd week of September (*Kharif,* 2021).In the experiments, observations were recorded for 10 characters *viz.,* number of effective raceme per plant, effective primary raceme length (cm), number of capsules per primary raceme, 100-seed weight (g), seed yield (g/plant) at 120, 150, 180 and 210 days after sowing, oil content (%) and ricinoleicacid content (%).

Results and Discussion
Among 30 hybrids, MCP-1-1 x MP-27-17 exhibited average stability for seed yield at 180 and 210 days after sowing and oil content. MCP-1-1 x MP-39-17 showed average stability for seed yield at 120 and 210 days after sowing. Best hybrid for seed yield at 120, 150, 180 and 210 days after sowing was MCP-1-1 x MP-35-17, which showed average stability over all the three environments. In the above-mentioned hybrids female parent (line) MCP-1-1 expressed average stability for seed yield at 210 days after sowing over environments. The results for female parent (line) are in agreement with Manilal(2016) [3]. Thus these hybrids may be utilized for getting high seed production and their parents can also be used in future breeding programs.

Conclusions
In conclusion, the present experimental results indicated that stable hybrid for seed yield was MCP-1-1 x MP-35-17 and for oil content MCP-1-1 x MP-12-17. MCP-1-1 x MP-27-17 was found suitable hybrid for both seed yield and oil content, therefore, these hybrids and their parents can be promoted for further evaluation in arid regions of Rajasthan.

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SSR Marker and Morphological Trait-Based Genetic Diversity Assessment in *Mori* CMS Based Lines and Restorers in Indian Mustard

Rohitash Sharma[1,2*], VV Singh[1], Ved Prakash[2], Monika[1], and Prashant Yadav[1]
[1]*ICAR- Directorate of Rapeseed and Mustard Research, Bharatpur, Rajasthan*
[2]*SKN College of Agriculture, SKNAU, Jobner, Jaipur, Rajasthan*
**Corresponding author: way2rsharma@gmail.com*

Abstract
This study aimed to evaluate the genetic diversity among 15 genotypes of Indian mustard consisting of 10 Mori CMS lines and 5 restorer lines, using SSR markers and agro-morphological traits. Out of 87 SSR primers screened, 40 showed successful amplification. A total of ninety-five alleles were amplified, with an average of 2.38 alleles per locus. The major allele frequency ranged from 0.30 to 0.93, with an average of 0.63 per SSR locus. The polymorphism information content (PIC) values ranged from 0.12 to 0.67, averaging 0.40, indicating moderate discriminative power. Notably, six SSR markers exhibited PIC values greater than 0.50. Cluster analysis of SSR profiles grouped the 15 genotypes into four clusters, while morphological traits analyzed using Torchers method grouped the genotypes into four clusters.

Keywords: *Genetic diversity, Mori CMS, SSR marker, morphological traits, mahalanobis's D^2 statistics*

Introduction
Indian mustard (*Brassica juncea* L. Czern&Coss.), a vital oilseed crop in the Brassicaceae family, evolved through natural hybridization between *B. rapa* and *B. nigra* and subsequent chromosomal duplication. India ranks third globally in brassica oilseed acreage and production, with B. juncea dominating 75–80% of rapeseed-mustard cultivation. Despite its prominence, India's average productivity of 1511 kg/ha is significantly lower than global leaders, necessitating edible oil imports to meet 60% of domestic demand. Enhancing *B. juncea* yield and oil content through genetic interventions is critical to reducing import dependency. Genetic diversity, crucial for breeding and adaptation, can be assessed using morphological, biochemical, and molecular methods, with SSR markers favored for their reliability. This study evaluated genetic diversity among 15 genotypes, including 10 Mori CMS lines and 5 restorer lines, to identify diverse genotypes for heterosis breeding, aiding the development of superior crosses and broadening the genetic base for improved yield.

Methodology
The study evaluated 15 Indian mustard genotypes (10 *Mori* CMS-based lines and 5 restorers) obtained from ICAR-DRMR, Bharatpur. The genotypes were grown in a randomized block design with three replications during the Rabi 2023-24 season at ICAR-IIRMR, Bharatpur. Morphological data for 18 traits, including flowering, maturity, yield, and physiological parameters, were recorded to assess phenotypic variation and support breeding efforts. Genomic DNA was extracted from fresh leaves using the CTAB method and analyzed for quality. SSR genotyping was performed using 300 SSR markers covering all 18 linkage groups. PCR amplification was carried out in a BIO-RAD T100™ thermal cycler, and amplicons were resolved on 3.5% SFR agarose gels. SSR data were scored in binary format, analyzed using Power Marker v3.25, and clustered via UPGMA in NTSYS v2.0. Morphological divergence was assessed using Mahalanobis' D^2 statistics, and heterozygosity and PIC values were calculated for genetic diversity analysis.

Results and Discussion
The phenotypic divergence analysis grouped 15 mustard genotypes into four clusters**.** Cluster 1, the largest, contained 11 genotypes, indicating significant similarity**.** Clusters 2, 3, and 4 each had a single genotype, suggesting high heterogeneity**.** SSR marker analysis revealed 95 alleles across 40 primers, averaging 2**.**38 alleles per locus, with moderate polymorphism **(**PIC values 0**.**12–0**.**67, average 0**.**40**).** Gene diversity ranged from 0**.**12 to 0**.**72 **(**average 0**.**45**).** Six SSR markers with PIC > 0**.**50 effectively differentiated genotypes**.** Based on SSR diversity, the genotypes formed four clusters**:** Cluster 2 had nine genotypes, Cluster 1 had three, Cluster 3 had two CMS lines, and the most diverse CMS line, MJA 1, formed Cluster 4**.**

Conclusions
This study revealed considerable phenotypic and genotypic variation among the Indian mustard genotypes examined. Morphological characterization show different clusters than the molecular characterization. Cluster analysis revealed relatively more diversity at molecular level as compared to morphological level. So, there was no relation between morphological and molecular diversity. The significant presence of private alleles suggests that these accessions can be valuable sources of novel genes for mustard breeding programs. Cluster analysis identified distinct genetic groupings, indicating that hybridization between genotypes from different clusters could produce promising heterotic combinations.

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Combining Ability Studies for Seed Yield and Yield Contributing Characters in Indian Mustard

Vedanti H Bagade*, Sandeep Kamdi, Archana Rai and Arjun Verma
College of Agriculture, Nagpur
**Corresponding author: vedbagade123@gmail.com*

Abstract

The experimental material consisted 6 parents *viz.,* RLC-3, NUDH-18, NUDH YJ-6, PM-31, DRMRQ-1-5 and LES-39 which were crossed in full diallel fashion during the year 2021-2022 in *rabi* season. The crosses, checks Kranti and TAM 108-1 along with their parents were planted in randomized block design in three replications at research field of AICRP on Linseed and Mustard, College of Agriculture, Nagpur in Rabi 2022-2023. The parents, crosses and checks were grown in randomized block design replicated thrice and eleven observations were taken. The predictability ratio was found 0.25 for siliqua length to 0.86 for 1000 seed weight. Parents NUDH-18 and DRMRQ-1-5 were recorded as good general combiners for seed yield and its contributing characters. The best specific cross combinations for yield and its attributing traits were crosses PM-31 x NUDH-18, NUDH YJ-6 x NUDH-18, NUDH-18 x DRMRQ-1-5, DRMRQ-1-5 x LES-39 and NUDH-18 x LES-39. These crosses also recorded significant performance for seed yield plant^{-1} and some yield contributing characters. The presence of negative SCA/RCA effects for several yield components in the above crosses indicates the predominant role of additive gene action for yield components, which is a general situation observed in self-pollinated crop. These five crosses were select as a best crosses which can be forwarded to the subsequent generations.

Keywords:Mustard, specific combining ability, general combining ability, reciprocal combining ability, full diallel.

Introduction

Indian mustard is a significant oilseed crop in the Indian subcontinent. It is the country's second largest oilseed crop, accounting for roughly 26% of the country's edible oil production. Combining ability analysis is one of the powerful tools to test the value of parental lines to produce superior hybrids and valuable recombinants (Singh *et al*., 2013). The principle of combining ability contributes an important role in determining the existence of parents and the development of superior lines or hybrids. Therefore, the present investigation was undertaken with an objective to identify the potential F_1 crosses.

Methodology

The experimental material consisted 6 parents *viz.,* RLC-3, NUDH-18, NUDH YJ-6, PM-31, DRMRQ-1-5 and LES-39 which were crossed in full diallel fashion during the year 2021-2022 in *rabi* season. The 30 crosses, two checks (Kranti and TAM 108-1) along with their parents were planted in randomized block design in three replications at research field of AICRP on Linseed and Mustard, College of Agriculture, Nagpur in *rabi*2022-2023. Each genotype was grown in five rows with spacing 45 x 15 cm^2 for row to row and plant to plant respectively. Observations were recorded on 11 quantitative characters *viz.,* days to first flower, days to maturity, plant height, number of branches plant^{-1}, point to first siliqua, siliqua length, number of seeds siliqua^{-1}, number of siliquae plant^{-1}, siliqua density on main branch, 1000 seed weight and seed yield plant^{-1}. The combining ability analysis was carried out by Diallel method-1 and model-1 given by Griffing (1956).

Results and Discussion

Analysis of variance for combing ability studies reveal that themean sum of squares due to general combining ability were significant for all characters under study except days to first flower and siliqua length. The mean sum of squares due to specific combing ability was significant for ten traits except days to maturity and reciprocal combining ability were significant for the all characters except siliqua density on main branch. The range of predictability ratio was noted from 0.25 for siliqua length to 0.86 for 1000 seed weight. For all the characters studied except siliqua length the predictability ratio was greater than 0.50 but not closer to unity. The ratio of variance due to GCA and SCA was below one for all the characters under study were reported by Sapkal*et al.* (2023) which is in accordance with the present study. The two parents NUDH-18 and DRMRQ-1-5 were identified as good general combiners and can be used in crossing program for seed yield plant^{-1}. Earlier worker Meena *et al.* (2017) and Yadav *et al.* (2024) identified as good general combiners on the basis of significant GCA effects for yield and yield contributing characteristics which supported the present findings. On the basis of high mean performance, high GCA of one or both the parents involved in the cross and with negative SCA effects decided the potential of the cross to be forward in next generation. Based on above criteria, promising crosses are selected. Out of thirty crosses studied, the cross combinations PM-31 x NUDH-18, NUDH YJ-6 x NUDH-18, NUDH-18 x DRMRQ-1-5, DRMRQ-1-5 x LES-39 and NUDH-18 x LES-39 involved one of the parents with highly significant or non-significant positive GCA effect for yield plant^{-1} and some yield contributing characters. These crosses also recorded significant performance for seed yield plant^{-1} and some yield contributing characters**.**

Conclusions

The combining ability study concluded that the presence of negative SCA/RCA effects for several yield components in the selected five crosses indicates the predominant role of additive gene action for yield components, which is a general situation observed in self-pollinated crop. These five crosses were select as a best crosses which can be forwarded to the subsequent generations.

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Non-Targeted Metabolomics Unravel Bioactive Compounds of Fennel Genotypes

MK Mahatma*, RS Meena, Swetesh John, Mohit R Sharma and Kailashpati Tripathi
ICAR-National Research Centre on Seed Spices, Tabiji, Ajmer-305206, Rajasthan, India
**Corresponding author: maheshmahatma@gmail.com*

Abstract
This study aimed to investigate the metabolic diversity of 30 fennel genotypes using non-targeted GC-MS metabolomics. Two groups were analyzed: Ajmer fennel (AF) and other fennel (OF). A total of 98 metabolites were identified, classified into 14 groups. Multivariate analysis (PCA and OPLS-DA) revealed distinct metabolic profiles between AF and OF genotypes. AF genotypes exhibited higher levels of arabinofuranose, cinnamic acid, 13-octadecenal, serine, fenchyl acetate, isobutyric acid, and linolenic acid, while OF genotypes showed higher levels of tyrosine, alpha-D-glucopyranose, octanedioic acid, and pentitol. Essential oil analysis corroborated these findings, with AF genotypes demonstrating higher anethole content. This study highlights the significant metabolic divergence between AF and OF fennel genotypes, providing valuable insights into their phytochemical composition.

Keywords : *Bioactive compounds, essential oil, fennel, Metabolites, seeds*

Introduction
Fennel (*Foeniculumvulgare Mill.*), a member of the Apiaceae family, is a valuable medicinal and culinary herb. Its diverse phytochemical profile, including terpenoids, flavonoids, and coumarins, contributes to its numerous health benefits (Saxena *et al.*, 2023). Metabolomics provides a powerful tool for understanding the complex biochemical pathways and phenotypic variations within a species. By analyzing the unique fingerprint of small molecules produced by a cell under specific conditions, metabolomics can shed light on genotype-phenotype relationships, responses to environmental stimuli, and the underlying mechanisms of various biological processes. This study aims to employ non-targeted GC-MS-based metabolomics to comprehensively characterize the metabolic diversity within a collection of 30 fennel genotypes.

Methodology
Thirty fennel genotypes were taken for the study and divided into two groups: Ajmer fennel (AF) and other fennel (OF). Metabolites were from fennel seeds extracted using methanol:ethyl acetate (50:50,v/v) , derivatized with 100 µl each of methoxylamine hydrochloride and N-methyl-N-trimethylsilyl trifluoroacetamide (Mahatma et al., 2018). One-microliter of derivatized samples were.injected into a HP-5 MS capillary colum and analysed using Agilent make GC-MS. Data analysis involved multivariate statistical techniques, including PCA and OPLS-DA using Metaboanalyst6 online software (pang et al., 2024).

Results and Discussion
A total of 98 metabolites from fennel seed were identified using NIST library yand classified into 14 groups. Orthogonal partial least squares discriminant analysis (OPLS-DA) revealed distinct metabolic profiles between AF and OF genotypes. PLS-DA variable importance in projection (VIP) exhibited that AF genotypes had higher levels of arabinofuranose, cinnamic acid, 13-octadecenal, serine, fenchyl acetate, isobutyric acid, and linolenic acid (omega-3 fatty acid). In contrast, OF genotypes showed higher levels of tyrosine, alpha-D-glucopyranose, octanedioic acid, and pentitol. Essential oil (EO) analysis corroborated these findings, with AF genotypes demonstrating higher anethole content. These results suggest that AF and OF fennel genotypes exhibit significant metabolic divergence, likely influenced by genetic and environmental factors.

Conclusions
The findings highlight significant metabolic divergence between AF and OF genotypes, characterized by distinct profiles of key metabolites and EO constitents. These results have important implications for fennel breeding programs, quality control, and the development of novel functional foods and nutraceuticals.

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Mitigation Strategies for Terminal Heat Stress on Seed Yield in Chickpea (*Cicer arietinum* L.)

Jogendra Singh*and NK Gupta
Sri Karan Narendra Agriculture University, Jobner, Rajasthan
**Corresponding author: jogendra.pbg.rari@sknau.ac.in*

Abstract
A field experiment was conducted *rabi* 2020-21 to study the mitigation strategies to reduces the effects of terminal heat stress on seed yield and its quality in chickpea in a split-split plot design comprising three dates of sowing (main plot), eight mitigation treatments (sub plot), and three spray schedules (sub-sub plot). Results showed that a significant effect of date of sowing and heat mitigating treatments on all the traits were found while, effect of spray schedules was non-significant for some traits. However, all the interactions were non-significant for all the characters studied**.** Therefore, it is concluded that heat mitigation treatment [Salicylic acid @400 ppm] spray once at anthesis stage can be advocated as suitable strategy to improve the seed yield and its quality in chickpea under heat stress condition**.**

Keywords : Chickpea, terminal heat stress, mitigation treatments, seed yield

Introduction
Global warming has become a serious threat worldwide. High temperature is a major environmental factor limiting crop productivity. The mean global temperature of the earth is expected to increase by 1**.**5°C within the next two decades (IPCC, 2021). However, to meet the demand for food from the population of an expected 9 billion people in 2050, a 70% increase in food production is deemed necessary according to the Declaration of the World Summit on Food Security. This means that the yearly increases in production for the coming 40 years need to be 38 % higher than those achieved historically. Here, we provide an overview of research that aims with study the mitigation strategies to reduces the effects of terminal heat stress on seed yield in chickpea.

Methodology
A field experiment was conducted at Rajasthan Agricultural Research Institute, Durgapura, Jaipur during *rabi* 2020-21 to study the mitigation strategies to reduces the effects of terminal heat stress on seed yield and its quality in chickpea**.** Experiment was laid out in a split-split plot design comprising three dates of sowing *i.e.*,normal (D_1), late(D_2), and very late **(**D_3**)** as a main plot treatments; eight mitigation treatments *i.e.*,control (T_1), Salicylic acid @800 ppm (T_2), Salicylic acid @400 ppm (T_3), Ascorbic acid @10 ppm (T_4), KCl @1% (T_5), Thiourea @400 ppm (T_6), Cycocel @1000 ppm (T_7), KNO_3 @0.3% (T_8) as a sub plot treatments; and three spray schedule *i.e.*,at vegetative stage (S_1), at anthesis stage **(**S_2**)** and at both the stages (S_3) as sub-sub plot treatments.

Results and Discussion
Results showed that a significant effect of date of sowing (D) and heat mitigating treatments (T) on all the traits were observed under heat stress condition while, effect of spray schedules (S) was found non-significant for earliness traits, seeds per pod, 1000-seed weight and harvest index. However, all the interactions **(**D×T, D×S, T×S, and D×T×S**)** were non-significant for all the characters studied**.** Normal sowing had produced significantly higher seed yield (20.48 q ha^{-1}) than late sowing (15.66 q ha^{-1}) and very late sowing (8.89 q ha^{-1}). Heat mitigating treatment T_3 [Salicylic acid @400 ppm] (15.88 q ha^{-1}) were observed significantly higher seed yield than control (14.42 q ha^{-1}). Spray schedule [S_2] (15.08 q ha^{-1}) was produced significantly higher seed yield than [S_1] (14.66 q ha^{-1}) and statistically at par with [S_3] (15.30 q ha^{-1}) (Lakhani *et al.*, 2025; Debnath *et al.*, 2022).

Conclusions
Therefore, it is concluded that Salicylic acid @400 ppm spray once at anthesis stage can be advocated as suitable strategy for mitigating of heat stress by improving growth and yield attributing traits, which ultimately achieve higher yield in chickpea**.**

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Transgressive Segregation Analysis in F_3 Generation of Mungbean [*Vigna radiata* (L.) Wilczek]

AS Kharbas[1], BL Kumhar[2]*, SS Punia[3] and A Jaiswal[4]
[1, 4]*Deptt. of Genetics and Plant Breeding, SKN College of Agriculture (SKNAU) Jobner-303329, (Raj), India*
[2, 3]*Division of Genetics and Plant Breeding, Rajasthan Agricultural Research Institute (SKNAU), Durgapura-Jaipur, (Raj), India*
**Corresponding author: blkumhar.pbg@sknau.ac.in*

Abstract
The present investigation was carried out to estimate genetic variability and transgressive segregants among eight genotypes of mungbean for twelve characters. Transgressive segregants in desirable directions were observed for most of the studied characters. The highest proportion of transgressive segregants was recorded for chlorophyll content followed by plant height, number of seeds per pod, 100-seed weight, pod length, seed yield per plant, number of pods per plant, number of clusters per plant, number of pods per cluster and number of primary branches per plant. The most promising transgressive segregants *viz.*, plant No. 90 of LGG 4604 x ML 818, plant No. 8 of LGG 4604 x MH 2-15, plant no. 16 of LGG 4604 x RMG 975 and plant no. 89 of ML 818 x MH 2-15 were transgressed for seed yield per plant and other yield attributing characters.

Keywords : *mungbean, transgressive segregants, F_3 generation, genetic variability*

Introduction
India is the world's top producer, consumer, importer and exporter of pulses. Mungbean is widely cultivated in Asia, particularly in India, which ranks third in mungbean production after chickpea and pigeon pea. In 2021-22, India farmed mungbean on 51.3 lakh hectares, producing 30.9 lakh metric tonnes at 601 kg/ha (DES, 2023). Rajasthan leads in production, with 25.61 lakh hectares yielding 9.05 lakh tonnes at 354 kg/ha (DES, 2023). Mungbean's low productivity is due to cultivation on degraded lands, insufficient fertilizer use, disease and pest losses, and a lack of high-yielding, beneficial varieties and improved cultivation techniquesTransgressive segregants in the F_3 population, with high heritability and variability, aid in understanding yield traits and support population development and breeding programs.Research on transgressive segregation in mungbean enhances genetic diversity, crucial for crop improvement. It reveals genetic mechanisms of key traits, aiding breeders in developing resilient, high-yielding cultivars to address food security and nutritional needs.

Methodology
The experimental material used in the present investigation consisted of four F_3 generations of 4 crosses (LGG 4604 × ML 818, LGG 4604 × MH 2-15, LGG 4604 × RMG 975 and ML 818 × MH 2-15) along with their 4 parents *viz.,*LGG 4604, ML 818, RMG 975 and MH 2 -15. Four F_3s with their four parents were sown in a Randomized Block Design with three replications during *Kharif,* 2022. The F_3s were sown in five rows and parents in single row of 3-meter length. The observations were recorded on 40 best selected plants in each F_3 generation and on 10 randomly selected plants in each parent for all the characters (plant height (cm), number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, pod length (cm), number of seeds per pod, 100-seeds weight (g), chlorophyll content (SPAD) and seed yield per plant (g)) except day to 50% flowering and days to maturity. Analysis of variance was computed as per standard statistical procedure (Panse and Sukhatme, 1978).Transgressive segregants were estimated by calculating limiting value.

Results and Discussion
In F_3 generations, desirable transgressive segregants were observed in each of the four crosses for ten characters. The first rank appeared for eight characters in ML-818 x MH 2-15 and for two characters in LGG 4604 x RMG 975. This indicated that ML-818 x MH 2-15 was found to be promising among the four crosses for producing desirable transgressive segregants for yield and yield contributing characters. LGG 4604 x RMG 975 secured the second rank for most characters, indicating a relatively lesser number of transgressive segregants. LGG 4604 x ML 818 and LGG 4604 x MH 2-15 had relatively lesser number of transgressive segregants.The highest yielding transgressantsproduced 9.87, 9.97, 9.91 and 9.98 g seed yield per plant in LGG 4604 x ML 818, LGG 4604 x MH 2-15, LGG 4604 x RMG 975 and ML-818 x MH 2-15, respectively, whereas 6.43, 5.46, 5.46 and 6.43 g seed yield per plant produced by their respective increasing parents. The intensities for the 100-seed weight were 4.86 (LGG 4604 x ML 818), 4.69 (LGG 4604 x MH 2-15), 4.65 (LGG 4604 x The most promising transgressive segregants *viz.*, plant No. 90 of LGG 4604 x ML 818, plant No. 8 of LGG 4604 x MH 2-15, plant no. 16 of LGG 4604 x RMG 975 and plant no. 89 of ML 818 x MH 2-15 transgressed for seed yield per plant in addition to the higher expression of other characters than the increasing parent.

Conclusions
From the above-mentioned results of this research, it is concluded that the most promising transgressive segregants *viz.*, plant No. 90 of LGG 4604 x ML 818, plant No. 8 of LGG 4604 x MH 2-15, plant no. 16 of LGG 4604 x RMG 975 and plant no. 89 of ML 818 x MH 2-15 transgressed for seed yield per plant and other yield attributing characters like number of clusters per plant, number of pods per cluster, number of pods per plant, pod length and number of seeds per pod.

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Genetic Improvement of Crop Plants Using Mutation Breeding : Perspective & Current status

Archana N Rai*, Shankar Bhujbal and Archana Joshi
Saha NuclearAgriculture & Biotechnology Division Bhabha Atomic Research Centre, Trombay Mumbai -400055
Homi Bhabha National Institute, Anushaktinagar, Mumbai-400094
**Correspondingauthor: archana@barc.in*

Abstract
Crop improvement is a key route to ensure continued benefits arises from food and plant products. However, seed yield in most of the crop pants has reached to stagnation mainly due to narrow genetic base. Mutation breeding is an appropriate approach to fulfil the present plant breeding needs for sustainable crop yield enhancement through generation of wide range of variability in different qualitative and quantitative traits, which is utilized further in developing high yie1dinp• crop varieties. Present talk will highlight the current status of mutation breeding for the development of superior crop varieties through radiation research with special emphasis on the activities carried at Bhabha Atomic Research Centre for the development and exploitation of mutants in various crops. In addition. mustard crop improvement using induced mutagenesis will be discussed in details.

Keywords: *Mutation breeding, crop improvement, mutant, mustard*

Introduction
n India, 139.90 million ha was reported to be net some area to match the food demand of continuous increasing population under diminishing land and water resources and increasing abiotic and biotic stresses. Synergistic combination of crop improvement methodologies, crop production and crop protection would holistically contribute to agricultural research for achieving national food and nutritional security (Badigannavar et al., 2024). Crop improvement is a continuous process of development of improved varieties for which greater genetic variability of target traits is extremely crucial. Mutation breeding is the induction, isolation and stabilization of mutants for crop improvement and appropriate for the improvement in the crops having narrow genetic base. Mutation breeding starts with well-defined objectives for improvement of one or two traits in an adapted variety; to break the tight linkages between the traits in both seed and vegetatively propagated crops.

Methodology
The effective dose ideal for mutant induction has to be standardized for the selected variety in each crop by treating seeds with series of doses of mutagen. Later, seed germination and seedling growth data are subjected to Probit analysis to derive the LD 50 and GR 50 doses. The treated M1 seeds are sown in the fields to raise M1 plants. Seeds (M2) from the M1 plants are sown to raise M2 generation. Usually genetic mutants are identified from M2 generation onwards. In the subsequent generations, breeding behavior of the induced mutants is studied and is followed till the induced mutant becomes genetically stable. Sometimes, mutants are crossed with other mutant or variety to integrate the beneficial traits from both the parents. The stabilized mutants/derivatives are evaluated with the existing varieties over the locations and seasons for their yield superiority and adaptability in the trials.

Results and Discussion
Through mutation breeding 3460 mutant varieties in various plant species have been released worldwide (MVD, IAEA). Creation and fixation of DNA changes in different crop genomes through mutation breeding activities at BARC have resulted in the development 70 high yielding crop varieties with desired traits like higher yield, early maturity, seed color, disease and pest resistance, abiotic stress tolerance, large seed size, improved seed quality etc. In oilseed brassica, 39 mutant varieties have been developed globally. In Indian mustard, first yellow seed coat mutant in India, Trombay Mustard 1 (TM1) was developed by BARC. Besides, mutants for dwarf, early, appressed, non locular silique & other yield contributing traits have been developed. Use of these mutants has led to the development of nine high-yielding varieties for different state of India.

Conclusions
Mutation breeding is an important breakthrough in crop breeding as this technology have been used in 228 crop species, which utilizes the induced genetic variability for various morphological, biochemical, physiological, higher yield, nutritional value, disease resistance, and abiotic stress tolerance. Many mutants have made a worldwide impact on the yield of seeds propagated crops. As most of the mutant varieties are in cereals, pulses, and oilseeds crops and therefore has a direct impact on global food security. Mutant germplasms are now being utilized to identify the nature of mutations and causal genes which can be useful for targeted mutagenesis using gene editing.

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Estimation of General and Specific Combining Ability Effects of Parents and Crosses

Ramanand, Arjun Verma, Vedanti H. Bagade, Sandeep R. Kamdi and Vandana S Madke
College of Agriculture, Nagpur
**Corresponding author: ramanand192000@gmail.com*

Abstract
The experimental material consisted 13 and testers *(*TAM 108-1, Kranti and ACN-327, during *Rabi* 2022-23, 10 lines was crossed with 3 testers in line x tester mating design. In *Rabi* 2023-24, crossed seeds of 30 crosses along with 13 parents (10 lines and 3 testers, TAM 108-1 and Kranti was used as parents as well as checks) were planted in Randomized Block Design replicated thrice for evaluation at research field of AICRP on Linseed and Mustard, College of Agriculture, Nagpur. Analysis of variance for combining ability indicated that mean squares due to general combining ability were significant for all the twelve characters under study. The mean squares due to specific combining ability were significant for all the twelve characters. The predictability ratio ranged from 0.48 for days to 50% flowering to 0.82 for point to first siliqua. Based on the criteria, six crosses NUDH-YJ-6 x Kranti, PM-31 x ACN-237, DRMRQ 1-5 x TAM 108-1, NUDH-18 x ACN-237, Krishna x ACN-237 and RLC-3 x Kranti reported significant *per se* performance, useful heterosis and SCA effect for seed yield and positive significant SCA effect and significant useful heterosis.

Keywords: *Mustard, specific combining ability, general combining ability*

Introduction
The majority of mustard is self-pollinated, with honeybees facilitating 2–15% cross-pollination. It makes up over 13% of the edible oil produced worldwide. Even though farmers grow mustard from the last week of November to the second week of December, after the paddy harvest, it is still regarded as a minor crop in the eastern Vidarbha region. Delays in planting generally result in shrivelled seeds because they shorten the vegetative phase, speed up blooming, and decrease the seed development period. The productivity and output of Indian mustard are greatly increased by the application of heterosis, or hybrid Vigor. Investigations into heterosis aid in the selection of favourable crossings and offer crucial information regarding possible gene function. One intriguing method for getting over yield restrictions is heterosis breeding.

Methodology
The experiment material consisted 10 line viz*.,* (LES-39, DRMRQ 1-5, PM-31, NUDH-YJ-6, RLC-3, NUDH-18, Brijraj, Krishna, Narendra rai, Radhika) 3 tester *viz*., (TAM 108-1, Kranti and ACN-327) which were crossed during the rabi season of 2022–2023 in a line x tester arrangement. In *rabi* 2023–2024, the crosses and their parents were planted in 3 replications in a randomized block design at the Research field of AICRP (Linseed and Mustard), College of Agriculture, Nagpur. Twelve quantitative characteristics were observed *viz.,* days to 50% flowering, days to maturity, plant height, number of branches plant-1, point to first siliqua, siliqua length, number of seeds siliqua-1, number of siliquae plant-1, siliquae density on main branch, 1000 seed weight, seed yield plant-1 and oil content. The combining ability analysis was carried out following the methodology of Kempthorne (1957) with fixed effect model (model - 1).

Results and Discussion Analysis of variance for combining ability indicated that mean squares due to general combining ability were significant for all the twelve characters under study. This reveals that both GCA effects of parents and SCA effect of crosses to be considered for their exploitation to recover transgressive segregants. The present findings were in accordance with the results reported earlier by Kumar *et al.* (2016), Akabari *et al.* (2017) who also found predictability ratio close to unity. The estimations of GCA impacts among lines and testers demonstrated a broad range of importance for different traits. Among the lines, Brijraj had a highly significant positive GCA influence on the number of siliquae plant-1, plant height, siliqua length, point to first siliqua and seed yield plant-1. The cross combinations PM-31 x Kranti, NUDH-18 x Kranti, Narendra rai x Kranti, RLC-3 x ACN-237 and NUDH-YJ-6 x TAM 108-1 involved in parent with highly significant or non-significant positive GCA effect for yield plant-1 and some yield contributing characters.

Conclusions
High mean performance, significant useful heterosis in desirable direction and positive significant SCA effect were considered as the criteria for selecting potential crosses.

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Molecular Profiling of Black Turmeric (*Curcuma caesia* Roxb*)* Germplasm of Central India using Microsatellite Markers

Pramod Kumar[1], Radheshyam Sharma*[1], Shashank Bhargava[1], Aashish Kumar[2], Stuti Sharma[2], R. Shivram Krishnan[2], Asheesh Sharma[3] and Anubha Upadhyay[4]

[1]*Biotechnology Centre, Jawaharlal Nehru Krishi Vishwa Vidhyalya, Jabalpur, 482004, India.*
[2]*Depatment of Plant Breeding & Genetics, Jawaharlal Nehru Krishi Vishwa Vidhyalya, 482004, Jabalpur, India.*
[3]*College of Agriculture, Powarkheda, Jawaharlal Nehru Krishi Vishwa Vidhyalya, Jabalpur, 482004, India.*
[4]*Department of Plant Physiology, Jawaharlal Nehru Krishi Vishwa Vidhyalya, Jabalpur, 482004, India.*
**Corresponding author: radhebiotech88@gmail.com*

Abstract

Curcuma caesia Roxb, generally known as 'Black Turmeric, is an underutilized, medicinal plant species from the Zingiberaceae family, characterized by bluish-black rhizomes. This species is primarily found in northeast and central India and holds significant economic value due to its diverse medicinal properties. Presently, Black turmeric is classified as critically endangered species by NMPB, GoI, New Delhi. As a result, there is an urgent need to conserve this rare medicinally plant. Studies on genetic diversity of *C. caesia* Roxb are still in primitive stage for selecting the superior germplasm. During the present study, fifty-four black turmeric germplasms were collected from different part of central India, and genetic diversity was accessed using 110 species-specific SSR primers. Out of these, 97 primers successfully generated screenable alleles and were used for further study. A total 311 alleles were generated with an average of 3.20 alleles per primer. Among the 97 primers, 30 produced 100% polymorphism, with an average polymorphism rate of 54.90%. The PIC values were ranged from 0 to 0.97, with an average of 0.41 per primer. The maximum PIC value (0.97) was observed for the JHH-31 primer, while all the monomorphic primers had a PIC value of 0. Primer CuAI-18 showed the highest Marker Index (MI) and Effective Multiplex Ratio (EMR), averaging 19.16 and 24.68 per primer, respectively. The collected germplasm were classified into two genetically distinct cluster, with the major group further divided into five subgroups. The dendrogram illustrated the genetic distance between the germplasm. Based on Jaccard's coefficient analysis, the highest similarity coefficient (0.93) was observed between JCC-6 and JCC-8, while the lowest (0.50) was existed between JCC-35 and JCC-6. The observed intraspecific genetic variation may be associated with cultivation and targeted germplasm selection of desirable characters in *C. caesia*. These findings provide an initial understanding of the available germplasm in central India and can assist in the conservation efforts for this species.

Evaluation of Chickpea (*cicer arietinum L.*) Germplasm for Yield and Yield Attributing Traits

Surbhi Gour[1], GM Lal[2] and Aditya Mohan Maharishi[1]

[1]*M.Sc. Scholar, Department of Genetics and Plant Breeding, NAI, SHUATS, Prayagraj (Uttar Pradesh), India*
[2]*Professor, Department of Genetics and Plant Breeding, NAI, SHUATS, Prayagraj (Uttar Pradesh), India.*
**Corresponding Author : surbhi.gor@gmail.com*

Abstract

Chickpea (*Cicer arietinum* L.) is a major food crop, especially in tropical and subtropical climates (Fikre and Bekele 2019), and is classified as one of the world's ancient and most often cultivated legumes in the Fabaceae (Leguminosae) family (Ullah et al., 2020). It is a cool-season pulse crop (Zwart et al., 2019), and also known as Gram, Bengal gram or Chana in Hindi (as well as other names). Despite the fact that it is a diploid (2n=2x =16) and primarily self-pollinated crop, cross-pollination by insects does occur on occasion (Ahmad et al., 2005).The present investigation was carried out to assess the genetic variability parameters, correlation and path analysis in twenty four +1 chickpea genotypes for thirteen quantitative traits *Rabi* 2022 at Field Experimentation Centre, Department of Genetics and Plant Breeding, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Uttar Pradesh in Randomized Block Design replicated thrice. Analysis of variance for all characters revealed that treatment differences were highly significant under study at 1% level except for number of Genotype CSJ-512 depicted highest grain yield in the grown environment. The values of PCV were higher than GCV values for all the character, which indicated that environmental factors significantly influenced the seed yield. All the traits studied had higher heritability except for Days to 50% flowering. High heritability coupled with high genetic advance as per cent of mean was observed for plant no. of primary branches, no. of secondary branches no. of pods per plant, pod length, no. of seeds per pod, biological yield per plant, seed index and harvest index. Correlation and path coefficient studies suggest that selection based on characters plant height, days to maturity, no. of pods per plant, no. of seeds per pod, biological yield per plant, seed index and harvest index had positive correlation and direct effects with grain yield per plant. Therefore, it is concluded that effective selection must be attempted for these traits, which would help in improvement of seed yield in chickpea genotypes.

Keywords: *Variability, heritability, path coefficient, correlation*

"Barley: A Resilient and Versatile Crop for Global and Indian Agriculture"

SS Rajput and RR Choudhary
Sri Karan Narendra Agriculture University, Jobner 303329 Jaipur (Rajasthan)
**Corresponding author email:.....*

Abstract

Barley stands as one of the most widely cultivated cereal grains globally, with an estimated 145 million acres dedicated to its production each year. This makes it the fourth most grown cereal crop, following maize, rice, and wheat. Global barley production reaches approximately 150 million metric tons annually, with major producers including countries like Russia, Canada, France, and Germany, where the climate and soil conditions are highly favourable for its growth. Barley is primarily used for animal feed, malting (especially for brewing beer), and as a food grain in various regions worldwide.

In India, barley is grown across approximately 0.60 to 0.80 million hectares annually, yielding between 1.50 and 2.00 million metric tons. Though its acreage is significantly smaller compared to major crops like wheat or rice, barley remains an important crop in specific regions, especially in the northern states of Rajasthan, Uttar Pradesh, Madhya Pradesh, Punjab, and Haryana. The cooler climates of these areas are ideal for barley cultivation, and the crop plays an important role in crop rotation, which helps maintain soil fertility. Additionally, barley is valued for its use in food and fodder, with its nutritional benefits gaining increasing demand, especially in the brewing industry. Barley is also one of the few crops capable of thriving in India's semi-arid regions, particularly where soil salinity or insufficient water availability makes it difficult for other crops to grow.

Both globally and in India, barley's growing acreage and production are supported by its remarkable adaptability to diverse climates and environmental conditions. Its ability to withstand extreme weather stresses—such as cold, heat, and salinity—makes it a versatile and resilient crop. This adaptability is particularly valuable in the face of climate change, as it helps ensure a reliable supply of barley for various industries, including brewing, food production, and livestock feed.

One of barley's most distinguishing features is its cold tolerance. Unlike many other cereal crops, barley can endure low temperatures and even frost during its growing season, making it ideal for cultivation in regions with harsh winters or early spring frosts. This resilience allows barley to grow in northern latitudes and areas with unpredictable climates where many other crops would fail.

Barley is also highly heat-tolerant, a crucial trait in regions experiencing warmer temperatures or increasingly hot summers. Its ability to thrive in warmer climates—when managed with proper irrigation and soil moisture enables it to flourish even in areas where other crops might struggle due to heat stress.

Additionally, barley exhibits remarkable resistance to salinity, an issue that is becoming more prominent due to soil salinity from irrigation and climate change. As one of the few cereal grains capable of tolerating saline soils without a significant reduction in yield, barley provides a crucial solution in arid or semi-arid regions where water quality may be compromised. Its ability to grow in saline conditions makes barley an invaluable crop in areas where other crops would be unable to survive, further reinforcing its status as a globally significant and resilient agricultural product.

In summary, barley's combination of environmental adaptability, nutritional value, and multifaceted use in global and Indian agriculture makes it an indispensable crop. Its growing potential in the face of climate change underscores its importance, not only for food security but also for its role in various industries such as brewing, livestock feed, and health-conscious food products.

Genotypic Variability's on Flexibility of Growing Time, Yield and Duration of Toria Varieties TS-36, TS-38, TS-46 and TS-67 for Comparative Studies Under Timely and Late Sown Conditions in Assam

PK Deb Choudhury, PK Bordoloi, B Kalita, R Chakrabarty, RN Borkakati and HK Borah
AAU-Zonal Research Station, Shillongani-782002, Nagaon, Assam
**Corresponding author: binod.kalita@aau.ac.in*

Abstract

Recommended Toria cultivars (*Brassica rapa* L. var. *toria*), developed at Assam Agricultural University-Zonal Research Station, Shillongani, Nagaon, Assam were evaluated for genotypic variations on early harvest, growth duration, crop geometry and yield performances under rainfed situations in Assam. The crops were raised under different sowing conditions during 2021-22 to 2023-24. Considering the growth and yield attributes, timely sown TS 38 was found significantly superior for primary and secondary branches, number of siliquae per plant and high yield. While, TS 67 was found considerably higher in total seed productivity under late sown situations. Maximum cover of sowing period was observed in TS 46, followed by TS 36.

Keywords: *Toria, genotype, rapeseed-mustard, early maturing*

Genetic Architecture and Stability Analysis for Grain Yield and its Contributing Characters in Barley [*Hordeum vulgare* (*L.)]*

Shravan Kumar Sharma and AK Sharma
Department of Genetics and Plant Breeding, College of Agriculture , Bikaner-334006
**Corresponding author: sksharma.pbg@sknau.ac.in*

Abstract

The present experiment was under taken to study the Genetic Architecture and Stability Analysis for Grain Yield and its Contributing Characters in Barley [*Hordeum vulgare (L.*)]" in under three environments. Eight genetically different parents namely BH902, RD2904, RD2909, HUB242, UPB1059, DWR143, DWR137 and BH902 were considered diallel fashion excluding reciprocals during 2015-16. All the eight parents and F s were evaluated in a randomized block design with 3 replications under three different environments created by three different dates of sowing *(*15 November, 30 November and 15 December) during Rabi 2016-17. Significant differences among the parents on pooled basis as well as individual environment combining ability analysis indicated that GCA variances were significant on pooled as well as individual environmental basis for all the characters GCA X Environment were significant for all the attributes in all the environments. Based on perse performance and GCA effects, the parent RD2909, DWR143 and DWR137 in E1, DWR137, RD2909 and DWR143 in E2 while the parent DWR137, DWR143 and RD2909 in E3 environment showed presence of sufficient genetic variability. Significance of GCA for all the characters except GCA for number of tillers per plant in E3 and SCA for number of tillers per plant in E1 and E2 and spike area in E1 and E2 indicated the importance of both type of gene action. The mean sum of squares due to E + (G x E) and G x E (linear) were also found significantly for all the characters. Mean squares due to E (linear) were found significant (except number of spikelet's per spike and harvest index) for all the characters, revealed that environment differ from each other which satisfied the basic requirement of stability analysis. Joint consideration of mean performance and stability parameters indicated that genotypes viz., BH902 x DWR143, RD2904 x RD2909 and RD2904 x DWR137 were suitable for variable environmental conditions; while the DWR143 xDWR137 genotypes were suitable for better environmental conditions. Conclusively, it has been suggested that diallel selective mating, bi-parental mating and multiple cross could be useful breeding approached for developing of heat tolerant genotypes and further amelioration of grain yield can be achieved in Barley.

Elucidating Genetic Architecture and Marker-Trait Associations for Seed Weight and Oil Content in *Brassica juncea*

Mohit Sharma[1]*, Prashant Vasisth[1], Gokulan Dhanasekaran[1], Mohan Lal Meena[1], Omkar Maharudra Limbalkar[1], Bhaskar Chandra Sahoo1[2], Neeraj Kumar[3], Nanjundan Joghee[4], Rajendra Singh[1], Ram Avtar[3], Anshul Watts[5] and Naveen Singh[1]
[1]*Division of Genetics, Indian Council of Agricultural Research (ICAR)-Indian Agricultural Research Institute, New Delhi, India*
[2]*ICAR-Indian Institute of Agricultural Biotechnology, Ranchi, Jharkhand, India*
[3]*Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar, Haryana, India*
[4]*ICAR-Indian Agricultural Research Institute, Regional Station, Wellington, India*
[5]*ICAR-National Institute for Plant Biotechnology, New Delhi, India*
**Corresponding Author : mohitsharma.kv@gmail.com*

Abstract

Most of the released high-yielding hybrids of *B. juncea* have a low test weight (TSW) with no increment in oil content (OC), and, therefore, these hybrids have poor acceptance among the farmers in India. It is, thus, imperative to understand the genetic basis of these traits and deploy them in commercial hybrid breeding programs. Further, identifying underlying genes and associated markers will help in deploying them in indirect selection through molecular markers. For this purpose, a set of 15 diverse *B. juncea* genotypes with TSW and OC ranging from 1.32 to 8.26 g and 31.93 to 43.39%, respectively, was used to generate 210 hybrids following a full diallel mating scheme. Parents with bold seeds, viz., NPJ 253, RH 761, and EC 223389, were identified as good general combiners for both traits. Hybrids, NPJ 253 x EC 223389 and NPJ 253 x NPJ 161, were identified as promising using the Multi-trait Genotype-Ideotype Distance Index. Furthermore, a GWAS was conducted for both traits using a set of 152 *B. juncea* genotypes. This set was evaluated across the six distinct environments and genotyped by GBS, leading to the identification of 16 stable MTAs for TSW and three for OC. *In-silico* analysis revealed the presence of several candidate genes viz., *WRKY6*, *MYB67*, *AP2/ERF, AHK1, AP3, AIL 7, LRR, LEA, EDD1, ARF18, MKK2 and STK,* involved in the regulation of seed weight. Further, a few candidate genes, viz., *SWEET*, *acyl desaturase*, *AP2/ERF*, *glycosyl transferase* and *pyruvate decarboxylase,* were identified to regulate oil content. The material and insights from the study unveiled the schemes for deploying higher seed weight and improved oil content in *B. juncea* hybrids and cultivars.

Keywords: *B. juncea, inheritance, combining ability, hybrids, GWAS, MTA, seed weight, oil content*

Genetic Variability Analysis in Onion (*Allium cepa* L.)

Surbhi Singh[1*], KD Ameta[2], SK Bairwa[3], Uadal Singh[1], YK Sharma[1] and LN Bairwa[3]
[1]Deptt. of Horticulture, Rajasthan Agriculture Research Institute, [3]College of Horticulture, Durgapura, Jaipur-302018
[2]Deptt. of Horticulture, Rajasthan College of Agriculture, MPUAT, Udaipur-313001
Sri Karan Narendra Agriculture University, Jobner, Jaipur-303339, Rajasthan
**Corresponding author : surabhi.sinsinwar@gmail.com*

Abstract

Onion *(Allium cepa*L.*)* is the second most widely cultivated vegetable crop belonging to*Alliaceae* family. In India, it occupies an area of 1.64 million hectare with the production of 26.83 milliontonnes and productivity is 16.36 tonnes per ha (Anonymous, 2021).It has predominantly expansion as a food source and value addition for a range of meals, it can be eaten raw (salads) or cooked as well as in processed form *e.g.,* flakes.The study was conducted at open field of Hi-tech Unit, Department of Horticulture, Rajasthan College of Agriculture, Udaipur from June, 2023 to February, 2024 (24º 34' 50.0556'' N latitude, 73º 42' 19.8648'' E longitude). Twelve onionvarieties*viz.,* Bhima Super, Bhima Raj, Bhima Safed, Bhima Dark Red, BhimaShubhra, Bhima Red, N-241, Bhima Light Red, Agrifound Light Red, Baswant-780 and Desi Tejaswere planted with row-to-row distance of 30 cm and plant-to-plant distance of 10 cm in Randomized Block Design (RBD) with three replications.

Results revealed that phenotypic coefficient of variation were higher than corresponding genotypic coefficient of variation for all the traits studied and magnitude of various variability parameters were significantly differ among the genotypes studied. Highest heritability (98.95 %) has been reported in fresh weight of bulb, followed by dry weight of bulb (98.83 %) and neck diameter (96.64 %). Bhima Dark Red was best performing variety on the basis of yield per ha, followed by Bhima Super and Bhima Red by yielding 298.24, 279.64 and 266.84 q/ha, respectively.

Combining ability and heterosis studies for yield, grain iron and zinc content in pearl millet [*Pennisetumglaucum* (L.) R. Br.]

Shailesh Kumar Jain[1*], Sharwan Kumar Sharma[1], DK Gupta[2], Vikas Khandelwal[3], Rohit Kumar Sharma[1], Anuradha[1], Vaibhav Sharma[1], BL Dhaka[1] and SK Gupta[4]
Rajasthan Agricultural Research Institute (SKN Agriculture University), Durgapura, Jaipur, Rajasthan, India 302018
**Corresponding author email:.....*

Abstract

Pearl millet (*Pennisetumglaucum* L.) is a vital food crop in semi-arid regions of Asia and Africa. To enhance its iron (Fe) and zinc (Zn) content, a line × tester study was conducted at the Rajasthan Agricultural Research Institute, Durgapura, Jaipur, during Summer 2023 and *Kharif* 2023. The study revealed significant genetic diversity among parents and hybrids, particularly for Fe and Zn. The analysis of general combining ability (GCA) revealed significant differences among lines and testers across environments. Key general combiners for grain yield were P4 and P11, while P5, P11, P12, and P13 contributed significantly to fodder yield. For Fe and Zn enhancement, P1 and P3 emerged as effective combiners. Among 105 hybrids, 30 exhibited significantly positive specific combining ability (SCA) for grain yield, while four and five hybrids showed positive SCA for Fe and Zn, respectively. Notably, 89 hybrids displayed positive heterosis for grain yield. Fe content ranged from 20.83 to 83.50 ppm, with two hybrids showing significant positive heterosis, whereas Zn content varied from 20.00 to 57.17 ppm, with five hybrids performing well. Limited positive mid-parent and better-parent heterosis for Fe and Zn suggested heterosis has restricted potential for micronutrient improvement. The study underscores the need to incorporate Fe and Zn into parental lines for effective hybrid development. Hybrids P1 × P19 and P14×P18 were promising for micronutrient enhancement, supporting strategic breeding for yield, fodder and nutritional quality.

cDNA Synthesis And Gene Expression Profiling of Charcoal Rot Resistance in Soybean (Glycine max L.)

Vanshika Panjwani*, Keerti Tantwai and Sushma Nema
Biotechnology Centre, JNKVV, Jabalpur 482004, MP
**Corresponding author : vanshikapanjwani21@gmail.com*

Abstract

In molecular biology, cDNA (complementary DNA) synthesis is an essential step that allows RNA to be transformed into its matching DNA form. Because it enables researchers to examine mRNA levels, this procedure is essential for studying gene expression. This process has been simplified by the use of commercially available cDNA synthesis kits, which offer simplicity, effectiveness, and reproducibility. These kits usually use oligo(dT) primers or random hexamers to start the synthesis of cDNA after reverse transcriptase enzymes have converted RNA into cDNA. Following synthesis, the cDNA can be utilized for subsequent processes including sequencing, cloning, and quantitative PCR. Using these kits guarantees the production of high-quality cDNA with reduced contamination and enhanced sensitivity. The concepts, elements, and benefits of utilizing cDNA synthesis kits are covered in this abstract, along with the impact on gene expression analysis in charcoal rot resistance gene of soybean.

Keywords: *Gene Expression, Charcoal, synthesis*

Reaffirm the Validity Periods of Certified Seed of Field Crop Foxtail Millet (as per the IMSCS Regulations)

R. C. Meena*, Sunita Gupta, AK Meena, MR Yadav, Nitin Garg, Bhavya Mishra and Birbal bairwa
STR, RARI, Durgapura (S K N Agriculture University, Jobner)
**Corresponding author : meenarc2004@yahoo.co.in*

Abstract

The study aimed to evaluate the germination percentage and seedling performance of certified seed lots of Foxtail millet (Setaria italica) under laboratory conditions over a 12-month storage period, in alignment with the Indian Minimum Seed Certification Standards (IMSCS). Three varieties were tested: V_1 (DHFT 109-3), V_2 (Sia 3156, IIMR/2023/R/4), and V_3 (Sia 3156, IIMR/2023/R/6), using two types of storage bags: Jute and HDPE. Germination percentages and seedling characteristics, including seedling length, fresh seedling weight, dry seedling weight, Seedling Vigour Index I, and Seedling Vigour Index II, were recorded to assess seed viability and vigour over time. The initial germination percentage (0 months) was high, averaging 93.42% across all varieties. A gradual decline in germination was observed with prolonged storage, more prominently in Jute bags compared to HDPE bags. Germination percentages remained above 75% for 6 months in V_1 and V_2, and for 5 months in V_3, in both storage conditions. By the 12th month, all varieties exhibited germination below the IMSCS threshold of 75%, with values ranging from 63.75% to 70.50%, indicating significant viability loss after this period. Significant differences were observed among the varieties for seedling length, fresh seedling weight, dry seedling weight, Seedling Vigour Index I, and Seedling Vigour Index II, demonstrating the influence of varietal characteristics on seedling performance. HDPE bags provided slightly better conditions for maintaining seed vigour and viability compared to Jute bags. The results reaffirm that certified seeds of Foxtail millet maintain germination above the IMSCS-prescribed standard for a period of 8 to 9 months, depending on the variety and storage conditions. The findings emphasize the importance of proper storage practices and timely utilization of certified seeds to ensure optimal germination and seedling performance in compliance with IMSCS regulations.

Performance of Toria Variety TS-38 With Mustard Variety PM-27 in Golaghat District of Assam

TP Saikia[1], J Enghipi[2], AS Borah[3] , S Bhattacharjee[4] , J Phookon[5], DD Singha[6] , T Borbora[7] and PK Bordoloi[8]
[1-7]*AAU-Sugarcane, Medicinal & Aromatic Plants Research Station, Buralikson, Golaghat-785618, Assam*
[8]*AAU-Zonal Research Station, Shillongani, Nagaon-782002, Assam*
**Corresponding author: tulshi.p.saikia@aau.ac.in*

Abstract
The demonstration on Toria var. TS-38 and Mustard var. PM-27 was carried out in rabi season (2023-24) in four (4) different location of Golaghat District by Assam Agricultural University-Sugarcane, medicinal and aromatic plants research station, Buralikson, Assam with an objectives to evaluate the performance of toria variety TS-38 with mustard variety PM-27. The result revealed that toria variety TS-38 performed better than mustard variety PM-27 in respect of growth and yield attributing characters, yields and economic. The highest value of primary branches (9.73), No. of siliquae/plant (242.80), number of seeds/siliqua (16.52) and yield(9.00 qt/ha) was recorded in Toria var. TS-38 as compared to Mustard var. PM-27.

Keywords: *Rapeseed-mustard, toria, CFLD*

Introduction
Rapeseed-mustard is the third most important edible oilseed crops of the world after soybean and Oil palm. India ranked second in rapeseed-mustard production and major growing states are Rajasthan, Madhya Pradesh, Uttar Pradesh, Haryana, Punjab, West Bengal, Gujarat, Bihar and Assam occupies approximately 86.72% of total area which is 6.86 million hectares in the country and 89.53% of total production of 9.12 million tones (AICRP on R&M,2020-21). Assam ranked sixth in rapeseed-mustard crop producing states in the country. In Assam rapeseed-mustard is the principal oilseed crop, which contributes more than 92 per cent of the total oilseed area (2.86 lakh ha) and production (1.85 lakh tonnes) of the state during 2020-21. Though rapeseed-mustard is grown in substantial area in Assam, but productivity is very low (647 kg/ha).In Assamtraditional variety of rapeseed-mustard is mostly grown and under rainfed condition. Hence, the present study was undertaken to compare the yield performance of recommended varietiesof toria (TS-38) and mustard (PM-27) during rabi season on farmers field inGolaghat district of Assam.

Methodology (150 words)The study was carried out by AAU-Sugarcane, Medicinal and Aromatic Plant Research Station (Buralikson) Golaghat district , Assam under Cluster Front Line Demonstration (CFLD) on toria (variety TS-38) and Mustard (Var. PM-27) with recommended package of practices under rainfed conditions during rabi season of 2023-24 at four different location of Golaghat district, Assam viz. Merapani, Kobalpam, Uppertemara, Chawdangpathar under DRMR. Rapeseed and Mustard was sown as second crop after the harvest of rice during the fortnight of November. The soil of farmers field was sandy loam in texture, low in organic carbon, low in available N and K with medium P content and pH 5.1. Application of 40:35:15 kg/ha each of N, P2O5 and K2O along with 10 kg of borax was applied as basal.The selected farmers under the CFLD were guided by AAU-SMAPRS (Buralikson) scientists in performing field operations like land preparation, seed rate, sowing time, nutrient management, weed management, soil water management, plant protection, harvesting, threshing, storage, etc.

Results and Discussion
The mustard variety PM-27 recorded highest plant height as compared to toria (TS-38) at harvesting stage. It was recorded 167.50 cm in PM-27 as compared to 103.28 cm in TS-38; The toria variety TS-38 recorded highest number of primary branches as compared to mustard (PM-27). It was recorded 9.73 in TS-38 as compared to 7.00 in PM-27; Highest Number of siliquae/plant was 242.80 in TS-38 as compared to PM-27 (195.60); Highest Number of seeds/siliqua was 16.52 in TS-38 as compared to 13.80 in PM-27; Highest Yield was 9.00qt/ha in TS-38 as compared to 6.00qtl/ha in PM-27

Conclusions
Based on the study, it can conclude that the HYV of toria performed better than mustard variety in Assam condition under the Mega Project in each of the cluster.

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Pharmacological potential of Mutated Brassica juncea

Anubhuti Sharma[1*] and Poornima Sogarwal[2]
[1*] *ICAR-Indian Institute of Rapeseed-mustard Research, Bharatpur*
[2] *GLA University, Mathura*
**Corresponding author email:sharmaanubhuti98@gmail.com*

Abstract

Brassica junceais commonly known for nutraceutical properties of bioactive compounds including glycosides, flavonoids, phenolic compounds, sterols and triterpene alcohols, proteins and carbohydrates. The potential importance of such secondary metabolites of the plant as bioactive molecules and their therapeutically interesting pharmacological properties of seeds and greens has also been now often considered to be promising constituents and therefore often called a healthy Brassica. Mutation breeding is an effective way to generate rare variations in germplasm collections in a comparatively short time. The seeds of two low Erucic acid varieties were irradiated with different doses of gamma rays & treated in combination with different EMS concentrations with an aim to achieve the nutritional content of the mustard. The treated seeds were then grown for several generations. As, induced mutagenesis also brings about changes in the overall morphology of the plants, distinct morphological mutants were observed in the M4, M5 & M6 generations. Following is a brief account of the mutations recorded: Black seeds produced yellow seeded plants, both yellow seeded & black seeded siliqua were present in the same plant, colour variation of seeds from black to grey & light grey, light grey & yellow seeded siliqua in the same plant, white flower bearing plant, plant with whorl pattern of branching of siliqua, plants ranging up to 245cms to as low as 135cms in height & plants with big leaves.In the present study, investigation was up taken to collect the data of such morphological mutants and analyse the differences from the non mutated plants.

Keywords: *Brassica juncea, Gamma rays, EMS, Mutation breeding*

HORTICULTURE AND FLORICULTURE

Influence of Growth Parameters of Strawberry (*Fragaria* x *ananassa* Duch.) As Affected by Various Organic Inputs and Growing Conditions

Jahnabi Hazarika*, Pritom Kumar Borthakur[1], Raaj Kumar Kakoti[2] and Monuj Gogoi[3]
*[2, 3]*Citrus and Plantation Crops Research Station, Assam Agricultural University, Tinsukia*
Department of Horticulture, College of Agriculture, Assam Agricultural University, Jorhat
***Corresponding author :** jahnabi.hazarika@aau.ac.in*

Abstract
An experiment was conducted to evaluate the "Influence of organic inputs and growing conditions on plant growth parameters of strawberry (*Fragaria* x *ananassa* Duch.)" in the Experimental Farm of AAU, Jorhat during 2020-2021. Experiment was laid out in Factorial Randomized Block Design (RBD) with five treatments replicated three times under four different growing conditions with spacing of 30cm x 60cm. The growing conditions were rain shelter with insect proof net (S_1), rain shelter without insect proof net (S_2), net house (50% shade) i.e. S_3 and open condition (S_4). Treatments were FYM @ 180 g/plant (T_1), rock phosphate @ 4.50 g/plant + microbial consortium @ 0.063g/plant (T_2), T_2 + vermicompost @ 45 g/plant (T_3), T_2 + enrich compost @ 45 g/plant (T_4) and T_2 + poultry manure @ 45 g/plant (T_5). Out of 20 different treatment combinations, T_3S_1 was best in growth characteristics viz. plant height, plant spread, number of leaves, number of branches measured at 30, 60 and 90 days interval, leaf area, root length, dry root weight and also showed earliness in initiation of first flower bud, first flower in fruit set from the date of transplanting in Strawberry variety cv. Sweet Charlie.

Introduction
One of the most appealing, intriguing, tasty, revitalizing, and nourishing soft fruits in the Rosaceae family is the strawberry. The cultivated straweberry is a hybrid between two American strawberries, *Fragaria virginiana* and *Fragaria chileonsis*, having chromosome number 2n=2x=56. Strawberry is one of the most important temperate berry fruit, which can also be cultivated in subtropical and tropical regions. Organic manures viz. FYM, vermicompost, rock phosphate, enriched compost, press mud in combination with microbial consortium like improves the physical properties of soil and also prevent soil degradation and increase important beneficial micro organism population. Since strawberries have shallow roots, proper fertilizer control is necessary. Kumar *et al.* (2015) investigated the combined effects of organic manure and biofertlizers on strawberry plant growth and yield. They found that the treatment that received vermicompost, NPK, and Azotobacter had higher plant growth metrics. Growing strawberries in a polyhouse reduces the reliance of fruit quality on climate and soil conditions, and it also allows for better control of water, light, and temperature to some degree (Kumar and Ahad, 2012). Nowadays, the risk of producing strawberries in an open field is very high as they are highly susceptible to insects, pests, diseases, and weeds. Therefore, taking into account the aforementioned facts and the growing demand for organic farming and sustainable agriculture, the current study was conducted to assess the optimal growing conditions through organic cultivation that can impact strawberry growth characteristics.

Methodology
The investigation was conducted in the Experimental Farm of Assam Agricultural University, Jorhat during 2020-2021.The experiment was laid out in Factorial Randomized Block Design (RBD) with five treatments replicated three times under four different growing conditions with spacing of 30cm x 60cm. The four different growing conditions were rain shelter with insect proof net (S1) (top covered with 200 micron UV film and side wall of 40 mesh net), rain shelter without insect proof net (S2), net house (50% shade) i.e. S_3 and open condition (S_4). Treatments were FYM @ 180 g/plant (T_1), rock phosphate @ 4.50 g/plant + microbial consortium @ 0.063g/plant (T_2), T_2 + vermicompost @ 45 g/plant (T_3), T_2 + enrich compost @ 45 g/plant (T_4) and T_2 + poultry manure @ 45 g/plant (T_5). There were 20 different treatment combinations. Each treatment comprised of beds having 10 numbers of plants in each beds depending on spacing. The variety used for experiment was sweet Charlie. Just after planting of tissue cultured plantlets on 27th October 2020, light irrigation was given for the better establishment of the plants. According to the treatment schedule prescribed quantity of microbial consortium culture (*Rhizobium* +*Azotobacter* + *Azospirillum* + *PSB*) was mixed with recommended quantities of rock phosphate and applied to the respective treatment plots except for treatment T_1. Whereas vermicompost, enrich compost and poultry manure were directly applied to the corresponding treatment plots. After 25 days of planting, paddy straw was arranged on each bed in such a way it form a mulch layer of 3 cm thickness and all the branches are left above the layer. A measuring scale was used for measuring different plant parameters and measurements were taken at 30, 60 and 90 DAP from five representatives (tagged) plants. Fisher's method of analysis of variance in Randomized Block Design was used for the statistical analysis of the experimental data (Panse and Sukhatme, 1995).

Result and Discussion
Plant height was significantly affected by various growing conditions, treatments and combination of various treatment and growing conditions at 30, 60 and 90 DAP during the study. Among different treatment combinations T_3S_1 recorded highest plant height, plant spread, number of leaves, number of branches measured at 30,60 and 90 days after planting. Also it shows maximum leaf area (92.33 cm^2) at 90 DAP, root length (24.00 cm), dry root weight (4.87g) and also showed earliness in initiation of first flower bud (25.66 24.33days), first flower (42.33 days), fruit set (47.33 days) from date of transplanting of strawberry tissue culture plantlets. The increase in plant height may be due to improvement of physical properties of soil, higher nutrient

uptake and increased activity of microorganisms which were manifested in the form of enhanced growth and higher carbohydrates production (Yadav *et al.,* 2011a). Secondly, it could be because of continuous supply of available nutrients from organic form and effect of bio active substance produced by common application of microbial consortium.

Conclusion

This analysis has shown that growing strawberries using organic methods is a very profitable and healthful practice. The combination of treatments T_3S_1 was the best in terms of strawberry growth parameters of strawberry plants as affected by organic inputs as well as development circumstances, according to the findings of a two-year experiment.

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Evaluation of Pomegranate Propagules Against Biotic And Abiotic Stresses

Nirmal Kumar Meena*, Ladhu Ram, P. Bhatnagar, Yogendra Kumar Sharma and Hansa Kumawat

ICAR-AICRP on Arid Zone Fruits, Agriculture University, Kota

** Corresponding author : nirmalchf@gmail.com*

Abstract

Healthy and clean planting material is utmost and important factor in quality fruit production. Pomegranate cultivation is facing serious problems of climate change, diseases like bacterial blight, oily spot, fruit spot and rot, disorders like cracking, scald etc. Under the harsh soil conditions, the cultivation becomes very challenging. The present study aimed to evaluate different propagules (Hardwood cutting, air layering, tissue cultured and four rootstocks IC-118, IC-318706, IC-318707, IC-318712) of pomegranate since 2016. Based on the data, it was observed that Bhagwa scion grafted over IC-318707 (P3) exhibited higher plant height (2.97 m), plant spread E-W (2.99 m) & N-S (2.83 m). The fruits yield (10.56 kg/plant) was obtained higher in P3 (IC-318707) followed by P2 (9.35). The mortality of the plants was maximum (40%) in plants grafted on IC-118 (P1). All the fruits showed severe infestation of mite and infection of fruit spot and blight.

Keywords: *Rootstock, mortality, infection, rootstock, Bhagwa*

Effectiveness and Efficiency of Low Tunnel in Watermelon Cultivation in Alwar district of Rajasthan

PC Garhwal*[1], BL Ola[2], Sunil Kumar[3], SK Sharma[4] and PK Rai[5]

[1] SMS (Horticulture), [2]SMS (Agronomy), [3] SMS (Plant Pathology),

[4]Senior Scientist & Head, KVK (ICAR-IIRMR), Gunta, Bansur, Alwar-II, Rajasthan 301 402

[5] Director, ICAR-IIRMR, Sewar, Bharatpur, Rajasthan 321 303

**Corresponding Author : premhorti75@gmail.com*

Abstract

In India, watermelon grown in 122 thousand hectares area with production of 3521 thousand metric tonnes. In Rajasthan it grown in 3744 hectares with the production of 33383 metric tones. The waermelon grown in Alwar in 900 hectares area with production of 2392 metric tones (Source: Agriculture Statistics at a Glance, 2023). Farmers grown the watermelon through trench method widely in the region which is costly and laborious than low tunnel technique. So, Krishi Vigyan Kendra (ICAR-IIRMR), Gunta, Bansur, Alwar-II conducted method demonstrations on "Production of watermelon through mulching, drip Irrigation and low tunnels" in 4 hectare area by deciding 1 acre for each demonstration to 10 farmers in different villages of Bansur, Alwar, Rajasthan in Rabi 2023 and 2024, respectively. The average yield of demonstration of low tunnels in watermelon was 565.59 quintal/hectare, which was 9.69 per cent more than without low tunnels i.e. trench method watermelon cultivation gave 515.82 quintal/hectare fresh watermelon fruits. The cost of cultivation of watermelon with demonstration was Rs. 176718/hectare whereas check watermelon crop cost of cultivation was Rs. 209368/hectare. The method demonstration gave Rs. 618883 gross return/hectare, Rs. 442165 net profit/hectare and 3.50 benefit cost ratio whereas the check i.e. trench cultivation of watermelon gave Rs. 564088 gross return/hectare, Rs. 354720 net profit/hectare and 2.69 benefit cost ratio. The low tunnel cultivation profited Rs. 87445/hectare than trench cultivation in watermelon.

Keywords: *Low Tunnel, watermelon, alwar, rajasthan, demonstration*

Production and Consumption Pattern of Evergreen Organic Traditional Vegetables Grown in Hot Arid Regions of Western Rajasthan, India

SR Meena*, RC Balai, D Singh, BR Choudhary, M Kaur and Jagadish Rane
ICAR-Central Institute for Arid Horticulture, Bikaber- 334 006, Rajasthan, India
**Corresponding Author : srm.extn @ gmail.com*

Abstract

The hot arid zones of the country are spread over 32 million ha (0.32 million Sq.Km.) in the state of Rajasthan (61%), Gujarat (20%), Andhra Pradesh (7), Punjab (5%), Haryana (4%), Karanataka (3%) and Maharashtra(0.4%) which are characterized by hostile agro-climate and fragile eco-system. In Rajasthan, the hot arid regions covers 61% of the total geographical area of the sate falling in 12 district of whole western Rajasthan characterized by an annual rainfall between 100 – 500 mm with a coefficient of variation (CV) varying from 40-70 per cent. low and erratic rainfall combined with extremes of temperature (450-500 cal/cm^2/day); low relative humidity; high potential evapo-transpiration value ranging from 1600 mm - 1800 mm, the relative humidity (RH) is highest during monsoon season, hot and high wind velocity (25-35 Km/ hr) ; poor soil condition, the ground water is poor, brackish and saline in reaction etc. In such hard and hostile climatic condition, various evergreen vegetables are grown organically in natural system and used throughout the year in fresh as well as dehydrated form. To find the their production and use pattern, study conducted in hot arid region of western Rajasthan and the finding of the study revealed that the Khejri *(Prosopis cineraria* (L) Druce), Ker *(Capparis deciduas Edgew*), Khimp *(Leptadenia pyrotechnica* (Fork.) Decne), Drumstick (*Moringa oleifera* Lamk), Phog *(Calligonum polygonoides* L.), Lasoda *(Cordia myxa Roxb,* vegetable type cactus (*Opuntia ficus indica),* ber/boradi(*Zuzuphus spp),* etc., were the major evergreen traditional vegetables which are grown organically in natural system and used throughout the year in fresh as well as dehydrated/value added forms. They are mostly green tree or bush type in nature. They are mostly grow naturally or grown by some the farmers also using their own traditional practices. The farmers grow them using their own traditional methods and not use any chemical fertilizers and pesticides. The parts/organs of these vegetables like tender / immature pods, fruits, flower buds, leaf pads/nopales/cladodes, etc are consumed as vegetable. These vegetables are consumed by 54 - 92 % farmers/local people of the hot arid regions in fresh as well as in dehydrated form or in different value added forms. The local people of the hot arid regions have a lot of experiences and ancestral knowledge through which they prepare various value added products arid fruits and vegetables for earning money and for their own consumption in future. These vegetables are organic in nature, healthy and have very good nutritional as well as medicinal value as responded by farmers/local people during the study.

Keywords: *Khejri, drumstick, lasoda*

Effect of Soil, Foliar and Combined Application of L-Tryptophan and L-Glutamic Acid of Yield andQuality of Carrot (Daucus carota L) under Subtropical Conditions of Srinagar Garhwal

Gulab Kumawat[1*] , KN Shah[2], Vivek singh[2] and LN Bairwa[1]
1 Department of Horticulture, Rajasthan Agricultural Research Institute, Durgapura, Jaipur
2 Department of Horticulture, Hemvati Nandan Bahuguna Garhwal University, Srinagar, Uttarakhand
**Corresponding author : kumawatgulabchand940@gmail.com*

Abstract

Carrot (Daucus carota L.) 2n=18, a member of family Umbelliferae Most probably it was originated from Mediterranean region. The experiment was carried out to study "Effect of Soil, Foliar and Combined Application of L-Tryptophan and L-Glutamic Acid of Yield and Quality of Carrot (Daucus carota L) under Subtropical Conditions of Srinagar Garhwal" conducted during winter season, 2023-24 at Horticultural Research Centre Department of Horticulture, Chauras Campus, H.N.B Garhwal University (A Central University), Srinagar (Garhwal), Uttarakhand (India). The experiment was carried out with three major objectives i.e., To find out the effect of soil and foliar application of L-tryptophan and L-glutamic acid on growth, yield & quality of carrot. To assess the combined influence of soil and foliar application of L-tryptophan and L-glutamic acid on growth, yield & quality of carrot. To determine the effect of soil, foliar & combined application of L-tryptophan and L-glutamic acid on growth, yield & quality of carrot on different varieties. The experiment was laid out in factorial randomized block design with three replications having 24 treatments. During the experiment 17 different growth, yield and quality parameters were recorded. The result of analysis of variance revealed that the mean sum of square due to treatment were significant at 5% level for all of the characters studied. The result of the present investigation revealed that, the treatment V2A3M3 (Pusa Rudhira + L-Tryptophan + L-glutamic acid +(Soil application@ 2.5mg +20 mg) +(foliar application @25ppm +200ppm) was rated best for the characters like plant height at 60 DAS, 75 das, 90 DAS and at harvest and NO. of leaves. On the other hand, the treatment V1A3M3 (Nantes + LTryptophan + L-glutamic acid +(Soil application @ 2.5 mg+20 mg) +(foliar application @25ppm +200ppm) showed the best result with respect to total soluble solid, total sugar content, ascorbic acid content, beta-carotene, vitamin-A, and yield per plot and yield per hectare.

Keywords: *Carrot, Tryptophan, Glutamic and Yield*

Effect of Foliar Application of Sea Weed Extract on Growth, Yield and Quality of Potato (*Solanum tuberosum* L.)

Hemant Kumar Meena[1*] and Pushpa Choudhary[2]

[1]*Department of Horticulture (Vegetable Science)Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya,Gwalior, M.P.*

[2] *Department of Horticulture (Vegetable Science) K.L.S. College of Horticulture and Research Station, Rajnandgaon C.G.*

**Corresponding author: hk656857@gmail.com*

Abstract

The experiment involved the application of various organic nutrient sources, including seaweed extract along with conventional chemical fertilization. Parameters such as plant growth (height, leaf area, stem growth), yield components (tuber size, number, and weight), and quality aspects (tuber firmness, sugar content, and starch percentage) were measured. Results indicated that organic nutrient management practices significantly improved the growth and yield of Kufri Chipsona-1 compared to the control, with seaweed extract treatments showing superior performance. In terms of quality, organic treatments enhanced the nutritional value, with better starch content and reduced sugar accumulation in tubers, contributing to higher consumer acceptance. The study demonstrates that organic nutrient management not only enhances the growth and yield of Kufri Chipsona-1 but also improves the quality of the tubers, thereby supporting sustainable potato farming and promoting environmental health.

Keywords : *Potato,Seaweedextract,Growth,Yield and quality*

PLANT PROTECTION

Field-Evolved Resistance and Mechanisms in *Bemisia Tabaci* Asia I to a Novel Pyropene Insecticide, Afidopyropen, in India

Debashis Roy[1*], Durga Mahalanobish[2] and Subhramalya Dutta[3]
Dhaanya Ganga Krishi Vigyan Kendra[1], Ramakrishna Mission Vivekananda Educational & Research Institute, Murshidabad, West Bengal, Department of Agricultural Entomology[2], Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal Agricultural Technology Application Research Institute[3], Salt Lake, Kolkata, West Bengal
**Corresponding author: debashisroy915@gmail.com*

Abstract
The cotton whitefly, *Bemisia tabaci* is a devastating polyphagous insect pest worldwide and is resistant to most insecticide classes. This study aimed to evaluate the susceptibility of *B. tabaci* Asia I from ten provinces of India to a newly commercialized insecticide afidopyropen and other novel molecules. Most field strains were susceptible to afidopyropen, however, four field populations exhibited moderate resistance levels, but no cross-resistance to cyantraniliprole and pymetrozine. Diethyl maleate and piperonyl butoxide significantly restored the susceptibility of field-resistant *B. tabaci* strains to afidopyropen. The elevated activities of P450 monooxygenase and over expression of candidate genes were observed in the resistant population. The knockdown of the upregulated *CYP6DW3* gene by RNA interference increased the afidopyropen toxicity against *B. tabaci*suggesting a potential risk of afidopyropen resistance development.

Keywords: *Whitefly, insecticide toxicity, cross-resistance, metabolic detoxification, P450 gene, RNAi.*

Introduction
The silverleaf whitefly, *Bemisia tabaci* Gennadius (Hemiptera: Aleyrodidae), is a major polyphagous pest worldwide on several agricultural and horticultural crops. Concerns about the evolution of insecticide resistance underline the need for insecticides with novel modes of action with unique target sites [1].Afidopyropen interacts with chordotonal stretch receptor neurons in insects, which serve as mechanosensory functions by detecting articulatory movements, and cause insect death via starvation and desiccation [2].Monitoring susceptibility in different field populations of a target pest to a newly recommended insecticide is critical, even before widespread application. However, no information is available on the toxicity of *B. tabaci* biotypes in Indian field populations to afidopyropen to date. The present study aimed to evaluate the baseline susceptibilityof *B. tabaci*field strains to afidopyropenand cross-resistance with the potential resistance mechanisms and expression of detoxification-related genes.

Methodology
From September 2020 to July 2021, seventeen field populations of *B. tabaci* were collected from ten Indian provinces across nine different agro-climatic zones in India. The insecticide-susceptible reference strain (Lab-WB) was generated using the single-pair cross technique in 2016.Commercial formulations of the tested insecticides were used in the bioassay. The adult leaf-dip method was used using cotton leaf discs through serially diluted stock solutions with 30-40 randomly selected *B. tabaci* adults per concentration at a temperature of 26 ± 2 p C, 60 ± 5% RH, and a photoperiod of 16:8 h light: dark, and mortality was recorded after 48 h. The P450, GST, and esterase activities were measured using 7-ethoxycoumarin O-deethylase, 1-chloro-2, 4-dinitrobenzene, and á-Naphthyl acetate as substrates. LC_{50} values were estimated by Probit analysis using PoloPlus 2.0 software, andmetabolic enzymes were compared with one-way ANOVA and Tukey's HSD in SPSS.

Results and Discussion
The present data revealed moderate levels of afidopyropen resistance (19.09 to 35.27-fold) in four field populations of *B. tabaci*, indicating potential risks for continuous use of this insecticide without scientific knowledge. No evidence of cross-resistance to afidopyropen with cyantraniliprole and pymetrozine was observed in *B. tabaci*, however, a low level of cross-resistance (23.75-fold) between pymetrozine and thiamethoxam might be attributable to similar detoxification mechanism or over expression of P450 gene.Higher activities of P450 (2.00-2.77-fold) were observed in the field-resistant strains of *B. tabaci*, and the corresponding candidate *CYP6DW3* gene was overexpressed (2.36-fold) in the afidopyropen-resistant strain. Silencing of *CYP6DW3* through RNAi restored the susceptibility (75.3%) of *B. tabaci* to afidopyropen and confirmed its involvement in metabolic resistance.

Conclusions
The variation in susceptibility of *B. tabaci* field populations, on the other hand, raises the possibility of resistance evolution to afidopyropen. Therefore, rotation of afidopyropen with the chemical classes that lack cross-resistance could be a potential resistance management strategy for effective control of *B. tabaci.* Current results indicate that the P450 enzyme and *CYP6DW3* might play a pivotal role in the development of afidopyropen resistance in *B. tabaci*, however, inheritance pattern and amino acid substitutionin afidopyropen resistance are required to be expatiated. Our study creates the benchmark for generating afidopyropen resistance management strategies against *B. tabaci* in the future.

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Actinobacteria of Semi and Deep-Water Rice Ecosystems of Assam to Manage Rice Sheath Blight and Bacterial Leaf Blight Disease

Nripen Kumar Gogoi*, Prabal Saikia and Bibha Ozah
AAU-Zonal Research Station, Assam Agricultural University, North Lakhimpur, Assam
**Corresponding author: nripen.k.gogoi@aau.ac.in*

Abstract

Sheath blight and bacterial leaf blight are two major diseases of rice in Assam. In this study, attempt was made to isolate actinobacteria species antagonistic to *Rhizoctonia solani*and *Xanthomonas oryzae* pv *oryzae* (*Xoo*) from semi and deep water rice ecosystem of Lakhimpur district of Assam. Twenty fouractinobacteria species were isolated in three specific media and screened against these pathogens*in vitro***.** 30-54 percent inhibition of pathogenswas observed by eight different actinobacteria strains**.** Morphological, cultural and biochemical properties of isolated strains were studied**.** Micro-morphology along with cultural and biochemical studies suggested that the isolated strains belonged to the genus, *Streptomyces***.** A talc based formulation of a potent actinobacterial strain **'**Act 209**'** was developed and shelf life was studied**.**

Keywords: *Rice, sheath blight, BLB, actinobacteria*

Introduction

Sheath blight (ShB) and bacterial leaf blight (BLB) are two major diseases of rice which causesaverage 50 and 70 percent yield losses respectively under favourable conditions. Rice disease management through biocontrol approach holds promise in the present day context of sustainable farming. Among the diverse group of biocontrol agents, actinobacteria, especially those belonging to the genus *Streptomyces,* appear to be good candidates. Semi and deep water rice ecosystem of rice is an unique habitat which has not been explored much for isolating potent actinobacterial strains. The present research work was therefore undertaken to explore actinobacteria from these rice ecosystems of Assam and to test their efficacy against rice sheath blight and BLB diseases.

Methodology

The present investigation was carried out at the AAU-Zonal Research Station, North Lakhimpur, Assam during 2022-2023. Soil samples were collected from semi and deep water rice growing areas and actinobacteria was isolated using Starch casein agar (SCA),Ken Knight Agar and Asparagine glycerol salt agar medium. Morphological, cultural and biochemical properties of isolated strains were studied following the Bergey's Manual of Determinative Bacteriology[1]. The micromorphology was studied following the cover slip culture technique [2]. The *in vitro* screening against two rice pathogens *R. solani* and *Xoo*was done by dual culture and agar well diffusion methods. A talc based formulation of the most potent actinobacterial strain was developed and it**'**s shelf life was studied**.**

Results and Discussion

Twenty four actinobacterial strains were isolated from semi and deep water ecosystem of rice**.** Eight isolates exhibited antagonistic activity against both the test pathogens at varying level. Actinobacterial strain 'Act 209' exhibited the maximum inhibition of *R. solani* and*Xooin vitro* recording 54.4 and 30.0 percent respectively. The growth of isolated actinobacteria in SCA medium was observed mostly abundant with powderyconsistency and aerial mycelium. The micromorphology study of actinobacteria revealed straight to flexous or retinaculiaperti type of spore chains which indicated these strains to be *Streptomyces* species. Morphology has been an important characteristic to identify actinobacterial isolates, which was used in the first descriptions of *Streptomyces* species [3].Talc based formulation of 'Act 209' is found to be stable upto 6 months of preparation with average cell count of 2.5 X 10^5 CFU/g.

Conclusions

It can be concluded from the above study that actinobacterial strain **'**Act 209**'** have biocontrol potential against the rice sheath blight and bacterial leaf light disease**.** However, further field level evaluation need to be done for confirmation and recommendation of the results.

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Effect of Environmental Factors on *Alternaria* Blight Disease of Rapeseed (*Brassica rapa* var. *toria*) under Assam Condition

Ranjana Chakrabarty*[1], RN Borkakati[2] and B Kalita[3]
Sr. Scientist (Plant Pathology)[1], Scientist (Entomology)[2], Scientist (Agronomy)[3], AAU-ZRS, Shillongani, Nagaon-782 002
**Corresponding author: ranjana.chakrabarty@aau.ac.in*

Abstract
The average productivity of rapeseed-mustard which is an important oilseed crop of Assam, is quite low due to different diseases, and among them *Alternaria* blight is one of the major cause of loss, which is greatly influenced by environmental factors.Regression line showed a strong positive linear relationship between disease severity and, maximum and minimum temperature (T) and, morning relative humidity (RH). The favorable environmental factor for progression of disease was found to be maximum T of 23–24!, minimum T of 10–11!, morning RH of 90–91 %, evening RH of 61-67 % and R/F of 0–26 mm from 2nd week of January to 1st week of February, during 2016-17 to 2023-24.

Keywords**:** *Alternaria* blight, disease severity, environmental factor, rapeseed, regression line

Introduction
The oilseeds, particularly the *Brassicas* play a significant role in edible oil production and hence, in Indian economy**.** In Assam, rapeseed-mustard covered an area of 3**.**19 lakh ha and produced 2**.**51 lakh t with a productivity 785 kg/ha **(**2022-23; Directorate of Agriculture, Govt**.** of Assam, Khanapara, Guwahati**).** Low production might be attributed to low level of productivity due to poor disease management**.** Among the diseases, *Alternaria* blight caused by *Alternaria brassicae* ***(***Berk***)*** Sacc*., A.brassicicola* ***(***Schw***)*** Wiltshire is an important limiting factor, resulting in 17 – 45 *%* yield loss in mustard ***(***Kumar *et.al.*, 2009***)*** and 42**.**4 *%* in rapeseed ***(***Chakrabarty *et.al.*, 2022***).*** An experiment was laid out to study the effect of time of sowing of the crop, so as to minimize the loss caused by *Alternaria* blight to enable the farmers for effective and economically viable options and thereby maximizing the yield of rapeseed.

Methodology
A field trial was laid out for nine years at Assam Agricultural University**-**Zonal Research Station, Shillongani, Assam during *rabi* season from 2016**-**17 to 2022**-**23 to study optimum time of sowing of rapeseed to minimize yield loss due to *Alternaria* blight disease**.** The trial was laid out in a split design with three replications**.** The soil of the experimental field was sandy-loam having pH of 5**.**6**.** The rapeseed variety **'**TS 46**'** was sown at weekly interval staring from 22nd October to 19th November in respective year of experimentation using a seed rate of 7**.**5 kg/ha under rainfed conditions**.** The crop was fertilized with the recommended dose of 60**:**30**:**0 kg N, P_2O_5, K_2O and 7**.**5 kg Borax/ha**.** Plot size was 4 m x 3 m and spacing adopted was 30 cm x 10 cm**.** The disease was observed on leaves and pods of 10 randomly selected plants using revised rating scale 0-9 **(**Conn *et.al.*, 1990**).**

Result and Discussion
Regression line showed a strong positive linear relationship between disease severity and, maximum and minimum temperature and morning relative humidity having coefficient, r = 0**.**5199**,** r = 0**.**7318and r = 0**.**9564 with equation, y = 23**.**31 + 0**.**03x,y = 9**.**11 + 0**.**07xand y= 88**.**19 + 0**.**11x,respectively, whereas, relationship between disease severity and evening relative humidity and rainfall was negative. The favorable environmental factor for progression of disease was found to be Maximum T of 23–24!, Minimum T of 10–11!, morning RH of 90–91 %, from 2nd week of January to 1st week of February, during 2016-17 to 2023-24. The disease progresses rapidly with increase of temperature. Similar result was reported byMeena *et.al*. (2010).

Conclusion
From the above findings, it can be concluded that the three weather factors viz. temperature (minimum and maximum) and relative humidity (morning) greatly influenced the severity of the disease in rapeseed. Considering the severity of the disease, resulting in yield loss, early sowing can minimize the loss to farmers and increase their farm income. Further, knowing the first appearance of the disease and its peak period of severity, growers can be advised or can take necessary measures for management of the disease.

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Assessment of Optimum Germination Conditions and Viability in Oospores of *Albugo Candida* Infecting *Brassica Juncea*

Nitish Rattan Bhardwaj*, Prashant Yadav, Bheeru Lal Meena, Hariom Kumar Sharma and Pramod Kumar Rai
ICAR-Indian Institute of Rapeseed-Mustard Research, Sewar, Bharatpur, Rajasthan-321303
**Corresponding author: nitish.rattanbhardwaj@gmail.com*

Abstract
Albugo candida causing white rust disease is a serious threat in cultivation of *Brassica juncea* when staghead infectionis high. In *A. candida-B. juncea* pathosystem, optimum oospore germination conditions and oospore viability assessment still needs to be addressed. A protocol for optimum oospore germination in samples derived from stagheads of *B. juncea* on â-glucuronidase aryl sulfatase treatment was developed. 3% enzyme concentration induces e"50% of oospores to germinate at 7 °C, 10 °C and 13 °C after incubating for 24 to 48 hours. Viability of staghead and seed lot derived oospores through plasmolysis and trypan blue staining was also determined. Plasmolysis method was found significantly superior in detecting viable oospores of *A. candida* than trypan blue staining.

Keywords:*Albugo candida*, oospores, germination, viability, *brassica juncea*

Introduction
Albugo candida (Pers.) Roussel is one of the most important pathogen of *Brassica juncea* and is responsible for causing white rust disease (Saharan et al., 1984; Petkowski et al., 2010). The most conspicuous symptom of white rust disease is formation of malformed inflorescence (staghead) on the infected plants. The staghead contain large number of oospores, which are the resting structures of *A. candida* and are the primary incitant of infection (Verma & Petri, 1975). Optimized techniques for oospore germination and assessment of oospore viability are lacking in *A. candida-B. juncea* pathosystem. Hence to address these issues, we have described protocols for oopsore germination in samples derived from naturally infected stagheads of *B. juncea* and reported the assessment of *A. candida* oospore viability.

Methodology
10 mg of oosporic powder was put into 50-mL conical flasks with 10 ml of sterile distilled water containing 0to 3.0% mixture of â-glucuronidase aryl sulfatase. The suspension was placed in a rotary shaker at room temperature. After 24 h, the suspension was centrifuged at 5000 rpm. The pellet was resuspended in 10 ml of SDW and put on a rotary shaker for 72 h. 5 mL aliquots from each concentration were placed at 13°C and room temperature for 20 h. 50 oospores were observed in a florescence microscope. In plasmolysis, to 40 µL oospore suspension 40 µl of 4M NaCl was added. 30 oospores were observed in a florescence microscope after 30 minutes. In trypan blue staining, to 40 µL suspension 40 µl of 0.4% trypan blue was added. The suspension was kept for 1 minute at room temperature and observations were taken in a florescence microscope.

Results and Discussion
In this study, 3% enzyme concentration was significantly superior (68% germination) to other concentrations in inducing oospore germination. Oospore germination was significantly higher at lower temperatures (7°C, 10°C and 13°C) as compared to other temperatures. High oospore germination at lower temperatures once again highlights the importance of chilling in inducing oospore germination in *A. candida*. In this study, plasmolysis method was found superior to trypan blue staining as it detected between 35% to 85% (staghead derived) and 72% to 88% (seed derived) viable oospores respectively. Trypan blue staining detected between 23% to 40% (staghead derived) and 30% to 43% (seed derived) viable oospores respectively. From this study, it can be implicated that plasmolysis method can be used for rapidly assessing the *A. candida* oospore viability.

Conclusions
This study reports the effect of low temperature and incubation duration on oospore germination upon â-glucuronidase aryl sulfatase treatment. This study highlights that *A. candida* when carried through mustard seeds as oospores remain in a viable state and can be transmitted along with seed to newer areas. In conclusion, the techniques described here will be useful in carrying out genetic studies in *A. candida* as well as for estimating the viable inoculum load of *A. candida* infecting *B. juncea*.

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Spore Germination Test of Cumin Blight Pathogen (*Alternaria Burnsii*) under *In-Vitro* Conditions

RD Meena[1], Kartar Singh[1], NL Meena[2], Rekha Choudhary[1]*, NK Meena[1], Sharda Choudhary[1], MK Mahatma[1] and Vinay Bhardwaj[1]

ICAR-NRC on Seed Spices[1], Ajmer (Rajasthan)

MPUAT, Udaipur[2] (Rajasthan)

**Corresponding author: .....*

Abstract

Cumin (*Cuminum cyminum* L.) is an important seed spice crop. Alternaria blight caused by *Alternaria burnsii* is one of the serious diseases of cumin that causes loss up to 70%. An experiment on *Alternaria burnsii* spore germination was conducted *in-vitro* at ICAR-NRCSS, Ajmer (Rajasthan), India in 2024 and 2025 for understanding about disease spreading behavior. The spore solution was made using 7 days old *Alternaria burnsii* pure culture added with autoclaved distilled water. In the investigation total 17 different treatments (time period interval) *viz*., 0, 6, 12, 18, 24, 30, 36, 42, 48, 54, 60, 66, 72, 78, 84, 90 and 96 hours were included and spore germination in each treatment was counted under the microscope at resolution 400x. The master solution was kept and the spore population was maintained at 10^5 and incubated this at 25±2^{0}C for different time durations. The result showed that after 96 hours duration total 67.8% *Alternaria burnsii* spores germinated whereas 32.2% spores were reported non-germinated. None of the experiment showed more than 67.8% germination up to 96 hours period.

Key words: Cumin, *Alternaria burnsii,* pure culture, spore, germ tube

Introduction

Cumin (*Cuminum cyminum* L.) commonly known as jeera belongs to the Apiaceae family.India is the largest producer (70% of world production), exporter and consumer of cumin seed across the globe (Shastry and Anandaraj, 2014). In India, cumin is cultivated in Rajasthan, Gujarat and in some part of Madhya Pradesh as a *Rabi* crop. Rajasthan and Gujarat together contribute approximately 90 per cent of the production of the country. Cumin blight (Alternaria blight) caused by *Alternaria burnsii* is one of the important diseases of the cumin that causes huge loss up to 70%. For the majority of fatal plant fungal pathogens, spore germination is the key process that required to initiate vegetative growth and finally cause the disease (Ortiz *et al*., 2019). Since, germination is very required for pathogenesis, the process can hold fungus-specific targets for new antifungal drug development. Compounds those inhibit spore germination could be developed into high-efficacy, low-toxicity drugs for use in the prevention or treatment of fungal spore-spreading diseases. For the management of the cumin blight disease and identify effective drugs against the disease that inhibit pathogenic fungal spore germination, it is very much required fungal spore germination behavior for further study.

Methodology

An experiment on *Alternaria burnsii* spore germination was conducted at ICAR-NRCSS, Ajmer (Rajasthan), India in 2024 and 2025 for understanding about disease spreading behavior. The experiment was conducted *in-vitro* (laboratory) conditions. The spore solution was made using 7 days old *Alternaria burnsii* pure culture grown on PDA (potato dextrose agar) added with autoclaved distilled water. In the investigation total 17 different treatments (time period interval) were included and spore germination was counted in each treatment under the microscope on resolution 400x. The spore solution was maintained the spore population at 10^5 and kept this at incubation temperature (25±2^{0}C) for spore germination at different periods of durations (table 1). One drop solution was used for making microscopic slide to observed germination tube formation in spores. Germinated and non-germinated spores were counted separately and analyzed. Germination of spores were calculated using the formula

$$\mathbf{Germinated fungal spores} = \frac{\text{Number of spores showing germ tube}}{\text{Total number of spores observed}} X100$$

Results and Discussion

Results shows that the germ tube formation percent in *Alternaria burnsii* spores was gradually increased from 0 hours to 96 hours duration of incubationin both the years of the study. The pooled result of two years showed that after 96 hours duration total 67.8 percent *Alternaria burnsii* spores germinated and observed the germ tube formation whereas 32.2 percent spores were non-germinated and not reported germ tube at all.

Conclusions

Alternaria burnsii spores was gradually increased from 0 hours to 96 hours duration of incubation. The pooled result of two years showed that after 96 hours duration total 67.8 percent *Alternaria burnsii* spores germinated and observed the germ tube formation whereas 32.2 percent spores were non-germinated and not reported germ tube at all. None of the experiment showed more than 67.8 percent spore germination up to 96 hours' time period.

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Effect of Environmental Factors on *Alternaria* Blight Disease of Rapeseed (*Brassica Rapa* Var. *Toria*) under Assam Condition

Ranjana Chakrabarty*[1], RN Borkakati[2] and B Kalita[3]
Sr. Scientist (Plant Pathology)[1], Scientist (Entomology)[2], Scientist (Agronomy)[3],
AAU-ZRS, Shillongani, Nagaon-782 002
**Corresponding author : ranjana.chakrabarty@aau.ac.in*

Abstract
The average productivity of rapeseed-mustard which is an important oilseed crop of Assam, is quitelow due to different diseases, and among them *Alternaria* blight is one of the major cause of loss,which is greatly influenced by environmental factors. Regression line showed a strong positive linear relationshipbetween disease severity and, maximum and minimum temperature (T) and, morning relative humidity (RH). The favorable environmental factor for progression of disease was found to bemaximum T of23–24 , minimum T of 10–11 , morning RH of 90–91 %, evening RH of 61-67 % and R/F of 0–26mm from 2n d week of January to 1s t week of February, during 2016-17 to 2023-24.

Keywords: *Alternaria blight, disease severity, environmental factor, rapeseed, regression line*

Introduction
The oilseeds, particularly the *Brassicas* play asignificant role in edible oil production and hence, inIndian economy. In Assam, rapeseed-mustard covered an area of 3.19 lakh ha and produced 2.51 lakh t with aproductivity 785 kg/ha (2022-23; Directorate of Agriculture, Govt. of Assam, Khanapara, Guwahati). Low production might be attributed to low level ofproductivity due to poor disease management. Amongthe diseases, *Alternaria* blight caused by *Alternariabrassicae* (Berk) Sacc*., A.brassicicola* (Schw) Wilt shireis an important limiting factor, resulting in 17 – 45 % yield loss in mustard (Kumar *et.al*., 2009) and 42.4 % inrapeseed (Chakrabarty *et.al*., 2022). An experiment waslaid out to study the effect of time of sowing of the crop,so as to minimize the loss caused by *Alternaria* blight toenable the farmers for effective and economically viable options and thereby maximizing the yield of rapeseed.

Methodology
A field trial was laid out for nine years at AssamAgricultural University-Zonal Research Station,Shillongani, Assam during *rabi* season from 2016-17 to2022-23 to study optimum time of sowing of rapeseed tominimize yield loss due to *Alternaria* blight disease. The trial was laid out in a split design with three replications. The soil of the experimental field was sandy-loamhaving pH of 5.6. The rapeseed variety 'TS 46' wassown at weekly interval staring from 22nd October to 19thNovember in respective year of experimentation using aseed rate of 7.5 kg/ha under rainfed conditions. The cropwas fertilized with the recommended dose of 60:30:0 kgN, P2O5, K2O and 7.5 kg Borax/ha. Plot size was 4 m x 3m and spacing adopted was 30 cm x 10 cm. The diseasewas observed on leaves and pods of 10randomlyselected plants using revised rating scale 0-9 (Conn*et.al*., 1990).

Results and Discussion
Regression line showed a strong positive linear relationship between disease severity and, maximum and minimumtemperature and morning relative humidity having coefficient, r = 0.5199**,** r = 0.7318 and r = 0.9564 with equation,y = 23.31 + 0.03x, y = 9.11 + 0.07x and y = 88.19 + 0.11x, respectively, whereas, relationship between diseaseseverity and evening relative humidity and rainfall was negative. The favorable environmental factor forprogression of disease was found to be Maximum T of 23–24 , Minimum T of 10–11 , morning RH of 90–91 %, from 2n d week of January to 1s t week of February, during 2016-17 to 2023-24. The disease progresses rapidly with increase of temperature. Similar result was reported by Meena *et.al*. (2010).

Conclusions
From the above findings, it can be concluded that the three weather factors viz. temperature (minimum andmaximum) and relative humidity (morning) greatly influenced the severity of the disease in rapeseed. Consideringthe severity of the disease, resulting in yield loss, early sowing can minimize the loss to farmers and increase theirfarm income. Further, knowing the first appearance of the disease and its peak period of severity, growers can beadvised or can take necessary measures for management of the disease.

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Integrated Management of Root-knot Nematode (*Meloidogyne incognita)* in Tomato (*Solanumlycopersicum* L.)

Hemraj Gurjar[1*], Vishnu Gurjar[1], Aklesh Gocher[1], Seema Yadav[2] and BS Chandrawat[3]
[1]*rajasthan Agricultural Research Institute, Durgapura-Jaipur (Sknau, Jobner-Jaipur)*
Ph.D. Scholar, Nematology, Rca, Mpuat, Udaipur (Raj.)
[3]*Skn College Of Agriculture, Jobner-Jaipur*
**Corresponding author : hrg.nematology@sknau.ac.in*

Abstract
In this research applied two fungal bio-agents and one chemical in nursery. Okra (*Abelmoschusesculentus*) was used as trap crop except untreated check for the nematode trapped at initial stage and okra plants were uprooted after 18 days of germination. Fungal bio-agents *viz.Paecilomyceslilacinus*and *Trichodermaharzianum* @ 5.0 and 10 g /m2 doses were applied of each respectively and one chemical Carbofuran 3G @ 2.5 and 5.0 g /m2 were applied untreated check (control) was maintained. Research findings of the research trial was *Paecilomyceslilacinus*@ 10g/ m2 area in nursery treatment was found best fungal bio-agent for the management of root-knot nematode, *M. incognita*. *P. lilacinus*@ 10g/ m2 area.Highest tomato yield was recorded. Minimum nematode population were recorded.

Keywords: *INM, RKN, Bio agents, Chemicals & Trapcrop*

Introduction
Tomato (*Solanumlycopersicum* L.) is an important crop grown throughout the world. India is the second largest producer of vegetable in the world next to China. The tomato is cultivated throughout the year in the country. Tomatoes are used as a vegetable as well an addition in almost all vegetable preparation and used for soup, salad, pickles, ketchup, sauce and in many other ways. It is the most important "Protective food" because of its special nutritive value and also of its widespread production.Root-knot nematode cause severe losses in the tomato. Bhatti and Jain (1977) estimated the crop losses up to 46 per cent in Haryana state. Estimated overall average annual yield losses of the world major vegetable crops by nematodes are 12.3 % an average loss for the 40 crops in developed countries were estimated to be 8.8 % compared with 14.6 per cent for developing countries (Ravichandra, 2008).

Methodology
Estimation of Soil Population:200 cc soil of each sample was processed using Cobb's sieving and decanting technique (Cobb's 1918), followed by Baermann's funnel technique (Cristie and Perry, 1951). After 24 hours, suspension was drawn in a beaker from funnel and kept for some time to allow the nematode to settle down at the bottom. Upper water layer from the beaker was gently removed in order to have a concentrated nematode population. The volume of the suspension was maintained to 100 ml, from this maintained suspension 10 ml nematode suspension was drawn with the help of a pipette and poured over a counting dish. Identification of Root-knot Nematode:Root-knot nematode infested roots were washed thoroughly and stained with 0.1 % acid fuchsin lacto phenol at 80 °C for 2-3 minutes (Mc Beth *et al.* 1941). After staining the females were teased out from the roots and perineal pattern were prepared.

Results and Discussion
Research findings and results of two years studies were conducted for the management of nematode in tomato nursery with trap crop okra, two different doses of two fungal bioagents*viz. P. lilacinus* (new name *P. lilacinum*)and *T. harzianum* @ 5.0g / m^2 and 10 g / m^2 and one chemical with two different doses @ 2.5 g and 5.0 g / m^2 nursery area in soil with line application method.*P. lilacinus* (new name *P. lilacinum*) @ 10 g / m^2 dose was found significantly superior over untreated control plant parameters recorded highest. These findings are in agreement with the results of De Leij and Kerry (1991) reported the potential of *P. chlamydosporium* as a biological control agent against *M. arenaria* on tomato plants.

Conclusions
This study revealed that *P. lilacinus*(New name *Purpureocilliuml ilacinum*), @ 10g / m2 area was found most effective reducing population of *M. incognita* on tomato and enhancing plant growth characters.Okra (*Abelmoschusesculentus*) was used as trap crop except untreated check for the nematode trapped at initial stage and okra plants were uprooted after 18 days from date of germination.Tomato growth and yield wasimproved and nematode population was decreased. Finally Highest tomato yield was recorded. Minimum nematode population were recorded.

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Physiological Traits as Determinants of Resistance or Susceptibility in Rapeseed-Mustard Against Mustard Aphid (*Lipaphis erysimi*): An Evaluation Using DUALEX Leaf Clip Device

Arvind[1], Dalip Kumar[2] and Vinod Goyal[4]
Ph.D. Scholar[1], Scientist[2] Department of Entomology, Department of Plant Physiology [3],
Chaudhary Charan Singh Haryana Agricultural University, Hisar, India- 125004
**Corresponding author: arvindmor555@gmail.com*

Abstract

This study recorded the nitrogen balance index, chlorophyll index, anthocyanin, flavonoid content, and specific leaf weight across four crop stages from 79 rapeseed-mustard genotypes during *Rabi* 2022-23 with DUALEX leaf clip device. NBI ranged from 24.27 to 36.1 before aphid appearance, 37.75 to 54.5 at first aphid appearance, 25.05 to 65.3 at full bloom, and 14.22 to 39.6 at maturity. Significant negative correlations were observed at first aphid appearance (r = -0.420**) and full bloom (r = -0.464**). CI values ranged from 21.9 to 38.67 before aphid appearance, 17.0 to 35.5 at first aphid appearance, 19.1 to 31.2 at full bloom, and 9.6 to 21.2 at maturity. Highly significant negative correlations were found at first aphid appearance (r = -0.781**) and full bloom (r = -0.548**). Anthocyanin content ranged from 0.14 to 0.18 before aphid appearance, 0.14 to 0.21 at first aphid appearance, 0.16 to 0.21 at full bloom, and 0.10 to 0.17 at maturity. Highly significant negative correlations were noted at all stages, with the strongest at first aphid appearance (r = -0.82) and full bloom (r = -0.716**). Flavonoid content ranged from 0.30 to 1.06 before aphid appearance, 0.90 to 1.03 at first aphid appearance, 0.51 to 1.11 at full bloom, and 0.25 to 1.09 at maturity. Non-significant correlations were observed across all stages, with the weakest at first aphid appearance ($r = 0.023^{NS}$). SLW values ranged from 0.54 to 5.59 before aphid appearance, 0.57 to 5.26 at first aphid appearance, 1.1 to 9.8 at full bloom, and 1.1 to 13.18 at maturity. A significant positive correlation was found at first aphid appearance (r = 0.306**), with non-significant correlations at later stages. These findings highlight key physiological traits associated with aphid infestation resistance in rapeseed-mustard genotypes.

Keywords: *Rapeseed-mustard genotypes; nitrogen balance index; chlorophyll index; anthocyanin; flavonoid; specific leaf weight; aphid.*

Biochemical Constituents of Different Okra (Abelmoschus esculentus L.) Varieties in Relation to Infestation of Okra Mite (*Tetranychus cinnabarinus*, Boisduval)

BL Naga[1*] and Manisha Sharma[2]
Assistant Professor[1], ARSS Diggi (Tonk)
Assistant Professor[2], RARI, Durgapura, Jaipur
**Corresponding author : blnaga.skncoa@sknau.ac.in*

Abstract

Okra a commercial vegetable crop belongs to family Malvaceae. It originates from Ethiopia and is widely spread all over tropical, subtropical and warm temperate regions of the world. It plays an important role in the human diet and is a good source of protein, carbohydrates, vitamins, calcium, potassium, enzymes, and total minerals which are often lacking in the diet of developing country. Its medicinal value has also been reported in curing ulcers and relief from hemorrhoids. A number of factors are responsible for low productivity of the okra, but one of the most important factor is the damage caused by the insect pests. Okra crop is infested by a number of insect pests , right from germination to harvesting stage of the crop attacked by 72 species of insect pests. The major insect pests are shoot and fruit borer, *Earias insulana* (Boisd.), *Earias vittella* (Fab.), leaf hopper, *Amrasca biguttula biguttula* (Ishida), leaf roller, *Sylepta derogata* (Fab), whitefly, *Bemisia tabaci* (Genn.), aphid, *Aphis gossypii* (Genn.), and mite, *Tetranychus cinnabarinus* (Boisd). The present investigation was carried out to find biochemical factors in Okra, (Abelmoschus esculentus L.) Moench infesting Mite (Tetranychus cinnabarinus, Boisduval) during 2004-2005. The infested and healthy leaves of different okra varieties were examined for different biochemical parameters using standard techniques. Total soluble sugars and silica contents were higher in healthy leaves in comparison to damaged leaves, while protein and phenols were low as compared to infested leaves in all the varieties. The reduction in total soluble sugars in mite infested leaves might be due to impaired photosynthesis and subsequent utilization by T. cinnabarinus. observations recorded on different biochemical attributes for both the years also indicated that total soluble sugars and silica contents were higher in healthy leaves in comparison to damaged leaves while, protein and phenols were low in healthy leaves as compared to infested leaves. The biochemical analysis of leaves of different varieties showed highly positive correlation between total soluble sugars and total soluble protein with mite population while such correlations were negative with regards to total phenol and total silica.

Keywords: *okra, varieties, sugars and biochemical*

Disease Reaction of Chickpea Germplasm against *Rhizoctonia Bataticola* Causing Dry Root Rot

RP Ghasolia*, SL Yadav, Anupriya and TP Bajaya
Department of Plant Pathology, SKN College of Agriculture (SKNAU), Jobner-303 329, Jaipur (Rajasthan, India)
**Corresponding author : rpghasolia.ppath@sknau.ac.in*

Abstract

Chickpea (*Cicer arietinum* L.) is one of the most important pulse crops grown in Rajasthan as well as in India and our country is the main producer, contributing 60% to world production. It is the third most important grain legume crop in the world after common bean and pea. This crop is prone to several fungal diseases, among them dry root rot (DRR) is a devastating disease caused by the soil-borne necrotrophic pathogen *Rhizoctonia bataticola* (=*Macrophomina phaseolina*). DRR is known to be exacerbated mainly by drought and sometimes by high-temperature stress, posing a significant threat to chickpea production under rainfed cultivated areas. The disease generally appears around ûowering and podding time in the form of scattered dried plants. Drooping of petioles and leaûets, lower portion of the tap root usually remains in the soil when plants are uprooted, taproot is dark and is devoid of most of its lateral and ûner roots. In the present study, a total of 1050 germplasm were evaluated at SKNCOA Jobner in Augmented Block Design in 6m x 2.5m plot size having 2.5m row length under artificial created sick field. Susceptible check L-550 and resistant check CSJ-515 were included as standard check. PDI was calculated and percentage of dry root rot was categorized as per standardized rating scale with slight modification i.e. resistant (R) = 0-10% mortality, moderately resistant (MR) = 10.1-20% mortality, moderately susceptible = 20.1-30% mortality, susceptible (S) = 30.1-50% mortality, highly susceptible (HS) = above 50% mortality. Out of 1050 germplasm screened, 67 germplasm were resistant (PDI=0.1-10%), 92 were moderately resistant (PDI=10.1-20%), 100 moderately susceptible (PDI=20.1-30%), 172 susceptible (PDI=30.1-50%) and 619 germplasm were found highly susceptible (PDI above 50%) to the disease.

Keyword : *Chickpea, Rhizoctonia necrotrophic, germplasm*

To Determine the Effect of Temperature and Humidity Levels on Growth and Development of *C. Chinensis*

Suman Choudhary*, Manisha Sharma[1], DR Bajiya, AK Hussain, SL Sharma and Pinky Sharma[2]
Department of Entomology SKNAU, Jobner, Rajasthan, India
[1]Rajasthan Agricultural Research Institute Durgapura[a]
[2]Department of Plant Pathology SKNAU, Jobner, Rajasthan, India
**Corresponding author : suman.ento@sknau.ac.in*

Abstract

Soybean (*Glycine max* (L.) Merrill) is the world's most valuable oilseed crop, and is an excellent source of plant protein (34–40%) and oil (20%). Soybean is also known as 'meat of the field' in the Orient and 'Cinderella crop' in the USA. Soybeans can be categorized into two distinct types: commodity beans, which are generally crushed by domestic processors; and specialty beans, which are typically consumed as whole beans. Soybeans are consumed in different forms (e.g. oil, protein-rich meal, full-fat soy flour, low fat protein flour, de-fatted flour, de-fatted flakes and grits, protein concentrates and isolates) and in a variety of foods (e.g. snack foods, bakery products, tofu, meat products, sauces and soups, desserts, drinks, oils, salad dressings), as well as in animal feed (full-fat or de-fatted meals). The growth and development of C. chinensis was studied under stored conditions on different temperature (20, 25, 30 and 35°C) and humidity (60, 70, 80 and 90%). The temperature and humidity played a vital role in the growth and development of various stages of this pest. The ovipositional potential increased with the increase in temperature from 20°C to 30°C decrease 35 °C. The adult emergence, grain damage and loss in weight increased up to 30°C and maximum at 30°C and 70% relative humidity and less at 20°C and 90% relative humidity. On the basis of various parameters, it can be concluded that for development of this pest the optimum conditions were 30±1°C temperature and 70±5% relative humidity.

Keywords : *Soybean, cinderella, snack foods, bakery products, tofu*

Viability of Sclerotia of *Sclerotinia Sclerotiorum* causing Sclerotinia rot of Indian Mustard under *In Vtro* Condition

Archana Kumawat*, RP Ghasolia and S Godika
Department of Plant Pathology, Sri Karan Narendra College of Agriculture (SKNAU), Jobner, Jaipur, Rajasthan
**Corresponding author : archukumawat8@gmail.com*

Abstract

Brassica juncea (L.) Czern and Coss. commonly known as Indian mustard, *Rai* or *Laha* belongs to the family *Brassicaceae* (*Crucifereae*) grown primarily for edible oil. It is a self-pollinated and herbaceous crop grown during *Rabi* season. Among the seven edible oilseed crops grown in the country, mustard oilseeds account for over 30% of total oil production. The crop faces significant yield and production instability due to its sensitivity to various abiotic and biotic stresses with changing climatic conditions which may pose risk to the productivity of Indian mustard. Among biotic stresses, Sclerotinia rot of mustard has emerged as one of the major factors impacting crop productivity and currently, it is one of the most destructive diseases globally, leading to 5-100% losses. This destructive disease is caused by the widely distributed soil-borne hemi-biotrophic fungus, *Sclerotinia sclerotiorum* (Lib) de Bary, resulting in huge losses amounting hundreds of dollars. Sclerotinia rot affects various plant parts, but the stem is susceptible, leading to girdling and plant lodging. *S. sclerotiorum* survives in soil through sclerotia and it causes infection either through mycelia (myceliogenic) or ascospores (carpogenic germination). Sclerotial bodies are liable to destroy by higher temperature (40-50^{0}C) during hottest part of the summer particular during the month of May-June in Rajasthan. Around 10-15°C soil temperature can be raised by soil solarization during May-June with plastic mulch in comparison to ambient soil temperature that is fatal for sclerotial viability. In lieu of this, the present study was carried out to destroy sclerotia viability through varying temperature levels and durations like at 40^{0}C (2, 4, 6, 8, 10 and 12 h), at 45^{0}C (2, 3, 4, 5, 6 and 7 h), at 50^{0}C (2, 2.5, 3, 3.5, 4 and 4.5 h) and at 55^{0}C (1.5, 2, 2.5, 3, 3.5 and 4 h) by placing sclerotia on “dry blotter paper” and “in wet soil in Petri plats overnight” and kept in BOD incubator for varying temperature levels. The findings of this study are promising in destroying sclerotial viability at different temperature levels. The highest number of sclerotia lost their viability at higher temperature (e” 50^{0}C) at all durations under study. Among these two conditions, maximum numbers of sclerotia were destroyed in moist condition as compared to dry condition which indicates to apply the light irrigation in the field before soil solarisation in the month of June for getting maximum benefit of high temperature to reduce the viability sclerotia as well as disease incidence.

Keywords:*Brassica juncea, sclerotinia, ascospores*

Screening of Rapeseed-Mustard Genotypes for Resistance against Mustard Aphid (*Lipaphis erysimi* Kalt.)

Ankit Saini[1], Dalip Kumar[2], Arvind[1] and Lomash Kumar[1]
Research Scholar, Department of Entomology[1], College of Agriculture, CCS HAU, Hisar-125004, Haryana, India.
[2]Assistant Scientist, Department of Genetics and Plant Breeding, College of Agriculture, CCS HAU, Hisar, Haryana, India.
[*]Corresponding author : ankitsaini778@hau.ac.in

Abstract

A comprehensive field study was conducted during the 2022–23 growing season to evaluate the resistance of 50 rapeseed-mustard (*Brassica* spp.) genotypes against mustard aphid (*Lipaphis erysimi*). The genotypes were cultivated using a paired-line design with two replications and a spacing of 30 × 15 cm. Significant genotypic variations in aphid susceptibility were observed. At the flowering stage, infestation ranged from 2.4 aphids/plant (PRO 5111 Hybrid**)** to 74.4 aphids/plant (RH 725), whereas at the siliqua stage, infestation varied from 0.6 aphids/plant (Q80623) to 69.4 aphids/plant (YSH 401). Based on the Aphid Resistance Index (ARI), genotypes were classified into resistant (R), moderately resistant (MR), and tolerant (T) categories. Notably, 33 genotypes exhibited resistance at the flowering stage, whereas only 8 genotypes maintained strong resistance at the siliqua stage. PRO 5111 **(**Hybrid**)** and DRMRYS 205 demonstrated superior resistance, while RH 725 and YSH 401 were highly susceptible. These findings provide critical genetic resources for breeding aphid-resistant cultivars and highlight the importance of integrating host-plant resistance into sustainable pest management strategies.

Keywords:*Brassica, lipaphis erysimi, aphid resistance index, genotypes*

Elicitation of Defense Mechanisms of Groundnut Through Multiwalled Carbon Nanotubes Against Collar Rot Incited by *Aspergillus niger*

Suman Chopra* and RP Ghasolia
Department of Plant Pathology, SKN College of Agriculture (SKNAU, Jobner,) Jaipur, Rajasthan
**Corresponding author : sumanchopra9829@gmail.com*

Abstract

Groundnut (*Arachis hypogaea* L.) is the most important legume and oil seed crop grown in Rajasthan and other parts of the country. In India, groundnut occupies first position in terms of area and second in terms of production among oilseed crops. Collar rot caused by *Aspergillus niger* van. Tiegham is one of the important and destructive diseases in groundnut growing areas. Locally, it is famous by the name of "*Kaalijad*" among the farmers of Rajasthan and neighboring areas. It causes yield loss up to 50.00 per cent under field conditions. The typical symptoms of the disease are seed and seedling rotting, dark, shrunken and shredded crown portion of plant with black masses of the pathogen. For managing this disease, extensive and increased uses of different chemical pesticides are in practices that affect both environment and human health. Therefore,there is a growing need of new and more suitable eco-friendly chemicals to enhance disease resistance in plants to fight with pathogens without harming human beings and environment. Nanotechnology has enabled the use of materials at the nano-scale with exceptional functionality in different economic domains including agricultural production. This study aim to evaluate multiwalled carbon nanotubes (MWCNTs) in field through seed soaking-cum-foliar application on groundnut plants to elicit a defense mechanism to minimize disease incidence. The results are promising in minimizing disease incidence and enhancing pod yield by seed soaking (75 ppm for 150 min) + one spray of MWCNTs (50 ppm at 25 DAS) was found most effective in reducing higher disease incidence (30.59 %) with increased pod yield (29.61 %) followed by seed soaking (90 min) + spray of MWCNTs. The analysis of the proteins, total phenol compounds and sugars in treated healthy and untreated infected roots of groundnut. The maximum increased percentage of total phenol content and protein and minimum decreased percentage of sugar in diseased roots was found due to seed soaking (75 ppm for 150 min) + spray (50 ppm) of MWCNTs.

Keywords: *Groundnut, collar rot, aspergillus niger, multiwalled carbon nanotubes, defense mechanism*

Evaluate the Efficacy of Various Integrated Pest Management (IPM) Modules Against the Major Pest *Helicoverpa Armigera* in Chickpea

Rajkumar Bajya*
Department of Entomology, SKN College of Agriculture (SKNAU, Jobner) , Jaipur, Rajasthan
Corresponding author : rajbajya5960@gmail.com

Abstract

The adoption of IPM not only reduces pesticides residue in chickpea but also enhances the profitability of its cultivation. Therefore, it is critical to develop IPM modules that can help to manage the pest population below the Economic Threshold Level (ETL), conserve beneficial bio-agents and reduce environmental pollution. To address these concerns, efforts are being made to develop IPM strategies that target the most destructive pest gram pod borer, *H. armigera* aiming to enhance chickpea production while minimizing environmental and health risks. Integrated pest management (IPM) strategies are essential for effective control of *Helicoverpa armigera* on chickpea crops. This study evaluates the efficacy of various IPM modules in managing the pest, focusing on pod damage, seed yield and the economic benefit-cost ratio (ICBR). Among the tested modules, Module-6 (bird perches + spray of spinosad + indoxacarb + emamectin benzoate) proved to be the most effective, resulting in minimal pod damage, maximum seed yield, and the highest ICBR. Module-3 (bird perches + spray of HaNPV + spinosad + chlorantraniliprole), Module-4 (bird perches + spray of HaNPV + spinosad + flubendiamide), Module-2 (bird perches + spray of azadirachtin + profenophos + emamectin benzoate), and Module-1 (bird perches + spray of NSKE + spinosad + indoxacarb) were moderately effective in reducing the larval population of *H. armigera*. Conversely, Module-5 (bird perches + spray of NSKE + HaNPV + spinosad) was the least effective, showing maximum pod damage, minimum seed yield, and the lowest ICBR. The results suggest that Module-6 offers the most efficient and economically viable approach for managing *H. armigera* in chickpea cultivation.

Keywords: *Chickpea, helicovercpa armigera, integrated pest management, population, ICBR*

Management of Powdery Mildew Disease of Mustard through SAR, Micronutrients and Fungicides

Shailesh Godika*, Astha Sharma and Pinki Sharma
Department of Plant Pathology, Sri Karan Narendra College of Agriculture (SKNAU, Jobner), Jaipur, Rajasthan
*Corresponding author : shaileshgodika.ppath@sknau.ac.in

Abstract

Powdery mildew of mustard caused by *Erysiphe cruciferarum* has been a constraint in recent years cultivation in Rajasthan. The disease appeared in the first week of February and reached its peak in March. Powdery mildew disease is easily detected through the presence of white floury patches on both sides of the leaves and tendril stem, pods, etc. In extreme severe conditions, it causes significant losses in the quantity and quality of mustard. Present studies conducted in field condition under RBD Design with three replication at SKNCOA, Jobner. Among six micronutrients, two sprays of Copper Sulphate (CuSO4), @ 0.5 per cent at 45 and 75 days after sowing recorded minimum disease intensity 28.6 per cent by decreasing 45.31 per cent disease intensity with maximum 11.29 q/ha yield. Out of six systemic acquired resistance (SAR)activators, two sprays of Salicylic acid @ 200 ppm recorded a minimum 24.36 per cent disease intensity by decreasing 54.57 per cent disease intensity and maximum11.98 q/ha yield. Among plant extracts, two sprays of NSKE (20%) at 45 and 75 days intervals were observed most effective with 53.11 per cent disease control and Panchgavya (20%) second best and statistically at par with NSKE (20%) in reducing disease over control. Out of six fungicides evaluated for their efficacy for the control of powdery mildew in mustard, two sprays of Tebuconazole 50 % + Trifloxystrobin 25% WG at 45 and 75 day intervals were observed minimum 8.33 per cent disease intensity with a maximum 85.37 per cent disease control as well as yield 13.62 q/ha.

Keywords: *Erysiphe cruciferarum, management, mustard, powdery mildew.*

Management of Stemphylium Blight of Onion through Novel Combined Formulations of Fungicides

Pinki Sharma*, Divya Gurjar, Astha Sharma and Shailesh Godika
Department of Plant Pathology, Sri Karan Narendra College of Agriculture (SKNAU, Jobner), Jaipur, Rajasthan
**Corresponding author: E-mail: pinkisharma.ppath@sknau.ac.in*

Abstract

Onion (*Allium cepa* L.) is a one of the important vegetable crop grown in India. It is belong to *Alliaceae* family and called as queen of kitchen. It is grown throughout *Rabi, Kharif* and *Zaid* season. Onion suffers from many diseases caused by biotic and abiotic factors which affect its production. Among the fungal diseases stemphylium blight is the most serious and devastating disease of onion. Stemphylium blight of onion caused by *Stemphylium vesicarium* [(Wallr.)E. Simmons], with its perfect state as *Pleospora allii [(*Pers. er. Fr.) Rabenh.], It is the most important disease that causes maximum reduction in yield, quality and quantity of both bulb and seed. It can cause severe damage specially to the seed crops and losses of about 80-85% on the crop by affecting leaves and seed stalk. Present studies conducted in field condition under RBD Design with three replication at SKNCOA, Jobner. Seven fungicides namely Tebuconazole, Difenaconazole, Azoxystrobin, Flupyram, Azoxystrobin+Difenaconazole, Flupyram+Tebuconazole and Copper oxychloride were tested at 50,100 and 200 ppm concentration under in vitro condition by Poisoned Food Techniques against *Stemphylium vesicarium* of onion pathogen. All the tested fungicides showed significantly higher mycelial growth inhibition over control. Among them, Flupyram+Tebuconazole gave complete mycelial growth inhibition 98.51 percent, 100 per cent and 100 per cent at 50, 100 and 200 ppm concentrations. Seven fungicides were evaluated under field conditions against Stemphylium blight and it was found that Flupyram+Tebuconazole (0.08%) showed minimum per cent intensity 10.00 with highest per cent reduction of 84.62 disease and maximum yield.

Keywords: *Onion, stemphylium blight, stemphylium vesicarium, fungicide*

Management of Powdery Mildew of Pea Through Natural Products and Fungicides Incited by *Erysiphe Polygoni* DC.

Dinesh Kumar Meena*, Jitendra Singh, Shailesh Godika, GL Kumawat and Pankaj Kumar Sharma
Department of Plant Pathology, Sri Karan Narendra College of Agriculture (SKNAU, Jobner), Jaipur, Rajasthan
**Corresponding author : dineshkumarmeena8386059704@gmail.com*

Abstract

Pea (*Pisum sativum* L) is a valuable crop all over the world, is also known as "Matar". It belongs to family *Leguminosae* and sub family *Papilionaceae*. It's affected by various Fungal, Bacterial and Viral diseases. Powdery mildew of pea is one of the major diseases of pea incited by *Erysiphe polygoni* DC. Major symptoms of powdery mildew disease are the presence of white floury patches appeared on the leaves as well as stems, tendrils and pods. An experiment was conducted at farm of SKNCOA, Jobner during *Rabi* season 2021. Six natural products with one control *viz*. Panchgavya **(**10**%)**, Butter milk **(**10**%)**,Neem seed kernel extract **(**NSKE 10**%)**, Duranta**(**10**%)**, Parthenium**(**10**%)** and Mehandi**(**10**%)** were applied as two foliar spray. During evaluation, all the treatments were found effective against powdery mildew of pea but Neem Seed Kernel Extract (NSKE 10%) and Panchgavya (10%) were found as best treatment to control powdery mildew disease of pea and second experiment conducted for efficacy of chemicals against the disease. Six treatments with one control *viz*. Hexaconazole, Tebuconazole, Propiconazole, Bupirimate, Wettable sulphur and Copper oxychloride were applied as foliar spray. However, among the treatments, Hexaconazole found to be the most effective fungicide performing better than others in controlling powdery mildew disease of pea.

Keywords*: Natural products, fungicides, powdery mildew, NSKE, hexaconazole*

Sustainable Pest Management: Leveraging Indigenous Wisdom in Assam

RN Borkakati[1*], Sinki Barman[2], PK Bordoloi[1], E Phukon[1], HK Borah[1] and AK Sharma[3]
AAU-ZRS[I], Shillongani, Nagaon-782 002, Assam, India
KVK, Simaluguri[2], Assam Agricultural University, Nagaon -782 002
ICAR-IIRMR[3], Sewar, Bharatpur-321303, Rajasthan, India
**Corresponding author email: rudra.n.borkakati@aau.ac.in*

Abstract

Indigenous Technical Knowledge **(**ITK**)** has been an integral part of traditional agricultural practices in Assam, offering eco-friendly and cost-effective pest management solutions**.** Farmers have developed various techniques, such as clipping rice seedlings before transplanting to control stem borer and leaf folder, installing bamboo perches for predatory birds, and using Akash Bonti to attract and eliminate flying insects**.** Storage pests are managed using dried neem and curry leaves, while botanical solutions like neem seed extract help control rice pests**.** Other methods include beating drums and tying reel tapes to deter herbivore birds, applying mustard oil to pulses for bruchid management, and using mustard cake and fly ash to control red ants and epilachna beetles**.** Lime painting citrus trunks and binding mango trees with rice straw are also practiced to prevent pest infestations**.** Scientific validation has reinforced the efficacy of these methods, encouraging their integration into modern Integrated Pest Management **(**IPM**)** strategies**.** However, challenges such as lack of standardization and documentation persist**.** Strengthening research, conducting field trials, and raising farmer awareness can promote ITK**-**based practices for sustainable, environmentally friendly pest management in Assam**.**

Keywords: *Indigenous Technical Knowledge **(**ITK**)**, sustainable agriculture, eco**-**friendly practices, neem extract, botanical solutions, integrated pest management **(**IPM**).***

Monitoring of Mustard Aphid, *Lipaphis Erysismi* in North-Western Haryana with Yellow Sticky Trap

Dalip Kumar*, Rakesh Punia, Ram Avtar, Neeraj Malik, Rajbir Singh Khedwal and Mahavir Bishnoi
Oilseeds Section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar 125004
**Corresponding author : dshroff@hau.ac.in*

Abstract

Mustard crop comes under the genus *Brassica* that belongs to the family *Brassicaceae*. Rapeseed and mustard are grown in 53 countries across the globe and are cultivated in India during the *Rabi* season in a variety of agro-climatic conditions ranging from the North-Eastern/North-Western highlands to the low lands, under irrigated/rainfed, timely/late sown and mixed cropping and is widely used as edible oil and cattle feed. Production of rapeseed-mustard (*Brassica* sp.) is severely hampered by aphid infestation in India, specifically *Lipaphis erysimi* (Kalt.). Insect-pests are one of the major biotic constraints in attaining the full yield potential of oleiferous *Brassica* from germination to maturity of crop. Impact of weather on the occurrence and multiplication of mustard aphids is very crucial and should be taken into consideration when developing an aphid management plan. Keeping this in view, an experiment was conducted at Oilseeds Section, Department of Genetics and Plant Breeding, CCS HAU, Hisar using yellow chrome painted smeared with transparent grease of 1kg tin box, five in number, height maintained at 30-45 cm above the crop canopy. Maximum numbers of aphid catches were recorded in 10th and 11th standard week. Sunshine hour seems to favour the presence of aphid in significant positive association in both the crop season 2020-21 and 2021-22. Maximum and minimum of temperature of exhibited positive correlation to the numbers of aphid. Presence of numbers of aphid on cane be in surrounding mustard field can decide the volume of infestation in forthcoming period through the catch of aphid via yellow chrome smeared tin box to be vigil to manage it.

Keywords: *Mustard aphid, brassicaceae, rapeseed, genetics*

Harnessing Nanoparticles for Crop Improvement and Crop Protection in Mustard (*Brassica juncea*)

Aman Kumar[1]* and Dalip Shroff[2]
M.Sc. Scholar[1], Department of Entomology, Assistant Scientist,[2] Department of Entomology
Chaudhary Charan Singh Haryana Agricultural University, Hisar (Haryana)
**Corresponding author : amanbeniwal68@gmail.com*

Abstract

In recent years, nanotechnology has emerged as a transformative force in agriculture, offering novel solutions for enhancing crop productivity and managing pest infestations. This study explores the potential of nano-formulations, including nano zinc, nano sulphur, nano silica, and nano urea, at concentrations of 500 ppm and 1000 ppm, to improve mustard (*Brassica juncea*) growth and manage aphid (*Lipaphis erysimi*) populations under field conditions. Among the various treatments, nano silica at 1000 ppm stood out as the most effective, reducing aphid populations by 13-15% and significantly boosting key yield parameters. This treatment increased siliqua per plant by 33.7%, seed yield per plant by 24.6%, and test weight by 28.9% compared to the control, demonstrating its exceptional potential for enhancing both crop quality and quantity. Following closely were nano silica at 500 ppm and nano sulphur at 1000 ppm, which also contributed to notable improvements in yield. In contrast, nano urea showed only a modest 3-4% reduction in aphid infestation at the higher concentration, with no significant effect at the lower concentration. These results underscore the potential of nano-formulation, particularly nano silica and nano sulphur as sustainable and eco-friendly alternatives for improving mustard productivity and pest control. The study highlights the vast potential of nanotechnology in agriculture, offering an innovative path toward sustainable crop protection and enhanced yield. Further research is essential to optimize these nano-formulations and unlock their full potential for long term agricultural sustainability.

Keywords*: Nanotechnology, nano-formulations, mustard (Brassica juncea), aphid management, sustainable agriculture, crop productivity*

Habitat Manipulation Strategies for Sustainable Management of Mustard Aphid

RN Borkakati*[1], B Kalita, R Chakrabarty[1], PK Bordoloi, E Phukon[1], HK Borah[1] andAK Sharma[2]
AAU-ZRS[1], Shillongani, Nagaon-782 002, Assam, India
ICAR-IIRMR[2], Sewar, Bharatpur-321303, Rajasthan, India
**Corresponding author : rudra.n.borkakati@aau.ac.in*

Abstract
A field experiment was conducted at Tokowbari Farm, AAU-ZRS, Shillongani, during 2020–21 to 2022–23 to evaluate the effect of habitat manipulation on the management of mustard aphid (*Lipaphis erysimi*). The pooled data over three years revealed that the lowest mustard aphid population (25.08 and 15.98 aphids/plant) was recorded in the mustard + coriander intercrop, followed by mustard + fennel (38.84 and 25.77 aphids/plant) and mustard + chickpea (41.87 and 29.68 aphids/plant) during the flowering and siliqua formation stages, respectively. Similarly, the highest population of coccinellids (2.22 beetles/plant) was observed in mustard + coriander, followed by mustard + fennel (2.01 beetles/plant) and mustard + chickpea (2.00 beetles/plant). Mustard-fennel intercrop recorded a significantly higher yield (677.44 kg/ha mustard + 172.89 kg/ha fennel) compared to sole mustard (586.89 kg/ha) and intercrops with chickpea (660.44 kg/ha mustard + 156.00 kg/ha chickpea) and coriander (702.11 kg/ha mustard + 171.78 kg/ha coriander). The yield of sole mustard and its intercrops with chickpea and coriander were statistically at par. The highest benefit-cost ratio (BCR) of 2.43 was observed in mustard-fennel intercrop, followed by mustard-coriander (2.10), mustard-chickpea (1.75), and sole mustard (1.69). These findings suggest that intercropping mustard with fennel or coriander can effectively manage mustard aphids while enhancing natural enemy populations and economic returns.

Keywords : *mustard aphid, habitat manipulation, intercrop, benefit-cost ratio*

Management of Blast Disease (*Magnaporthegrisea*) of Pearl millet Through Novel Combined Formulations of Fungicides

Ratan Lal Sharma[1], Astha Sharma*, Arjun Lal Bijarnia[2] and Dharmendra Meena[3]
**Department of Plant Pathology, Agricultural Research Station, (Agriculture University, Jodhpur), Keshwana, Jalore, Rajasthan 343-001, India.*
Department of Plant Pathology[1], S.K. N. College of Agriculture, (SKNAU), Jobner, Jaipur, Rajasthan 303329, India.
Department of Agrostology[2&3], ARS, (Agriculture University, Jodhpur), Keshwana, Jalore, Rajasthan 343-001, India.
**Correspondence author : sharmaratanlal851@gmail.com*

Abstract
The present investigation aimed to find the most efficient and novel combined formulation of fungicides belonging to triazole and strobilurin groups for managing blast disease of Peral millet crop under open field conditions. Blast disease caused by *Magnaporthegrisea* has emerged as a serious threat to pearl millet cultivation in India. Most of the hybrids being grown in India are susceptible to blast as not much efforts have been made to breeding for blast resistance in pearl millet. In the absence of host plant resistance, the disease can be effectively managed with chemical fungicides. Therefore, seven fungicides, hexaconazole, azoxystribin + tebuconazole, propiconazole, carbendazim, chlorothalonil, carbendazim + mancozeb and tebuconazole + trifloxystrobin were tested for their eûcacy to manage blast disease on a blast susceptible pearl millet variety of HHB-67(Improved) at ARS, Keshwana, Jalore, Rajasthan conducted for two consecutive years (*Kharif*-2022 and 2023). Results of this study clearly demonstrated that the disease can be effectively managed with two sprays foliar sprays of Propiconazole@ *(*0.1*%)* at 15 days intervals provided maximum disease reduction *(*84.20*%)* with increased crop yield *(*55.91*%)* over control, followed by tebuconazole + trifloxystrobin @ *(*0.04*%) (*82.02*%* and 48.20*%*, respectively*)*. Blast of pearl millet is one of the significant biotic stresses that limit crop productivity and grower's prosperity. Systemic fungicides, particularly triazoles, play a substantial role in preventing infection by *Magnaporthe grisea.* Thus, two foliar sprays of Propiconazole *(*0.1*%)* or Tebuconazole + Trifloxystrobin *(*0.04*%)* at 15 days intervals reduced disease intensity effectively with increased crop yield and profitability.

Keywords : Blast, magnaporthe grisea, fungicides, peral millet.

Management of Cercospora Leaf Spot (*Cercospora canescens*) of Green Gram (*Vigna Radiata*) Through Botanicals

Manisha Khichar*, Shailesh Godika, SK Goyal, RP Ghasolia and Pinki Sharma
Department of Plant Pathology, Sri Karan Narendra College of Agriculture (SKNAU, Jobner), Jaipur, Rajasthan
*Corresponding author : manishakhichar1501@gmail.com

Abstract

Green gram (*Vigna radiata* L.) also known as moong in india. It is a member of the *Fabaceae* family and the *Papilionaceae* subfamily. This crop is susceptible to a range of fungal, bacterial, and viral diseases. Cercospora leaf spot of green gram is one of the major diseases of green gram incited by *Cercospora canescens* Ellis and Martin. The primary symptoms of this disease include distinct spots on the leaves, initially brown, which later turn grey or dirty grey with narrow reddish-brown borders on both surfaces. An experiment was conducted at farm of SKNCOA, Jobner during *kharif* season 2022. Seven botanicals (neem, amaranthus, arjun, wild sunflower, parthenium, giloy stem, and giloy leaves) were applied as foliar spray at a 10% concentration under artificially inoculated field conditions. During evaluation, all the treatments were found effective against Cercospora leaf spot of green gram but Neem leaves extract (10%) and giloy stem extract (10%) were found as best treatment to control CLS disease of green gram.

Keywords: *Botanicals, green gram, cercospora leaf spot, neem, cercospora canescens*

Incidence of Ber Fruit Borer, Meridarchis Scyrodes Meyrick (Lepidoptera; Carposinidae) in Relation to Weather Parameters and Their Identification

Pooja Sharma* and Sushila Choudhary
Department of Plant Pathology, Sri Karan Narendra College of Agriculture (SKNAU, Jobner), Jaipur, Rajasthan
*Corresponding author : poojasharma0377@gmail.com

Abstract

The fruit borer, Meridarchis scyrodes as serious pest of ber in southern and western India. The moths lay eggs on fruits at pea stage and upon hatching the newly emerged caterpillars bore into the fruits and feed on the pulp near the seed and accumulate fecal. The first and second instar larvae feeds on the fruit superficially but third to fifth instar larvae feeds internally and damages the pulp around the seed. The first instar larvae is greenish and older ones is reddish. The moths are small, dark brownish in colour. The relationship between pest incidence and temperature was positive while negative relationship of the incidence of the pests was found with relative humidity. wind speed and cloud cover. The activity of pest was from the first week of November and reaching its peak during the fourth week of December and continued up to second week January. The activity of pest gradually deceased toward the end of the season.

Keywords: *Incidence, fruit borer*

Effect of SAR Activators against Stemphylium Blight of Onion under *in Vivo* Condition

Divya Gurjar* and Pinki Sharma
Sri Karan Narendra Agricultural University, Jobner, Jaipur (Rajasthan)
*Corresponding author : divyagurjar315@gmail.com

Abstract

Onion **(***Allium cepa***)** is a biennial, cool-season crop but usually grown as annual crop and it is native to central Asia**.** India is the second largest onion growing country in the world which occupies a position of considerable importance in the agriculture economy**.** It is important condiments widely used in all households and highly rich in nutrients like calcium, phosphorus, sulphur and carbohydrates, manganese, biotin, vit C, vit B6**.** It suffers from many diseases caused by fungi, bacteria, viruses, nematodes and abiotic factors. Among them Stemphylium blight is most devasting and serious disease.It was characterised by oval-shaped, tan to brown lesions on leaf blades**.** Yellow streaks which later turn brown extended along the blade in both directions from lesion**.** It also exhibit multiple small lesions, which coalesce and cause blighted leaves**.** During the study efficiency of six SAR activators **(**Salicylic acid, Naphthalene acetic acid, ã-Amino butyric acid, â-Amino butyric acid, Oxallic acid, Isonicotinic acid**)** were evaluated under *in vivo* condition at concentration 200 ppm each**.** Among these, Salicylic acid was found most effective and recorded minimum disease intensity of 25**.**92 per cent and reduction of 59**.**67 per cent over control**.** Isonicotinic acid was second best recorded 34**.**54 per cent disease intensity with reduction of 46**.**26 per cent over control followed by Naphthalene acid **(**NAA**).**

The result of this study indicates that spray of salicylic acid after 30 days of transplanting has great potential to manage disease effectively and eco-friendly**.** These are considered safer for human health, as they often have lower toxicity levels and environmental pollution**.**

Keywords:*Stemphylium blight, Toxicity, Systemic acquired resistance*

Evaluation of Different Culture Media for Rapid Proliferation of *Pyricularia Grisea* Inciting Blast Disease of Pearl Millet

Kavita Kansotia*, RP Ghasolia and Shailesh Godika
Department of Plant Pathology, Sri Karan Narendra College of Agriculture (SKNAU, Jobner), Jaipur, Rajasthan
**Corresponding author : kavitakansotia6@gmail.com*

Abstract

Pearl millet [*Pennisetum glaucum* (L.) R. Br.] belongs to the grass family *Poaceae* and has diploid chromosomal number (2N=14). Vernacularly, it is well known by the name of "*Bajra*" in Rajasthan and in some parts of India. The crop is attacked by a number of diseases during its growth. Among several biotic diseases that affect pearl millet, leaf blast is an important, more recently it has emerged as a serious disease of dual purpose (grain and fodder) pearl millet hybrids in India. Leaf blast disease caused by ascomycetes fungus *Pyricularia grisea* (Cooke) Sacc. [perfect stage: *Magnaporthe grisea* (Hebert) Barr]. The pathogen belongs to hemi-biotrophic and intermediate class. The name 'Pyricularia' refers to the pyriform shape of conidia, hyaline, translucent, slightly darkened and mostly three-celled with tapering at the apex and a small appendage on base of the cell. This fungus takes longer time for proliferation and conidiasion on routine media. Therefore, present investigation was aimed to screen the best media for proliferation of P. grisea, which may be useful for mass multiplication of the pathogen in short period for further studies. During present study, several solid media were evaluated like Oat Meal Agar, Potato Dextrose Agar, Czapek Dox Agar and Corn Meal Agar for multiplication. Among all the evaluated solid media, the highest mean mycelial growth of the fungus was recorded on oat meal agar (OMA). Conclusively, OMA can be used for rapid multiplication of *Pyricularia grisea* for further utilization in field screen trials.

Keywords: *Pearl millet, blast, pyricularia grisea, Growth media*

Impact of Imidacloprid Insecticides for Control of Mustard Aphid in Amroha District of Uttar Pradesh

HH Khan*, AK Mishra, SP Singh, Amit Tomar & Prachi Patel
Krishi Vigyan Kendra, Gajraula-244235, Amroha
Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, U.P.
**Corresponding author : .....*

Abstract

Front Line Demonstration (FLD) was conducted for "Impact of Imidacloprid insecticides for Control of Mustard Aphid in Amroha District of U.P.". Mustard is an important crop of Amroha. However, there is high incidence of Aphid resulting in low yield of mustard. Total 10 farmers were selected in Raipur Shumali village of Gajraula block of Amroha District on the basis of their socio-economic conditions. Used of Dimethoate 30% EC @ 500 ml/acre as own or traditional practices by the farmers and used of Imidacloprid 17.8% SL @ 100 ml/acre as FLD practices for demonstration purpose. The assessed technology of application of Imidacloprid 17.8% SL @ 100 ml/acre. Reduced the percentage of Aphid insect pest infestation from 78.13 percent and yield was increased by 25.89 percent, respectively. Farmers accepted and adopted the technology, application of Imidacloprid 17.8% SL @ 100 ml/acre to manage the Mustard Aphid as it reduced the Aphid insect pest infestation effectively and significantly increased the yield of Mustard. The main objective of Front Line Demonstrations (FLDs) is to demonstrate new agricultural technologies and their management practices in farmers' fields. The results revealed that farmers were benefitted from the FLD practice in comparison to their own or traditional practices. The average yield of Mustard 10.65 quintals per hectarefrom farmers practices and from FLD practices was 14.37 quintals per hectare. The number of insect pest infestations of plants (per square meter) from farmers practices & FLD practices was 32 & 7 respectively. The B:C ratios from farmers & FLD practices was 3.09 & 3.61 respectively.

Keywords: *Aphid, farmer, FLD, imidacloprid, incidence & mustard*

Effect of Impregnation of Packing Material for the Management of *Callosobruchus Chinensis (linn.)* on Lentil

Suman Choudhary*, Manisha Sharma and Pinki Sharma
Sri Karan Narendra Agriculture University, Jobner
**Corresponding author : suman.ento@sknau.ac.in*

Abstract

Lentil is one of the important Rabi pulses. It is one of the oldest pulse crops and the most nutritious of the pulses. Lentil contains about 11per cent water, 25 per cent protein and 60 per cent carbohydrates. It is rich in calcium, iron and niacin. Lentil contributes about 6 per cent of total pulses area as well as production in India. Impregnation of packaging materials. The neem, karanj and eucalyptus oil each at three concentrations (1.0, 3.0 and 5.0%) were evaluated by impregnating the gunny and cloth bags. The adult emergence, grain damage and weight loss were recorded after 12 months of storage. The neem oil was the best treatment for impregnation of gunny and cloth bags resulting in minimum adult appearance. The next effective treatment was karanj oil followed by eucalyptus oil. All the concentration of each treatment was found significantly superior in reducing the grain damage and weight loss over control. The minimum per cent grain damage and weight loss was recorded in bags impregnated with neem oil.

Keywords: *Callosobruchus chinensis , Impregnation of packaging gunny & cloth bags, karanj oil eucalyptus oil and neem oil.*

Effect of Impregnation of Packing Material for the Management of *Callosobruchus Chinensis (linn.)*

Manisha Sharma, Suman Choudhary* and Pinki Sharma
Sri Karan Narendra Agricultural University ,Jobner , Jaipur (Rajasthan)
**Corresponding author : suman.ento@sknau.ac.in*

Abstract

Cowpea, *Vigna unguiculata* (L.) Walp. is one of the important *kharif* pulse crops in India referred as Lobia and developed for vegetable, grain, forage and green manuring. This crop has great significance due to its short duration, high yielding and rapid growing variety. It belongs to the Fabaceae family. Recognized for its nutritional value, especially in protein, it is versatile in culinary use. Cowpea is usually preferred by farmers owing to its role in maintaining soil fertility through nitrogen-fixing and production of nutritious fodder for livestock. The demand of cowpea is increasing since it is rich in antioxidants, polyphenols, polyunsaturated fatty acids and dietary fibre. It is the only arid legume of widespread across the continents and growing well in arid and semi-arid regions with wide adaptations. Bruchids causes substantial quantitative and qualitative losses manifested by seed perforation, reduction in weight, market value and germination ability of seeds. The insects spend its entire immature stage in individual legume seeds. There are encouraging reports on the use of certain indigenous plant products as grain protectants and impregnation of packaging materials with plant products. These conventional practices needed scientific evaluation. This situation dictates the need for safe, locally available and less expensive materials for pest control in storage**.** Definite information on mortality doses, efficacy of oils and extracts by treatment of packaging materials and direct feeding with the seed and their residual life was meagre. Among the plant oils, neem oil was the best treatment for impregnation of gunny bag,porous HDPE and cloth bags resulting resulting in minimum grain damage and weight loss. The next effective treatment was castor oil followed by mustard oil. The assessing results of chemicals, the minimum grain damage and weight loss was observed in emamectin benzoate and maximum in the treatment of malathion.

Keywords : *Callosobruchus chinensis (linn.), gunny bag ,porous HDPE and cloth bags, plant products*

Bio-efficacy of Novel and Bio-Rational Insecticides Against the Shoot and Fruit Borer, *Earias* spp. of Okra

Arti Sharma*, RK Meena and Manisha Sharma
Department of Entomology, S.K.N. Agriculture University, Jobner- 303329
**Corresponding author : sartivk2@gmail.com*

Abstract

The investigations on the "Bio-efficacy of novel and bio-rational insecticides against the shoot and fruit borer, *Earias* spp., of okra" under semi-arid conditions were conducted at the Horticulture farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during *Kharif* 2022. The experiment consisted of thirteen treatments, including an untreated control, and was laid out in a simple randomized block design with three replications. Two sprays of different insecticides were applied to the okra crop to evaluate their bio-efficacy against the shoot and fruit borer. The population of these pests was recorded on the okra crop before spraying and 1, 3, 7, and 14 days after spray application. The efficacy of the insecticides evaluated against the shoot and fruit borer indicated that Malathion 50% EC proved to be the most effective, showing the minimum infestation of shoots, followed by Spinosad 45% SC and Novaluron 10% EC. However, these treatments were observed to be at par in terms of efficacy. The treatments of Lufenuron 5.40% EC, Emamectin benzoate 5% SG, Flupyradifurone 17.09%, Spiromesifen 22.90% SC, Pyridalyl 10% EC, and Pyriproxyfen 5% + Fenpropathrin were moderately effective. The treatments of Diafenthiuron 50% WP, followed by Tolfenpyrad 15% EC and Fenpropathrin 30% EC, were observed to be least effective. A similar trend was observed in fruit damage caused by the pest.

Keywords : *Earias spp., okra, Kharif ,treatments, bio-efficacy*

A Study on the Field Efficacy of Biopesticides Against Mustard Aphid [*Lipaphis Erysimi,* (Kaltenbach)] on Mustard [*Brassica Juncea* (L.).]

Longjam Boris Singh*, S Zeshmarani, Chuwang Hijam, S Prabin Singh, Yanglem Herojit[1]
Krishi Vigyan Kendra, Thoubal, Department of Agriculture, Manipur, ICAR-ATARI Zone-VII, Umiam, Meghalaya
[1]Krishi Vigyan Kendra, East Garo Hills - 794111, Meghalaya
**Corresponding author : borislongjam86@gmail.com*

Abstract

The mustard aphid is a highly destructive pest that significantly impacts the productivity of Indian Mustard (Brassica juncea L.). The current experiment aimed to evaluate the effectiveness of biopesticides *Metarhizium anisopliae, Beauvaria bassiana* and *Bacillus thuringiensis* in controlling mustard aphid (*Lipaphis erysimi* Kalt.). Biopesticides have a specific target, inhibit insect growth and metabolic processes, and have a lower toxicity to mammals. Several bioassays were conducted using five different concentrations of insecticide. The mortality data was collected over a three-day period, with measurements taken every 12 hours. According to the research findings, *M. anisopliae*, demonstrated the highest efficacy (80.10%) in controlling mustard aphid, followed by *B. bassiana* (76.81%) and *B. thuringiensis* (73.01%). Furthermore, the results demonstrated the beneficial effects of the biopesticides on a number of plant parameters, including plant height, the number of leaves, branches, and siliques on the plant as well as the total number of seeds per silique, 1000 seed weight, germination percentage, shoot and seedling length, seed yield per plot, and overall seed yield. The findings of this experiment indicate that bio-pesticides have potential as a viable approach for pest management in the context of mustard aphid.

Keywords: *biopesticides, mustard aphid,Lipaphis erysimi, yield*

Approaches and Implementation for Integrated Pest Management in Rice

Longjam Boris Singh*, S Zeshmarani, Chuwang Hijam, S Prabin Singh, Yanglem Herojit[1]
Krishi Vigyan Kendra, Thoubal, Department of Agriculture, Manipur, ICAR-ATARI Zone-VII, Umiam, Meghalaya
[1]Krishi Vigyan Kendra, East Garo Hills - 794111, Meghalaya
**Corresponding author :borislongjam86@gmail.com*

Abstract
Rice is an essential grain item and an essential source of nutrition for over 50% of the world's population. The main goal of sustainable pest control is to enhance sustainable agriculture practices. Integrated Pest Management (IPM) demonstrates various conceptual, ecological, and practical parallels with sustainable agriculture. The pest management tetrahedron comprises four fundamental components: the environment, a crop, a pest, and humans. Agricultural methods that integrate crop production and insect pest management utilize cultural, physical, mechanical, and biological strategies. In agro-ecosystems, the population of natural enemies is augmented by the production and release of substantial quantities of live organisms to manage pest populations and diminish them to levels that do not inflict considerable harm. The insufficient comprehension of the effects of shifting climate patterns on pesticide application technology and safety measures, especially concerning the persistence and degradation of chemical pesticides, will continue to jeopardize the stability and sustainability of our agricultural ecosystems against pests. Consequently, integrated pest management will be essential for achieving sustainable and eco-friendly plant protection.

Keywords : *Biological techniques, integrated pest management, natural enemies, pest control*

Biosynthesis and characterization of silver nanoparticles using Trichodermaviride and evaluation of antifungal activity

Rakesh Kumar and RS Sharma
Biotechnology Centre, JNKVV, Jabalpur 482004, MP
Corresponding author email: rakeshthory862@gmail.com

Abstract
The biosynthesis of silver nanoparticles (AgNPs) using Trichodermaviride offers a natural, eco-friendly, and sustainable alternative to conventional chemical methods. In this study, the culture filtrate of T. viridewas employed to synthesize AgNPs, with the formation confirmed by a colour change to brown upon the addition of silver nitrate (AgNO3). Characterization techniques, including UV-Visible Spectroscopy, FTIR, XRD, Zeta Potential, SEM and TEM, revealed the nanoparticles' optical properties, functional group interactions, crystalline nature, and morphology. The biosynthesized AgNPs exhibited strong antifungal activity against Fusariumoxysporum, Aspergillus niger, and Cproducing clear zones of inhibition (15-25 mm). This green synthesis method highlights the potential of fungal-derived AgNPs in agricultural and medical applications, offering a promising and environmentally safe alternative for combating fungal infections.

Keywords: *Biosynthesis, Trichoderma, nanoparticles*

Effect of substrate treatment methods on Moulds infestation in Blue Oyster Mushroom Cultivation

Pankaj Kumar Sharma*, Fateh Singh[1], SK Goyal, Shailesh Godika, GL Kumawat and Dinesh Kumar Meena
Department of Plant Pathology, SKN College of Agriculture, Jobner
[1]District Extension Specialist (Plant Pathology) KrishiVigyan Kendra Jind
**Corresponding Author : pnkj3526@gmail.com*

Abstract
Mushrooms, the fruiting bodies of macro fungi comprise a large heterogeneous group and vary in shape, size, colour, appearance and edibility and also known for numerous nutritional and medicinal values. Blue oyster mushroom is a high yielding mushroom and is gaining popularity in Asia and Europe owing to its simple and low cost production technology and higher biological efficiency.Mushrooms cultivation affected adversely by a large number of Moulds from substrate preparation to fruiting. Occurrence of moulds were minimum during the month October (15.9 per cent) and it increased considerably with the changing environmental conditions and reached its peak during the month of April (18.5 per cent). The untreated substrate showed the highest mould incidence (84 %), whearas, hot water and chemical treatment methods significantly reduced the mould incidence. In case of hot water treatment, the mould incidence was 4 per cent, whereas, the incidence was similar when Bavistin; 50 ppm alone or Bavistin; 50 ppm + Formalin; 500 ppm were used and when Formalin; 500 ppm alone was used, it had higher mould incidence (38.7 %).

Keywords: *Mushrooms, moulds, substrate, hot water treatment, chemical treatment.*

SOCIAL SCIENCE, TRADE AND POLICIES

Enhancing Rapeseed-Mustard Productivity in Assam: An Analysis of Crop Demonstrations and Yield Gap Reduction in Nagaon District of Assam

Sanjana Bora[1]*, Amarjyoti Khound[2], Ashok Kumar Sharma[3] and GN Hazarika[4]
*Technical-Assistant[1] * District Level, NMEO-OP under District Agricultural Office, Nagaon, Assam*
Assistant Professor[2], Dept of Agril. Engg. B.N College of Agriculture, Assam Agricultural University
Principal Scientist[3], Former Resident Consultant[4], ICAR-IIRMR-APART Project, ICAR-IIRMR, Bharatpur, Raj
**Corresponding author : sanjanabora37@gmail.com*

Abstract
The productivity of rapeseed-mustard in Assam is significantly lower than the national average due to factors like inadequate irrigation, poor soil fertility, and marginal land cultivation. To address these challenges, the ICAR-IIRMR, in collaboration with the Directorate of Agriculture under the Assam Agri-business Rural Transformation Project, implemented Crop Demonstrations in Nagaon district. This study evaluates the effectiveness of these demonstrations in reducing the yield gap and their socio-economic impact. Findings indicate a 23% increase in yield, financial benefits, and expanded cultivation areas. The results highlight the potential of Crop Demonstrations in promoting sustainable agriculture and enhancing regional edible oil production.

Keywords: *Rapeseed-mustard, crop demonstrations, assam, yield gap*

Introduction
Rapeseed-mustard is a key crop for smallholder farmers in Assam, providing both subsistence and income. However, productivity remains below the national average, with Assam recording 660 kg/ha compared to the national average of 1511 kg/ha in 2018-19. This gap arises from inadequate irrigation, traditional farming methods, and marginal land cultivation. To counter these limitations, the ICAR-IIRMR OPIU (Agri)-APART project introduced Crop Demonstrations in Nagaon district of Assam. The project aimed to improve rapeseed-mustard yield through the adoption of high-yielding varieties and modern agronomic practices. This paper examines the impact of these interventions on productivity income and sustainability.

Methodology
A structured approach was employed, involving field-level demonstrations and surveys. The methodology included:

1. **Selection of Study Area and Farmers:** The Nagaon district was chosen due to its significant rapeseed-mustard cultivation. Farmers were selected based on landholding size, willingness to participate, and prior cultivation experience.
2. **Implementation of Crop Demonstrations:** Demonstrations were conducted with three improved varieties of Indian mustard, namely NRCHB-101, PM-28, and DRMR-150-35, and one variety of toria, TS-38.
3. **Supply of Inputs:** Farmers received quality seeds, bio-fertilizers, weedicides, and plant protection chemicals to enhance crop management.
4. **Capacity Building:** Training programs, field days, and exposure visits were organized to educate farmers on best agricultural practices.

Data Collection and Analysis
Crop yield data were collected from both Crop Demonstration plots and farmers' traditional plots. Statistical analysis was performed to determine the yield advantage and economic benefits.

Result and Discussion
The adoption of improved technologies through Crop Demonstrations led to a 23% increase in yield. Productivity improved by 21.8% due to high-yielding varieties, modern Agronomic practices and other technical support given by ICAR-IIRMR,APART. Farmers' income increasedby 30-40%, reducing dependence on external markets and enhancing economic resilience. The cultivation area expanded by 16% from 2020-21 to 2022-23, reflecting increase in farmer confidence. These advancements contributed to regional edible oil self-sufficiency and thereby reducing reliance on imports.The significant impact of the project is clearly reflected in the successful demonstrations of farmers. One such example is Biman Senapati, a farmer from Mahadeoseal village in the Raha block of Nagaon district, who was a successful beneficiary of the program in 2021–2022. With support from IIRMR and the Department of Agriculture, he adopted a range of advanced agricultural techniques, including proper soil preparation, correct seed rates, intercultural operations, recommended fertilizer applications, and plant protection measures.Under the ICAR-IIRMR-OPIU (Agri.)-APART Programme, Farmer Biman cultivated Indian Mustard (Variety: DRMR-150-35) on a 2-bigha plot in 2021–2022. With an investment of Rs. 28,750 and a B:C ratio of 2.29, he achieved an average yield of 183 kg per bigha (1370 kg per hectare). His efforts generated an income of Rs. 11,895 at Rs. 65 per kg, which was significantly higher than what he earned from cultivating the local toria variety. In the 2022–2023 season, Biman's dedication continued to pay off, as he achieved an average yield of 175 kg per bigha (1314 kg/ha).

Conclusion
The Crop Demonstrations have proven to be an effective tool in enhancing the productivity of rapeseed-mustard in Nagaon district, Assam. The adoption of improved varieties and agronomic practices has resulted in higher yields, increased farmer income, and a boost in regional food security. The successful implementation of this project provides a replicable model for other districts in Assam and beyond, promoting sustainable agricultural practices and improving the livelihoods of farmers.

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Knowledge Level of Farmers on Pradhan Mantri Fasal Bima Yojana (PMFBY) inTripura

Dipak Nath*[1], Diptanu Das[2] and Th Robindro Singh[1]
Directorate of Extension Education[1], CAU, Imphal, Manipur, College of Agriculture[2] , CAU Imphal, Manipur
**Corresponding author : spd020@yahoo.co.in*

Abstract
The study was undertaken with 160 respondents comprising of beneficiaries and non beneficiaries of Pradhan Mantri Fasal Bima Yojana (PMFBY) in the state of Tripura. Out of eight districts, 80 beneficiaries and 80 non-beneficiaries of respondent's data was gathered from two districts, viz., Gomati and South Tripura. The knowledge level of beneficiaries and non-beneficiaries reported that more than half (68.8%) of the beneficiaries had medium level followed by 16.3 per cent had low level of and 15 per cent had high level of knowledge. Among non-beneficiaries, 57.5 per cent had medium level of knowledge, followed by 28.8 per cent had high and 13.8 per cent had low level of knowledge. The variables like education, training exposure, achievement motivation and economic motivation had positive significant correlation with knowledge level of beneficiaries.

Keywords : *Knowledge, crop insurance, PMFBY, Beneficiary, non beneficiary and tripura*

Introduction
Agriculture is the backbone of Indian economy.Indian agriculture is often hit by natural disasters such as droughts, floods, cyclones, hurricanes, landslides and earthquakes. The disasters that affect agriculture include disease outbreaks and human-caused disasters like fires, the distribution of false seeds, fertilizers, insecticides, and pesticides, as well as fluctuations in market prices.Pradhan Mantri Fasal Bima Yojana (PMFBY) is a scheme involving several stakeholders including State Governments, financial institutions, insurance companies and farmers, both loanee and non-loanee. It also envisages adoption of technology for integration of all stakeholders on the National Crop Insurance Portal for scheme administration and in capturing crop loss assessment etc.According to 2021–22 data, the PMFBY scheme insured a total area of 52,858.38 hectares in the state of Tripura, benefitting 339,911 farmers. Among the districts Gomati district recorded the highest participation with 30,113 farmers, followed by South Tripura with 27,392 farmers.

Methodology
The study was conducted in two districts of Tripura State with the ex-post facto research design. The district was chosen purposively based on having highest numbers of PMFBY beneficiaries. The districts of Gomati (30,113) and South Tripura (27,392) having highest number of beneficiaries. Data was collected randomly from respondents 60 beneficiaries and 60 non beneficiaries from the purposively selected blocks and randomly selected villages. The knowledge level of the respondents was measured in terms through pre structured questions with a score 1 for true and 0 for false answer. Based on the scores obtained, the respondents were categorized as low, medium and high by using mean and standard deviation. Independent variables, viz., Age, Education level, Land holding, Farming experience, Cropping intensity, Annual income, Training Exposure, Possession of farm machineries, Achievement motivation, Innovativeness, Mass media Exposure, Risk orientation, Extension contacts and Economic motivation were also measured.

Results and Discussion
The findings shows that, 68.8 per cent of the beneficiaries had medium level, followed by 16.3 per cent had low level and 15 per cent had high level of knowledge. knowledge. It was found that beneficiaries had a significantly higher level of knowledge compared to non-beneficiaries. This cou Among non-beneficiaries, 57.5 per cent hadmedium level, followed by 28.8 per cent with high level and 13.8 per cent with low level of ld be attributed to the fact that beneficiaries enrolled in the PMFBY were familiar with the features of the scheme, such as premium rates, notified crops, the commencement and closing dates of insurance applications, and the implementation of cropping-cutting experiments by insurance agents, bank officials, and other department officers.

Conclusions
It was found that farmers have only a moderate level of knowledge. Generally, farmers have limited awareness of the benefits, coverage details, premium rates, and claim procedures of the Pradhan Mantri Fasal Bima Yojana (PMFBY). This knowledge gap hinders their participation and effective use of the insurance, emphasizing the need for better awareness and education efforts among farmers.A comprehensive knowledge on scheme and an insurance of crops against natural disasters can become immense value to farmers. Extension personnel working at gross root level should provide timely and complete information on PMFBY by using suitable extension methods.

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Impact of Cluster Front Line Demonstration on Niger in Jharkhand

Amrendra Kumar*[1], DV Singh[1], Md Monobrullah[1], Tejaswini Kapil[2], Amrit Kumar Jha[3], Sujeet Kumar[1], Abhay Kumar[1], Somya[1] and Anjani Kumar[1]
[1]ICAR ATARI Zone IV Patna, [2] KVK Piprakothi, [3] KVK Sahibganj
**Corresponding author: amrendra14d@gmail.com*

Abstract
Niger crop's resilience in challenging conditions makes it a promising option forfarmers of Jharkhand seeking sustainable and lucrative agriculturefor boosting rural livelihoods and income. Study was conducted with 3261 farmers and 1247 ha area during 4 years. Among the different varieties (Birsa Niger-1, Birsa Niger-3 and Pooja-1) assessed under CFLD, it was observed that all were outperformed compared to farmer practice. The per cent increase in yield with Improved Practices (IP) over FP was found to be 43.64. The extension gap and technological index were 1.55 q/ha and 15.40 per cent, respectively. The observed technology gap (0.99 q/ha) reflected the farmer's cooperation in carrying out demonstrations.Therefore, it clearly indicates that use of improved practices with scientific intervention contributed to increase the productivity and profitability of Niger.

Keywords*: Niger,Cluster frontline demonstrations, Extension gap, Technology gap*

Introduction
India is a major producer of oilseeds, contributing 20% of the net sown area with crops like rapeseed, mustard, groundnut, sesame, linseed, castor, soybean, cottonseed, sunflower, safflower, and niger. Among these, Niger is gaining attention due to its high oil (37-47%) and protein content, making it valuable for culinary, medicinal, and industrial applications. Grown during the kharif season, India cultivates niger on 2.61 lakh hectares, with an average productivity of 3.21 q/ha. Major niger-producing states include Andhra Pradesh, Assam, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Maharashtra, Odisha, and West Bengal. Jharkhand, a tribal-dominated state, cultivates niger on 2.5 thousand hectares, achieving an average productivity of 3.98 q/ha. The yield gap is primarily due to the lack of improved varieties and poor adoption of scientific practices. To address this, demonstrations were conducted in Jharkhand with recommended varieties(Birsa Niger-1, Birsa Niger-3 and Pooja-1) and improved agronomic practices to enhance productivity and profitability.

Methodology
Cluster Front Line Demonstrations (CFLDs) on niger were conducted by KVKs of Jharkhand under ICAR-ATARI, Zone IV, Patna from 2019-20 to 2022-23. Farmers and farmwomen were identified through surveys, awareness programs, and interactive meetings. Trainings on improved cultivation practices, recommended by Birsa Agricultural University, were organized, and critical inputs like seeds, fungicides, and insecticides were provided, while farmers supplied balanced nutrients. Scientists monitored crop growth, offering need-based advisories. A total of 3,261 demonstrations were conducted on 1,247 ha with farmer participation to showcase improved niger cultivation. In farmers Practice, traditional methods were followed, while demonstration plots used improved varieties Birsa Niger-1, Birsa Niger-3, and Pooja-1 with line sowing, weedicide application, and balanced fertilization..Yield data were analysed using statistical tools, and technology gap and index were calculated.

Results and Discussion
The study highlights a gap in technology adoption between demonstration plots and farmers' practices (FP) regarding improved variety, seed treatment, plant protection, and weed management. CFLD interventions significantly enhanced niger yield, averaging 5.28 q ha{ [1], a 43.64% increase over FP (3.74 q ha{ [1]). Birsa Niger-1 yielded the highest (5.55 q ha{ [1]), followed by Birsa Niger-3 (5.44 q ha{ [1]) and Pooja-1 (4.86 q ha{ [1]).The extension gap (1.32–1.68 q ha{ [1]) highlights the need for farmer education. The technology gap (0.37–1.64 q ha{ [1]) indicates positive farmer cooperation, aligning with prior studies. The technology index (6.37–25.23%) confirmed the feasibility of improved technologies, with Birsa Niger-3 having the lowest (6.37%), indicating higher adaptability. The results are aligning with findings by Kumar A. et. al(2023) in pigeonpea, Katare et al. (2011) in oilseeds and Jha et al. (2021) in rice and mustard.

Conclusions
The Cluster Frontline Demonstrations (CFLDs) conducted by KVKs of Jharkhand under ICAR-ATARI, Zone IV significantly improved niger yield and facilitated the widespread adoption of recommended production technologies. Through training programs, field days, and exposure visits, CFLDs increased niger yield by 46.64%. The potential yield of improved varieties - Birsa Niger-1, Birsa Niger-3, and Pooja-1 can be realized through scientific knowledge dissemination, quality input supply, and proper utilization. These demonstrations strengthened farmer-scientist relationships and empowered farmers as knowledge hubs and seed sources for neighbouring communities. Adoption of improved cultivation practices can substantially enhance niger productivity and profitability, ensuring sustainable agricultural growth.

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Impact of Improved Rapeseed Cultivation in Enhancing the Productivity and Income of Farmers- A Study in Dibrugarh district of Assam, India.

Hemchandra Saikia*, Manoranjan Neog, Chayanika Thakuria and Ranjit Kumar Saud
Assam Agricultural University Jorhat Assam
Corresponding author: saikia.hemchandra@rediffmail.com

Abstract

Assam is an agrarian state having net sown area and gross cropped area as 2801 and 4060 thousand hectares, respectively and resulting cropping intensity is about 145 per cent. Among all the oilseed crops rapeseed and mustard covers 88.17 % of total oilseed area of the state and covers 11.62 % of its net sown area. The sample for the present study consisted of 100 randomly selected respondent farmers from two randomly selected blocks of Dibrugarh district and data were collected in the especially designed pre-tested interview schedules. The study revealed that the productivity of rapeseed in the district increased by 524 kg per hectare(69% increase), gross return and net return increased by 88.50% and 183.21 %, respectively over its traditional method of crop cultivation.

Keywords: *Impact, productivity, income, gross return and net return*

Introduction

Assam is an agrarian state having net sown area and gross cropped area as 2801 and 4060 thousand hectares, respectively and resulting cropping intensity is about 145 per cent. Rapeseed is the most dominant oilseed crop of Assam occupying 88.17 % of total oilseed area and covers 11.62 % of its net sown area. The average productivity of rapeseed and mustard in Assam is 785 kg per hectare. State has enough potential for exploiting rapeseed cultivation through adoption of improved method of cultivation due to inherent soil fertility aggravated by recurrent flood and after flood during kharif season large scale cultivation of rapeseed is possible during Rabi season and hence scope for sustaining farmers income through improved method of rapeseed cultivation. Present study was conducted in Dibrugarh district of Assam India to know the impact of improved method of rapeseed cultivation in enhancing productivity and income of farmers from rapeseed cultivation.

Methodology

Present study was conducted in Dibrugarh district of Assam during the year 2021-22 as district is important from agricultural point of view besides being convenient for data collection. The sample for the study consisted of 100 randomly selected respondent farmers from two randomly selected blocks of Dibrugarh district and from these two blocks 50 farm households from each randomly selected block were selected randomly. The primary data were collected from the respondent farmers with the help of specially designed pre-tested interview schedules through personal method. Respondent farm households were stratified into four size group on the basis of their operational holding as – Marginal (below 1 ha) 57, Small (1-2 ha) 25 and Medium (2-10 ha)18. There were no large farmers and data collected were compiled and analyzed duly for the purpose of report writing and future decision making.

Results and Discussion

Study revealed that due to the adoption of improved method of rapeseed cultivation by the sample farmer's productivity increased by 524 kg per hectare (69 % increases) over the traditional method of crop cultivation. The gross return per hectare in rapeseed cultivation increased by 88.50 per cent(¹ 22983) over its traditional method of cultivation and that of net return per hectare increased by 183.21 per cent(¹ 19280) over the cultivation without the adoption of improved technology. The benefit-cost ratio in improved method of rapeseed cultivation was 2.56 and in traditional method it was 1.68. There was variation of both the returns across different size group of farms due to the variation of technology used. This was in conformity with the findings of Jha *et al.*, 2012; Kiresur *et al.,* 2001; Sharma *et al.*, 2013 and Balai *et al.,* 2012.

Conclusions: The results from the study implied that adoption of improved technology in rapeseed cultivation increased productivity by 69 %, gross return by 88.50 %, net return by 183.21 % and resultant benefit-cost ratio was 2.56 over the traditional method of rapeseed cultivation in the sample area. thus study justified very positive impact of adoption of improved technology in rapeseed cultivation in enhancing the productivity and income of farmers in the sample area. thus adoption of improved technology in suitable crops in due space and time in areas with similar agro-ecological situation can enhance the productivity and income of farmers to a great extent.

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Impact of CFLD on Pulse Production in Dhemaji District of Asssam

Rekhamoni Gogoi[1*], G Gogoi[1], AK Barthakur[1], S Gogoi[2], RK Saud[2] and M Neog[3]
[1]*Krishi Vigyan Kendra, Dhemaji*
[2]*Associate Director of Extension Education, Assam Agricultural University, Jorhat*
[3]*Director of Extension Education Assam Agricultural University, Jorhat*
**Corresponding author: rekhamoni379@gmail.com*

Abstract

The main objective of cluster front line demonstrations (CFLDs) is to demonstrate newly released crop production and protection technologies and its management practices at the farmer's field in cluster approach under different agro-climatic regions and farming situations. Pointing the importance of cluster frontline demonstrations in transfer of pulse production technologies, Krishi Vigyan Kendra, Dhemaji conducted CFLDs at farmers' field and accordingly study was conducted in Dhemaji district of Assam from 2019-20 to 2023-24 to see the impact of the technology. During study period, the yield increase is the highest 25.0%, 70.53% and 87.5% in Blackgram, Lentil and Field pea respectively under technology demonstration compared to farmer's practice.

Introduction

Pulses play a significant role in the group of food crops to address national food and nutritional security and tackle environmental challenges (Abraham *et. al.,* 2024). Pulses are major sources of proteins and also sources of vitamins and minerals and are popularly known as "Poor man's meat" and "Rich man's vegetable", which contribute significantly to the nutritional security of the country. In India, pulses can be produced with a minimum use of resources and hence, it becomes less costly even than animal protein (Singh & Singh, 2020). The cultivation of pulses builds-up a mechanism to fix atmospheric nitrogen in their root nodules. In India, pulses can be produced with a minimum use of resources and hence, it becomes less costly even than animal protein. It is also seen that CFLD programme were much more helpful in conveying technical message and changing the attitude of other farmers toward adopting new and improved farming and management practices that also helps in doubling the farmer's income (Kumar et. al., 2023).

Methodology

Cluster Frontline Demonstrations (CFLDs) were conducted by Krishi Vigyan Kendra Dhemaji in blackgram ,lentil and field pea to disseminate latest package of practices to the farmers in order to boost pulse production and productivity. Before starting the demonstrations, farmers were trained on scientific cultivation practices. The data were collected from beneficiary farmers through personal interviews method and after that data were tabulated and analysed to find out the findings and conclusions. The yield increases in demonstrations over farmers practice, Technology yield gap, Extension yield gap and Technology index were calculated by using standard formula. The fields were regularly monitored and periodically observed by the Scientists of KVK. At the time of harvest, yield data were collected from both the demonstrated plots as well as from the farmers' practice.

Results and Discussion

The results of cluster frontline demonstrations conducted during 2019-20 and 2023-24 indicate that the demonstrated plots have given a good impact over the farmers' practice. An average increase of 11.43 per cent yield was recorded during 2019-20 and 20 per cent was recorded during 2023-24 in case of black gram(Table 1B). The data clearly showed that the yield enhancement was due to the impact of advanced technology over the farmer practice like adoption of high yielding varieties, following advanced farming practices under CFLD & Pulses programme in the state. The demonstrated technology gave higher net returns and B:C ratio of 28087 Rs/ha and 3.02 in comparison to control (16245 Rs/ha, 1.67). Table 1B, 2B & 3B represent the the average extension gap, technology gap and technology index of black gram, lentil and pea respectively which indicate that adoption of improved production technologies minimized the yield gap and provided higher economic returns to the farming community.

Conclusions

It is concluded from the above findings that Cluster frontline demonstrations on Blackgram, lentil and field pea can reduce the technology gap to a considerable extent by adopting scientific methods of pulse cultivation thus leading to increase productivity of pulses in the district. Horizontal expansion of improved technologies may be achieved by implementation of various extension activities like training programme, field day, exposure visit *etc*. organized in CFLD programmes. As the gaps still exists, the CFLDs should be continued in coming years so that gaps may be minimized as more and more area is covered under pulses. Therefore, cluster front line demonstrations (CFLD) were effective in updating knowledge, skills and attitude of farmers and enhancing production and productivity of pulses in the district.

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Introducing a New Flavour into Agricultural Extension System" A Case Study of Mobile Agricultural School & Services (MASS)

Vijay Bharat*
Mobile Agricultural School & Services (MASS) , ParvatiKaikasha ,GaeriGaon ,Hotwar , Ranchi 835217 , Jharkhand
**Corresponding author : massagriindia@gmail.com*

Abstract
MASS was initially conceptualized and established an "Institute on Wheel "with the idea of Participatory Research and Extension. The aim is to empower and capacitate the rural farmer on improved agricultural practices, offering immediate solution to the distance farmer at their Doorsteps. The Residential Training Centre with demonstration plots and the Mobile Equipped Buses (audio video tools), providing an opportunity to reach at doorstep of the farming communities ensuring their participation in the process. "On Farm" and "Off Farm" training on modern scientifictechnologies, providing platform to farmers, new comers and agriculture professionals to enhance their knowledge to increase the productivity, crop yield and high value crop to enhance income and encouraging them for marketing of produces for getting higher income for sustainable improvement of livelihoods.

Introduction
Food Insecurity is a challenge because of slow adoption of advance technologies in farming systemby deprived communities' especially tribal, small & Marginal farmers in rural area, and practicing the traditional farming approaches and getting very low productivities. Mobile Agricultural School and Services (MASS) has been conceptualized with the thought of reaching doorsteps of every farmer and make them acquainted with the latest advance technologies by ensuring theirparticipations without loss of its essence &flavour. MASS is introduced itself with a new flavour to theagricultural extension world by reaching at their doorstep using the fully equipped buses (Audio Video tools) for their empowerment, skill and capacity building for the adoption of advance technologies to enhance their productivities and increase their farm income and sustainable improvement of their livelihood. MASS isreaching to different villages and getting very good responses especially from women and deprived communities.

Methodology
"On Farm" and "Off Farm" training is the key interventions for transfer of new technologies in farmer's field and enhancement of farm productivity."Institute on Wheel" A modified buses,is providing an opportunities to reach at doorsteps. MASS emphasized on Participatory Research and Extension Processes by One toone interaction, showing films, PPT and demonstration of technology directly in the farmer's field encouraging them for their 100% participation and convert the learning into practice at their field. Further interested progressive farmers / youth have to attend intensive class training at residential centre of MASS. The methodology includes empowering them, skill and capacity building & exposure on various components andengaged them in the process of Learning by Doing and act as animator to motivate and encourage other farmer to adopt the learning.The content of training is revised based on feedback accepts this challenge to deliver new and innovative things among the famers.

Results and Discussion
In 18 years of Journey it has empowered and capacitates more than 4.5 lakh farmers/ youth/ women on different agricultural topics. Almost 65 percent women farmers have been trained and achieved different milestones in farming system. With the innovative approach, more than 90% farmers enhanced their knowhow on farming system and "Knowledge" has changed into the "habit". MASS has trained the farmers on Integrated farming system, seed treatment , Pest Management and found that majority of the farmers are more or less practicing this learning. Several technologies on advance vegetable production, Agro Horticulture, oyster mushroom production, vermi compost production etc. And have adopted these technologies to increased farm productivities and gaining good profit and farmers have been converted into a category of progressive farmers.

Conclusions
The approaches "Institute on Wheel" ensuring 100% participation of deprived farming communities through reaching at their doorstep and further their skill and capacity building on advance technologies for enhancement of farm productivities and its adoption with learning by doing. We have succeeded to convert majority of them into True / Progressive farmers– "Mega Achievement". MASS is also getting success to make the farmers technology driven and raising their curiosity on new upcoming advance technologies. Now, MASS has proved it initiatives for "mass" in a very short span in effective manner which is more relevant & effective than other Extension approaches.

A Comprehensive Exploration of Livestock Extension Services and its Current Scenario

Deepak Chaturvedi[1*], Sunil Kumar Sharma[2] and Subhas Chandra[3]
[1]*Senior Scientist and Head, KVK, Jaisalmer (Raj.)*
[2]*Subject Matter Specialist, Agriculture Extension, KVK, Pokaran (Raj.)*
[3]*Ex-Director, SKRAU, Bikaner*
**Corresponding author: dchatext@gmail.com*

Abstract
Livestock plays a crucial role in rural development by improving the socio-economic conditions of rural communities through income generation, improved nutrition, and enhanced livelihood opportunities (Saxena et al., 2020). A Livestock Extension Service (LES) is a process to provide technical aid to farmers on any livestock issues.The theories and models i.e. Diffusion of Innovations, Agricultural Knowledge and Information Systems (AKIS) and Human Capital Theory have been used to explain the mechanisms and impact of livestock extension services.Various studies have found that extension services contribute significantly to increased livestock productivity. The study concluded that LES play an essential role in guaranteeing livestock well-being, improving rural livelihoods, and supporting sustainable agriculture, Socio economic status in India.

Keywords:*LES, diffusion, innovation, AKIS, socio economic status*

Introduction
India is ranked first in milk production contributing 24.64 percent of global milk production. Egg production in the country has increased from 78.48 billion in 2014-15 to 138.38 billion Numbers.(*GOI,2021-22*). Livestock rearing provides an additional source of income, employment, food and nutritional security by providing nutrient-rich food products, risk mitigation strategy against crop failures for farmers. LES can be defined as the practice of transferring livestock technology and its knowledge to farmers throughdiverse educational methods. LES in India is being carried out by different organization broadly classified as public delivery system and private delivery system. Various government institutions which are involved in public delivery system are Directorate of extension, ICAR, NDDB, KVKs, SAUs, SVUs, SDAH etc. The focus of the initiatives which are implemented by the Government is on entrepreneur-ship development and breed improvement in poultry, sheep, goat and piggery including feed and fodder development.

Methodology
Several theories and models have been used to explain the mechanisms and impact of livestock extension services:

1. **Diffusion of Innovations**: Explored how innovations spread among members of a community. His theory significantly impacted how livestock extension services were designed and delivered. (Morgen, 2007)
2. **Agricultural Knowledge and Information Systems (AKIS):** This model views livestock extension services as part of a larger system, including research institutions, farmers, and the private sector.
3. **Human Capital Theory**: It posits that investment in education and training would result in increased production and productivity. This theory is often cited to support the economic feasibility of extension services
4. **The Treadmill of Production:** This theory offers a critical perspective, discussing how continuous technological innovation in livestock can lead to adverse ecological consequences (Abhijeet, 2023).

Result and Discussion
LES have significant social impacts in developing countries. The study revealed that 56.0 per cent of the farmers perceived that LES were available in time. The amount paid for the services, 58.66 per cent of the respondents perceived that LES were delivered free of cost. In the study area, 37.33 per cent respondents were satisfied with extension service delivery. (Rathoreet al., 2012)A project named JOHAR was designed by FAO. The JOHAR (Jharkhand Opportunities for Harnessing Rural Growth) project aims to enhance and diversify household income through the LES. JOHAR livestock activities target over 90 percent female beneficiaries. The JOHAR model is believed to be the most comprehensive and successful use of livestock extension services in Jharkhand(Helenet al., 2020).

Conclusion
The study indicates that livestock extension departments, their linkages and contacts, facilities etc. are not on par with the current need of the livestock owners. There is urgent need to improve the contacts of the livestock extension professionals with other extension agencies and animal owners that will lead to better understanding and the better solutions to the livestock problems.A well-functioning and dynamic livestock extension service and animal health services system can catalyze progress in the livestock sector by ensuring ethical practices, humane animal treatment, and improved farmer livelihoods, fostering a more resilient and prosperous agricultural landscape.

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Entrepreneurial Behavior of Kinnow Growers of Irrigated North -Western Plain Zone 1B of Rajasthan

Sandeep Kumar Rastogi[1*], BS Meena[2] and RK Verma[3]
[1]*KVK (ICAR-IIRMR) Gunta-Bansur, Alwar-II (Raj.)*
[2]*Dean &Professor, COA, Sriganganagar*
[3]*Head of Deptt., AE&C, COA, SKRAU, Bikaner*
**Corresponding author: sanon78@gmail.com*

Abstract
This study investigates the entrepreneurial behavior of kinnow growers in the Irrigated North-Western Plain Zone 1b of Rajasthan, focusing on the factors that influence the decision-making, risk-taking, and innovation of kinnow growers in kinnowcultivation practices. This study was carried out in Sriganganagar and Hanumangarh district of Rajasthan. These districts were selected purposively on the basis of having maximum area and production in the state. A total of 250 kinnow growers, as respondents had taken for the study for collecting the primary data with the aid ofpre-tested interview schedule. Data derived from the interview of the sampled growers was examined using competent statistical procedures. A total of eleven components of entrepreneurial Behaviour were taken for study.

Keywords : *Entrepreneurial behavior, kinnow growers, horticulture*

Introduction
Kinnow is a popular citrus fruit in Rajasthan, particularly known for its sweet taste, juiciness, and high nutritional value. Originating from a hybrid between the King and Willow leaf mandarin varieties, kinnow has found a favorable environment in the arid regions of Rajasthan, especially in districts like Sri Ganganagar, Hanumangarh, and surrounding areas. These regions have embraced kinnow cultivation due to the suitable climate and soil conditions. Kinnow growers in Rajasthan have increasingly adopted kinnow cultivation due to its economic viability and demand in both domestic and international markets. 80% kinnow growers are still dependent on trader/agents to sell their fruit. Among the supply, 60% comes from the waxing plant operators and 20% from traders/agents while only 20% supply comes from the farmer's side in the markets (RACP report 2018). Studying the entrepreneurial Behaviour of kinnow growers in Rajasthan is crucial for driving agricultural innovation, formulating effective policies, enhancing socio-economic conditions, and ensuring sustainable and profitable kinnow cultivation in the region.

Methodology
The study was conducted in North-Western plain zone 1b of Rajasthan comprising Sriganganagar and Hanumangarh district during the year 2023-24. Sriganganagar and Hanumangarh district have been purposively selected for the study because it comprises of highest area under kinnow production in the state along with major export hub for kinnow fruit.From the selected districts,5 tehsils were randomly selected on the basis of having largest area under the Kinnow cultivation. From five tehsils, 10 villages were randomly selected and from these villages 250 respondents were randomly selected for the study. Keeping in view the objectives of the study, the entrepreneurial Behaviour was selected as dependent variables.Entrepreneurial Behaviour was operationally defined as a function of eleven dimensions. Age, education, occupation, family size, experience in Kinnow cultivation, land holding, annual income, social participation, mass media exposure, extension participation, self- reliance, Cosmopoliteness and deferred gratification were selected as independent variables for the study.

Results and Discussion
The findings of the study revealed that more than two fifth (42.80 %) of the Kinnow growers in the area were in medium level (142.67 – 168.97) of entrepreneurial behaviour followed by high (30.40%) & low (26.80%) level.The probable reason for the trend might be due to a large number of kinnow growers belonged to medium level of innovativeness, achievement motivation, risk orientation, economic motivation and management orientation. Even the other factors like lack of knowledge on improved practices of kinnow cultivation, high cost of inputs and insufficient water availability, lack of conviction and fear of failure to become an entrepreneur are also responsible for the trend.

Conclusions
While the kinnow fruit is extensively grown in Sriganganagar and Hanumangarh districts and it was observed that the smaller number of kinnow growers belong to the high category of entrepreneurial behaviour. This calls for improvement of entrepreneurial behaviour of kinnow growers by organizing effective entrepreneurship development programmes by the department of horticulture in collaboration with the entrepreneurship development organizations like NIAM – Jaipur, NAARM, SFAC and EDI, Ahmedabad.

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Diversity and Distribution of Birds in Agricultural landscape of Assam

Prabal Saikia* and NK Gogoi
AAU-Zonal Research Station, Assam Agricultural University, North Lakhimpur, Assam
**Corresponding author: prabal.saikia@aau.ac.in*

Abstract
Agro biodiversity is a key component for sustainable development. Birds constitute an important component in the agro-ecosystems.A total of 167 species of birds belonging to 18 orders and 57 families were recorded in agricultural landscape of 5 agro climatic zones of Brahmaputra and Barak valley of Assam**.** Different bird**'**s species associated with different crops**.** Diversity indices of birds recorded from various microhabitats of paddy agro ecosystem. The feeding guilds of birds recorded in rice fields grouped into 9 types and they exploit different prey types**.** Birds were observed to adopt different feeding methods and the species were grouped in to 8 foraging guilds**.** The survey in the organic rice area clearly indicated that the occurrences of insectivorous birds were very high in organic farms and their diversity and density was significantly greater than conventional farms**.**

Introduction
Agro biodiversity is a key component for sustainable development. Birds constitute an important component in the agro-ecosystems. These bird groups depend on different types of food in agro-ecosystem and have evolved various social structures and behavioural responses (Javed and Kaul, 2002).The state of Assam is very rich in avifaunal diversity consisting of more than 900 species and subspecies, out of 1300 species found in India (Choudhury ,2000).Although Assam is predominantly an agrian state, studies in agricultural ornithology and other aspects of applied research were largely ignored. Some distributional and taxonomical aspects of wetland, forest and grassland birds have been studied by few a researchers of the state (Bhattacharjee et *al.,* 1998). Therefore, a study was conducted on birds in relation to agriculture in Assam. The major objective of the present study is to assess the density and diversity of different bird species in the agricultural landscape

Methodology
The study was carried out in the 11 districts under five agro climatic Zones of Assam during 2019 to 2021 by doing survey following Line Transact method for sampling major crops *viz.,* paddy, Mustard (*Toria*), Tea, Maize and homestead garden (*Bari* system). Bird survey was conducted using a field binocular (8x40). Photographs were taken whenever necessary. Identification was done using standard field guides (Grimmet *et al*; 1999). Bird census was also conducted in different seasons in the different agro ecosystems using Point count method (Hostetler and Main, 2001). A total of 30 transects was surveyed for sampling paddy, mustard, Tea, Maize, , homestead garden and open grassland as well as wetlands adjacent to paddy field were selected to study the bird communities. Shannon-Wiener Index of Diversity and Evenness was calculated using the Windows based software Biodiversity Professional.

Results and Discussion
A total of 167 species of birds belonging to 18 orders and 57 families were recorded in agricultural landscape of 5 agro climatic zones of Brahmaputra and Barak valley of Assam which 98 species are common **(**seen commonly in the study area**)**, 56 are abundant and are 13 Rare **(**seen only once or twice**).**

The bird species which are occurring in paddy field experimental field showed variation in their utilization pattern**.** Among species recorded, 62**%** of birds solely utilize for feeding, 8**%** for food and roosting 9**%** each for food and cover, food and nesting and 12**%** for food, cover and nesting**.** The feeding guilds of birds recorded in rice fields grouped into 9 types and they exploit different prey types**.** A total of 43 species recorded in Homestead gardenwith 2.91 Shannon-Weiner Index (H') followed by 17 bird species (H' = 2.33) in different growth stages of mustard crop field which was 17.7 % occurrence in relation to total birds recorded in Agricultural Landscape .A total 55 species of birds were recorded from study area starting from seed sowing to harvesting stage of paddy crop growth.Results revealed that total 19 species birds during seedling stage, 16 species birds during transplanting; 28 species during maximum tillering stage; 27 species during milky stage; 24 species at ripening stage and 21 species in harvested paddy field against 17 and 22 species in fallow and freshly ploughed paddy field respectively.

Conclusions
The study revealed that birds are an important component of agro ecosystem and distribution vary at different growth stages of the crops. Paddy agro ecosystem provides a favourable habitat of different bird species followed by homestead in the state of Assam **.**The organic rice area clearly indicated that the occurrences of insectivorous birds were very high in organic farms and their diversity and density was significantly greater than conventional farms**.**

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Impact of Different Improved Varieties under Front Line Demonstration

Devki Nandan, AK Sharma*, Yonika Saini, Vinod Kumar and PK Rai
ICAR-Indian Institute of Rapeseed-Mustard Research Institute
**Corresponding author: ashok.drmr@gmail.com.*

Abstract
The Frontline Demonstration (FLD) program on rapeseed and mustard was conducted during 2019-20 to 2023-24 across different states in India to evaluate the performance of different improved mustard varieties under irrigated conditions. Demonstrations on 1-acre plots were using four varieties like Giriraj, RH 725, NRCHB 101, and RH 749 compared improved practices with farmer practices (FP). Results showed that RH 725 recorded the highest mean yield (21.41 q/ha), a 19.40% improvement over FP, followed by Giriraj(21.26 q/ha, 18.30%), RH 749 (20.06 q/ha, 24.82%), and NRCHB 101 (16.58 q/ha, 26.27%). The FLD program proved instrumental in improving productivity and demonstrating the potential of high-yielding mustard varieties to farmers.

Keywords: *Rapeseed-Mustard, Field demonstration, varieties, yield*

Introduction
Indian mustard (*Brassica juncea*) is a significant oilseed crop cultivated predominantly during the rabi season across India, contributing substantially to the country's edible oil supply. Total oilseeds production in India for the 2023-24 agricultural year is recorded at 39.59 million tonnes. Among the various oilseed crops, rapeseed-mustard has emerged as the top contributor, with a production of 13.16 million tonnes, accounting for 33.24% of the total oilseeds production.The All India Coordinated Research Project (AICRP) and other research institutions of mustard have developed several high-yielding mustard varieties. These varieties are introduced to farmers' fields through FLDs programs, providing an opportunity for farmers to experience their potential first-hand. Frontline Demonstrations (FLDs) serve as a critical platform for showcasing and validating these advancements in farmer fields across diverse agro-climatic conditions. By bridging the gap between research outputs and field-level adoption, FLDs provide valuable insights into factors enhancing productivity and constraints limiting success. Keeping the above facts in view, this study investigates the impact of selected improved mustard varieties demonstrated under FLDs in enhancing productivity and closing yield gaps.

Methodology
A number of different improved varieties of Indian mustard were selected under Frontline Demonstrations (FLDs) during five years (2019-20 to 2023-24). Among these, four improved varieties were prominent: Giriraj (maximum 3,310 FLDs), followed by RH 725 (940 FLDs), NRCHB 101 (931 FLDs), and RH 749 (506 FLDs). These improved varieties having FLDs were used under irrigated conditions across various states, including Uttar Pradesh, Rajasthan, Jammu & Kashmir, Telangana, Jharkhand, Maharashtra, Odisha, Bihar, Manipur, Madhya Pradesh, West Bengal, and Haryana.

These FLDs with improved varieties were demonstrated at one acre plot and comparison was done against control plot with farmer prevailing practices (varieties). The impact of these varieties was studied in terms of average yield at FLDs and farmer plot as well as percent yield improvement using the formula as

$$\text{YIOFP (\%)} = \frac{\text{Improved Practices yield - Farmers practices yield}}{\text{Farmers practices yield}} \times 100$$

Results and Discussion
A total of 4 improved varieties of Indian mustard, namely Giriraj, RH 725, NRCHB-101 and RH 749 were used in FLDs under irrigated conditions. The RH 725 variety, demonstrated in 5 states, recorded the highest mean seed yield of 2141 kg/ha with a 19.40% yield improvement over FP, followed by the Giriraj variety, demonstrated in 7 states, which recorded an average mean seed yield of 2126 kg/ha with an 18.30% yield improvement over FP. The improved variety, demonstrated in 5 states, recorded a mean seed yield of 2006 kg/ha with a 24.82% yield improvement over FP. The short-duration variety NRCHB-101, demonstrated in 11 states, recorded a mean seed yield of 1658 kg/ha with the highest yield improvement of 26.27% over FP under late-sown condition.

Conclusions
The Frontline Demonstration (FLD) program significantly enhanced the productivity of Indian mustard by promoting improved varieties across diverse agro-climatic conditions. The FLD technique is an effective way to show the production potential of improved varieties and new technologies at farmers' fields. The study showed that demonstrated varieties namely Giriraj, RH 725, NRCHB-101 and RH 749 were at higher yield in comparison to farmer's varieties. The impact and results are important should be considered by the Department of Agriculture and other agencies who are working for transfer of technology from research station to farmers while promoting the new varieties.

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Instability Analysis of Major Oilseed Crops of Rajasthan

Himani[1*] and Vikram Yogi[2]
M.Sc. Scholar[1], Assistant Professor[2], Department of Agricultural Economics, SKRAU, Bikaner, Rajasthan
**Corresponding author: 1661.himanisain@gmail.com*

Abstract
The study analyzes the instability of area, production, and productivity of major oilseed crops in Rajasthan using time series data from 1990-91 to 2019-20. The period is further divided into 3 decades. The Cuddy-Della Valle Index was used for instability analysis. In Rajasthan, the lowest instability was observed during period III with variation of 7.44 %, 9.47% and 6.62% for area, production and productivity of groundnut. In India, the highest instability was during period II. The area of rapeseed-mustard has shown the highest (17.72%) instability compared to the instability of the area of other crops. Variation of production and productivity of groundnut was recorded at 24.79 and 21.88 percent, respectively, which is highest among the selected crops.

Keywords: *Instability, oilseed, cuddy della vella index.*

Introduction
India is a major producer of oilseeds, cultivating 30.24 million hectares (Mha) and producing 41.36 million tonnes (Mt) in 2022-23. Rajasthan leads with 5.79 Mha under oilseed cultivation, accounting for 21.25% of the total area and 22.78% of production (9.42 Mt), with rapeseed-mustard, groundnut, and soybean as major crops [1]. Oilseeds are vital for India's agriculture and economy, serving as a key source of edible oils and alternative proteins. Despite significant growth in production (43%) from 2015–16 to 2020–21[2], oilseeds face challenges due to reliance on rainfed farming, leading to output instability.. Analyzing this variability is critical for resource allocation, climate adaptation, and market stability. Insights on instability can guide policymakers to support farmers, improve food security, and ensure sustainable practices. Understanding production trends, influencing factors, and potential interventions is essential for shaping effective policies to enhance oilseed output and ensure long-term agricultural resilience.

Methodology
The study was completely based on secondary data and time series data of area production and yield of rapeseed-mustard, groundnut and soybean in Rajasthan for the period of thirty years from 1990-91 to 2019-20.The period of study was further divided into Period I (1990-91 to 1999-2000), Period II (2000-01 to 2009-10), and Period III (2010-11 to 2019-20). Instability, defined as the deviation from the trend, measures variability in the area, production, and yield of oilseed crops. To analyze this, the Cuddy-Della Valle Index (CDVI) is used, providing a more precise assessment by incorporating the trend component in time-series data. The formula for CDVI is: $CV*\sqrt{1-R^2}$

Here, CV is the coefficient of variation, and R^2 is the coefficient of determination from a time series trend regression adjusted by the number of degrees of freedom. The CDVI categorizes instability into three levels: Low: 0–15, Medium: 15–30 and High : >30

Results and Discussion
High range of variation has been reported during the period of study. In Period I of the study, rapeseed-mustard showed low instability, with area, production, and productivity indices at 10.14%, 13.94%, and 11.65%, respectively. Groundnut exhibited medium instability in productivity (16.58%), while soybean showed medium instability, with production at 24.39%, and area and productivity at 16.91% and 16.17%. Similar trends were observed by Sogra (2018) for oilseed production in Rajasthan. While during Period II, rapeseed-mustard showed high instability in area (32.49%) and production (34.49%), with low instability in productivity (13.34%). Groundnut exhibited medium instability in production (29.74%) and productivity (25.58%), while soybean had medium instability, with the highest fluctuation in productivity (27.85%), aligning with Laxminarayan's findings (2018).In case of Period III, rapeseed-mustard showed low instability, with productivity (10.02%) being the most stable. Groundnut had the highest instability in production (9.47%), while soybean experienced low to medium instability in area (14.29%), production (20.50%) and productivity (25.30%).

Conclusions
The analysis of instability across three decades reveals varying trends in oilseed crops in Rajasthan. Rapeseed-mustard demonstrated low instability in most parameters across all periods, except for high instability in area and production during Period II. Groundnut showed moderate to low instability, with the highest fluctuations observed in productivity and production during Period II. Soybean exhibited medium instability throughout, with notable fluctuations in production and productivity. These findings highlight the dynamic nature of oilseed crop stability in Rajasthan, emphasizing the need for targeted interventions to mitigate instability and enhance sustainable cultivation practices for improved resilience and productivity.

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Impact of Cluster Front Line Demonstration on Sesame in Bihar and Jharkhand

DV Singh[1*], Md Monobrullah[1], Amrendra Kumar[1], Sanjay Kumar[2], Abhay Kumar[1], Sujeet Kumar[1] and Anjani Kumar[1]
ICAR ATARI Zone[1] IV Patna,KVK Gumla[2],
**Corresponding author: drdvs.icar@gmail.com*

Abstract
Sesame, an ancient oilseed crop from Africa, is economically significant due to its high oil content and protein quality. Originating in Africa and spreading to India, China, and Japan, it offers low cholesterol, high polyunsaturated fat, and 80% unsaturated fatty acids. Sesame's high quality and stability are attributed to its balanced presence of fatty acids and antioxidants. This crop's resilience in challenging conditions makes it a promising option for farmers of Bihar and Jharkhand seeking sustainable and lucrative agriculture for boosting rural livelihoods and income. Study was conducted with 1194 farmers and 466 ha area during 5 years. Among the different varieties (RT-346, RT-351 and Krishna) assessed under CFLD, it was observed that all were outperformed compared to farmer practice. The per cent increase in yield with Improved Practices (IP) over FP was found to be 23.60 per cent. The extension gap and technological index were 1.16 q/ha and 50.53 per cent, respectively. The observed technology gap (5.61 q/ha) reflected the farmer's cooperation in carrying out demonstrations.Therefore, it clearly indicates that use of improved practices with scientific intervention contributed to increase the productivity and profitability of Sesame.

Keywords*:Sesame, Cluster frontline demonstrations, extension gap, yechnology gap*

Introduction
Sesame, an ancient oilseed crop, originated in Africaand spread to India, China, and Japan. Sesame (Sesamum indicum L.) is an ancient oilseed crop belonging to family Pedaliaceae. It is economically very important crop as it contains high oil of about 40-60% and good quality of 20-40% protein. It is a rich source of high-quality oil and protein, with excellent stability due to natural antioxidants like sesamolin and sesamin. Sesame offers low cholesterol and a high proportion of polyunsaturated fat, with 80% unsaturated fatty acids. Its proteins are rich in essential sulphur-containing amino acids methionine and tryptophan. The ideal growing conditions for sesame are 11° to 35°C and soil pH 4.3 to 8.7. Sesame is known as the "Queen of Oilseeds" due to its high quality and stability of oil, which is due to the balanced presence of saturated and unsaturated fatty acids and antioxidants. The yield gap is primarily due to the lack of poor adoption of scientific practices.

Methodology
Cluster Front Line Demonstrations (CFLDs) on Sesame were conducted by KVKs of Bihar & Jharkhand under ICAR-ATARI, Zone IV, Patna from 2019-20 to 2023-24 in different variety (RT-346, RT-351 and Krishna). Farmers and farm women were identified through surveys, awareness programs, and interactive meetings. Trainings on improved cultivation practices were organized, and critical inputs like seeds, fungicides, and insecticides were provided, while farmers supplied balanced nutrients. A total of 1194 farmers were participated with total of 466 ha area with farmer participation to showcase improved Sesame cultivation. In farmers Practice, traditional methods were followed, while demonstration plots used improved varieties with line sowing, weedicide application, and balanced fertilization. KVK scientists guided field operations, and field days were organized to highlight technological advantages. Yield data from demonstrations and farmers Practice were analysed using statistical tools, and technology gap and index were calculated.

Results and Discussion
The study highlights a gap in technology adoption between demonstration plots and farmers' practices (FP) regarding improved variety, seed treatment, plant protection, and weed management. CFLD interventions significantly enhanced sesame yield, averaging 4.89 q ha{ ¹, a 23.60% increase over FP (3.74 q ha{ ¹). Despite yield improvements, climatic variations limited potential output. The extension gap (0.71–1.66 q ha{ ¹) highlights the need for farmer education. The technology gap (3.52–9.58 q ha{ ¹) indicates positive farmer cooperation, aligning with prior studies. The technology index (43.76–63.86%) confirmed the feasibility of improved technologies. The average technology index (50.53%) supports the effectiveness of interventions, encouraging broader adoption.The results area ligning with findings by Sagwan et. al (2021) in Mustard, and Jha et al. (2020) in chickpea.

Conclusions
The Cluster Frontline Demonstrations (CFLDs) conducted by KVKs of Jharkhand under ICAR-ATARI, Zone IV, Patna significantly improved sesame yield and facilitated the widespread adoption of recommended production technologies. Through training programs, field days, and exposure visits, CFLDs increased sesame yield by 23.60%. The potential yield of improved varietiescan be realized through scientific knowledge dissemination, quality input supply, and proper utilization.

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Challenges in Accessing Information for Organic Vegetable Production : Constraints Faced by Farmers in Assam

Sanjana Bora*[1] , Amarjyoti Khound[2], Pabitra K Das[3] and Ashok Kumar Sharma[4]
*Technical-Assistant[1] * District Level, NMEO-OP under District Agricultural Office, Nagaon, Assam*
Assistant Professor[2], Dept of Agril. Engg., Professor[3], Dept of Ext. Edu., B.N College of Agriculture, AAU, Assam
Pr. Scientist[4], ICAR,IIRMR, Bharatpur, Raj
**Corresponding author : sanjanabora37@gmail.com*

Abstract
Timely access to agricultural information and inputs is crucial for enhancing productivity. This study examines the constraints faced by farmers in accessing information for organic vegetable production in Sonitpur and Nagaon districts of Assam. Using a purposive-cum-proportionate random sampling method, 120 farmers were selected, and data were analyzed using the Problem Confrontation Index (PCI) with a 3-point Likert-type scale. The major constraints identified included lack of knowledge about inspection and certification processes, market linkages, access to credit, and information sources, along with inadequate training and irrigation facilities. The study underscores the urgent need for improved information dissemination, credit access, and training programs to enhance organic vegetable farming.

Keywords*: constraints, information needs, organic vegetable production, farmers*

Introduction
Access to accurate agricultural information is critical for farmers to make informed decisions, especially in organic vegetable farming. However, various constraints hinder their ability to obtain essential knowledge. This study aims to identify these challenges and provide insights to improve information dissemination. Previous research has highlighted issues such as inadequate agricultural information centers (Patel, 2004), limited training and financial constraints (Haque, 2005), and language barriers (Tologbonse et al., 2009). Kalita (2016) emphasized the lack of awareness of different information sources, while Kumar et al. (2017) identified technological barriers in accessing online agricultural platforms. Phiri et al. (2018) noted limited extension visits and financial issues as key challenges for smallholder farmers. Addressing these constraints is essential to enhance farmers' access to information, improve productivity, and promote organic farming. This study provides policymakers and researchers with necessary data to develop strategies for overcoming these barriers.

Methodology
The study was conducted in Assam's North Bank Plains Zone (Sonitpur district) and Central Brahmaputra Valley Zone (Nagaon district). Within these districts, the Tezpur and Nagaon subdivisions were selected, and eight villages (four from each) were randomly chosen. A total of 120 farmers engaged in organic vegetable production were selected using a proportionate-cum-random sampling method. Data collection was carried out through structuredpersonal interviews. Fifteen independent variables, including education, occupational status, economic motivation, and scientific orientation, were measured using standardized scales. The dependent variables focused on farmers' information needs and information-seeking behavior. Data analysis techniques included frequency, percentage, mean, standard deviation, coefficient of variation, multiple correlation, multiple regression, and t-tests. The Problem Confrontation Index (PCI) was employed using a 3-point Likert-type scale to rank the severity of constraints. This structured approach ensured a comprehensive assessment of the challenges faced by farmers in obtaining agricultural information.

Results and Discussion
The Problem Confrontation Index (PCI) analysis identified major constraints affecting farmers' access to organic farming information. The most significant challenge was the lack of knowledge about inspection and certification processes (PCI 296), followed by inadequate awareness of market linkages (PCI 280). Limited access to credit facilities (PCI 278) and poor awareness of information sources (PCI 277) were also prominent barriers.Other key issues included restricted access to extension personnel (PCI 270), inadequate training facilities (PCI 262), and difficulties in attending meetings due to distance (PCI 231). Poor irrigation infrastructure (PCI 230) and economic constraints in purchasing modern tools (PCI 189) further hindered information access. Addressing these challenges is crucial for enhancing farmers' knowledge and boosting organic vegetable production.

Conclusions
The findings emphasize the need for improved knowledge of certification, market linkages, credit access, and extension services. Strengthening training programs, enhancing financial support, and ensuring timely information delivery can bridge these gaps. Policymakers, NGOs, and extension agencies should develop targeted interventions to address farmers' challenges. By improving information access and support systems, agricultural productivity in Assam can be significantly enhanced.

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Yield Gaps and Identification of Potential Cropping Districts in Oilseed Crops

GDS Kumar*, RK Mathur, A Srinivas and P Aswani
ICAR-Indian Institute of Oilseeds Research, Rajendranagar, Hyderabad-500 030, Telangana
**Corresponding author: gd.satshkumar@icar.gov.in*

Abstract
The frontline demonstrations (FLDs) conducted in various locations throughout India has indicated huge yield gaps ranging from 01 to 402% in castor, sunflower, safflower, sesame, niger and linseed crops. To bride these gaps, efficient cropping districts were identified in each crop for productivity enhancement and area expansion. The recommended technologies and the extension strategies for each of the identified district has to be adopted for increasing the production of oilseeds. Focused efforts and convergence of all the stakeholders will go a long way in productivity enhancement and area expansion of oilseed crops in India.

Keywords : *RSI, RYI, FLDs and convergence*

Introduction
India has achieved record production of 359.46 m t of oilseeds during 2020-21 in spite ofmajor constrains of rainfed cultivation, small operational land holdings, low varietal replacement (niger and sesame), losses due to pests and diseases and non-adoption of improved technologies. The frontline demonstrations (FLDs) conducted in various locations throughout India has indicated huge yield gaps ranging from 01 to 402% in six oilseed crops. To bridge these yield gaps, it is essential to delineate the potential districts for productivity enhancement and area expansion of oilseed crops. Delineation of potential districts and categorization into most efficient, moderately efficient, efficient and in efficient groups will help in formulating suitable strategies either for area expansion or productivity enhancement of oilseed crops. Suitable technologies can be identified for each district and the productivity potential and profitability can be demonstrated in farmers' fields through FLDs for wider dissemination and adoption.

Methodology
In order to assess the yield gaps, yield gap-I (YG-I), yield gap-II (YG-II) and yield gap-III (YG-III) were estimated based on the FLDs conducted during 2018-19 to 2022-23. For identifying efficient cropping districts, Relative Yield Index (RYI) and Relative Spread Index (RSI) were computed by using the methodology given by Kanwar (1972). The RYI and RSI were estimated based on crop area and productivity mean of five years for the six crops (castor, sunflower, safflower, sesame, niger and linseed). Most efficient districts are areas where a particular crop has high spread and high productivity. Efficient districts are areas where there is low spread but high productivity. Moderately efficient cropping districts are areas where there is high spread but low productivity. The three categories of districts are biophysically suitable to a particular crop. Inefficient cropping districts are areas where both spread and productivity were low and substitution of the crop is necessary in these districts.

Results and Discussion
In castor, the YG-III(increase in seed yield with IT over district average yield expressed in %) ranged from 6.0 to 402% under rainfed conditions and 39 to 59% under irrigated conditions during *kharif* and 145 to 267% during *rabi*. In sunflower, the YG-III ranged from 116 to 215% during *kharif* and 1.7 to 218% during *rabi*. In safflower, the YG-III ranged from 14.6 to 138.4% under rainfed conditions and up to 121% under irrigated conditions. In sesame, the YG-III ranged from 3 to 231% during *kharif* and in niger the YG-III ranged from 11.7 to 307%. In linseed, the YG-III ranged from 8.7 to 215% under rainfed conditions and 7.5 to 263% under irrigated conditions as compared to district mean yields. The potential cropping districts were identified for the six crops using RSI and RYI. Ramamurthy *et al*., (2018) also used RSI and RYI for computing the potential cropping districts for the study crops.

Conclusions
The study clearly brought out the existing yield gaps in oilseed crops and identified the efficient cropping districts for area expansion and productivity improvement. In order to scale-up the demonstrations and speed up the dissemination of improved technologies there is need to forge necessary partnerships involving extension agencies, state department of agriculture and input agencies in a mission mode approach. The recommended technologies and the extension strategies for each of the identified district has to be adopted for increasing the production of oilseeds. Focused efforts and convergence of all the stakeholders will go a long way in area expansion and productivity enhancement of oilseed crops in India.

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Overview of Frontline Demonstrations on Vertical and Horizontal Productivity and Area in South-Eastern Rajasthan

Pratap Singh[1]*, YK Meena[1], KC Meena[1], Mahendra Singh[2], H Verma[3], D Singh[4], TC Verma[5], BL Dhaka[6] and B Singh[7]
Directorate of Extension Education[1], Krishi Vigyan Kendara-Kota[2], Bundi[3], Baran[4], Jhalawar[5], Swaimadhopur[6] and Karauli[7] Agriculture University, Kota, Rajasthan
**Corresponding author : psd427@rediffmail.com*

Abstract
The present study evaluates the impact of Frontline Demonstrations (FLDs) conducted by Krishi Vigyan Kendras (KVKs) of Agriculture University, Kota, from 2013-14 to 2023-24 across diverse agro-ecological conditions. A total of 22,302 FLDs were implemented on 9,160 hectares to showcase the yield potential of newly released crop varieties and improved production and protection technologies. Demonstrations were conducted in kharif (9,289 FLDs, 3,763 ha), rabi (12,223 FLDs, 5,229 ha), and zaid (790 FLDs, 168 ha) seasons, covering cereals, pulses, oilseeds, seed spices, vegetables, and fodder crops. The performance of FLDs across different crops exhibited significant yield improvements over local cultivars, with increases yield ranging from 12.53% (wheat) and 37.21% (black gram). Notably, FLDs on chickpea contributed to a substantial expansion in cultivation area across districts, with increases of 361.48% in Kota, 602.66% in Bundi, 97.27% in Baran, 91.90% in Jhalawar, and 91.90% in Sawai Madhopur over the last decade. Productivity gains in chickpea ranged from 38.28% to 75.35%, emphasizing the effectiveness of FLDs in enhancing both area and yield. The findings highlight the pivotal role of FLDs in promoting advanced agricultural practices, improving productivity, and ensuring food security in the region.

Keywords : *Frontline Demonstrations, crop productivity, krishi vigyan kendras, yield improvement, agricultural extension.*

Introduction
Agriculture sustains rural livelihoods, ensuring food security and economic growth. In Sount-Eastern Rajasthan, pulses, cereals, oilseeds, and spices contribute significantly to farm incomes. Agriculture University, Kota, supports modern farming across Kota, Baran, Jhalawar, Bundi, Sawai Madhopur, and Karauli, where diverse agro-climatic conditions favor crops like wheat, soybean, mustard, chickpea, black gram, green gram, vegetables, and fodder. Despite their potential, pulses face challenges like low productivity, poor seed replacement, and limited mechanization.Farmers struggle with traditional methods, inadequate knowledge of high-yielding varieties, poor pest and nutrient management, and climate unpredictability, leading to yield gaps. To address this, KVKspromote technology transfer, capacity building, and Frontline Demonstrations to introduce improved techniques. This study evaluates FLDs conducted from 2013-14 to 2023-24, assessing their role in boosting yields, increasing profitability, and promoting sustainability.

Methodology
The study evaluated the impact of Front Line Demonstrations (FLDs) conducted by six Krishi Vigyan Kendras (KVKs) under Agriculture University, Kota. These demonstrations aimed to showcase the production potential of newly released new varieties and advanced production-protection technologies under different agro-ecological conditions. FLDs were conducted under the direct supervision of scientists on selected farmers' fields in 0.4-hectare blocks to maximize impact. Between 2013-14 to 2023-24, a total of 22,302 FLDs were implemented over 9,160 hectares to popularize proven agricultural technologies.Data on the number of demonstrations and area covered were obtained from the respective KVKs, while information on local yield, demonstration yield, cost, and returns were compiled from KVK's annual reports. Key performance indicators such as yield improvement (%), profitability (Rs./ha), and benefit-cost ratio (BCR) were calculated to compare FLD performance with farmers' traditional practices.

Results and Discussion
The implementation of 22,302 Frontline Demonstrations (FLDs) across 9,160 hectares under KVK's Agriculture University, Kota, from 2013-14 to 2023-24 has significantly improved crop productivity. Conducted across kharif, rabi, and zaid seasons, these demonstrations covered cereals, pulses, oilseeds, seed spices, vegetables, and fodder crops. The demonstrated varieties consistently outperformed local cultivars, with yield enhancements ranging from 12.53% in wheat and 37.21% in black gram. Among pulses, chickpea showed remarkable productivity gains between 38.28% and 75.35%, leading to a substantial expansion in cultivation, particularly in Kota (361.48%), Bundi (602.66%), and around 90% in Baran, Jhalawar, and Sawai Madhopur. The economic impact of FLDs has been substantial, with demonstrated plots consistently generating higher net returns than traditional practices. Data revealed that FLDs enhanced farm profitability through increased productivity and efficient resource utilization, improving the benefit-cost ratio (BCR). The large-scale adoption of improved pulse varieties in KVK districts indicates that FLDs have successfully encouraged farmers to transition from low-yielding traditional varieties to scientifically validated, high-yielding options. This transformation has not only increased individual farm incomes but has also contributed to the overall economic growth and sustainability of pulse production in the region.

Conclusions
FLDs have played a crucial role in enhancing crop productivity, profitability, and the adoption of improved farming technologies. Their success underscores the need to expand FLD coverage, integrate digital tools for knowledge dissemination, and strengthen farmer training programs. Continued efforts in these areas will further boost agricultural sustainability and economic growth in the region.

Emerging Marketing Trends, Opportunities, and Challenges in the Indian Organic Food Sector

Swati Sharma*
Associate Professor, ASPEE Institute of Agribusiness Management, Agricultural University Navsari, Navsari, Gujarat
**Corresponding author:swatisharma_abm@yahoo.co.in*

Abstract
The Indian organic food sector is witnessing significant growth as it adapts to changing consumer preferences, technological advancements, and government policies promoting sustainable agricultural practices. With the growing importance of transparency, traceability, and ethical sourcing, organic food products are becoming increasingly popular among Indian consumers. As a result, organic food sales are not only rising in urban markets but also in rural areas, driven by increased awareness and accessibility. The increasing demand for diverse organic product categories, such as gluten-free, vegan, and allergen-free foods, has opened new avenues for agribusinesses to innovate and capture niche markets. Technological advancements, particularly in agritech and urban farming, are transforming the production landscape, providing more efficient and scalable solutions for organic farming.

Introduction
The Indian organic food market is experiencing substantial growth as consumer preferences shift toward healthier, chemical-free alternatives. This review explores the emerging trends, growth opportunities, and challenges in the Indian organic food sector, with an emphasis on marketing strategies in agribusiness management. The support from government initiatives, including the National Program for Organic Production (NPOP), is helping strengthen infrastructure, certification processes, and market access, providing a solid foundation for growth.Despite the promising outlook, the sector faces several challenges that must be addressed to fully unlock its potential. These include supply chain inefficiencies, limited consumer awareness in certain regions, and complex certification processes. This paper also highlights the barriers to scaling up organic farming, such as the high cost of inputs and the lack of adequate training for farmers. Addressing these challenges requires strategic marketing approaches, such as building consumer trust through effective brand positioning, leveraging omnichannel marketing, and promoting the benefits of organic food consumption through education.

Methodology
The study analyzed the Indian organic food market using data from the India Organic Market Report (2023) and FAO (2023). Key aspects included market growth trends, consumer preferences, and marketing strategies, with a focus on digitalization, health awareness, and sustainability. Growth opportunities such as product diversification, export potential, and niche markets were examined alongside challenges like supply chain constraints, certification barriers, and limited rural penetration. Recent advancements, including agri-tech innovations and urban farming, were explored. Policy support through the National Program for Organic Production (NPOP) and government subsidies was also reviewed to assess its impact on market expansion.

Results and Discussion
The Indian organic food market has experienced significant expansion, with a projected CAGR of 25.2% over the next five years. As of 2023, India has 2.7 million hectares of organic farmland, ranking ninth globally in organic farming area. Key growth drivers include increased health awareness, sustainability concerns, and government initiatives. The adoption of e-commerce platforms has further fueled market penetration, with platforms like BigBasket and Amazon India witnessing increased organic food sales. However, challenges such as inadequate supply chain infrastructure, high certification costs, and limited rural consumer awareness persist. Addressing these issues through policy interventions and technological advancements, such as precision agriculture and urban farming, can enhance market sustainability and expansion.

Conclusions
The Indian organic food sector is poised for remarkable growth, driven by increasing consumer awareness, shifting dietary patterns, and favorable government policies. However, challenges related to supply chain infrastructure, certification, and consumer education remain significant. By adopting innovative marketing strategies, leveraging technological advancements, and navigating regulatory hurdles, agribusinesses can capitalize on the tremendous potential of this sector.

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Effect of Different Doses of Nitrogen Fertilizers on Growth, Yield and Economics of Wheat

Rahul Singh Jantwal and Pratibha Singh
Young Professional, Rajasthan Agricultural Research Institute, Durgapura, Jaipur, 302018
**Corresponding author: .....*

Abstract
The field experiment conducted at UnchapulHaldwani, Nainital, Uttarakhand during 2023 and 2024. The experiment was laid out in Randomized block design (RBD) with three Replications. Nitrogen @ 0, 30, 60, 90,120,150 and 180 kg ha^{-1} was applied in respective plots in the form of urea applied in split doses 50% at basal application and remaining 50% through top dressing at flowering stage with RDF of P2O5 and K2O at basal application. Various growth, yield and economic parameters of the crop were influenced significantly by various nitrogen levels. Significantly maximum plant height were obtained under highest nitrogen level, 180 kg ha^{-1}. But higher number of tillers, dry matter accumulation, higher grain yield, biological yield, No. of grain per spike, test weight, harvest index of wheat, highest gross return and net return and highest benefit cost ratio was obtained with successive increase of dose up to 125% (150 kg N ha^{-1}) recommended dose of N. Therefore, application of 150 kg ha^{-1} is an option to improve the wheat yield, growth and economics.

Keywords*:Triticum aestivum, spikes, grain, biological yield, harvest index, wheat*

Introduction
Nitrogen is a crucial nutrient for plant growth, playing a vital role in amino acid and protein synthesis, which are essential for the development of crops. The availability of nitrogen directly impacts growth, development, and yield (Hussain *et al*.2003). It is highly mobile in the soil and considered essential for increasing crop productivity, with agriculture consuming around 19.5 million tons of nitrogen fertilizer annually. Initially, a single nitrogen application was recommended, but due to its soil mobility, double split applications became common (Koch and Hussain 2020). However, nitrogen use contributes significantly to production costs and can negatively affect the environment (Ullah *et al.* 2019). In developing countries, high nitrogen costs are exacerbated by climate change. Increasing nitrogen use efficiency is key to reducing costs and improving crop yield. Adequate nitrogen application is particularly important for wheat, influencing growth, tillering, grain yield, and flour quality. Low nitrogen levels can hinder crop performance, highlighting the importance of managing nitrogen for optimal wheat production.

Methodology
Field experimental farm is located at Unchapul, Haldwani, Uttarakhand at an altitude of 443 m above sea level.29.227167æ%N,79.49600 1æ%E.The experiment was conducted November, 2023 to April, 2024. Wheat variety 'HD2967' was sown on 15th November, 2023.The experiment, arranged in a Randomized Complete Block Design, had Seven treatments and three replications. Wheat was planted at a seeding rate of 100 kg ha^{-1}, with a row spacing of 20 cm.Phosphate fertilizer was applied as DAP (46% P2O5, 18% N) at 85 kg P2O5 ha$^{-1,}$ with phosphorus incorporated at planting and nitrogen applied in split doses using granular urea. Urea was broadcasted at sowing, with top-dressing during flowering stage. Total three irrigations were applied to the crop at different stages. Harvesting took place in the Second week of April. Grain yield and yield components were measured from a one-meter square area, including spike count, 1000-grain weight, and average grains per spike.

Results and Discussion
Various growth, yield and economic parameters of the crop were influenced significantly by various nitrogen levels. Significantly maximum plant height were obtained under highest nitrogen level, 180 kg ha-1. But higher number of tillers, dry matter accumulation, higher grain yield, biological yield, No. of grain per spike, test weight, harvest index of wheat, highest gross return and net return and highest benefit cost ratio was obtained with successive increase of dose up to 125% (150 kg N ha-1) recommended dose of nitrogen.

Conclusions
The application of 125% recommended dose of N with 150 kg N ha^{-1} significantly the high values of growth, yield and economics. The application of nitrogen in split doses 50% at basal application and 50% at the time of flowering to improve nitrogen use efficiency. Thus 125% recommended dose of N with 150 kg N ha^{-1} recommended for obtaining maximum yield of wheat.

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Impact of Improved Cassava Varieties in Tamil Nadu: Adoption, Profitability and Policy Implications

P Prakash*[1], D Jaganathan and Sheela Immanuel
ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram, Kerala, India
**Corresponding author: prakashiari@yahoo.com*

Abstract
This study evaluates the socio-economic impact of improved cassava (*Manihot esculenta*Crantz) varieties in Tamil Nadu, India, based on a survey of 300 farm households across six districts during 2022-2023. Using cost-benefit analysis, propensity score matching, and a logit regression model, the study assesses the profitability and determinants of improved varieties. Findings indicate that 46% of farmers adopted improved cassava varieties, resulting in a 13% yield increase and a 17% rise in income compared to local varieties. Factors influencing adoption include higher yield (p=0.037), farm size (p=0.012), access to technical advice (p=0.001) and irrigation facilities. Policy recommendations include strengthening the seed system, enhancing market access and improving financial incentives for farmers adopting varieties.

Keywords:*Cassava cultivation, technology adoption, cost-benefit analysis, socio-economic impact, sustainability*

Introduction
Cassava is a vital crop for food security and industrial applications, particularly in Tamil Nadu, where it contributes to rural livelihoods. This study investigates the economic impact of improved varieties on cassava production, adoption patterns, profitability and associated socio-economic benefits. Despite its significance, cassava cultivation faces challenges such as limited formal seed systems, emergence of pests and diseases, reliance on intermediaries and labor-intensive harvesting. Understanding the economic advantages of improved varieties can guide policy interventions to enhance cassava production and farmer incomes.

Methodology
A multi-stage sampling approach was used to collect data from 300 cassava farmers in Salem, Tiruchirappalli, Namakkal, Cuddalore, Dharmapuri and Pudukkottai districts of Tamil Nadu. Cost-benefit analysis was conducted to compare the profitability of improved varieties vs. local varieties. Propensity score matching estimated the impact of improved varieties adoption, while a logit regression model identified key determinants influencing adoption decisions. Variables considered include farm size, yield potential, access to extension services and market conditions.

Results and discussion
The study found that adoption of improved varieties led to an average yield increase of 3.29 tons/ha and a net income of ₹ 26,182 per hectare. The most profitable variety 'Cassava - *SreeAthulya'* recorded the highest net income of ₹ 218,272 per hectare. Factors promoting improved varieties adoption include higher yield potential, access to technical advice, irrigation facilities and better market linkages. Challenges include reliance on informal seed systems, high labor costs for harvesting and price fluctuations due to intermediaries.

Conclusions
The adoption of improved varieties significantly enhances cassava productivity and farmer incomes. However, widespread adoption is hindered by factors such as pest susceptibility, lack of credit access and price volatility. Policy interventions should focus on strengthening the cassava seed system, promoting mechanization for harvesting and introducing financial incentives to encourage adoption of improved varieties. Addressing these challenges can transform the cassava sector, improving economic stability and sustainability in Tamil Nadu.

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Pattern and Trend in Technology Demonstration of Rapeseed-Mustard in India

RK Yogi*, AK Sharma, Vinod Kumar, Himani, Devki Nandan and PK Rai
ICAR-Indian Institute of Rapeseed-Mustard Research, Bharatpur, Rajasthan, India
**Corresponding author: raj.yogi@icar.gov.in*

Abstract
This study aimed to understand the pattern and recognize trend in technology demonstration. A total of 23,172 Frontline Demonstrations (FLDs) of rapeseed-mustard varieties were conducted across different states in India from 2010-11 to 2023-24 and these data has been used for tabular analysis. The Frontline Demonstration program in India showed a significant variation over the time due to the change in government priority for edible oil sector. Spatial pattern of FLDs showed 88% correlation with area under rapeseed-mustard. Varietal pattern of FLDs showed 90% correlation with seed indent raised by the Department of Agriculture & Farmers' Welfare. Varietal pattern of FLDs varied from the seed chain supply of the varieties significantly.

Keywords: *Correlation matrix, frontline demonstrations, spatial Analysis, temporal analysis, varietal pattern.*

Introduction
Harnessing cutting-edge technologies to enhance crop productivity is pivotal goal in modern plant breeding. The Frontline Demonstration (FLD) program is an initiative by the Indian Council of Agricultural Research (ICAR) under the Ministry of Agriculture & Farmers' Welfare, Government of India. It aims to transfer advanced agricultural technologies from research institutions to farmers' fields by demonstrating high-yielding and improved crop varieties, along with recommended agronomic practices. Rapeseed-mustard is a pivotal oilseed crop in India, contributing significantly to the country's edible oil production. This institution has been instrumental in developing and promoting ecologically sound and economically viable production and protection technologies. This study aimed to understand the pattern and recognise trend in technology demonstration on rapeseed-mustard.

Methodology
Time series secondary data on FLDs as well as area under rapeseed mustard collected from the Annual Reports on AICRP on rapeseed-mustard and Department of Agriculture and Farmers' Welfare, Government of India. A total of 23,172 Frontline Demonstrations (FLDs) of rapeseed-mustard varieties were conducted across different states in India from 2010-11 to 2023-24 and these data has been used for tabular analysis. Trend analysis of the time series data used to study the linear relationship. For spatial analysis in relation to the area, the tabular and graphical tools were used. For pattern recognition in seed chain as well as varieties used for FLDs, the correlation matrix applied.

Results and discussion
The demonstrations have increased significantly over 14 years, from 454 in 2010-11 to a peak of 6462 in 2022-23. There was a sharp rise between 2015-16 (469) and 2016-17 (1989), and another major jump in 2022-23. A sharp decline is observed between 2022-23 (6462) and 2023-24 (933), which may be due to shift in government priority for edible oil sector. Spatial analysis revealed that Rajasthan, Uttar Pradesh, Assam, Manipur and Madhya Pradesh contributed nearly 70% of total demonstration. Rajasthan (6415) has the highest number of FLDs accounting for nearly 28% followed by Uttar Pradesh (15%), Assam (10%), Manipur (8%) and Madhya Pradesh (6%) in India. However, Rajasthan contributes 43% of total area under this crop. Only 10 FLDs were conducted in Chhattisgarh in year 2010-11 and it discontinued afterwards. Nearly 80%of FLDs (18723) were covered by 25 improved varieties and rest covered by 176 varieties. The prominent variety for which the highest number of FLDs conducted were Giriraj (18.7%), NRCHB 101(15.5%) and TS 38(7.6%). Among these Giriraj recommended for Zone II while NRCHB 101 for Zone III & Zone V and TS 38 for Zone V. The next prominent varieties were RH 749 (5.5%), RH 725 (4.9%) PM 30 (4%) and DRMR 1165-404 (3.5%). A total 14 varieties having more than 60% FLDs contributes about 30% in seed chain of rapeseed-mustard.

Conclusions
The Frontline Demonstration program on rapeseed-mustard in India showed a significant variation over the time due to the change in government priority for edible oil sector. Spatial pattern of FLDs showed 88% correlation with area under rapeseed-mustard. Varietal pattern of FLDs showed 90% correlation with seed indent raised by the Department of Agriculture & Farmers' Welfare. Varietal pattern of FLDs varied from the seed chain supply of the varieties significantly. Variability in the trend and pattern in technology demonstration of rapeseed-mustard in India is governed by various factors including area, production, productivity, zonalisation, seed indent, government priorities and other policy issues.

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A Multidimensional Study on Entrepreneurial Behavior of Kinnow Growers of Irrigated North -Western Plain Zone 1b of Rajasthan

Sandeep Kumar Rastogi* and BS Meena
Department of Agricultural Extension and Communication, College of Agriculture Sriganganagar, Swami Keshwanand Rajasthan Agricultural University, Bikaner-334006
**Corresponding author: .....*

Abstract

Kinnow is a popular citrus fruit in Rajasthan, particularly known for its sweet taste, juiciness, and high nutritional value. Originating from a hybrid between the King and Willowleaf mandarin varieties, Kinnow has found a favorable environment in the arid regions of Rajasthan, especially in districts like Sri Ganganagar, Hanumangarh, and surrounding areas. These regions have embraced Kinnow cultivation due to the suitable climate and soil conditions. Kinnow growers in Rajasthan have increasingly adopted Kinnow cultivation due to its economic viability and demand in both domestic and international markets. 80% Kinnow growers are still dependent on trader/agents to sell their Kinnow fruit. Among the supply, 60% comes from the waxing plant operators and 20% from traders/agents while only 20% supply comes from the farmer's side in the markets (RACP report 2018). Studying the entrepreneurial behaviour of Kinnow growers in Rajasthan is crucial for driving agricultural innovation, formulating effective policies, enhancing socio-economic conditions, and ensuring sustainable and profitable Kinnow cultivation in the region. The present study was carried out in Sriganganagar and Hanumangarh district of the Rajasthan because of highest area and production of Kinnow crop. The data were collected from a sample of 250 respondents using a pre tested interview schedule. Eleven dimensions of entrepreneurial behaviour as dependent variable and thirteen independent variables were selected for the study. The salient findings of the study are as follows; An overview of the findings revealed that most of the respondents (50.40%) belonged to middle aged, having medium land holding size (44.00%) between 2.01 – 4.0 ha. , having senior secondary level (25.60%) of education with Agri. +Animal husbandry + Horticulture (48.80%) as their major occupation, live in medium sized family (43.60%) of 4-7 members, having medium level of experience (37.20%), medium level (67.20%) of annual income, social participation (38.80 %), mass media exposure (41.60%), extension participation (40.80%), self-reliance (41.20%), Cosmopoliteness (43.60%) and deferred gratification (43.20%). More than two fifth (42.80 %) of Kinnow growers were in medium level (142.67 – 168.97) of entrepreneurial behaviour followed by high (30.40%) & low (26.80%). Dimension like economic motivation rank first (88.4) followed by leadership ability (85.0) as second and knowledge in kinnow cultivation (84.7) as third and so on.

Current Trends in Agriculture Research and Extension Services: Shaping the Future of Sustainable Agriculture and Food Security

RK Lembisana[1*], S Zeshmarani[2], S Prabin Singh[3]
[1]SMS Home Science, [2] Senior Scientist & Head,[3.] Prog. Asst. Ext,
Krishi Vigyan Kendra Thoubal, Manipur, ICAR-ATARI Zone VII, Umiam, Meghalaya
Host: Department of Agriculture, Manipur
**Corresponding author : rajkumarilembisana42@gmail.com*

Abstract

Vegetable based nutri-garden is the cheapest source of nutrition which play an active role for eradication the malnutrition burden. Nutrition rich vegetable crops from own home or nutrition garden are cheapest, safest and natural way to get functional food. The home and kitchen garden is an advance form of kitchen garden in which vegetables are grown along with fruits, spices and other crops as a supplementary source of food and income.This nutrition -garden based intervention was carried out by Krishi Vigyan Kendra Thoubal in the five villages of Thoubal District of Manipur. For small and marginal farmers nutri-garden produce can make a critical contribution to the family diet and provide several other benefits,particularly for women and children. Provide nutrition rich veg. ensuring good health of whole family and source of balanced diet. Data from 100 farm families across 5 villages with 200 square meter area nutrition garden has been analyzed through questionnaire, indicates that Nutri-Gardens positively impact the family nutrition. Reason specific crop sequence is also maintained for Rabi, Zaid and Kharif seasons. In conclusion, Nutrition -Gardening offer a holistic approach to improving nutrition in rural areas, empowering women, raising their socio-economic status, and promoting nutrition education and community participation.Other stakeholders is essential to disseminate information effectively and ensure the success and sustainability of Nutrition-Gardening.

Keywords : Diversification, nutrition garden specific crop

Community Composting:A Sustainable Way to Achieve Self-Sufficiency in Organic Farming in Rajasthan

Narendra Kumar Pareek*
College of Agriculture, (Sri Karan Narendra Agriculture University, Jobner), Fatehpur-Shekhawati, Sikar (Rajasthan), India- 332301
**Corresponding author : nkpareek.agro@sknau.ac.in*

Abstract

Organic foods are becoming popular among the consumers and now farmers and traders prefer organic farming as business activity. After covid-19 era, importance of organic farming is much more realized by all the stake holders. However, the profitability under organic farming is an important issue. Studies report that when actual price premiums (higher prices awarded to organic foods) were included, organic agriculture proved significantly more profitable (22 to 35% greater net present values) and had higher benefit/cost ratios (20 to 24%) than conventional agriculture. In this way, it can become a profitable venture and help in doubling the income of farming community. The major constraint in adoption and popularization of organic farming is the availability of large quantities of organic matter to meet the nutrient requirements of different crops grown on one hand and to sustain the soil health on the other hand. Rajasthan, a state with around 60 % area under dryland farming and minimal use of chemical inputs can be easily brought under organic cultivation. It is a state whose economy is mainly based on production from agriculture and livestock. Rajasthan state with gross cultivated area of 26.10 M.ha., produces 24.31 M. tones food grains, 7.94 M. tones, oilseeds and many other agricultural commodities. Besides this, livestock population of 56.80 million including 13.94 million cattle, 13.70 million buffalo, 7.90 million sheep and 20.8 million goat are also providing a huge amount of animal waste in the state. By considering these two important sources of organic waste (animal and plant), a sizable compost can be prepared and can be used to promote organic cultivation in the state which otherwise may impose environmental threat by creating many kinds of pollutions.

Community composting refers to a collective effort where individuals, organizations, or communities work together to recycle organic waste, converting it into nutrient-rich compost. This compost can then be used to improve soil health, support sustainable agricultural practices, and reduce the environmental impact of waste disposal. The process of community composting is integral to achieving self-sufficiency in organic farming, as it supports local food production, reduces dependence on external inputs and promotes environmental sustainability. Besides some benefits of community composting like reduction of waste, soil health and fertility, reduction in external inputs, increased self-sufficiency, community engagement and education etc., there are some challenges as awareness and participation, regulations and standards, logistical barriers, scale and sustainability, contamination with which one has to deal to get success in preparation of composts at community level.

Community composting plays a crucial role in achieving self-sufficiency in organic farming by providing sustainable alternatives to synthetic fertilizers and promoting local waste management solutions. By recycling organic waste into valuable compost, communities can enhance soil health, improve crop production, and reduce their environmental footprint.

Keywords: Organic farming, animal waste, crop waste, soil health, community compost

Trends and Growth Dynamics of Pomegranate Cultivation in India

Manpreet Kaur*, SR Meena, RC Balai and Anita Meena
ICAR-Central Institute for Arid Horticulture, Bikaner
**Corresponding author : .....*

Abstract

Pomegranate (*Punicagranatum*) is a versatile fruit capable of thriving in a wide range of climatic conditions, from the temperate regions of Himachal Pradesh to the arid zones of Rajasthan. In arid regions, it has emerged as a major economic crop, demonstrating substantial growth in recent years. Over the last 15 years (2006-07 to 2020-21), the area under pomegranate cultivation in India has grown at a compound annual growth rate (CAGR) of 8.83%, with production increasing by 14.77% and productivity by 5.44%. The primary states contributing to pomegranate cultivation include Maharashtra, Gujarat, Karnataka Andhra Pradesh, and Rajasthan. From 2016-17 to 2020-21, Rajasthan experienced the highest increase in cultivation area (35.02% CAGR), whereas Karnataka recorded the least growth (1.49% CAGR). In terms of production, Rajasthan achieved the highest growth rate (61.11%), while Maharashtra showed a negative growth rate (-0.42%). Similarly, Rajasthan observed the most significant improvement in productivity (19.25%), whereas Maharashtra and Gujarat experienced declines in productivity, with growth rates of -4.92% and -0.33%, respectively. Karnataka and Andhra Pradesh reported modest productivity growth rates of 2.06% and 0.63% from 2016-17 to 2020-21. The data from the past five years indicates remarkable progress in pomegranate cultivation and productivity in Rajasthan, a trend that is expected to continue in the foreseeable future.

Keywords*: Arid fruits, CAGR, growth, economics*

Assessment of knowledge gain by Millets growing Farmers through printed extension literature

Shivam Pratap
SMS Agriculture Extension KVK,R.B.S College Bichpuri, Agra (U.P.)
Corresponding author : shivamthakur01731@gmail.com

Abstract

This study was conducted to assess the effect of dissemination of literature on "Improved Pearl Millet Production Technology" to farmers in a selected area. Millet farming plays a vital role in nutrition security and livelihoods in many regions, but adoption of advanced technology is stilllimited. The purpose of literature distributed was increase farmers' understanding and acceptance of modern millet farming practices. The method of distributing of training materials to farmers, then assessing their knowledge before and after the intervention. Surveys, interviews and focus groups were used to collect data, which were analyzed to measure changes in farmers' knowledge levels. Preliminary findings indicate that farmers' understanding of advanced production techniques improved significantly after dissemination. The literature shared was generally well received and farmers reported an increased awareness and willingness to adopt best practices. The implications of this research highlight the importance of educational interventions in promoting sustainable agriculture and improving farmers' livelihoods. Under this study, farmers were assessed before and after distribution of printed literature, which found that the technology efficiency of farmers increased from 22 percent to 92 percent and the acceptance of technology increased from 25 percent to 87 percent. Pre-assessment of knowledge revealed that only 32 percent people had knowledge of requirement and time-based technology, which increased to 95 percent during post assessment of knowledge. Through this study, it was found that after distribution of literature, the net income of farmers through literature has increased by 22 percent. The findings add to the knowledge of agricultural extension strategies and highlight the potential of literature distribution as an effective communication tool. Recommendations include expanding similar initiatives, adapting training materials to local conditions and including feedback from farmers in future activities. Further research is warranted to examine the long-term effects of training interventions on agricultural practices and productivity.

Keywords: *Millets,Assessment of knowledge, dissemination*

Adoption of Improved Technology of Mustard by ST Farmer's through Participatory Approach under FLD

Ashok Kumar, Navlesh Kumar, Sushma Lalita Baxla
Krishi Vigyan Kendra,Garhwa, Birsa Agricultural University,Ranchi,Jharkhand
**Corresponding author : garhwakvk@gmail.com*

Abstract

A national-wide programme of demonstrations known as *"*Front Line Demonstrations*"* on major food crops, was launched on recommendations of a panel of scientist*'*s constituted by Ministry of Food & Agriculture, Govt. of India. The reason behind it was to provide an direct interface between researcher and farmers as the scientists are directly involved in planning,executeion and monitoring of the demonstrations. The main objective was to show the potentiality of technologies i.e. latest released recommended varieties along with component or full package of practices directly under close supervision of scientists on selected farm field to the participating farmers, neighboring farmers, extension workers to analyze the production constrains if any, and to assess the performance of technologies for scientific feedback. On the basis of survey, intervention points were identified on consultation with farmers from problem-cause diagram. The deciding factors for selecting critical inputs under demonstrations were gap in adoption of technology *(*full, partial*)* and percentage of farmers not following the recommended improved practices. in these FLDs, the top down approaches was avoided and the real concept of bottom-up approach with scientist-farmer linkage was taken up for programme formulization and implementation through FLD.Newly released variety, BBM-1 with full package demonstrations were conducted at ST farmers in Garhwa district during Rabi 2022-23 and 2023-24. The KVK Garhwa provided only critical inputs like seed, deficient nutrients- B&S @1*:*20 kg*/*ha for based application and imidacloprid @1 litr*/*ha for foliar spray at flowering stage for management of aphid. The technology demonstrated was line sowing of variety BBM-1 with N*:*P*:*K*:*B*:*S*::*80*:*60*:*40*:*1*:*20 kg*/*ha+pre-emergence pendimethalin @3litre*/*ha+3 irrigation at 30,60 and 90 DAS+Imidacloprid @1litre*/*ha foliar spray at flowering stage. The average seed yield obtained was 10.5 & 12.7 q*/*ha at farmer field during 2022-23 & 2023-24 respectively. The result showed that the improved technology having BBM-1 and application of B&S as well as foliar spray of imidacloprid increase the seed yield *(*13.0 & 15.3 during 2022-23 &2023-24 respectively*)* by 23.80*%* & 20.47*%* in 2022-23 and 2023-24. The net return was also found 34.98*%* & 26.91*%* higher in FLD over farmers field during 2022-23 and 2023-24 respectively.

Keywords: *FLD, mustard, Imidacloprid*

Performance of Groundnut Var. GJG 19 under CFLDs at Farmers' Fields in Alwar district of Rajasthan

Sunil Kumar[1*], BL Ola[2], PC Garhwal[3], SK Rastogi[4],SK Sharma[5] and PK Rai[6]
[1]*SMS (Plant Protection),* [2]*SMS (Agronomy),* [3]*SMS (Horticulture),* [4]*SMS (Agriculture Extension),*
[5]*Principal Scientist & Head, KVK (ICAR-IIRMR), Gunta, Bansur, Alwar-II, Rajasthan 301 402*
[6]*Director, ICAR-IIRMR, Sewar, Bharatpur, Rajasthan 321 303*
**Corresponding Author: sunilphd09@gmail.com*

Abstract
In India,Groundnut is grown in 59.7 lakh hectares area with production of 102 lakh metric tonnes. In Rajasthan it grown in 8.96 lakh hectares with the production of 18.95 lakh metric tons. The Groundnut is grown in Alwar in 606 hectares area with production of 1529 metric tons (Source: Agriculture Statistics at a Glance, 2023).Traditional cultivation methods, often reliant on monsoon rainfall and less efficient irrigation practices, can lead to fluctuating yields. To improve productivity and profitability for groundnut farmers in Alwar district, Krishi Vigyan Kendra (KVK), Alwar-II, had conducted the Cluster Front Line Demonstrations(CFLDs) on improved variety GJG 19, critical inputs such as fungicides for seed treatment, sulphurs and micronutrients. Besides these, in demonstrated field also adopted others improved groundnut cultivation practices during the Kharif seasons 2019-2024 in 10 hectare/ year by deciding 1 acre for each demonstration to 25 farmers every year in different villages of Bansur and Behror tehsil of Alwar district. The average yield of demonstration of groundnut was 21.07 quintal/hectare, which was 37.17 per cent more than local check groundnut cultivation which gave 15.36 quintal/hectare fresh groundnut pods. The cost of cultivation of groundnut with demonstration was Rs. 43766/hectare whereas check(Farmers Practices) cost of cultivation was 40725/hectare. The demonstration gave Rs. 118228 gross return/hectare, net profit Rs. 74461 /hectare and benefit cost ratio was 2.69 whereas the check i.e. Farmers Practices was gave Rs. 87168 gross return/hectare, Rs. 45843 net profit/hectare and 2.04 benefit cost ratio. The demonstration cultivation profited Rs. 28618/hectare more than the local cultivation in groundnut. These results highlight the potential of improved technologies to enhance groundnut productivity and profitability for farmers in Alwar district, Rajasthan.

Keywords: Groundnut, CFLDs, Monsoon, Alwar, Rajasthan,

Effects of exogenously applied nanoparticles on terminal heat stress in Indian mustard

Ashika Ansari[1], P. Bhasker[1], Anita Kumari[1], Ramavatar[2] and Vinod Goyal[1*]
[1]*Department of Botany and Plant Physiology, CCS Haryana Agriculture University, Hisar-125004.*
[2]*Oilseed Section, Department of Genetics & Plant Breeding, CCS Haryana Agriculture University, Hisar-125004.*
**Corresponding author : goyal2973@gmail.com*

Abstract
Brassica juncea, also known as Indian mustard, is an important oilseed crop. The present investigation was conducted to evaluate the impact of nanoparticles on the morphological, physiological, and yield attributes of *Brassica* crops under late sown terminal heat stress conditions. The crop was sown under late sown conditions on 15th November 2023.Nanoparticles (Zn-NP's, S-NP's, Si-NP's &nanonitrogen) were applied exogenously at vegetative state (30 DAS) and flowering stage (60 DAS), on two genotypes (RH 1706 and RH 1975).The application of Zn-NP, Si-NP's, and Nanonitrogen (2 ml/L) improved photosynthetic rates by 30.57% with 1 ml/ L Zn-NP in RH 1706 and 33.14% with Nanonitrogen in RH 1975. Antioxidant enzyme activities increased with the highest SOD activity observed with (48.83%) 2 ml/L Nanonitrogen in RH 1706 and the highest CAT activity (30.16%) with 1 ml/L Nanonitrogen in RH 1975, which indicates enhanced oxidative stress tolerance and improved physiological efficiency. Yield attributes showed significant improvements with nanparticle application, enhancing seed yield by 17.57% (1 ml/L Nanonitrogen) in RH 1706 and 16.92% in RH 1975. Among all nanoparticle treatments, Nanonitrogen (1 ml/L) performed best followed by Si-NP's (1ml/L) and Zn-NP (2ml/l), that resulted into enhanced photosynthetic rates and better source to sink strength. These findings suggest that nanoparticles improve crop resilience to terminal heat stress by enhancing physiological and antioxidant enzymes activity, which ultimately contributed to better yield.

Keywords: *Brassica juncea, Heat stress, Nanoparticles, Yield*

Knowledge Assessment of Farmers on Pratapdhan Breed in Backyard Poultry Farming under AICRP in Udaipur District, Rajasthan

Meenu and Ananda KR
*Ph.D. Scholar, DepartmentofAgriculturalExtension,ICAR-IARI,New Delhi
*Corresponding author : .....

Abstract

This study evaluates the knowledge levels of backyard poultry farmers in Udaipur district, Rajasthan, regarding the Pratapdhan breed under the All India Coordinated Research Project (AICRP). Conducted in 2022-23 across four villages in Girwa and Gogunda tehsils, the study surveyed 120 farmers. Findings revealed that 69.17% of respondents had a moderate level of knowledge, while 16.67% and 14.17% exhibited low and high knowledge levels, respectively. In Girwa tehsil, 75% of farmers had moderate knowledge, compared to 59.09% in Gogunda. Statistical analysis indicated a significant difference in knowledge levels between the two tehsils ($Z = 3.233$, $p < 0.01$). The results highlight the need for targeted training programs and enhanced exposure to improve poultry management knowledge, thereby fostering sustainable backyard poultry farming in rural areas.

Keywords: *Backyard poultry, Pratapdhan breed, poultry farming, knowledge assessment, rural development*

Impact Analysis of Cluster Front Line Demonstrations (CFLDs) On Indian Mustard (*Brassica juncea* L. Czern & Coss) In District Amroha of Western Uttar Pradesh Region

Amit Tomar, AK Mishra, HH Khan, SP Singh and Prachi Patel
ICAR-Krishi Vigyan Kendra, Gajraula, Amroha, Directorate of Extension, SVPUA&T, Meerut
**Corresponding author: tomarcsa@gmail.com*

Abstract

Cluster Front Line Demonstrations (CFLDs) on Indian Mustard (*Brassica juncea* L. Czern & Coss) was conducted in Eleven villages namely; Raipur Shumali, Khajoori, Dhanora Mafi, Dhanora Mandi, Nagla Mafi, Rehmapur Mafi, Baldana Asgar Ali, Fatehpur Chitra, Nanai, Gajraula Basti & Salempur Gonsai of Districts Amroha. Total 75 farmers were selected on the basis of their socio-economic conditions. The main objective of the CFLDs to improve the socio-economic condition of the marginal farmers, increasing the Indian Mustard (*Brassica juncea* L. Czern & Coss) cultivated area during *Rabi* season in Eastern Uttar Pradesh region and also utilization of the *Rabi* fellow land for cultivation of Mustard as a sole crop/Inter-cropping model. The results revealed that farmers were benefitted from the CFLDs practice in comparison to their own traditional practices. The average yield production of Indian mustard from farmers practices and from CFLDs practices (RH-0725) was 10.25 quintals per hectare and 16.81 quintals per hectare, respectively. The cost: benefit ratios from farmers & CFLDs practices was 2.32 & 3.59, respectively. Most of the Marginal/Micro land holding Farmers with or without resources keep their land fallow in *Rabi* and cultivate wheat, gram, linseed and lentil in *Rabi*. Here we found Indian Mustard a promise crop to increase Cropping intensity in Western region of Uttar Pradesh. With majority of Scheduled Castes population / marginal farmers living in villages under studied area were economically isolated. Those were below poverty line and their livelihood dependent solely on agriculture and livestock rearing the SCSP/NFSM Plan seems to be boon for uplifting their status.

Keywords: *Brassica juncea*, Cluster Front Line Demonstrations (CFLDs), Indian Mustard & *Rabi.*

CLIMATE SMART AGRICULTURE IN DRYLAND

Microbial Inoculants as a Strategy to Improve Drought Resilience and Productivity in Indian Mustard Under Varying Irrigation Levels

Priyanka Kumawat*[1], Uma Devi[1] and Pankaj Kumar[2]
[1]*Pulses Section, Department of G & PB, CCS Haryana Agricultural University, Hisar, Haryana, India*
[2]*Department of Soil Science, CCS Haryana Agricultural University, Hisar, Haryana, India*
**Corresponding author: pkumawat.agro@gmail.com*

Abstract
Drought stress significantly affects mustard cultivation, necessitating strategies like microbial inoculation and optimized irrigation. A field experiment was conducted during the *Rabi* Seasons of 2020-21, 2021-22, and 2022-23 at SKN College of Agriculture, Jobner, using a split-plot design with irrigation (no irrigation, 50% deficit, and normal) in main plots and microbial inoculants in subplots. Normal irrigation (two irrigations) resulted in superior yield (1542 kg/ha), relative water content (70.72%), and Among microbes, CRIDA MI-II showed the highest seed yield (1312 kg/ha) and water use efficiency (5.88 kg/ha-mm). The findings highlight the effectiveness of integrating irrigation and microbial inoculants to enhance mustard productivity and drought resilience in Rajasthan's arid and semi-arid regions.

Keywords : *Mustard, irrigation, microbes, relative water content, yield*

Introduction
Indian mustard is a vital oilseed crop, particularly in India, where Rajasthan leads in both cultivation area and production. Though its water requirement is moderate, maintaining proper moisture balance is crucial, especially during sensitive growth stages. Optimal irrigation scheduling enhances yield and quality while ensuring efficient water use, essential in arid and semi-arid regions. Microbial inoculants offer an eco-friendly, cost-effective solution to enhance drought tolerance. Beneficial bacteria like Bacillus, Pseudomonas, and Rhizobium improve plant resilience. Kavamura *et al.* (2013) highlights the role of PGPR from harsh environments in mitigating drought stress, boosting productivity. Identifying efficient microbial strains and irrigation strategies is crucial for sustainable mustard cultivation. This study explores the combined impact of irrigation and microbial inoculants to enhance drought tolerance and productivity in mustard under water-limited conditions.

Methodology
In the winter *(Rabi*) seasons of 2020-21, 2021-22, and 2022-23, a field experiment was carried out at Agronomy Farm, S.K.N. College of Agriculture, Jobner.The experimental design employed was a split-plot design, encompassing eighteen distinct experimental treatments distributed across three replications. The main plots were assigned three different irrigation levels, (No irrigation, 50% deficit irrigation and Normal level of irrigation) while the subplots accommodated six distinct microbial inoculants (MRD-17, MKS-6, Biophos and Biophos^{+}, CRIDA MI-I, CRIDA MI-II and Control). The seeds of mustard were inoculated with these microbial inoculants prior to sowing. To assess the significance of variations among treatment effects in split-plot design experiments, the 'F' test was employed, following the approach outlined by Panse and Sukhatme(1985).

Results and Discussion
The application of normal irrigation levels resulted in the optimum enhancement of both seed (1542 kg/ha),stover yield (3677 kg/ha) and WUE (7.50 kg/ha-mm) of mustard. These values were significantly superior to both 50% deficit irrigation and the control. The increasedcan be attributed to increased soil moisture availability in the mustard crop's rhizosphere, which encourages increased production of photosynthates and improved transfer of photosynthates to reproductive structures.The results are in close conformity with the findings of Yadav *et al.* (2021).Among the inoculants, CRIDA MI-II exhibited the most pronounced effects, resulting in the highest seed (1312 kg/ha), stover yield (3262 kg/ha) and WUE (5.88 kg/ha-mm).Similar findings have also been reported by Asha *et al.* (2021).

Conclusions
Based on the findings, it is recommended to adopt a two-irrigation strategy for optimal productivity of mustard, as it consistently outperformed 50% deficit irrigation and no irrigation treatments. Additionally, incorporating microbial inoculants, especially CRIDA MI-II, CRIDA MI-I, Biophos, and Biophos+, is advised to enhance drought tolerance and overall yield. This integrated approach holds promise for sustainable mustard farming in the arid and semi-arid regions of Rajasthan, offering a practical solution to address the challenges posed by drought stress.

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Enhancing Yield and Stress Resilience in Toria (*Brassica rapa* L.) through Salicylic Acid Application under Moisture Stress Conditions

B Kalita*, PK Bordoloi, R Chakrabarty, RN Borkakati, PK Deb Choudhuryand HK Borah
AAU-Zonal Research Station, Shillongani-782002, Nagaon, Assam
**Corresponding author: binod.kalita@aau.ac.in*

Abstract
Moisture stress is a significant constraint affecting the yield of toria (*Brassica rapa var*. toria) in rainfed and semi-arid regions. Salicylic acid (SA), a plant growth regulator, plays a crucial role in mitigating abiotic stress and enhancing plant resilience. This study investigates the impact of foliar application of salicylic acid on the physiological traits, growth parameters, and yield of toria under moisture stress conditions. Results indicate that SA application improves photosynthetic efficiency, water use efficiency, and antioxidant defense mechanisms, leading to increased seed yield and oil content compared to untreated controls. These findings suggest that salicylic acid could be an effective strategy for enhancing toria productivity in moisture-deficient environments.

Keywords: *Salicylic acid, moisture stress, toria, yield enhancement, abiotic stress tolerance, Brassica rapa*

Introduction
Rapeseed-mustard is a critical oilseed crop in Assam, contributing significantly to the agricultural economy of the state. Toria (*Brassica rapa* var. toria) is a vital oilseed crop in India, particularly in moisture-stressed regions. Drought and erratic rainfall patterns significantly reduce its productivity. Salicylic acid has been reported to enhance stress tolerance by modulating physiological and biochemical pathways. This study aims to explore the effectiveness of SA in improving toria yield under moisture stress conditions.

Materials and Methods
The study was conducted at AAU-Zonal Research Station, Shillongani, Nagaon, Assam, situated at 26022' N latitude, 92038'E longitude and 50.2 M above mean sea level. The soil was sandy loam with pH 5.51, organic carbon (OC- 0.85%), available nitrogen (218.8 kg/ha), available phosphorus (15.18 kg/ha) and potassium (128.5kg/ha). The experiment was laid out in a randomized block design (RBD) with three replications and nine treatments consecutively for three years during the rabi season under moisture stress conditions during 2019-20, 2020- 21and 2021-22. Toria variety TS-38 was used in the study. Standard agronomic practices were followed. Fertilizers were applied @ 60, 30 and 30 kg N, P_2O_5 and K_2O kg/ha, respectively. Full of nitrogen, phosphorus and potash was applied as basal. Observations were recorded on plant height, leaf area index, relative water content, chlorophyll content, proline accumulation, seed yield, and oil percentage. Data were statistically analyzed to determine treatment effects.

Results and Discussion
The application of salicylic acid (SA) significantly enhanced plant height, leaf area index (LAI), and chlorophyll content in toria under moisture stress. The highest LAI (3.50) and chlorophyll content (48.5 SPAD units) were recorded in the treatment combining hydrogel (5.0 kg/ha) with SA 200 ppm (T_9), improving photosynthetic efficiency. SA-treated plants exhibited higher proline accumulation, superoxide dismutase (SOD), catalase (CAT), and ascorbate peroxidase (APX) activities, enhancing stress tolerance. The highest proline content (6.89 µmol/g FW) and enzyme activities were in T_9. The highest seed yield (1120 kg/ha) and oil content were obtained in T_9, followed by T_7 (1084 kg/ha). Hydrogel and SA application improved soil moisture retention (15.5%) and water use efficiency (4.85 kg/ha-mm), supporting plant growth and economic viability.

Conclusion
The study demonstrates that foliar application of salicylic acid, particularly at 200 ppm during flowering and siliqua formation stages, significantly enhances toria's resilience to moisture stress. The combined application of SA and hydrogel maximizes physiological and biochemical benefits, leading to improved yield and profitability. These findings suggest that SA application can be an effective strategy for mitigating drought stress in rainfedtoria cultivation. Further research is needed to refine application protocols for diverse agro-climatic conditions.

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Enhancing Yield and Stress Resilience in Toria (*Brassica rapa* L.) through Salicylic Acid Application under Moisture Stress Conditions

B. Kalita[1*], PK Bordoloi[2], R Chakrabarty[3], RN Borkakati[4], PK Deb Choudhury[5] and HK Borah[6]
[1]*Scientist (Agronomy),* [2]*Pr. Scientist (PBG),* [3]*Sr.Scientist (PP),* [4]*Scientist (Entomology),*[5]*Pr. Scientist (PBG),*[6]*Pr. Scientist (PBG)*
AAU-Zonal Research Station, Shillongani-782002, Nagaon, Assam
**Corresponding author: binod.kalita@aau.ac.in*

Abstract
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Agronomic Strategies for Enhancing Growth, Yield, and Economic Returns of Pearl Millet (*Pennisetum glaucum* L.) in the Challenging Climatic Conditions of the Great Indian Desert

Sheilendra Kumar* and Sagarmal Kumawat
Department of Agronomy, Swami Keshwanand Rajasthan Agricultural University, Bikaner, India-334006
**Corresponding author : sheilendra0003@gmail.com*

Abstract

Pearl millet (*Pennisetum glaucum*), a highly drought-tolerant cereal crop, serves as a staple food and fodder source in the arid regions of the Great Indian Desert. Well renowned for its resilience to extreme temperatures and nutrient deficient soils, it plays a pivotal role in ensuring food security and sustaining livelihoods in marginal environments. The adoption of efficient planting techniques and appropriate nutrient management strategies is essential for enhancing the productivity and quality of pearl millet, particularly in resource-constrained vulnerable arid regions. To investigate the effects of various planting techniques and nutrient management practices on pearl millet production, a field experiment was conducted during the Kharif seasons of 2018 and 2019. The experiment followed a split-plot design, with six planting techniques assigned to the main plots and four nutrient management options allocated to the subplots, replicated thrice. Results revealed that crop transplanted with 2 plants pit^{-1} realized significantly higher plant height, dry matter accumulation $plant^{-1}$ and nitrogen, phosphorus, potassium and protein content in grain during both the year of investigation. Pearl millet transplanted with 4 plants pit^{-1} recorded highest grain yield (3142 and 3030 kg ha^{-1}), stover yield (6852 and 6357 kg ha^{-1}), gross return (Rs 97105 and 92383 ha^{-1}), net return (Rs 52480 and 47372 ha^{-1}). The increasing dose of nutrients resulted in significant increase in grain and stover yield, protein content, nutrient contents and uptake, while minimum values of all these parameters were observed in control. Nutrient management practice NMP_3 increased the grain yield, stover yield, gross monetary return, net monetary return and B:C ratio. The findings underscore the importance of innovative agronomic practices in mitigating environmental stresses and maximizing the yield potential of pearl millet in arid regions.

Keywords: *Arid climate, grain and stover yield, nutrient management, pearl millet, planting techniques.*

Effect of Biosynthesized ZnO Nanoparticles on Drought Tolerance Mechanism in Wheat (*Triticumaestivum*L.)

Sunita Gupta*, Asha Kumawat and NK Gupta
Rajasthan Agricultural Research Institute, Durgapura, Jaipur
**Corresponding author: sunita.pphy.rari@sknau.ac.in*

Abstract

In modern era, nanotechnology has gained a considerable attention because of its ability to support sustainable agriculture. It is commonly referred that nanoparticles have the potential for the site-specific delivery of nucleotides, proteins and chemicals including fertilizers for improving crop performance in terms of better growth and productivity. Biosynthesis of nanoparticles via the green route is natural, environmentally friendly, cost-effective, safe and biocompatible. The green synthesis method involves the use of bacteria, fungi, algae, yeast, plant extracts, etc. They permit the mass production of ZnO-NPs without additional impurities. In this study, zinc oxide nanoparticles were synthesised from leaves of *Saraca asoca* plant using a green synthesis methodology and characterized with X-ray Diffraction (XRD), Scanning electron microscopy (SEM) and UV visible spectroscopy (Sharma et al., 2022).Two genotypes of wheat Raj- 4037 (drought tolerant) and Raj-4238 (drought sensitive) were grown in pots and raised under recommended package and practices. The plants were sprayed with ZnO nanoparticles at concentrations of 0, 100, 200 and 300 ppm at flowering and grain filling stage. The drought conditions were generated by withholding irrigation for a period of 8 days at flowering and grain filling stage while the nonstress plants were irrigated as and when required. Different physiological and biochemical parameters were recorded at flowering and grain filling stages whereas yield and yield contributing parameters were recorded at maturity. Drought associated with a significant decrease in carotenoids, total chlorophyll content, membrane stability index, and relative water content but an increase in proline, total soluble sugar, MDA and antioxidant enzymes (SOD and Catalase) were noted. In both genotypes, ZnO nanoparticle treatment significantly increased the relative water content, membrane stability index, total chlorophyll content, carotenoids, proline content, total soluble sugar, MDA and antioxidant enzymes (SOD and Catalase). ZnO nanoparticles at 200 ppm was found to be an effective concentration for increasing the physio-biochemical parameters and yield of both genotypes under both control and water-stress conditions. It is suggested that Raj-4037 performed better under water stress condition and application of ZnO nanoparticles can be used to ameliorate the adverse effect of water stress in wheat by adjusting physio-biochemical parameters, yield and yield attributing characteristics.

Keywords : *Nanotechnology, antioxidant, drought, wheat*

Adaptive Strategies for Enhancing Vegetable Crop Resilience against High-Temperature Stress in Rajasthan's Arid and Semi-Arid Regions

Yogesh Sharma*[1] and Ramakant Sharma[2]
[1]*Rajasthan Agricultural Research Institute, Durgapura, Jaipur*
[2]*Agricultural Research Sub-station(SKNAU, Jobner), Ajmer*
**Corresponding author : yogeshsharma.rari@sknau.ac.in*

Abstract

The arid and semi-arid regions of Rajasthan present significant challenges for vegetable cultivation due to extreme temperatures, erratic rainfall, and limited water availability. Traditional farming systems in these regions rely on heat-tolerant crops and indigenous water conservation practices. However, climate variability and rising temperatures necessitate the adoption of advanced strategies to ensure sustainable vegetable production. This study highlights key adaptive measures to mitigate high-temperature stress in vegetable crops. These include the selection of heat-tolerant varieties, implementation of mulching techniques to regulate soil temperature, and optimization of irrigation practices such as drip irrigation for efficient water management. The use of shade structures, agroforestry models, and improved cropping systems plays a crucial role in reducing thermal stress. Additionally, plant growth regulators and bio-stimulants can enhance stress tolerance, while modern breeding techniques and genetic advancements offer further potential for developing heat-resilient crop varieties. Integrated research focusing on moisture conservation, soil fertility management, stress-resilient crop establishment, and sustainable land-use systems is essential for enhancing vegetable crop productivity in arid environments. The adoption of these strategies, combined with climate-smart agricultural practices, can significantly improve the resilience of vegetable farming in Rajasthan's arid and semi-arid zones, ensuring long-term food security and economic sustainability for farmers.

Keywords : *Stress, vegetable, resilience*

Impact of Crop Diversification in NICRA Adopted Village on Socio-economic Condition of the Farmers

Sanjay Kumar[1], Atal Bihari Tiwari[1], Neeraj Kumar Vaishya[1], Nisha Tiwari[1], Anjani Kumar[2] and Amrendra Kumar[2]
[1]*Krishi Vigyan Kendra Gumla, Vikas Bharti Bishunpur, Jharkhand,*
[2]*ICAR-ATARI Patna, Zone-IV*
**Corresponding author: kvk.gumla@gmail.com*

Abstract

The present study on impact of crop diversification was conducted in NICRA adopted village of Krishi Vigyan Kendra Gumla in Gumla district. Considering various parameters change viz change in cropping system, change in cost of cultivation. change in income, self-sufficiency and socio- economic conditions. Both primary data and secondary data were used for the study. The study revealed that after implementation of the project, area under rice-wheat, rice-mustard, groundnut, ragi, vegetables and watermelon cultivation increased by 10, 15, 18, 22, 132 and 8 percent respectively, whereas area under Upland Paddy, Maize and Rice -Fallow declined by 40, 32 and 25%. After the intervention of climate resilient practises, the crop diversification index increased form. 0 .42 to 0.58 on the scale. Yield performance of vegetables crops has been impressive performance with 100 to 130 percent increase in both *Kharif* and *Rabi* season. Of the total respondent's 65.52 percent, 69.35 percent, 41.55 percent and 63.56 percent of have attained Self-sufficiency in production of rice, wheat, mustard and vegetables. About 72.5 percent of the respondents opined that their annual income has increased due to diversification. Crop diversification has great potential in improving yield, coping in climate variability, reducing the cost of cultivation and finally increase the net income realized the farmers.

Keywords : *Crop diversification, yield, income, cropping system, cost, vegetables.*

Latent Attributes of Toria Variety TS-67 Under Delayed Sowing Hindering Yield and Profitability During Cold and Dry Winter Season in Assam

PK Deb Choudhury, PK Bordoloi, B Kalita*, R Chakrabarty, RN Borkakati and HK Borah
AAU-Zonal Research Station, Shillongani-782002, Nagaon, Assam
**Corresponding author : binod.kalita@aau.ac.in*

Abstract

Toria crop has long been considered as an essential oilseed crop to cultivate after winter or *sali* paddy crop in Assam and the NE states during winter season. With the start of pre-monsoon showers in March-April and the monsoon rainfall in this domain, cause the land masses to suffer from the havoc of unusable excess water every year. This is coupled with a volley of adverse weather factors like thunder-storm, hail-storm, flash floods, and flood-waves created by the mighty Brahmaputra river and its tributaries, have compelled in overall inundation in the floodplains in Assam causing delayed start of *Rabi* crops and more particularly cultivation of rapeseed & mustard. Inundation and late recession of water after flood deepens the situation causing the farming communities to opt for late and very late cultivation of rapeseed-toria varieties in End-December to Early-January. With the existing Rapeseed (Toria) -Mustard varieties with farmers, the crop may not thrive well in late winter. However, a toria strain **TS 67** developed and recommended by AAU-ZRS Shillongani, Nagaon, may serve as a boon to cultivate in late and very late winter up to 1st week of January. This paper is presented with on-station records and on-farm yield performances and crop geometry over a number of time and locations, to exhibit the possibilities of untimely cultivation of toria crop with 3.5 to 4.0 q/ha of seed yield in 90-days with minimum support for harvest before the pre-monsoon rain. This may serve as an alternative idea to go for a contingency crop with late start with a safer harvest for at par yield.

Keywords : *Toria, late sown, contingency crop, pre-monsoon shower*

SUCCESS STORIES

Transforming Rapeseed-Mustard Production in Assam : A Success Story of Collaborative Efforts

Ashok Kumar Sharma*[1], Vinod Kumar[2], Arun Kumar[3], Harvir Singh[4], Pankaj Sharma[5], GN Hazarika[6] and PK Rai
[1-3]*Principal Scientists;* [4]*Sr. Scientist and* [7]*Director, ICAR-IIRMR, Bharatpur, Raj.*
[5]*Joint Director, ICAR-NIBSM, Raipur, CG.* [6]*Former Resident Consultant, ICAR-IIRMR-APART Project*
**Corresponding author: ashokdrmr@gmail.com*

Introduction and Background

Assam, a key rapeseed-mustard-producing state in India, has long struggled with low productivity of this crucial oilseed crop, averaging 660 kg/ha compared to the national average of 1511 kg/ha in 2018-19. Recognizing the potential for improvement, the Directorate of Agriculture, Government of Assam, in collaboration with the ICAR-Indian Institute of Rapeseed-Mustard Research (IIRMR), launched a project in 2020 to enhance rapeseed-mustard production for sustainable livelihood security. Implemented through the Assam Agribusiness and Rural Transformation Project (APART), this initiative sought to bridge productivity gaps and improve the livelihoods of farmers.

Keywords : *Assam, rapeseed, mustard, APART, productivity, livelihood security*

Objectives and Implementation

The project aimed to enhance rapeseed-mustard cultivation through technology dissemination, capacity building, and value chain development. Key interventions included:

1. Demonstration of Proven Technologies: Over 15,440 crop demonstrations showcased high-yielding varieties, improved agronomic practices, integrated pest and nutrient management, and other technological advancements across diverse agro-climatic zones.

2. Capacity Building: Training programs reached 62658 primary beneficiaries, including farmers, extension workers, and stakeholders. These efforts included 838 technical trainings, 718 field days, and exposure visits, ensuring widespread knowledge dissemination.

3. Improved Inputs Supply: Quality seeds, bio-fertilizers, and plant protection chemicals were made available to farmers.

4. Technical Advisory Support: Customized guidance on optimal sowing, irrigation, pest control, and marketing was provided through extension materials and digital platforms. Initially implemented in seven districts, the project expanded to eight

Impact and Achievements

By the 2022-23 crop season, the project delivered remarkable results, including:

1. Increase in Cultivation Area: Rapeseed-mustard cultivation expanded by 11.9% from 2020-21 to 2022-23, reflecting growing farmer confidence.

2. Production Growth: Production surged by 35.4%, demonstrating the effectiveness of modern practices and inputs.

3. Productivity Boost: Productivity increased by 21.3%, attributed to improved techniques and resilient varieties.

4. Economic Benefits: Farmers experienced a 20-30% profit increase due to higher yields, reducing market dependency and ensuring income stability.

5. Livelihood Security: Enhanced productivity contributed to reduced rural poverty and improved quality of life.

6. Employment Opportunities: Expanded cultivation created jobs in the agriculture value chain.

7. Edible Oil Self-Sufficiency: Assam moved closer to reducing dependency on edible oil imports, supporting national self-reliance.

Conclusion

The program's success was rooted in the seamless collaboration between the Government of Assam, ICAR-IIRMR, and local farmer groups. This integrated approach enabled smallholder farmers, the backbone of Assam's agricultural economy, to access necessary resources and knowledge. The project empowered farmers to adopt modern techniques, optimizing resources and achieving better yields. The project laid a strong foundation for sustainable rapeseed-mustard cultivation in Assam. Encouraged by the results, the government plans to upscale interventions, reaching more farmers and extending the value chain to include post-harvest processing and marketing. With ICAR-IIRMR continuing as a knowledge partner, Assam is poised to become a leading contributor to India's rapeseed-mustard production.

This initiative highlights how technology adoption, capacity building, and collaborative strategies can transform agriculture. Assam's journey exemplifies resilience and empowerment, serving as a model for agricultural development and rural prosperity.

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Impact of Cluster Front Line Demonstration (CFLD) Rapeseed Mustard Crop to Sustain Livelihood of Tribal Farmers in Latehar District of Jharkhand Under STCDRMR Project.

Jerai, Ch. Mahesh., Kandyang, Sunita., Yadav, Brahmdeo., Kamal,K. Sunita., Mishra, Arvind., Kumar, SP and Ekka, B. Arti.

**Corresponding author: .....*

Introduction and Background

The study was conducted by Krishi Vigyan Kendra, Latehar to find out the impact of CFLD on mustard crop under DRMR project among tribal farmers. The clustered front-line demonstration on mustard crop were conducted during Rabi season of five sequential year i.e. 2020-21 to 2024-2025under STC DRMR project.CFLD's programme were conducted in 200 ha of land in five years with among 500 farmers with involvement of scientist, technical staff, Krishak Mitra, progressive farmers and representative of farmers. According to the observed data,in the year 2020-21 to 2024-2025, 35.36%,37%, 39%, and 28.57% more yield was obtained in comparison to farmers' yield in the respectiveyears. The maximum yield was obtained with the demonstration of Birsa Bhabha Mustard-1,13.5q/ha while in farmers field it was 10.5q/ha in the year 2023-2024.

Keywords: *Mustard,front line demonstration, technology gap, practices yield agriculture, production*

Objectives and Implementation

The state Jharkhand falls under agro-climatic zone vii, i.e., Eastern plateau and hilly region with annual rainfall of 1200-1600 mm. Climate ranges from dry semi humid to humid semi-arid types. Major oilseed crops grown in the district are Groundnut, Mustard, Sesame and Nizer. Rapeseed and Mustard (*Brassica species*) is an important crop grown in Rabi season and it contribute significant role in Indian economy about 327 billion Indian rupees in the Indian economy in the fiscal year 2021. Keelery, Sandhya. April 10,2024. Cluster Front Line Demonstration is an applied approach for extension the technology at farmers field in a participatory mode with an objective to explore the production to sustain the livelihood of the farmers. STC DRMR project is very important for uplifting the livelihood of tribal farmers in Latehar district of the Jharkhand. The tribal population of Latehar district is around 45.54% of the total population.

Impact and Achievements

The Cluster Front Line Demonstration on Mustard Crop was conducted by Krishi Vigyan Kendra, Balumath, Latehar, Birsa Agricultural University Kanke, Ranchi, under DRMR Project among tribal farmers of Latehar district with the supervision of ATARI, Patna,Zone IV. The CFLDs programme on mustard crop were conducted in five villages (Banio,Dhadhu, Jaryang, Shibla, Kalkalia, Komar,Chetag, Daraha) of three blocks, Latehar, Balumath and Bariatu of Latehar in five consecutive rabi seasons from 2020-2021to 2024-2025. The soil of the demonstrated areas was acidic in nature and its pH ranges from 6 to 6.5 In most area. A baseline survey was done in all the villages to know the existing cultivation practices of the mustard growers. Group meeting with the farmers and training programme also organized. A total of 500 mustard farmers in an area of 200 ha were demonstrated in five years, 10 training programme,11 awareness camp such as field day,333 small implements and 55 large implements were distributed to tribal farmers in five years .New recently developed Pusa 26,Pusa -30, RH761, Birsa Bhabha Mustard-1 of Indian mustard and bunch of technology including critical inputs such as seeds, inorganic fsrtilizer, Sulphur and plant protection measure required for demonstration was demonstrated. Before conducting the CFLD programme10 training programme on the scientific method of mustard cultivation starting from seed treatment to harvesting of the crop11 awareness' camps, 2 kisan melas on mustard crop were conducted for better extension of the technology. Yield as well growth parameters and morphological parameters were immediately collected both from the check plots as well as the demonstration plots to identify the yield gaps

Conclusion

In the year 2020-21 Pusa 30 variety was sown and the average yield was 11.31q/ha in the demonstrated field while the farmers field yield was 8.36 q/ha about 35.36% yield increased and the total yield obtained from the demonstrated field was 1131.75q. In the year2021-2022 and 2022-2023 variety Pusa mustard 30 was demonstrated 37% and 39% yield was increased respectively in comparison to framer's yield. In the year 2022-2023 In the year 2023-2024 Birsa Bhabha Mustard -1 was demonstrated with all the critical input and 13.5q/ha while in framers' field 10.5 q/ha yield was obtained which 28.57% more than the control. With the intervention of STC DRMR project on mustard crop at Latehar district 1500 tribal farmers directly or in directly benefits and they are self-sustainable for consumption of mustard oil in 8 villagers of the district throughout the year. More than 90 % technology adaptation was observed regarding the variety selection, time of sowing as well as the use of micro nutrients. Demonstration of small implements such as sprayer enhanced the work efficiency of farmers and seed bin helped to conserve the in next year for sustainable production.

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Raising Pigs, Raising Hopes: The Success Story of Piggery based IFS farmer - Smt. Kangabam Indira Devi

Sarangthem Zeshmarani* and Salam Prabin Singh
Krishi Vigyan Kendra Thoubal, Manipur
**Corresponding author: zeshma.sarangthem@gmail.com*

Background information of the Farmer

Smt. Kangabam Indira Devi, a 31-year-old married farm woman with two children, has been engaged in piggery farming for over 4 years in a Icham Khunou village, Thoubal District Manipur, India. She initially started farming to improve her family's income and food security, but faced challenges such as limited technical knowledge, lack of resources, and poor credit facilities. Due to prolonged poor economy, her mindset changes for the improvement of economy through diversified farming practices**.** Later on, with the intervention of KVK Thoubal with various training, on-farm demonstrations and other hands-on management practices for better breeding, feeding, and health management techniques to convert her rudimentary pig raising methods into a proficient and sustainable piggery-based IFS Model**.**

Before Intervention of KVK

Smt. K. Indira before adopting scientific technologies and KVK intervention, she used to do only piggery rearing with limited poultry birds where she used to earn an annual gross income of Rs.932600.00 with a net return of Rs. 225200.00 only from rice, Piggery and poultry duck.

After Intervention of KVK

With the objective to create a sustainable Piggery based IFS model, she used to get many training programmes including national level training programme on Scientific Pig Production Practices and Value Addition of Pork held at ICAR-NRC on pig at Rani, Guwahati and many other within the state training programmes, KVK Thoubal also conductedon-farm demonstrations and other hands-on management practices for better breeding, feeding, and health management techniques. She changed her way of farming system like involvement of production of horticulture crop production under the guidance and supervision of KVK Thoubal besides her livestock production system such as Tomato, Cabbage, Potato etc.

Outcome/Impact of the Intervention

After adopting the technological interventions suggested by the KVK, Smt. K. Indira Devi used to get annual income of Rs. 661700.00 annually from her livestock production system. She is also getting an additional net income of Rs. 826075 including seed production, Mustard oilseed and other horticultural crops with a B/C Ratio of 2.56 and 1.51 from livestock production and Agricultural and Horticultural crop production respectively.

Institutional involvement

- Smt. K. Indira's transformation into a successful IFS model was facilitated by her active involvement with various institutions, including:
- Krishi Vigyan Kendra (KVK) Thoubal: Provided training, on-farm demonstration, technical guidance, and hand-on practices.
- Member of Manipur Progressive Piggery Farmer Association for creating mass awareness for making sustainable livelihood through income generation from diverse Agriculture and Allied sectors.
- Shareholder member of FPC promoted by KVK Thoubal and sponsored by ***NABARD Imphal – Loumigi Thouna FPC Ltd, Thoubal***

Horizontal spread of technology

Being a successful farmer with many awards under her name, Smt**.** K**.** Indira became the role model in her village by bringing SHG and FPO including KVK to bridge the gap between conventional farming and scientific technological farming. Moreover, she also organised training sessions on sustainable and scientific piggery farming system, set up demonstration units for showcasing new techniques and technologies in her farm.

Awards and Recognition

- Best Innovative Farmer in Thoubal District in the Technology Day
- Organised by Krishi Vigyan Kendra Thoubal during 2023
- Best Women Entrepreneur Award given by KVK Thoubal during Mahila Kisan Diwas during 2023
- Mahila Kisan Award 2024 Conferred by National Gender Resource centre in Agriculture
- 'Innovative Farmer Award' 2025 conferred by AAU, Jorhat on the occasion of Regional Agriculture Fair 2025 held at AAU,Jorhat January 4-6, 2025

Success Stories: Participatory Seed Production Programme at Farmers' field

Th. Robindro Singh*
Directorate of Extension Education, Central Agricultural University, Imphal,Manipur
**Corresponding author: robindroth2017@gmail.com*

After soil and water, seed is one of the most important components of agricultural production for a successful harvest. It is a vehicle for delivering enhanced technology while also utilizing the intrinsic genetic potential of a variety/hybrid. Seed can play a vital part in increasing output; using quality seeds alone can raise productivity by 15-20%, highlighting its importance in agriculture.Technology transfer helps increase agricultural productivity, cut production costs, and lower consumer prices.Agricultural research has supplied farmers with new and improved technologies resulting in large yield increases.

Major factors/ drivers contributing for achieving intended results

The yield level of the area was not uniform from year to year ; Yield was becoming less remunerative year after year; The farmers had encountered various problems to stabilize yield from their field due to lack of awareness, uses of excessive quantity of fertilizers, communication gap etc.

Specific intervention implemented in conjunction with other available technologies, if any synergy between them

Technology transfer helps increase agricultural productivity, cut production costs, and lower consumer prices. Agricultural research has supplied farmers with new and improved technologies resulting in large yield increases.

A progressive farmer **Yambem Ibocha Singh**of Yaripok Yambem, Imphal East, Manipur holding 2-hectare land used to cultivate a farmers' variety of paddy available in their area. The cost of cultivation at the present rate was around Rs 80000 and used to get a gross return of Rs 85,000 (estimated at a crop yield of 5000 kg /ha and price of paddy @Rs 17/kg). The net profit was only Rs 5000 per ha.

Impact

With the intervention of the AICRP on Seed (Crops), CAU, Imphal centre, he started cultivating a CAU released rice variety CAU-R1 and was part of the participatory seed production programme. In this venture, he got an estimated gross return of Rs 1,38,000 (estimated at a yield of 6000 kg/ha and price of paddy seed @ Rs 23/kg). **The net profit was Rs 58,000** per ha. The programme was greatly appreciated by the farmers of the area and now, Seed Project, CAU, Imphal centre is expanding participatory seed production programme in 35 ha. with the joining of other interested farmers of the area.

Major challenge faced by the centre during implementation

Lack of regular manpower in seed section of the University

Changes to be adopted in future for refinement of referred technology:

i. Need for new technologies and techniques to be developed to keep pace with the growing demands without price increases or deteriorating natural resources and environment.

ii. Investment in agricultural research should increase in the future and it be highly beneficial to society in solving problems of food insecurity and poverty.

iii. Research and technology generation are central to achieve the structural transformation of the agricultural sector.

iv. Various agricultural experiments and activities can be comparatively easily simulated or reproduced on a limited or large scale according to the possibilities.

Need based support of research institute/ university may be provided for development and strengthening of seed infrastructures along with strong and healthy variety development activity and maintenance breeding.

Enhancing the Productivity of Rapeseed Mustard Among Tribal Farmers in the Chatra District of Jharkhand Through the Introduction of Superior Varieties and Best Agricultural Practices

RK Singh*, Dharma Oraon, Amrendra Kumar, Anjani Kumar, KP Ranjan and Zunaid Alam
Krishi Vigyan Kendra, Chatra, Birsa Agricultural University, Ranchi, Jharkhand ICAR-ATARI, Patna, Zone-IV
DNS Regional Institute of Cooperative Management Shastri Nagar, Patna,
**Corresponding author : kvkchatra2012@gmail.com*

Abstract

Oilseed crops have long been a cornerstone of the Indian agricultural economy. Edible oils are primarily derived from two categories: primary and secondary sources. Among the primary sources, farmers produce edible oils from crops such as groundnut, rapeseed-mustard (including toria, mustard, and sesame), soybean, sunflower, sesame, and niger. Non-edible sources include castor and linseed. In the secondary category, cottonseed oil, palm oil, and rice bran oil are quite popular. In Jharkhand, significant oilseed crops include groundnut, sesame, and niger during the Kharif season, as well as rapeseed-mustard, toria, and linseed in Rabi Season. Mustard is the major oilseed crop in Jharkhand. It is grown in medium irrigated land in the rabi season in Chatra district, covering about 13000 ha under irrigated conditions. Out of that, tribal community farmers are cultivating mustard with local varieties under poor management conditions, resulting in productivity that is very low compared to other farmers in the district. Keeping this fact in consideration, the Directorate of Rapeseed-Mustard Research, Sewar, Bharatpur (Rajasthan), launched a program with the objective to increase productivity, profitability, and area expansion of mustard crops among tribal community farmers in Chatra district in the year 2019-20, which continues to date. Under the program, every year, 40 ha are covered under Frontline Demonstration with improved varieties BBM-1, with N:50 P:25 K:25 S:20, along with other critical inputs like insecticides and pesticides as required according to the needs of the farmers. The average results for the years 2022-23 and 2023-24 indicate a 56.59% increase in yield from the demonstration plot, accompanied by a 56.58% rise in gross income and an impressive 82.99% increase in net income. This was achieved after investing an additional 26.47% in the cost of cultivation for the demonstration plot compared to traditional farming practices.

Success through natural farming: A story of a farm women from Sonitpur district of Assam

Angana Sarmah and Manoranjan Neog
[1]*Subject Matter Specialist, Horticulture, Krishi Vigyan Kendra, Sonitpur, AAU, Napam, Tezpur, Assam, India*
[2]*Director of Extension Education, Assam Agricultural University, Jorhat -785013, Assam, India*
**Corresponding author: tulshi.p.saikia@aau.ac.in*

Abstract
This articlehighlighted the activities of Mrs. Dipali Mandal, a lady farmer engaged with vegetable and flower cultivation since last fifteen years. By converting her entire farm (less than 1ha) under natural farming system since last three years, she could able to increase production by 30.55% over traditional farming byfocusing mainly on the different cropping systems of natural farming and comparing theeconomics of natural farming (NF) with traditional farming (TF) systems. It is found that intercropping with leguminous crops isconsidered as one of the most important components of natural. The analytical results from soil samples collected from different locations of her farm reflected that there was incredible enrichment of soil in terms of organic carbon (0.86-0.89), available nitrogen (279.4 -288.5kg/ha) andavailable potash (323.5-239.8kg/ha). These studies revealed that the farm soils where natural farming practices were adopted, were exuberantly loaded with bacterial population ($45x10^7$ CFU/ml) in comparison to traditional farming ($18.6x10^7$ CFU/ml).

Keywords: *Natural farming, sustainability, traditional farming, intercropping, Sonitpur, Assam*

Introduction
In Assam, Natural Farming now-a-days is becoming increasingly popular among the smallholder farmers of Sonitpur district of Assam. The state is mostly organic by default as out of net cultivable area of 4.3 million hectares, about 30.92 lakh hectare area have not seen the use of inorganic fertilizers and pesticides (Das, 2020). Sonitpur district comes under North Bank Plain Zone of Assam. Cropping intensity of the district is 185% and fertilizer consumption rate of 40%. Besides the areas where intensive cultivation of vegetables is practicing, rest of the cultivable land of the district is organic by default. To know the impact of cropping systems of natural farming, this study was conducted in the farm of Mrs. Dipali Mandal, a lady farmer of Teenmile village of Sonitpur District holding 6 bigha of farm land where she is practicing natural farming since 2019. The objectives of the study was:To study the economics of natural farming with traditional farming system,andthe soil conditions under natural farming system.

Methodology
Study area, Deepali mandal is a marginal farmerof Sonitpur districtwithland holding of <1 ha (6bighas) where she is practicing Low Budget Natural Farming (LBNF) since 2019. The crops which were primarily grown at the farm are cabbage, cauliflower, pea, gerbera, tuberose and marigold. Dipali mandal used to cultivate her crops by using natural formulations prepared at her own farm with the products which are easily available at farmSoil samples of the farm were collected in collected from both plots under natural farming (NF) (3years of conversion plot) and traditional farming (TF) plot. The enumeration of the total microbes in soil samples was done following "Serial dilution plate technique" using nutrient agar medium for bacterial and potato dextrose agar (PDA) medium for fungi." By applying a technique given by Francis (1986), crops equivalent yield can be calculated. Relative Economic Efficiency given by Farrell (1957) was used to calculate the comparative economic gain of the two farming systems.

Results and Discussion
The yield in NF system was found to be higher than in TF system and REE varied from9.32% to 61.96% in all crop combinations with an average of 30.55% during both the seasons. It has been observedthat the total cost of all the crop combinations in NF systems during the cultivation process was substantially reduced. Soil pH of the samples under natural farming (NF) ranged from 5.0 to 5.3 and samples from traditional farming (TF) ranged from 5.0 to 5.2. Organic carbon values in the NF plots ranged from 0.86 to 0.89 percent with a mean of 0.86%.

Conclusions
On the basis of initial investigation and observations recorded under the study, it appears that Natural Farming may be a promising model in sustainable Agriculture. Application of jeevamrit and ghanajeevamrit in the fields promotes the multiplication of microbes in the field. However, incorporation of green manuring crops, mulching, minimum tillage and crop rotation etc. are other complementary practices which form a composite package for improving soil health under Assam condition.

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EMPOWERING RURAL PROSPERITY

Enhancing Rural Livelihood Security through Agricultural Extension in Western UP

Neetu Singh*, Roshan Lal and Bhagwati Joshi
Amity Centre for Agricultural Extension Services Amity University Uttar Pradesh Sec-125 Noida
**Corresponding author: nsingh19@amity.edu*

Abstract
Agricultural extension plays a pivotal role in enhancing rural livelihood security by disseminating scientific knowledge and best practices to farmers in and around Western Uttar Pradesh. The Amity Center for Agricultural Extension Services (ACAES) has implemented various field based projects and programmes focused on improving agricultural productivity, sustainability, and income generation for rural communities. This paper highlights ACAES's key extension activities, including training programmes, frontline demonstrations, and technology transfer initiatives aimed at empowering farmers through a participatory approach. ACAES fosters innovation adoption, thereby strengthening food security and rural livelihoods. The study assesses the impact of these interventions on agricultural sustainability, productivity, and socio-economic conditions of rural farmers. The results showed that a well-structured agricultural extension framework significantly improves rural livelihood security by enhancing access to knowledge, financial resources, and market linkages.

Keywords : *agricultural sustainability, extension activities, livelihood security*

Introduction
Agricultural extension services serve as a crucial link between research centres/institutions and rural farming communities, ensuring the effective dissemination of knowledge and technology. The Amity Center for Agricultural Extension Services (ACAES), Amity University, Noida has been actively involved in conducting various extension projects and programmes aimed at promoting agricultural sustainability and enhancing the livelihoods of rural communities. Rural livelihoods are directly dependent on agricultural productivity, which is influenced by factors such as climate change, soil health, access to inputs, and market opportunities. Extension activities, including training, field demonstrations, and advisory services, equip farmers with the necessary skills and knowledge to adopt improved agricultural practices and livelihood security. This paper explores the role of ACAES in agricultural extension services in and around western U.P , with a focus on initiatives that address key challenges faced by rural farmers.

Methodology
The study employed a participatory approach to assess the effectiveness of agricultural extension activities implemented by ACAES. A mixed-method approach, including qualitative and quantitative techniques, was used to gather data from farmers, extension personnel and stakeholders. Key methodologies included structured interviews, focus group discussions, and field observations to evaluate the impact of training programs and technology demonstrations. Secondary data from ACAES reports and agricultural research studies were analyzed to complement primary data. The effectiveness of extension services was measured based on key indicators such as adoption rates of improved practices, crop yield improvements, and income enhancement among farmers. The participatory approach ensured active involvement of stake holders, enabling a comprehensive assessment of the impact of ACAES interventions.

Results and Discussion
The study findings showed a significant improvement in agricultural productivity and livelihood security among farmers who participated in ACAES extension programs. Farmers reported increased knowledge and adoption of improved agricultural practices such as integrated pest management, soil fertility management, and climate-resilient farming techniques. The introduction of advanced technologies and innovative farming practices led to enhanced crop yields and higher income levels. Additionally, market linkages facilitated through extension services improved farmers' access to better pricing and value addition opportunities. Challenges such as limited financial resources and infrastructural constraints were identified, necessitating further policy support and investment in extension services. Overall, ACAES extension activities have demonstrated a positive impact on rural livelihood security, reinforcing the need for continuous support and innovation in agricultural extension.

Conclusions
Agricultural extension is a critical tool for rural development, ensuring food security and improved livelihoods. The Amity Center for Agricultural Extension Services has successfully implemented various initiatives that have contributed to knowledge dissemination, technology adoption, and economic empowerment of farmers. The study underscores the importance of participatory extension models in addressing agricultural challenges and enhancing productivity. Strengthening extension services through capacity building, training, field demonstrations and exposure visits can further enhance their effectiveness. Future efforts should focus on integrating digital tools and precision agriculture to maximize the outreach and impact of extension services. ACAES's role in agricultural extension serves as a model for promoting rural development and ensuring sustainable agricultural growth.

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Empowering Rural Prosperity Through Agri Startup

RK Yogi*, Vinod Kumar, Anupam Agrawal, Ramveer Singh, Himai, LK Meena, AK Sharma and PK Rai
ICAR-Indian Institute of Rapeseed-Mustard Research, Bharatpur, Rajasthan
**Corresponding author: raj.yogi@icar.gov.in*

Abstract
The study provides a comprehensive overview of mustard-based agri-business opportunities, which are provided by Agribusiness incubation centre including seed production, oil extraction, marketing, and startup development. It highlights high-yielding mustard varieties such as DRMRIJ-31along with their respective oil content and yield potential, emphasizing the role of improved seeds in increasing productivity. It also showcases mustard oil extraction technologies such as Kachhi Ghani Expeller and provides a fixed cost analysis for startup ventures.Furthermore the study also highlights digital marketing and procurement opportunities through platforms like **e-**NAM and M-Kisan, encouraging mustard entrepreneurs to integrate modern trading and supply chain mechanisms. The initiative aims to foster rural prosperity by linking mustard growers with industrialists, wholesalers, and traders.

Keywords : *Agribusiness, oil extraction, digital marketing*

Introduction
The Agri-Business Incubation Centre (ABIC) is a government-backed initiative aimed at fostering entrepreneurship and employment in the agricultural sector. It provides a structured platform for agripreneurs, startups, and rural enterprises to develop and commercialize innovative agricultural solutions. ABI centers offer technical training, financial assistance, market linkages, and mentorship to emerging businesses, ensuring their sustainability and growth. It bridges the gap between research institutions and industry, enabling rural employment and self-sufficiency. One of the key benefits of the ABI project is its role in employment generationby supporting startups in areas such as oilseed processing, organic farming, precision agriculture, and value-added food products. It bridges the gap between research and commercialization, helping small entrepreneurs scale up their operations. Government platforms likee-NAM (National Agriculture Market), M-Kisan, and other digital trading portals provide crucial market access, enabling farmers and startups to sell their produce directly to buyers, ensuring better price realization, reduced intermediaries, and higher profitability. These initiatives collectively contribute to rural economic growth and self-reliance.

Methodology
The data were collected from official government sources. The e-NAM (Electronic National Agriculture Market) and m-Kisan portals, which are key digital platforms facilitates agricultural trade and farmer support in India. Additionally, a cost analysis was conducted to estimate the financial requirements for establishing an oil processing unit. The cost estimation included both fixedand variable costs. The fixed cost primarily accounted for capital investments such as machinery and accessories installation, while the variable cost included operational expenses such as raw material, labor, electricity, and maintenance.

Results and discussion
e-NAM connects various APMC mandis across different states, allowing farmers and traders to access a broader marketplace beyond their local mandis. The platform facilitates real-time online bidding and price discovery based on actual demand and supply conditions.e-NAM has integrated 1,361 mandis across 23 states and 4 Union Territories, with over 1.75 crore farmers and 2.43 lakh traders registered on the platform. The total value of trade recorded on e-NAM has reached approximately ₹ 2.50 lakh crore (PIB Report, 2024). The m-Kisan portal enables government organizations to send agriculture-related advisories to farmers via SMS in their preferred language, tailored to their location and practices. It is integrated with Kisan Call Centers (KCCs)**,** allowing farmers to call for expert guidance in their local dialects. Unresolved queries are escalated to higher-level specialists for accurate solutions. Furthermore, to enhance mustard production efficiency, several high-yielding varietieslike Giriraj, Radhika, DRMR 1165 40, DRMRIC-16-38 and NRCDR-2 of mustard have been developed by ICAR-IIRMR. These improved varieties are aimed at increasing productivity, disease resistance, and adaptability to diverse agro-climatic conditions. The cost analysis of an oil expeller unit reveals a structured cost distribution between fixed and variable expenses. The study estimates that the fixed cost for setting up an oil expeller unit is 6.39 lakh, which includes the cost of machinery and other capital investments. In addition to the initial fixed cost, the variable cost associated with the operation of the oil expeller is estimated at₹ 40,000 per month. This includes expenses on raw materials, wages, electricity, maintenance and other recurring operational costs.

Conclusion
The study highlightsseveral sources which support the farmers in various aspectsto get better returns.e-NAM and mKisan play a crucial role in enhancing market accessibility, price transparency, and digital support for farmers in India. It also explains theeconomic feasibility of establishing an oil expeller unit by considering both capital investment and operational expenditures also. These cost estimations serve as a basis for financial planning and profitability assessment in mustard oil processing startups, contributing to informed decision-making for entrepreneurs in the edible oil sector.

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Transforming Agricultural Waste into Organic Manure : A Sustainable Approach for Soil Health, Climate Mitigation, and Food Security

Sanjib Kumar Goswami*
Nagaon, Assam, India
**Corresponding author: sanjib2day@gmail.com*

Abstract

Sustainable agriculture is crucial for ensuring long-term food security, environmental protection, and the health of both farmers and consumers. This presentation explores the conversion of agricultural waste into organic manure as an effective strategy to reduce dependency on hazardous chemicals. By utilizing waste materials, farmers can produce nutrient-rich organic fertilizers that promote soil health, enhance crop productivity, and minimize the environmental impact of chemical fertilizers. Additionally, this approach helps in reducing carbon emissions into the atmosphere, mitigates methane release from organic waste decomposition, and supports climate change mitigation efforts. It also contributes to healthier farming practices by lowering the exposure of farmers to harmful chemicals and promoting a cleaner, more sustainable ecosystem. As a result, this sustainable practice not only fosters eco-friendly agricultural development but also improves the health of consumers who benefit from chemical-free produce. Ultimately, the adoption of waste-to-manure practices aligns with the goals of sustainable development, offering a viable solution for a healthier, more sustainable agricultural future, while addressing pressing environmental challenges like climate change.

Keywords : *Sustainable agriculture, organic manure, agricultural waste, soil health, climate change mitigation, carbon emissions, chemical-free farming, environmental sustainability, crop productivity, eco-friendly practices.*

AGRICULTURAL ENGINEERING AND TECHNOLOGY

A Deep Learning-Based Classification Model for Prediction of LncRNA Crop Plants

Bhavesh kumar Choubisa*, Anu Sharma*, KK Chaturvedi, Mohammad Samir Farooqi, DC Mishra, Shashi Bhushan Lal, Sudhir Srivastava, and Amol Kumar U Solanke
Division of Computer Applications, ICAR-IASRI, PUSA, New Delhi, 110012
**Corresponding author:anu.sharma@icar.gov.in*

Abstract
Nucleic acids are essential molecules carrying genetic information. RNA, a polymeric molecule, plays key roles in gene expression and regulation. It includes coding RNA (mRNA) and non-coding RNA (ncRNA), with long non-coding RNAs (lncRNAs) being transcripts over 200 nucleotides that do not code for proteins. Plant lncRNAs regulate vital processes like embryogenesis and gene silencing. To predict lncRNAs in crop plants, we developed a deep learning-based model ANN. The model, built with Python, Pandas, and Scikit-learn, achieved 94.99% accuracy, 95.06% precision, 94.99% sensitivity, and an AUC-ROC of 94.99% with 5-fold cross-validation. The developed model allows direct FASTA sequence input, for classification and predicts the lncRNA.

Keywords : *Nucleic acids, lncRNAs, deep learning*

Introduction
Recent studies show that many RNA molecules in an organism do not code for proteins but help regulate gene expression, stress response, and cell development (1,2). Among them, long non-coding RNAs (lncRNAs) are transcripts longer than 200 nucleotides that influence crucial biological processes. However, their functions in plants remain largely unknown. Identifying lncRNAs in crops is challenging, requiring specialized computational methods. Existing tools like CPC2 (3) and PLEK(4), work well for animals but struggle with plant data. To bridge this gap, we developed, a deep learning-based ANN model to classify transcripts as coding or non-coding. ANN model is trained on Wheat, Sorghum and Maize crop-specific RNA transcripts data sets which uncover the roles of lncRNAs in crops.

Methodology
We downloaded lncRNA sequences from the GREENC database and cRNA sequences from EnsemblPlants, representing three crops: wheat, sorghum, and maize. Redundant sequences were removed using CD-HIT at an 80% similarity threshold. A balanced dataset of sequences per class was selected. The dataset was splited into training, validation, and test sets in the ratio of 8:1:1. For feature extraction, a 324-dimensional vector (sequence length, ORF coverage, GC content, codon count, and tetramer frequency) was calculated. The trained ANN model was validated on validation dataset using 5-fold cross-validation.The test dataset was used to check the model's performance for classification of unknown sequences as lncRNAs or cRNAs.

Results and Discussion
The ANN model, trained achieved 94.99% accuracy, 95.06% precision, 94.99% sensitivity, and an AUC-ROC of 94.99%. These results confirm its reliability in distinguishing lncRNAs from coding RNAs in crops. Most existing lncRNA prediction tools focus on humans, with limited options for crops. Our deep learning-based ANN model bridges this gap, offering an efficient, alignment-free approach. It enables large-scale transcriptome analysis, aiding plant genomics research. Future improvements include expanding crop datasets, refining deep learning architectures, and integrating biological feature selection. This work enhances lncRNA identification in crops, crucial for understanding gene regulation and functional genomics.

Conclusion
Nucleic acids play a crucial role in genetic and biological functions across all living organisms. While coding RNA (cRNA) produces proteins, non-coding RNA (ncRNA), including long non-coding RNA (lncRNA), regulates gene expression and other regulatory works. Identifying lncRNA in crops is challenging due to the lack of specialized tools. In this case, we developed aANN-based deep learning model for binary classification of lncRNA and cRNA using features extracted from FASTA sequences. The developed model is an efficient tool for lncRNA classification, aiding advancements in plant genomics and gene regulation studies.

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Reducing Fallow Periods in Rice-Based Cropping Systems : A Case Study for Mechanical Stubble Incorporation

Amarjyoti Khound*[1], Manas Jyoti Barooh[2] and Sanjana Bora[3]
Assistant Prof.[1], Dept. of Agricultural Engineering, BN College of Agriculture, Assam Agricultural University, Assam,India*
Assistant Prof.[2],Dept. of Agricultural Engineering, Assam Agricultural University, Jorhat, Assam,India
Technical-Assistant[3] District Level, NMEO-OP under District Agricultural Office, Nagaon, Assam
**Corresponding author : amarjyoti.khound@aau.ac.in*

Abstract
An experiment was conducted at NeulGaon, Jorhat,Assam, India, to assess the efficiency of a tractor-operated paddy straw chopper and its impact on straw incorporation. Using a 55 hp Eicher 855FE tractor, the chopper was tested at two gear settings (L2 and L3), with an effective field capacity of 0.67 ha/h. The L3 gear produced finer straw (89.1% in the 0-20 cm range). Post-chopping incorporation using a rotavator and tyne tiller (8 cm depth) showed weight reductions of 36.20% and 37.36%, respectively. The findings highlight that finer straw accelerates decomposition, enhancing soil health. This integrated approach provides an eco-friendly solution for managing rice straw residues, promoting sustainability in rice cultivation.

Keywords: *Stubble, Chopped Straw,Rotavator, Chopper, Incorporation*

Introduction
Rice straw left after harvest poses challenges for sowing and crop establishment, leading to poor seed placement, yellowing, and stunted growth. Traditionally, rice straw is removed for livestock feed, bedding, fuel, and packaging. Globally, paddy cultivation generates 800 million tons of straw, often managed through burning or soil incorporation. Straw contains essential nutrients like N, P, K, and S, contributing to soil fertility when incorporated. Approximately 0.7 billion tons of organic residues provide 25% of the nutrients supplied by chemical fertilizers. Incorporating straw accelerates decomposition, enhances microbial activity, and improves soil structure. Conservation tillage using rice stubble or maize stover maintains moisture and stability. Studies show that chopping efficiency depends on chopper speed and forward speed. In situ utilization of stubble enhances fertility, supporting sustainable rice farming while reducing environmental impact. Effective straw management can optimize nutrient cycling and improve soil health, ensuring long-term productivity in rice-based systems.

Methodology
The experiment was conducted in a farmer's field at NeulGaon, Jorhat, Assam state of India (26°04′N, 94°57′E, 90 m MSL). The soil was silty loam with a pH of 6.72 and 1.08% organic carbon. The average maximum and minimum temperatures were 29.55°C and 20.49°C, respectively. Total rainfall was 17.4 mm over four rainy days. A PTO-driven, mounted-type paddy straw chopper (working width: 2100 mm) was operated using a 55 hp Eicher 855FE tractor. The chopper had an inverted "Y"-shaped flail blade system with a rotary shaft diameter of 200 mm. Traditional paddy variety Bus was manually harvested using sickles. Three plots (0.267 ha each) were selected, and straw conditions were recorded before and after chopping. Two gear levels (L2 and L3) were used. A 0.5×0.5 m² quadrat was used for sampling, and moisture content was measured using a Contech moisture meter and dried stubbles were weighed to determine dry matter.

Results and Discussion
The tractor-operated paddy straw chopper had an effective working width of 2.1 meters and a field capacity of 0.67 ha/hr at an average speed of 3.3 km/hr in L2 and 3 km/hr in L3. The cut straw length varied significantly across gear settings, with 71.9% of straw in L2 and 89.1% in L3 falling within the 0–20 cm range, indicating finer chopping in L3. The chopped straw was categorized into three segments: 0–10 cm, 11–20 cm, and 21–30 cm. In L2, the distribution was 29%, 42%, and 28%, respectively, while in L3, 42% fell within 0–10 cm. One week post-chopping, straw was incorporated using a rotavator and a tyne tiller at 8 cm depth. After two weeks, straw weight reduction was 37.36% (tyne tiller) and 36.20% (rotavator), highlighting effective incorporation and decomposition. The study confirms the chopper's efficiency in sustainable straw management.

Conclusion
The tractor-operated paddy straw chopper proved to be an efficient tool for reducing straw size, with the L3 gear setting producing finer chopped straw. The chopped straw, when incorporated into the soil using a tyne tiller or rotavator, showed significant weight reduction after two weeks, indicating faster decomposition and nutrient recycling. The incorporation process effectively integrated the straw into the soil, promoting microbial activity and improving soil health. These findings highlight the potential of mechanized straw management as a sustainable alternative to open-field burning, reducing environmental impact while enhancing soil fertility. The study demonstrates that adopting mechanized straw chopping and incorporation techniques can support sustainable rice farming by improving soil structure, nutrient availability, and overall agricultural productivity.

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Study of Engineering Properties of N-53

Ekta Sharma[1]*,Sanwal Singh Meena[2]

Ph.D. Research Scholar and Associate Professor, Department of Farm Machinery and Power Engineering, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan

**Corresponding author : ektagbpant@gmail.com*

Abstract

Onions are one of the most extensively grown vegetables in India. Understanding onion bulb qualities is crucial for designing and developing technology that can handle them. In this study, various engineering properties of onion bulb were studies in prospect to design and development battery–powered onion bulb planter. The present study was about aggregatum group N -53 onion. Physical parameters were measured, including polar diameter, thickness, Arithmetic mean diameter, geometric mean diameter, sphericity, shape index, aspect ratio, surface area, frontal surface area, cross-sectional area, and mass. The onion bulb's bulk density, true density, porosity, moisture content, and mechanical parameters such as angle of repose and coefficient of static friction were all measured.

Keywords: *Coefficient of friction, bulk density, sphericity, angle of repose, liner diameter, arithmetic mean diameter, geometric mean diameter***.**

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