



IARI NEWS



Kalanamak

Pusa Narendra KN1

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From Director's Desk

In this quarter, the Institute released two specialty rice varieties, Pusa Narendra KN1 and Pusa CRD KN2 for commercial cultivation in eastern Uttar Pradesh. These varieties are set to revolutionise the GI tagged traditional landrace "Kalanamak" with their potential high yield and non-lodging trait. Additionally, major research highlights include

identification of rhizosphere-active rice microbiome in rice, establishing the damaging potential of the nematode *M. incognita* in rice and Zucchini yellow mosaic virus (ZYMV) in papaya. A hazard analysis of grapevines in Vijaypura, Karnataka was conducted under the 'Clean Plant Program' to ensure virus free and true-to-type planting material to farmers. Novel donors for high night



temperature tolerance were identified in early sown wheat, with early vigor as a promising trait for selection. The Institute organized a number of capacity building programmes and high-end workshops to strengthen the skills of farmers and students. We introduced open field days for various *kharif* crops to facilitate cross-disciplinary discussions among scientists. IARI also celebrated World Food Day, World Soil Day, Constitution Day, *Kisan Diwas* and Agricultural Education Day by organising lectures of eminent speakers. Under the Lab to Land initiative, patents were filed and renewed, and copyrights granted to IARI technologies. *Kisan Goshthis*, exhibitions and demonstrations were organised for farmers and farm women.

I am sure that the information included in the newsletter would be useful to the farmers and stakeholders. I wish to congratulate all the scientists and staff of publication unit for bringing out the newsletter in time.



Ashok Kumar Singh
Director, ICAR-IARI

RESEARCH

Improved semi-dwarf short grain aromatic rice varieties poised to transform the landscape of the GI tagged “Kalanamak” rice

Two specialty rice varieties, Pusa Narendra KN1 and Pusa CRD KN2 were released for commercial cultivation in eleven districts of eastern Uttar Pradesh, promising improved yield and non-lodging trait against the GI tagged traditional landrace “Kalanamak”. Pusa Narendra KN1 was developed from the cross between traditional Kalanamak and an elite aromatic short grain breeding line, Pusa 1176 with breeding efforts spanning over 15 years. It produces an average



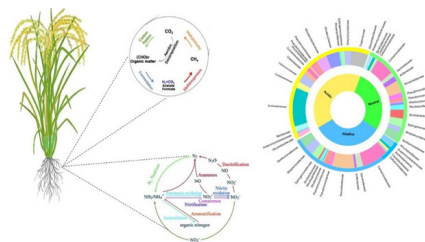
Field and grain view of Pusa Narendra KN1 yield of 36 quintals per hectare in 145 days and shows a yield potential of 46.6 quintals per hectare. The grains are medium slender with an average kernel length of 8.39 mm and an elongation ratio of 1.64 after cooking. The grains possess a

strong aroma due to the presence of 289.9 ppb of the volatile aromatic compound, 2 acetyl-1-pyrroline.

(Dr. A.K. Singh and co-workers, Division of Genetics)

Meta-transcriptomic insights into the functionally active microbiome of rice

The rice rhizosphere is a unique niche characterized by the oxic-anoxic interfaces due to the radial oxygen loss by the host plant roots. Meta-transcriptomic analysis of rice rhizosphere soils showed that eubacteria (84.6%) dominated the microbial community, with a relatively small proportion of archaea (15.4%). The rhizosphere-active rice microbiome was taxonomically complex, exhibiting transcriptional activities by about 180 microbial phyla (~ 155 bacterial and 25 archaeal phyla). Proteobacteria



The diversity of rice rhizosphere microbiome in terms of bacterial and archaeal phyla

(18-30%), Actinobacteria (6-10%), Firmicutes (0.4-4.5%), Acidobacteria (1-2.5%), Chloroflexi (0.5-2.5%), Planctomycetes (0.4-1.8%) and Bacteroidetes (0.3-1%) were the dominant bacterial phyla in the rice rhizospheres. Further, the key microbial taxa regulating the elemental recycling of carbon, nitrogen, phosphorus, iron and sulphur were identified through transcriptional activity of marker genes in the microorganisms. The introduction of DNA and RNA-based molecular surveys opens up new opportunities for a better understanding of the soil microbiome to derive agronomic benefits.

(Dr. Ramakrishnan B., Division of Microbiology)

Root-knot nematode *Meloidogyne incognita*: another devastating pest of basmati rice

Comparative infection potential of *M. incognita* and *M. graminicola*



Infection of *M. incognita* and *M. graminicola* on rice roots causing galls

was investigated in basmati rice cultivar Pusa Basmati 1121 (PB1121) growing in Pluronic gel medium and pot soil. *M. incognita* laid eggs outside the galled root, while *M. graminicola* egg masses were deposited inside the galled root, which was correlated to their specific adaptation in irrigated and upland cultivation practices, respectively. Thus, it was established that *M. incognita* also causes significant economic damage to rice and nematode management strategies must consider the damaging potential of both the root-knot nematode species.

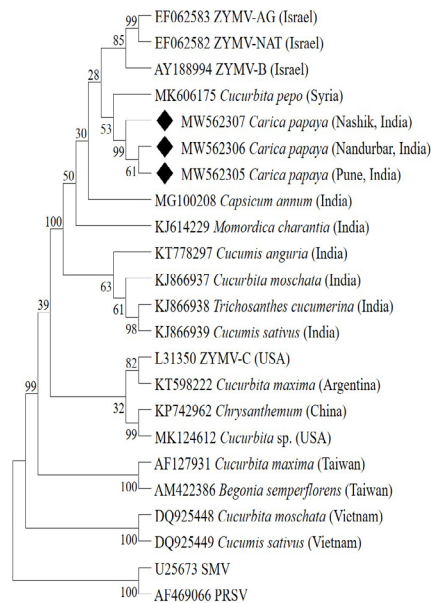
(Dr. Tushar Kanti Dutta,
Division of Nematology)

Zucchini yellow mosaic virus (ZYMV): A new concern for papaya farmers

Papaya (*Carica papaya*) plants exhibiting mosaic, mottling, blistering, chlorosis, leaf reduction and deformation were observed in farmers' fields in Pune, Nashik and Nandurbar districts of Maharashtra. DAS-ELISA was used to test a large number of samples for papaya ringspot virus (PRSV), cucumber mosaic virus (CMV) and ZYMV and 14% of plants tested positive for



Infected papaya leaf



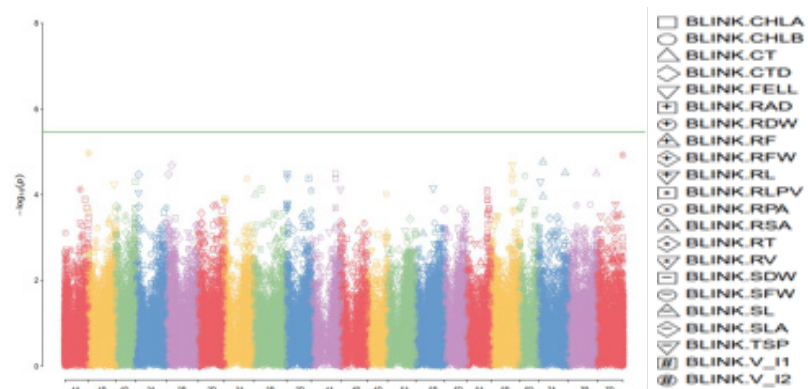
Phylogenetic tree

ZYMV and PRSV. Confirmation was done by RT-PCR employing ZYMV-specific primers, amplifying a fragment covering the Nib, coat protein and three UTR regions. Amplicons from Pune, Nashik and Nandurbar samples were sequenced and deposited in GenBank (MW562305, MW562307 and MW562306). The sequences shared more than 98% identity with ZYMV Syria isolate and clustered closest to it in the phylogenetic analysis.

(Dr. S. Tripathi, IARI-RS Pune)

Identification of donors and MTAs associated with seedling stage high night temperature (HNT) tolerance in wheat

Early sowing of wheat is undertaken in North-Western and Central parts of India to capitalize on the residual soil moisture after the paddy harvest which may lead to establishment of a poor crop stand due to high temperature, especially HNT, which prevails during seedling emergence. A study was conducted to phenotype 290 diverse wheat germplasm for selection of donors for tolerance to HNT of ~4.9°C over ambient and identify associated SNPs/genes. The correlation matrix of 41 selected tolerant genotypes (<10% reduction in SDW) with physiological traits showed that early vigor (Vigor Index-II) was positively ($r=0.431^{***}$) correlated with HNT tolerance at seedling stage. Trait association mapping of 290 genotypes revealed the presence of 22 SNPs associated with HNT tolerance, with three highly significant SNPs located on chromosomes 1A, 1B and 7D, related to early vigor. *In silico* analysis led



Manhattan plot representing significant MTAs identified from the traits under HNT

to prediction of Phosphatidyl glycerophosphate phosphatase PTPMT2-like gene as an effector for early vigor under HNT.

(Dr. Anjali Anand, Division of Plant Physiology)

‘Clean Plant Program’- Virus free and true-to-type grapevines for growers

The ‘Clean Plant Program’ at ICAR-IARI envisages to provide clean (free from non-separable, non-culturable, clonally propagated pathogens: viruses, virus - like pathogens) and true-to-type planting material of grapevine to the growers. A hazard analysis of grapevines was carried out to decipher the virome profile through high throughput sequencing at Vijayapura, Karnataka.



Vineyard at Vijayapura, Karnataka, with leaf roll and mottling symptoms

(Dr. Susheel Sharma, Division of Plant Pathology)

EDUCATION

Lectures

Eminent Expert lecture

Speaker	Topic	Date	Organizers
Dr. H. Pappu, Professor and Director, Plant Pathology PG Programme, Washington State University	Application of Multi-omics for Host-virus Interactions and Disease Management	October 06, 2023	Plant Pathology and Internal Quality Assurance Cell (IQAC)
Prof. Derick H. Lindquist, Neuroscientist, University of Yale, USA and alumnus Dean, Jindal School of Psychology and Counselling, OP Jindal Global University, Sonipat	Stress and Coping Skills	October 18, 2023	Student Service Centre, IARI and IQAC
Dr. Serge Savary, Honorary Professor, Plant Pathology	Global Impacts of Potential Plant Disease Epidemics: Rice & Wheat	October 27, 2023	Plant Pathology and IQAC
Dr. R.S. Paroda, Former Secretary, DARE & DG, ICAR and Chairman, TAAS	Opportunities in Agriculture	December 03, 2023	Graduate School ICAR-IARI
Prof. Rattan Lal, World Food Prize Laureate and Director, Carbon Management and Sequestration Centre, The Ohio State University, Columbus, USA. (Online Mode)	Soil and Water: A Source of Life: Highlighting the Soil Ecosystem Services in Food, Energy, Water Nexus	December 05, 2023	Soil Science and Agricultural Chemistry and IQAC



Prof. Derick H. Lindquist, Neuroscientist, University of Yale, USA alumnus and Dean, Jindal School of Psychology and Counselling, OP Jindal Global University, Sonipat

Organization of the Orientation Week

The Graduate School, ICAR-IARI, organized the Orientation Week program from November 28-December 01, 2023 for the newly admitted students to mark the commencement of academic session 2023-24.

Secretary, DARE and DG, ICAR, Dr. Himanshu Pathak addressed the students during the inaugural session held on November 28, 2023. The other activities during the week-long program included



Address by Secretary, DARE and DG, ICAR, Dr. Himanshu Pathak

(i) Lecture by Dr. Meena Mishra, Director, Brain Behaviour Research Foundation of India, New Delhi on November 29, 2023 (ii) Motivational session on “HeartFulness Enabled

Leadership Mastery Program” on November 30, 2023 (iii) Dean’s address and interaction session with Padma Shri farmers. A campus tour was also organized for the UG students.



Field Day for Kharif Crops



Field day of pearl millet, maize and greengram organized by Division of Genetics on October 06, 2023 to evaluate the progress and discuss suggestions to strengthen the breeding programs



Field day of rice, maize and soybean organized by Division of Genetics on October 27, 2023 to interact and integrate with scientists from other Divisions



Field day of new variety of Pigeon pea, Pusa Arhar 2018-4 organized by KVK Shikohpur, Gurugram on November 16, 2023 to showcase the features of new variety



Field day of protected, open-field tomato varieties and hybrids by CPCT in collaboration with ZTM & BPD Unit and Vegetable Science Division on December 19, 2023 to showcase various protected and open-field tomato varieties and hybrids to farmers and seed companies

Training Programmes



- Hands-on training on “Hydroponic Plant Culture” was coordinated by ZTM & BPD Unit and conducted at the Division of Plant Physiology on October 03-06, 2023
- Training on hydroponic culture techniques for microgreens, fodder crops and ornamental plants
- Participants- 38



- Two-day farmers' training on "Promotion of Improved Varieties and Technologies for Agri-horticultural Crops" was organized by IARI under SCSP at Alipur, Distt. Meerut and Shahpur, Budhana, Distt. Muzaffarnagar, U.P on October 08-09, 2023
- Farmers trained on various aspects of crop and livestock production. Seeds of wheat, vegetables and farm machinery (Knapsack Sprayers, Spade, Sickle) were distributed to farmers
- Participants-Aprox.1200

- Postgraduate students' training program entitled "Phenomics: High Throughput Phenotyping for Development of Climate Resilient Crops" organized by the Division of Plant Physiology on October 26-November 04, 2023
- Training on application of imaging technologies in agriculture
- Participants -41



- One-day In-service training on "IPM in Cole Crops" for extension personnel of the Department of Horticulture, organized by KVK, Gurugram on October 31, 2023
- Knowledge on various pests, insects and their cultural, mechanical, biological and chemical management practices was shared
- Participants -11

- Agri-preneurship development program on "Soil Testing and Water Quality Assessment" was organized by ZTM & BPD Unit on October 31-November 07, 2023
- Participants were trained on soil and water analysis techniques
- Participants -18



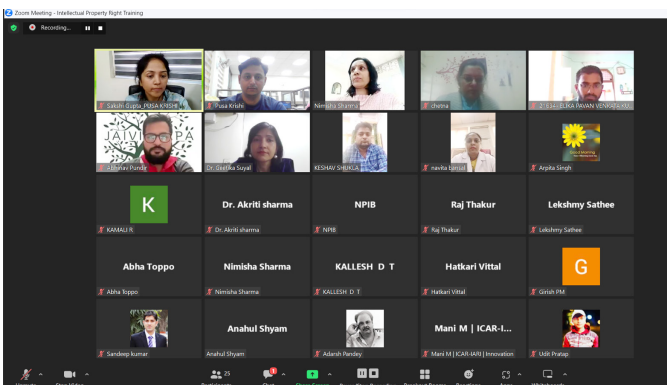
- Two training programs on "Preservation of Seasonal Fruits and Vegetables" were organized at villages Tajnagar & Tripari by KVK Shikohpur, Gurugram on November 02 & 10, 2023
- Various products and preservation methods for different fruits & vegetables were discussed with farm women
- Participants -26

- Training on “Biological Control of Insect Pest in Mustard Crop” was organized at village Kankrola by KVK Shikohpur, Gurugram on November 13-16, 2023
- The farmers were educated on various pests, insects of mustard and their biological management practices
- Participants - 20



- Training on “Income Generation Activities for Empowerment of Rural Women” was organized at village Kankrola, by KVK Shikohpur, Gurugram on November 13-16, 2023
- Beneficiaries were trained on value addition, dress designing and stitching, mushroom production, vermicompost, dairy, etc., that can be adopted for the income generation
- Participates-18

- A one-day training program on “Group Dynamics of SHGs and Farmers’ Organizations” was organized at village Hazipur by KVK Shikohpur, Gurugram on November 14, 2023
- Problems of groups and their remedial methods through group dynamics were discussed
- Participants -21



- Online Intellectual Property Rights (IPR) training program on “Patent, Copyrights Act, Trademark and Industrial Designs” was organized by ZTM & BPD Unit on November 20-22, 2023
- Patent experts discussed the concept of intellectual property, types of intellectual properties: patent, trademarks, copyright, designs, requirement for registration of IP, with students, scientist and startups
- Participants -38

- Agri-preneurship development program on “Processed Food Products from Millets” was organized by ZTM & BPD Unit in collaboration with the Division of Food Science and Post-harvest Technology, on December 04-08, 2023
- Participants were educated on labeling, packaging and certification norms essential for commercial success
- Participants -29





- Training program on “विभिन्न फसलों के लिए टपक सिंचाई प्रणाली के डिजाइन और इसके रख रखाव” was organized in Water Technology Centre under the project Precision Farming Development Centre (PFDC) on December 21, 2023
- Drip irrigation system and its maintenance techniques were explained to farmers. Visits at PFDC and CPCT were organized to show advanced irrigation technologies, hydroponics and polyhouse cultivation
- Participants -21

Mission / Special Programmes

Swachhata Abhiyan 3.0

Swachhata Abhiyan 3.0 was organized by KVK Gurugram on October 01-31, 2023 at different locations. Farmers were advised to make compost from crop residue instead of burning it. School students were motivated to maintain personal hygiene like washing hands, brushing, bathing, etc.



Cleanliness drive at KVK, Gurugram

Viksit Bharat Sankalp Yatra

Awareness on Natural Farming and Soil Testing was created under *Viksit Bharat Sankalp Yatra* in different Gram Panchayats and wards of Gurugram District. The importance of drones in agriculture through use of drones for spraying pesticides over the fields was demonstrated. A total of 152-gram panchayat and wards of Gurugram district were covered, benefitting 139827 participants.

Demonstration and evaluation of Pusa Decomposer

An awareness program on management of residue burning and demonstration of Pusa Decomposer WP was conducted in Safidon, Ellanabad, Radaur, Bass, Matlauda in Haryana and Rajpura, Amritsar, block of Punjab in collaboration with Ebro India Pvt Ltd.



Organization of awareness program at Sirsa, Haryana with the help of Pusa Decomposer licensee M D Biocoals Pvt Ltd.

World Food Day

ICAR-IARI, New Delhi, celebrated World Food Day 2023 on October 17, 2023. Prof. Rattan Lal, the World Food Prize Laureate, Padma Shri awardee and Director of Carbon Management and Sequestration Centre, The Ohio State University, Columbus, USA delivered a lecture through virtual mode which was attended by the faculty and students.

Another online lecture was organized by IQAC, The Graduate

School, ICAR-IARI, New Delhi on the topic “Water Management for Sustainable Agriculture, Food Security and World Peace” delivered by Dr. P.S Brahmanand, Project Director, WTC on October 16, 2023.



Kisan Goshthi to celebrate World Food Day & Mahila Kisan Diwas

KVK Gurugram also organized a *Kisan Goshthi* to celebrate World Food Day & *Mahila Kisan Diwas* at village Bhoda Kalan. The participants (49 rural women) were motivated to eat healthy and nutritious food and keep themselves and their surroundings clean.

World Soil Day

Division of Soil Science and Agricultural Chemistry, ICAR-IARI, New Delhi and Delhi Chapter of the Indian Society of Soil Science celebrated World Soil Day on December 05, 2023, under the theme “Soil and Water: A Source of Life”. A video on significance of soil and water and pathways to save the resources was screened. A visit to the soil museum in the



World Soil Day celebration at the Division of SS&AC, ICAR-IARI, New Delhi

SS&AC Division was organized to show the genesis and development of soil followed by a photo contest, extempore competition and quiz.

An online lecture was also delivered by Prof. Rattan Lal, World Food Prize Laureate, Padma Shri awardee and Director of Carbon Management and Sequestration Centre, The Ohio State University, Columbus, USA on the theme “Soil and Water: A Source of Life”, highlighting the Soil Ecosystem Services in Food, Energy, Water Nexus.

Constitution Day

The PGSSU, IQAC and ICAR-IARI celebrated the Constitution Day on November 26, 2023. On this occasion, a debate competition on the topic “Role of youth as Embodied in the Constitution of India” and a painting competition on the topic “Constitution of India and SDGs” was organized for the students.

Kisan Diwas celebration at Pusa Agri Krishi Haat

Kisan Diwas was celebrated at Pusa Agri Krishi Haat on December 23, 2023 to commemorate the birth anniversary of Late Chaudhary Charan Singh, former Prime Minister of India with the theme “Empowering FPOs through Technologies of Pusa Institute.” Dr. R.N Padaria, Joint

Director (Extension), ICAR-IARI, welcomed the dignitaries, farmers and media personnel. Dr. A. K. Singh, Director, ICAR-IARI, urged the farmers to join FPOs to increase their bargaining power for input purchase and sale of produce. He also motivated the farmers to venture into value addition with a caution to maintain adequate quality standards for better remuneration. Mr. Ajay Nayak from NABARD discussed NABARD's role in formulating FPOs. Sri Achalaram Choudhary, an IARI innovative farmer awardee from Jaisalmer, shared his experience with FPOs for the betterment of the farming community.



Kisan Diwas at ICAR-IARI, New Delhi

Agricultural Education Day

Agricultural Education Day was celebrated on December 03, 2023 at ICAR-IARI, under the chairmanship of Dr. R.S. Paroda, Padma Bhushan awardee and former Secretary DARE & DG, ICAR and Chairman TAAS, New Delhi, who delivered a lecture on “Opportunities in Agriculture”. The



Dr. R.S Paroda, Former Secretary, DARE & DG, ICAR and Chairman, TAAS, New Delhi delivering the lecture on Agricultural Education Day

programme was presided over by Prof. R.B Singh (Former President, NAAS & Former Director, ICAR-IARI, New Delhi) and attended by the students and faculty of IARI.

An inter-school painting competition was also arranged as part of the celebration, in which 60 students participated.

Celebration of Foundation Day Division of Plant Physiology



Division of Plant Physiology celebrating its 57th Foundation Day

Division of Plant Physiology celebrated its 57th Foundation Day on November 24, 2023, by organising the 13th R.D. Asana Endowment Award Lecture delivered by Dr. K. Suresh, Director, ICAR-IIOPR, on the topic “Oil Palm for edible oil security in India.”

Kisan Goshthis

Kisan Goshthi on “Nutri-kitchen garden”

The Division of Agricultural Extension, ICAR-IARI organized “*Kisan Goshthis*” under MGMG extension intervention on “Nutri-Kitchen Garden for Enhanced



Distribution of seed to the farmers under MGMG activities

Nutrition Security” at Mirpur, Gogulpur and Jant villages of Rewari district of Haryana and Villages of Baghpat district, Uttar Pradesh, during October 26 - November 16, 2023. Nutri-kitchen garden kits, wheat and mustard seeds were distributed to farmers for demonstration and seed production purpose, respectively.

Krishak Goshthi on Integrated Framing System

Division of Agronomy in collaboration with INYAS-NCT zone, INSA New Delhi organized *Krishak Goshthi* on Integrated Farming Systems at S.B.I.C. Salarpur, Garh Mukteshwar, Hapur, Uttar Pradesh on October 26, 2023 to create awareness among

the farmers about the resource optimization in Integrated Farming Systems. Pusa vegetable seed kits were also distributed to the farmers.

Women farmer centric “Kisan Goshthi” - cum - Training programme

The Division of Agricultural Extension, ICAR-IARI, in collaboration with ICAR- NICRA project organized a women farmer-centric *Kisan Goshthi* on “Importance of Gender Responsibilities in the Climate Change Adaptation in Agriculture” in Sangel village of Nuh district, Haryana and Vrindavan cluster villages of Mathura, Uttar Pradesh on November 01 and 03, 2023, respectively. The multidisciplinary

experts gave capacity-building lectures about climate-smart agricultural practices such as using leaf colour charts for optimum fertilizer application, biofertilizer usage for seed treatment, gender-specific processing and value addition for higher income and the SHG-based community mobilization for sustainable development. About 110 female farmers benefited from the program.



Goshthi lecture by JD (Extension)



Farmers at *Krishak Ghoshthi* on Integrated Farming Systems



Kisan Goshthi on the importance of “Gender Responsibilities in the Climate Change Adaptation in Agriculture”

CAPACITY BUILDING

International Workshop

Division of Seed Science and Technology, ICAR-IARI, New Delhi conducted a four-days International Workshop on “Advanced Post-harvest Technologies for Seed Quality Improvement” from November 28-December 01, 2023 under the aegis of Indo-German Cooperation on Seed Sector Development. The workshop aimed to provide practical knowledge through hands-on-experience to



Workshop on “Advanced Post-harvest Technologies for Seed Quality Improvement”

enable the participants to develop technical skills in the area of seed quality improvement.

Workshop on Organic Farming

Division of Agronomy, ICAR-IARI, New Delhi in collaboration with the INYAS-NCR Chapter, organized a one-day workshop on



Workshop on organic farming

organic farming on September 02, 2023 aimed at empowering high school and intermediate science teachers. Deliberation by experts on organic farming and a visit to field was organized.

XXII Biennial National Symposium

The XXII Biennial National Symposium on “Climate Smart Agronomy for Resilient Production Systems and Livelihood Security” was organized on November 22–24, 2023, at ICAR-CCARI, Ela, Goa by the Division of Agronomy in collaboration with The Indian Society of Agronomy (ISA). The inaugural session was graced by the Governor of Goa, Shri P.S Sreedharan Pillai, DG, ICAR, DDG (NRM) and presided over by the President of ISA, Dr. B.S Mohapatra. The Conference brought together professionals from Agronomy, Soil Science, Soil & Water Conservation



Inauguration of Symposium by Hon'ble Governor of Goa

Engineering, Forestry, Horticulture and Allied Agricultural Sciences, NGOs to delve upon sustaining productivity in the era of climate change while managing the scarce natural resources.

SC Collaborator conference

Division of Agronomy organized a three-day conference at NASC, New Delhi on Natural Mineral Fertilizers. Dr. U.S Awasthi, CEO & MD IFFCO, presided the function and highlighted the need for stronger linkages between Industry and Academia.



Conference on Natural Mineral Fertilizers

CGIAR Conference

A panel discussion on ‘Youth Responsiveness for Climate-Resilient Agri-Food Systems through Adaptation-Mitigation and Digitalization Interventions for Green Livelihoods’ was orchestrated by Pusa Krishi on October 10, 2023 during CGIAR Conference at NASC, New Delhi. Panelist Dr. Dinesh Panday, Ms. Jyotsana Kaur Habibullah, Ms. Shruti Shandilya, Minushri Madhumita, Dr. Rajkumar Halder and Dr. Zenebe Uruguchi discussed the strategies for making agriculture lucrative for the younger generation, featuring personal journeys, challenges, achievements and innovative products benefiting Indian farmers, particularly in remote areas.

MISCELLANEOUS

Research Grants

Externally Funded Projects Sanctioned and Implemented

Title	Amount (in lakhs)	Duration	Funding Agency	Principal Investigator
Drone robotics and machine learning	30.00	2023-2024	ICAR Education	Dr. Rabi N Sahoo, PS, Division of Agricultural Physics
Mushroom production to packaging	30.00	2023-2024	ICAR Education	Dr. Deebea Kamil, SS, Division of Plant Pathology
The South Asia Agriculture Adaption Atlas: Interconnections between climate risks, practices, technologies and policies	27.20	2023-2026	BISA	Dr. Arti Bhatia, PS, Division of Environmental Science
Accelerating the development of climate-resilient germplasm of pulse crops through the application to biotic and abiotic stresses	8.32	2023-2025	ICAR and ICARDA	Dr. H. K. Dikshit, PS, Division of Genetics



Abundance and diversity of AMF in the North Eastern hills of India	8.61	2023-2025	SPUN	Dr. Subrata Nath Bhowmik, PS, Division of Microbiology
Characterizing, reviving, supporting, monitoring, and managing sustainable food systems to address malnutrition in indigenous tribal communities in India, CARISHMA sustainable study system	25.00	2023-2028	DBT-Welcome Trust India Alliance	Dr. Sangeeta V, SS, Division of Agricultural Extension
Tailoring plant architecture for enhancement of baby corn yield through marker-assisted selection of <i>liguleless1 (lg1)</i> gene	37.61	2023-2025	DBT-ATGC	Dr. Rajkumar U. Zunjare, S, Division of Genetics
Clean Plant Programme (CPP)	175.00	2023-2024	National Horticulture Board	Dr. Susheel Sharma, SS, Division of Plant Pathology
Baseline study of PII 8007 against brinjal shoot and fruit borer and fall armyworm	14.84	2023-2024	IARI and PI Industries Ltd	Dr. Suresh Nebapure, SS, Division of Entomology
Customization of the technologies for conversion of crop residue into feed, fuel, and soil amendments for eco-friendly, profitable and sustainable farming	30.00	2023-2025	IARI and CNH Industrial (India) Pvt. Ltd	Dr. Tapan Kumar Khura, PS, Division of Agricultural Engineering
Micronutrient-embedded sulphur fertilization in rice-wheat and maize/pearl-millet-mustard systems for enhancing productivity and biofortification	45.00	2023-2025	IARI and Sulphur Mills Limited	Dr. R. S. Bana SS, Division of Agronomy
Agronomic field studies with nano-NPK fertilizer	11.80	2023-2024	IARI and Rashtriya Chemicals & Fertilizer Ltd	Dr. Dinesh Kumar PS, Division of Agronomy
Designing an IARI technology (Jalopchar™) based Eco-friendly Wastewater Treatment Facility for a Rail Coach Factory in Kapurthala, Punjab	4.73	Dec 20-30, 2023	IARI and Rail Coach Factory, Kapurthala, Punjab	Dr. Ravinder Kaur PS, WTC

Technology Commercialization

During October - December 2023 under the Lab to Land Initiative, twenty-five technologies of ICAR-IARI were commercialized which were adopted by 111 industry partners, resulting in a total revenue generation of ₹ 2,24,51,200.

IP management

During this quarter, eight Patents were renewed, one patent was granted and one copyright application was filed.

ITMC Meeting

One ITMC meeting was organized on October 06, 2023, wherein five technologies for IP protection and 49 technologies for commercialization were approved.

Incubation Activities

SHITIJ

Under phase I, mentoring sessions of Shitij a year-long incubation initiative designed to support and empower fledgling startups were held from October 16-31, 2023.

The second phase of Shitij was organized from December 19-20, 2023. During this phase, PUSA Krishi gave an opportunity to startups to benefit from one-on-one mentoring sessions, offering valuable guidance and support.

Industry-Academia Interaction Meet

The Division of Soil Science and Agricultural Chemistry, ICAR-IARI, New Delhi and the Delhi Chapter of the Indian Society of



Interaction of staff of the SS&AC with industry representatives during the Industry-Academia Interaction Meet

Soil Science jointly organized an Industry-Academia Interaction Meet on December 01, 2023. Representatives from five industries, viz. Indian Farmers Fertilizer Cooperative (IFFCO), International Zinc Association (IZA), Harvest Group, Anglo American and Mosaic India Private Limited participated in the workshop. Scientists and students interacted with the representatives and discussed the role of academia in the Industry-Academia collaboration.

Agri India Meet 3.0

The second session of the "Third Edition of Agri India Meet: Food Business Start-ups & FSSAI," was organized by Pusa Krishi, IARI, on December 05, 2023. With 80 + participants, the event featured esteemed speakers, including Dr.

Ankur Ojha, Ms. Vaidehi Kalzunkar and Ms. Yashi Shrivastava. The discussions revolved around pivotal themes like safety & hygiene, offering Start-ups guidance on establishing robust food safety practices.

Pusa Krishi AGRINNO Connect 2023

On December 15, 2023, the ZTM-BPD unit orchestrated the successful 'Pusa Krishi AgriInno Connect' at the B.P Pal Auditorium, IARI, New Delhi. Chief Guest Mr. Ashish Kumar Srivastava, Joint Secretary - RKVY, Ministry of Agriculture & Farmers' Welfare, was joined by esteemed dignitaries like Dr. A.K Singh, Director, ICAR-IARI and Dr. Anupama Singh, JD(E), ICAR-IARI. Dr. Akriti Sharma, CEO & Incharge of Pusa Krishi &

ZTM & BPD, welcomed guests, providing a concise overview of the event. The full-day event served as a pivotal platform for agri startups, allowing them to engage directly with the scientific community at IARI. The collaborative spirit was further strengthened by the signing of a MoA between Pusa Krishi, ZTM-BPD Unit, IARI and 31 selected startups destined to receive grant-in-aid support under RKVY-RAFTAAR as part of the Pusa Krishi cohort for 2023-24.

Corporate Membership

In this quarter, the unit enrolled 71 new industry partners for membership and renewed the membership of 87 industry partners, generating a revenue of ₹ 6,88,000.

Awards and Recognitions

- Dr. Nitika Gupta (Scientist, Plant Pathology) received the Best Oral Presentation Award at the Asian Citrus Congress -2023 held at Nagpur, India, from October 28-30, 2023.
- Dr. Ruchi Bansal (Senior Scientist, Plant Physiology) was awarded SERB International Research Experience Fellowship to carry out research work at Oklahoma State University, USA.

MoU between ICAR-IARI and Uttar Pradesh Distillers' Association (UPDA), New Delhi

To popularize IARI-bred maize hybrids for their utilization in bioethanol and DDGS production, the ICAR-IARI, New Delhi and UPDA, New Delhi, signed an MoU. Dr. A.K Singh, Director, ICAR-IARI and Shri Shashi Kant Shukla, President, UPDA, signed the MoU on behalf of ICAR-IARI and UPDA, respectively, on October 04, 2023, at ICAR-IARI, New Delhi.



MoU between IARI and DDGs

National & International Visits at IARI



Visit of Dr. Josephine Caffery, Associate Professor, University of Canberra, Australia on October 13, 2023



Visit of Dr. Johannes Sauer, Chair for the Group of Agricultural Production and Resource Economics at the Technical University of Munich (TUM) on October 17, 2023



Visit of representatives of Ist Global South Young Diplomats Forum from Sushma Swaraj Institute of Foreign Service, Ministry of External Affairs on November 29, 2023

Publications with NAAS rating > 10.0

- Chakraborty R, Purakayastha T J, Pendall E, Dey S, Jain N, Kumar S. (2023) Nitrification and urease inhibitors mitigate global warming potential and ammonia volatilization from urea in the rice-wheat system in India: A field to a lab experiment. *Science of the Total Environment* 898: 165479. <https://doi.org/10.1016/j.scitotenv.2023.165479>
- Chakraborty R, Sharma V K, Das D, Biswas DR, Mahapatra P, Shahi D K, Barman M, Chobhe K A and Chakraborty D. (2023). Change in phosphorus availability, fractions and adsorption-desorption by 46 years of long-term nutrient management in an Alfisol of eastern India. *Soil & Tillage Research*, 236:105940 <https://doi.org/10.1016/j.still.2023.105940>
- Danakumara T, Kumar T, Kumar N, Patil B S, Bharadwaj C, Patel U, Joshi N, Bindra S, Tripathi S, Varshney R K and Chaturvedi S K. A multi-model based stability analysis employing multi-environmental trials (METs) data for discerning heat tolerance in chickpea (*Cicer arietinum L.*) landraces. *Plants*. 2023; 12(21):3691
- Dikshit H K, Manjunatha P B, Aski M S, Mishra G P, Gupta S, Devate N B, Singh A, Bansal R,

- Kumar S and Nair R M. (2023). Genome-wide association studies for phenological and agronomic traits in mungbean (*Vigna radiata* L. Wilczek). *Frontiers in Plant Science*, 14, p.1209288
- Dutta T K, Akhil V S, Dash M, Kundu A, Phani V and Sirohi A. (2023). Molecular and functional characterization of chemosensory genes from the root-knot nematode *Meloidogyne graminicola*. *BMC Genomics* 24: 745. DOI: 10.1186/s12864-023-09864-7
 - Dutta T K, Ray S and Phani V. (2023). The Status of the CRISPR/Cas9 research in plant-nematode interactions. *Planta* 258(6): 103. DOI: 10.1007/s00425-023-04259-0
 - Khandelwal A, Sugavanam R, Ramakrishnan B, Nain Lata, Nanavati V, Banerjee T, Varghese E and Singh N. (2023). Degradation, altered microbial community composition and protein expression in bacterial consortium/fungus inoculated crude oil contaminated loamy soil. *Biocatalysis and Agricultural Biotechnology* 54: DOI: 10.1016/j.bcab.2023.102940
 - Kokila V, Prasanna R, Kumar A, Nishanth S, Singh B, Gaur-Rudra S, Pal P, Pal M, Shivay Y S and Singh A K. (2023). Elevated CO₂, along with the inoculation of cyanobacterial biofilm or its partners, differentially modulates the C-N dynamics and the quality of tomatoes beneficially. *Heliyon* 9 (10), e20470
 - Kushwaha A K, Ellur R K, Maurya S K, Bashyal B M, Bhowmick P K, Vinod K K, Bollinedi H, Singh N K and Singh A K. 2023. Fine mapping of qBK1. 2, a major QTL is governing resistance to bakanae disease in rice. *Frontiers in Plant Science*. 14: 1265176. doi: 10.3389/fpls.2023.1265176
 - Limbalkar O M, Vasisth P, Singh G, Jain P, Sharma M, Singh R, Dhanasekaran G, Kumar M, Meena M L, Iquebal M A, Jaiswal S, Rao M, Watts A, Bhattacharya R C, Singh K H, Kumar D and Singh N (2023). Dissection of QTLs conferring drought tolerance in *B. carinata* derived *B. juncea* introgression lines. *BMC Plant Biology* 23(1): 1-22. <https://doi.org/10.1186/s12870-023-04614-z>
 - Nath P C, Bandyopadhyay T K, Mahata N, Tiwari O N, Md. Nazneen Bobby, Indira M and Bhunia B. (2023). C-phycoerythrin production from *Anabaena* sp. BTA 903: Optimization, production kinetics, thermodynamic and stability analysis. *Biomass Conversion and Biorefinery*. doi.org/10.1007/s13399-023-04109-9
 - Pappula-Reddy S P, Pang J, Chellapilla B, Kumar S, Dissanayake B M, Singh M P, Millar A H and Siddique K H M. Insights into chickpea (*Cicer arietinum* L.) genotype adaptations to terminal drought stress: Evaluating water-use patterns, root growth and stress-responsive proteins. *Environmental and Experimental Botany*, Volume 218, p. 105579 – 102023
 - Sachin K S, Dass A, Dhar S, Rajanna G A, Singh T, Sudhishri S, Sannagoudar M S, Choudhary A K, Kushwaha H L, Praveen B R, Prasad S, Sharma V K, Pooniya V, Krishnan P, Khanna M, Singh R, Varatharajan T, Kumari K, Nitinkumar K, San A A and Devi A D. (2023). Sensor-based precision nutrient and irrigation management enhances the physiological performance, water productivity and yield of soybeans under a system of crop intensification. *Frontiers in Plant Science*, 14-2023 <https://doi.org/10.3389/fpls.2023.1282217>
 - Saini S, Burman R R, Padaria R N, Mahra G S, Bishnoi S, Aditya K, Nithyashree M L, Mallick S, Mukherjee S and Padhan S R. (2023). Mapping the research trends of migration behavior in agricultural households: A bibliometric analysis. *Frontiers in Sustainable Food Systems*, 7, 1241716. <https://doi.org/10.3389/fsufs.2023.1241716>
 - Sakpal A, Yadav S, Choudhary R, Saini N, Vasudev S, Yadava D K, Ercişli Ş, Marc R A and Yadav S K (2023). Heat-stress-induced changes in Physio-biochemical parameters of mustard cultivars and their role in heat stress tolerance at the seedling stage. *Plants* 12(6):1400
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 - Singh K, Meena R S, Kumar S, Dhyani S, Sheoran S, Singh H M ... & Byun C (2023). India's renewable energy research and policies to phase down coal: Success after Paris agreement and possibilities post-Glasgow Climate Pact. *Biomass and Bioenergy*, 177, 106944
 - Tippannanavar M, Banerjee T, Shekhar S, Sahu SR, Singh B, Narayanan N, Rudra S G, Chakrabarti B, Gupta S and Singh A (2023). Develop, validate, and a GAPI greenness assessment for the determination of 103 pesticides in mango fruit drink using LC-MS/MS. *Frontiers in Chemistry* 1:1283895. doi: 10.3389/fchem.2023.1283895
 - Vasisth P, Singh N, Limbalkar O M, Sharma M, Dhanasekaran G, Meena M L, Jain P, Jaiswal S, Iquebal M A, Watts A, Gaikwad K B and Singh R (2023). Introgression of heterotic genomic segments from *Brassica carinata* into *Brassica juncea* for enhancing productivity. *Plants* 12(8):1677. <https://doi.org/10.3390/plants12081677>
 - Yadav D, Singh D, Babu S, Madhu M, Singh D, Mandal D, Rathore A C, Sharma V K, Singhal V, Kumawat A, Yadav D K, Yadav R K and Kumar S. (2023) Intensified cropping reduces soil erosion and improves rainfall partitioning and soil properties in the marginal land of the Indian Himalayas. *International Soil and Water Conservation Research*, <https://doi.org/10.1016/j.iswcr.2023.10.002>