



# IARI NEWS



## PM dedicates 109 Climate-resilient and Bio-fortified Varieties to the Nation

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हर कदम, हर डगर  
किसानों का हमसफर  
भारतीय कृषि अनुसंधान परिषद

*Agrisearch with a human touch*

### From Director's Desk



This quarter was marked by significant contributions which included, dedication of 109 crop varieties to the nation, developed by various ICAR Institutes, by the Hon'ble Prime Minister, Shri Narendra Modi. During this period, researchers identified quantitative trait loci (QTLs) for sheath blight resistance in wild rice, marker-trait associations (MTAs) for seedling-stage drought resilience in lentil

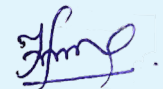
and released crop varieties for diverse agroclimatic zones. 'KTCF-33' was selected as a heat-tolerant cauliflower genotype for summer cultivation in mid- and high-hill regions and three highly prolific flowering genotypes of annual chrysanthemum were also developed.

Our long-term studies in conservation agriculture within the rice-wheat cropping system revealed an early initiation of the crown root initiation (CRI) stage in wheat, underscoring the need to reschedule irrigation under these conditions. The persistent yield gap in wheat across North-west India was attributed to technology gaps, with critical management factors identified to ensure sustainable yield improvement. In response to climate change projections indicating yield declines in maize in Manipur, our Scientists are analyzing additional commodities for viable adaptation strategies.

A series of capacity-building programs, high-end workshops and open field days were conducted, fostering skill enhancement for farmers and students and promoting multidisciplinary exchange among IARI scientists. The Institute secured ten externally funded research grants to strengthen its research efforts. Sixteen high-impact publications in renowned peer-reviewed journals have added to the Institute’s academic achievement. ICAR-IARI also organized five agripreneurship programs to enhance outreach activities.

IARI organized Kisan Goshthis, exhibitions and demonstrations to educate farmers, especially women in agriculture. Memoranda of Understanding (MoUs) were signed with public and private partners facilitating collaborative research and commercial ventures. We continue to serve the nation through our commitment towards sustainable development and farmer-centric growth.

I am sure that the information included in the IARI NEWS 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.



T.R. Sharma  
Director, ICAR-IARI

**PM dedicates 109 Climate-resilient and Bio-fortified Varieties to the Nation**

The Hon’ble Prime Minister, Shri Narendra Modi, visited ICAR-IARI, New Delhi on August 11, 2024 and dedicated 109 climate-resilient, biofortified and nutrient-rich varieties of 61 crops to the nation. These include cereals, millets, pulses, oilseeds, fibre, forage, sugarcane, potential crops, fruits, vegetables, flowers, plantation crops, spices and medicinal plants developed by ICAR Institutes. The launch represents a major step forward in enhancing the resilience

and nutritional value of Indian agriculture and addressing future challenges in the agricultural sector. The 109 varieties include the following 13 varieties developed by the ICAR-IARI.

Crop	Variety
<b>Bread Wheat</b>	Pusa Gehun Sharbati (HI 1665)
<b>Durum Wheat</b>	Pusa Gehun Gaurav (HI 8840)
<b>Maize</b>	Pusa Popcorn Hybrid – 1 (APCH 2)
	Pusa Biofortified Maize Hybrid – 4 (APH 4)
	Pusa HM 4 Male Sterile Baby Corn - 2 (ABSH 4-2)
	Pusa Popcorn Hybrid – 2 (APCH 3)
<b>Pearl millet</b>	MH 2417 (Pusa 1801)
<b>Lentil</b>	PSL-17
<b>Mungbean</b>	PMS-8
<b>Forage Maize</b>	Pusa Forage Maize Hybrid-1 (AFH 7)
<b>Tomato</b>	Pusa Shakti
	Pusa Tomato Hybrid 6
<b>Marigold</b>	Pusa Bahar



Hon’ble Prime Minister interacting with IARI Scientist on mango (Pusa Arunima)



Hon’ble Prime Minister with the Union Minister of Agriculture and Farmers Welfare, GOI, ICAR Officials and Farmers during his visit to ICAR-IARI, New Delhi



### QTLs for Sheath Blight Tolerance identified from *Oryza rufipogon*

Sheath blight disease, a major fungal disease in rice, can cause up to 50% yield loss and is predominantly controlled by chemicals due to limited resistance breeding resources. An introgression line, Pusa 1908-13-12-5, derived from the resistant *Oryza rufipogon* accession, IC336719, was developed and found to be highly resistant to sheath blight. Quantitative trait loci (QTL) mapping identified six loci for relative lesion height and relative yield loss, including three novel QTLs. A SNP (AX-182186537) on chromosome 1 was validated through Kompetitive Allele Specific PCR (KASP™) assay, offering scope for its utilisation in marker-assisted breeding. (Plant Breeding, doi.org/10.1111/pbr.13210).



**Pusa Basmati 1** Susceptible (Relative Lesion Height > 50%)  
**Pusa 1908-13-12-5** Resistance (Relative Lesion Height > 20%)

(Gopala Krishnan S, Singh AK, Bashyal BM, Vinod KK, Nagarajan M, Ellur RK, Bhowmick PK, Bollinedi H, Senapati M, Tiwari A, Amaresh, Dhawan G, Munegowda and Gowda M, Division of Genetics)  
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### Field Crop Varieties identified/released across various Agroclimatic Zones

#### Released wheat varieties

Crop	Variety	Potential Yield	Recommended Zone
<b>Wheat (2 varieties)</b>			
Wheat	HD 3386	Potential yield 76.90 q/ha Average yield 63.50 q/ha	Irrigated, timely sown conditions of North Western Plains Zone: Punjab, Haryana, Delhi, Rajasthan (except Kota and Udaipur Divisions), Western UP (Except Jhansi Division), parts of J & K (Kathua district), parts of HP (Una district & Paonta Valley) and Uttarakhand (Tarai region)
	HD 3388	Potential yield 68.8 q/ha Average yield 52.0 q/ha	Irrigated, timely sown conditions of North Eastern Plains Zone: East of UP, Bihar, Jharkhand, West Bengal (excluding hills), Odisha, Assam and plains of N. E. States under irrigated, timely sown conditions

#### Crop varieties identified in the AICRP meetings (July to September 2024)

Crop	Variety	Yield Potential	Recommended Zone
<b>Maize (6 varieties)</b>			
Maize	Pusa Biofortified Maize Hybrid – 4 (APH 4)	Yield 84.33 q/ha (NWPZ), 71.13 q/ha (PZ), 56.58 q/ha (CWZ), maturity 79.8 days (NWPZ), 93.9 days (PZ), 86.4 days (CWZ)	Recommended for Punjab, Haryana, Delhi, Uttarakhand (Plain), Uttar Pradesh (Western region), Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu, Gujarat, Madhya Pradesh, Chhattisgarh and Rajasthan
	Pusa Pop Corn Hybrid – 1 (APCH 2)	Yield: 46.04 q/ha (NWPZ), 47.17 q/ha (PZ), maturity 120.2 days (NWPZ), 102.1 days (PZ), higher popping percentage (97.3% in NWPZ and 98.3% in PZ)	Recommended for Punjab, Haryana, Delhi, Uttarakhand (Plain), Uttar Pradesh (Western region), Maharashtra, Karnataka, Andhra Pradesh, Telangana and Tamil Nadu
	Pusa Pop Corn Hybrid – 2 (APCH 3)	Yields 45.13 q/ha in 102.5 days	Recommended for Maharashtra, Karnataka, Andhra Pradesh, Telangana and Tamil Nadu

	Pusa HM 4 Male Sterile Baby Corn - 2 (ABSH4 2)	Baby corn yield without husk: 19.56 q/ha (NEPZ), 14.07 q/ha (PZ) & 16.03 q/ha (CWZ)	Recommended for Bihar, Jharkhand, Odisha, Uttar Pradesh (Eastern region), West Bengal, Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu, Gujarat, Madhya Pradesh, Chhattisgarh and Rajasthan
	Pusa Biofortified Maize Hybrid-5 (APTQH 5)	NWPZ: 80.83 q/ha NEPZ: 51.58 kg/ha, PZ: 76.61 q/ha, CWZ: 72.31 q/ha	Punjab, Haryana, Delhi, Uttarakhand, Bihar, Jharkhand, Odisha, Uttar Pradesh (Eastern region), West Bengal, Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu, Gujarat, Madhya Pradesh, Chhattisgarh and Rajasthan
Forage Maize	Pusa Forage Maize Hybrid-1 (AFH 7)	Green fodder yield 413.1 q/ha	Tarai region of Uttarakhand, Punjab, Haryana and Rajasthan
<b>Indian Mustard (1 variety)</b>			
Indian Mustard	Pusa Mustard 37 (NPJ 253)	Average seed yield is 26.4 and 26.8 q/ha in Zone-II and Zone-III,	Timely Sown Irrigated Conditions of Zone-II and Zone-III
<b>Chickpea (1 variety)</b>			
Chickpea	BG 4037	3646 kg/ha (Av 2673 kg/ha)	North West Plain Zone for the states of Punjab, Haryana, Delhi & NCR, Rajasthan and Western UP and Plains of J & K

### 'KTCF-33'- A Heat-tolerant Genotype of Snowball Cauliflower

The heat-tolerant snowball cauliflower genotype, is also tolerant to black rot disease forms compact, snow-white curds at high temperatures (25-32° C) in hilly regions of Himachal Pradesh. It produces marketable curds averaging 0.96 kg and yields 377.79 q/ha, respectively, maturing in 85-90 days. The curds retain their natural color and compactness for 3-5 days after maturity. Suitable



Flower view of 'KTCF-33'

for summer cultivation in mid- and high-hills (zones II, III, & IV) and winter cultivation in low- and mid-hills (zones I, II, & III) of Himachal Pradesh.

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### Promising lines of Annual Chrysanthemum

#### Pusa Ivory

The cream-colored, open-pollinated selection of Annual Chrysanthemum (*Chrysanthemum coronarium*) or 'Crown Daisy' developed by purification through sib mating reaches 62 cm in height with 16 primary and 68 secondary branches. It is a hardy and prolific flowering type, producing 137 double medium-sized flowers (5.2 cm) with cream ray florets. Blooming in March- April, it lasts longer in the field to be used as a loose flower.



Field view of Pusa Ivory

#### Pusa Dhaval

The white-colored open-pollinated selection of Annual Chrysanthemum attains a height of 76 cm with 30 primary and 102 secondary branches. It bears 162 double, medium-sized flowers (5.3 cm) with white ray florets, blooms in March- April, stays in the field

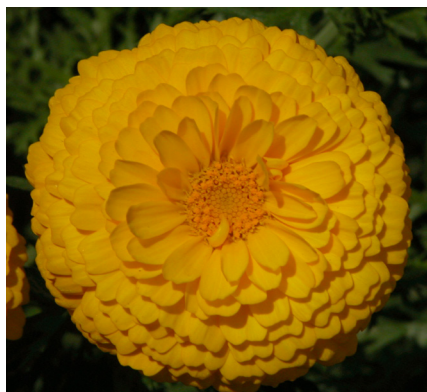
for 58 days and is used to maintain gardens or as loose flowers.



Flower of Pusa Dhaval

**Pusa Swarna**

The yellow-colored open-pollinated selection of Annual Chrysanthemum grows to 85 cm with 26 primary and 106 secondary branches. It produces approximately 190 double medium-sized (5.5 cm) flowers with yellow ray florets, blooming in March-April and stays in the field for 55 days. It is suitable for garden or loose flower purposes.



Flower of Pusa Suvarn

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**Early Crown Root Initiation (CRI)-Rescheduling Irrigation Timing in Wheat under Zero-Tillage**

Understanding the initiation of CRI stage is important for optimizing the timing of first irrigation and other agricultural practices. CRI stage was evaluated under a long-

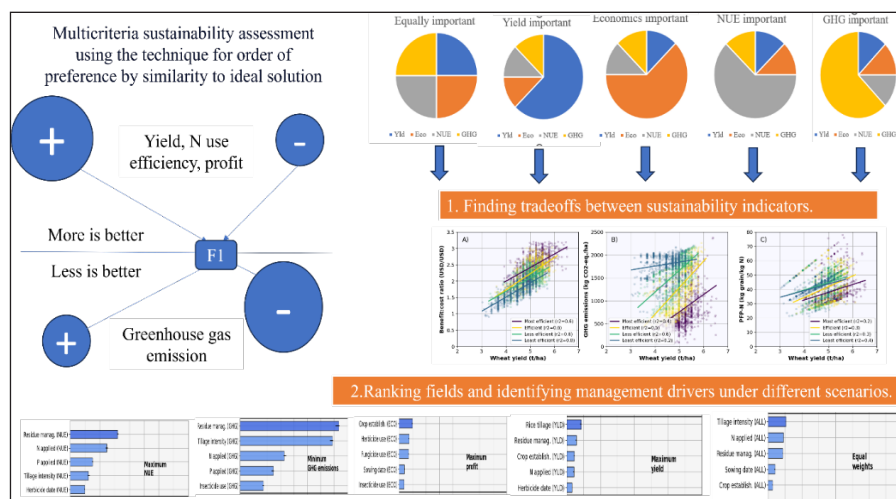
term conservation agriculture-based rice-wheat cropping system with six tillage and residue practices, viz., T<sub>1</sub>: zero-till (ZT) direct-seeded rice (ZTDSR)–zero-till wheat (ZTW); T<sub>2</sub>: ZTDSR + wheat residue (WR)–ZTW + rice residue (RR); T<sub>3</sub>: ZTDSR + WR + brown manuring (BM) – ZTW+RR; T<sub>4</sub>: ZTDSR–ZTW–ZT mungbean (ZTMB); T<sub>5</sub>: ZTDSR + mungbean residue (MBR)–ZTW + RR–ZTMB+WR; T<sub>6</sub>: puddled transplanted rice (PTR)–conventional till wheat

roots (0.40 cm). This necessitates the rescheduling of irrigation time in wheat grown under zero-tillage conditions.

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**Multicriteria Integrated Assessment for Sustainable Wheat Production in North-West (NW) India**

A multicriteria integrated assessment of 3928 wheat farms from NW India evaluated



Multicriteria integrated assessment for wheat production

(CTW). Zero-tillage conditions under T<sub>1</sub> (ZTDSR-ZTW) and T<sub>4</sub> (ZTDSR–ZTW–ZTMB) showed early initiation (16 days after sowing; DAS) of CRI stage with longer crown root length (3.7 cm) compared to conventional tillage practices under PTR-CTW treatment (23-25 DAS), with shorter



CRI in zero-tillage wheat at 16 DAS

sustainability based on yield gap, nitrogen-use efficiency (NUE), profitability and greenhouse gas (GHG) emissions. Stochastic frontier analysis combined with simulated wheat potential yield (Y<sub>p</sub>) identified yield gaps of 25-30% of Y<sub>p</sub>, mainly due to a technology gap (ca. 20% of Y<sub>p</sub>). The study used TOPSIS to rank farm efficiency and identified rice crop establishment methods, tillage frequency and wheat residue retention as the key management factors. The finding demonstrates that NW India can achieve sustainable wheat production without sacrificing yields, focusing on the pathways

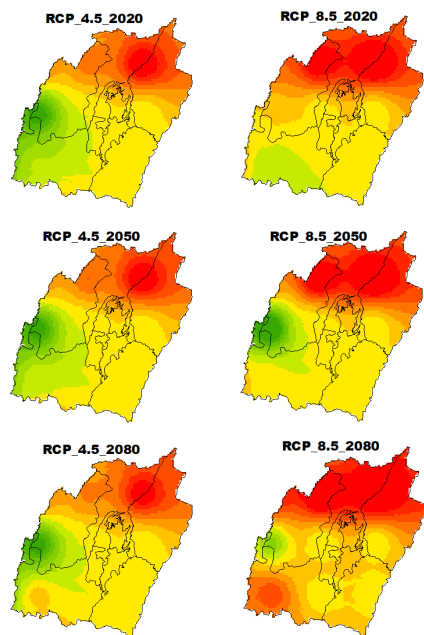
for enhancing productivity in less efficient farms while reducing GHG emissions.

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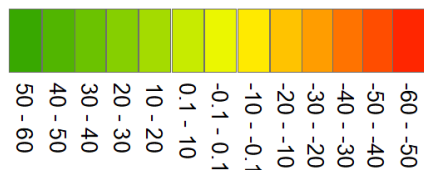
### Impact of Climate Change on Maize Yield in Manipur

Climate change impacts on maize cultivated in Manipur were simulated using the bias-corrected CORDEX CMIP 5 Regional Climate Model (daily data for RCP 4.5 and RCP 8.5 scenarios). Daily minimum and maximum temperatures, rainfall, estimated solar radiation and scenario atmospheric CO<sub>2</sub> levels were assimilated into the InfoCrop v2.1 to project crop growth and yield.

The analysis indicated that maize yields are projected to decline across all districts, except



Yield deviation (%) from 2010-2015 mean



Spatial variation in impacts of climate change on maize productivity in Manipur without adaptation

Churachandpur and Tamenglong, with up to 30% decrease in RCP 4.5. More severe impacts are expected in RCP 8.5 scenarios with significant spatiotemporal variations. After analyzing more crops and other commodities, adaptation strategies are being developed to mitigate this impact.

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### Identification of MTAs for Seedling Stage Drought Tolerance in Lentil

Lentil (*Lens culinaris*), a cool-season legume cultivated in rainfed conditions, suffers significant yield losses from drought stress. A diverse lentil panel of 243 genotypes was evaluated for drought tolerance at the seedling stage by restricting the pre-sowing irrigation. Different morpho-physiological traits including seedling vigor, normal differential vegetation index (NDVI), root length (RL), shoot and root fresh weight and dry weight (SDW, RDW showed significant reduction under stress. Seedling vigor under drought stress was positively correlated to shoot dry weight, root parameters and NDVI. Six genotypes viz., IC560032, FLIP-96-51, IC560246, P3227, IC560051, and IG134349 were selected as drought-tolerant genotypes based on a stress susceptibility index <0.5. Genome-wide association mapping showed the presence of 62 and 72 SNPs under control and stress, respectively, with putative candidate genes linked to drought

tolerance predicted through in silico analysis.

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### Alumni Lecture

The Division of Seed Science and Technology organized an alumni lecture on August 23, 2024, by Dr. Prasad Kesanakurti (NGS Scientist at Sanofi, USA) on “My journey with DNA identification systems: from RAPDs to NGS” for the post-graduate students and faculty.



Alumni Lecture delivered by Dr. Prasad Kesanakurti

### Seminar-cum-Awareness program on Responsible Use of the Crop Protection Products

The Internal Quality Assurance Cell (IQAC), ICAR-IARI in collaboration with BASF, Agricultural Solutions, India, organized a Seminar-cum-awareness program on “Suraksha Hamesha-Responsible Use of the Crop Protection Products” on July 4, 2024. Dr. Nilanjan Saniyal, R&D-South Asia, BASF, Agricultural Solutions (AS) highlighted the industry initiatives for responsible use of crop protection products. Dr. Vandana Tripathy, Principal Scientist & Project Coordinator,

AINP-PR, ICAR-IARI, discussed the importance of “Triple Rinse Study on the Empty Used Pesticide Containers”.



Awareness program on responsible use of crop protection products

**Special Lecture-cum-interactive Session on Scientific Writing**

Dr. Sergey Savary, the renowned plant disease epidemiologist from France and an Adjunct Professor at the Division of Plant Pathology conducted a series of lectures on “Scientific Writing” from July 9-11, 2024, at the Virology Auditorium, Division of Plant Pathology, under the auspices of IQAC Cell, ICAR-IARI, New Delhi.

**Teachers’ Day Lecture**

The Graduate School in collaboration with the Genetics Club organized the Teachers’ Day Lecture on September 5, 2024, marking the birthday of former Hon’ble President of India, Dr. S. Radhakrishnan. Prof. Appa Rao Podile, Senior Professor and JC Bose Fellow and Former Vice-Chancellor, University of Hyderabad, Hyderabad, delivered a lecture on “Drivers of Change in Higher Education”. He emphasized the significance of diversity, mental health awareness, integration of AI in learning, addressing the skills gap and reimagining degree programs to meet contemporary needs. The session was presided over by Prof. S.L. Mehta, former Vice Chancellor, MPUAT and former Deputy Director General (Education), ICAR, New Delhi.



Teacher’s Day Celebration



*Training Programs*

Training	Salient Features
	<ul style="list-style-type: none"> <li>Division of Plant Physiology conducted a research Internship, Vritika, “Trait-based phenotyping for plant-environment interaction” from July 1-30, 2024. Twenty lectures were delivered on various aspects of phenotyping, including phenomics, genomics, biodiversity, germplasm management, and scientific communication.</li> <li>Participants: 5</li> </ul>
<ul style="list-style-type: none"> <li>KVK, Gurugram, organized a five-day skill development training on “Value addition in millet” from July 23-27, 2024 at the KVK campus. During the program, different products, such as millet biscuits, namkeen, flour, etc. were demonstrated.</li> <li>Participants: 25</li> </ul>	

Training	Salient Features
	<ul style="list-style-type: none"> <li>• SERB-ANRF sponsored “High-End workshop on “Phenotyping for nitrogen use efficiency and stress tolerance: dissection of component traits using physiological and phenomic approaches” was conducted by the Division of Plant Physiology from August 5 – 14, 2024</li> <li>• Participants: 28</li> </ul>
<ul style="list-style-type: none"> <li>• ADP on “Innovative processing technologies and functionalized food products” was conducted by ZTM &amp; BPD Unit and the Division of FS &amp; PHT from August 5-10, 2024. The objective of the training was to enhance the skills and knowledge of agripreneurs in processing techniques for developing functional foods as well as FSSAI regulations, quality assurance &amp; standards.</li> <li>• Participants: 25</li> </ul>	
	<ul style="list-style-type: none"> <li>• KVK Gurugram organized a five-day skill development training on “Production technology of mushrooms” at KVK Campus from August 05-09, 2024. During the program, the cultivation practices of different mushrooms were discussed. A visit to a button mushroom unit was also organized.</li> <li>• Participants: 25</li> </ul>
<ul style="list-style-type: none"> <li>• KVK Gurugram organized a five-day skill development training on “Vermicompost production technology” from August 6-10, 2024 at village Dhani Chitrasen. During the program, the production of vermicompost, vermiwash, construction and management of vermicompost unit, etc. were discussed.</li> <li>• Participants: 25</li> </ul>	
	<ul style="list-style-type: none"> <li>• An Agripreneurship Development Program was organized on “Cultivation and harvesting of Spirulina biomass towards developing value-added products” during August 12-14, 2024, by ZTM &amp; BPD unit-CCUBGA and Division of Microbiology.</li> <li>• Participants: 34</li> </ul>



Training	Salient Features
<ul style="list-style-type: none"> <li>• Division of Agronomy in collaboration with the Indian National Young Academy of Science (INYAS)- Indian National Science Academy (INSA), organized a skill-building program for high school and intermediate science teachers on “Next generation science standards: learning by doing” from August 24-25, 2024.</li> <li>• Participants: 21</li> </ul>	
 <ul style="list-style-type: none"> <li>• Division of Agronomy ICAR-IARI, New Delhi, organized a farmer’s training-cum-exposure visit on “Organic farming for higher income and environmental sustainability” for progressive farmers of the Gajapati (ATMA) District, Odisha from August 27-28, 2024.</li> <li>• Participants: 40</li> </ul>	<ul style="list-style-type: none"> <li>• Division of Agronomy ICAR-IARI, New Delhi, organized a farmer’s training-cum-exposure visit on “Organic farming for higher income and environmental sustainability” for progressive farmers of the Gajapati (ATMA) District, Odisha from August 27-28, 2024.</li> <li>• Participants: 40</li> </ul>
<ul style="list-style-type: none"> <li>• The Division of Environment Science organized a workshop on “Adaptation options for managing climatic risks in major in India” under AKASA project during August 28-29, 2024</li> <li>• Participants: 45</li> </ul>	
 <ul style="list-style-type: none"> <li>• KVK Gurugram organized a one-day training on “Leadership development in farmers’ groups” at village Lakuwas on September 06, 2024. During the program, farmers were informed about the benefits of forming farmers’ groups/FPOs; leadership traits including knowledge, communication skills, persuasion skills, documentation, etc.</li> <li>• Participants: 35</li> </ul>	<ul style="list-style-type: none"> <li>• KVK Gurugram organized a one-day training on “Leadership development in farmers’ groups” at village Lakuwas on September 06, 2024. During the program, farmers were informed about the benefits of forming farmers’ groups/FPOs; leadership traits including knowledge, communication skills, persuasion skills, documentation, etc.</li> <li>• Participants: 35</li> </ul>
<ul style="list-style-type: none"> <li>• The ZTM &amp; BPD unit and the Division of Seed Science and Technology jointly organized an agri-preneurship development program (ADP) on “Seed production, testing and storage in field and vegetable crops” from September 9 to 13, 2024.</li> <li>• Participants: 32</li> </ul>	

Training	Salient Features
	<ul style="list-style-type: none"> <li>ZTM &amp; BPD Unit and the Division of Soil Science and Agricultural Chemistry jointly organized an Agripreneurship Development Program on “Pusa STFR Meter for developing entrepreneurship in soil testing” from September 23-28, 2024.</li> <li>Participants: 29</li> </ul>

## Mission / Special Programs

### Parthenium Awareness Week

The Division of Agronomy observed the ‘Parthenium Awareness Week’ from August 16-22, 2024. The undermentioned activities were carried out during the program:

- Field Day on August 16, 2024 at Agronomy Research Farm area which was attended by 150 students. Dr. T.K. Das, an eminent weed scientist and Professor (UG), ICAR-IARI, New Delhi educated everyone on the biology, impact and integrated management of *Parthenium*.



Interaction of Dr. T.K. Das, an eminent weed scientist

- A lecture-cum-awareness campaign in the Govt



Awareness campaign by Dr. S.S. Rathore, Head, Division of Agronomy

Senior Secondary School, Pusa Campus, by Weed Science team, Division of Agronomy, attended by more than 400 girl students from class V to IX.

- Keynote lecture on ‘Identification, menace, health hazards and management of *Parthenium*’ on August 22, 2024 by Dr. T.K. Das, Professor (UG) & Principal Scientist, Division of Agronomy, ICAR-IARI, New Delhi.
- KVK Gurugram also organized *Parthenium* eradication awareness week, during which eradication activities were conducted at KVK farm, dairy demo unit, farmers’ Guest house, etc.

### Farmers-Scientists Interaction Meet on Maize-based Crop Diversification

A Farmers-Scientists interaction meet on Maize-based crop diversification was organized on September 9, 2024, at the Division of Agricultural Extension. Farmers from 40 villages participated in the event. Dr. R.N. Padaria, Joint Director (Extension) encouraged maize-based diversification for nutritional security, climate resilience and growing market opportunities of the specialty corn and ethanol industry. Dr. Gopala Krishnan S, Head, Division of Genetics, emphasized the income potential from maize-based ethanol production,



Farmers-Scientists interaction meet

while Dr. Firoz Hossain, Principal Scientist, Division of Genetics, outlined the improved hybrids and varieties for various growing seasons and purposes.

## *Kisan Goshthis*

### **Kisan – Drone Spray Demonstration**

The Division of Agricultural Extension and KVK, Gurugram organized a Kisan–Drone spray demonstration program at Udaipuri village of Gurugram on August 5, 2024. The Chief Guest of the program, Dr. R.N. Padaria, Joint Director (Extension), ICAR-IARI, highlighted the importance of Kisan–Drone spray demonstration for sustainable and cost-effective fertilizer application. The effective use of nutrients through Kisan–Drone spray was demonstrated live in pearl millet.



Live demonstration of *Kisan* drone technology for the efficient application of nutrients

### **Climate Smart Agriculture**

The Division of Agricultural Extension, in collaboration with the Division of Environment Science, IARI, organized a kisan goshthi on “Climate Smart Agriculture” at Rajpur Village of Aligarh on August 9, 2024, under NICRA activities. Dr. L. Muralikrishnan, Scientist, IARI and Mr. Mukul Dev, Technical Assistant, interacted with the farmers of the villages and identified the possible climate-resilient agriculture-based livelihood promotion in the existing farming systems. A total of 40 farmers participated.

### **Kisan Goshthi on National Pest Surveillance System**

KVK Gurugram organized a kisan goshthi on August 15, 2024, during the launch of the National Pest Surveillance System by the Hon’ble Minister of Agriculture & Farmers’ Welfare. The methods of operating the National Pest Surveillance System were discussed with 46 farmers and farm women.



Kisan goshthi on National Pest Surveillance system

### **Kisan Goshthi-cum-Scientist - farmers Interaction on New Technologies**

KVK Gurugram organized a kisan goshthi-cum-scientist - farmers interaction on “New technologies for obtaining better yield” at village Basunda, Farrukhnagar on August 29, 2024. Different crop production technologies, insect pest management practices, newly launched varieties by ICAR and awareness about fermented organic manure (FOM), liquid fermented organic manure (LFOM) were discussed with 17 participants.



Scientist - farmers interaction on new technologies for obtaining better yield



### **Online Short Course on Statistical Analysis and Role of Agriculture in Industry Domain**

The Division of Agronomy and the Indian Society of Agronomy, New Delhi, imparted hands-on training



Dr. D.P. Singh, Ex Vice-Chancellor, JNKVV Jabalpur and former President of ISA addressing the participants

on “Statistical Analysis and Exploring the Role of Agriculture in Industry Domains” to 1180 participants from August 22 to 31, 2024. The training focused on equipping participants with essential data collection, management, and analysis skills using tools like R, Excel, etc., graphic generation, data interpretation, and multivariate analysis.

### International Micro-organism Day

The Division of Microbiology celebrated International Micro-organism Day on September 19, 2024. Dr. Minakshi Parsad, Editor-in-Chief, Indian Journal of Microbiology and Emeritus Scientist, delivered a lecture on “Diversity and Benefits of Microorganisms”. Visits to



Celebration of International Micro-organism Day

the Biomass Unit & Farm Machinery Unit of Agricultural Engineering, biofertilizer production, Pusa decomposer and Pusa *Mycorrhiza* production units were organized.

### Workshop

#### National Workshop on Sustaining the Tank-fed Agriculture through Community-led Water Conservation Models

The workshop was jointly organized by WTC and Dhan Foundation, Tamil Nadu on September 19, 2024 for (a) showcasing the success stories in community-led water conservation models, (b) Disseminating the technologies that sustained tank-fed agriculture and (c) Generating a way forward to expand the partnership for scaling up tank-fed agriculture. Dr. P.K. Singh, Agriculture Commissioner, Government of India, highlighted the importance of flagship programs of the Government of India for ensuring water conservation, water management and tank-fed agriculture. The event was attended by 100 delegates, 25 farmers and students of ICAR-IARI.

## MISCELLANEOUS

### Research Grants

#### Externally Funded Projects Sanctioned and Implemented (>10 lakh ₹)

Title	Amount (in lakhs ₹)	Duration	Funding Agency	Principal Investigator
Application of machine learning for Hyperspectral imaging and remote sensing aimed at early detection of fungal foliar disease and bacterial wilt disease in potato crop	39.46	July 31, 2024 - July 30, 2027	DBT	Dr. V. Shanmugam, PS, Division of Plant Pathology
Genome editing and Genetic engineering for improvement in aroma, drought tolerance and yield of Kala Joha and Manipur black rice	74.28	August 08, 2024 - August 07, 2027	DBT	Dr. C. Viswanathan, Joint Director (Research)
Farm Selfridge for woman farmers to store agriculture produce, products and milk chilling for enhancing livelihood security.	41.24	August 13, 2024 - August 12, 2027	DST-SEED scheme	Dr. Sangeeta Chopra, PS, Division of Agril. Engineering
Mapping and mobilization of leaf rust resistance genes from Indian landraces to broaden the genetic base for improvement of wheat varieties -Component -1	209.07	September 09, 2024- September 08, 2029	DBT	Dr. S.K. Jha, SS, Division of Genetics
Mapping and mobilization of leaf rust resistance genes from Indian landraces to broaden the genetic base for improvement of wheat varieties -Component -3	31.59	September 09, 2024- September 08, 2029	DBT	Dr Prakash T.L., S, Regional Station, Indore

## Contract Research & Consultancy Projects

Title	Amount (in lakh ₹)	Duration	Funding Agency	Principal Investigator
<b>Contract Research Project</b>				
Experimentation on agronomic efficacy of TSP in predominant cropping systems in diverse locations for enhanced productivity, economics and phosphorous use efficiency in India	50.51	July 24, 2024- July 23, 2027	OCP Support Services Private Ltd.	Dr. S.S. Rathore, Head, Division of Agronomy
Evaluation of SYL, Florastart and Tetrapotassium Pyrophosphate on growth, productivity and profitability of <i>Kharif</i> Cucumber ( <i>Cucumis Sativus</i> L.)	15.33	August 05, 2024- August 04, 2025	Tradecorp Rovensa India Private Ltd.	Dr. Rajiv Kumar Singh, PS, Division of Agronomy
Characterization of iron-ore tailing and assessing its suitability for agricultural application	26.52	September 20, 2024-December 20, 2025	ArcelorMittal Nippon Steel India Ltd	Dr. Bhupinder Singh, PS, Division of Environment Science
Optimizing application of sulphur-coated urea in rice-wheat cropping system for enhanced nitrogen use efficiency and profitability	23.60	September 26, 2024- September 25, 2026	Rashtriya Chemical Fertilizer	Dr. Dinesh Kumar, PS, Division of Agronomy
<b>Consultancy Project</b>				
Bio-efficacy of Picoxystrobin 7.05%+ Propiconazole 11.71% w/w (Picoxystrobin 7.5% + Propiconazole 12.5% w/v SC) against foliar disease of apple	16.46	July 24, 2024- July 23, 2026	Corteva Agriscience Pvt. Ltd.	Dr. Santosh Watpade, SS, Regional Station, Shimla

## Technology Commercialization

Under the Lab to Land initiative from July to September 2024, 23 technologies from ICAR-IARI were commercialized to 12 industry partners, generating a total revenue of ₹ 43.56 lakhs.

## IP management

- A patent was granted to the Division of Agricultural Engineering for technology 'UAN-cum- Seed Applicator' (patent No. 544047). This technology has been developed to precisely place liquid fertilizers like UAN and seed sequentially at pre-determined depths for maintaining proper horizontal and vertical spacing between the two.
- In this quarter, the ZTM & BPD unit filed five patents and one was granted.

## INCUBATION ACTIVITIES Upja & Arise 2024

The RAFTAAR Incubation Committee (RIC) convened from July 4-10, 2024, as part of the UPJA and ARISE 2024 incubation programs to select pre-seed and seed-stage startups for further evaluation. In total, 46 startups out of 1300 applicants received grants.

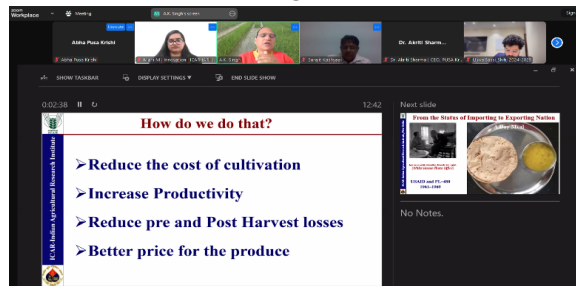
## SHITIJ 2024

SHITIJ 2024, our innovative year-long incubation program, was launched on July 20, 2024, with 27 startups admitted for Phase 1 training after a first round of screening. The training commenced on August 20 and included a diverse range of sessions designed to meet the specific needs of agri-tech startups.

## OTHER ACTIVITIES

### Hosted AGRI UDAAN 7.0 (Road Show/Start-Up Hunt) in collaboration with ICAR-NAARM

A-IDEA, ICAR-NAARM, in collaboration with PUSA Krishi, ICAR-IARI, hosted Agri Udaan 7.0 (Road Show/Start-Up Hunt) on September 13, 2024, at IARI, New Delhi. The event attracted over 80 distinguished participants, including innovative start-ups, industry experts, mentors, academic faculty and students, reflecting its broad appeal and relevance in agriculture. Agri Udaan is a dynamic accelerator program designed by a-IDEA to empower innovative startups in the food and agribusiness sector.



SHITIJ 2024, innovative year-long incubation program



AGRI UDAAN 7.0

### Corporate Membership

The ZTM&BPD Unit enrolled 10 new industry partners for membership and renewed the membership of four industry partners, generating a revenue of ₹71,500.

### AWARDS AND HONOURS

1. Dr. Firoz Hossain, Principal Scientist and Dr. Vignesh Muthusamy, Senior Scientist, Division of Genetics were conferred with 'Fellowship' of Maize Technologists Association of India (MTAI) held at PAU, Ludhiana during August 23-25, 2024.
2. Dr. Firoz Hossain, Principal Scientist, Division of Genetics, received the 'Dr. S.K. Vasal Award for Excellence in Maize Research and Development of MTAI held at PAU, Ludhiana during August 23-25, 2024.
3. Dr. Vignesh Muthusamy, Senior Scientist, Division of Genetics, received the 'Dr. N.N. Singh Young Scientist Award' of Maize Technologists Association of India (MTAI) held at PAU, Ludhiana during August 23-25, 2024.
4. Dr. Rajkumar U. Zunjare, Scientist, Division of Genetics, received the 'Dr. R. Saikumar Memorial Award' of Maize Technologists Association of India (MTAI) held at PAU, Ludhiana during August 23-25, 2024.

5. Dr. Veda Krishnan, Scientist, Division of Biochemistry awarded as INSA Young Associate 2024 in Agriculture and NASI member in Biochemistry.

### Publications with NAAS rating >10.0

- Ali A, Das B, Dhakar MK, Naik SK, Patel VB, Mishra GP. 2024. Enhancing soil health and fruit yield through Tephrosia biomass mulching in rainfed guava (*Psidium guajava* L.) orchards. *Scientific Reports* 14. doi: 10.1038/s41598-024-64814-x.
- Arunachalam T, Gade K, Mahadule PA, Soumia PS, Govindasamy V, Gawande SJ and Mahajan V. 2024. Optimizing plant growth, nutrient uptake, and yield of onion through the application of phosphorus solubilizing bacteria and endophytic fungi. *Frontiers in Microbiology* 15. doi: 10.3389/fmicb.2024.1442912.
- Gouda HS, Singh YV, Shivay YS, Biswas DR, Bana RS, Poornima S, Manu SM, Maitra S,

Sairam, M, Salmen SH, Alharbi SA, Ansari MJ and Hossain A. 2024. Root parameters and water productivity of rice and wheat in a rice-wheat cropping system as influenced by enriched compost and crop establishment methods. *Journal of Agriculture and Food Research* doi: 10.1016/j.jafr.2024.101317.

- Jha GK, Velayudhan PK, Bhatia A, Laishram C, Kumar D, Begho T and Eory V. 2024. Transitioning towards sustainable agriculture: analysing the factors and impact of adopting multiple sustainable inputs by paddy farmers in India. *Frontiers in Sustainable Food Systems* 8. doi: 10.3389/fsufs.2024.1447936.
- Kaur S, Godara S, Singh N, Kumar A, Pandey R, Adhikari S, Jaiswal S, Singh SK, Rana JC, Bharwadaj R, Singh BK, Riar A. 2024. Multivariate data analysis assisted mining of nutri-rich genotypes from North Eastern Himalayan germplasm collection of Perilla (*Perilla frutescens* L.). *Plant Foods for Human Nutrition* doi: 10.1007/s11130-024-01220-8.
- Kumari K, Parray R, Basavaraj, Godara S, Mani I, Kumar R, Khura T, Sarkar S, Ranjan R and Mirzakhani-fchi H. 2024. Spectral Sensor based device for real time detection and severity estimation of Groundnut Bud Necrosis Virus in Tomato. *Journal of Field Robotics* 41. doi: 10.1002/rob.22391.
- Nivedha RM, Bhardwaj A, Prasanna R, Bavana N, Kokila V, Nishanth S, Rudra, SG, Singh AK, Reddy KS, Shivay YS. 2024. Enhancing fruit quality and yield in tomato through cyanobacterium mediated nutrient-fertilization. *Biocatalysis and*

*Agricultural Biotechnology* 61: 103344.

- Rajput J, Singh M, Lal K, Khanna M, Sarangi A, Mukherjee J, Singh S, Dimple. 2024. Development of single and dual crop coefficients for drip-irrigated broccoli using weighing type field lysimeters in semi-arid environment. *Environment, Development and Sustainability* doi: 10.1007/s10668-024-05416-5.
- Rathore SS, Babu S, Shekhawat K, Kumar V, Gairola A, Wani OA, Singh VK. 2024. Exploring sustainable agricultural production models to coordinate system productivity, soil biological health and eco-efficiency in the semi-arid region. *Environmental and Sustainability Indicators* 24. doi: 10.1016/j.indic.2024.100480.
- Shankar K, Awasthi OP, Saha S, Prakash J, Pandey R, Murugan T, Dolatabadin. 2024. Unravelling metabolomics and antioxidant potential of sweet orange cultivar Pusa Sharad grafted on various citrus rootstocks under sodium chloride stress. *Plant Stress* 14. doi: 10.1016/j.stress.2024.100562.
- Sharma N, Singh B, Krishnan SG, Bollinedi H, Mandal PK, Lal MK, Jha PK, Anand A, Prasad PVV. 2024. Higher grain filling rate in inferior spikelets of tolerant rice genotype offset grain weight loss under post-anthesis high night temperature. *Rice Science* doi: 10.2139/ssrn.4689366.
- Sharma S, Bindraban PS, Dimkpa CO, Pandey R. 2024. Phosphorus fertilizer: from commodity to speciality—from fertilizing the field to fertilizing the plant. *Current Opinion in Biotechnology* 90. doi: 10.1016/j.copbio.2024.103198.
- Swain SS, Chobhe KA, Rajput J, Bandyopadhyay K, Sahoo PK, Parray RA and Malkani P. 2024. Modelling and optimization of urea super granule (USG) placement depth in paddy cultivation under check basin irrigation using HYDRUS-2D model. *Soil and Tillage Research* 241. doi: 10.1016/j.still.2024.106104.
- Talaviya H, Singh A, Singh

N, Manna S and Banerjee T. 2024. Development and validation of LC-MS/MS method for trace analysis of acrylamide, acrylic acid and N, N-methylene bis acrylamide in sandy loam soil. *Journal of Chromatography A* 1729. doi: 10.1016/j.chroma.2024.465012.

- Tippannanavar M, Banerjee T, Shekhar S, Sahu SR and Rudra SG. 2024. Eco-scale based greenness assessment of a validated multi-residue method for the quantification of 103 pesticides in cookies sample. *Journal of Food Composition and Analysis* 134. doi: 10.1016/j.jfca.2024.106474.
- Zerouali B, Bailek N, Islam ARMT, Katipoğlu OM, Ayek AAE, Santos CAG, Rajput J, Wong YJ, Abda Z, Chettih M, Elbeltagi A. 2024. Enhancing groundwater potential zone mapping with a hybrid analytical method: The case of semiarid basin. *Groundwater for Sustainable Development* doi: 10.1016/j.gsd.2024.101261.

### MoU between ICAR-IARI and M/s Sukoon Solutions Pvt Ltd

An MoU was signed on September 9, 2024, between ICAR-IARI, New Delhi and M/s Sukoon Solutions Pvt. Ltd., Ghaziabad, to promote and commercialize the Pusa Battery-operated variable height platform.



### MoU between CCRH and IARI

On September 17, 2024, CCRH and ICAR-IARI signed and exchanged an MoU to undertake collaborative research projects on Agrohomoepathy. Dr. Subhash Kaushik, Director General of CCRH, signed and exchanged the MoUs with Dr. Renu Pandey, Head, Division of Plant Physiology, ICAR-IARI, New Delhi.

**National & International Visits at IARI**



**Visit of CIKS, UKZN, Durban, South African Delegation to IARI on July 25, 2024**



**Visit of Togo Delegation to IARI on August 19, 2024**



**Visit of African Development Bank Delegation to IARI on August 23, 2024**



**Visit of Hon'ble Agriculture Minister Shri Shivraj Chauhan to Nanaji Deshmukh Plant Phenomics Centre on September 13, 2024**



**Visit of Dr. Gary Atlin from BMGF to ICAR-IARI, New Delhi along with Dr. Vikas Kumar Singh from IRRI- SA Hub, Hyderabad on September 25, 2024**



**Visit of delegation of 77th Edition of Know India Programme (KIP), Ministry of External Affairs, GoI to IARI on September 20, 2024**

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