ANNUAL REPORT

2025-26









Indian Council of Agricultural Research
Department of Agricultural Research and Education
Ministry of Agriculture & Farmers Welfare
Government of India, New Delhi

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

Institutes, Bureaux, Directorates, National Research Centres and ATARIs

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Foreword

भारतीय कृषि अनुसंधान परिषद (भाकृअनुप) की वार्षिक रिपोर्ट 2025-26 भारत के कृषि, पशुपालन, मत्स्य एवं जैव-प्रौद्योगिकी क्षेत्रों में हुई उल्लेखनीय वैज्ञानिक तथा उत्पादन-आधारित प्रगति प्रतिबिंबित करती है। देश की कृषि उत्पादन प्रणाली को अधिक उत्पादक, जलवायु-सहिष्णु एवं लाभकारी बनाने की दिशा में भाकृअनुप के 114 संस्थानों ने अनुसंधान, नवाचार और तकनीकी हस्तांतरण के माध्यम से महत्वपूर्ण उपलब्धियाँ अर्जित की हैं। इन प्रयासों से भारत की खाद्य, पोषण एवं आय सुरक्षा को सुदृढ़ आधार मिला है।

पिछले एक दशक में भारतीय कृषि उत्पादन में ऐतिहासिक वृद्धि दर्ज की गई है। वर्ष 2014-15 में जहाँ कुल खाद्यान्न उत्पादन 252 मिलियन टन था, वहीं 2025-26 तक यह बढ़कर 357.7 मिलियन टन से अधिक हो गया है। वर्ष 2025 में भारत ने 150.18 मिलियन टन चावल उत्पादन का नया कीर्तिमान स्थापित करते हुए विश्व का सबसे बड़ा चावल उत्पादक बनने का गौरव प्राप्त किया। इसी अवधि में गेहूं उत्पादन 117.94 मिलियन टन से अधिक पहुँचा, जबकि दलहन उत्पादन बढ़कर 25.24 मिलियन टन तथा तिलहन उत्पादन 42.98 मिलियन टन के ऐतिहासिक स्तर तक पहुँच गया, जो अब तक का सबसे उच्च स्तर है।

इस वृद्धि का प्रमुख आधार वैज्ञानिक रूप से उन्नत एवं जलवायु-सहिष्णु किस्मों का विकास रहा है। रिपोर्टिंग वर्ष के दौरान 366 नई कृषि एवं बागवानी फसल किस्में विकसित की गईं। ये किस्में सूखा, लवणता, बाढ़, कीट एवं रोग जैसे विभिन्न जैविक और अजैविक तनावों का प्रभावी ढंग से सामना करने में सक्षम हैं। वहीँ पोषण सुरक्षा को सुदृढ़ बनाने की दिशा में 185 जैव संवर्धित किस्में विकसित की गईं, जिनमें चावल, गेहूं, मक्का, बाजरा, दलहनी तथा तिलहनी फसलें शामिल हैं।

जीनोमिक्स और जैव-प्रौद्योगिकी के क्षेत्र में भारत ने वैश्विक स्तर पर अग्रणी भूमिका स्थापित की है। देश ने विश्व की पहली जीनोम एडिटेड धान किस्में- पूसा डीएसटी राइस-1 और डीआरआर धान-100 (कमला) विकसित कीं, जिनसे 19 प्रतिशत तक अधिक उपज, शीघ्र परिपक्वता तथा सूखा एवं लवणता सहनशीलता प्राप्त हुई है।

उन्नत किस्मों के विकास के साथ-साथ उनके गुणवत्तापूर्ण बीज किसानों तक समयबद्ध रूप से पहुँचाने की व्यवस्था को भी सुदृढ़ किया गया है। वर्ष 2024-25 के दौरान 1,09,370 क्विंटल प्रजनक बीज का उत्पादन किया गया, जो निर्धारित मांग से अधिक रहा, जबकि 4,33,115 क्विंटल प्रमाणित गुणवत्ता बीज उपलब्ध करवाए गए। बीज गुणवत्ता सुनिश्चित करने हेतु रैपिड सीड वायबिलिटी टेस्टिंग तथा यूनिप्राइम प्राइमिंग जैसी आधुनिक तकनीकों को अपनाया गया, जिससे उच्च अंकुरण क्षमता और बेहतर उत्पादकता सुनिश्चित हुई।

फसल प्रबंधन और संरक्षण तकनीकों के क्षेत्र में भी उल्लेखनीय उपलब्धियाँ प्राप्त हुई हैं। माइक्रोबियल कंसोर्टिया एवं नैनो-बायो इनपुट के उपयोग से सोयाबीन की उपज में 17 प्रतिशत वृद्धि दर्ज की गई। जूट आधारित प्रणालियों में सटीक सिंचाई अपनाने से जल उपयोग में 18 प्रतिशत कमी, ऊर्जा दक्षता में 14.8 प्रतिशत सुधार तथा उत्पादकता में लगभग 25 प्रतिशत वृद्धि प्राप्त हुई। संरक्षण कृषि प्रणालियों से खरपतवार दबाव में 22 प्रतिशत कमी और अरहर की उपज में 41 प्रतिशत वृद्धि दर्ज की गई। एआई सक्षम फेरोमोन ट्रैप्स के प्रयोग से कीटनाशकों की खपत में 38.6 प्रतिशत कमी तथा उपज में 18.54 प्रतिशत वृद्धि हुई।

प्राकृतिक खेती को बढ़ावा देने के उद्देश्य से राष्ट्रीय प्राकृतिक खेती मिशन की शुरुआत की गई है, जिसके अंतर्गत कम-लागत, कम-इनपुट तथा पर्यावरण-अनुकूल कृषि पद्धतियों को प्रोत्साहित किया जा रहा है। प्राकृतिक खेती से उत्पादित फल एवं सब्जियों की मांग में तेजी से वृद्धि हुई है, जिससे युवा उद्यमियों के लिए नए व्यावसायिक अवसर भी सृजित हुए हैं। यह प्रणाली सीमित भूमि और न्यूनतम संसाधनों के साथ टिकाऊ उत्पादन का एक प्रभावी मॉडल प्रस्तुत करती है।

पशुपालन क्षेत्र में भी वैज्ञानिक प्रगति से ठोस लाभ प्राप्त हुए हैं। भारतीय कृषि अनुसंधान परिषद ने फुट-एंड-माउथ डिजीज, पीपीआर तथा कैनाइन पार्वोवायरस के लिए टीकों का विकास किया, मुर्गियों की दो उन्नत प्रजातियां विकसित कीं तथा 18 स्वदेशी पशुधन नस्लों का पंजीकरण किया। इन पहलों से उत्पादकता वृद्धि के साथ जैव विविधता संरक्षण को भी सुदृढ़ आधार मिला है।

मत्स्य क्षेत्र में चार सजावटी मछली प्रजातियों हेतु प्रजनन एवं बीज उत्पादन प्रौद्योगिकियों का विकास, आर्गुलस के विरुद्ध 'आर्गुवैक्स-1' वैक्सीन का शुभारंभ तथा प्रेरित प्रजनन के लिए जीएनआरएच फॉर्मूलेशन 'ओवाक्वा' का विकास महत्वपूर्ण उपलब्धियाँ रहीं। इस क्षेत्र में उत्पादन और मूल्य दोनों में वृद्धि दर्ज की गई है।

विकसित कृषि संकल्प अभियान–2025 के अंतर्गत 'प्रयोगशाला से खेत तक' दृष्टिकोण अपनाया गया, जिसके माध्यम से लगभग 1.4 लाख गाँवों में 2,000 से अधिक वैज्ञानिकों और 1.35 करोड़ किसानों के बीच प्रत्यक्ष संवाद स्थापित हुआ। इस प्रक्रिया में 500 से अधिक क्षेत्र–आधारित अनुसंधान प्राथमिकताओं की पहचान की गई तथा लागत–प्रभावी तकनीकों का तीव्र प्रसार सुनिश्चित किया गया। किसान उत्पादक संगठनों और फसल कटाई उपरांत अवसंरचना को समानांतर रूप से सुदृढ़ करने से मूल्य श्रृंखला दक्षता एवं खेत–द्वार मूल्य प्राप्ति में उल्लेखनीय सुधार हुआ। अभियान के दौरान देश के 177 आदिवासी जिलों के 1,024 ब्लॉकों में 8,000 से अधिक कार्यक्रम आयोजित किए गए। जिनसे लगभग 18 लाख किसानों को प्रत्यक्ष लाभ मिला।

फसल अवशेष प्रबंधन पहल के अंतर्गत पंजाब और हरियाणा में पराली जलाने की घटनाओं में 90 प्रतिशत तक कमी दर्ज की गई। सटीक मृदा प्रबंधन एवं पारिस्थितिकी तंत्र बहाली के समर्थन हेतु एक राष्ट्रीय भूमि क्षरण और मृदा स्पेक्ट्रल डेटाबेस भी विकसित किया गया।

इस प्रकार भाकृअनुप की वर्ष 2025–26 की उपलब्धियाँ स्पष्ट करती हैं कि भारतीय कृषि प्रणाली वैज्ञानिक नवाचार, जलवायु–सहिष्णुता, डिजिटल प्रौद्योगिकी और टिकाऊ उत्पादन के माध्यम से वैश्विक नेतृत्व की ओर अग्रसर है। यह प्रगति भारत को वास्तविक अर्थों में विश्व की खाद्य टोकरी के रूप में स्थापित करने की दिशा में निर्णायक सिद्ध हो रही है।

(शिवराज सिंह चौहान)
अध्यक्ष, भाकृअनुप सोसायटी

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The Mandate of the Indian Council of Agricultural Research

- Plan, Undertake, Coordinate and Promote Research and Technology Development for Sustainable Agriculture.
- Aid, Impart and Coordinate Agricultural Education to enable Quality Human Resource Development.
- Frontline Extension for Technology Application, Adoption, Knowledge Management and Capacity Development for Agri-based Rural Development.
- Policy, Cooperation and Consultancy in Agricultural Research, Education and Extension.

1. Overview

The Indian Council of Agricultural Research (ICAR) serves as the cornerstone of India's agricultural research, education, and extension system, functioning as the apex national body for advancing agricultural growth and resilience. During 2025–26, ICAR recorded steady and tangible progress across key domains, including the development of impactful technologies, rollout of innovative programmes, strengthening of the agricultural education system, and firm adoption of the principle of "One Organization–One Purpose–One Narrative." The year emerged as a landmark, with record production of foodgrains, horticultural crops, and milk, reflecting the collective strength of ICAR's scientific, academic, and extension systems nationwide. A total of 367 agri-horti crop varieties and 152 production and protection technologies were developed. All major agriculture missions announced by the Government of India in the Union Budget 2025–26 are closely aligned with ICAR's mandate. These include the Mission for Aatmanirbharta in Pulses to achieve self-reliance in tur, urad, and masoor through improved seeds, enhanced productivity, and better post-harvest management; the Mission for Cotton Productivity to boost yield and sustainability through climate-resilient varieties, mechanization, and improved agronomic practices; the National Mission on High-Yielding Seeds to strengthen R&D and commercialization of pest-resistant and climate-resilient varieties; the National Makhana Board to promote production, processing, value addition, and marketing of makhana; and the Second National Genebank for safety duplication of vital crop germplasm. Additionally, through focused initiatives in natural farming, the Clean Plant Programme, and nano-research, ICAR continues to advance science-led sustainability, productivity, and resilience in the Indian agricultural production system. In a transformative move, ICAR for the first time introduced comprehensive "Gender" and "Communications" policies while reinforcing its "Research Data Management" framework, advancing its commitment to inclusivity, transparency, and data-centric operations. The major achievements of the Council are presented below:

Crop Improvement: During the reporting period, a total of 339 crop varieties were released across diverse agro-ecological zones of the country, including cereals, oilseeds, pulses, commercial crops and forage crops. Notably, the world's first genome-edited rice varieties DRR Dhan 100 (Kamla) and Pusa DST Rice-1, were developed showing enhanced drought and salinity tolerance, early maturity, and up to 19% higher yield. Genome editing in mustard produced yellow-seeded lines with 3–4% higher oil content. Biotechnological interventions improved pest and disease management, including root-specific promoters reducing nematode infection by 60–90% and Bt-pigeon pea resistant to pod borer. Breeder seed production in 2024-25 reached 109,370.2 quintals, exceeding the indent besides quality seed production of 433,114.7 quintals. Innovations such as rapid viability testing and Uniprime seed priming enhanced seed quality. In horticulture, 28 varieties across 18 crops were notified, covering mango, guava, bael, potato, onion, coconut, spices, medicinal plants, and mushrooms.

Crop Management: ICAR institutes achieved significant advances in crop management, crop protection, and sustainable production technologies across field and horticultural crops, enhancing productivity, resource-use efficiency, climate resilience, and farmers' profitability. In field crops, microbial consortia and nano bio-inputs improved soil health and crop performance, increasing soybean yield by up to 17% and Flue-cured Virginia (FCV) tobacco cured leaf yield by 7% with higher benefit–cost ratios. Precision irrigation in jute-based systems reduced water use by up to 18%, improved energy efficiency by 14.8%, and enhanced system productivity by about 25%, while studies identified waterlogging-tolerant jute genotypes and stage-specific vulnerabilities. Conservation agriculture-based rice–chickpea and pigeonpea–wheat systems reduced weed pressure by up to 22%, increased yields (41% in pigeonpea), and generated higher net returns (Rs. 33,061/ha over rice–wheat). In crop protection, AI-enabled smart pheromone traps for pink bollworm enabled real-time surveillance, reducing pesticide use by 38.6% and increasing yields by 18.54%. In horticultural crops, bioreactor-based propagation, disease-free planting material, precision irrigation, and integrated pest and disease management improved yield, quality, and efficiency.

Livestock Improvement: Under the All India Coordinated Research Project (AICRP) on Cattle, the Indigenous Breeding Programme was significantly strengthened through the establishment of new data

recording centres for Sahiwal cattle and the inclusion of Rathi and Tharparkar breeds. Progeny testing progressed with the induction of the sixth set of Sahiwal bulls, resulting in the production of nearly 49,000 doses of superior-quality semen from Gir, Kankrej and Sahiwal breeds. This facilitated over 7,600 artificial inseminations and the birth of more than 900 female calves, advancing genetic improvement and conservation. Genomic selection using single-step genomic best linear unbiased prediction (ssGBLUP) enhanced accuracy for key traits, particularly milk yield. The Network Project on Sheep Improvement expanded to 14 units, covering about 31,000 sheep from 483 breeders. Productivity gains were notable, with Avishaan sheep recording 67.52% prolificacy and Patanwadi sheep yielding 56.35 kg milk in 90 days. Under AICRP on Poultry Breeding, over 1.17 million chicks were distributed, and three rural varieties—Janapriya, Aslibro and Tokbari—were released for backyard systems. Conservation efforts extended to endangered camel breeds, Doom and Ghoongroo pigs, Bhimthadi horse, Indian yak genome development, and the release of the "Indimus" mouse strain for biomedical research.

Livestock Management: Recent advances in livestock management and protection delivered integrated solutions to enhance productivity, health, adaptability, and sustainability. Significant achievements include the development of vaccines for Foot-and-Mouth Disease, Peste des Petits Ruminants (PPR), and Canine Parvovirus. Novel nutritional and microbial interventions showed significant benefits, including postbiotics from *Lactobacillus rhamnosus* exhibiting antibacterial activity against *E. coli* and *Salmonella* through combined effects of pH reduction, proteins, and volatile compounds. A herbal feed blend rich in bioactive compounds (30.8% crude protein, 10.8% ether extract, and ω-3 fatty acids) improved reproductive hormones and advanced puberty in 100% of Malpura ewes before 450 days. Oat brewery waste containing up to 28% crude protein was validated as a safe 20% concentrate replacement, maintaining growth and rumen function while marginally reducing enteric methane emissions. Reproductive and biotechnological innovations included optimized progesterone-based estrus synchronization, vitrified embryo transfer producing India's first foal "Raj-Sheetal," a patented liposome-based semen extender preserving stallion semen up to 10 days at 4°C, and *in vitro* sex-specific embryo production achieving up to 89% male and 77% female embryos. Poultry studies revealed greater heat-stress resilience in slow-growing coloured genotypes than in commercial broilers. Livestock protection efforts delivered major vaccines and diagnostics, including a trivalent Salmonella vaccine, a live attenuated African swine fever vaccine with over 83% efficacy, sensitive PCR-based diagnostics for swine and zoonotic diseases, and rapid anthrax assays. Disease surveillance, forecasting, and epidemiological modelling strengthened preparedness against lumpy skin disease and foot-and-mouth disease.

Fisheries Improvement: Significant advances were achieved in fisheries development through targeted interventions in breeding, nutrition, conservation, and digital innovation. These included the development of seed production technologies for four ornamental fish species, the creation of ArguVax-1 (a peptide-based vaccine) for controlling the fish ectoparasite *Argulus* and the introduction of Ovaqua, a potent GnRH formulation for induced breeding in fish. Captive breeding and seed production technologies were successfully developed for high-value finfish and shellfish species, including Giant Trevally (*Caranx ignobilis*), marine ornamental fishes such as royal dottyback and four goby species, and Blue Swimmer Crab (*Portunus reticulatus*). Giant Trevally attained market size within one year with farm-gate prices of Rs. 400-800 per kg, while Blue Swimmer Crab breeding produced 0.6-1.2 lakh megalopa per cycle, with survival rates of 40–66.6%, improving to 62–82% during nursery rearing. Integrated seaweed–shrimp farming enhanced shrimp body weight by 17% and productivity by 18%, with additional production of about 1.2 t seaweed per 0.1 ha without external nutrients. The indigenous Super-Intensive, Precision, and Natural Shrimp Farming System achieved 40–50 t/ha production, 86.5-97.8% survival, and FCR of 1.1-1.2 within 90-122 days. Innovative feeds and nutraceuticals, including BSF-based fishmeal-free feeds, micro-particulate larval diets, growth boosters, and vitamin–mineral formulations, improved growth and stress tolerance. Conservation initiatives included ranching over 54 lakh fingerlings in the Ganga basin, revival of hilsa and *Hypselobarbus pulchellus*, drone-based marine mammal surveys, and deployment of digital platforms, data science tools, and the MARLIN@CMFRI mobile app to strengthen fisheries production.

Fish Health Management: A novel peptide-based fish vaccine, 'CIFA: ArguVax-I' developed to control *Argulus* parasitic infestation in fish, was launched during Viksit Krishi Sankalp Abhiyan (VKSA-2025) campaign at ICAR–Central Institute of Freshwater Aquaculture (ICAR-CIFA), Bhubaneswar. The vaccine represents a major advancement in fish health management. Significant progress was also achieved in the development of aqua phage therapy for controlling bacterial infections in rainbow trout farms of the Indian Himalayan Region. A total of fifteen highly specific bacteriophages were isolated and characterized from water samples, including five phages each targeting *Aeromonas hydrophila*, *A. salmonicida*, and *Lactococcus garvieae*. These phages demonstrated high specificity and narrow host ranges, making them highly suitable for targeted biocontrol applications in cold-water aquaculture systems.

Genetic Resources: ICAR advanced conservation, characterization, and sustainable use of genetic resources across plants, animals, microbes, insects, and fish, reinforcing food, nutrition, and livelihood security. In plant genetic resources, 18 exploration missions collected 1,247 accessions (717 cultivated and 530 wild), including landraces and crop wild relatives. The National

Genebank added 2,726 seed accessions, raising the base collection to 4.74 lakh, while cryopreservation holdings reached 13,102 accessions along with 2,194 genomic resources. Over 25,000 accessions were imported from 32 countries and more than 83,000 supplied for research. Additionally, 41 trait-specific germplasm donors were registered to accelerate trait-based breeding. Microbial conservation under the National Agriculturally Important Microbial Culture Collection reached 9,868 accessions, with 942 new cultures added and DNA fingerprinting services provided for over 380 biopesticide samples. The National Insect Repository expanded to about 3.15 lakh specimens, adding 29,363 samples and documenting 55 new insect species, new genera, and host records. In animal genetic resources, 10 new indigenous breeds were registered and 17 gazette-notified, with cryopreservation strengthened by 21,500 semen doses and 1,920 somatic cell vials. Fish resources recorded seven new species, four first marine records, chromosome-level genome assembly of *Clarias dussumieri*, and molecular tools for species identification and sex determination. A landmark innovation was the development of designer clownfish hybrids at ICAR-National Bureau of Fish Genetic Resources, including F_4 variants of *Amphiprion percula* × *A. ocellaris*. The unified "Gau Chip" and "Mahish Chip," developed by National Dairy Development Board and partners, were dedicated to the nation by the Hon'ble Prime Minister.

Soil and Water Productivity: Integrated innovations in soil and water resource management, climate-smart agriculture, digital soil intelligence, and sustainable farming technologies were implemented across diverse agro-ecological regions of India. In Nayagarh district, Odisha, groundwater revitalization through the construction of 100 recharge shafts in traditional dug wells led to a post-monsoon rise of 15–30 cm in groundwater levels, improving *rabi*-season water availability under an average annual rainfall of 1,550 mm. A large tunnel-type PV/thermal hybrid solar dryer (6.4 × 3.0 m) demonstrated superior drying efficiency for ber and date palm, achieving moisture reduction to 18–19% within eight days, with thermal and solar utilization efficiencies of 36.6% and 35.0%, respectively. An IoT-enabled bio-acoustic deterrent device effectively reduced crop damage by wild animals, achieving up to 85% deterrence over 8–20 acres. The Precision Fertilizer Recommendation System (PFRS), based on digital soil maps and target-yield approaches, achieved 97.3% of the targeted wheat yield (4,867 kg ha^{-1} against 5,000 kg ha^{-1}), validating its field applicability. Conservation agriculture practices enhanced productivity, soil health, and resource-use efficiency through mechanized raised-bed systems and stress-mitigation strategies such as foliar KNO_3 application. The first Digital Soil Depth Map of India, developed at 90 m resolution using 25,683 soil profiles and machine learning techniques, revealed soil depths ranging from 6 to 250 cm, with about 52% of the country having very deep soils. Random forest models delivered the highest accuracy, making the map a key resource for land-use planning. The National Soil Spectral Library enabled over 80% prediction accuracy for major soil properties using artificial intelligence, supporting rapid soil health assessment. The Groundwater Quality Map of India for irrigation integrated information from 47,131 geo-tagged sites across 16 states. Spatial mapping using IDW and Kriging techniques classified irrigation water into seven quality classes. Results indicated that 68.21% of irrigation water is of good quality, while saline and alkali waters dominate parts of Gujarat, Rajasthan, Punjab, Haryana, Uttar Pradesh, Tamil Nadu, Andhra Pradesh, and Karnataka. Compared with the 1994 CSSRI map, saline water areas increased from 12% to 27%, highlighting emerging concerns. Biological interventions such as "Halo-Care" achieved 77% crop residue decomposition within 21 days, while "Mrida Sudharak" enabled 12.3% dissolution of native $CaCO_3$ in calcareous sodic soils. Climate-resilient systems, including quinoa–chickpea intercropping, improved net returns with water, energy, and carbon savings. Geospatial analyses supported aquaculture site selection in Kargil and revealed land-use and mangrove changes in the Sundarbans, underscoring sustainability challenges.

Climate-Resilient Agriculture: Climate-resilient and data-driven agricultural innovations are vital for sustaining productivity under increasing climatic variability. A newly released drought-tolerant rice variety, NICRA Aerobic Dhan 2, matures in 117 days and yields 5.3 t ha^{-1}, showing 10.8-36.1% superiority over national and local checks across eastern and northern India, along with resistance to major pests and diseases. Climate mitigation efforts included a methanotroph bio-formulation that reduced methane emissions by 8–12% while increasing rice yields by 7-10%. Stress-resilient vegetable production was achieved through grafting technologies. Tomato grafts on eggplant rootstocks mitigated waterlogging stress and enabled full recovery, while drought-resilient grafts yielded up to 3.13 kg per plant. Advanced ecosystem monitoring using eddy covariance in high-altitude tea plantations revealed Gross Primary Productivity (GPP) of 74.8-174.3 g C m^{-2} $month^{-1}$ and WUE exceeding 2.0 g C kg^{-1} H_2O. A climate-smart Integrated Farming System (IFS) model generated ₹5.5 lakh annual net returns with a B:C ratio of 3.42. Machine-learning-based analysis in the Sundarbans revealed significant land loss and rising salinity, guiding adaptive planning.

Mechanization and Energy Management: Recent advancements in agricultural mechanization and energy management have focused on improving operational efficiency, optimizing resource use, and minimizing environmental impact in agricultural production systems. A wide range of manually operated, tractor-mounted, robotic, and renewable energy-based technologies were developed and evaluated across diverse crops and farming systems. Ergonomic hand tools, including weed thinning devices, nursery cutters, and kiwi vine pruners, reduced drudgery by lowering Rapid Upper Limb Assessment (RULA), Rapid Entire Body Assessment

(REBA) scores from 7-8 to 3 and improving work rates by 40–45%. Mechanized planters and seeders, such as potato planters, spice seeders, and multi-crop dibble seeders, achieved field capacities up to 0.4 ha h^{-1}, reduced costs by 47%, and maintained missing rates below 3%. Precision input delivery systems integrating sensors, IoT, and AI enabled substantial input savings. Variable-rate nitrogen applicators reduced fertilizer use by 8–38%, improved nitrogen use efficiency by up to 28.6%, and increased yields by 7.6%. Detection-based and telerobotic pesticide sprayers achieved 24-25% chemical savings, eliminated operator exposure, and ensured optimal droplet sizes (140-200 µm). Energy-efficient tillage and drainage tools reduced fuel consumption by 31–37% and emissions by over 40%. Renewable energy solutions, including solar weeders, LPG and heat-pump-based curing systems, and solar thermal storage units, reduced energy consumption by 25-50% while eliminating wood fuel use.

Post-harvest Management and Value Addition: Post-harvest and value-addition innovations focused on reducing losses and enhancing income. An infrared–UV-C grain disinfestation system achieved 100% insect mortality, ensuring safe storage for up to one year. X-ray imaging combined with deep learning enabled real-time detection of mango defects with 84.9% accuracy. Digital tools, quality meters, and miniature spinning machinery improved monitoring, grading, and processing efficiency. Sustainable value-addition technologies included nanocellulose biocomposite films, biodegradable soy-based cutlery, and agro-waste valorisation for xylitol and bacterial cellulose production. Functional foods with enhanced protein, fibre, antioxidants, and extended shelf life were developed. Advanced diagnostics using Liquid Chromatography-Tandem Mass Spectrometry (LC–MS/MS), Raman spectroscopy, Volatile Organic Compounds (VOC) profiling, and immunoassays strengthened food safety. Collectively, these innovations enhanced productivity, sustainability, safety, and profitability for farmers and Micro, Small, and Medium Enterprises (MSMEs) across agroclimatic zones.

Agricultural Education: The Agricultural Education Division strengthened India's agricultural human resource base through education reforms, quality assurance, and digital transformation. Under the "Strengthening and Development of Higher Agricultural Education in India" scheme, 77 ICAR-accredited institutions received support. The National Agricultural Education Accreditation Board conducted 35 peer reviews in 2025, accrediting 23 institutions. Under the READY programme, 19,852 students completed RAWE training, and 545 experiential modules were operational. National-level admissions attracted over 1.8 lakh applicants. During reporting period, 3,970 Undergraduate (UG) and 2,899 Postgraduate (PG) students received scholarships, along with 1,046 PG and 623 JRF/SRF awards. International collaboration was enhanced through ASEAN–India and BIMSTEC fellowship programmes.

Social Sciences: Gender-responsive climate-resilient interventions increased crop diversification and adoption of green manuring. Capacity building expanded outreach from 86 to 350 women, while technology access rose from 28% to 93%. Under the "Shree Anna Gram" project, finger millet VL-376 recorded yields of 2.83–3.16 t ha^{-1}. The JANANI Nutri-garden model produced 315–325 kg vegetables annually. Gender-responsive aquaculture increased fish yields by 95% and net income to ₹1.57 lakh ha^{-1}. FPOs and digital initiatives strengthened institutional and data-driven agriculture.

Basic and Strategic Research: The National Agricultural Science Fund (NASF) supported 60 projects during reporting period. Major achievements included genome-edited rice varieties and CRISPR-edited buffalo and sheep with higher growth rates. AI-enabled disease datasets, crop yield prediction models, and IoT-based systems advanced precision agriculture. Sustainable technologies included minimal-water jute retting, nano-sulphur for oilseeds, and botanical acaricides. Breakthrough diagnostics and molecular tools strengthened disease surveillance. nine new projects under Call XI (₹8.10 crore) were approved in 2025–26, focusing on pan-genomics, multi-omics, recombinant vaccines, and nutrient-efficient systems.

Information and Communication Technology (ICT) and Digital Resources: ICAR's ICT initiatives supported comprehensive digital transformation. The e-HRMS 2.0 platform served 15,104 employees, while SPARROW generated 15,817 appraisal reports. ICAR e-Office processed over 3.47 lakh files across 115 institutes. The ICAR-DARPAN dashboard monitored 65 KPIs. SAMARTH payroll systems were implemented in 86 institutes. Kisan Sarathi registered over 2.75 crore farmers and disseminated nearly 4 crore advisories annually. The platform supported VKSA by digitally reporting 60,917 programmes. Precision agriculture initiatives included PUSA-eCMS, VASUDHA, IoT-based systems, and AI-enabled pest surveillance.

Technology Assessment, Demonstration and Capacity Development: The KVK system, comprising 731 centres under 11 ATARIs, played a key role in technology transfer. A total of 8,767 On-Farm Testing trials validated location-specific technologies. KVKs conducted 1.77 lakh frontline demonstrations, including major interventions in crops, livestock, enterprises, and mechanization. Cluster Frontline Demonstrations (CFLDs) on pulses and oilseeds achieved yield gains of 28.9% and 27.7%, respectively. Capacity development included 73,063 training programmes benefiting 23.92 lakh participants. Extension activities reached 2.20 crore farmers. National initiatives such as ARYA, NICRA, Farmer FIRST, Natural Farming, and VKSA demonstrated strong impacts. VKSA covered 1.40 lakh villages and engaged 1.35 crore participants, strengthening research-extension linkages.

Research for Tribal and Hill Regions: ICAR implemented participatory demonstrations, seed production, and capacity-building programmes across

Uttarakhand, J&K, Arunachal Pradesh, and NEH states. A total of 18.54 t breeder seed and 1.15 t nucleus seed of 38 varieties were produced. ICAR-CICFR supported trout seed self-reliance in Ladakh. Likewise, ICAR-CIFRI promoted community aquaculture in Purulia, West Bengal benefiting 481 tribal women.

Organization and Management: In line with the "One India-One Examination" policy, ICAR implemented major reforms in direct recruitment for administrative posts in coordination with DoPT, UPSC, and SSC. Recruitment through UPSC and SSC panels for Group A, B, and C posts was notified to reduce delays, resource savings, and ensure timely filling of the vacancies. During the reporting period, multiple administrative and financial posts were filled under the promotion quota, including Joint Secretary, Directors, Deputy Directors, Finance and Accounts Officers, and other administrative staff.

Finance: The financial support to Department of Agricultural Research & Education (DARE), and ICAR during the financial year 2025-26 was accounted for ₹10,466.39 Crores for strengthening agricultural research, education, and extension systems.

Intellectual Property and Technology Management: ICAR significantly strengthened its innovation, intellectual property, and technology commercialization ecosystem. A total of 55 patents were granted during the year under report besides registration of 165 varieties. Capacity building remained a major priority, with 320 awareness and training programmes organized by 80 institutes, benefiting over 20,000 stakeholders, along with advanced exposure of more than 300 personnel through national and international platforms. Strategic initiatives such as SAMIKSHA, World IP Day 2025, and the Maitri 2.0 Indo-Brazil Cross-Border Incubation Programme strengthened institutional review mechanisms, global collaboration, and startup ecosystem integration. Technology transfer activities gained strong momentum, with 792 licensing agreements executed with about 600 partners, facilitating the commercialization of 475 technologies, including 284 IP-protected technologies. Under the Incubation Fund, 50 Agri-Business Incubation Centres supported 532 stakeholders, enabled 274 start-ups and enterprises, conducted 334 Entrepreneur Development Programmes, and engaged 5,689 technology seekers and delegates. Collectively, these outcomes demonstrate ICAR's growing impact in translating scientific research into protected, scalable, and market-ready agricultural innovations.

Partnership and Linkages: The International Relations (IR) Division actively facilitated international partnerships through Memoranda of Understanding (MoUs), operational Work Plans, participation in global forums, and coordination of foreign delegations, thereby enhancing India's agricultural presence worldwide. Under bilateral cooperation, six MoUs were signed with leading international institutions from Morocco, Brazil, Australia, Togo, the USA, and Russia, focusing on collaborative research, capacity building, and technology exchange. In addition, five Work Plans were operationalized with reputed organizations, including CABI, IFDC, IFPRI, Western Sydney University, and INTA, Argentina, providing structured frameworks for joint research programmes, expert exchange, and dissemination of sustainable agricultural technologies. On the multilateral front, the Division contributed to major global platforms such as G-20, ASEAN, BRICS, BIMSTEC, SAARC, QUAD, and APAARI. Key achievements included the implementation of seven research projects under the QUAD AI-Engage Initiative, emphasizing precision agriculture through artificial intelligence and robotics, and active participation in the BIMSTEC Workshop on Mountain Agriculture Technology in the context of climate change and food system transformation. Furthermore, the IR Division coordinated 108 international delegation visits to ICAR headquarters and research institutes, involving high-level representatives from Europe, the USA, Africa, and Asia.

Training and Capacity Building: The Capacity Building Unit (CBU) of DARE/ICAR has been formulating and implementing the Annual Capacity Building Plan (ACBP) to strengthen the skills and competencies of all categories of employees. About 9,400 employees from ICAR Headquarters and institutes were onboarded on the digital platform, and 2,998 employees completed online courses during reporting period. Six specialized online and offline training programmes were organized by four ICAR institutes, covering areas such as AI and AR/VR applications in agriculture, executive development for newly recruited research managers, vigilance training, and identification of plant-parasitic nematodes. A total of 212 employees participated in these need-based competency programmes. ICAR also celebrated National Learning Week during 22-25 October 2024 and organized an Orientation Workshop on "Mission Karmayogi" on 28 February 2025, as per the directions of the Capacity Building Commission, Government of India. During the reporting period, 2,793 employees were trained, including 1,283 scientists, 664 technical staff, 715 administrative and finance staff, and 131 MTS personnel.

Publication and Public Relations: The Directorate of Knowledge Management in Agriculture (DKMA), plays a pivotal role in strengthening India's agricultural knowledge dissemination system by ensuring timely and wide-reaching communication of scientific innovations. Three important policy documents were published during this year. The 'Gender Strategy' promotes equity and integration of gender perspectives across research and extension, enhancing participation, leadership diversity, and relevance for women farmers. The 'Communication Strategy' ensures unified, proactive engagement with stakeholders, *reinforcing "One Organization–One Purpose–One Narrative*". The upgraded 'Research Data Management Policy' standardizes data generation,

curation, and sharing, enhancing research transparency, reproducibility, and evidence-based policymaking. The ICAR e-publications platform hosted over 45,000 articles from more than 60 scientific journals and periodicals, serving researchers, students, extension personnel, and policymakers. Three flagship open-access research journals--The Indian Journal of Agricultural Sciences (IJAgS), Indian Journal of Animal Sciences (IJAnS), and Indian Journal of Fisheries Sciences (IJFS), continued to disseminate high-quality research. Two farmer-oriented periodicals, Indian Farming (IF) and Indian Horticulture (IH), are also being published to translate scientific research into practical knowledge for farmers and other stakeholders besides popular periodicals *Kheti* and *Phalphul* for strengthening research-farmer interface. The ICAR website enhanced real-time information dissemination by updating 5,131 pages and recording 4,156,458 page views from users in over 200 countries. ICAR maintained a strong social media presence with an average of three posts per day and followers numbering 255K on Facebook, 262.9K on X, 85,815 on YouTube, and 36,700 on Instagram. A major highlight was ICAR's leadership of the 15-day VKSA, which significantly enhanced research visibility through extensive digital outreach. Additionally, ICAR participated in 63 exhibitions nationwide, facilitating effective dissemination of climate-resilient practices, value-added technologies, and research innovations.

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Crop Improvement

The report on Crop Improvement highlights significant achievements across field crops, horticultural crops, biotechnology, genomics, seed production, and pest management during the reporting period. In the past decade (2014-2025) alone, 3,236 field crop varieties were developed and notified, comprising 1,576 cereals, 444 oilseeds, 473 pulses, 408 fibre crops, 205 forage crops, 96 sugarcane, and 34 other crops. 2,996 varieties (about 93%) developed during this period are climate-resilient, addressing challenges caused by climate variability. Further, significant progress has been made in nutritional security through bio-fortification of crops. Around 185 bio-fortified varieties were developed, of which 142 varieties were released during 2020-2025. These include major cereals and millets such as wheat (54), maize (39), rice (9), pearl millet (6), finger millet (6); pulses like lentil, chickpea and faba bean (one each); and oilseeds including mustard (8), soybean (7), groundnut (3) and gobhi sarson (1), among others. These achievements highlight ICAR's continued commitment to enhancing productivity, climate resilience and nutritional quality of crops for sustainable agricultural development. Major advances were achieved using genome editing and genomic interventions. India identified the world's first genome-edited rice varieties-Pusa DST Rice 1 and DRR Dhan 100 (Kamala) showing enhanced drought, salinity tolerance and up to 19% higher yield with early maturity. Genome editing in mustard resulted in stable yellow-seeded lines with 3–4% higher oil content. Novel genes and QTLs such as OsSRDP and qGN4.1 contributed to multi-stress tolerance and 15–20% yield enhancement in rice, while high-density SNP arrays and GWAS facilitated trait discovery in pigeon pea, amaranth and moth bean. Biotechnological interventions strengthened insect, nematode and disease management, including root-specific promoters reducing nematode infection by 60–90%, genomic insights into insect behavior, and development of Bt-pigeon pea lines resistant to pod borer. In seed production, breeder seed output during 2024-25 reached 109,370.2 quintals, exceeding the indent of 69,850.8 quintals, while quality seed production totaled 433,114.7 quintals, surpassing targets. Recent innovations such as a rapid seed viability test kit and Uniprime seed priming technology further enhanced seed quality management system. In horticultural crops, 28 varieties across 18 crops were notified, including climate-resilient, high-yielding and nutritionally superior varieties of mango, guava, bael, potato, onion, coconut, spices, medicinal plants and mushrooms. Overall, these achievements demonstrate integrated progress in crop improvement, climate resilience, productivity enhancement and food and nutritional security.

FIELD CROPS

Crop Varieties released and notified

During 1969 to 2025, a total of 7,206 field crop varieties has been developed, released and notified by NARES under the aegis of ICAR comprising 3,569 of cereals; 1,131 of oilseeds; 1,259 of pulses; 693 of fibre crops; 308 of forage crops; 180 of sugarcane and 66 of other/potential crops. During last 10 years *i.e.* 2014-2025, a total of 3,236 field crop varieties have been developed, released and notified comprising 1,576 of cereals; 444 of oilseeds; 473 of pulses; 205 of forages; 408 of fibre crops, 96 of sugarcane and 34 of other crops out of which 2,996 varieties are climate resilient (cereals 1,455; oilseeds 397; pulses 446; fibre crops 392; forage crops 168, sugarcane 96 and other crops 27). During last decade around 185 bio-fortified varieties have been developed of which since 2020 to 2025 142 bio-fortified varieties have been developed comprising rice (9); wheat (54); barley (1); maize (39); sorghum (1); pearl millet (6); finger millet (6); little millet (2); proso millet (1); foxtail millet (1); lentil (1); chickpea (1); faba bean (1); mustard (8); soybean (7); groundnut (3) and gobhi sarson (1).

Cereals: During reporting period 195 of cereals comprising 75 of rice, 13 of wheat, 76 of maize, 10 of sorghum, 7 of pearl millet, 3 each of barley, little millet and finger millet. additionally, 2 each of proso millet and foxtail millet and 1 of barnyard millet were released for cultivation across different agro-ecological zones of the country which are listed below:

List of released varieties/hybrids of cereals

Variety	Area of adoption	Salient features
Rice		
ADV 8200 UPLRH181325 (IET-29694)	Haryana, Rajasthan, Uttarakhand, Uttar Pradesh, Punjab, Odisha, West Bengal, Jharkhand, Bihar, Maharashtra, Madhya Pradesh, Chhattisgarh and Gujarat	Suitable for transplanted conditions with early duration, yield 62.50 q/ha, maturity 115–120 days, moderate resistance to leaf blast, neck blast, brown spot and glume discoloration
JKRH-2062 (JKRH-1004) (IET-29700)	Punjab, Haryana, Rajasthan, Western Uttar Pradesh and Uttarakhand	Suitable for irrigated transplanted condition of *Kharif* season, yield 67.61 q/ha, maturity 110–115 days, resistant to lodging and non-shattering, tolerant to Brown Planthopper (BPH), stem borer, gall midge, leaf blast and sheath rot
JKRH-2082 Suraksha (JKRH-1135) (IET-30579)	West Bengal, Bihar, Jharkhand, Odisha and Eastern Uttar Pradesh	Suitable for irrigated transplanted condition of *Kharif* season, yield 66.20 q/ha, maturity 125–130 days, resistant to lodging, moderately resistance to leaf blast, neck blast and sheath blight
JKRH-2601 (IET-28956)	Madhya Pradesh, Chhattisgarh, Gujarat and Maharashtra	Suitable for irrigated *Kharif* transplanted condition, yield 55–60 q/ha, maturity 120–123 days, moderately resistance to leaf blast, neck blast, glume discolouration, tolerance to stem borer and leaf folder.
JKRH-2092 (JKRH-1170) (IET-30561)	Punjab, Haryana, Rajasthan, Western Uttar Pradesh and Uttarakhand	Suitable for irrigated transplanted condition of *Kharif* season, yield 67.86 q/ha, maturity 115–120 days, moderate resistance to leaf blast, neck blast and grain discolouration, tolerance to stem borer and leaf folder, resistant to lodging
PNPG 114 (IET-30819)	Odisha, Bihar, Eastern Uttar Pradesh, West Bengal, Jharkhand, Tamil Nadu, Karnataka, Telangana and Andhra Pradesh	Suitable for transplanted condition with medium duration, yield 62.06 q/ha, maturity 131 days, moderately resistant to leaf blast, brown spot
Srikar 2123 (SRH 333) (IET-30573)	Odisha, Uttar Pradesh, Jharkhand, West Bengal, Bihar, Tripura and Assam	Suitable for transplanted condition, mid early duration, yield 64.09 q/ha, maturity 115–125 days, moderately resistant to leaf blast, neck blast and brown spot, leaf folder, tolerant to gall midge
KKL (R) 5 (IET-32036)	Puducherry, Tamil Nadu Kerala and West Bengal	Suitable for alkaline and inland saline soils, yield 34.4 q/ha, maturity 115–120 days under salinity stress, moderately resistant to leaf blast, neck blast, stem borer dead hearts
LG 90303 (IET-30593)	Odisha, West Bengal, Bihar, Jharkhand, Uttar Pradesh, Maharashtra, Madhya Pradesh, Chhattisgarh, Tamil Nadu, Kerala, Karnataka, Andhra Pradesh and Puducherry and Telangana	Suitable for transplanted conditions with mid early duration, yield 67.74 q/ha, maturity 123–127 days, resistant to leaf blast, neck blast, moderately resistant to Bacterial Leaf Blight (BLB)
Indam 200-055 (IET-30604)	Bihar, Jharkhand, Orissa, West Bengal, Uttar Pradesh, Maharashtra, Gujarat, Andhra Pradesh, Telangana, Tamil Nadu, Karnataka, Kerala and Puducherry	Suitable for transplanted conditions with medium duration, yield 69.00 q/ha, maturity 135 days, moderately resistant to leaf blast, neck blast, sheath rot and leaf folder
Telangana Rice-1719 (WGL 1719) (IET-30669)	Chhattisgarh Madhya Pradesh and Maharashtra	Suitable for transplanted conditions with early duration, yield 57.36 q/ha, maturity 115–120 days, moderately resistant to leaf blast
Telangana Rice-35105 (RNR35105) (IET-36041)	Haryana, Punjab, Rajasthan, Uttar Pradesh, Bihar, Jharkhand, Odisha, West Bengal, Chhattisgarh, Maharashtra and Madhya Pradesh	Suitable for transplanted conditions with early duration, yield 59.44 q/ha, maturity 120–125 days, moderately resistant to leaf blast and neck blast.
Telangana Rice 12509 (KNM-12509) (IET-30642)	Odisha, Bihar, West Bengal, Jharkhand and Uttar Pradesh, Tripura, Assam, Chhattisgarh, Madhya Pradesh, Maharashtra and Gujarat	Suitable for transplanted conditions with early duration, yield 57.78 q/ha, maturity 115–120 days, moderately resistant to leaf blast and neck blast
JagtialaVari 28639 (IET-30636) (JGL 28639)	Bihar, West Bengal, Odisha, Jharkhand, Uttar Pradesh, Tripura and Assam	Suitable for transplanted conditions with early duration, yield 57.62 q/ha, maturity 120 days, moderately resistant to leaf blast, neck blast, sheath blight and BLB
MRP 5499 (MEPH 170) (IET-30608)	Haryana, Uttarakhand, Punjab, Uttar Pradesh	Suitable for transplanted conditions with medium duration, yield 65.20 q/ha, maturity 127–130 days, tolerance to leaf blast, neck blast, sheath rot and whorl maggot
RRX 3366 (IET-30574)	Haryana, Uttarakhand, Punjab and Uttar Pradesh	Suitable for transplanted conditions with mid-early duration, yield 67.52 q/ha, maturity 121–125 days, moderately resistant to leaf blast, neck blast, stem borer and leaf folder

Variety	Area of adoption	Salient features
CR Sankar Dhan-706 (IET-30613)	Bihar, West Bengal, Odisha, Jharkhand and Uttar Pradesh	Suitable for transplanted conditions with medium duration, yield 69.83 q/ha, maturity 135–139 days, moderately resistant to leaf folder, brown plant hopper (BPH), white backed plant hopper (WBPH) and resistant to blast
CR Dhan 812 (IET-32123)	Odisha, West Bengal, Bihar, eastern Uttar Pradesh, Assam, Tripura and Jharkhand	Suitable for dry direct seeded rice (DSR) conditions, maturity 140–145 days, yield 52.30 q/ha, moderately resistant to brown spot and sheath rot, marker assisted selection (MAS) derived near isogenic line (NIL) in the background of Swarna Sub 1
CSR 108 (IET-31055)	Haryana and Western Uttar Pradesh	Suitable for alkaline and inland saline soils, yield 35.63 q/ha (alkaline stress), 39.00 q/ha (saline stress), maturity 115–120 days, moderately resistant to leaf folder
CR DHAN 417 (IET-30961)	Assam, Tripura, Andhra Pradesh and Karnataka, Tamil Nadu, Telangana, Puducherry and Kerala	Suitable for transplanted condition, yield 64.59 q/ha, maturity 125–147 days, moderately resistant to leaf blast, neck blast, sheath rot, stem borer, leaf folder
Mangala/B Dhan 24 (IET-29940)	Haryana, Rajasthan, Punjab, Uttar Pradesh, Odisha, Bihar, West Bengal, Jharkhand, Maharashtra, Madhya Pradesh, Chhattisgarh, Tamil Nadu, Kerala, Karnataka, Andhra Pradesh, Puducherry and Telangana	Suitable for transplanted conditions with early duration, yield 60.21 q/ha, maturity 123 days, moderately resistant to leaf blast and neck blast
OUAT Kalinga Rice 20 (Jayada) (ORJ 1356) (IET-30336)	Odisha, West Bengal and Jharkhand	Suitable for direct seeded conditions with early duration, yield 46.07 q/ha (normal condition), 28.98 q/ha (moderate drought stress condition), maturity 110–115 days, moderately resistant to leaf blast and BPH
RNE-0456 (NK7104) (IET-30603)	Andhra Pradesh, Karnataka, Kerala, Puducherry, Tamil Nadu and Telangana	Suitable for transplanted condition with medium duration, yield 71.68 q/ha, maturity 135 days, moderately resistant to bacterial blight, leaf blast, neck blast, sheath rot, sheath blight, brown spot
RNE-0463 (NK7006) (IET-30605)	Odisha, West Bengal, Jharkhand, eastern Uttar Pradesh and Bihar	Suitable for transplanted condition with medium duration, yield 66.67 q/ha, maturity 135 days, moderately resistant to leaf blast, neck blast, brown spot, sheath blight, sheath rot and bacterial blight
ICAR NEH TRC 739 (IET-30772)	Odisha, Bihar, West Bengal, Uttar Pradesh and Jharkhand	Suitable for transplanted condition with medium duration, yield 55.93 q/ha, maturity 135 days, moderately resistant to leaf blast, neck blast, bacterial blight, brown spot and sheath rot
DRR Dhan 82 (IET-30756)	Odisha, West Bengal, Bihar, Jharkhand and Eastern Uttar Pradesh	Suitable for transplanted condition with mid early duration, yield 59.57 q/ha, maturity 130–135 days, moderately resistant to bacterial leaf blast
DRR Dhan 83 (IET-32045)	Andhra Pradesh, Telangana, Kerala, Karnataka, Tamil Nadu, Puducherry, Tripura and Assam	Suitable for transplanted condition with mid early duration, yield 46.79 q/ha, maturity 120–125 days, resistant to bacterial leaf blast, blast, MAS derived near isogenic line in the background of Krisha Hamsa with introgression of *xa5, Xa21* for bacterial blight and *Pi9* for blast resistance, has alleles of *Pi1, Pi20* and *Pi38* for blast resistance
DRR Dhan 84 (Mahajaya) (IET-32051)	Andhra Pradesh, Telangana, Tamil Nadu, Maharashtra, Bihar, Odisha and Jharkhand	Suitable for transplanted condition with medium duration, yield 54.58 q/ha, maturity 125–130 days, resistant to bacterial leaf blight, blast, moderately resistant to plant hoppers
DRR Dhan 85 (IET-32054)	Telangana, Andhra Pradesh, Tamil Nadu, Karnataka, Odisha, Chhattisgarh, Bihar, Jharkhand, Gujarat and Maharashtra	Suitable for transplanted conditions, yield 53.94 q/ha, maturity 130–135 days, resistant to bacterial leaf blight and gall midge, MAS derived NIL for BLB (*Xa21, xa13*) and gall midge (*Gm4* and *Gm8*) resistance in the background of Improved Samba Mahsuri
DRR Dhan 87 (IET-31110)	Telangana, Andhra Pradesh and Karnataka, Odisha, Jharkhand and Bihar	Suitable for transplanted and aerobic conditions with tolerance to low soil phosphorous, yield 54.67 q/ha, maturity 135 days, moderately resistant to leaf blast, neck blast, bacterial blight and sheath blight and tolerance to plant hoppers
DRR Dhan 88 (IET-28070)	Karnataka, Telangana, Andhra Pradesh, and Maharashtra	Suitable for transplanted conditions with tolerance to low soil phosphorous, yield 59.88 q/ha, maturity 125 days, moderately resistant leaf blast
DRR Dhan 89 (Super Swarna) (IET-32064)	Odisha, Bihar, West Bengal, Jharkhand and eastern Uttar Pradesh	Suitable for transplanted conditions with late duration, yield 53.54 q/ha, maturity 135–140 days, resistant to bacterial leaf blight, blast, moderately resistant to leaf folder, stem borer, MAS derived NIL for BLB (*Xa21*), blast (*Pi54*) resistance and yield gene (*OsSPL14*) in the background of Swarna
DRR Dhan 90 (IET-29581)	Karnataka, Telangana and Andhra Pradesh	Suitable for transplanted conditions with tolerance to low soil nitrogen, yield 45.90 q/ha (50% N application), maturity 125–130 days, moderately resistant to leaf blast, neck blast, moderately resistant to plant hoppers, stem borer, BPH, WBPH

Variety	Area of adoption	Salient features
DRR Dhan 91 (IET-32061)	Telangana, Andhra Pradesh, Tamil Nadu, Karnataka, Odisha, Chhattisgarh, Bihar Jharkhand, Gujarat and Maharashtra	Suitable for transplanted and submergence stress conditions, yield 49.82 q/ha, maturity 135–140 days, resistant to leaf blast and tolerant to submergence, moderate resistant to plant hoppers MAS derived NIL for BLB (*Xa21*, *xa13*), blast (*Pi54*) and submergence (*Sub1*) tolerance in the background of Improved Samba Mahsuri
DRRH-7 (IET-30165)	Haryana, Uttar Pradesh, and Tamil Nadu	Suitable for alkaline and inland saline soils, yield 35.35 q/ha (alkaline stress), 34.78 q/ha (inland salinity stress), maturity 115–123 days, moderately resistant to leaf blast, neck blast, brown spot, discoloration and tolerant to plant hoppers
IIAB Dhan 5 (IET-30656)	Odisha, Bihar, Jharkhand, West Bengal, Uttar Pradesh, Tripura and Assam	Suitable for transplanted conditions with early duration, yield 57.62 q/ha, maturity 115–120 days, moderately resistant to leaf blast and neck blast.
Pusa Rice Hybrid 60 (Pusa RH 60) (IET-28965)	Bihar and Eastern Uttar Pradesh	Suitable for transplanted conditions with early duration, yield 54.63 q/ha, maturity 120 days, moderately resistant to leaf blast, neck blast and glume discoloration
KRH 7374 (Kaveri-7374) (IET-30565)	Haryana, Punjab, Rajasthan, Western Uttar Pradesh and Uttarakhand	Suitable for irrigated transplanted condition, yield 69.14 q/ha, maturity 115–120 days, moderately resistant to leaf blast and neck blast
KRH 7117 (Kaveri-7117) (IET-31193)	Gujarat and Maharashtra	Suitable for direct seeded conditions with early duration, yield 48.61 q/ha (normal conditions), 28.22 q/ha (drought stress), maturity 105–110 days, moderately resistant to leaf blast, brown spot
RC Manichakhao-1	Manipur	Suitable for transplanted conditions, colored rice, yield 45–50 q/ha, maturity 129 days, tolerant to blast, brown spot, sheath rot and stem borer, gall midge.
Irabati CN2068 (IET-25903)	West Bengal	Suitable for semi deep water ecology, yield 54.42 q/ha, maturity 150–155 days, moderately resistant to sheath rot, stem borer, leaf folder
Suvashini HTW-46-IR 16L1833 (IET-29216)	West Bengal	Suitable for transplanted conditions with mid early duration, yield 51.90 q/ha, maturity 120–124 days, resistant to brown spot, moderately resistant to leaf blast, neck blast
Lachmanti HTW-33-IR 105690-1-1B-B (IET-28367)	West Bengal	Suitable for transplanted conditions with early duration, yield 53.12 q/ha, maturity 116–120 days, moderately resistant to brown spot, bacterial blight, sheath blight, whorl maggot, leaf folder and dead heart
Musafir HTW-30-IR 90257-B-273-1-B-B (IET-28374)	West Bengal	Suitable for transplanted conditions with early duration, yield 55.50 q/ha, maturity 127–132 days, moderately resistant to neck blast and false smut, tolerance to BPH, leaf folder
ADT 60 (IET-28471)	Tamil Nadu	Suitable for transplanted thaladi and late sown conditions, yield 60.28 q/ha, maturity 130–135 days, resistant to sheath blight, blast, rice tungro disease, moderately resistant to bacterial leaf blight, sheath rot, false smut, moderately resistant to stem borer, leaf folder, gall midge
CO 59 (CBMAS 14065) (IET-24247)	Tamil Nadu	Suitable for transplanted conditions with early duration, yield 43.90 q/ha, maturity 120 days, moderately resistant to leaf blast, glume discoloration and stem borer
PDKV Sakshi (IET-31949)	Maharashtra	Suitable for transplanted conditions with late duration, yield 43.90 q/ha, maturity 140–145 days, moderately resistant to neck blast, brown spot, grain discoloration and stem borer
Phule Maval-7 (VDN-1808)	Maharashtra	Suitable for transplanted thaladi and late sown conditions, yield 60.28 q/ha, maturity 130–135 days, resistant to sheath blight, blast, rice tungro disease, moderately resistant to bacterial leaf blight, sheath rot, false smut, moderately resistant to stem borer, leaf folder and gall midge
Konkan Suwas (RTN 15M6-52)	Maharashtra	Suitable for early sowing condition, yield 40.39 q/ha, maturity 115–120 days, moderately resistant to neck blast, sheath rot, moderately susceptible to leaf blast, bacterial leaf blight, stem borer and gall midge
CR Dhan 325 (IET-29240)	Odisha	Suitable for irrigated transplanted condition, yield 54.78 q/ha, maturity 115–120 days, moderately resistant to leaf blast, neck blast, brown spot, sheath rot
CR Dhan 215 (IET-29446)	Odisha	Suitable for aerobic conditions, yield 41.94 q/ha, maturity 105–110 days, moderately resistant to leaf blast, neck blast, brown spot, sheath rot, glume discoloration, resistant to leaf folder, gall midge and tolerance to BPH
CR Dhan 335 (IET-30754)	Odisha	Suitable for transplanted conditions with mid early duration, yield 55.90 q/ha, maturity 130–135 days, moderately resistant to neck blast, bacterial blight, sheath rot, glume discoloration, moderately resistant to BPH

Variety	Area of adoption	Salient features
CR Dhan 912 (IET-26446)	Odisha	Suitable for *Boro* cultivation, aromatic variety, yield 59.28 q/ha, maturity (medium) 130 days, moderately resistant to leaf blast, neck blast and bacterial leaf blight
CR Sankar Dhan-705 (Ganga) (IET-29752)	Odisha	Suitable for *Boro* conditions, yield 59.28 q/ha, maturity 130 days, moderately resistant to leaf and neck blast, bacterial blight, leaf folder, stem borer and BPH
CSR 64 (CSR TPB 99) (IET-27723)	Uttar Pradesh	Suitable for salt affected soils, yield 43.85 q/ha, maturity 125–135 days, moderately resistant to leaf and neck blast and sheath rot
HKR-49 (IET-27866)	Haryana	Suitable for transplanted conditions with early duration, yield 57.56 q/ha, maturity 118–120 days, moderately resistant to leaf blast, brown spot, stem borer, leaf folder and BPH
Dweep Dhan-7	Andaman and Nicobar Islands	Suitable for rainfed shallow lowland, yield 55.6 q/ha, maturity 125–130 days, moderately resistant to bacterial blight, sheath blight, stem borer
Dweep Dhan-8	Andaman and Nicobar Islands	Suitable for rainfed shallow lowland, yield 40.90 q/ha, maturity 125–130 days, moderately resistant to sheath blight and stem borer
Dweep Dhan-9	Andaman and Nicobar Islands	Suitable for rainfed shallow lowland, yield 41.30 q/ha, maturity 125–130 days, moderately resistant to stem borer
Dweep Dhan-10	Andaman and Nicobar Islands	Suitable for rainfed shallow lowland, yield 55.6 q/ha, maturity 150 days, moderately resistant to bacterial blight, sheath blight and stem borer
DRR Dhan 81(IET 31929) RP 6771-IRRI-147	Bihar and Uttar Pradesh, Assam, Maharashtra and Gujarat and Kerala and Karnataka	Suitable for timely sown irrigated medium duration ecology, yield 51.3 q/ha, maturity 130–135 days, low glycemic index (55), Zn 22.3 ppm, salinity tolerant, moderately tolerant to bacterial leaf blight, moderately resistant to stem borer
Sabour Mahsuri Dhan (BRR 2141) (IET 28489)	Bihar, Uttar Pradesh, Jharkhand, Madhya Pradesh,Chhattisgarh, Maharashtra and Gujarat	Suitable for irrigated medium duration ecology, yield 60.14 q/ha, maturity 135–140 days, resistant to neck blast, moderately resistant to leaf blast and sheath rot
Sabour Kunwar Dhan (BRR 2176) (IET 29140)	Bihar, Jharkhand, Odisha, West Bengal and Uttar Pradesh	Suitable for transplanted early duration ecology, yield 52.11 q/ha, maturity 115–120 days, resistant to neck blast, leaf blast and stem borer
Jagtiala Vari-33124 (JGL-33124) (IET-28764)	Telangana	Suitable for timely/late sown irrigated condition, yield 67.24 q/ha, maturity 135–140 days, protein 9.81% (crude form), moderately resistant to leaf blast, neck blast, moderately resistant to BPH and yellow stem borer
Jagtiala Vari-28639 (JGL-28639) (IET-30636)	Telangana	Suitable for timely/late sown irrigated condition, yield 66.37 q/ha, maturity 120–125 days, protein 10.31% (crude form) moderate resistance to blast, bacterial leaf blight, moderate resistance to yellow stem borer and BPH
Warangal Vari-1246 (WGL 1246) (IET-28406)	Telangana	Suitable for timely/late sown irrigated early duration ecology, yield 64.80 q/ha, maturity 125–130 days, moderately resistant to neck blast, sheath rot, moderately resistant to BPH
Kampasagar Vari-6251 (KPS-6251)	Telangana	Suitable for timely/late sown irrigated condition, yield 78.00 q/ha, maturity 115–120 days, protein 8.1% (crude form), moderately resistant to neck blast, leaf blast, moderately resistant to BPH, gall midge
Rudrur Vari-1162 (RDR-1162) (IET 29160)	Telangana	Suitable for timely/late sown irrigated early duration ecology, yield 66.56 q/ha, maturity 115–120 days, moderately resistant to brown plant hopper and gall midge
Rudrur Vari-1200 (RDR-1200)	Telangana	Suitable for both timely/late sown irrigated medium duration ecology, yield 69.01 q/ha, maturity 130–135 days, moderately resistant to brown plant hopper and gall midge
Indravati Dhan (JDP-2018) (IET 28364)	Chhattisgarh	Suitable for timely sown rainfed and aerobic condition, yield 45.78 q/ha, maturity 105–110 days, tolerant to leaf blast, tolerant to leaf folder
Malviya Dhan 105 Sub 1 (IET-28024)	Uttar Pradesh	Suitable for submergence stress conditions, near isogenic line (NIL) in the background of Malviya Sugandh Dhan 105 (HUR 105), yield 45–50 q/ha, maturity 130–135 days, medium slender grain, good cooking qualities with aroma, having *Sub1* gene, submergence tolerant, tolerant to leaf and neck blast
Phule Super Pawana (IGP-13-12-19)	Western Maharashtra	Suitable for timely sown irrigated/rainfed conditions, yield 47.69 q/ha, maturity 130–135 days, moderately resistant to neck blast, brown spot, moderately resistant to stem borer, brown plant hopper, mutant of Pawana
Sikkim Organic Chirakey Selection-1 (CS-1) (IET-30517)	Sikkim	Suitable for timely sown irrigated late duration ecology, yield 35.00 q/ha, maturity 140 days, moderately resistant to blast, resistant to sheath rot, pure line selection of local Chirakey

Variety	Area of adoption	Salient features
Gangavathi Churumuri (GNV 1109) (IET-30167)	Zone-II & III of Karnataka	Suitable for timely sown, irrigated mid-early duration ecology with alkaline and saline stress conditions, yield 36.77 q/ha, maturity 125–130 days, moderately resistant to leaf blast, tolerant to soil salinity stress up to 10 ds/m
CAU-R5 (Emoinu phou) (IET-30811)	Manipur	Suitable for timely sown, both direct seeded and transplanted mid-early duration ecology, yield 65 q/ha, maturity 125–130 days, resistant to lodging
Wheat		
PBW 891	Maharashtra, Karnataka and Plains of Tamil Nadu	Suitable for timely sown, irrigated conditions, yield 50.7 q/ha, maturity 107 days, resistant to stem and leaf rust
Pusa Wheat Kranti (HI-1669)	Madhya Pradesh, Chhattisgarh, Gujarat, Rajasthan (Kota and Udaipur Divisions) and Western Uttar Pradesh (Jhansi Division)	Suitable for timely sown irrigated conditions, yield 59.2 q/ha, maturity 119 days, resistant to stem rust (ACI-5.1) and leaf rust (ACI-12.2), Karnal bunt, leaf blight and flag smut, tolerant to heat stress (HSI=0.85)
HI-1674 (Pusa Wheat Atulya)	Madhya Pradesh, Chhattisgarh, Gujarat, Rajasthan (Kota and Udaipur Divisions) and Western Uttar Pradesh (Jhansi Division) Maharashtra, Karnataka and Plains of Tamil Nadu	Suitable for late sown irrigated conditions, yield 50.3 q/ha (CZ) and 46.0 q/ha (PZ), maturity 110 days (CZ) and 98 days (PZ), resistant to stem rust (ACI-3.5) and leaf rust (ACI-2.0)
NIAW 4114 (Phule Shashwat)	Maharashtra, Andhra Pradesh, Karnataka, Telangana and Tamil Nadu	Suitable for irrigated late sown condition, yield 47.9 q/ha, maturity 98 days, protein 12.7%, bread loaf volume 553, chapati quality 8.1, Fe 39.9 ppm, Zn 39.5 ppm, resistant to brown rust, black rust and powdery mildew
Lok-79	Maharashtra, Andhra Pradesh, Karnataka and Goa, Plains of Tamil Nadu and Kerala	Suitable for irrigated late sown conditions of peninsular zone, yield 45.1 q/ha, maturity (early) 103 days, resistant to leaf rust, stem rust, tolerance to heat stress, rich in protein (12.9%), iron (44.4 ppm) and zinc (42.35 ppm)
AKAW 5100	Maharashtra, Andhra Pradesh, Karnataka, Telangana and plains of Tamil Nadu	Suitable for irrigated timely sown conditions, yield 49.4 q/ha, maturity 109 days, protein 12.47%, resistant to black rust, moderately resistant to all the pathotypes of brown rust, Karnal bunt and powdery mildew, heat and drought tolerant
GW-543	Madhya Pradesh, Gujarat, Rajasthan (Kota and Udaipur Division) and Chhattisgarh, Jhansi Division of Uttar Pradesh	Suitable for early sown irrigated conditions, yield 64.0 q/ha, maturity (medium) 120 days, high level of leaf rust resistance, moderately resistant to prevalent and virulent leaf rust pathotypes and black rust pathotype
Karan Khushboo (DBW-386)	Eastern Uttar Pradesh, Bihar, Jharkhand, Odisha, West Bengal, Assam and plains of North Eastern	Suitable for timely sown irrigated conditions, yield 52.0 q/ha, maturity 123 days, resistant to stripe rust, leaf rust, wheat blast, tolerant to heat stress (HSI:0.67)
Karan Saanvi (DBW-443)	Maharashtra, Karnataka and plains of Tamil Nadu	Suitable for timely sown irrigated condition, yield 49.20 q/ha, maturity 109 days, highly resistant to leaf and stem rust, resistant to wheat blast, Karnal bunt, lower foliar aphid score and brown mite score, heat (HSI=0.85) and drought (DSI=0.89) stress tolerance, rich in zinc (43.0 ppm), grain iron (41.9 ppm) and protein content (13.4%)
NWS-2222	Maharashtra, Karnataka and plains of Tamil Nadu	Suitable for timely sown irrigated condition, yield 52.0 q/ha, maturity 111 days, resistance to black and brown rust, protein 12.1%
Pusa Surya (HD-3428)	Punjab, Haryana, Delhi, Rajasthan (excluding Kota and Udaipur), Western Uttar Pradesh (except Jhansi), Jammu and Kathua district of Jammu and Kashmir, Paonta Valley and Una district of Himachal Pradesh and Tarai region of Uttarakhand	Suitable for late sown irrigated condition, yield 51.20 q/ha, maturity 127 days, highly resistant to leaf and stripe rusts, highly tolerant to both heat (HSI: 0.67) and drought (DSI: 0.79), protein 12.2%
WH-1306	Maharashtra, Karnataka and plains of Tamil Nadu	Suitable for timely sown irrigated conditions, yield 50.43 q/ha, maturity 107 days, highly resistant to stem rust, black rust, leaf rust, brown rust, stripe rust, yellow rust, resistant to leaf blight, flag smut and powdery mildew, protein 12.4%
Rajendra Gehun-4	Bihar	Suitable for timely sown irrigated conditions, yield 47.0 q/ha, maturity 126–135 days, high iron (43 ppm) and zinc (38 ppm) content, resistant to major diseases and insect pests prevalent in Bihar

Variety	Area of adoption	Salient features
Maize		
ADV7154 (ADV-7434)	Karnataka, Tamil Nadu, Maharashtra, Telangana and Andhra Pradesh and Central Western Zone (Rajasthan, Madhya Pradesh, Gujarat and Chhattisgarh)	Suitable for *Kharif* season irrigated conditions, yield 92.5 q/ha, maturity 110–115 days (late), moderately resistant to Maydis leaf blight, Charcoal rot, bacterial stalk rot, *Turcicum* leaf blight, *Curvularia leaf spot*, *Fusarium* stalk rot, *Chilo partellus* and Fall Army Worm insect
Rajendra Baby Corn-2 (MBC 21-10)	Punjab, Haryana, Uttarakhand plains, Delhi and western Uttar Pradesh	Suitable for *Rabi* season irrigated conditions, yield 21.5 q/ha, maturity 80 days (early), moderately resistant to Charcoal rot, *Turcicum* leaf blight, shoot fly insect
Rajendra Pop Corn 2 (MPC-2141)	Punjab, Haryana, Uttarakhand plains, Delhi and western Uttar Pradesh	Suitable for *Rabi* season irrigated conditions, yield 45.1 q/ha, maturity 90 days (medium), moderately resistant to Charcoal rot, popping volume 94.3% and popping expansion 1:15
VNR-4324	Karnataka, Andhra Pradesh, Telangana, Maharashtra and Tamil Nadu	Suitable for irrigated ecologies in *Kharif* season, yield 96.8 q/ha, medium maturity 110–115 days, moderately resistance to *Turcicum* leaf blight, Charcoal rot diseases, Fall Army Worm and *Chilo partellus*
VNR-4445 (VNR-37706)	Punjab, Haryana, Uttarakhnad plain, Delhi, and Western Uttar Pradesh	Suitable for *Rabi*/spring season, irrigated conditions, yield 106 q/ha, medium maturity 115–120 days, moderately resistant to *Charcoal* rot
JKMH-4546	Maharashtra, Andhra Pradesh, Karnataka, Telangana and Tamil Nadu	Suitable for irrigated conditions in *Kharif* season, yield 105 q/ha, medium maturity 100–110 days, moderately resistant to *Turcicum* leaf blight, Charcoal rot, Banded Leaf and Sheath Blight, Fall Army Worm and *Chilo partellus* insects
SRMH 999	Maharashtra, Andhra Pradesh, Karnataka, Telangana and Tamil Nadu	Suitable for irrigated conditions in *Kharif* season, yield 101 q/ha, late maturity 100–120 days, moderately resistant to *Turcicum* leaf blight, Charcoal rot diseases, Fall Army Worm and *Chilo partellus* insects
SRMH 99M66	Punjab, Haryana, Delhi, Uttarakhand Plain, Western Uttar Pradesh, Rajasthan, Gujarat and Madhya Pradesh	Suitable for irrigated conditions in *Kharif* season, yield 80.5 q/ha, early maturity, moderately resistant to *Maydis* leaf blight, Banded leaf and sheath blight, Charcoal rot and *Fusarium* stalk rot diseases, Fall Army Worm and *Chilo partellus* insects
SMH 9099	Rajasthan, Gujarat and Madhya Pradesh	Suitable for irrigated conditions in *Kharif* season, yield 78.33 q/ha, late maturity 105–110 days, resistant to *Curvularia* leaf spot, moderately resistant to *Fusarium* stalk rot diseases, Fall Army Worm and *Chilo partellus* insects
CP-111	Punjab, Haryana, Delhi, Uttarakhand (Plain) and Western Uttar Pradesh	Suitable for early sowing in *Kharif* season, yield 72.5 q/ha, early maturity 85 days, moderately resistant to *Maydis* leaf blight, Banded leaf and sheath blight, Charcoal rot and *Turcicum* leaf blight diseases, *Chilo partellus* and Fall Army Worm insects
CP-509	Punjab, Haryana, Delhi, Uttarakhand (Plain), Uttar Pradesh, Bihar, Jharkhand, Odisha, Uttar Pradesh and West Bengal	Suitable for irrigated *Kharif* season, yield 82.26 q/ha, medium maturity 85–95 days, moderately resistant to Maydis leaf blight, Banded leaf and sheath blight, Charcoal rot diseases, *Chilo partellus* and Fall Army Worm insects
CP Golden Sweet Super (Misthi)	Jammu and Kashmir, Himachal Pradesh, Uttarakhand (Hill region), North Eastern Hills Region Meghalaya, Sikkim, Assam, Tripura Nagaland, Manipur and Arunachal Pradesh	Suitable for irrigated *Kharif* season, yield 156 q/ha, maturity 70–75 days (sowing to green ear harvest), 110–115 days (seed to seed), moderately resistant to *Turcicum* leaf blight, Banded Leaf and Sheath Blight diseases, *Chilo partellus* and Fall Army Worm insects
DHM 211 (Telangana Makka-5) (BH-417193)	Telangana, Andhra Pradesh, Karnataka, Tamil Nadu and Maharshtra	Suitable for irrigated *Rabi* season, yield 105 q/ha, late maturity 110–115 days, moderately resistant to *Turcicum* leaf blight, *Maydis* leaf blight, Charcoal rot and *Curvularia* leaf spot diseases, *Sesamia inferens* and Fall Army Worm insects
DHM 213 (Telangana Makka-6) (BH-417144)	Rajasthan, Madhya Pradesh, Chhattisgarh and Gujarat	Suitable for irrigated *Kharif* season, yield 81.4 q/ha, medium maturity 95–100 days, moderately resistant to *Turcicum* leaf blight, Maydis leaf blight, *Charcoal* rot, Banded leaf and sheath blight, Rajasthan downy mildew, Sorghum downy mildew, *Fusarium* stalk rot, *Curvularia* leaf spot diseases, *Chilo partellus* and Fall Army Worm insects
DHM 218 (Telangana Makka-7) (BH-417189)	Rajasthan, Madhya Pradesh, Chhattisgarh and Gujarat	Suitable for irrigated *Kharif* season, yield 84 q/ha, medium maturity 100–105 days, moderately resistant to Charcoal rot, *Turcicum* leaf blight, *Maydis* leaf blight, Banded Leaf and Sheath Blight, Rajasthan downy mildew, Sorghum downy mildew, Post-Flowering stalk rot, Curvularia leaf spot and *Fusarium* stalk rot diseases, *Chilo partellus* and Fall Army Worm insects
DM 9229 (HM 22201)	Maharashtra, Andhra Pradesh Karnataka, Telangana and Tamil Nadu	Suitable for irrigated *Kharif* season, yield 99 q/ha, medium maturity 100–105 days, moderately resistant to Charcoal rot, *Turcicum* leaf blight diseases, *Chilo partelluls* and Fall Army Worm insects

Variety	Area of adoption	Salient features
VL Sweet Corn Hybrid 4 (VL Madhubala) (FSCH 131)	Jammu and Kashmir, Uttarakhand Hills, Himachal Pradesh, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, Uttarakhand (Plain), Western Uttar Pradesh, Delhi, Haryana and Punjab	Suitable for irrigated *Kharif* season, yield 114.5 q/ha, early maturity 72–75 days, moderately resistant to Maydis leaf blight, *Turcicum* leaf blight diseases and Fall Army Worm insect
VL Biofortified Maize Hybrid 201 (VL Suposhita) (FMH 24)	Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura	Suitable for irrigated *Kharif* season, yield 68.2 q/ha, medium maturity 95–100 days, moderately resistant to *Turcicum* leaf blight disease and *Chilo partellus* insect
VL Biofortified Maize Hybrid 101 (VL Lophy)	Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura	Suitable for irrigated *Kharif* season, yield 60.5 q/ha, medium maturity 90–95 days, moderately resistant to *Turcicum* leaf blight disease and *Chilo partelluls* insect
PDKV Aarambha (BMH 18-2)	Karnataka, Tamil Nadu, Maharashtra, Telangana, Andhra Pradesh, Rajasthan, Madhya Pradesh, Gujarat and Chhattisgarh	Suitable for irrigated *Rabi* season, yield 105 q/ha, medium maturity 95–102 days, moderately resistant to *Turcicum* leaf blight disease and *Chilo partelluls* insect
1035D923-01 (PM21204L)	Andhra Pradesh, Telangana, Tamil Nadu, Maharashtra, Karnataka, Bihar, Uttar Pradesh, West Bengal, Jharkhand, Odisha Central Western Zone consisting of parts of Rajasthan, Madhya Pradesh, Gujarat and Chhattisgarh	Suitable for irrigated *Rabi* season, yield 107 q/ha, late maturity 110–135 days, moderately resistant to *Turcicum* leaf blight, Charcoal rot, *Fusarium* stalk rot diseases, *Chilo partelluls* and Fall Army Worm insects
P3309 (PM 22117)	Madhya Pradesh, Chhattisgarh, Gujarat and Rajasthan	Suitable for *Kharif* season, yield 83.2 q/ha, late maturity 125–135 days, moderately resistant to Maydis leaf blight, *Curvularia* leaf spot, Rajasthan downy mildew, *Fusarium* stalk rot diseases, *Chilo partelluls*, Fall Army Worm insects
IQMH 206 (IQPMH-2108)	Bihar, Jharkhand, Odisha, West Bengal and Eastern Uttar Pradesh	Suitable for *Kharif* irrigated conditions, yield 57.6 q/ha, maturity medium 91 days, moderately tolerant to Maydis leaf blight disease, *Chilo partellus* insect, rich in tryptophan (0.78%), lysine (3.28%)
IQMH 207 (IQPMH-2109)	Punjab, Haryana, Western Uttar Pradesh, Delhi and Plains of Uttarakhand, Bihar, Jharkhand, Odisha, West Bengal and Eastern Uttar Pradesh	Suitable for *Kharif* irrigated conditions, yield 69.0 q/ha, maturity medium 90 days, moderately resistant to Maydis leaf blight disease, *Chilo partellus* insect, rich in tryptophan (0.72%), lysine (3.19%)
IQMH 208 (IQPMH-2012)	Rajasthan, Madhya Pradesh, Chhattisgarh and Gujarat	Suitable for *Kharif* season, irrigated conditions, yield 67.9 q/ha, maturity medium 88 days, moderately resistant to *Curvularia* leaf spot, Rajasthan downy mildew diseases, *Chilo partellus* insect, rich in tryptophan (0.78%), lysine (3.25%)
IQMH 209 (IQPMH 2105)	Jammu and Kashmir, Himachal Pradesh, Meghalaya, Assam, Tripura, Arunachal Pradesh, Sikkim and Mizoram	Suitable for *Kharif* irrigated conditions, yield 74.0 q/ha, maturity medium 102 days, moderately tolerant to *Maydis* leaf blight disease, *Chilo partellus* insect, rich in tryptophan (0.78%) and lysine (3.25%)
IQMH 210 (IQPMH 2205)	Punjab, Haryana, Western Uttar Pradesh, Plains of Uttarakhand	Suitable for *Kharif* irrigated conditions, yield 85.0 q/ha, maturity medium 102 days, moderately tolerant to *Maydis* leaf blight, Banded leaf and sheath blight disease, *Chilo partellus* insect, rich in tryptophan (0.85%), lysine (4.07%)
IQMH 211 (IQPMH 2113)	Bihar, Jharkhand, Odisha, West Bengal and Eastern Uttar Pradesh, Rajasthan, Gujarat, Madhya Pradesh and Chhattisgarh	Suitable for *Kharif* irrigated conditions, yield 71.0 q/ha, maturity medium 102 days, moderately tolerant to Banded leaf and Sheath blight disease, *Chilo partellus* insect, rich in tryptophan (0.82%), lysine (3.55%)
IQMH 212 (IQPMH 2114)	Bihar, Jharkhand, Odisha, West Bengal and Eastern Uttar Pradesh	Suitable for *Kharif* irrigated conditions, yield 71.0 q/ha, maturity medium 91 days, moderately tolerant to *Maydis* leaf blight, Banded leaf and Sheath blight diseases, *Chilo partellus* insect, rich in tryptophan (0.91%), lysine (3.91%)

Variety	Area of adoption	Salient features
IQMH 213 (IQPMH-2203)	Rajasthan, Gujarat, Madhya Pradesh and Chhattisgarh	Suitable for *Kharif* irrigated conditions, yield 71.4 q/ha, maturity medium 91 days, moderately tolerant to *Curvularia* leaf spot, *Fusarium* stalk rot diseases, *Chilo partellus* insect, rich in tryptophan (0.82%), lysine (3.79%)
IQMH 214 (IQPMH-2204)	Maharashtra, Gujarat, Karnataka, Telangana, Andhra Pradesh, Tamil Nadu, Rajasthan, Madhya Pradesh and Chhattisgarh	Suitable for *Kharif* irrigated conditions, yield 86.0 q/ha, maturity medium 91 days, moderately tolerant to *Charcoal* rot, *Curvularia* leaf spot, *Fusarium* stalk rot diseases, *Chilo partellus* insect, rich in tryptophan (0.87%), lysine (3.98%)
IBCH 403 (Baby corn)	Jammu and Kashmir, Himachal Pradesh, Uttarakhand (Hill region), North Eastern Hill Regions (Meghalaya, Sikkim, Tripura, Nagaland, Manipur, Arunachal Pradesh), Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Telangana, Rajasthan, Gujarat, Madhya Pradesh, Chhattisgarh, Uttar Pradesh, Odisha, Bihar, West Bengal and Jharkhand	Suitable for *Kharif* irrigated conditions, average yield 19 q/ha, early maturity, moderately resistant to *Turcicum* leaf blight, *Curvularia* leaf spot, *Fusarium* stalk rot disease, *Chilo partellus* insect
IMH 232	Uttar Pradesh, Bihar, Jharkhand, Odisha and West Bengal	Suitable for *Kharif* irrigated conditions, yield 67.24 q/ha, maturity medium 89 days, moderately resistant to Maydis leaf blight, Charcoal rot, *Turcicum* leaf blight and *Fusarium* stalk rot diseases, *Chilo partellus* and Fall Army Worm insects
IMH 233	Punjab, Haryana, Plains of Uttarakhand, Western Uttar Pradesh and Delhi NCR	Suitable for *Rabi* irrigated conditions, yield 98.0 q/ha, maturity medium 126 days, moderately resistant to Charcoal rot, *Turcicum* leaf blight, Maydis leaf blight, *Fusarium* stalk rot diseases, *Chilo partellus* and Fall Army Worm insects
IMH 234	Uttar Pradesh, Bihar, Jharkhand, Odisha, West Bengal, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Telangana	Suitable for *Rabi* irrigated conditions, yield 98.0 q/ha, maturity medium 110–140 days, moderately resistant to Charcoal rot., *Turcicum* leaf blight, Maydis leaf blight, *Fusarium* stalk rot diseases, *Chilo partellus* and Fall Army Worm insects
IMH 235	Uttar Pradesh, Bihar, Jharkhand, Odisha and West Bengal	Suitable for *Rabi* irrigated conditions, yield 93.0 q/ha, maturity medium 148 days, moderately resistant to *Turcicum* leaf blight, Maydis leaf blight diseases, *Chilo partellus*, *Sesamia inference* and Fall Army Worm insects
Harlal-24	Maharashtra, Andhra Pradesh, Telangana, Karnataka and Tamil Nadu	Suitable for *Kharif* irrigated conditions, yield 102.0 q/ha, maturity late 115–120 days, moderately resistant to *Turcicum* leaf blight, Charcoal rot diseases, *Chilo partellus*, and Fall Army Worm insects
Bioseed 9766	Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu and Telangana	Suitable for *Kharif* irrigated conditions, yield 99.5 q/ha, maturity late 100–105 days, moderately resistant to Maydis Leaf Blight, Charcoal rot, *Turcicum* leaf blight, *Fusarium* stalk rot, Banded leaf and sheath blight diseases, *Chilo partellus* and Fall Army Worm insects
APQH 1	Spring Season: Punjab, Haryana, Delhi, Uttarakhand (Plain), Western Uttar Pradesh; *Rabi* season: Bihar, Jharkhand, Odisha, Eastern Uttar Pradesh, Assam, and West Bengal, Andhra Pradesh, Maharashtra, Telangana, Karnataka, Tamil Nadu, Gujarat, Madhya Pradesh, Chhattisgarh, and Rajasthan	Suitable for *Rabi* irrigated conditions, yield 81.0 q/ha, maturity medium 90–95 days, moderately resistant to Maydis Leaf Blight, Charcoal rot, *Turcicum* leaf blight diseases, *Chilo partellus* insects, rich in tryptophan (0.84%), lysine (4.09%), pro-Vit A (6.62 ppm)
APQH 5	Spring Season: Punjab, Haryana, Delhi, Uttarakhand (Plain), Western Uttar Pradesh *Rabi* season: Bihar, Jharkhand, Odisha, Eastern Uttar Pradesh Assam, and West Bengal, Maharashtra, Andhra Pradesh, Telangana, Karnataka and Tamil Nadu, Gujarat, Madhya Pradesh, Chhattisgarh and Rajasthan	Suitable for *Rabi* irrigated conditions, yield 80.0 q/ha, maturity medium 90–95 days, moderately resistant to *Turcicum* leaf blight, *Fusarium* stalk rot diseases, *Chilo partellus* and Fall Army Worm insects, rich in tryptophan (0.90%), lysine (3.98%), pro-Vit A (7.18 ppm)

Variety	Area of adoption	Salient features
ADC-3 Pusa Composite-5 (PC-5)	Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Meghalaya, Sikkim, Assam, Tripura, Nagaland, Manipur and Arunachal Pradesh	Suitable for *Kharif* irrigated conditions, yield 17.3 q/ha, maturity medium 103 days, moderately resistant to *Turcicum* leaf blight disease, Fall Army Worm and resistant to *Chilo partellus* insects
AH 8323 (Pusa Early Hybrid Maize-6)	Rajasthan, Madhya Pradesh, Chhattisgarh and Gujarat	Suitable for irrigated *Kharif* season, yield 81.8 q/ha, maturity (early) 96 days, moderately resistant to *Turcicum* leaf blight, *Maydis* Leaf Blight, *Curvularia* leaf spot, *Fusarium* stalk rot and Charcoal rot diseases, Fall Army Worm
Punjab Baby Corn 2	Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Meghalaya, Sikkim, Assam, Tripura, Nagaland, Manipur and Arunachal Pradesh	Suitable for irrigated, *Kharif* season, yield 18.86 q/ha, early maturity 52–55 days, moderately resistant to *Turcicum* leaf blight, *Chilo partellus* and Fall Army Worm insect
PMH 15	Gujarat, Rajasthan, Madhya Pradesh and Chhattisgarh	Suitable for irrigated *Kharif* season, yield 74.0 q/ha, early maturity, moderately resistant to *Fusarium* stalk rot, *Curvularia* leaf spot disease, *Chilo partellus* and Fall Army Worm insects
PMH 16	Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Meghalaya, Sikkim, Assam, Tripura, Nagaland, Manipur and Arunachal Pradesh	Suitable for irrigated *Kharif* season, yield 80.0 q/ha, early maturity, moderately resistant to *Turcicum* leaf blight, *Chilo partellus* and Fall Army Worm
RCRMH 20	Gujarat, Rajasthan and Madhya Pradesh	Suitable for irrigated, *Kharif* season, yield 80.8 q/ha, medium maturity 105–110 days, moderately resistant to *Chilo partellus* and Fall Army Worm
Indam 1202	Assam	Suitable for rainfed and irrigated *Boro* seasons, yield 64.3 q/ha, late maturity 135–150 days, resistant to moderately resistant to *Turcucum* leaf bligh, *Maydis* leaf blight, *Charcoal* rot and banded leaf sheath blight
Pant Sankar Makka-7 (PSM-7) (DH-344)	Uttarakhand	Suitable for irrigated *Kharif* season, medium maturity 90–95 days, yield 55.5 q/ha, moderately resistant *Maydis* Leaf Blight and *Turcicum* leaf blight diseases, *Chilo partellus* insect
Pant Sankar Makka-8 (PSM-8) (DH-346)	Uttarakhand	Suitable for irrigated *Kharif* season, yield 57.3 q/ha, medium maturity 90–97 days), moderately resistant *Maydis* leaf blight, *Charcoal* rot, *Curvularia* leaf spot, *Fusarium* stalk rot diseases, *Chilo partellus* insects
COH (M) 12 (CMH 15-005)	Tamil Nadu	Suitable for irrigated *Kharif* season, yield 81.3 q/ha, late maturity 110 days, moderately resistant *Turcicum* leaf blight, *Maydis* leaf blight, Charcoal rot, *Fusarium* stalk rot diseases, *Chilo partellus* and Fall Army Worm
R 8050 (R-3437)	Gujarat, Rajasthan, Madhya Pradesh and Chhattisgarh	Suitable for *Kharif* irrigated condition, yield 91.17 q/ha, maturity 100 days, moderately resistance to *Curvularia* leaf spot and *Fusarium* stalk rot diseases, *Chilo partellus* and Fall Army Worm insects
TMMH-2882	Gujarat, Rajasthan, Madhya Pradesh and Chhattisgarh	Suitable for *Rabi* irrigated condition, yield 106 q/ha, maturity 135–140 days, moderately resistant to Maydis leaf blight, banded leaf and sheath blight, Charcol rot
NK-7660 (SYN-207660)	Uttar Pradesh (West), Haryana, New Delhi, Punjab, Uttarakhand (Plain), Karnataka, Andhra Pradesh, Tamil Nadu and Telangana, Maharashtra	Suitable for *Rabi* irrigated condition, yield 98 q/ha, maturity 106–130 days, moderately resistant to *Turcicum* leaf blight disease, shoot fly, *Chillo partellus* and Fall Army Worm insects.
NK-7884 (SYN-207884)	Uttar Pradesh (West), Haryana, New Delhi, Punjab, Uttarakhand (Plain)	Suitable for *Rabi* irrigated condition, yield 103 q/ha, maturity 135 days, moderately resistant shoot fly
SMH 4555	Uttar Pradesh (West), Haryana, New Delhi, Punjab, Uttarakhand (Plain), Rajasthan, Gujarat and Madhya Pradesh, Chhattisgarh	Suitable for *Kharif* irrigated condition, yield 74 q/ha, early maturity 105–110 days, *Maydis* leaf blight, Charcoal rot, banded leaf and sheath blight, *Chilo partellus* and Fall Army Worm insects
ADV 785 (ADV-7733)	Bihar, Jharkhand, Odisha, West Bengal, Assam and Eastern Uttar Pradesh	Suitable for *Rabi* irrigated condition, yield 100 q/ha, maturity 140–145 days, *Maydis* leaf blight, *Turcicum* leaf blight diseases and *Chilo partellus* and *Sesamia inference*
ADV 752 (ADV-7211)	Karnataka, Maharashtra, Tamil Nadu, Telangana and Andhra Pradesh	Suitable for *Kharif* irrigated condition, yield 99.9 q/ha, maturity 110–115 days, *Turcicum* leaf blight, Charcoal rot and *Fusarium* stalk rot diseases, *Chillo Partellus* and fall army worm insects

Variety	Area of adoption	Salient features
Pusa Super Sweet Corn-3 (APSKH-1)	NWPZ: Haryana, Delhi, Uttrakhand (Plain), Uttar Pradesh (Western region); NEPZ: Uttar Pradesh (Eastern region), West Bengal, Bihar, Jharkhand, Odisha PZ: Karnataka, Tamil Nadu, Andhra Pradesh, Maharashtra, Telangana CWZ: Chhattisgarh, Madhya Pradesh, Gujarat and Rajasthan	Suitable for *Kharif* irrigated condition, yield 117.45 q/ha, maturity 65–75 days, rich in high provitamin-A (6.89 ppm), lysine (0.29% in flour and tryptophan (0.071%) in flour, moderately resistant to *Maydis* leaf blight
Pusa Waxy Maize Hybrid-1 (AQWH-4)	Punjab, Haryana, Delhi, Uttarakhand (Plain), Uttar Pradesh (Western region)	Suitable for *Kharif* irrigated condition, yield 72.7 q/ha, maturity 90 days, moderately resistant to maydis leaf blight disease.
Pusa Male Sterile Baby Corn Hybrid-3 (ABHS-27)	Gujarat, Madhya Pradesh, Chhattisgarh and Rajasthan	Suitable for *Kharif* irrigated condition, yield 14.08 q/ha, maturity 70 days, moderately resistant to *Curvularia* leaf spot, *Fusarium* stalk rot disease, Fall Army Worm insect
Pusa Biofortified Maize Hybrid-8 (ALQH-9)	Bihar, Jharkhand, Odisha, Uttar Pradesh (Eastern region), West Bengal	Suitable for *Kharif* irrigated condition, yield 49.6 q/ha, maturity 90–95 days, rich in lysine (0.347% in flour), tryptophan (0.074% in flour), low phytic acid (2.17 mg/g), moderately resistant to *Maydis* leaf blight disease
Pusa Biofortified Maize Hybrid-6 (APTQH-1)	(NWPZ) Punjab, Haryana, Delhi, Uttarakhand (Plain), Uttar Pradesh (Western region); (NEPZ) Bihar, Jharkhand, Odisha, Uttar Pradesh (Eastern region), West Bengal and (CWZ) Gujarat, Madhya Pradesh, Chhattisgarh and Rajasthan	Suitable for *Kharif* irrigated condition, yield 74.27 q/ha, maturity 93.2 days, rich in lysine (0.358% in flour), tryptophan (0.079% in flour), provitamin-A (6.03 ppm), a-tocopherol/vitamin-E (21.38 ppm), moderately resistant to Maydis leaf blight diseases
Pusa Biofortified Maize Hybrid-7 (ALPQH-1)	NWPZ: Punjab, Haryana, Delhi, Uttarakhand (Plain), Uttar Pradesh (Western region) CWZ: Gujarat, Madhya Pradesh, Chhattisgarh and Rajasthan	Suitable for *Kharif* irrigated condition, yield 72.57 q/ha, maturity 92.4 days, rich in lysine (0.327% in flour), tryptophan (0.080% in flour), low phytic acid (2.21 mg/g), moderately resistant to Maydis leaf blight
Pusa HQPM-4 Improved (APQH-4)	NWPZ: Punjab, Haryana, Delhi, Uttarakhand (Plain), Uttar Pradesh (Western region) CWZ: Gujarat, Madhya Pradesh, Chhattisgarh and Rajasthan	Suitable for *Kharif* irrigated condition, yield 78.50 q/ha, maturity 93 days, rich in lysine (0.345% in flour), tryptophan (0.078% in flour), provitamin-A (6.04 ppm), moderately resistant to charcoal rot, *Curvularia* leaf spot, *Fusarium* stalk rot diseases, *Chilo partellus* and Fall Army Worm insects
HQPM-29	Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Meghalaya, Sikkim, Assam, Tripura, Nagaland, Manipur and Arunachal Pradesh	Suitable for *Kharif* irrigated condition, yield 71.63 q/ha, maturity 90 days, rich in lysine (0.295%), tryptophan (0.07%), moderately resistant to bacterial stalk rot, *Turcicum* leaf blight, banded leaf and sheath blight disease and *Chilo partellus*
HPC-4	Punjab, Haryana, Delhi, Plains of Uttarakhand and Western Uttar Pradesh	Suitable for spring irrigated condition, yield 45.3 q/ha, maturity 116 days, moderately resistant to *Maydis* leaf blight, *Turcicum* leaf blight and *Fusarium* stalk rot diseases, *Chilo partellus* and Fall Army Worm insects
DKC-9126	Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu and Telangana, Jammu and Kashmir, Himachal Pradesh and Uttarakhand	Suitable for *Kharif* irrigated condition, yield 84.9 q/ha, maturity 115–120 days, moderately resistant to *Maydis* leaf blight, *Turcicum* leaf blight diseases, *Chilo partellus* insect
DKC-9133	Rajasthan, Gujarat, Chhattisgarh and Madhya Pradesh	Suitable for *Kharif* irrigated condition, yield 67.6 q/ha, maturity 115 days, moderately resistant to stalk rot, *Turcicum* leaf blight, *Maydis* leaf blight, banded leaf and sheath blight diseases, *Chillo Partellus* insect
DKC-9144	Andhra Pradesh, Telangana, Maharashtra, Karnataka and Tamil Nadu	Suitable for *Kharif* irrigated condition, yield 86.0 q/ha, maturity 105–110 days, moderately resistant to stalk rots disease, *Chilo partellus* insect.
DKC-9165	Rajasthan, Madhya Pradesh, Chhattisgarh and Gujarat	Suitable for *Kharif* irrigated condition, yield 103 q/ha, maturity 105–110 days, moderately resistant to *Turcicum* leaf blight, banded leaf and sheath blight diseases, *Chilo partellus* insect

Variety	Area of adoption	Salient features
KMH-8333	Andhra Pradesh, Telangana, Karnataka, Maharashtra and Tamil Nadu	Suitable for *Kharif* irrigated condition, yield 105 q/ha, maturity 100 days, moderately resistant to *Turcicum* leaf blight and Charcoal rot diseases, *Chilo partellus* insect
Rajendranagar Makka-182 (DHM 182) (BH-417182)	Telangana	Suitable for *Kharif* rainfed condition and *Rabi* irrigated condition, yield 102 q/ha, maturity 95–100 days, moderately resistant to *Maydis* leaf blight, *Turcicum* leaf blight and charcoal rot diseases; *Chilo partellus* and Fall Army Worm insects
Sikkim Organic Maize Composite-3/ SKOMC-3 (KDM-34)	Sikkim	Suitable for spring rainfed condition, yield 40.5 q/ha, maturity 95–100 days, moderately resistant to *Maydis* leaf blight, *Turcicum* leaf blight, banded leaf and sheath blight diseases, *Chilo partellus* insects
Sikkim Organic Maize Composite-4/ SKOMC-4 (KDM-35)	Sikkim	Suitable for spring rainfed condition, yield 38 q/ha, maturity 95–100 days, moderately resistant to maydis leaf blight, *Turcicum* leaf blight, banded leaf and sheath blight diseases, *Chilo partellus* insects
Gujarat Maize Hybrid 5 (GMH 5: Panam Gold) (GYH-1911)	Gujarat	Suitable for *Kharif* rainfed condition, yield 71.0 q/ha, maturity 103–106 days, moderately resistant to maydis leaf blight, *Turcicum* leaf blight, *Fusarium* stalk rot diseases, Fall Army Worm insect
MAHb 15-84	Zone-5 and 6 of Karnataka	Suitable for *Kharif* rainfed condition, yield 91.4 q/ha, maturity 125–130 days, moderately resistant to *Turcicum* leaf blight, Sorghum downy mildew, *Chilo partellus* insect.
Barley		
DWRB-223	Punjab, Haryana, Delhi, Rajasthan (excluding Kota and Udaipur), Western Uttar Pradesh (except Jhansi), Jammu and Kathua district of Jammu and Kashmir, Paonta Valley and Una district of Himachal Pradesh and Tarai region of Uttarakhand	Suitable for irrigated, timely sown conditions, yield 43.0 q/ha, maturity 138 days, moderately tolerant to lodging, rich in protein (11.7%), zinc (47.8 ppm) and iron (43.7 ppm), resistant to yellow and brown rusts
Azad Barley-34 (KB-2031)	Punjab, Haryana, Delhi, Rajasthan (excluding Kota and Udaipur) Western Uttar Pradesh (except Jhansi), Jammu and Kathua district of Jammu and Kashmir, Paonta Valley and Una district of Himachal Pradesh and Tarai region of Uttarakhand, Eastern Uttar Pradesh, Bihar, Jharkhand, Odisha, West Bengal and Assam	Suitable for timely sown, irrigated salinity-alkalinity stress soil, yield 37.0 q/ha, maturity 131–138 days, highly resistant to brown rust and yellow rust, resistant to leaf blight, tolerant to salinity and alkalinity soil stress, lodging resistant.
UPB 1106 (Pant Jau 1106)	Eastern Uttar Pradesh, Bihar, Jharkhand, Odisha, West Bengal, Assam and plains of NE States	Suitable for irrigated timely sown conditions, yield 44.5 q/ha, maturity 117 days, protein 12.3%, resistant to brown rust and moderately resistant to yellow rust and leaf blight, lodging tolerant
Sorghum		
CSH-56 (Mahabeej-727) (SPH-2021)	Maharashtra and Madhya Pradesh	Suitable for timely sown *Kharif* rainfed condition, yield grain–39.30 q/ha, fodder–129.0 q/ha, maturity 114–117 days, high grain Fe (31.05 ppm), Zn (19.01 ppm) and protein (9.93%), tolerant to major insects, pests and foliar diseases
CSV 67 (SPV-2976)	Gujarat and Rajasthan	Suitable for timely sown rainfed *Kharif* ecology, yield grain–29.30 q/ha, fodder–170.0 q/ha, maturity 115 days, moderate resistance to grain mold and foliar diseases, moderate tolerance to shoot fly and stem borer
Maldandi Supreme (SPH-2036)	Maharashtra, Andhra Pradesh, Karnataka and Telangana	Suitable for *Rabi* ecology, yield grain–35.23 q/ha, fodder–88.39 q/ha, maturity 115–117 days, crude protein–10.67%, better overall roti quality, color texture, taste, flavor and % total sugars, tolerant to charcoal rot and leaf blight diseases and to major insects and pests
CSH 57 (SPH 2024)	Maharashtra and Madhya Pradesh	Suitable for early, timely and rainfed (*Kharif*), conditions, yield grain–40.74 q/ha, fodder–131.31 q/ha, maturity 112–118 days, high grain Fe (27.41 ppm), Zn (16.94 ppm) and protein (9.63%), moderately resistant to major insect pests and for major foliar diseases
CSV 65 Yellow (SPV 2906)	Maharashtra, Gujarat Karnataka and Telangana	Suitable for *Kharif* rainfed condition, grain yield 22.5 q/ha, fodder yield 110.5 q/ha, maturity 110–112 days, protein 10.40%, grain amylose 16.6 %, Fe 30.8 ppm, Zn 23.2 ppm, resistant to major foliar diseases, resistant to major insects
DSH-7 (CSH-55) (SPH-1974)	Karnataka, Tamil Nadu and Rajasthan	Suitable for *Kharif* rainfed condition, grain yield 48.17 q/ha, fodder yield 118 q/ha, maturity 108–110 days, protein 7.92%, moderately tolerant to grain mold, tolerant to shoot fly

Variety	Area of adoption	Salient features
DSV-10 (CSV-62) (SPV-2773)	Karnataka, Telangana, Madhya Pradesh, Gujarat and Rajasthan	Suitable for *Kharif* rainfed condition, grain yield 35.92 q/ ha, fodder yield 150 q/ha, maturity 110–115 days, protein 8.61%, grain amylose 14.07%, moderately tolerant to grain mold, tolerant to shoot
CSV 66 SS (SPV-2890)	Maharashtra, Andhra Pradesh, Telangana, Karnataka, Tamil Nadu, Punjab, Uttar Pradesh, Madhya Pradesh and Gujarat	Suitable for *Kharif* season, sweet sorghum variety, fresh stalk yield 48 q/ha, juice yield 17378 l/ha, ethanol yield 1309 l/ha, brix 15.7%, maturity 125–130 days, tolerance to grain mold and foliar diseases, tolerance to shoot fly and stem borer
RTS-43	Zone-1, 2 and 3 of Karnataka	Suitable for rainfed *Kharif* season, yield 12.5 q/ha, maturity 96–110 days, improved mineral contents (Fe and Zn), moderately resistant to charcoal rot, blight, and rust disease, moderately resistant to shoot fly
GJ-103 (Surati Ponk-1) (SRP-5)	Gujarat	Suitable for *Rabi* season, yield 15.4 q/ha, maturity 114 days, higher in protein, brix value, ether extract, calcium and phosphorus content, moderately resistant to Charcoal rot, blight, rust disease and shoot fly
Pearl Millet		
US 7773 (MH 2717)	Maharashtra, Andhra Pradesh, Karnataka, Telangana, Tamil Nadu, Odisha, Rajasthan, Gujarat, Haryana, Madhya Pradesh, Uttar Pradesh, Punjab and Delhi	Suitable for rainfed *Kharif* season, grain yield 37–41.4 q/ha, dry fodder yield 93–123 q/ha, maturity 85–88 days, resistant / tolerant to downy mildew, blast, ergot smut and rust, rich in (Fe 49 ppm) and Zn (35 ppm)
MP 7173 (MH 2709)	Rajasthan, Haryana, Gujarat, Uttar Pradesh, Madhya Pradesh, Punjab and Delhi	Suitable for rainfed *Kharif* season, grain yield 41 q/ha, dry fodder yield 111 q/ha, maturity 84 days, resistant/tolerant to downy mildew, blast, ergot smut and rust, rich in Fe (54 ppm) and Zn (36 ppm)
VNR-3245 (MH 2712) (VNR-106)	Rajasthan, Haryana, Gujarat, Uttar Pradesh, Madhya Pradesh, Punjab and Delhi	Suitable for rainfed *Kharif* season, grain yield 39 q/ha, dry fodder yield 119 q/ha, maturity 87 days, resistant / tolerant to downy mildew, blast, ergot smut and rust, rich in Fe (60 ppm) and Zn (39 ppm)
RHB 273 (MH 2673)	Rajasthan, Gujarat and Haryana	Suitable for rainfed (Early A_1 Zone) condition, grain yield 22.4 q/ha, dry fodder yield 48 q/ha, maturity 75 days, resistant / tolerant to downy mildew, blast and other foliar diseases, rich in Fe (44 ppm) and Zn (37 ppm)
APHB 126 (MH 2682)	Maharashtra, Tamil Nadu, Karnataka, Andhra Pradesh, Telangana and Odisha	Suitable for rainfed *Kharif* season, grain yield 32.8 q/ha, dry fodder yield 71 q/ha, maturity 84 days, resistant / tolerant to downy mildew, blast and other foliar diseases, rich in Fe (50 ppm) and Zn (33 ppm)
MP-7214 (MH-2626) (Hybrid)	Rajasthan, Haryana, Gujarat, Uttar Pradesh, Madhya Pradesh and Punjab	Suitable for timely sown irrigated condition, yield 41 q/ ha, maturity 84 days, rich in Fe (60 ppm), Zn (36 ppm), highly resistance to downy mildew, blast, rust, smut and ergot, tolerant to shoot fly, stem borer, *Helicoverpa,* leaf roller
PA 9010 (MH 2631) (Hybrid)	Rajasthan, Haryana Gujarat, Uttar Pradesh, Madhya Pradesh and Punjab	Suitable for timely sown irrigated condition, yield 40.49 q/ha, maturity 85 days, rich in Fe (54 ppm), Zn (35 ppm), highly resistance to downy mildew, blast, rust, smut and ergot, tolerant to shoot fly, stem borer, *Helicoverpa*, leaf roller
Little millet		
PDKV Tejashree (BLM 18-21)	Maharashtra	Suitable for *Kharif* season, yield grain 22.63 q/ha, maturity 100–110 days, resistant to leaf blight, leaf blast and brown spot disease, tolerant to shoot fly
CLMV 3 (LMV 539)	Chhattisgarh and Madhya Pradesh	Suitable for rainfed *Kharif* condition, yield 14.81 q/ ha, maturity 80 days, protein 9.1%, Fe–2.3 mg/ 100 g and Zn–1.5 mg/100 g, resistant to leaf blight and brown spot, moderately resistant to banded blight, tolerant to shoot fly
GV-5 (Mavli)	Gujarat	Suitable for rainfed *Kharif*, yield 17.48 q/ ha, maturity 90–100 days, protein 7.82%, Ca (18.4 mg/100 g), Zn (3.88 mg/100 g), crude fiber (8.36%) and ash content (7.92%), resistant to leaf and neck blast, grain smut disease, resistant to shoot fly
Finger millet		
OUAT Kalinga Finger millet-3 (Shreenidhi) (FMV-1143) (OEB-604)	Odisha	Suitable for *Kharif* season, yield grain 25.20 q/ha, maturity 124 days, non-shattering, resistant to leaf blast, neck blast, finger blast and brown spot, highly resistant to stem borer, grasshopper and aphids
VL Mandua 410 (CFMV 8) (FMV 1209)	Bihar, Uttarakhand and Assam	Suitable for rainfed *Kharif* condition, yield 33.14 q/ha, maturity 117 days, superior calcium content (380.5 mg/100 g), moderately resistant to foliar diseases, tolerance to stem borer
Rajendra Madua-1 (RAUF-17)	Bihar	Suitable for irrigated/ rainfed condition, yield 38 q/ha, maturity 118 days, high iron (40.0 ppm) and calcium (341 mg), high degree of resistance against blast, tolerant to drought

Variety	Area of adoption	Salient features
Proso Millet		
Alluri (PMV 480)	Andhra Pradesh, Bihar, Karnataka and Tamil Nadu	Suitable for rainfed *Kharif,* yield grain 22.65 q/ha, fodder–45.36 q/ha, maturity 72–77 days, protein–10.85%, resistant to banded and leaf blight, less shoot fly incidence
CPRMV-2 (PMV-473) (DHPM-8-3)	Andhra Pradesh, Karnataka, Tamil Nadu and Puducherry	Suitable for rainfed *Kharif* condition, yield 24.15 q/ha, maturity 73 days, protein 12.71%, Zn–42.0 mg/kg, Fe–8.3 mg/kg, Mn–13.7 mg/ kg, Cu–8.6 mg/ kg, resistant to brown spot, leaf blast, leaf blight, tolerant to shoot fly
Foxtail Millet		
FXV-652 (GPUF-16) (CFXMV-3)	Bihar, Karnataka and Andhra Pradesh	Suitable for rainfed *Kharif* condition, yield 31.78 q/ ha, maturity 82–84 days, Zn–55.67 ppm, Fe–16.46 ppm and Ca–154.59 ppm, resistant to brown spot, moderately resistant to leaf blast, banded blight
CFXMV-2 (FXV 647)	Karnataka, Madhya Pradesh and Maharashtra	Suitable for rainfed *Kharif* condition, yield 27.89 q/ ha, maturity 85–88 days, protein 10.73%, Fe-37 ppm and Zn-48.43 ppm, resistant to rust, moderately resistant to brown spot, leaf spot, banded blight, tolerant to shoot fly
Barnyard Millet		
GB-2 (Sabari)	Gujarat	Suitable for rainfed *Kharif* condition, yield 19.57 q/ ha, maturity 90–100 days, protein 8.45%, calcium 22.3 (mg/100 g), Zn 2.89 (mg/100 g) and Fe 8.26 (mg/100g), moderately resistant to leaf and neck blast, grain and head smut disease, resistant to shoot fly

Oilseeds: Thirty two of oilseeds comprising 9 of indian mustard, 1 of gobhi sarson, 6 of groundnut, 4 of sesame, 2 of niger, 4 of safflower, 2 of sunflower, 1 of castor and 3 of soybean were released for different agro-ecological regions.

List of improved released varieties/hybrids of Oilseeds

Variety	Area of adoption	Salient features
Indian Mustard		
RHH 2101	Punjab, Haryana, Delhi and northern Rajasthan	Suitable for timely sown irrigated conditions, yield 28.49 q/ha, maturity 142 days, less susceptible to foliar diseases as compared to susceptible checks, low aphid infestation in comparison to checks, oil content 39.7%
Goverdhan KMR (L) 17-5	Uttar Pradesh	Suitable for late sown irrigated conditions, yield 12.56 q/ha, maturity 125–127 days, moderately resistant to *Alterrnaria* blight and white rust, oil content- 39.60–40.0%
PDKV Kartik (ACN 237)	Maharashtra	Suitable for timely sown irrigated conditions, yield 15.45 q/ha, maturity 103 days, tolerant to powdery mildew and less susceptible to aphid, oil content- 40.32%
PA-5252	Punjab, Haryana, Delhi and Rajasthan	Suitable for timely sown irrigated condition, yield 27.96 q/ha, maturity 133–145 days, less severity of *Alternaria* blight, white rust, *Sclerotinia* rot and powdery mildew, low aphid infestation, oil content 40 %
BPMQ 47 [DRMRCI(Q)47]	Jammu, Punjab, Haryana, Delhi and Rajasthan	Suitable for timely sown irrigated condition, yield 23.48 q/ha, maturity 143–145 days, low erucic acid, resistant to white rust disease, less susceptibility to *Alternaria* blight, *Sclerotinia* rot and downy mildew diseases, low aphid infestation, oil content- 40.5%
BPM 1825 (DRMR 2018-25)	Rajasthan, Uttar Pradesh, Madhya Pradesh, Uttrakhand and Bihar	Suitable for timely sown irrigated condition, yield 26.30 q/ha, maturity 133–137 days, resistant to white rust disease, less susceptibility to *Alternaria* blight, *Sclerotinia* rot, downy mildew, low aphid infestation, oil content 41.7%
SVJH-71	Punjab, Haryana, Delhi and	Suitable for timely sown irrigated condition, yield 29.34 q/ha, maturity 136–144 days, less susceptibility to *Alternaria* blight, white rust, *Sclerotinia* rot and powdery mildew, low aphid infestation, oil content- 39.4%
Pusa Mustard 37 (NPJ-253)	Jammu, Punjab, Haryana, Delhi, Western Uttar Pradesh and Northern Rajasthan and Uttarakhand, Uttar Pradesh, Madhya Pradesh, Eastern Rajasthan and Bihar	Suitable for timely sown irrigated condition, Zone-II: yield 26.41q/ha, maturity 145 days, oil content 35.3–41.60 %, Zone-III: yield 26.83 q/ha, maturity 134 days, oil content 37.30–44.80%, less susceptibility to *Alternaria* blight, white rust, *Sclerotinia* rot and powdery mildew, low aphid infestation
Malviya Nidhi HUJM-10-6	Uttar Pradesh	Suitable for timely sown irrigated condition, yield 15.76 q/ha, maturity 128 days, moderately tolerant to white rust disease, tolerant to heat stress, oil content 39.48%

Variety	Area of adoption	Salient features
Gobhi Sarson		
PGSH-2155	Himachal Pradesh, Jammu and Kashmir and Punjab	Suitable for timely sown irrigated conditions, yield 23.01 q/ha, maturity 158 days, low disease severity for downy, powdery mildew, *Sclerotinia* stem rot, less susceptible to aphid, oil content 40.0%
Groundnut		
GNH 804	Haryana	Suitable for irrigated conditions, yield 32.03 q/ha, maturity 121 days, moderately resistant to early leaf spot, rust, collar rot and dry root rot, moderately resistant to leafhopper, oil content 51.9%
Gujarat Groundnut-24 (Sorath Urja) (Virginia bunch)	Gujarat	Suitable for timely sown rainfed condition, yield 26.00 q/ha, maturity 119 days, protein 22.26%, Fe (ppm) 20.53, Zn (ppm) 27.94, tolerant to tikka, rust, stem rot, collar rot, less infestation of pests, oil content 51.37%
Gujarat Groundnut-42 (Sorath Shaan) (Virginia runner)	Gujarat	Suitable for timely sown rainfed condition, yield 23.93 q/ha, maturity 118 days, protein 25.89%, Fe (ppm) 16.43, Zn (ppm) 25.94, tolerant to late leaf spot, rust, stem rot and collar rot, oil content- 49.68%
Sahyadri Durga (Spanish bunch)	Zone-4 of Karnataka	Suitable for timely rainfed/irrigated both for *Kharif* and *Rabi*/Summer dual seasons, yield 25–28 q/ha, maturity 108–110 days, protein 28–29%, high oleic acid (78–80%), resistant to late leaf spot, rust, moderately tolerant to leaf miner and *Spodoptera*, oil content 50–51%
CAU-GSI (Spanish bunch)	Manipur	Suitable for timely sown rainfed condition, yield 21.44 q/ha, maturity 125–130 days, red kernel, moderately tolerant to late leaf spot, oil content 52%
Pratap Mungphali 4 (UG 243) (Spanish bunch)	Rajasthan	Suitable for rainfed/irrigated condition, yield 37.00 q/ha, maturity 112 days, protein 28%, resistant to early leaf spot, moderately resistant to collar rot, stem rot, late leaf spot, moderately resistant to *Spodoptera litura*, leaf miner, defoliators, jassids, thrips and leafhopper, oil content 46–48%
Sesame		
Thandava/ Simhagiri/ Ranga (YLM-146)	West Bengal, Madhya Pradesh, Bihar and Andhra Pradesh	Suitable for summer, medium-late, irrigated condition, yield 7.8 to 9.6 q/ha, maturity 90–95 days, moderately resistant to *Macrophomina* root, stem rot, phyllody, *Alternaria* and *Cercopspora* leaf spots, oil content 42- 43.6%, oleic to linoleic acid ratio in oil 1.13
RT-392 (Rajasthan Til-392)	Rajasthan, Punjab, Uttar Pradesh, Gujarat, Maharashtra and Telangana	Suitable for rainfed condition of *Kharif* season, yield 56.7 q/ha, maturity 88 days, moderately resistant to *Macrophomina* root rot, stem rot, phyllody leaf webber and capsule borer, white seeded, oil content 43.8%
Guiarat Til 9 (G.Til 9) (AT 383)	Madhya Pradesh and Uttar Pradesh	Suitable for *Rabi*-summer condition, yield 83.1 q/ha, maturity 88–92 days, resistant to shattering, fertilizer responsive, white seeded, oil content 45.4%
Jagtiala Nuvvulu-3287 (JCS-3287)	Telangana	Suitable for summer, yield 9.48–12.27 q/ha, maturity 90–95 days, black seeded variety, crude protein 25.42%, iron 129.27 mg/kg, zinc 81.18 mg/kg and calcium 14707 mg/kg, moderately resistant to powdery mildew, phyllody, M*acrophomina* stem and root rot. Gallfly, oil content 44.8–47%, oleic acid 40.96%, linoleic acid 38.65%
Niger		
GNNIG-5 (Aarohi)	Madhya Pradesh, Maharashtra, Odisha, Gujarat, Andhra Pradesh and Telangana	Suitable for rainfed, medium late *Kharif* condition, yield 5.5 q/ha, maturity 94 days, resistant to *Alternaria* leaf spot, stem/root rot, resistant to Niger caterpillar, white fly, leaf hopper, oil content 36.0%
OUAT Kalinga Niger-1 (Prabhat) (ONS-175)	Odisha	Suitable for *Kharif* and pre-*Rabi* situation, yield 6.0–7.0 q/ha, medium maturity 104–110 days, moderately resistant to *Alternaria* and *Cercospora* leaf spot, oil percentage 38.3–39.8%
Safflower		
PBNS-221 (Parbhani Sujalam)	Maharashtra, Andhra Pradesh and Karnataka, Telangana	Suitable for rainfed condition, yield 15.43 q/ha, maturity 125–128 days, moderately resistant to *Fusarium* wilt, tolerant to *Alternaria* leaf spot, oil content 33.9%
PBNS-222 (Parbhani Sufalam)	Maharashtra, Andhra Pradesh and Karnataka, Telangana	Suitable for rainfed condition, yield 15.51 q/ha, maturity 127–130 days, moderately resistant to *Fusarium* wilt, oil content 34.3%
Phule Siddhi (SSF-18-69)	Maharashtra, Andhra Pradesh Karnataka, Telangana Madhya Pradesh and Chhattisgarh	Suitable for rainfed and irrigated condition, yield 16.88 q/ha, maturity 132–139 days, moderately resistant to *Fusarium* wilt, tolerant to *Alternaria* leaf spot, oil content 37.2%
PDKV White (AKS-351)	Maharashtra	Suitable for rainfed condition, yield 16.95 q/ha, maturity 136–140 days, tolerant to Aphid and moderately resistant to *Alternaria* leaf spot, oil content 30.5%
Castor		
YRCH 3 (YRCH 19014)	Tamil Nadu (Except Nilgiris and Kanyakumari District)	Suitable for rainfed and areas of limited irrigated potential, yield 20.14 q/ha, maturity 150–170 days, resistant to lodging, non-shattering type, resistant to wilt, oil content 49.0 %

Variety	Area of adoption	Salient features
Soybean		
JS 23-03 (Jawahar Soybean 23-03)	Madhya Pradesh, Vidarbha and Marathwada regions of Maharashtra, Rajasthan, Gujarat and Bundelkhand region of Uttar Pradesh	Suitable for early rainfed condition, yield 21.67 q/ha, maturity 93.5 days, high to moderate resistant against major diseases of soybean, oil content 20.12%
JS 23-09 (Jawahar Soybean 23-09)	Madhya Pradesh, Vidarbha and Marathwada regions of Maharashtra, Rajasthan, Gujarat and Bundelkhand region of Uttar Pradesh	Suitable for early rainfed condition, yield 20.88 q/ha, maturity 92.1 days, high to moderate resistant against major diseases of soybean, tolerance to major insect pest, oil content 20.21%
CAU-MS 1	Manipur	Suitable for timely sown rainfed condition, yield 23 q/ha, maturity 105–110 days, oil content 12.5%, protein content 43.22%, resistant against *Alternaria* leaf spot, collar rot, moderately to least resistant against *Lepidopteran* defoliator pests, soybean aphid and whitefly, soymilk yield of 8.91 L/kg seed with 6.2% TSS and high tofu yield with 317 g/L of soymilk
Sunflower		
TilhanTec-SUNH-3 (IIOSH-434)	Uttarakhand, Jammu and Kashmir, Gujarat, Maharashtra, Northern Karnataka, Andhra Pradesh, Southern Karnataka, Tamil Nadu and Telangana	Suitable for both *Kharif* and *Rabi* seasons under rainfed and irrigated conditions, yield 15–20 q/ha (rainfed) 20–26 q/ha (irrigated), maturity 87–90 days, resistant to downy mildew, moderately resistant to leafhopper, oil content 37.8%
KBSH-90	Uttarakhand, Jammu and Kashmir, Gujarat, Maharashtra and Northern Karnataka, Andhra Pradesh, Southern Karnataka, Tamil Nadu and Telangana	Suitable for *Kharif* under rainfed and irrigated conditions, yield 16.7 q/ha, maturity 82–85 days, resistant to downy mildew, tolerant to leafhoppers, thrips, white flies and head borer, oil content 36.6%

Pulses: Thirty-six of Pulses comprising 3 of Mung bean, 4 of urd bean, 7 of pigeonpea, 2 of cowpea, 1 of rajmash, 2 of moth bean, 1 of *lathyrus*, 5 of lentil, 7 of chickpea and 4 of Field pea were released for different agro-ecological regions.

List of released varieties/hybrids of Pulses

Variety	Area of adoption	Salient features
Green gram/ Mung bean		
Dweep Mung-1	Andaman and Nicobar Islands	Suitable for rainfed rice fallow situations, yield 16.0 -17.0 q/ha, maturity 66–70 days, moderately resistant to prevailing pathotype of charcoal rot, powdery mildew and mungbean yellow mosaic virus
Dweep Mung-4	Andaman and Nicobar Islands	Suitable for rainfed condition, yield 17.0–18.0 q/ha, maturity 61–70 days, moderately resistant to prevailing pathotype of charcoal rot, powdery mildew and mungbean yellow mosaic virus
Pusa Sodicity Mungbean-12 (PSM-12)	Uttar Pradesh	Suitable for early sown condition, yield 6–7 q/ha, maturity 70–74 days, moderate sodic (usar conditions) tolerance (pH-8.7), resistant to pod borer, jassids and *Maruca* (pod borer moth)
Urd bean		
VBN 12 (VBG 13-003)	Tamil Nadu	Suitable for *Rabi* and rice fallow condition, yield 8.0–10.0 q/ha, maturity 75–80 days, resistant to mung bean yellow mosaic virus, powdery mildew, urd bean leaf crinkle virus diseases, protein content 25.6%
OUAT Kalinga Blackgram 1(Shreeya) (OBG 101)	Odisha	Suitable for rice fallow situations, yield 9.0–10.0 q/h, maturity 75–80 days, resistant to mung bean yellow mosaic virus, leaf crinkle and leaf curl virus, moderately resistant to *Cercospora* leaf spot, powdery mildew
Dweep Urd-1	Andaman and Nicobar Islands	Suitable for rainfed condition, yield 12.0–13.0 q/ha, maturity 60–70 days, moderately tolerant to aphid infestation and pod borer
IPU-13-6 (Tapti)	Madhya Pradesh	Suitable for irrigated spring season, yield 12.46 q/ha, maturity 75–80 days, protein 22.0%, highly resistant to mung bean yellow mosaic virus and resistant to urdbean leaf crinkle, leaf curl virus, web blight, bacterial leaf blight, powdery mildew and *Cercospora* leaf spots, resistant to white fly, pod borer and pod bug, tolerant to drought
Pigeon pea		
BDNPH 2018-05	Maharashtra, Gujarat, Madhya Pradesh and Chhattisgarh	Suitable for *Kharif* season, hybrid, yield 17–22 q/ha, maturity 155–160 days, moderately resistant to wilt and sterility mosaic disease
Telangana Kandi-4 (TDRG-272)	Telangana, Andhra Pradesh, Tamil Nadu, Karnataka and Odisha	Suitable for rainfed/irrigated areas in *Kharif* season, yield 16.59 q/ha, maturity 163 days, protein 22.36%, moderately resistant to wilt

Variety	Area of adoption	Salient features
GJP-1820 Gujarat Tur 111 (Sorath Ratan)	Gujarat	Suitable for *Kharif* rainfed condition, yield 21.97 q/ha, maturity 175–180 days, protein 20.26%, moderately resistant to wilt, resistant to sterility mosaic disease and *Phytophthora* blight, low pod borer and seed damage due to pod fly
Gujarat Tur-110 (Navtur) (NPD 18-03)	Gujarat	Suitable for *Kharif* rainfed condition, yield 21.31 q/ha, maturity 170–180 days, protein 23.6%, moderately resistant to sterility mosaic disease and wilt, low pod borer and seed damage due to pod fly
Pusa Jawahar Arhar Dwarf 22-01	Madhya Pradesh	Suitable for timely sown condition, yield 17.85 kg/ha, maturity 132–138 days (early), dwarf plant type with early and synchronous maturity, suitable for mechanical harvesting, spraying of insecticide is very easy, protein 22.50 %
Pusa Jawahar Arhar 22-02	Madhya Pradesh	Suitable for timely sown condition, yield 18.65 q/ha, early synchronous maturity 125–128 days, suitable for high density planting and mechanized cultivation, due to early maturity allows growing of mustard/wheat/potato after harvest, protein 22.70 %
Pusa Jawahar Arhar 21-29	Madhya Pradesh	Suitable for timely sown condition, yield 18–22 q/ha, maturity early (138–142 days), early and synchronous maturity, bold seeds (12.98 g 100 seed weight), suitable for mechanized cultivation, early maturity allows growing of chickpea /wheat/potato after harvest, protein 22.75 %
Cowpea		
KBC-12	Karnataka	Suitable under rainfed and irrigated condition in southern Karnataka, yield 15.96 q/ha, maturity 80–85 days, protein 23%, resistant to bacterial leaf blight, cowpea mosaic virus, *Cercospora* leaf spot, dry root rot diseases, less infestation of Aphids, white flies and pod borer, tolerant to drought stress
Sahyadri Samruddi (GP-1)	Zone-4 and 7 of Karnataka	Suitable for rainfed southern transition zone (Zone 7) and Central dry zone (Zone 4) condition, yield 12 q/ha, maturity 80–85 days, protein 24.56%, moderately resistant to rust, yellow mosaic virus, less percent of pod damage by *Maruca vitrata* and *Helicoverpa armigera*
Rajmash/ French bean		
BR-39	Jammu and Kashmir	Suitable for hilly zone and well adaptability to temperate zone, yield 13–15 q/ha, maturity 90–100 days, tolerant to *Anthracnose* and angular leaf spot, tolerant to all the major insects/pests of rajmash
Moth Bean		
CAZRI Moth-6 (CZMO-18-3)	Rajasthan, Gujarat, Maharashtra and Karnataka	Suitable for rainfed conditions, yield 6.28 q/ha, maturity 74–76 days, protein 22.7%, resistant to foliar and root diseases of moth bean, adapted to moisture stress conditions
CAZRI Moth-7 (CZMO-18-4)	Rajasthan, Gujarat, Maharashtra and Karnataka	Suitable for rainfed conditions, yield 6.52 q/ha, maturity 75–77 days, protein 21.5%, no serious diseases reported
Grass pea/ Lathyrus		
Bidhan Khesari-2 (KL-5)	Budelkhand part of Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Bihar, Jharkhand, West Bengal and Assam	Suitable for timely sown, normal fertility and both irrigated and un-irrigated conditions, yield - 10.5 q/ha (seed), 190.6 q/ha (green fodder), 40.9 q/ha (dry matter), maturity 74 days, drought and heat tolerant, moderately tolerant to water logged conditions for a short period, resistant to *Fusarium* wilt and collar rot, aphid and thrips, highly resistant to stored grain pests
Lentil		
Pant Lentil 16 (PL-366)	Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and hills of West Bengal	Suitable for timely sown conditions of north hill zone, yield 14.91 q/ha, maturity 154 days, moderately resistant to rust, wilt, protein 22%
IPL-341 (Jagrati)	Madhya Pradesh	Suitable for normal sown rainfed condition, large seeded, yield 16.94 q/ha, maturity 111 days, moderately resistant to major diseases including rust and *Fusarium* wilt, protein 23.6%
IPL-342 (Uttam)	Madhya Pradesh	Suitable for normal sown rainfed condition, large seeded, yield 17.69 q/ha, maturity 112 days, resistant to major diseases including rust and *Fusarium* wilt, protein 22.9%
Kota Masoor 5 (RKL 14-175)	Rajasthan	Suitable for normal sown condition, yield 20.96 q/ha, maturity 120 days, moderately resistant to wilt and rust, protein 22%
JL6 – 3 (Jawahar Lentil 6-3)	Madhya Pradesh	Suitable for both irrigated and rain-fed conditions, yield 16.57 q/ha, maturity 109 days, moderately resistant to major diseases like wilt, rust and *Ascochyta* blight
Chickpea		
Karan Chana 20 (RSGD 1155)	Eastern Uttar Pradesh, West Bengal, Bihar, Assam, Odisha and Jharkhand	Suitable for late sown conditions in *Rabi* season, yield 16.38 q/ha, maturity 116 days, moderately resistant to wilt, dry root rot and stunt disease, protein 19.7%

Variety	Area of adoption	Salient features
Pusa Chickpea Aswini (BG-4037)	Northern Rajasthan, Punjab, Haryana, Western Uttar Pradesh, plains of Uttarakhand, Delhi and part of Jammu and Kashmir	Suitable for irrigated timely sown conditions, yield 26.73 q/ha, maturity 134–160 days, resistant/moderately resistant to *Fusarium* wilt, dry root rot and stunt diseases, suitable for machine harvesting, protein 24.8%
Raj Vijay Gram 2023 (RVG-2023)	Bihar, Assam, Jharkhand, Eastern Uttar Pradesh, Odisha and West Bengal	Suitable for timely sown condition, yield 15.89 q/ha, maturity 125 days, resistant to moderately resistant against wilt, dry root rot and stunt, amenable to machine harvesting, protein 21%
Raj Vijay Kabuli Gram (RVKG-2024)	Andhra Pradesh, Telangana and Karnataka	Suitable for timely sown irrigated condition, yield 14.39 q/ha, maturity in 100 days, moderately resistant to *Fusarium* wilt, large seeded *Kabuli* (100 seed wt. 44 g)
ADBeG-2 (Adilabad Shanaga-2)	Telangana	Suitable for both rainfed and irrigated condition, yield 25.62 q/ha, maturity 100–105 days, early duration, resistant to *Fusarium* wilt
Pusa Sumangala BGD-133	Zone- 3 and 8 of Karnataka	Suitable for timely sown condition, yield 17–18 q/ha, maturity 94–96 days, moderately resistant to *Fusarium* wilt, medium bold seeded (28g/100 seed wt.)
PDKV – Super Jaki (AKG 1402)	Maharashtra	Suitable for rainfed condition with mechanical harvesting, yield 20.48 q/ha, maturity 90–100 days, moderately resistant to *Fusarium* wilt, bold seeded (26.4 g/100 seed)
Field pea		
Pant Pea 509	Eastern Uttar Pradesh, Bihar, West Bengal, Jharkhand and Assam	Suitable for rainfed / irrigated conditions of *Rabi* season, yield 18.09 q/ha, maturity 114 days, resistant to powdery mildew, *Ascochyta* blight, moderately resistant to rust, protein 26.36%, dwarf type
Pant Pea 517	Punjab, Haryana, Delhi, North-West & Central Rajasthan, Western Uttar Pradesh and Plains of Uttarakhand and Jammu and Kashmir	Suitable for rainfed / irrigated conditions of *Rabi* season, yield 21.30 q/ha, maturity 127 days, resistant to powdery mildew and *Ascochyta* blight, moderately resistant to rust, protein 23.2%
Purvansh (IPFD 18-3)	Bihar, Jharkhand, Assam, West Bengal and eastern parts of Uttar Pradesh	Suitable for irrigated ecology *Rabi*, yield 17.3 q/ha, maturity 117 days, highly resistant to powdery mildew, *Ascochyta* blight, moderately resistant to rust, high protein (25.7%)
HFP 1709	Eastern Uttar Pradesh, Bihar, Jharkhand, West Bengal and Assam	Suitable for irrigated ecology *Rabi*, yield 16.52 q/ha, maturity 112 days, resistant to powdery mildew, moderately resistant to rust, protein content 21.6%, dwarf type

Commercial crops: Forty-two varieties of commercial crops including 6 of cotton, 26 of Bt cotton, 1 of mesta (Roselle), 1 of jute and 8 of sugarcane were released for different agro-ecological regions.

List of released varieties/hybrids of Commercial crops

Variety	Area of adoption	Salient features
Non Bt Cotton Varieties/ Hybrids		
F 2743	Haryana, Punjab and Rajasthan	Suitable for north zone under recommended planting system, yield 27.81 q/ha, medium maturity 160–165 days, resistant to fungal foliar leaf spot, bacterial leaf blight and tolerant / less infestation of jassids, thrips, white fly
FDK 324	Haryana, Punjab and Rajasthan	Suitable for irrigated condition, yield 28.87 q/ha, medium maturity 140–165 days, resistant to fungal foliar leaf spot, bacterial leaf blight and tolerant / less infestation of jassids, thrips, white fly
KR-149	Haryana, Punjab and Rajasthan	Suitable for irrigated, early-medium conditions, yield 32.69 q/ha, maturity 155–160 days, resistant to bacterial leaf blight, fungal foliar leaf spot and tolerant to root rot disease, resistant to sucking pests and tolerant to leaf hopper
KR-150	Haryana, Punjab and Rajasthan	Suitable for irrigated, medium conditions, yield 31.66 q/ha, maturity 160–165 days, resistant to bacterial leaf blight, fungal foliar leaf spot and tolerant to root rot disease, resistant to sucking pests and tolerant to leaf hopper, resistant to lodging, shattering, responsive to fertilizers
Gujarat Desi Cotton 5 (GDC 5: Anand Kanchan) (GVhv-1028)	Gujarat	Suitable for rainfed *Kharif* condition, yield 13.75 q/ha, maturity 193 days, less infestation of major pests including sucking pests and boll worm complex, spinnable *G. herbaceum* variety, first semi open boll type variety with long staple fibre
RVJK-SGF-1	Madhya Pradesh	Suitable for irrigated condition, yield 8.87 q/ha, maturity 144–160 days. tolerant to sucking pests, ability to tolerate the terminal and mid-season drought, medium-long fiber (28–30mm), tenacity 27–30 g/tex, spinnability 16s–34s count

Variety	Area of adoption	Salient features
Bt Cotton Varieties/ Hybrids		
Chhava BG-II (BGCH-2001 BG-II)	Gujarat, Madhya Pradesh and Maharashtra	Suitable for irrigated condition, yield 25.29 q/ha maturity 155–165 days, resistant to bollworm complex, resistant to *Alternia* leaf spot, *Corynespora* leaf spot, lodging resistant
Indam-1624 BG-II	Madhya Pradesh, Maharashtra and Rajasthan	Suitable for assuring rainfall and irrigated areas, yield 17.68 q/ha, late maturity 170–180 days, moderately tolerant to sucking pests
Indam-1643 BG-II	Madhya Pradesh, Maharashtra and Rajasthan	Suitable for assuring rainfall and irrigated areas, yield 17.50 q/ha, late maturity 170–180 days, moderately tolerant to sucking pests
PRCH 8721 Bt 2	Telangana, Andhra Pradesh, Karnataka and Tamil Nadu	Suitable for rainfed areas of south zone, yield 27.96 q/ha, early maturity 140–150 days, compact, resistant to bacterial leaf blight, *Alternaria* leaf spot, grey mildew and rust, tolerant to sucking pest
PCH 7781 Bt 2	Telangana, Andhra Pradesh, Karnataka and Tamil Nadu	Suitable for rainfed areas of south zone, yield 28.45 q/ha, compact early maturity 140–150 days, resistant to bacterial leaf blight, *Alternaria* leaf spot, grey mildew and rust
NCS 5455 Bt 2	Telangana, Andhra Pradesh, Karnataka ,Tamil Nadu, Madhya Pradesh, Maharashtra, Gujarat and Rajasthan	Suitable for rainfed *Kharif* season, high density planting, yield 29.48 q/ha in south zone and 25.08 q/ha in central zone, early maturity 140–150 days, resistant to bacterial leaf blight, *Alterneria* leaf spot, grey mildew, *Corynospor*a leaf spot and tobacco streak virus, moderately resistant to boll rot under unprotected rainfed conditions, drought tolerant
KCH 9224 BG-II	Telangana, Andhra Pradesh, Karnataka and Tamil Nadu	Suitable for irrigated condition with low to high fertile soils during *Kharif*, yield 30.89 q/ha, medium maturity 160–165 days, compact, highly tolerant to moisture stress, tolerant to *Alternaria* leaf spot, grey mildew, rust, bacterial leaf blight and tobacco streak virus
KCH 9216 BG-II	Telangana, Andhra Pradesh, Karnataka, Tamil Nadu, Madhya Pradesh, Maharashtra, Gujarat and Rajasthan	Suitable for irrigation condition, yield 32.39 q/ha in south zone and 28.16 q/ha in central zone, medium maturity 160–165 days, highly tolerant to moisture stress, tolerant to *Alternaria* leaf spot, grey mildew, rust, boll rot, bacterial blight and tobacco streak virus in South zone
KCH 9214 BG-II	Telangana, Andhra Pradesh, Karnataka and Tamil Nadu, Madhya Pradesh, Maharashtra, Gujarat and Rajasthan	Suitable for irrigated condition with low to high fertile soils during *Kharif*, yield 30.23 q/ha in south zone and 27.84 q/ha in central zone, medium maturity 155–160 days, highly tolerant to moisture stress, tolerant to *Alternaria* leaf spot, grey mildew, rust, boll rot and tobacco streak virus
KCH 9377 BG-II	Punjab, Haryana and Rajasthan	Suitable for irrigated condition for low to high fertile soil during *Kharif*, yield 26.8 q/ha, medium maturity 160–170 days, tolerant to leaf hopper and whitefly, tolerant to lodging
DLCH 459 BG-II	Andhra Pradesh, Telangana, Karnataka and Tamil Nadu	Suitable for irrigated condition, yield 27.05 q/ha, moderately resistant to resistant to major diseases like rust, tobacco streak virus, grey mildew, *Alternaria* leaf spot and boll rot
33 SS 66 BG II	Telangana, Andhra Pradesh, Karnataka and Tamil Nadu	Suitable for rainfed conditions, yield 25.38 q/ha, medium maturity 150–170 days, compact, moderately resistant to *Alternaria l*eaf blight, bacterial leaf blight, grey mildew and rust, moderately resistant to sucking pest and boll worms including pink bollworm
HYCH-411 Bt-II	Maharashtra, Gujarat and Madhya Pradesh, Andhra Pradesh and Karnataka	Suitable for early/late sowing, yield 25.47 q/ha in central zone and 28.51 q/ha in south zone, mid-early maturity 140–145 days, tolerant to tobacco streak virus, bacterial leaf blight, pink bollworm, white flies and leaf hoppers
RSCH-189 BG-II	Maharashtra, Gujarat and Madhya Pradesh	Suitable for light, medium and heavy soils, yield 24.36 q/ha in central zone, maturity 150–165 days, resistant to rust, *Alternaria* leaf spot, grey mildew and bacterial blight
RSCH-459 BG-II	Maharashtra, Gujarat and Madhya Pradesh	Suitable for medium and heavy soils, yield 24.60 q/ha in central zone and 24.15 q/ha in south zone, maturity 150–165 days, resistant to rust, *Alternaria* leaf spot, grey mildew and bacterial blight
US 714 BG-II	Telangana, Andhra Pradesh, Karnataka and Tamil Nadu	Suitable for irrigated condition, yield 29.03 q/ha, medium maturity 160–165 days, resistant to tobacco streak virus, bacterial leaf blight and grey mildew
SP 7704 BG-II	Maharashtra, Madhya Pradesh and Gujarat	Suitable for irrigated condition, yield 25.57 q/ha, medium maturity 160–170 days, moderate tolerance to jassids and thrips, resistant to bacterial blight and grey mildew
DC 5301 BG-II	Andhra Pradesh, Telangana, Karnataka, Tamil Nadu	Suitable for rainfed condition, yield 25.45 q/ha, compact and medium maturity 150–155 days, resistant to bacterial leaf blight, *Alternaria* leaf blight, grey mildew, rust, tolerant to jassids, thrips, white fly, aphids
DC 5104 BG-II	Andhra Pradesh, Telangana, Karnataka, Tamil Nadu, Maharashtra, Madhya Pradesh, Gujarat and South Rajasthan	Suitable for irrigated condition, yield 23.90 q/ha in central zone and 24.80 in south zone, medium maturity 160–165 days, resistant to tobacco streak virus, bacterial leaf blight, *Corynespora* leaf spot, *Alternaria* leaf blight, *Myrothecium* leaf spot, root rot, *Alternaria* leaf spot and boll rot, tolerant to aphids, thrips, white fly

Variety	Area of adoption	Salient features
DC 5418 BG-II	Punjab, Haryana and Rajasthan	Suitable for irrigated condition, yield 26.00 q/ha, medium maturity 150–170 days, moderately resistant to *Alternaria* leaf blight, bacterial leaf blight, grey mildew, moderately resistant to sucking pest and boll worms
DC 5103 BG-II	Andhra Pradesh, Telangana, Karnataka, Tamil Nadu, Maharashtra and Madhya Pradesh	Suitable for irrigated condition, yield 24.84 q/ha in central zone and 28.63 in south zone, medium maturity 150–155 days, resistant to tobacco streak virus, grey mildew, bacterial leaf blight, *Corynespora* leaf spot, fungal foliar spots, wilt, *Alternaria* leaf blight, tolerant to leaf hopper, aphids, white fly
KCH 9228 BGII	Maharashtra, Madhya Pradesh and Gujarat	Suitable for irrigated condition with low to high fertile soils during *Kharif*, yield 30.13 q/ha, medium maturity 160–165 days, tolerant to leaf hopper, thrips, aphid, whitefly and *Alternaria* leaf spot, grey mildew, rust, bacterial leaf blight, tobacco streak virus
DC 5417 BG-II (Irrigated condition)	Punjab, Haryana and Rajasthan	Suitable for irrigated condition, yield 25.5 q/ha, maturity 150–155 days, resistant to cotton leaf curl disease, bacterial leaf blight and fungal foliar diseases
KCH 9111 BG-II	Telangana, Andhra Pradesh, Karnataka and Tamil Nadu	Suitable for irrigated condition, yield 30.93 q/ha, maturity 150–155 days, tolerant to *Alternaria* leaf spot, bacterial leaf blight, grey mildew, boll rot, tobacco streak virus, tolerant to leaf hoppers, thrips, white fly and bollworms
DC 5100 BG-II	South Rajasthan	Suitable for rainfed condition, yield 22.52 q/ha, maturity 150–160 days, tolerant to leaf hopper, thrips, white fly, bacterial leaf blight, grey mildew, anthracnose, *Corynespora* leaf spot, *Alternaria* leaf blight, boll rot, resistant to *Myrothecium* leaf spot
C 9403 BG-II	Punjab, Haryana and Rajasthan	Suitable for closer spacing with synchronous boll bursting, yield 27.37 q/ha, maturity 150–160 days (early-medium), resistant to bacterial blight, *Alternaria* leaf spot and leaf hopper, thrips, bollworms infestation found to be below economic threshold level
Sugarcane		
Co 18022 (Karan 18)	Haryana, Punjab, Rajasthan, Central Western Uttar Pradesh and Uttarakhand	Suitable for growing under medium and high fertile soil in North-West zone of India and under irrigated and water deficit condition, cane yield 986.5 q/ha, commercial cane sugar yield 125.9 q/ha, maturity mid-late (12 months), moderately resistant to red rot, smut, less susceptible to early shoot borer, stalk borer and top borer, tolerant to salinity stress and resilience to drought condition
CoPb 100 (CoPb 18213)	Haryana, Punjab, Rajasthan, Central Western Uttar Pradesh and Uttarakhand	Suitable for growing under medium and high fertile soil in North-West zone under irrigated condition, average cane yield 868.6 q/ha, commercial cane sugar yield 113.3 q/ha, maturity mid-late (12 months), moderately resistant to red rot, resistant to smut, less susceptible to early shoot borer, stalk borer and top borer, tolerant to salinity stress and drought
CoH 17261 (CoH 179)	Haryana, Punjab, Rajasthan, Central Western Uttar Pradesh and Uttarakhand	Suitable for growing under medium and high fertile soil and under irrigated condition, average cane yield 894.2 q/ha, commercial cane sugar yield 111.5 q/ha, maturity mid-late (12 months), moderately resistant to red rot and resistant to smut, less susceptible to early shoot borer, stalk borer and top borer
CoS 17231 Bismil	Haryana, Punjab, Rajasthan, Central Western Uttar Pradesh and Uttarakhand	Suitable for growing under medium and high fertile soils of North-West zone under irrigated condition, cane yield 863.5 q/ha, commercial cane sugar yield 111.8 q/ha, maturity early (10 months), moderately resistant to red rot and resistant to smut, less susceptible to early shoot borer, stalk borer and top borer. tolerant to drought and salinity
CoVSI 18121	Maharashtra	Suitable for growing under irrigated condition, maturity 14 months, cane yield 1497.8 q/ha, commercial cane sugar yield 220.3 q/ha, moderately resistant to red rot, resistant to smut, less susceptible to early shoot borer and internode borer
CoH 188 (CoH-20261)	Haryana	Suitable for growing under irrigated condition, maturity early (10 months), cane yield 996.4 q/ha, commercial cane sugar yield 128.1 q/ha, moderately resistant to red rot, smut, wilt and yellow leaf disease, less susceptible to early shoot borer, stalk borer and top borer
Ruduru Cheruku-81	Telangana	Suitable for mid-late/irrigated condition, yield 1255 q/ha, sucrose in juice 19.44%, maturity 12 months, moderately resistant to red rot and smut, resistant to wilt and less susceptible to early shoot borer, inter-node borer and scales, drought tolerant.
CoN-18071 (GNS-13) (Madhuri)	Gujarat	Suitable for early irrigated condition, yield 1251.9 q/ha, sucrose in juice 19.77%, maturity 12 months, moderately resistant to red rot, wilt and smut.

Variety	Area of adoption	Salient features
Fibre Crops/Jute and Allied Crops		
Tossa Jute		
JRO-2024 (Shanta)	West Bengal, Bihar, Odisha, Assam and Maharashtra	Highly resistant to premature flowering making it suitable for early sowing (1st week of March to mid-April) under rainfed conditions in medium to high fertile land, fiber yield 31.81 q/ha, maturity 120 days and seed to seed maturity 130–150 days, tolerant to root rot, stem rot diseases and yellow mite, semi looper insects
Mesta (Roselle)		
AMV-11 (AHS-333)	Andhra Pradesh, Tamil Nadu, Maharashtra, Odisha and Bihar	Suitable for timely sowing from mid-May (under irrigated condition) to June (under rainfed condition), average yield 29.09 q/ha, maturity 140–150 days, tolerant to foot, stem rot disease, tolerant to aphids, whiteflies and leaf hoppers.

Forage and other crops: Twenty-nine varieties of forage crops comprising 7 of forage oats, 3 each of forage maize and lucerne, 4 of forage sorghum, 2 of berseem, 9 of forage pearl millet, 1 of napier bajra hybrid and 5 of other crops (Tobacco) were released for different agro-ecological regions.

List of Improved released varieties/hybrids of Forage and other crops

Variety	Area of adoption	Salient features
Oats		
OL 1988	Telangana, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala	Suitable for irrigated condition, seed yield 10.6 q/ha, green fodder yield (GFY) 317.8 q/ha, dry matter yield 65.7 q/ha, crude protein yield 4.43 q/ha, single cut, maturity 152 days (seed to seed), moderately resistant to *Helminthosporium* leaf blight
JHO-21-1 (Bundel Jai 2021-1)	Telangana, Andhra Pradesh, Tamil Nadu, Kerala and Karnataka	Suitable for timely sown normal fertility, irrigated condition, yield (seed) 8.5 q/ha, green fodder yield 318 q/ha, dry matter yield 61.8 q/ha, crude protein 6.8%, maturity 110 days (seed to seed), resistant to leaf blight, powdery mildew no diseases is reported in south zone, single cut fodder
HFO-915	Himachal Pradesh and Jammu and Kashmir	Suitable for timely sown, normal fertility and irrigated conditions, green fodder yield 233.9 q/ha, protein content 10.0%, tolerant to powdery mildew
HFO-917	Assam, Odisha, Bihar, Jharkhand and Eastern Uttar Pradesh	Suitable for timely sown, normal fertility and irrigated conditions, green fodder yield 185.2 q/ha (NWZ), 238.2 q/ha (NEZ), protein content 14.37% (NWZ), 9.38% (NEZ), moderately resistant *to Helminthosporium* leaf blight in NWZ and resistant to *Helminthosporium* leaf blight in NEZ, highly resistant to *Sclerotium* root rot in NEZ
HFO-1014	Punjab, Haryana, Rajasthan plain of Uttarakhand, Assam, Odisha, Bihar, Jharkhand and Eastern Uttar Pradesh	Suitable for timely sown, normal fertility and irrigated conditions, yield 185.2 q/ha, green fodder yield 191.80 q/ha (NWZ), 245.81 q/ha (NEZ), protein content 15.53% (NWZ), 9.31% (NEZ), moderately resistant to *Helminthosporium* leaf blight in NWZ and resistant to *Helminthosporium* leaf blight in NEZ, highly resistant to *Sclerotium* root rot in NEZ
OL-1931	Assam, Odisha, Bihar, Jharkhand and Eastern Uttar Pradesh	Suitable for timely sown, normal fertility and irrigated conditions, green fodder yield 242.2 q/ha, dry matter yield 48.4 q/ha, seed yield 16.4 q/ha, maturity (seed to seed)152 days (medium), crude protein 9.2%, resistant to leaf blight
OL-1949	Himachal Pradesh and Jammu and Kashmir	Suitable for timely sown, normal fertility and irrigated conditions, green fodder yield 233.6 q/ha, dry matter yield 49.8 q/ha, seed yield 10.5 q/ha, maturity 155 days (seed to seed), crude protein 10.5%, moderately resistant to leaf blight, moderately resistant to insect-pests
Forage Sorghum		
CSV 63F (SPV-2884)	Maharashtra, Tamil Nadu and Karnataka	Suitable for timely sown rainfed/irrigated conditions, green fodder yield 459 q/ha, dry matter yield 188 q/ha, grain yield 12.51 q/ha, protein 6.7 (%), maturity medium 117–120 days, moderately resistant to leaf blight, zonate leaf spot and rust, tolerant to shoot fly, moderately tolerance to stem borer
CSV 64F (SPV-2881)	Haryana, Punjab, Rajasthan, Uttarakhand, Gujarat and Jharkhand	Suitable for all sorghum growing irrigated areas of North India in *Kharif* season, green fodder yield 446.3 q/ha, dry matter yield 121.3 q/ha, grain yield 15.2 q/ha, protein 7.4%, maturity 82 days, tolerant to shoot fly and stem borer, resistant against major foliar diseases like *Anthracnose*, zonate leaf spot, grey leaf spot, leaf blight and sooty stripe

Variety	Area of adoption	Salient features
CSH 58MF (Sprint Gold Super) (SPH 2018)	Haryana, Punjab, Rajasthan, Gujarat, Maharashtra and Karnataka	Suitable for timely sown irrigated conditions, green fodder yield 798.9 q/ha, dry fodder yield 224.7 q/ha maturity 1st cut at 60 days and subsequent cuts at 45 days after 1st cut, protein 7.4%, tolerant to major insects, pests and foliar diseases, resistant to lodging and highly responsive higher doses of fertilizer
CSV 69 BMR (BMR Forage Gold) (SPV-2912)	Tamil Nadu, Maharashtra, Punjab and Uttarakhand	Suitable for rainfed *Kharif* ecology, green fodder yield 364 q/ha, dry fodder yield 133 q/ha, maturity 77 days, protein 8.02%, resistant to shoot fly, stem borer, fall army worm, leaf blight, anthracnose and zonate leaf spot
Forage maize		
MAH 15-84	Telangana, Andhra Pradesh, Tamil Nadu, Kerala and Karnataka	Suitable for cultivation during *Kharif* under irrigated and timely sown conditions, green fodder yield 462.6 q/ha, grain yield 40.0 q/ha, maturity 125–130 days, resistant to *Turcicum* leaf blight and moderately resistant to other major diseases and pests
Pusa Jawahar Hybrid Maize-1 (PJHM-1) (Hybrid)	Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Jammu and Kashmir Maharashtra and , Himachal Pradesh	Suitable for normal fertility, rainfed / irrigated condition, green fodder yield 313.1–420.6 q/ha (central zone), 255.7–418.1 q/ha (hill Zone), maturity 60–65 days (dough stage), 90–95 days (grain), protein 10.61%, resistant to *Turcicum* leaf blight, banded leaf and sheath blight and moderately resistant to Maydis leaf blight, **r**esistant to Fall Army Worm, spotted stem borer, tolerant to drought
Master 1323 (FSM 2021-1)	Manipur, Odisha, Jharkhand, Bihar and eastern Uttar Pradesh	Suitable for rain fed / irrigated conditions, green fodder yield 364.5 q/ha, dry matter yield 84.8 q/ha, maturity 105–110 days, high biomass, high crude protein yield, moderately resistant to *Turcicum* leaf blight, Maydis leaf blight, branded leaf, sheath blight, moderately resistant to Fall Army Worm, stem borer
Forage Pearl Millet		
ADV 2184	Madhya Pradesh, Chhattisgarh, Gujarat, Bundelkhand region of Uttar Pradesh, Telangana, Karnataka, Kerala, Tamil Nadu and Andhra Pradesh	Suitable for cultivation during summer season under irrigated condition, green fodder yield 823.3 q/ha and dry fodder yield 174.4 q/ha (central zone); green fodder yield 548.0 q/ha and dry matter yield 110 q/ha (south zone), resistant to all major diseases and pests, multi-cut, non-hairy, stay green
ADV 2285	Punjab, Haryana, Rajasthan, eastern Uttar Pradesh, Bihar, Jharkhand, Odisha and West Bengal	Suitable for cultivation during *Kharif* under irrigated, timely sown conditions for single cut, green fodder yield 425.0 q/ha (NEZ) to 550.0 q/ha (NWZ), crude protein 8.7% and moderately resistant for all important diseases
ADV 175020	Uttarakhand, Uttar Pradesh, Rajasthan, Punjab, Haryana, Madhya Pradesh, Bihar, Jharkhand, Assam, West Bengal, Odisha, Chhattisgarh, Gujarat and Maharashtra	Suitable for cultivation during *Kharif* under irrigated, timely sown conditions for single cut, green forage yield 425–620 q/ha, crude protein 8.5%, moderately resistant for all important diseases and insect-pests
Bundel Bajra-1 (JHPM-22-2)	Punjab, Haryana, Rajasthan, Western Uttar Pradesh Tarai parts of Uttarakhand	Suitable for irrigated and rainfed timely sown condition, green fodder yield 531.1 q/ha, medium maturity 90–100 days, crude protein content 8.47–9.28%, moderate resistance to disease and pests, resistance to leaf blast
SBH 002 (SiraTej)	Punjab, Haryana, Rajasthan, Eastern Uttar Pradesh, Bihar, Jharkhand, Odisha and West Bengal	Suitable for irrigated and rainfed condition, green fodder yield 491.2 q/ha, dry matter yield 98.7q/ha, crude protein yield 9.1 q/ha, late maturity 110 days, resistant to downy mildew, moderately resistant reaction for leaf blast
SBH 104	Madhya Pradesh, Chhattisgarh, Gujarat, Bundelkhand region of Uttar Pradesh, Telangana, Karnataka, Kerala, Tamil Nadu and Andhra Pradesh	Suitable for irrigated summer season, green fodder yield 673.79 q/ha, late maturing 100–110 days, crude protein 9–10%, tolerant to major pest and diseases
Wonder Leaf (FSB 2021-1)	Punjab, Haryana, Rajasthan, Gujarat, Madhya Pradesh, Chhattisgarh, Maharashtra, Uttar Pradesh, Bihar, Odisha, Jharkhand, Telangana, Tamil Nadu and Karnataka	Suitable for rainfed and irrigated during *Kharif* season, green fodder yield 463.4 q/ha, dry fodder yield 93.1 q/ha, maturity medium (75–80 days), first cut 50–55 days after sowing, second cut 35–40 days after first cut, moderately resistant to leaf blast, major pests, resistant to lodging, moderately tolerant water stress
PCB-169 (FBL-7)	Bihar, Odisha, Jharkhand and Eastern Uttar Pradesh	Suitable for timely sown, normal fertility irrigated areas, green fodder yield 362.3 q/ha, dry matter yield 85.1 q/ha, seed yield 6.5 q/ha, maturity late 115–130 days (seed to seed), crude protein 8.7%, moderately resistant to leaf blast, no major insect pest incidences
DFB-10 (VFB-10)	Zone-3 of Karnataka	Suitable for summer sowing irrigated condition in agro-climatic zone-3 of Karnataka, green fodder yield 590 q/ha, dry fodder yield 131 q/ha, seed yield 17–18 q/ha, maturity 102–105 days (late), tolerant to lodging, high palatability 94–97%, dry matter 26–28%, no incidence of diseases in summer season

Variety	Area of adoption	Salient features
Berseem		
Bundel Berseem-9 (JHB-20-1)	Madhya Pradesh, Maharashtra, Chhattisgarh and Bundelkhand parts of Uttar Pradesh	Suitable for timely sown, irrigated condition, green fodder yield 609 q/ha, dry matter yield 100 q/ha, maturity 175–185 days, crude protein 18.2%, resistant to leaf spot and blight, moderately resistant to stem rot, resistant to *H. armigera* and leaf defoliators
BL 48 (PC 114)	Punjab, Haryana, Rajasthan, plain parts of Uttarakhand	Suitable for timely sown, normal fertility irrigated conditions during winter season, green fodder yield 734.6 q/ha, dry matter yield 105.7 q/ha, seed yield 3.9 q/ha, maturity (seed to seed) 255–265 days, crude protein 18.9%, moderately resistant to stem rot in NWZ and resistance to *Helicoverpa armigera*
Lucerne		
LLC-6	Punjab and Rajasthan	Suitable for timely sown, normal fertility, irrigated areas during winter season, green fodder yield 616.9 q/ha, dry matter yield 115.0 q/ha, seed yield 1.6 q/ha, maturity (seed to seed) 250–260 days, crude protein 18.7%, moderately resistant to downy mildew, tolerant to Lucerne weevil and *Helicoverpa armigera*
LLC-7	Punjab, Haryana and Rajasthan	Suitable timely sown, normal fertility and irrigated conditions for all fodder growing irrigated areas, green fodder yield 724.3 q/ha, dry matter yield 145.0 q/ha, perennial variety, first cutting in 75 days, subsequent cuttings 30–40 days interval, crude protein 17.8%, better tolerance to Lucerne weevil and *Helicoverpa armigera*
IGFRI-DL-2 (IGFRI Dharwad Lucerne-2) (AWCL-2)	Punjab and Rajasthan	Suitable for timely sown, normal fertility, irrigated condition in winter, greed fodder yield 850–950 q/ha/year in 10 harvests, maturity not applicable since it is perennial, first cut 55–60 days after sowing, subsequent cuts 25–30 days interval, crude protein content 16–18%, resistant to rust and leaf miner, moderately resistant to Weevil and *Helicoverpa armigera*
Napier Bajra Hybrid		
BNH-26 (BAIF Napier Hybrid-26)	Gujarat, Chhattisgarh, Madhya Pradesh, Maharashtra and Uttar Pradesh	Suitable for irrigated condition, green fodder yield 1,418.89 q/ha, maturity-first cut at 60 days after planting and subsequent cut at 40–45 days interval, protein content 8.40%, resistance to leaf blight, no incidences of pests
Others crops		
Tobacco		
ABD 132 (Nandyal Pogaku 2)	Andhra Pradesh	Suitable for rainfed bidi tobacco growing areas of black soils of Kurnool districts in high / low fertility condition during *Kharif*, cured leaf yield 214.6 q/ha, maturity 195–210 days from seed to completion of harvest, tolerant to drought and water logging conditions, tolerant to black shank, tobacco mosaic virus, tobacco leaf curl virus, *Orobanche* and tolerant to *Spodoptera litura*, aphid and mealy bugs
Sahyadri Swarna (FCS-4)	Zone-7 of Karnataka	Suitable for rainfed and irrigated condition, yield 30.0 q/ha, maturity 160–170 days, moderately resistant to black shank and frog eye leaf spot, tolerant to major insect pests
CTRI Navya (FCH 2)	Karnataka	Suitable for rainfed and irrigated condition, yield 30.00 q/ha, maturity 170–180 days, tolerant to black and major insect pests, withstand heavy rainfall even in maturity
FCRH 11 (LSTC 9)	Karnataka	Suitable for timely rainfed and irrigated condition, yield 35.00 q/ha with higher bright grade outturn (78%), maturity 75–85 days, tolerant to major pests and diseases
DTV 9 (NBD 316)	Karnataka	Suitable for rainfed and irrigated condition, yield 19.0 q/ha, maturity 165–167 days, tolerant to aphid and water logging, cured leaf is attractive parrot green coloured.

Application of Advanced Biotechnogical tools in Crop Improvement

Enhancing Climate Resilience and Ensuring Food Security with Genome Editing Tools

Globally first Genome Edited Rice Varieties, Pusa DST Rice 1 and DRR Dhan 100 (Kamala):

Pusa DST Rice 1: To improve the drought and salt tolerance of a mega rice variety MTU1010, Drought and Salt Tolerance *(DST)* gene was edited and a 2 bp deletion mutant (DSTΔ2bp) of Site-Directed Nuclease 1 (SDN1) category was developed by ICAR-IARI, New Delhi. This

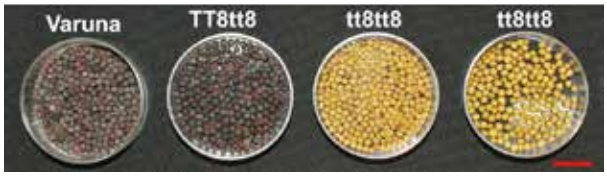
Hon'ble Agricultural Minister announced the identification of world's 1st genome-edited rice varieties developed by India on 5th May 2025

DSTΔ2bp mutant showed enhanced water use efficiency, drought and salt tolerance. The DST mutant has been found superior to MTU1010 which exhibits significant average superiority of 9.66% over the parent rice variety, MTU 1010 under Inland salinity stress; 14.66% under alkalinity condition and 30.4% under coastal salinity stress.

DRR Dhan 100 (Kamala): To improve the yield of a mega rice variety Samba Mahsuri (BPT5204), the *CYTOKININ OXIDATE 2* (*CKX2*) was edited and a loss of function mutant of SDN1 category was developed. The *CKX2* mutant showed 19% increased grain yield, 20–25 days early maturity, and stronger culm than Samba Mahsuri.

Both the DST mutant (Pusa DST Rice 1) and CKX2 (DRR Dhan 100/Kamala) were identified for release.

Development of yellow-seeded mustard line through CRISPR/Cas9 mediated genome editing: Genome-edited lines in *Brassica juncea* have been developed by creating new variation in *BjTT8A* and *BjTT8B* genes simultaneously at TT8 locus. Hypocotyl-mediated transformation was carried out in the *B. juncea* cultivar Varuna using this construct. Four independent transgenic events were generated, of which three produced a yellow seed coat in the T_1 seeds, while the fourth event exhibited a yellow seed coat in subsequent generations. The yellow seed coat phenotype was stable and heritable across generations. Oil content analysis revealed a 3–4% increase in the edited lines compared with controls, without affecting seed size. This study successfully generated new yellow-seeded lines and demonstrated increased oil content.

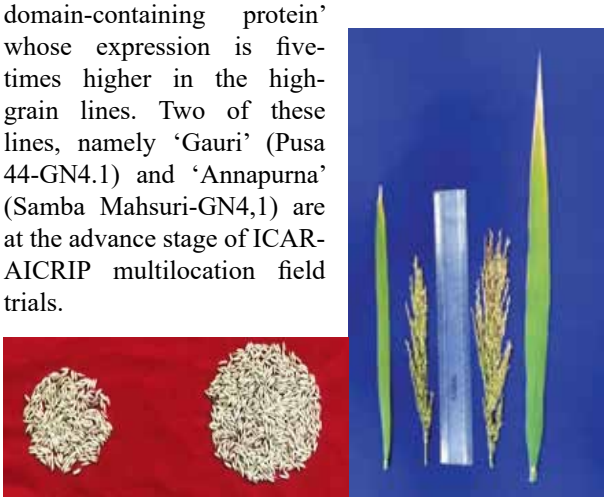


Seed coat colour photograph of Varuna and T_1 seeds of different edited lines. 1- Varuna; 2- Black-seeded edited line; 3- Yellow seeded edited line; 4- Yellow seeded edited line.

Genomic interventions facilitating crop improvement

A novel DUF740 polynucleotide associated with multiple stress tolerance from rice: A DNA construct comprising of a stress-inducible promoter (*AtRd29A*) operably linked to a polynucleotide fragment, *OsSRDP* gene, has been developed, which conferred enhanced tolerance to multiple stresses in transgenic rice, in the background of cv. PS2. Transgenic plants showed better resilience than PS2 when subjected to drought, salinity and cold stresses. Additionally, the transgenic plants showed resistance to a virulent strain of rice blast fungus *Magnaporthe oryzae* .

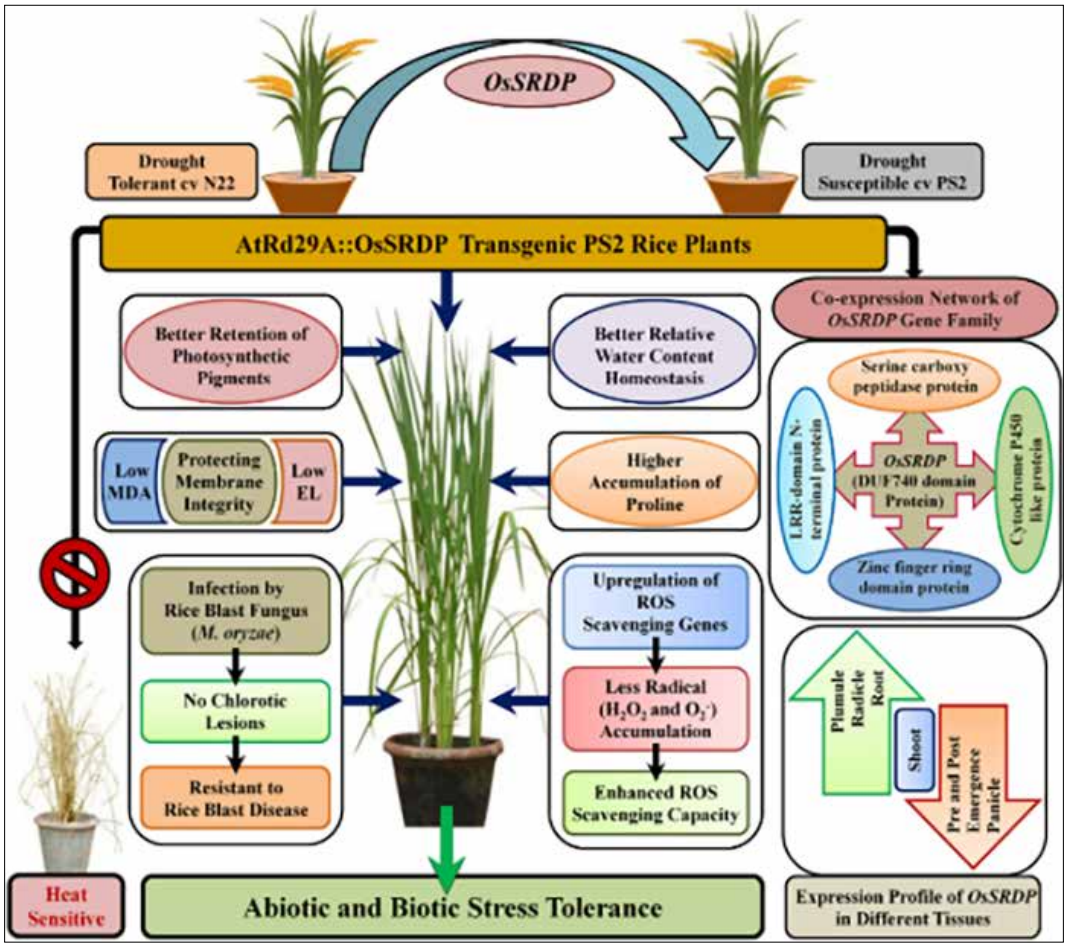
QTL *qGN4.1* for enhancing rice productivity by grain yield: A new major locus *qGN4.1* for enhancing the grain yield of rice by increasing root and shoot biomass, tiller thickness, leaf size and doubling the number of well-filled grains per panicle, leading to 15–20% yield grains in the popular green revolution rice varieties such as, Pusa 44 and Samba Mahsuri has been discovered. Further, the duration of the crop is reduced by 7–10 days thus saving the valuable irrigation water. The gene was identified in a new plant type breeding line, viz. Pusa 1266 developed by IARI, New Delhi and was genetically mapped by ICAR-NIPB on rice chromosome 4 using DNA markers genomic tools during 2010, and since then has been transferred to a dozen popular high-yielding mega varieties of rice. The underlying gene has been identified as coding for a 'protein kinase domain-containing protein' whose expression is five-times higher in the high-grain lines. Two of these lines, namely 'Gauri' (Pusa 44-GN4.1) and 'Annapurna' (Samba Mahsuri-GN4,1) are at the advance stage of ICAR-AICRIP multilocation field trials.



Larger flag leaf, panicle size and number of grains per panicle of the QTL-NIL (near-isogenic line) 'Annapurna' possessing yield QTL *qGN4.1* (Right) as compared to the recipient popular green revolution rice variety Samba Mahsuri (Left)

Field view of the popular green revolution rice variety Samba Mahsuri (left) and its near-isogenic line 'Annapurna' (Samba Mahsuri-GN4.1) (right), showing higher bio-mass, large panicles and early maturity due to the effect of yield QTL *qGN4.1*

Molecular mapping of QTLs conferring aluminium (Al) toxicity tolerance in *Brassica carinata* derived *Brassica juncea* introgression lines: To enhance Al tolerance, *Brassica carinata* derived *B. juncea* introgression lines (ILs) were developed at ICAR-IARI, New Delhi, and evaluated under Al stress. The ILs showed wide genetic variability for morpho-physiological and agro-morphological traits. Root traits were strongly correlated with seed yield. Path coefficient analysis identified root surface area ($\rho = 0.99$) as the most important trait. Tolerance indices such as stress tolerance index, geometric mean productivity, harmonic



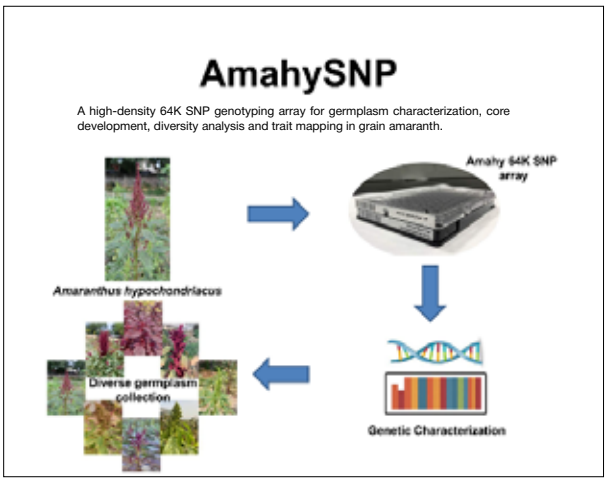
Cumulative effect of the *OsSRDP* gene

mean, and mean productivity were positively associated with root traits, validating their use for selection. Based on these indices, ILs 180, 176, 182, 170, 169, and 161 were identified as tolerant. High-throughput genotyping-by-sequencing (GBS) generated a high-density linkage map of 7,434 SNPs spanning 3,234.9 cM, with higher marker density in the B genome reflecting *B. carinata* introgression. QTL mapping identified 38 significant loci for morpho-physiological traits (17), agro-morphological traits (14), and stress tolerance indices (7). Five QTL hotspots were detected, including one on chromosome 2B harboring four tolerance-related loci. *In silico* candidate gene analysis revealed several functionally relevant genes linked to root development, oxidative stress response, and stress signaling. This study demonstrated the value of interspecific introgression for broadening genetic variability and identified key genomic regions for marker-assisted breeding of Al-tolerant Indian mustard cultivars for acidic soils.

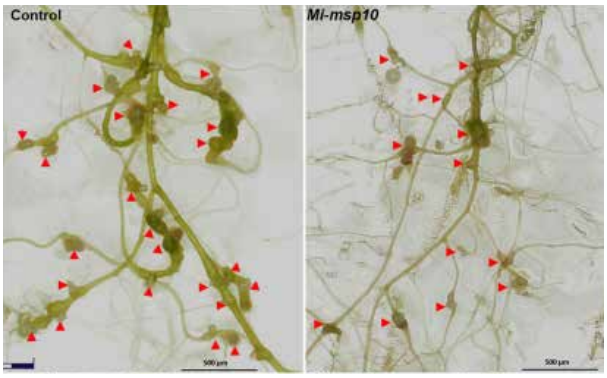
62K SNP genotyping chip for pigeonpea: A 62K genic-SNP chip array, CcSNPnks, of pigeonpea for Affymetrix Gene Titan platform has been developed consisting of 62,053 SNPs from 9629 genes. It has been used successfully for the analysis of genetic diversity and population structure of 95 pigeonpea varieties and high-resolution mapping of 11 yield related QTLs for number of branches, pod bearing length and number of seeds per pod in a biparental RIL population. Furthermore, as an accurate high-density genotyping tool, 'CcSNPnks' chip array will be useful for high resolution fingerprinting, QTL mapping and genome-wide as well as gene-based association studies in pigeonpea.

Development of high-throughput SNP genotyping array: A 64 K high-throughput SNP genotyping array named "AmahySNP", containing 64,069 high-density SNPs distributed across both genic (55.17%) and non-genic (44.83%) regions of the *Amaranthus hypochondriacus* genome was developed. The array was effectively utilized for population structure analysis, genetic diversity studies, core development, and genome wide association studies (GWAS) in amaranth germplasm. GWAS conducted using 22,763 polymorphic SNPs from 540 genotypes identified 13 novel loci associated days to flowering (DTF) trait, seven of which were located within annotated genes.

In mothbean, through a genome-wide association study (GWAS) on a diverse panel of 327 moth bean (*Vigna aconitifolia*) accessions conserved at the National Genebank using 8,518 SNP markers and phenotypic data from three environments, 17 significantly associated SNPs have been identified for seed weight. Among them, four SNPs exhibited major effects on the 100-seed weight trait. Potential candidate genes associated with seed size and development have also been identified, including



Process and applications of AmahySNP array



(a) (b)

Representative gall formation in control (2a) and reduction in the number of galls in RNAi line (2b).

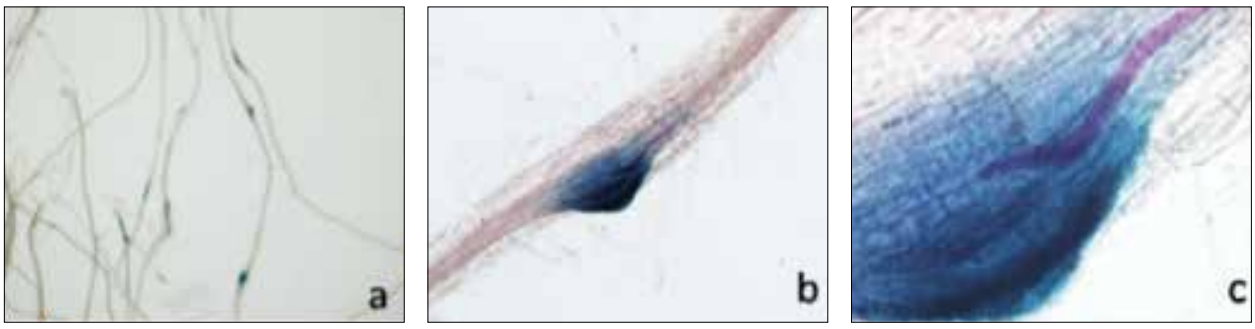
S-protein-like protein, purple acid phosphatase, and CBL-interacting protein kinase 8-like.

Biotechnological interventions in insects and microbes management

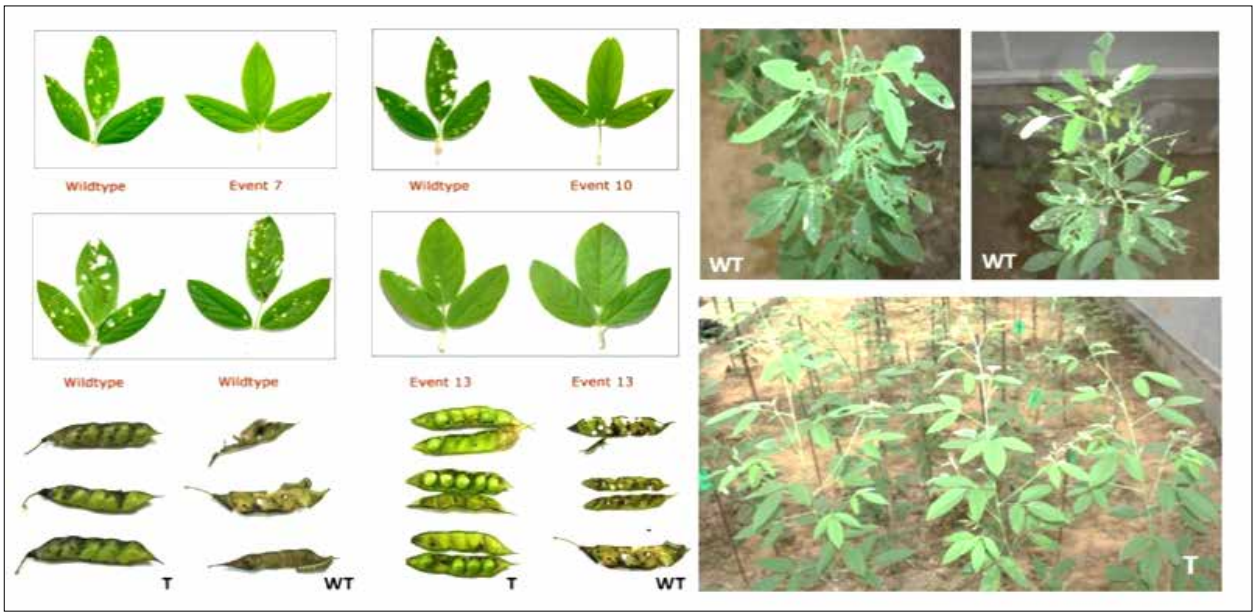
A root-specific and nematode-responsive promoter for expressing target genes to develop nematode resistance in plants: Nematode-responsive and root-specific (NRRS) promoters have been identified and functionally characterized, which showed preferential expression upon nematode infection, exclusively in the root in one and galls in the other. Gall-specific promoter, an alternative to the constitutive CaMV35S promoter, drives host-derived RNA interference targeting nematode gene(s) to confer effective nematode resistance. There was significant reduction in nematode infection in *Arabidopsis* and tomato plants (number of galls, adult females and egg masses was reduced by 60–90% depending upon the genes employed). The novel promoters can be used for developing nematode resistance in crop plants.

Deciphering insect genomics/transcriptomics for management: A chromosomal-level genome assembly of the green lacewing predator *Chrysoperla zastrowii sillemi* has been generated, using a combination of short-read (Illumina) and long-read (PacBio) sequencing technologies, coupled with Hi-C scaffolding. The assembly comprises six chromosomal pseudomolecules, representing 84% of the total genome, with sizes ranging from 29.36 Mb to 170.05 Mb. Genome annotation using RefSeq, EggNOG, SwissProt, and the Eukaryotic Orthologous Groups (KOG) databases identified 14,495 protein-coding genes. Whole-genome transcriptome sequencing revealed that four genes are upregulated and four genes down-regulated to govern hibernation in the larvae of *Chilo partellus*. Computational analysis and functional validation of odorant-binding proteins (OBPs) in whitefly, *Bemisia tabaci* revealed that OBP3 and OBP10 are key mediators of host recognition, identifying potential attractants, repellents, and oviposition deterrents for behavioural management.

Bt-pigeonpea for pod borer resistance: Transgenics in pigeonpea were developed harboring *cry1AcF* and *cry2Aa* using apical meristem-targeted in planta transformation strategy for resistance to pod borer *Helicoverpa armigera*. After analysis through advanced generations, 5 events with cry1AcF (cv. TTB7) and 5 events with cry2Aa (Pusa992) were selected based on molecular and bioefficacy characterization. After the necessary regulatory approvals, the trial was planted in the transgenic testing field of IARI in July 2023. The transgenic plants were challenged and assessed for their performance against pod borer, resulting in the identification of at least 3 superior events.



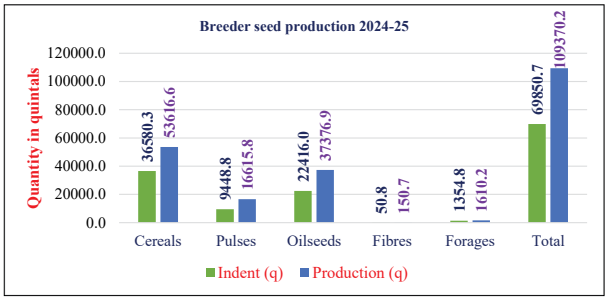
(a) Nematode-responsive root-specific promoter driven expression of GUS reporter gene in nematode infected root of transgenic plant exhibiting GUS activity only in the nematode induced galls at 10 dpi.
(b and c) Enlarged microscopic view of galls from nematode infected roots of transgenic plant.



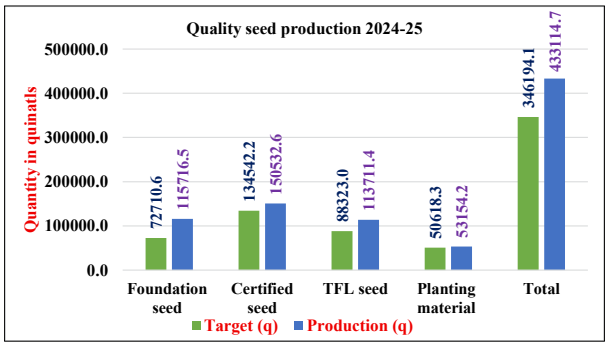
The setup of event selection trial (top) and the differential damage on control and transgenics due to feeding by pod borer *Helicoverpa armigera*.

Seed Production

Breeder seed production: During 2024-25, total breeder seed production in field crops was 1,09,370.2 quintals against the indent of 69,850.8 quintals. The major share in total breeder seed production belongs to cereal crops i.e. 53,616.6 q against indent of 36,580.3 q. Under pulse crops a total of 16615.8 q breeder seed was produced against the indent of 9,448.8 q. In oilseeds, total breeder seed production was 37,376.9 q against the indent of 22,416.0 q. Breeder seed produced in case of fiber crops was 150.7 q against the indent of 50.8 q and in forage crops, 1610.2 q was produced against the indent of 1,354.8 q.



Quality seed/ planting material production: During the year 2024-25, total production of quality seed including all classes was 4,33,114.7 q against the target of 3,46,194.1 q. Production comprises 1,15,716.5 q of foundation seed, 1,50,532.6 q of certified seeds, 1,13,711.4 q of truthfully labelled seed and 53154.2 q of planting material of field crops. In addition, 117.2 lakh planting material and 16.1lakh tissue culture plantlets were produced against the targets of 116.9 and 11.8 lakh, respectively.



Speedy seed viability kit: A rapid colourimetric test kit capable of distinguishing between viable and non-viable seeds has been developed. The kit includes an indicator that changes colour in response to *pH* shifts by capturing the CO_2 released by the respiring viable seeds. The kit consists of a concentrated indicator sufficient for testing 300 seeds, dropper bottle, seed holders, and 100 transparent airtight incubation tubes. The testing process involves securing pre-soaked seeds (2–4 h) in a seed holder placed inside the incubation tube containing 250 µL indicator for 1–4 h (incubation). The colour of the solution, if it turns green or yellow, indicates viable seeds, while those that remain blue (initial indicator colour) signify non-viable seeds. A patent (Patent no.: 202511002330 dated 10-01-2025) was filed and commercialized.

Speedy seed viability kit

Uniprime technology: An imbibition phase-based seed priming technique developed for rice, where, instead of an arbitrary imbibition time, a varietal-specific, precise

moisture content is identified for imbibing the seeds. It is applicable across various crop species, different types of priming, and diverse water potential conditions. It is also helpful in determining the amount of water to be added during hydropriming. This technology is also beneficial to precisely compare different priming types with varying imbibition periods to determine the most effective priming type in seed priming experiments. ICAR-IARI, New Delhi, offers a service to assess the varietal-specific moisture content for seed priming of various crop varieties on a fee-for-service basis.

HORTICULTURAL CROPS

Release and notification of varieties

During the reporting period, a total of 28 varieties in 18 crops were notified by the Central Sub-Committee on Crop Standard, Release and Notification of Varieties of Horticultural Crops, Government of India as mentioned below.

Sl. No.	Crop and Variety	Area(s) of cultivation	Salient features
	Fruits		
1.	**Mango**		
	Awadh Abhaya	Uttar Pradesh	It is a climate resilient, nutri-smart, high yielding (85-90 kg/ plant), regular bearing and late maturing (July/ August) hybrid. Fruits are medium to large; weigh about 300-400 g, firm in texture, pulp 80.76% and light yellow in colour.
	Awadh Samriddhi	Uttar Pradesh	It is a climate resilient, nutri-smart, regular bearing, high yielding (85-90 kg/plant) and late maturing (July/ August) mango hybrid. Fruits are uniform and weigh about 300-350 g. Pulp per cent is 71.8, dark yellow, firm with scanty fibre, TSS is 21.6°B.
2.	**Guava**		
	Awadh Bhushan	Uttar Pradesh	It is a selection from half-sib population of var. Sardar, which is prolific bearer, fruits are yellowish-green in colour with average fruit weight about 300 g. It has relatively few and soft seeds and rich in ascorbic acid content (280 mg/100 g pulp). Average yield 80.0 kg/tree after 6 years of planting, suitable for HDP.
3.	**Bael**		
	Awadh Arpan	Uttar Pradesh	It is early-ripening (April), drought-tolerant, prolific bearer (75.20 kg/tree at 15 years age). Fruits are oblong (1.0-1.3 kg) with fewer seeds (91.64). Pulp is rich in marmelosin (596.57 µg/g), psoralen (102.02 µg/g), polyphenols (3.66 µg/g), riboflavin (158 µg/g), niacin (1340.0 µg/g) and ascorbic acid (23.60 mg/100g pulp).
	Awadh Shrestha	Uttar Pradesh	It is high-yielding (67.43 kg/tree after 15 years), fruits are large oblong to round (1.4-2.35 kg), mid-season (May) with pale yellow pulp (moderate TSS: 32.03 °B, acidity: 0.41%, ascorbic acid: 14.41 mg/100g). Thin shelled (2.14 mm) with high riboflavin (182.57 µg/g).
4.	**Pummelo**		
	NRCC Pummelo-2	Assam	Fruits are medium, 800 g in weight, have smooth surface, yellow in colour. The segments are light pink in colour, soft and tender. Yield 26.5 t/ha.
5.	***Jamun***		
	Awadh Jamwant	Uttar Pradesh	It is a high yielding (55 kg/plant) and bold large sized bunches with attractive deep purple colour. It matures during second week of June. Fruits are bold, oblong and have average weight of 18-21 g, pulp percentage is 92.26 and TSS is 16.4°B. It is suitable for both table and processing purpose.
6.	**Apple**		
	CITH-Ammol	Jammu and Kashmir	It is an improvement over indigenous apple cultivar "CITH-Ambri-1" having traits like early maturity, higher aroma and better shelf-life. Yield: 40-45 t/ha.
	CITH-Pride	Jammu and Kashmir	It is scab resistant variety with superior fruit quality. Yield: 45-54 t/ha.
	CITH-Priame	Jammu and Kashmir	It is also scab resistant variety with superior fruit quality. Yield: 42-48 t/ha.
7.	**Walnut**		
	CITH-Early	Jammu and Kashmir	It is early maturing with better nut and kernel quality features. Yield: 3.5 t/ha.
	CITH-Prolific	Jammu and Kashmir	It has lateral bearing habit and thus high yielding (4.5 t/ha) with better quality nuts & kernel characteristics, can replace existing non-descriptive heterogeneous walnut varieties.

Sl. No.	Crop and Variety	Area(s) of cultivation	Salient features
	Vegetables		
1.	**Potato**		
	Kufri Ratan	Haryana, Punjab, Plains of Uttarakhand, Uttar Pradesh, Madhya Pradesh, Rajasthan, Gujarat, Chhattisgarh, Odisha, Bihar, West Bengal, Assam, Arunachal Pradesh, Maharashtra and Karnataka	It is a medium maturing (90 days), high-yielding (37–39 t/ha) red-skinned table potato with wide adaptability across north Indian plains & plateau regions and has excellent storability.
	Kufri Tejas	Haryana, Punjab, Uttarakhand, Uttar Pradesh, Madhya Pradesh, Gujarat and Maharashtra	It is a heat-tolerant, medium maturing (90 days), high-yielding (37–40 t/ha) table potato, suitable for Indian plains of Haryana, Punjab, UP, MP, Gujarat, and Maharashtra. It has good storability under ambient conditions.
	Kufri ChipBharat-1	Haryana, Punjab, Uttarakhand, Uttar Pradesh, Madhya Pradesh, Gujarat, Rajasthan, Karnataka, Telangana and Tamil Nadu	It is a medium maturing (100 days), high-yielding (35–38 t/ha) chip making variety recommended for Indian plains. It has high dry matter (21%), low reducing sugars, and produces chips of acceptable colour.
	Kufri ChipBharat-2	Haryana, Punjab, Uttarakhand, Uttar Pradesh, Madhya Pradesh, Gujarat, Rajasthan, Karnataka, Telangana and Tamil Nadu	It is an early maturing (90 days), high-yielding (35–37 t/ha) chip making variety, with similar high dry matter and excellent storability, ensuring consistent supply for processors.
2.	**Pointed gourd**		
	Awadh Suchitra	Uttar Pradesh	Ii is a high-yielding (18-20 t/ha) hybrid with uniform, light green, white-mottled fruits (45-55 g) having soft seeds and excellent culinary quality. Tolerant to fruit fly, whitefly, and root-knot nematode, and can withstand high temperatures up to 40°C and low temperatures down to 10°C.
	Awadh Surekha	Uttar Pradesh	It is a high-yielding dual-purpose variety (20–25 t/ha) suitable for both vegetable and sweet preparations. It produces attractive green-striped fruits (50–60 g) with tender, non-fibrous flesh and a yellow inner cavity ideal for making *parwal ki mithai*. Tolerant to major pests and diseases, has excellent keeping quality, and fit for long-distance transport.
3.	**Onion**		
	CITH-Red Gem	Jammu and Kashmir	It is first long day onion variety with red colour having higher yield (54 t/ha), better bulb quality traits and enhanced shelf-life, which will improve the availability period and market value of the produce.
4.	**Garlic**		
	CITH-Jumbo	Jammu and Kashmir	It is first long day garlic variety with higher yield (31 t/ha) and better clove quality and can replace the non-descriptive local and Chinese genotypes and will have better market potential due to uniformity and quality in produce.
	Plantation crops		
1.	**Coconut**		
	Kalpa Nakshatra	Kerala (under irrigated conditions)	This variety has high nut yield of 151 coconuts/palm/year with an average yield of 26,497 nuts/ha (5.47 tonnes of copra per ha.), good tender nut (5.9°B), and is also good for neera production.
2.	**Arecanut**		
	Terai Shankar	Sub-Himalayan Terai region of West Bengal and lower Brahmaputra zone of Assam.	It has 320–340 medium-sized oval nuts of orange colour, dry weight of 6.75 g kernel and 2.19 kg/palm/year with 21% kernel recovery.
	Spices		
1.	**Small Cardamom**		
	IISR Sujyothi	Karnataka	This variety is a high-yielding hybrid producing approximately 3,805 kg/ha of fresh capsules and 705 kg/ha of dry capsules under optimal cultivation conditions. It boasts high essential oil content of 8.38%, making it particularly valuable for flavour and aroma, which are critical parameters in cardamom trade.
	Medicinal and aromatic plants		
1.	**Brahmi (*Bacopa monnieri* L.)**		

Sl. No.	Crop and Variety	Area(s) of cultivation	Salient features
	Vallabh Ganga Brahmi-1	Gujarat, Madhya Pradesh, Maharashtra, West Bengal, Odisha, Assam, Bihar and Uttar Pradesh	It has higher bacoside A3 (0.605%) and bacopside-X (0.715%) contents, superior in total bacoside yield (181.17 kg/ha) compared to CIM-Jagriti (114.68 kg/ha). It has a maximum dry herbage yield (133.96 q/ha).
2.	**Chakoda (*Cassia tora* L.)**		
	Vallabh Chakoda-1	Gujrat, Rajasthan, Madhya Pradesh, Maharashtra, Assam, Bihar and Uttar Pradesh	It is a high yielding variety having seed yield of 1900-2500 kg/ha. with total anthraquinones 0.01-0.03%. The variety can be cultivated in tropical and sub-tropical regions of India.
3.	**Salparni (*Desmodium gangeticum* L.)**		
	Vallabh Salparni-1	Kerala, Odisha, Rajasthan, Gujarat, Chhattisgarh, Madhya Pradesh, Maharashtra and Nagaland	It is a high yielding variety having root yield of 1200-1300 kg/ha with high phenolics (0.07-0.08%).
	Mushrooms		
1.	DMR Milky-299 and DMR Milky-321	All India	These mushroom varieties have longer shelf-life (up to 7 days at room temperature and 10–15 days under refrigeration). They are high yielders (14.2% and 11.2%, respectively) over DMRO-985.

GLIMPSES OF THE VARIETIES RELEASED

Mango – Awadh Abhaya

Mango – Awadh Samriddhi

Guava – Awadh Bhushan

Bael – Awadh Arpan

Bael – Awadh Shrestha

Jamun – Awadh Jamwant

Apple – CITH-Ammol

Walnut – CITH-Early

Glimpses of the Varieties Released


Coconut – Kalpa Nakshatra


Arecanut – Terai Shankar


Onion – CITH-Red Gem


Potato – Kufri Ratan


Potato – Kufri Tejas


Potato – Kufri Chibharat-1


Garlic – CITH Jumbo


Brahmi – Vallabh Ganga Brahmi-1


Chakoda – Vallabh Chakoda-1


Salparni – Vallabh Salparni-1


Mushroom – DMR Milky-321


Cardamaom – IISR Sujyothi

3. Crop Management

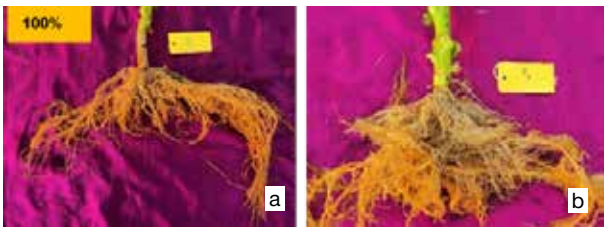
ICAR institutes achieved significant advances in crop management, crop protection, and sustainable production technologies across field and horticultural crops, contributing to enhanced productivity, resource-use efficiency, climate resilience, and farmers' profitability. In field crops, microbial consortia and nano bio-inputs improved soil health and crop performance, increasing soybean yield by up to 17% and Flue-cured Virginia (FCV) tobacco cured leaf yield by 7% with higher benefit-cost ratios. Precision irrigation in jute-based systems reduced water use by up to 18%, improved energy efficiency by 14.8%, and enhanced system productivity by about 25%, while waterlogging recent studies identified tolerant jute genotypes and stage-specific vulnerabilities. Conservation agriculture-based rice-chickpea and pigeonpea-wheat systems reduced weed pressure (up to 22%), increased yields (41% in pigeonpea), and generated higher net returns (₹33,061/ha over rice-wheat). Climate-resilient integrated farming system models promoted resource recycling, water harvesting, and soil carbon enrichment. In crop protection, AI-enabled smart pheromone traps for pink bollworm enabled real-time surveillance, resulting in 38.6% reduction in pesticide use and 18.54% yield increase. Biocontrol agents, microbial consortia, and eco-friendly formulations effectively managed major insect pests, diseases, and nematodes, while rapid molecular and AI-based diagnostics enabled early, accurate detection. In horticultural crops, advanced bioreactor-based propagation, disease-free planting material technologies, precision irrigation, and integrated pest and disease management modules significantly improved yield, quality, and resource-use efficiency. Overall, ICAR's innovations strengthened sustainable digital agriculture, and climate-smart farming, directly contributing to farmers' income enhancement and environmental sustainability.

FIELD CROPS

Crop Production

Microbial consortia for soil health and soybean yield: Microbial consortia (*Bacillus aryabhattai* + *Bradyrhizobium lioningense* + AMF) significantly improved enzymes and available nutrient content in soil over control. The phytohormones Tria 2 ppm with arbuscular-mycorrhizal (AM) inoculation found significantly higher nodule biomass, leghemoglobin content in nodules, and soybean yield. Also, the seed inoculation of heterotrophic sulfur-oxidizing bacteria (H3) *Bacillus amyloliquefaciens* significantly enhanced soybean yield by 17% over control.

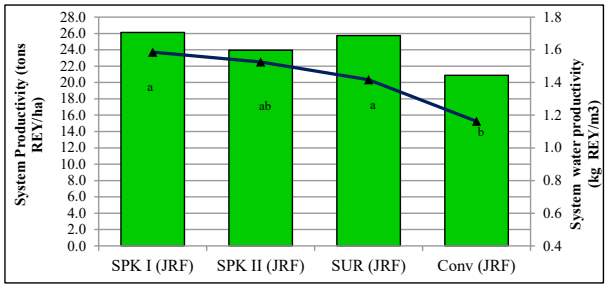
Nano BioTech capsules for sustainable cultivation of FCV tobacco: Nano Biotech Capsule is a consortium of microorganisms, which reproduce and grow in the soil by utilizing carbon source available near root zone enhancing nutrient uptake by converting insoluble major nutrients into plant-available forms and improving fertilizer efficiency. Nano Bio-Tech Capsules along with the 100% recommended dose of fertilizers (RDF) and farmyard manure (FYM) enhanced cured leaf yield significantly by 7% over 100% RDF alone in rainfed conditions of Karnataka. Under, irrigated conditions of Andhra Pradesh, the same treatment resulted in a 5% numerical yield increase and economically, the application of 10 Nano Bio-Capsules per acre with 100% RDF and FYM yielded a higher benefit-cost ratio (1.43) compared to 1.39 with 100% RDF alone, ensuring an additional income of ₹12,152/h.



Root architecture in tobacco with
(a) Treatment with 100% RDF; (b) Treatment with 10 Nano Bio-capsules per acre with 100% RDF and FYM

Precision irrigation scheduling for augmenting yield, resource-use efficiency and water productivity in jute-based cropping systems: Field trials comparing sprinkler and surface irrigation at different irrigation levels demonstrated that sprinkler irrigation at 50% of the available soil moisture depletion performed most effectively. This treatment recorded the lowest total water footprint (1,538–1,993 m³ per tonne), reducing water use by up to 18% compared to conventional practices and 10% compared to surface irrigation, while maintaining similar yields. It also resulted in a 14.8%

improvement in energy efficiency and a 41% increase in net energy returns. System-level analysis across the jute–rice–flax cropping sequence showed that sprinkler irrigation improved overall system productivity by about 25% and system water productivity by up to 37% relative to conventional irrigation. Hence, properly scheduled sprinkler irrigation not only conserves water but also enhances energy efficiency and reduces the carbon footprint of jute-based systems.



Field trials comparing sprinkler and surface irrigation at different irrigation levels

Water management strategies for profitable and sustainable jute cultivation under rainfed and irrigated ecosystem: The study on waterlogging-induced stress responses in jute (*Corchorus* spp.) was undertaken to evaluate the comparative tolerance of *C. olitorius* and *C. capsularis* varieties under varying stages of waterlogging imposition. Early-stage waterlogging [30 days after sowing (DAS)] had the most detrimental effect, causing a 27–33% reduction in plant height, approximately 19% decline in chlorophyll content (SPAD values), and around 15% decrease in relative leaf water content (RLWC) across both *C. olitorius* and *C. capsularis*. In contrast, late-stage waterlogging (60 DAS) resulted in only marginal yield losses, indicating partial recovery capability at advanced growth stages. Biochemical assays demonstrated a notable upregulation of catalase (CAT) activity, signifying enhanced reactive oxygen species (ROS) scavenging under stress. Specifically, *C. capsularis* exhibited a 15–24% increase in catalase activity, while *C. olitorius* showed a broader enhancement ranging from 14–69%, suggesting stronger antioxidative defense in the latter species. Yield analysis indicated substantial fibre yield reductions of 39–44% when waterlogging occurred at 30 DAS, 17–21% at 45 DAS, and 4–9% at 60 DAS, clearly establishing the early vegetative phase as the most sensitive growth stage to waterlogging stress. Among the tested varieties, JRCJ 11 (*C. capsularis*) outperformed JRO 204 (*C. olitorius*) under early and mid-stage waterlogging, reflecting better physiological tolerance, efficient recovery post-stress, and comparatively higher fibre retention. Overall, the study provided significant insights into the stage-specific sensitivity and adaptive biochemical responses of jute to transient waterlogging, emphasizing the potential of JRCJ 11 as a promising tolerant genotype laying the groundwork for developing waterlogging-resilient jute varieties and devising management strategies to mitigate

Root structural modifications a. Waterlogged condition b. Non-waterlogged condition

yield losses in flood-prone regions of eastern India.

Conservation tillage and weed management module for rice-chickpea rotation: Conservation tillage comprising zero-tilled (ZT) direct seeded rice (ZTDSR) – zero-tilled chickpea (20 cm standing stubble of rice) and weed management through pre + post herbicides such as pendimethalin 1 kg a.i./ha (2 DAS) followed by metsulfuron-methyl + chlorimuron ethyl (ready-mix) 4 g a.i./ha at 25 DAS in rice; and oxyfluorfen 150 g a.i./ha at 2 DAS followed by propaquizafop 100 g a.i./ha at 25 DAS were tested in chickpea for higher weed control efficiency and crop productivity of rice-chickpea system. The ZTDSR-ZTC+RR led to the lower weed density in chickpea (by 10%) and system (by 7%) than conventional-tilled (CT) puddled transplanted rice - CT chickpea without residues (PTR-CTC-R; farmer practice). Pendimethalin 1 kg a.i./ha – metsulfuron-methyl + chlorimuron ethyl (ready-mix) 4 g a.i./ha in rice and oxyfluorfen 150 g a.i./ha – propaquizafop 100 g a.i./ha in chickpea decreased the weed density in system by 14–22% ($p < 0.05$) than pendimethalin + one hand weeding.

An integrated approach for management of purple nutsedge (*Cyperus rotundus* L.) in pulse-based cropping system: System-based approaches such as growing of green manure cover crop dhaincha (Sesbania, *Sesbania aculeata*) during summer season (April to June) for 45 days followed by knockdown with 2,4-D at 500 g a.i./ha, and summer irrigation under zero tillage followed by application of halosulfuron-methyl 70 g a.i./ha at 20 days after irrigation (chemical management; halosulfuron-methyl) at two leaf stage of motha can reduce the infestation of purple nutsedge and total weeds in cropping systems (pearlmillet–chickpea and pigeonpea–wheat) in conservation agriculture (CA) than conventional practice.

Evaluating conservation agriculture based pigeonpea-wheat system for higher productivity and profitability under irrigated conditions: A pulse-based intensive cropping system developed for diversification of rice-wheat system. Zero-tilled flatbed (ZTFB) with pigeonpea variety 'IPH 15-03' – ZTFB wheat (cv. 'Unnat Halna') + ZTFB summer mungbean (cv. 'Virat') with 75% NPK + added residues and resulted in 41% higher pigeonpea yield over conventional tilled pigeonpea-wheat system. Pigeonpea-wheat system had additional net income of ₹ 33,061.0 than rice-wheat system.

Crop Protection

Real-time monitoring of the pink bollworm in cotton using AI Smart pheromone trap in Punjab: A success story: The ICAR-Central Institute for Cotton Research (CICR), Nagpur has deployed AI-enabled smart pheromone traps on a pilot scale across three major cotton-growing districts of Punjab for real-time monitoring of pink bollworm (PBW) and issuing timely alerts to farmers. Leveraging automated, real-time data, daily alerts and weekly advisories on PBW incidence, damage status, and management strategies were disseminated to stakeholders. Over 4 lakh voice messages in Punjabi were transmitted through the Global System for Mobile Communications network to 28,190 cotton growers, providing district-specific alerts whenever trap catches exceeded the economic threshold level (ETL). In addition, PBW management advisories were circulated through mass media and social media platforms to ensure wider farmer outreach.

The implementation of AI-driven pest monitoring has markedly improved pest detection accuracy, management efficiency, and cost-effectiveness compared to conventional surveillance methods. The pilot-scale deployment in Punjab yielded encouraging outcomes, including a 38.6% reduction in pesticide use, while maintaining effective PBW control, and an 18.54% increase in yield compared to traditional practices. These results underscore the potential of AI-based smart traps to enhance cotton productivity, minimize chemical dependency, and promote sustainable pest management.

Shri Shivraj Singh Chouhan, Hon'ble Union Minister of Agriculture and Farmers Welfare, and Shri Devendra Fadnavis, Hon'ble Chief Minister of Maharashtra, jointly launched the AI Smart Trap during the 'Vikasit Krishi Sankalp Abhiyan' held at Nagpur on 18 May 2025, in the presence of Dr. M.L. Jat, Secretary, DARE & Director General, ICAR, along with other distinguished dignitaries.

Unraveling sesame's defense mechanisms against the emerging mirid bug (*Campylomma livida*): The study investigated the resistance mechanisms of sesame (*Sesamum indicum* L.) against the emerging pest *Campylomma livida* at ICAR-Indian Institute of Oilseeds Research, Hyderabad. A total of 455 germplasm lines-including 279 from ICAR-IIOR, 116 from USDA, and 60 advanced breeding lines-were screened under natural field conditions over two seasons (2023–2024). Several ICAR–IIOR accessions (IC-205628, IC-205630, IC-500355, IC-500497, IS-482-B, IC-500476, and KMR-60) consistently exhibited resistance, while selected USDA lines (PI 231035, PI 238442, PI 599476) showed moderate resistance. Highly susceptible genotypes included SES-K-20-2009 and PI 254705. These findings provide valuable insights into host-pest interactions and underpin strategies for developing durable resistance in sesame.

Integrated management of mirid bug (*Campylomma livida*) in sesame: Efficacy of chemical and botanical approaches for yield and profitability: Field trials studies to evaluate the efficacy of chemical and botanical treatments against the mirid bug (*Campylomma livida*) in sesame and their effects on yield and economic returns showed that Thiamethoxam + Lambda-cyhalothrin achieved the highest suppression of *C. livida*, followed by Buprofezin + Acephate and Acephate 75% SP. Bifenthrin and Fipronil + Imidacloprid provided moderate control, while botanical treatments were comparatively less effective. The reduction in pest populations translated into improved sesame yields, with Thiamethoxam + Lambda-cyhalothrin producing 6.12 q/ha in *Kharif* and 5.86 q/ha in *Rabi*, followed by Buprofezin + Acephate and Acephate 75% SP. Moderate yields were recorded in plots treated with Bifenthrin, Fipronil + Imidacloprid, and Azadirachtin, while the lowest yields were obtained in the untreated control. Economic analysis (ICBR) indicated that Thiamethoxam + Lambda-cyhalothrin was the most profitable treatment during *Kharif*, whereas Acephate 75% SP provided the highest economic returns in *Rabi*. Botanical treatments, although eco-friendly, were less cost-effective due to lower yield gains. The study demonstrates that chemical insecticides, particularly Thiamethoxam + Lambda-cyhalothrin and Acephate-based formulations, provide superior control of *C. livida*, enhance sesame yield, and improve profitability.

Management of biotic stresses in soybean: For the management of aerial blight disease, seed treatment with Thiophanate methyl + Azoxystrobin + Thiomethoxam @10 ml/kg seed + spray of Fluxapyroxad 167 g/L + Pyraclostrobin 333 g/L SC @300 g/ha 30, 45 and 65 DAS produced lowest disease severity of 48.35%.

EPN technology for management of white grubs: Entomopathogenic nematode formulation is first of its kind in a unique combination of carrier materials with wettable powder to attain a longer shelf-life with viable infective nematode juveniles (IJs) of EPN by providing adequate aeration and moisture. The formulation containing *Heterorhabditis indica* strain SBITND78 (GenBank Accession No. KF937809) has a shelf-life of nine months with 92% survival of nematodes

EPN formulation

at a temperature range of 28±5°C. The formulation containing *Steinernema glaseri* strain SBILN1 (GenBank Accession No. MK503713) has a shelf-life of 12 months with 90% survival of nematodes at a temperature range of 28±5°C. The EPN formulation caused mortality of the insect larvae of coleopteran white grub *Holortrichia serrata* and lepidopteron larvae *Galleria mellonella*. Successful control of white grub under field conditions was obtained with ICAR-SBI EPN formulation.

Mass production technology of *Cotesia flavipes* and *Telenomus dignus* for integrated control of sugarcane internode borer: Mass production technology by using target and alternative hosts was developed for the parasitoids *Cotesia flavipes* and *Telenomus dignus*. The usefulness of these parasitoids in internode borer control individually and as a combination through augmentative releases was explored and the parasitoid releases was found to enhance parasitism rate and decrease internode borer attack.

INB egg parasitoid, *Telenomus dignus*

Microbial consortia for management of fall armyworm (*Spodoptera frugiperda*) and soil borne pathogens: Four bacterial strains *Pseudomonas fluorescens*, *Bacillus subtilis*, *B. cereus*, and *B. thuringiensis* and one fungus, *Trichoderma harzianum*, were evaluated against maize fall armyworm under laboratory conditions. *B. thuringiensis* caused the highest larval mortality (71%) with the lowest LC_{50} (1.85×10^3 cfu/ml), followed by *P. fluorescens* (70% mortality; $LC_{50} = 2.84 \times 10^3$ cfu/ml). The microbes were mutually compatible, and their consortium achieved the greatest suppression of fall armyworm under field conditions, reducing infestation by 68% compared to 48–61% reduction with individual treatments. All five antagonists inhibited mycelial growth of maize soil-borne pathogens. *B. subtilis*, *P. fluorescens*, and *T. harzianum* were most effective against *Fusarium verticillioides*, *Macrophomina phaseolina*, and *Rhizoctonia solani*, showing inhibition zones of 3.2, 3.0, and 3.3 cm, respectively.

Development of rapid colorimetric LAMP assay for detection of chickpea wilt pathogen: *FGB1* gene-based Polymerase Chain Reaction (PCR), Quantitative PCR (qPCR), and Loop-Mediated Isothermal Amplification (LAMP) assays were developed for *Fusarium oxysporum* f. sp. *ciceris* causing wilt of chickpea. Conventional PCR produced a specific band, while qPCR detected as little as 0.6 fg/µL DNA with no false positives. The LAMP assay showed the highest specificity and sensitivity, detecting 3.21 fg/µL DNA within 15 min, outperforming PCR. It was successfully validated on plant and soil samples from chickpea fields across locations and time intervals. LAMP diagnostic assay offers early onset of the disease prediction for the timely management of Fusarium wilt.

Rapid detection assays for the identification of insect pests: PCR, LAMP, and RPA-based assays were developed at ICAR-IARI, New Delhi for the rapid and specific detection of, *Spodoptera frugiperda,* facilitating timely pest monitoring and management in the field. The assays demonstrated high sensitivity, with RPA detecting as low as 100 fg/µL, enabling early detection even at low pest infestations. The study introduced the RPA colorimetric assay for, *S. frugiperda* offering for the first time, a time-efficient and cost-effective detection method that requires minimal equipment, making it ideal for on-site field applications.

Biosystematics and pest diagnostics: Comprehensive taxonomic and molecular studies across Lepidoptera, Coleoptera, and Hemiptera identified over 270 insect specimens and added ~2,500 curated specimens to the National Pusa Collection. A YOLOv5-based model was developed for real-time crucifer pest identification with 99.5% accuracy. The LAMP and RPA assays provided rapid, sensitive, detection of *Phthorimaea absoluta* in 45–60 min and validated with 100% accuracy.

AI based disease diagnostics: AI-based image analysis system utilizing deep learning models was developed for early detection of wheat leaf blight. The system, trained on 1,000 digital images, achieved high accuracy (>90%) in classifying leaf blight symptoms using Convolutional Neural Networks (CNNs). Four deep learning architectures: Squeeze Net, Google Net, Inception V3, and alexnet applied to the leaf blight complex disease dataset. Google Net achieved the highest accuracy of 98.45%, followed by Inception V3 with 91.47%. Squeeze Net and alexnet demonstrated lower performance, with accuracies of 47.29% and 52.7%, respectively.

dsRNA-based molecular interventions against key insect pests, including *Bemisia tabaci*, *Spodoptera frugiperda*, *Leucinodes orbonalis*, and *Maconellicoccus hirsutus*: Treating with dsBOP1 in *S. frugiperda* caused significant BOP1 gene silencing, leading to sterile egg production post-mating. Oral delivery of dsRNA targeting AChE and ChS2 in *B. tabaci* via artificial diet achieved ~85% mortality within 96 h.

Applications of Plant Volatile Organic Compounds (pVOC) in insect pest management: The pVOC tested consistently reduced pest damage and improved crop yield across crops, underscoring their potential as eco-friendly

pest management tools. In rice, application of octadecane against yellow stem borer (*Scirpophaga incertulas*) gave multifaceted benefits. In wheat, octadecane demonstrated strong efficacy against the pink stem borer (*Sesamia inferens*). For chickpea, the combination of octadecane, azulene, and eicosane significantly suppressed pod borer (*Helicoverpa armigera*) damage. In maize, the fall armyworm (*Spodoptera frugiperda*) was strongly affected by cyclohexane and eicosane, which acted as feeding suppressants. Similarly, in pulses, the cutworm (*Spodoptera litura*) responded to octadecane and eicosane with even higher feeding inhibition, leading to 48.95–73.92% reductions in growth rate. Against whitefly (*Bemisia tabaci*), a combination of eicosane and squalane produced strong repellency, ranging from 46.81%–83.40%. Likewise, pulse aphid (*Aphis craccivora*) infestations were suppressed through eicosane and octadecane, which caused 42.33–46.71% repellency, thereby preventing feeding and limiting transmission of aphid-borne viruses. Overall, the results demonstrate that specific plant-derived volatiles, particularly octadecane and eicosane, provide broad-spectrum protection against both chewing and sap-feeding pests across multiple crops. The yield gains observed in rice, wheat, and chickpea further validate the practical field relevance of these compounds.

Bio-enriched coco-peat technology for sustainable nematode management in FCV tobacco in Karnataka light soils: Flue-cured Virginia (FCV) tobacco in Karnataka light soils under rain-fed conditions, is plagued by root knot nematode (*Meloidogyne incognita*). Costly and eco-unfriendly chemical controls have driven the adoption of bio-enriched coco-peat technology. Coir-pith is fortified with *Paecilomyces lilacinus* (2×10^6 spores/g, 50 g/1.2 kg medium), incubated under shade for a week, and used in polystyrene trays for raising seedlings. This delivers the bio-agent to the main field, reducing nematode damage. Media significantly reduced the Root Knot Index by 51.5% and subsequently increased the FCV Tobacco cured leaf yield by 12.1% over check with Incremental Cost-Benefit Ratio (ICBR) of 1:5.9. The eco-friendly, cost-effective method for nematode management which enhances seedling health and boosts tobacco yields in Karnataka has been licensed to one industry.

HORTICULTURAL CROPS

Crop Management
Production and Propagation technologies

Clean plant production of banana through novel bioreactor technology: Automated bioreactor systems are increasingly replacing conventional semi-solid tissue culture due to better aeration, higher biomass production, reduced somaclonal variation, and lower cost. To meet the growing demand for disease-resistant banana planting material, especially against *Fusarium oxysporum* f. sp. *cubense* (TR4), a novel, low-cost Double-Decker Temporary Immersion Bioreactor (DDTIB) was developed for mass propagation of bio-immunized Grand Naine plantlets, where bio-immunization involves treating plantlets with antifungal metabolites. The optimized DDTIB system (6 h frequency, 3 min immersion) achieved significantly higher regeneration (22.32 shoots/clump vs. 7.86 in semi-solid medium) and biomass production (1,112.24 mg vs. 996.36 mg), along with 91.52% survival in a new primary hardening method. Genetic fidelity was confirmed using Inter-Simple Sequence Repeat (ISSR) markers and metabolomics, indicating that DDTIB is a robust platform for rapid, large-scale commercial multiplication of disease-resistant banana plantlets.

Bioreactor-based ECS technology for large-scale banana propagation: A pioneering bioreactor-based technology combining Embryogenic Cell Suspension (ECS) with a Temporary Immersion Bioreactor (TIB), the world's first such system for banana has revolutionized banana tissue culture. It enables mass regeneration of healthy, genetically stable, and uniform plants from minimal embryogenic culture, demonstrated successfully in multiple commercial cultivars including Grand Naine, Rasthali, Poovan, Nendran, Ney Poovan, and Red Banana. Over one lakh plants have been distributed

A view of ECS derived quality tissue culture plants

Somatic embryogenesis regeneration vessels using a bioreactor (SERV) for mass production of banana tissue culture plants

to farmers, showing consistent field performance. The ECS–TIB system greatly enhances propagation efficiency, reduces production costs considerably.

India's first tissue culture derived oil palm clones: ICAR–Indian Institute of Oil Palm Research, Pedavegi has developed an efficient tissue culture protocol for *dura* and *tenera* genotypes using immature male inflorescence explants through somatic embryogenesis. This protocol enables the production of uniform hybrid and semi-clonal planting material.

***In vitro* micro-rhizome plantlets for disease-free planting material production in ginger**: *In vitro* micro-rhizome technology presents a promising breakthrough for producing pathogen-free seed rhizomes in ginger. This protocol facilitates efficient, reproducible, and scalable production of *in vitro* micro-rhizome plantlets that can be directly planted in grow bags under shade net conditions/ roof tops. This technology which is applicable to commercial tissue culture labs also improves hardening procedures, reducing time (by 30 days) and increasing survival rates to ~96%.

Optimization of grafting technology in Brimato and Pomato production: Rootstock evaluation was carried out in Brimato, wherein three brinjal rootstocks, i.e., IC 111056, *Solanum incanum* and Zippy were taken tomato (Kashi Aman) and brinjal (Kashi Sandesh) scions. The maximum cumulative yields of brinjal and tomato were obtained with use of *S. incanum* or Zippy rootstocks (11.35 and 11.14 kg/plant, respectively). These two rootstocks produce 16–18% higher yield than non-grafted brinjal and tomato plants. Furthermore, application of NPK @120:60:60 kg/ha produced maximum cumulative yield of 6.03 kg/plant followed by 150:60:60 kg NPK/ha (5.81 kg). For optimization of pomato production, tomato scions (single, double or triple) were grafted over white cultivar of potato (Kufri Badshah). The results indicated that using triple scion grafting produced maximum cumulative yield of tomato (2.16 kg) and potato (0.97 kg) with 26.3% higher yield over their sole production (tomato - 1.82 kg and potato 0.66 kg).

In vitro micro-rhizome plantlets of ginger

Micro-rhizome plantlets of ginger in grow bags

Standardized Espalier training system for guava: A design patent has been granted for an innovative training structure of guava under high-density planting. This system efficiently utilizes vertical space to achieve maximum light interception, better air circulation, and improved orchard productivity, enabling the accommodation of 7–8 times more trees per unit area compared to conventional systems. The structure consists of five tiers of galvanized iron (GI) wires erected on sturdy angles with a total height of 2.5 m, and fixed at 7.3 m apart. The first tier is positioned 60 cm above the ground, while the subsequent tiers (2nd to 5th) are placed at intervals of 50–60 cm. The tiered espalier-like structure ensures that all scaffold branches receive uniform sunlight exposure resulting in high-quality fruits with enhanced colouration, sweetness, and size, while minimizing pest and disease incidence.

Irrigation scheduling in litchi: The irrigation scheduling in litchi showed that 100% irrigation with mulching produced the best results, yielding 48.57 kg fruit per tree with an average fruit weight of 22.83 g. All mulched treatments outperformed non-mulched and control plots in yield and moisture retention. Soil moisture remained highest under mulched conditions,

Espalier training system in guava

indicating that full irrigation combined with mulching is most effective for improving yield and fruit quality.

Irrigation techniques for tropical tuber crops: Drip irrigation @50% Cumulative Pan Evaporation (CPE) along with porous ground cover mulching resulted in 10.1% increase in tuber yield and 50% saving in irrigation water compared to drip irrigation at 100% CPE in cassava. Drip irrigation at 75% CPE was optimum for Chinese potato during the first season study (25 t/ha). Drip fertigation of recommended dose of fertilizer (NPK @100:60:100 kg/ha) in 60 numbers of splits at 3-day interval is recommended for high yield and income in greater yam.

Fertigation module for guava under high density planting (HDP): Application of 340:70:260 g N:P:K per tree for HDP of 3 m × 2.5 m (1,333 plants/ha) and 210:40:160 g N:P:K per tree for HDP system of 2 x 1.5 m (3,333 plants/ha) through drip fertigation was found optimum for mature guava plants. A uniform dose of 20 kg farmyard manure/tree + Actinobacterial consortium (200 g/plant – five split applications @ 40 g/2.0 L water) and two foliar sprays of 0.5% $MgSO_4$, 0.5% $ZnSO_4$ and 0.1% boric acid during critical periods (flowering and fruit setting) is suggested.

Nutrient scheduling in polyhouse capsicum: Nutrient scheduling in capsicum revealed that the estimated dose of fertilizer (EDF) at 125% of the phenophase-based nutrient uptake, comprising N: 236.38 kg, P: 105.96 kg, and K: 283.16 kg, maximized yield (3.1 kg/plant) with significantly higher fruit weight. However, higher doses (150 and 175%) reduced fruit number and yield. EDF @125% also recorded the highest chlorophyll (1524.4 ± 34.9 mg/kg), total carotenoids, radical scavenging activity (96.4 ± 0.12%), and firmer fruit texture (2.62 ± 0.02 N).

Soilless cultivation of sweet potato: Production technology for soilless cultivation of sweet potato in rectangular grow bags (4 ft × 1 ft × 1 ft; L × B × H) was standardized using Arka Fermented Cocopeat as the substrate (40 kg for each bag) and Arka Sasya Poshak Ras as the nutrient solution. From each grow bag planted with six cuttings an average tuber yield of 3.25 kg per bag was harvested (550 g/plant), translating to a total yield of 13 kg from just four bags occupying an area of approximately 1.5–2.0 m².

***In situ* organic matter recycling to self-sustain *Annona* production system:** In custard apple cv. Arka Sahan, regular pruning recyclable biomass of about 30–40 kg of leaves, stem and stalk which can be composted *in situ* as vermicompost or microbial compost with 70% recovery. The composted leaf biomass has potential to meet 60–70% of N and P demand of Arka Sahan. The stem biomass can also be recycled as biochar (0.71% N, 0.52% P, 0.38% K, 1.80% Ca and 0.88% Mg) for making the production system self-sustainable. A three year study of recycled compost was comparable to integrated nutrient management in terms of fruit yield (13.3–16.1 kg per tree) and fruit quality, besides bringing down the cost of production by ₹70 per tree per year.

Intercropping in arecanut: The resource recycling and application of organics and 3/4th RDF to arecanut in high density multi-species cropping system (HDMSCS) could give maximum yield in arecanut, saving 25% recommended dose of fertilizer. Cabbage emerged as the best intercrop in arecanut among winter vegetables, yielding 13.17 t/ha with a higher B:C ratio of 2.04. The carbon sequestration in arecanut-cocoa cropping systems was estimated at 167 t CO_2/ha, offering significant contribution in combating climate change.

Management of fruit cracking in litchi: Bagging with white colour polypropylene bags 30 days after fruit set; use of under-canopy micro-sprinkler; bagging with pink colour polypropylene bags 30 days after fruit set; foliar application of salicylic acid @50 ppm and foliar application of sea weed extract (Sagarika liquid @0.5%) were found to be most effective in minimizing the incidence of fruit cracking and scorching in litchi cv. Shahi. Installation of under-canopy mini-sprinkler @1 sprinkler per tree placed 1.0–1.2 m above ground and sprinkling of water daily for one hour between 10.00 AM to 11.00 AM @ 475 L/day from fruit set to maturity mid-canopy resulted in reduction of canopy temperature by 4–6°C during peak heat hours, which in turn resulted in 90.2% reduction in cracking and 79.0% reduction in fruit scorching in litchi cv. Shahi. The benefit: cost ratio of this technology has been found to be 2.14.

Sun burn injury management in dragon fruit: Sunburn is a major abiotic stress affecting dragon fruit (*Hylocereus* spp.) where summer temperatures exceed 38°C. The injury leads to stem rot disease and yield loss. ICAR-IIHR, Bengaluru has standardized an integrated technology of using kaolin (5%) + seaweed extract (0.5%) + neem soap (0.5%) with or without microbial consortium (0.5%) for sunburn management and productivity enhancement in dragon fruit cultivation under high-temperature conditions.

Efficient plants for indoor air purification: Based on anatomical, physiological and biochemical studies, ICAR-DFR, Pune identified six indoor foliage ornamentals that are more efficient in absorbing more CO_2 and liberating more O_2 during day. Similarly, one foliage ornamental *Sansevieria trifasciata* plant was found to liberate O_2 during the night. Oxygen release efficiency of *Dypsis lutescens*, *Sansevieria trifaciata* and *Saribus rotundifolius* was found the best among the

Kaoline treated dragon fruit plants for protection from sun burn

Untreated plant

studied indoor plants. Carbon di-oxide fixing capacity was found best in *Aspidistra elatior*, *Epipremnum aureum* and *Aglaonema commutatum*.

Cultivation of Turkey tail (*Trametes versicolor*), a highly medicinal mushroom: *Trametes versicolor* (syn. *Coriolus versicolor*, *Polyporus versicolor*) is a globally distributed polypore mushroom known for its multicolored appearance and ability to degrade lignin as a white-rot fungus. It contains bioactive compounds, including polysaccharides such as PSP, β-glucans, and triterpenoid sterols like ergosta-7,22-dien-3β-ol, fungisterol, and β-sitosterol. The polysaccharide extract PSK (krestin) is clinically approved in Japan as an adjuvant cancer therapy. Cultivation was carried out on sawdust and wheat straw supplemented with 20% wheat bran; 2 kg substrate bags were autoclaved and inoculated at 3% spawn rate. Spawn run completed in 35–40 days at 24–25°C, pinning occurred 18–20 days after bag opening, and a biological efficiency of 2.66% was achieved by the second flush.

Crop Protection

Mango wilt management technology demonstrated in hotspots: The wilt disease of mango caused by *Ceratocystis fimbriata* has emerged as a major threat to the Indian mango industry in the past 15 years. Based on extensive research in hotspot areas, an integrated management module combining physical, cultural, chemical, and biological measures was developed for sustainable control. Demonstrations were conducted in severely affected orchards of mango cv. Chausa (30–70 years-old) across Uttar Pradesh. Treatments included soil drenching with thiophanate methyl followed by *Trichoderma reesei*, along with seasonal foliar sprays of either *T. reesei* or propiconazole. Tree recovery was monitored monthly, and after one year, 1,759 out of 1,860 treated trees recovered, indicating a 94.56% success rate. The highest recovery was recorded in Meerut (98.66%), followed by Pratapgarh (97.43%), Amroha (96.27%), Bulandshahr (94.35%), and Barabanki (88.33%). The results highlight the importance of initiating management measures promptly at the first sign of wilt symptoms.

Integrated pest management in plantation crops: A cost effective, simple and rapid technique called "Detached Leaf Assay", using zoospore suspension of highly virulent *Phytophthora meadii* isolate (P19) was developed to accelerate identification of disease resistant arecanut germplasm/ hybrids. The Standard Operating Procedure (SOP) for coconut palms using UAV sprayer was optimized. The association of virus with ring spot disease of arecanut was reported for the first time in India. Among the diverse whiteflies, *Paraleyrodes bondari*, followed by *Aleurodicus rugioperculatus* and to limited extent by *Aelurotrachelus atratus* were currently recorded on coconut palms with complete displacement of *A. disperses* as well as *P. minei* in coconut system. Morphometric characters of different stages of palm whitefly *Aleurotrachelus atratus* and its molecular identification was established. A refined integrated management strategy for Red Palm Weevil (RPW) in endemic area was validated. An entomopathogenic fungus isolated from infected red palm weevil, identified as *Beauveria bassiana* was found promising for the bio-suppression of RPW and a solid state formulation of this biocontrol agent was developed. An insect repellent "kernel pellet" was developed for the field level repulsion of coconut rhinoceros beetle.

Integrated management of pests and diseases in horticultural crops: Essential oils, viz. cinnamon bark and thyme oils were found to be effective against *Thrips parvispinus*. The effective doses of thyme oil (*Thymus vulgaris*), cinnamon bark oil, and vetiver oil (*Chrysopogon zizanioides*) against *T. urticae* were 0.05, 0.2, 1.6 and 3 mL/L, respectively. Field evaluation of biochar with bioinoculants and biocontrol formulations (IIHR) on wilt incidence of brinjal revealed that biochar @3% reduced the incidence of bacterial wilt to 1% compared to 35% in control. Among several bioagents tested *in vitro* against GSB *Staganosporopsis cucurbitacearum, Trichoderma asperellum* strain IIHR TV5 and *Bacillus subtilis* strain IIHR BS-2 were found promising in inhibiting the growth of pathogen.

Flonicamid 50% wg and Afidopyropen 50 g/L dc were the most effective treatments against brinjal jassids, recording the lowest pest populations (2.64 and 2.67/leaf) and the highest reduction over control (62.71 and 62.29%). For whiteflies, Flonicamid 50% wg proved best (0.69 adults/leaf; 76.69% reduction), closely followed by Pyroproxyfen 10% EC (0.70 adults/leaf; 76.35% reduction). Entomopathogenic fungi (EPF) were compatible with new insecticides, showing synergistic effects. The combination of *Beauveria bassiana* with Tolfenpyrad at half of the recommended doses produced the fastest mortality (LT_{50} = 15.79 h), followed by *B. bassiana* + Dinotefuran (18.27 h). All EPF–insecticide combinations had co-toxicity coefficients greater than 1 and lower LT_{50} values compared to individual treatments.

Pest and disease management in potato: *Phytophthora infestans* isolates showed reduced sensitivity to cymoxanil (ED_{50} ~518 mg/L), but remained sensitive to dimethomorph and fenamidone. Self-fertile isolates were detected, posing added epidemiological risk. Near-Infrared spectroscopy achieved 93% and 88% accuracy in detecting late blight and dry rot in potato tubers. Endophytic bacteria (*B. amyloliquefaciens*, *S. maltophilia*, *P. geniculata*) suppressed *Streptomyces scabiei in vitro. S. scabiei*, *P. brasiliense*, *R. solanacearum* and *F. sambucinum* were fully inhibited by NaOCl and ClO_2; NaOCl also controlled *Rhizoctonia solani*. Tuber dips with NaOCl (2%) or ClO_2 (0.3%) minimized common scab. Valifenalate + mancozeb was as effective for late blight as fenamidone + mancozeb and dimethomorph; fluxapyroxad matched other fungicide seed treatments against black scurf. Indo-Blightcast reliably predicted late blight. *Bemisia tabaci* infestation increased *Tuta absoluta* attraction *via* β-caryophyllene and germacrene D. Tanker spraying gave best imidacloprid uptake and

whitefly control, followed by drones with adjuvant. Crop rotations with mustard, French bean, oat and trap crops cut potato cyst nematodes (PCN) populations by up to 84.6%.

Management of black pepper root mealybug: Application of Clothianidin 50 wdg at 0.3 g/L, followed by either Spiromesifen 22.9 SC or Spirotetramat 15.31 OD at 1 mL/L of water as a soil drench around the root zone, using 3–5 L per vine is found to be effective in controlling this pest. It is recommended to apply the pesticides at monthly intervals during February–March, April–May, or in the post-monsoon period.

P**est and disease management in seed spices:** Root rot in nigella (*F. solani*) and root/stem rot in *ajwain* (*F. oxysporum*, *S. sclerotiorum*) were effectively managed using *Trichoderma* spp. + *Pseudomonas fluorescens*, also boosting seed yield. Tebuconazole + trifloxystrobin and propiconazole were the best chemical options. *Ajwain*- and neem-oil nano-emulsions showed strong *in vitro* antifungal activity against cumin blight, *ajwain* stem rot, *Fusarium* wilt, and sheath blight at 1000 µg/mL. IPM modules improved yields by 13.51%; M1 (Thiamethoxam + Difenthiuron + Acephate) gave highest jassid (90%) and thrips (92%) control and 2,597 kg/ha yield, while M6 (Dimethoate + Chlorfenapyr + Emamectin benzoate + Flubendiamide) best controlled weevils (4.11% infestation) with 2,458 kg/ha. Resistance monitoring showed low resistance to thiamethoxam in *Aphis gossypii* (7.2-fold) and moderate resistance to quinalphos in *Hyadaphis coriandri* (14.2-fold), linked to elevated GST and protein levels.

Evaluation of management modules for root knot nematodes in guava: Pre-planting application of Fluopyram @0.5 mL/plant and *Bacillus amyloliquefaciens* IIHR Ba-2 enriched FYM followed by post planting application of bioagent enriched neem cake suspension at quarterly intervals @ 2 L/plant showed maximum decrease in nematode population of root knot nematodes up to 74.03% and increase in yield by 20.46% compared to control in guava.

Bio-intensive management of root-knot nematode in brinjal: Brinjal rootstocks IC-111056, *Solanum torvum* and Surya were highly resistant to root-knot nematode, while seven others showed resistance; okra lines VRO-W-M-22, *A. caillei* VRO-W-TP-32, VRO-W-TP-19, VRO-W-F2, VRO-W-T-2, and TPM-39, and brinjal genotypes GB-6, GB-11, and GB-14 were also resistant. Five rhizobacterial strains (ORB6, ORB8, ORB10, CURB3, CURB10) caused >75% juvenile mortality at 50% CFF. *Trichoderma asperellum* proved most effective against *M. incognita* in field conditions, followed by *T. citrinum*, and microbial communities were assessed *via* PLFA analysis.

Molecular characterization of emerging distinct watermelon bud necrosis virus (WBNV): Characterization of complete genome sequence of WBNV isolate (22ToNV) infecting tomato from India was completed. The nucleotide sequences of the viral RNA segments in 22ToNV exhibit <91% similarity compared to the published WBNV genome sequence. Whereas, the amino acid sequences encoded by these segments, shared identity of about 96–98.54% among the other WBNV isolates. There is a notable divergence observed specifically within the intergenic regions (IGRs) of the S and mRNAs, with a lower similarity range of 78–84%.

Bacterial consortia for growth promotion and rhizome rot suppression in ginger and turmeric: Bacterial consortia consisting of *Bacillus safensis, B. amyloliquefacien, Raoultella terrigena* and *Acinetobacter baumannii* is recommended as a soil drench at the time of planting ginger, followed by drenching with 0.125% metalaxyl-mancozeb at 45 days after planting (DAP), and subsequent consortia applications at 60 and 90 DAP for growth promotion, rhizome rot suppression and enhanced yield in ginger/ turmeric. By adopting the technology, 25% recommended dose of fertilizers can be reduced and is suitable for organic production systems. ❑

4.
Livestock Improvement

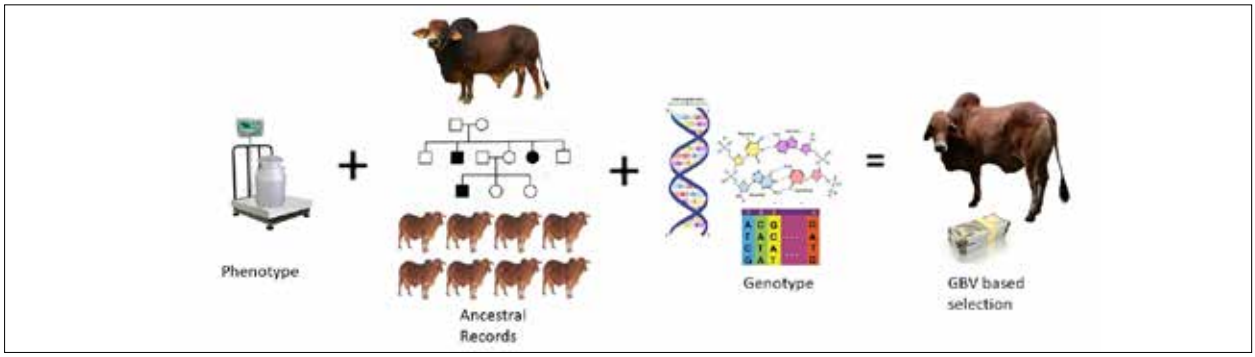
Livestock improvement programmes continued to make significant advances across multiple species through coordinated breeding, genetic evaluation, conservation and dissemination initiatives. Under the AICRP on Cattle, the Indigenous Breeding Programme was implemented with the addition of new data recording centres for Sahiwal Cattle and two new cattle breeds, Rathi and Tharparkar. Progeny testing progressed with the induction of the sixth set of Sahiwal bulls, leading to the production of nearly 49,000 doses of high-quality semen from Gir, Kankrej and Sahiwal. These efforts resulted in more than 7,600 artificial inseminations and the birth of over 900 female calves, contributing to genetic gain and breed conservation. Similarly, genomic selection was implemented at ICAR-NDRI Karnal using single-step genomic BLUP, integrating genomic, pedigree and performance data to enhance the accuracy of selection for economically important traits, particularly milk yield. In sheep, the Network Project on Sheep Improvement expanded to 14 cooperating units, covering about 31,000 sheep from 483 breeders for performance recording and selection. Improved productivity was observed, with Avishaan sheep recording 67.52% prolificacy in Avishaan and Patanwadi sheep yielding 56.35 kg milk over 90 days. The poultry sector under AICRP on Poultry Breeding distributed 11.8 lakh chicks to farmers, evaluated diverse native and improved populations across multiple centres, and improved seed production nationwide. Three rural chicken varieties i.e. Janapriya, Aslibro and Tokbari were released to support backyard and low-input poultry systems. Targeted initiatives were also undertaken in other species. Three endangered camel breeds were surveyed for characterization and conservation. In pigs, genomic selection signatures were identified in Doom and Ghoongroo breeds, complemented by image-based phenotyping approaches. The Bhimthadi horse was recognized as the 8th indigenous horse breed, supported by institutional mechanisms for conservation and promotion. In yak, the first chromosome-level reference genome of Indian yak was generated, enabling future marker-assisted breeding and genomic selection. Additionally, the "Indimus" inbred mouse strain was developed and released to enhance reproducibility in biomedical research.

Cattle

All India Coordinated Research Project (AICRP) on cattle: The Indigenous Breeding Programme expanded with four new data recording centres for Sahiwal cattle at BASU (Patna), DUVASU (Mathura), BAIF (Urulikanchan), and DSVCKV (Durg). Two new cattle breeds, Rathi and Tharparkar, were introduced in the Indigenous Breed Programme. For Tharparkar, IVRI (Izatnagar) was identified as a germplasm unit while RAJUVAS (Bikaner) and CAZRI (Jodhpur) were integrated as data recording centres. Similarly, RAJUVAS, Bikaner served as both germplasm and data unit for Rathi cattle.

The sixth set of 20 Sahiwal bulls were introduced under the progeny testing scheme of the Indigenous Breed Programme. The production of 8,395, 13,030, and 27,414 high-quality semen doses of Gir, Kankrej, and Sahiwal cattle respectively, totaling 48,839 doses, was recorded. Over 7,600 artificial inseminations (AI) were carried out using these semen doses, resulting in the birth of more than 900 female calves.

Implementation of genomic selection of livestock breed at ICAR-NDRI: Genomic selection has been implemented at ICAR-NDRI, marking a transformative



step in cattle breeding program. This initiative combines cutting-edge genomic technologies with traditional pedigree and performance evaluation, ensuring more accurate and timely prediction of breeding values. Through the use of single-step genomic BLUP (ssGBLUP) methodology, genomic data is being seamlessly integrated into cattle breeding evaluation system, enhancing the reliability of selection for economically important trait, milk yield.

Sheep

Network Project on Sheep Improvement (NWPSI): The NWPSI comprises 14 cooperating units, following the addition of four new units in November 2024. The coordinating unit is located at the ICAR-CSWRI, Avikanagar (Rajasthan), which coordinated the Project covering 31,000 sheep from 483 breeders for performance recording and selection. Avishaan sheep recorded 67.52% prolificacy, while Patanwadi sheep achieved 56.35 kg milk yield in 90 days.

Sahabadi ram

Changthangi ewe

Garole ram

Mecheri ram

Sonadi ram

Madras Red ram

Poultry

AICRP on poultry breeding: Under AICRP on poultry breeding, 11,77,284 chicken germplasm were distributed to 16,635 farmers. Centres evaluated a wide range of poultry breeds: Mannuthy (IWN/IWP), Anand (Ankleshwar, White Leghorn), Bangalore and Ludhiana (PB-1, PB-2, native), Udaipur (Mewari, Pratapdhan), Guwahati (Kamrupa, indigenous, Dahlem Red), Palampur (Himsamridhi), Jabalpur (Jabalpur Colour G-4, Kadaknath), and Agartala (Tokbari). Control populations were maintained at DPR, Hyderabad. Seed centres ensured local germplasm production at Patna, Jharnapani, Gangtok, Imphal, Hosur, Panaji, Port Blair, Srinagar, Warangal, Tirupati, and Umiam.

Rural chicken varieties released: Three rural chicken varieties were released for wider propagation: *Janapriya*, a promising dual-purpose variety; *Aslibro*, a meat-purpose variety developed as an alternative to native bird rearing; and *Tokbari*, a location-specific, multi-coloured variety for backyard poultry in the NEH region (Tripura Centre, AICRP-PB).

Camel

Characterization and conservation of endangered camel breeds: A survey covering parts of Rajasthan

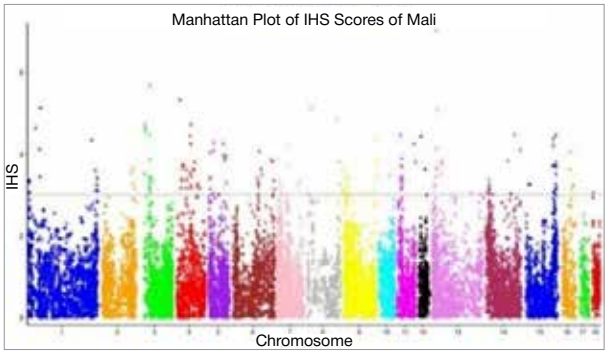
Genetic resources maintained at farm

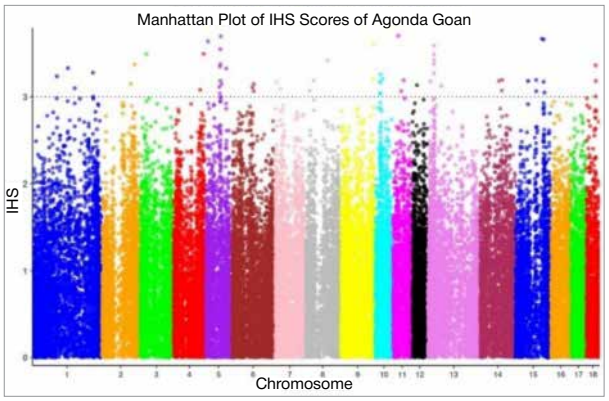
Category	Deccani	Nellore	Magra	Marwari	Muzaffarnagari	Mandya	Mecheri	Sonadi	Malpura
Male	138	125	93	199	115	77	160	83	138
Female	284	288	231	365	357	329	466	279	388
Total	422	413	324	564	472	406	626	362	526
Breedable									
Ewe	210	143	179	259	250	261	347	201	299
Ram	50	55	29	89	31	21	53	26	56

and Madhya Pradesh assessed the status of the critically categorized Mewari, Malvi, and Mewati camel breeds.

Pig

Selection signatures in Doom (28) and Ghoongroo (28) pigs were analyzed along with three other breeds, detecting strong signals on seven Sus Scrofa chromosomes (SSC) for Doom and 6 Sus Scrofa autosomes (SSA) for Ghoongroo, using iHS values. Separately, facial features were extracted from images, captured under non-stressful conditions, using local binary patterns histograms (LBPH), histograms of oriented gradients (HOG), and principal component analysis (PCA).





Horse

Bhimthadi was recognized as 8th indigenous horse breed. The characterization and recognition of Bhimthadi horse as the 8th breed of indigenous horses has been the outcome of joint efforts of ICAR-NRCE and ADT, Baramati. In order to conserve, improve and promote the breed, “All India Bhimthadi Horse Association" was formed at Baramati, Maharashtra and registered under the Companies Act. The breed has been gazette notified on dated December 9, 2024 by the Government of India.

Yak

Conservation and genetic improvement of yak germplasm: First chromosome-level reference genome of Indian Yak (*Arunachali* breed*)* has been sequenced and publicly released under the NCBI BioProject PRJNA1164156 through long read sequencing technology (PacBio HiFi, Bionano and Hi-C). This will significantly enable marker-assisted and genomic selection of yak supporting the conservation of native yak germplasm and would aid in research on climate resilience and disease resistance. This would give a boost in productivity traits like milk, fiber, and fertility, further strengthening the livelihoods of Himalayan yak herders and positioning India in global livestock genomics leadership.

Mouse

“Indimus" inbred mouse strain developed: The "Indimus" inbred mouse strain was developed from Swiss albino mice through 20 generations of full-sibling mating and rigorous selection for adult weight 30 g and litter size 8 to enhance research reproducibility in India. Genotyping confirmed progressive homozygosity and stability. Phenotypically, Indimus showed a lower litter size but higher weaning weight compared to Swiss Albino mice. The stable, high-quality strain was certified and released by ICAR on July 16, 2025.

AICRP on Goat

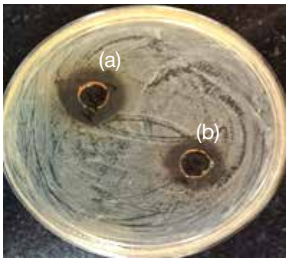
ICAR-CIRG under the AICRP on Goat Improvement, covers 25 indigenous goat breeds across the country through 19 funded and 11 non-funded units. During the period, new breeds including Bundelkhandi and Andamani goats were registered, strengthening conservation and genetic improvement efforts. Changthangi breed produced 337.7 gm Pashmina/year. A total of 352 fibroblast vials (Attapaddy Black, Sumi-Ne, Andamani, Barbari) stored with 85–95% viability for short and long term conservation.

5.
Livestock Management

Recent advances in livestock management and protection have delivered integrated solutions to enhance productivity, health, adaptability, and sustainability of livestock species. Novel nutritional and microbial interventions demonstrated significant benefits, including postbiotics derived from Lactobacillus rhamnosus exhibiting antibacterial activity against E. coli and Salmonella through combined effects of pH reduction, proteins, and volatile compounds. The herbal feed blend, rich in bioactive compounds (30.8% crude protein; 10.8% ether extract; ω-3 fatty acids), improved reproductive hormones in sheep and advanced puberty in 100% of Malpura ewe before 450 days. Oat brewery waste, containing up to 28% crude protein, was validated as a safe 20% concentrate replacement in sheep diets, maintaining growth and rumen function while marginally reducing enteric methane emissions. Reproductive and biotechnological innovations included optimized progesterone-based estrus synchronization protocols, vitrified embryo transfer resulting in India's first foal "Raj-Sheetal," a patented liposome-based semen extender improving stallion semen preservation up to 10 days at 4°C, and in vitro strategies for sex-specific embryo production, achieving up to 89% male and 77% female embryos. Studies on poultry revealed superior heat stress resilience in slow growing coloured genotypes compared to commercial broilers. Livestock protection efforts delivered impactful vaccines and diagnostics, including a trivalent Salmonella vaccine for poultry, a live attenuated African swine fever vaccine with 83% protective efficacy, highly sensitive PCR-based diagnostics for major swine and zoonotic diseases, and rapid field assays for anthrax. Comprehensive disease surveillance, forecasting systems, and epidemiological modelling strengthened preparedness against emerging diseases such as lumpy skin disease and foot-and-mouth disease.

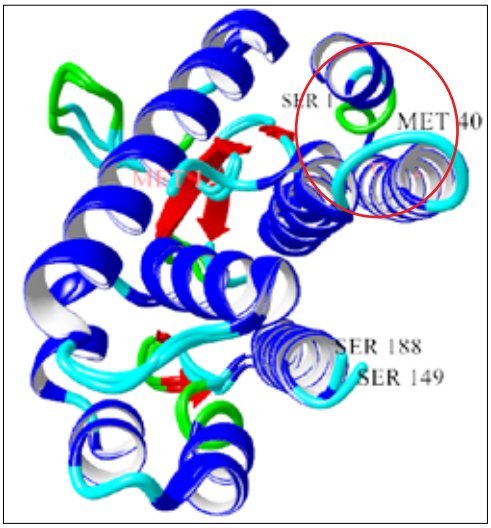
Nutrition

Potentiated postbiotic as an antibacterial and anti-inflammatory agent: An *in vitro* study was carried out to assess the antibacterial activity of postbiotics produced from *Lactobacillus rhamnosus* (probiotic) in presence of different classes of prebiotics and pathogens. The study revealed that the postbiotic produced possessed antibacterial properties against *E. coli* and *Salmonella* spp., which could be attributed to a combination of pH reduction, protein, and volatile substances.



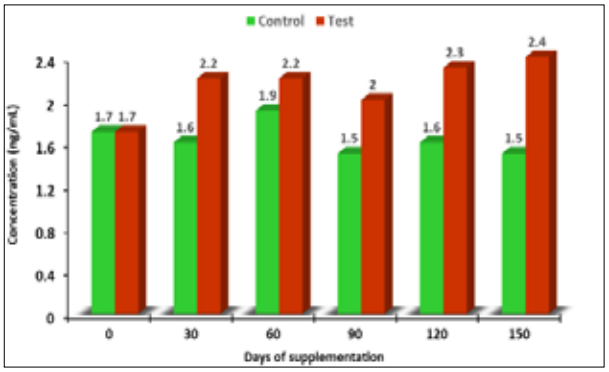
Zone of inhibition of postbiotic against *E. coli.* (a) Long chain prebiotic; (b) Short chain prebiotic

Bactericidal phage endolysin against *E. coli*: A biologically active form of engineered endolysin exhibiting potent antibacterial activity against multiple pathogenic *E. coli* strains was produced. Engineered endolysin showed potent antibacterial activity against *E. coli* (4-5 log reduction), overcoming the Gram-negative outer membrane barrier, which limits the wild-type protein. However, the engineered variant suffered from instability and partial degradation during storage. Future work aims to enhance the structural stability and catalytic efficiency for a robust therapeutic candidate. This advancement highlights the potential of rational engineering to improve endolysin efficacy against MDR *E. coli*.

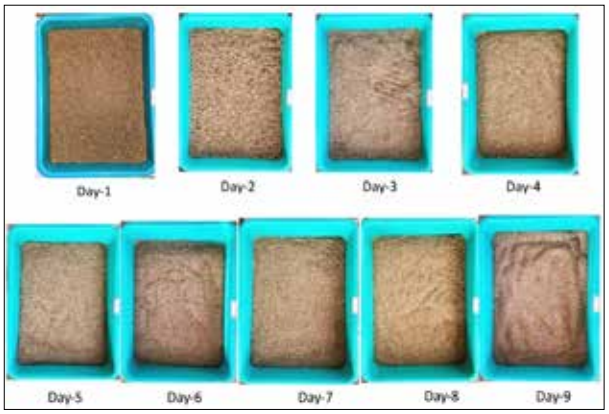


Overlapped structural models of endolysin and engineered endolysin. A membrane permeabilizing peptide (shown in the ellipse) was tagged with the endolysin to create the engineered endolysin with improved antimicrobial activity

Herbal feed blend rich sheep feed: Herbal feed blend rich in bioactive compounds, antioxidants, essential oils, and trace minerals (30.8% crude protein, 10.8% ether extract, rich in ω-3 fatty acids) was developed. Supplementation with this blend advanced puberty in all Malpura ewe lambs (19/19) before 450 days, compared to 14/19 in controls, and enhanced serum testosterone levels and early puberty in Avishaan lambs.

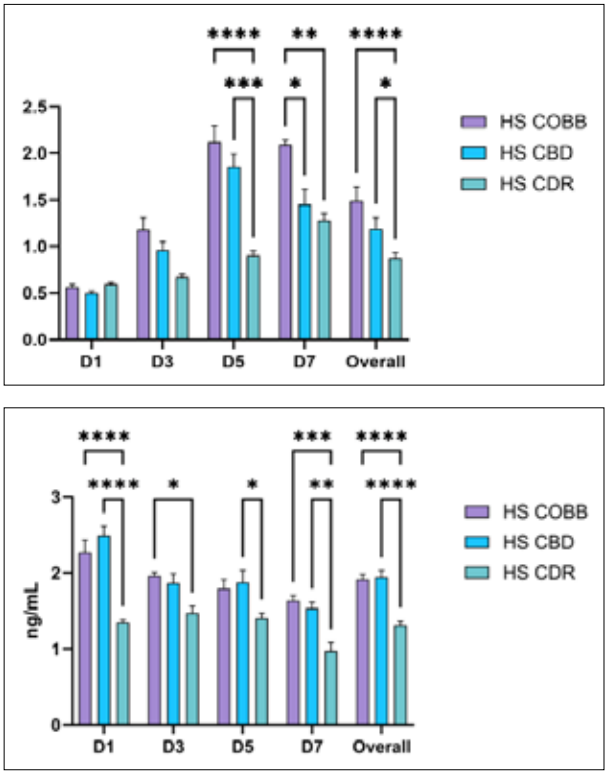


Potentiality of oat brewery waste as a partial replacement of ruminant concentrate: The study assessed oat brewery waste (OBW) as a substitute for expensive concentrate in ruminant diets. It contained high crude protein (up to 28%) and comparable energy to the concentrate mixture, with aflatoxin levels below permissible limits. The *in vitro* results showed that OBW replacement (at 20%) significantly decreased methane production, but also reduced digestibility. The optimal *in vivo* level was 20%. At this level of feeding, OBW did not negatively affect intake, nutrient digestibility, rumen fermentation, or growth performance in growing sheep compared to the control group, along with a marginal decrease in enteric methane emission. Therefore, 20% replacement level can be a viable and safe method for economizing feeding costs and mitigating environmental biowaste.



Physiology

Productivity and adaptability in broilers and backyard varieties: A study on three meat-type chicken strains-COBB, CARIBRO DHANRAJA (CBD), and CARI DEBENDRA (CDR)—under heat stress (THI > 90) revealed distinct adaptability patterns. The heterophil/lymphocyte ratio rose sharply in COBB (2.12) but remained lowest in CDR (1.28), indicating higher heat tolerance. CDR showed the strongest thyroidal response with peak T4 (35.45 ng/mL) and stable T3 levels, while corticosterone rise was least in CDR (1.30 ng/mL). Overall, the slow growing coloured genotypes (CDR and CBD) exhibited superior physiological and hormonal resilience to heat stress compared to the commercial COBB strain.

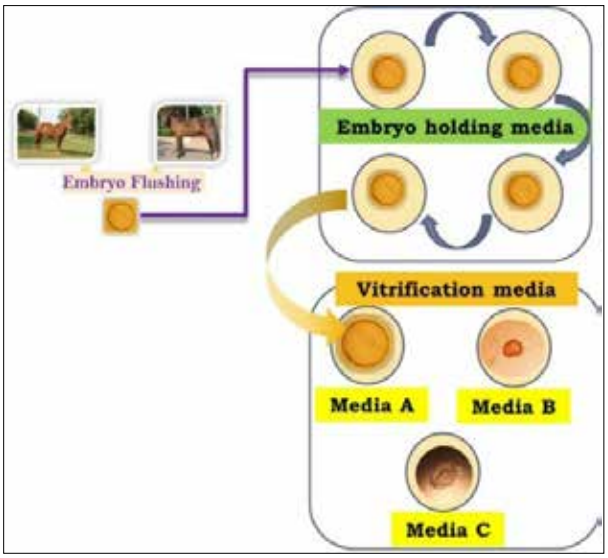


Column bars showing Heterophil to Lymphoctye ratio and plasma Corticosterone concentrations in different meat type strains of chicken as influenced by heat stress expsoure at varied time points. Bars bearing asterisks indicates significant difference across strains.

Reproduction

Study on effect of progesterone and prostaglandin-based estrus synchronization protocols on various reproductive outcomes exhibited that the short-term progesterone plus prostaglandin protocol (P4+PG) was most effective in inducing estrus and achieving high pregnancy rates in Dumba ewes. Long-term progesterone (P4) treatment also demonstrated acceptable reproductive performance but with slightly lower efficiency. The prostaglandin-only (PG+PG) protocol, despite achieving a high conception rate among responsive ewes, was less reliable in inducing estrus. Overall, the progesterone-based protocol can be considered a viable, practical, and efficient alternative for estrus synchronization programs aimed at improving reproductive efficiency in sheep.

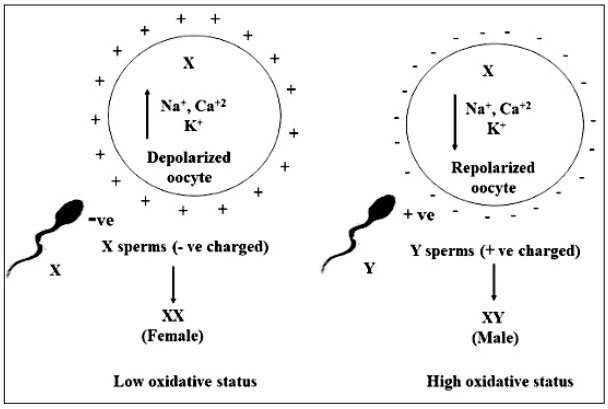
Raj-Sheetal: India's first horse foal born through vitrified embryo transfer: To produce the foals from vitrified embryo transfer in Zanskari horses, estrus of the mares was closely monitored through ultrasonography



Procedure of equine embryo vitrification

and at near ovulation, the donor mare was inseminated using frozen semen from proven fertile stallion. The recipient mare was checked for pregnancy on day 14 and found pregnant. The mare carried the foal until 324 days and delivered unassisted a healthy foal on 21 September 2024. The foal weighed 20 kgs and the foal was named as Raj-Sheetal. This is the first foal produced in India through vitrified embryo transfer.

***In vitro* production of sex-specific embryos, an alternative approach to semen sorting:** The production of desired sex offspring is one of the major challenge for profitable and sustainable livestock farming. The current approaches address the challenge of producing desired-sex livestock by manipulating the oxidative status of the *in vitro* culture environment, achieving up to 89% male and 77% female embryos. Key findings show that reduction of O_2 concentration under the *in vitro* culture environment from 20% to 5% doubled the proportion of female embryos production. Further, it was observed that the addition of free radical scavenger i.e L-carnitine into culture medium increased the proportion of female embryos by 7 folds. It keeps the oocyte depolarized, favoring X-sperm specific fertilization and female embryo production. Conversely, high oxidative status favors the Y-sperm fertilization. The underlying



mechanism is that the oocyte membrane's polarity determines sex-specific sperm binding, suggesting that manipulating oocyte ion channels *in vitro* and *in vivo* or using genome editing for sex reversal are promising next steps to increase the female population for improved farm income and nutritional security.

Patent obtained for novel semen extender developed for stallion semen cryopreservation: Adding 5-10 % (v/v) liposome concentration in semen extender base solution is beneficial and protects stallion sperm from cold shock. It also maintains total motility (TM), progressive motility (PM), straight-line velocity (VSL), average pathvelocity (VAP) and curvilinear velocity (VCL) of stallion spermatozoa during the liquid preservation of stallion semen at 4ºC temperature for 10 days.

Livestock Protection

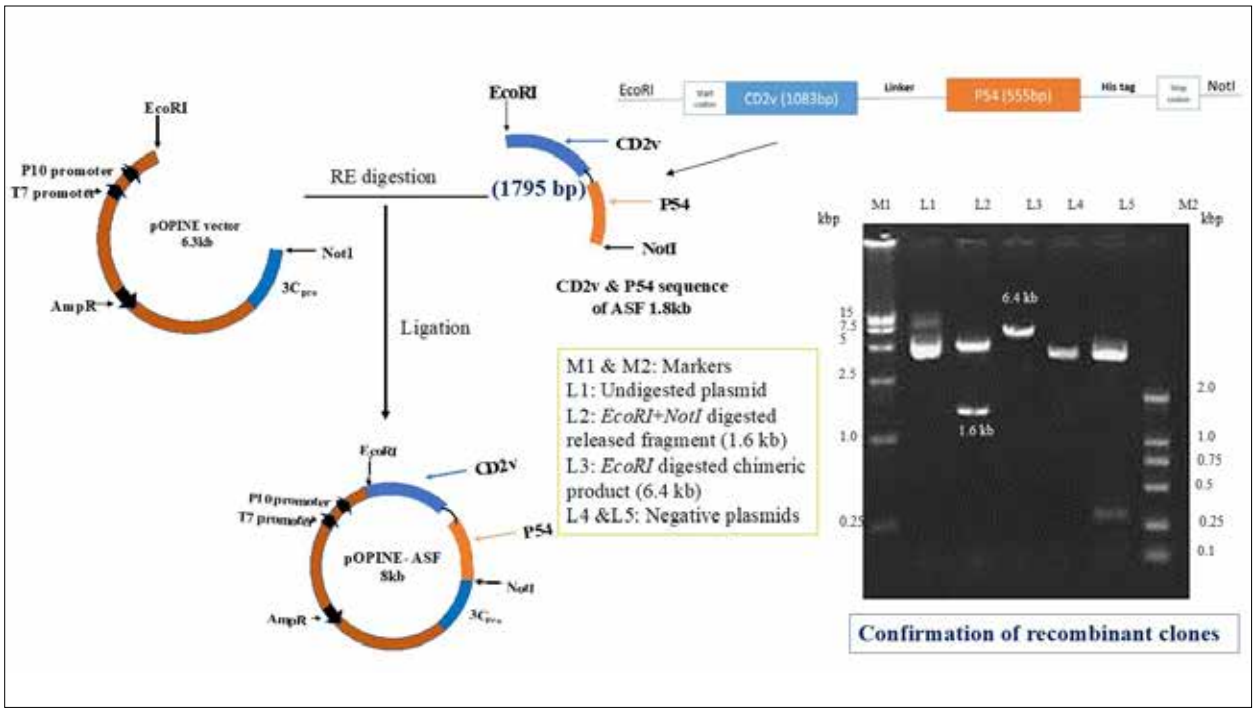
Vaccines

Vaccine against *Salmonellsis*: A trivalent inactivated Salmonella vaccine against *S. Typhimurium, S. Enteritidis, and S. Gallinarum* has been developed, which elicited robust immune responses in poultry, supporting its potential application in layer immunization programs.

Live attenuated vaccine for African Swine Fever (ASF) in Pigs: ASF, caused by the African Swine Fever Virus (ASFV), is a highly fatal transboundary disease of pigs, often causing up to 100% mortality. A field ASFV isolate was successfully adapted to a heterologous cell line through serial passaging to attenuate the virus and subsequent use as a vaccine candidate. Whole-genome sequencing confirmed substantial deletions (over 8 kb) in the left variable region, including several virulence-associated genes. The vaccine candidate demonstrated complete attenuation and an excellent safety profile in piglets, eliciting robust immune responses with negligible viral shedding. Upon challenge, the vaccine candidate provided >83% protective efficacy against the virulent ASFV challenge.

Chimeric P54-CD2v protein of ASFV expressed in Baculovirus system for vaccine research

Expression of chimeric proteins of African swine ASFV in Baculovirus expression system was done to explore their immunological potential and applications in vaccine development in future. Targeting key ASFV proteins, P54 and CD2v, a chimeric construct was developed, codon-optimized, and expressed in insect cells. The chimeric protein retained antigenic determinants, highlighting its potential for immunological assessment



Cloning of the ASFV P54-CD2v chimeric construct in Baculo-viral expression vector

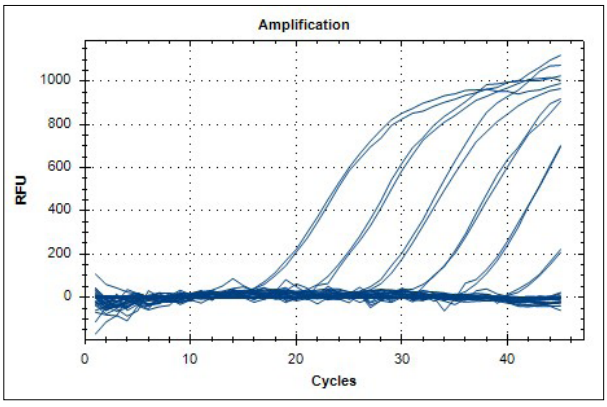
in porcine models and vaccine development.

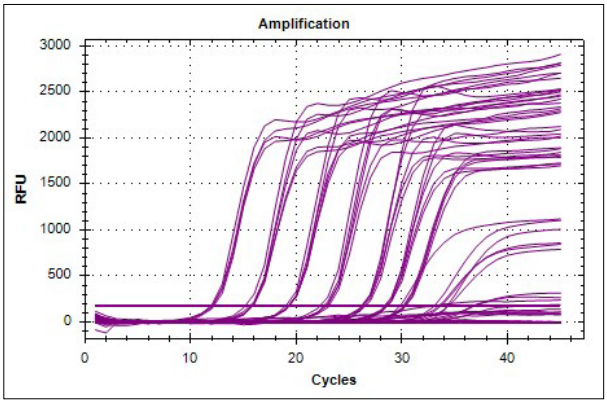
Diagnostics

Development and validation of diagnostics and translational Tools: An indigenous ELISA kit CYSTISURE for porcine cysticercosis (>96% sensitivity, >98% specificity), a sELISA Capripox-Detect for Capri poxviruses (GPV/LSDV/SPV), a Recombinant Cathepsin B-based indirect ELISA ('Flukevey-Kit') for fasciolosis in bovines, and a monoclonal antibody-based DIVA-compliant Competitive ELISA (cELISA) for Bluetongue (BTV) population surveys were developed.

Novel nested PCR assay for diagnosis of scrub typhus: A novel nested PCR assay targeting a unique *tsa56* gene segment for diagnosis of scrub typhus with an analytical sensitivity of 4.7 (95% CI: 2–7.4) copies/µL, it was able to detect *Orientia. tsutsugamushi* in multiple hosts including rodent, human and mite samples.

One-Step RT-qPCR Assays for Detection of Porcine Epidemic Diarrhoea Virus (PEDV) and Transmissible Gastroenteritis Virus (TGEV) in Pigs: Porcine Epidemic Diarrhoea (PED) and Transmissible Gastroenteritis (TGE) are highly contagious enteric viral infections of pigs caused by PEDV and TGEV, respectively—both belonging to the genus *Alphacoronavirus*. These diseases cause severe diarrhoea, vomiting, and dehydration, with mortality often reaching 100% in neonatal piglets. Probe-based one-step reverse transcription real-time PCR (RT-qPCR) assays were developed for sensitive and specific





detection of PEDV and TGEV genomes. For PEDV, N gene sequences from diverse field isolates were aligned to design primer–probe sets, and the target gene was cloned into the pTZ57R/T vector for generating *in vitro* transcribed RNA (IVT-RNA) as a positive control. The optimized assay achieved a detection limit of approximately 2 RNA copies (10^{-12} dilution of IVT-RNA) and showed no cross-reactivity with TGEV, SIV, CSFV, PRRSV, or PEDV-negative field samples (n-250). Similarly, a one-step RT-qPCR assay was optimized for TGEV detection, demonstrating analytical sensitivity up to ~10 RNA copies without cross-reactivity to other swine viruses or TGEV-negative field samples (n-250). Both assays were highly specific and reproducible, offering reliable diagnostic tools for early detection and surveillance of PEDV and TGEV infections in pigs.

Lateral Flow Assay for the detection of *Bacillus anthracis* spores: Anthrax is a fatal zoonotic disease caused by *B. anthracis*. Novel synthetic peptides were developed for rapid, safe, and on-site detection of its spores in animal feed and soil using user-friendly Latex Agglutination Test (LAT) and Lateral Flow Assay (LFA). The LFA offers good sensitivity (10^6 spores/g of soil/animal feed supplements), making these assays practical for use with minimal laboratory infrastructure.

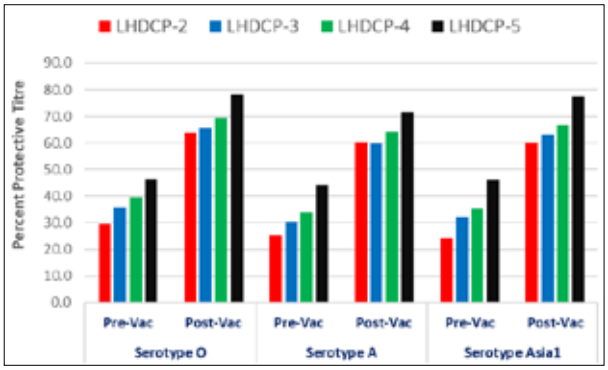
Exotic/Emerging diseases

Lumpy skin disease: Genetic characterization of lumpy skin disease viruses **(**LSDV) from 2022 outbreaks on Great Nicobar Island revealed emergence of the LSDV clade 2.5 recombinant strain (East/Southeast Asian lineage), which is distinct from the epidemic 1.2.1 and 1.2.2 strains circulating in mainland India. Detection of cluster 2.5 recombinant LSDV in India, highlights the need for monitoring of cross-border transmission of LSD.

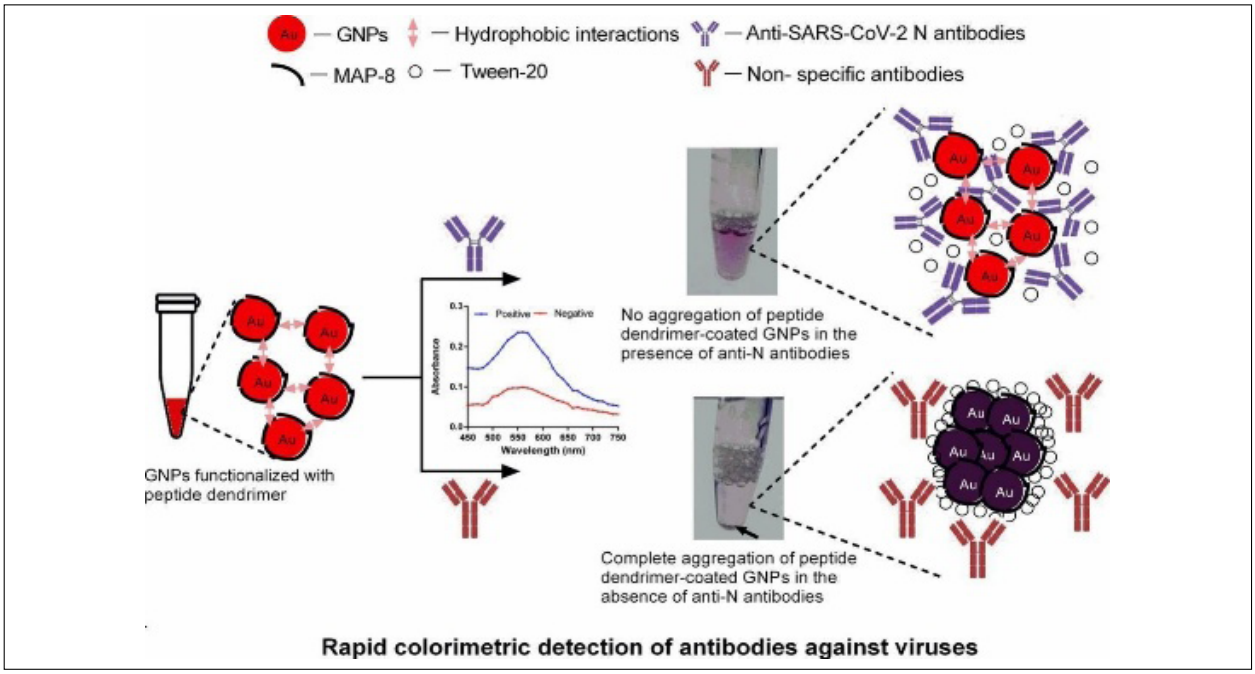
Molecular evidence of LSDV infection in water buffaloes was found in three states, while serological evidence was found in 6 states. Phylogenetic analysis of LSDV from water buffaloes during 2020-24 revealed circulation of wild-type strains of two divergent LSDV lineages (1.2.1 and 1.2.2) in Indian buffaloes with evidence of co-circulation of two LSDV sub-clusters in the same area. Detection of laboratory confirmed cases of buffalopox in LSD-negative buffaloes in Maharashtra highlight the need for monitoring the zoonotic impact of buffalopox virus (BPXV).

Foot and Mouth Disease: A one-tube multi-target RT-PCR assay was developed for pan-serotype detection of the Foot and Mouth Disease Virus (FMDV) genome. Assay demonstrated 100% relative diagnostic sensitivity and specificity compared to the serotype-differentiating mPCR assay currently used in India.

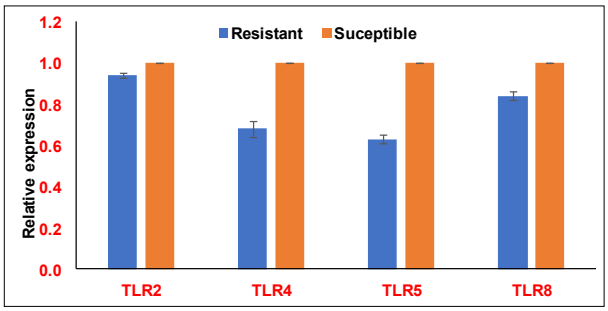
FMD Seromonitoring: A total of 1,29,339 serum samples (1,28,195 from LHDCP and 1,144 from yak and mithun) were analyzed using SPCE to evaluate immunization effectiveness. Protective titers were detected in 42.0, 36.5, and 37.8% of animals against serotypes O, A, and Asia-1, respectively, in pre-vaccination samples. In post-vaccination samples,



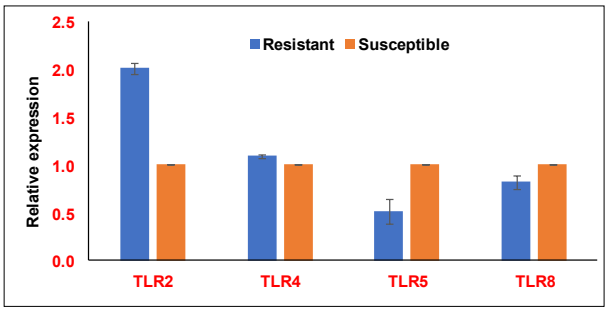
Round wise percentage of animals showing protective titer against FMD virus serotypes O, A and Asia1



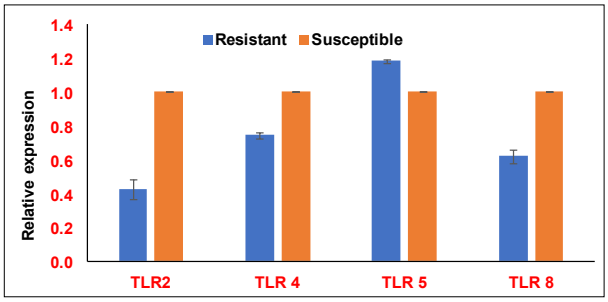
Rapid colorimetric detection of antibodies against viruses



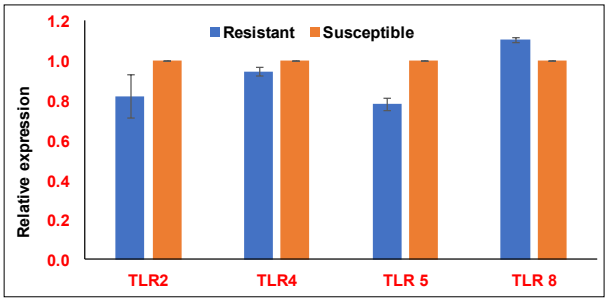
Malpura_male



Malpura_female



Avikalin_male



Avikalin_female

TLR gene expression differences in R and S line of Malpura and Avikalin sheep in October month

collected at the end of round 4, the protective titers increased to 73.8, 68.6, and 71.0% for serotypes O, A, and Asia-1, respectively.

FMD Serosurveillance: A total of 77,829 serum samples were collected from various species across the country and tested using the r3AB3 NSP-ELISA. The samples included cattle (48,555), buffalo (21,564), sheep (979), goat (5,946), pig (14), yak (668), and mithun (103). The overall seropositivity in bovine samples was 13.9%, marking a slight decrease from the previous year's seroprevalence rate of 16.7%.

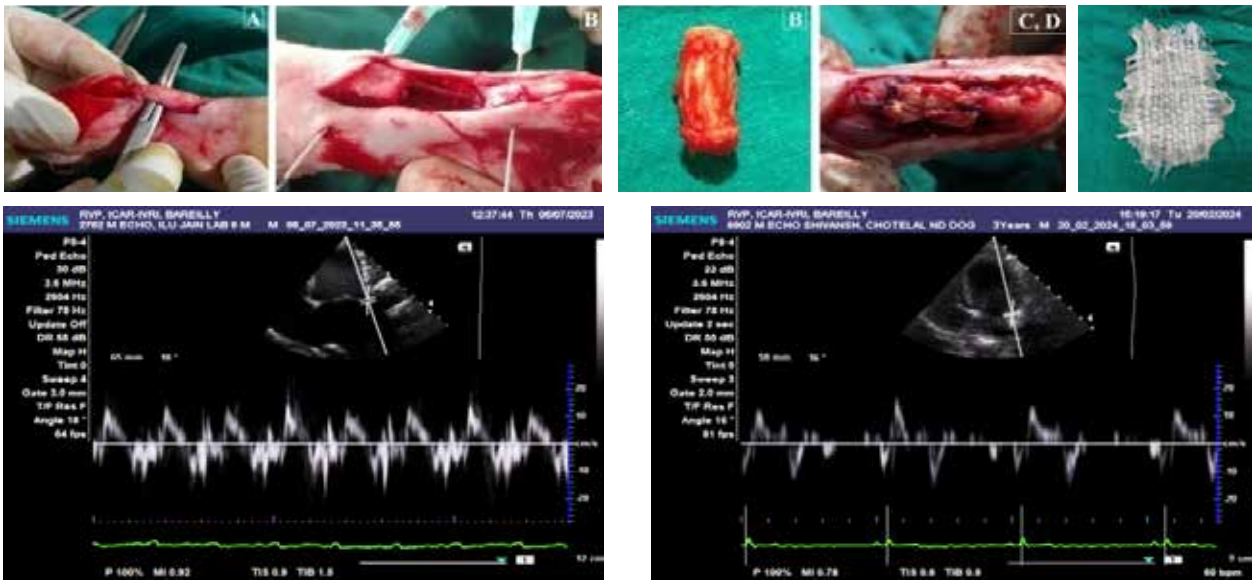
Host Pathogen Interaction

Host's response to Lumpy Skin Disease Virus (LSDV): Host's response to LSDV was investigated in cattle during natural infections resulting in varied clinical outcome of the disease. In mild cases, an early and well-regulated immune response was marked by elevated IL-2, IL-10 and IFN-γ, indicative of efficient T-cell activation and immune modulation. In contrast, severely affected cattle exhibited delayed immune activation with heightened IL-6 and TNF-α expression causing exaggerated inflammatory response that may drive disease severity. Studies on neutralizing and non-neutralizing antibodies to LSDV indicated sero-conversion to LSDV as early as 1-7 days post symptoms (dps). The peak antibody titre was noted after 14 dps and declined by 126 dps. Notably, antibody titers did not correlate with disease severity, highlighting the dominant role of cell-mediated immunity in determining the clinical outcome of the disease.

Genotype and Sex-Specific Toll-Like Receptor (TLR) Responses in Sheep Resistance to *Haemonchus contortus*: On real time PCR analysis, Male Malpura sheep from *Haemonchus contortus* resistant line (R-line) had significantly downregulated expression of TLR-2, 4, 5 and 8 as compared to susceptible line (S-line). In female Malpura sheep R animals had significantly upregulated expression of TLR-2 and 4 while significantly downregulated expression of TLR-5 and 8 as compared to S sheep. In Avikalin sheep TLR-2, 4 and 8 has downregulated expression in R line males as compared to S line, while only TLR-5 has upregulated. In female Avikalin sheep, TLR-2, 4 and 5 showed downregulated expression in R sheep as compared to S sheep while TLR-8 showed upregulated expression in R sheep as compared with S sheep.

It is speculated that TLRs play different and often genotype specific roles during *H. contortus* infection in Malpura and Avikalin sheep, which further adds complexity and diversity to their role in GIN infection. Taken together, these results indicated that the interactions between individual TLRs and different combinations of adapters directs differential response against *H. contortus* infection in R and S sheep.

Disease Informatics, Forecasting, and Socio-economic Impact and Policy Research for Disease Control: A fully operational and scalable forecasting system was developed which generated forecasts for 15 livestock diseases using 20 well-tuned models with 11 indices and real-time tuning capabilities. The DLT SMS alert was made operational in 14 states. The National Animal Disease Referral Expert System (NADRES) website attracted about 26.8 lakh visitors and activated 5 social media channels. The post-forecast dashboards, annual reports and stakeholder audits were also established to ensure evidence-based decision-making. The National Livestock Epidemiology and Disease Modelling (INLEAD) Program was launched through a two-day (24-25th June, 2025) international workshop



(A) (B)

Tissue Doppler tracing of mural mitral annulus in a normal animal (A) and in a case of CHF (B)

to advance disease modelling, surveillance, and data integration for improved livestock health management in India.

Microbial accessions in the NCVTC repository: A total of 294 microbes were accessioned into the NCVTC repository, raising the cumulative total to 5,543 microbial cultures. The bacterial repository grew to 1,990 isolates with the addition of 48 new bacterial cultures, including unique strains such as *Corynebacterium flavescens, Vagococcus luciliae, Arthrobacter gandavensis, Mammaliicoccus sciuri*, *Streptococcus equi ssp. equi*, *Brevundimonas faecalis*, *Pantoeavagans, Empedobacter brevis, Pseudomonas hunanensis*, and *Myroides odoratus*. The virus repository processed 64 virus cultures, of which 18 were accessioned, bringing the total number of virus isolates to 426.

Tissue Bank of bone: Developed composite scaffolds and ready to use Tissue Bank of bone, tendon, cartilage and soft tissue for clinical application.

Tissue Doppler echo cardiography was used successfully in the detection of diastolic dysfunction based on the Myocardial velocities and differentiated the cases of pseudo normalization from normal diastolic function.

6.
Fisheries Improvement and Management

Significant advances were achieved in fisheries improvement and management through focused interventions in breeding, nutrition, health management, sustainability, conservation, and digital innovation. Captive breeding and seed production technologies were successfully developed for several high-value finfish and shellfish species, notably Giant Trevally (Caranx ignobilis), marine ornamental fishes including royal dottyback and 4 goby species, and blue swimmer crab (Portunus reticulatus). Giant trevally attained market size within one year with farm-gate prices of Rs. 400-800 per kg. Blue swimmer crab breeding yielded 0.6-1.2 lakh megalopa per cycle with survival of 40-66.6%, improving to 62-82% during nursery rearing. Integrated seaweed shrimp farming resulted 17% higher shrimp body weight and 18% increased productivity, along with additional production of approx.1.2 ton seaweed per 0.1 ha without external nutrients. The indigenous Super-Intensive, Precision and Natural Shrimp Farming System recorded 40-50 t/ha production, 86.5-97.8% survival, and FCR of 1.1-1.2 within 90-122 days. Innovative fish feeds and nutraceuticals, including fishmeal-free BSF-based feeds, micro-particulate larval feeds, growth boosters for winter and saline conditions, and vitamin–mineral formulations, improved growth, feed efficiency, and resilience to stress. Fish health management was strengthened through the launch of the peptide-based vaccine CIFA: ArguVax-I, development of aqua phage therapy, snail control formulations, and arsenic biosensors with detection limits below WHO standards. Conservation initiatives led to ranching of over 54 lakh fingerlings in the Ganga basin, revival efforts for hilsa and endangered Hypselobarbus pulchellus, and adoption of drone-based marine mammal surveys. Digital platforms, data science tools, and the MARLIN@CMFRI mobile app further strengthened fisheries production.

Breeding and rearing of fish and shellfish species

Captive breeding and seed production technology was developed for Giant Trevally (*Caranx ignobilis*), a valuable marine fish, popular for food and game, and having a huge potential for commercial farming. The species being strong, fast-growing and easily adaptable to different salinity conditions, makes it highly suitable for cage, pond and pen culture systems. It reaches market size within a year, and fetches good price of ₹400–800 per kg. It offers excellent opportunities to diversify mariculture in India. To promote its farming, ICAR-CMFRI has supplied its juveniles to farmers, conducted cage farming trials throughout the coast, and has taken initiatives to establish nursery units in many parts of Kerala. These efforts attempt to ensure steady seed availability, create livelihood opportunities, and help meet the rising demand for quality seafood.

The high-value marine ornamental fish, royal dottyback, *Pictichromis paccagnellorum* commands Rs. 2500–4000 per piece in international aquarium trade. Its captive breeding and seed production protocol was developed by environmental manipulation and feed management. Regular spawning resulted in deposition of egg masses inside shelters. Hatching was achieved within three days of spawning. Larvae were reared on live feed, copepods and then weaned to formulated feeds. Larvae metamorphosed to juveniles in one month and were ready for stocking by the end of the fourth month after spawning.

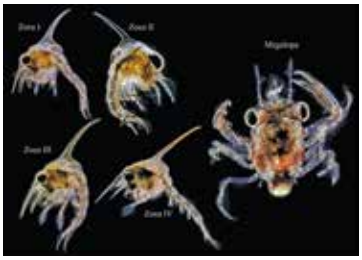
Royal dottyback, *Pictichromis paccagnellorum*, brooders

Marine ornamental gobies are in high demand in the global marine ornamental fish trade. Scientific information on biology, behaviour, embryology, larval development, growth, and reproduction of several of these species has been documented. Technologies of captive breeding and seed production of four goby species viz., wide-bar shrimp goby, *Amblyeleotris latifaciata,* ornate goby, *Istigobius ornatus,* citron goby, *Gobiodon citrinus,* and bluefin watchman goby, *Cryptocentrus fasciatus,* have been developed.

Marine ornamental gobies

Blue swimmer crab (*Portunus reticulatus*), a promising candidate species for profitable brackishwater aquaculture, was successfully bred and reared in brackishwater conditions. Successful breeding at 15–32 ‰ salinity yielded 60,000–1.2 lakh megalopa per breeding cycle with 40–66.6% survival. Nursery rearing in hapa and lined ponds with different substrate and seaweed hideouts improved survival (62–82%).

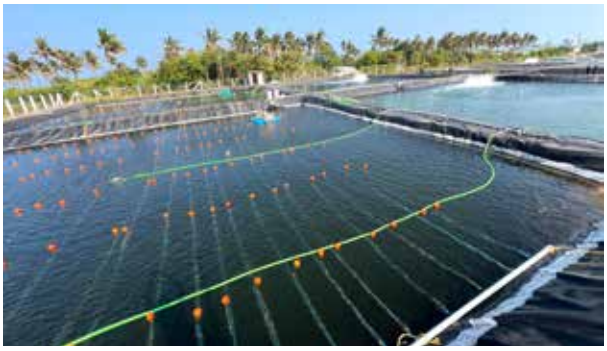
Larval stages of blue swimmer crab



Adult male blue swimmer crab

Integrated seaweed shrimp farming

Integrating seaweed with shrimp farming enhanced productivity, environmental sustainability and economic resilience. White shrimp, *Penaeus vannamei* (PL12 @40 nos/m^2) were stocked in HDPE-lined ponds having 25 ‰ salinity along with the seaweed, *Gracilaria salicornia* (@7.5 kg/tube line, 30 lines). Shrimp attained 17% higher average body weight and 18% increased productivity during the culture period. Additionally, about 1.2 tonnes of seaweed per 0.1 ha was produced without any external nutrient supplementation. Such integration was also found to improve the water quality in the farming environment. This ecosystem-based farming model offers a sustainable, resource-efficient, and environmentally responsible alternative to conventional shrimp monoculture.



Tubeline-based farming of *Gracilaria salicornia* in integrated seaweed-shrimp culture system

Harvested *Gracilaria salicornia* monoline tube net

Fish feed formulations

Cadalmin™ BSF-FFF and Cadalmin™ BSF-Pro: The black soldier fly larvae meal (BSFLM) based fish meal free feeds, Cadalmin™ BSF-FFF for the juveniles of silver pompano, *Trachinotus blochii* and Cadalmin™ BSF-Pro for the juveniles of Indian pompano were formulated and commercialized. Feeding trials proved that BSFLM can be used as a total replacer for fish meal in the diets of pompano juveniles without any adverse effects on their growth and environmental conditions,

Cadalmin™ MICROFIN: Micro-particulate feed for the early-stage of marine fishes, viz., cobia, *Rachycentron canadum* and silver pompano, *Trachinotus blochii* was designed. It contains high quality marine protein mixture and is prepared through extrusion, spheronization, fluidized bed processing (drying and spray coating), and precision sieving.

CIFE-Pangas Shakti: Formulated pangasius fish feed line to precisely meet the nutrient requirements of the different growth stages, improve feed utilization, maintain pond water quality, reduce reliance on expensive and non-sustainable ingredients, and make pangasius aquaculture profitable, especially for small to medium-scale farmers.

SUCCESS STORY

Super-Intensive, Precision and Natural Shrimp Farming (SIPNSF)

ICAR–CIBA developed an indigenous "Super-Intensive, Precision and Natural Shrimp Farming System" with the financial support of Pradhan Mantri Matsya Sampada Yojana (PMMSY), an initiative of Government of India. This farming system improved productivity with reduced input costs. Its key features include smart feeding, intelligent aeration, stringent biosecurity, *in-situ* natural feed production, minimal water exchange, and low energy consumption-making it climate-resilient and environmentally sustainable. In the recent past, sixteen harvests of SPF *Penaeus vannamei* were successfully completed with each crop cycle of about 90 to 122 days, achieving a production of 4-5.5 kg/m³ (equivalent to 40 – 50 tonnes/ha) with survival rates of 86.5%–97.8% and FCR 1.1–1.2. With proper planning, it is possible to undertake three crops in a year.

CIFE-Vruddhi: It is a novel vitamin-mineral-based nutraceutical formulation to enhance compensatory growth in carp fingerlings, particularly those that are stunted. The composition excludes water-soluble vitamins and comprises 0.1–0.5% of a non-enzymatic, antioxidant-rich conglomerate that significantly boosts weight gain percentage, specific growth rate, and protein efficiency ratio. It also mitigates the effects of both abiotic and biotic stressors during the critical compensatory growth phase. This formulation supports antioxidant defense system of fish, improves resilience to oxidative stress, and enhancing overall health and immunity.

CIFE-WINT: CIFE-WINT is a fish growth booster, developed specifically for winter conditions. It can be used as a premix incorporated into routine commercial or farm-made feeds. Its application increases fish metabolism, stimulates feed intake, improves tolerance to low temperatures, and enhances growth during the colder months.

CIFE - Tila Grow: This feed is tailored to meet the rigorous physiological and nutritional requirements of fish grown in inland saline water (ISW) conditions. Especially the GIFT Tilapia (Genetically Improved Farmed Tilapia, *Oreochromis niloticus*), as it is well-suited for culture in saline inland environments due to its high salinity tolerance, rapid growth, robust disease resistance, efficient feed conversion and wide dietary adaptability.

Fish Health Management

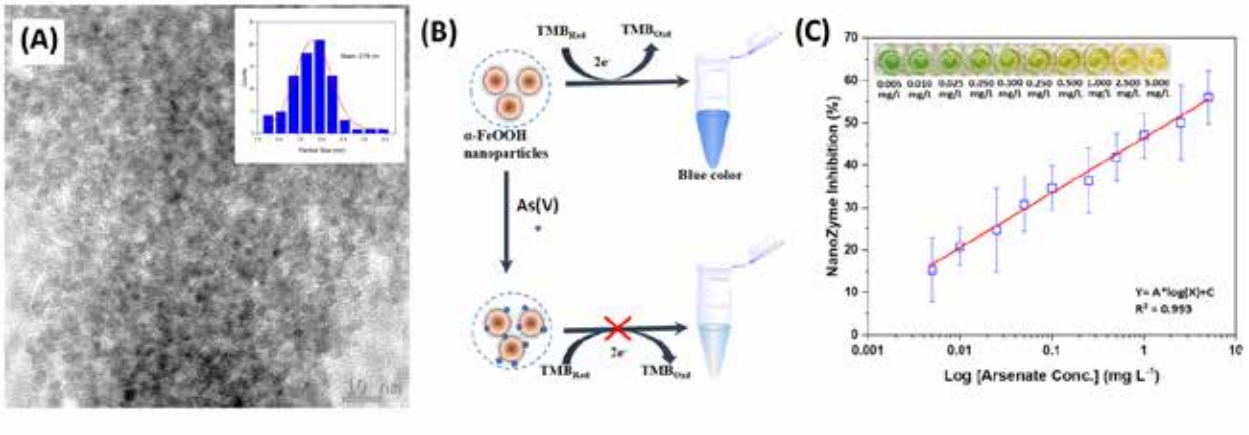
Fish vaccine, CIFA: ArguVax-I: A novel peptide-based fish vaccine, 'CIFA: ArguVax-I', was developed to combat argulus parasitic infestation in fish, which was released by the Hon'ble Union Minister of Agriculture and Farmers' Welfare, Shri Shivraj Singh Chauhan, during the launch of Viksit Krishi Sankalp Abhiyan (VKSA-2025) at ICAR-CIFA, Bhubaneswar on 29 May 2025. This vaccine is vital for fish health management and helps to reduce economic losses in aquaculture.

Aqua phage therapy against bacterial infections: Significant progress was made in development of aqua phage therapy for controlling bacterial infections in rainbow trout farms of the Indian Himalayan Region. Fifteen highly specific bacteriophages, with

5 phages each targeting *Aeromonas hydrophila, A. salmonicida* and *Lactococcus garvieae* were isolated and characterized from water samples. These phages exhibited high specificity and narrow host ranges, which makes them suitable for targeted biocontrol applications in coldwater aquaculture.

Formulation for controlling snail and helminthic parasites: Snails host various types of parasitic worms and protozoan and often invade the fish culture systems. For control of snails, a chemical formulation has been developed incorporating FDA-approved ingredient combined with a hydrophilic polymer and a surfactant for better dispersion in water. Particle size of formulation dispersed in water measured 2.01 µm and its zeta potential was - 53 mV. The acute toxicity of formulation against *Filopaludina bengalensis*, a prevalent snail species in the Indo-Gangetic plain, with 96 hr LC_{50} value of 0.093 mg L^{-1} indicated its efficacy even at low concentrations.

Biosensors for detection of hazardous metalloid in aquatic environments: Arsenic poses serious hazards for both human and environmental health. For quick and easy quantitative detection of arsenate in fish and water, a feroxyhyte (FeOOH) nanoparticles sensor probe was developed. In presence of H_2O_2, the FeOOH nanoparticles exhibited peroxidase mimetic activity and oxidized 3,5,3'5'-tetramethyl-benzidine (TMB) to a blue product (oxTMB, λmax 650 nm). On the other hand, arsenate by attaching to the catalytic active sites, prevents the peroxidase activity of FeOOH nanoparticles. This method has an excellent linear response (R^2= 0.99) spanning the range of 0.005 to 5.000 mg L^{-1} arsenate with a detection limit of 0.006 mg L^{-1}, which is lower than the WHO-recommended limit (0.010 mg L^{-1}) for drinking water.



Schema of arsenate detection using FeOOH nanoparticle and the obtained linearity curve

Fish Conservation

Wild fish germplasm conservation: Prized indigenous fishes of River Ganga namely, Indian major carps and mahseer were bred and reared in captive facility and more than 54 lakh fingerlings were released across the length of river Ganga through thirty ranching activities. Maximum fish ranching activities were conducted in the State of West Bengal (68%), followed by Bihar (17%), Uttar Pradesh (9%), Jharkhand (5%) and Uttarakhand (1%).

For conserving population of hilsa, *Tenualosa ilisha*, stocks of the species were maintained in pond and cage culture systems at Farakka, West Bengal under the Namami Gange project. In the current year, about 48,000 adult and juveniles were ranched in depleted portions of River Ganga.

Hypselobarbus pulchellus is a critically endangered peninsular fish, endemic to Tunga river, Karnataka. For revival of its fishery in open waters, about 5000 captive bred advanced fingerlings and around 50 pairs of adult fishes were released in Gajanur reservoir on Tunga river.

Drone-based survey of marine mammal and fishery interactions: Drone-based survey method was used to investigate marine mammal and fishery interactions. This approach enhances marine mammal conservation by overcoming limitations of traditional survey methods, which are often constrained by time, cost, and difficulty of monitoring elusive species across

Fish ranching by Dr Abhilaksh Likhi, Secretary, Department. of Fisheries, Government of India at Barrackpore

Fish ranching by Shri C.R. Patil, Hon'ble Union Minister of Jal Shakti, Govt of India at Haridwar

Artificial breeding and ranching of Hilsa in River Ganga at upstream of the Farakka Barrage, West Bengal

River ranching of *Hypselobarbus pulchellus* in Gajanur reservoir on Tunga river by Joint Director, Fisheries & Officials from Department of Forestry, Government of Karnataka and local fishermen

vast ocean areas. Drones provided a more efficient, non-invasive, and cost-effective solution for collecting comprehensive data.

Interaction of coastal dolphins with trawl fisheries off Kochi, focusing on three broad behavioral states: travelling, socializing, and foraging, indicated that travelling was the most prevalent activity, followed by socializing and foraging.

Data science pipeline for informatics of native Indian freshwater fish: A scalable data science framework was developed for data-driven assessment of Indian freshwater fish species taxa and their conservation status. It integrates automated checklist preparation from online resources and suitable analytics. The automated web harvesting component updates the checklist of

Drone view of pod of humpback dolphins

Travelling

Socializing

Foraging

1,239 Native Indian Freshwater Fish (NIFF) species. This empowers fish taxonomists to prepare accurate and periodic updates and also facilitates efficient policy planning on NIFF. Fish species discovery analytics indicated the national temporal discovery rate of 18.86 per year for the period 1999-2024. Northeast India contributed the highest biogeographic species discovery rate of 8.3 per year. It demonstrated 84 % accuracy in predicting threat status of NIFF. It also helps to identify threat risk factors in order of habitat degradation, alien invasion, land use change, development activities, unsustainable fishing, destructive fishing, pollution and water abstraction, which will be useful to prioritize strategic policy planning for NIFF resources.

MARLIN@CMFRI mobile app: 'MARLIN@CMFRI' mobile app encourages citizen science initiatives in marine fisheries research. It is a gateway for comprehensive media sharing, poised to transform marine fishery research, species identification, and assessment efforts within India's Exclusive Economic Zone (EEZ). It allows public to effortlessly upload photos of marine fish species encountered in the vast expanse of the Indian EEZ, fostering development of rich visual repository of marine fishery resources. The App encourages users to provide species details ensuring that the database is scientifically enriched, facilitating accurate species identification. This data will contribute to generate an AI-powered system for automated identification of marine fishery resources. Geotagging is one of the pivotal features of this app which enables users to pinpoint the exact location where each of the marine species was landed. This information will enhance the precision of database, providing crucial information for researchers and conservationists studying the distribution patterns of various marine fish species within the Indian EEZ.

7.
Genetic Resources

The Indian Council of Agricultural Research (ICAR) made significant advancements in the conservation, characterization, utilization and policy support of genetic resources across plants, animals, microbes, insects and fish, strengthening food, nutrition and livelihood security. In plant genetic resources, 18 germplasm exploration missions resulted in the collection of 1,247 accessions (717 cultivated and 530 wild), including valuable landraces and crop wild relatives. The National Genebank was enriched with 2,726 seed accessions, taking the total base collection to 4.74 lakh accessions, while cryopreservation holdings reached 13,102 accessions along with 2,194 genomic resources. Over 25,000 accessions were imported from 32 countries, and more than 83,000 accessions were supplied for research, evaluation and characterization. A total of 41 trait-specific germplasm donors were registered, enhancing trait-based breeding programmes. In microbial genetic resources, the National Agriculturally Important Microbial Culture Collection conserved 9,868 accessions, with 942 new cultures accessioned and DNA fingerprinting services extended to over 380 biopesticide samples. The National Insect Repository added 29,363 specimens, bringing total holdings to about 3.15 lakh, and documented over 55 new insect species, besides multiple new genera, host records and first reports from India. In animal genetic resources, ten new indigenous breeds were registered and 17 breeds gazette-notified, increasing the total registered breeds across species substantially. Cryopreservation efforts added 21,500 semen doses and 1,920 somatic cell vials, contributing to SDG 2.5.1. Fish genetic resources witnessed the discovery of seven new fish species, first records of four marine fishes, chromosome-level genome assembly of Clarias dussumieri, and development of molecular tools for species identification and early sex determination. A notable success was the development of designer clownfish hybrids, highlighting ICAR's innovation-driven approach. Collectively, these achievements safeguarding genetic resources, advancing cutting-edge genomics, and supporting sustainable agricultural development at national level for improving sustainable productivity.

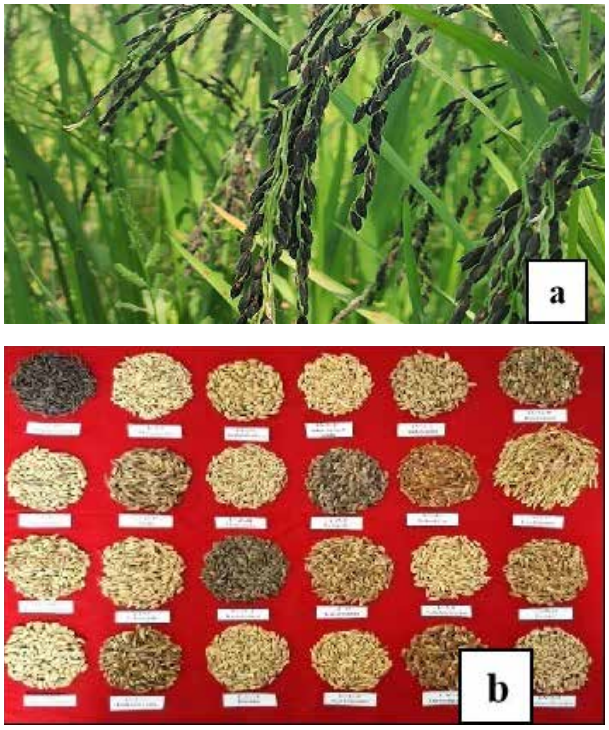
Plant Genetic Resources

Germplasm exploration: During the period under report, a total of 18 exploration were undertaken and 1,247 accessions (717 cultivated and 530 wild) were collected from different parts of Andhra Pradesh, Himachal, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttarakhand and West Bengal. Significant collection includes landraces and crop wild relatives of cereals, pulses and vegetables. During the period the significant number of wild relatives under different crop groups like *Abelmoschus, Cajanus, Cucumis, Solanum, Vigna* and wild form of *Punica granatum* were collected.

A total of 317 herbarium specimens were processed/ added to National Herbarium of Cultivated Plants (NHCP), New Delhi bringing the holding to a total of 26,707 specimens. The processed herbarium includes 56 unrepresented taxa. A total of 3,910 virtual herbarium specimens were added to the database of NHCP, New Delhi taking the total to 6,518.

Germplasm conservation: Total of 2,726 accessions

(a) Seed variability in foxtail millet; (b) *Hygrophila auriculata* being sold as wild vegetable; (c) Occurrence of *Vigna angularis* var. *nipponensis* reported first time in Tripura; (d) Profuse bearing of *kalmegh*; (e) Wild *Gymnopetalum chinense* collected as wild vegetable from Tripura



Collection of a rare Rice landrace- Illuppai poo samba (a); Variability in seeds of rice landraces (b) collected from Thiruvannamalai district, Tamil Nadu

of orthodox seed species were added to the National Genebank for long-term storage, bringing the base collection of Seed Genebank to the total of 4,73,718 accessions. Seventeen accessions of fruits, tubers, bulbs and medicinal plants were added to the *in vitro* Genebank, raising the total *in vitro* active genebank collection to 2,058 accessions in the form of ~42,000 *in vitro* cultures belonging 183 species; and 13 *in vitro* accessions were cryopreserved. Fifty-five accessions of seeds, embryo, embryonic axes and pollen grains of different crop species were successfully cryopreserved, raising the total collection to 13,102 accessions. Besides 2,194 genomic resources were also cryopreserved.

Germplasm exchange: A total of 25,537 accessions were imported from 32 countries. Additionally, 24,802 entries of "germplasm under development" were imported in the form of trials/ nurseries from CG Centres. Besides this, domestic supply of germplasm is being done using Germplasm Supply Management System at ICAR-NBPGR. During the reporting period, 3,862 accessions of 42 species were supplied to various research organizations in the country. In addition, 79,557 accessions of 26 crops were supplied for morphological characterization and preliminary evaluation.

Germplasm characterization/evaluation: A total of 10,514 germplasm accessions of different crops were characterized for various agromorphological traits. A total of 2,889 germplasm accessions of different crops were evaluated for various biotic and abiotic traits. A total of 9,169 germplasm accessions of different crops were characterized for various biochemical traits. Core set in barnyard millet (271 acc.), triticale (110 acc.), lablab bean (108 acc.), *Lathyrus sativus* (264 acc.) were developed. Reference set for *Alternaria* blight resistance and salinity tolerance in linseed were developed. Two Germplasm Diversity Days were organized.

Plant quarantine: A total of 1,21,535 imported samples were processed for quarantine clearance. 1,260 samples were infested/ infected with different pest, of which 12 samples were rejected due to fungal pathogens of quarantine importance. Among interceptions, 133 were economically important pests comprising insects (23), Fungi/ bacteria (52), viruses (21), nematodes (5) and weeds (25). Of these, 35 pests comprising insects (5), fungi/ bacteria (2), viruses (6) and weeds (14) are not yet reported from India. Important interceptions include - *Callosobruchus subinnotatus, Peronospora manshurica, Convolvulus erubescens,* and *Fallopia convolvulus*. Multiplex PCR-based diagnostic technologies have been developed in soybean for viruses and in rice for fungal pathogens of quarantine significance for India.

DNA fingerprinting and genome sequencing

Plants: During the period under report, 83 samples of 17 agri-horticultural crops (bottle gourd, brinjal, cotton, garden pea, groundnut, lablab bean, mustard, paddy, pearl millet, French bean, sesame, sorghum, soybean, sponge gourd, tomato, watermelon and wheat) received from different public and private sector organizations were DNA profiled. Genetically Modified Organism (GMO) testing services were provided for 24 samples of maize in compliance with ISO17025 accreditation. Molecular testing of nine samples of imported transgenic seeds of maize and *Medicago truncatula* was performed to confirm the presence of the respective transgenic elements and to ensure the absence of the embryogenesis deactivator gene (terminator gene technology) before release to the importer. Molecular testing of 96 samples of transgenic maize (to be exported to Israel) and 25 samples of transgenic cotton (to be exported to the USA) was performed for the respective transgenes.

Microbes: To maintain the authenticity of biopesticides and to check the spurious and substandard products, the Central Insecticide Board and Registration Committee (CIB & RC) has included molecular identification and DNA fingerprint as mandatory requirements for registration and recognized ICAR-National Bureau of Agriculturally Important Micro-organisms (NBAIM), Mau, Uttar Pradesh is the nodal agency for developing DNA fingerprints of microbial cultures to be registered as biopesticides. More than 380 samples from 98 companies and biopesticide units under SAUs were processed for fingerprinting during the reporting period.

Insects DNA barcode for 462 insect species and whole genome sequencing for 5 species including three insects, and two *Bt* strains were generated. Around 40 stage /age/ tissue specific transcriptomes were generated and analysed for the characterization of different genes and gene families. Important gene families of insects, EPNs and entomopathogenic microbes (*Bt*) were mined from the genome and transcriptome datasets and many

novel genes were observed as a target for RNAi and genome editing.

Plant Germplasm registration: Total 41 special trait germplasm/ donors of 28 species were registered during the period of report taking the tally of total trait specific germplasm 2,325 registered in the National Genebank for use in the trait-based breeding by the scientists working in National Agricultural Research System.

Trait-specific Germplasm registered during October, 2024 to September 2025 with current status of donors registered by Plant Germplasm Registration Committee

Crop group	No. of germplasm entries registered during period of report	Present status
Cereals and Pesudocereals	09	826
Millets	04	162
Fibre and Forages	00	130
Grain legumes	06	232
Vegetables	04	146
Oilseeds	06	282
Commercial Crop	01	125
M & AP & Spices and Masticatory	05	145
Fruits and Nuts	04	89
Tubers	02	63
Ornamentals	00	107
Narcotic/ Beverages	00	09
Agro-forestry	00	09
Grand Total	41	2,325

Some notable germplasm registered by the Plant Germplasm Registration Committee

Microbial Genetic Resources

The National Agriculturally Important Microbial Culture Collection (NAIMCC), ICAR-NBAIM, Mau, Uttar Pradesh is designated national repository for conservation of agriculturally important microorganisms (AIMs) and holding 9,868 microbial accessions (Cyanobacteria 442; Bacteria 4746; Fungi 4680). During the reporting period 807 microbial cultures have been accessioned as general deposits while 119 microbial cultures were accessioned as safe deposits. A total 16 microbial cultures were accessioned as patent deposits. NAIMCC initiated microbial identification services during the reporting period. A total 138 authentic microbial cultures were also supplied to the academia and industries during this period.

Insect Genetic Resources

ICAR-National Bureau of Plant Genetic Resources (NBAIR) Museum was recognized by the Ministry of Environment, Forest and Climate Change as the "National Repository" under the Biological Diversity Act, 2002 on 12 September 2012, for conserving agriculturally important insects, mites, and spiders. The National Insect Museum currently houses about 3.15 lakh insect specimens (excluding wet collections) with 29,363 insect specimens added during the reporting period. About 55 new insect species from different regions of the country have been described, many originating from biodiversity hotspots such as the Western Ghats, Eastern Ghats, North Eastern States, and the Andaman & Nicobar Islands.

The Live Insect Repository Unit (LIRU) of the Bureau is maintaining 137 live insect species germplasm including 107 parasitiods, 15 predators, and 15 host insects/pests for supply to various stakeholders.

New insect species discovery

Pseudococcidae, Coccidae, Diaspididae: Three new species published viz. *Leptopulvinaria harishi* Joshi sp. nov., *Pulvinarisca greeni* Joshi & Dubey, sp. nov. and new mealybug species, *Paraputo blackmani* Joshi, sp. n. was described and illustrated based on adult females collected from *Butea monosperma* (Fabaceae) in Bengaluru Rural district, Karnataka.

Scarabaeidae: Eight new species were discovered and described from the collections made from Southern India and North East India with one new distributional record to the country and 12 new to different states. Six new scarab species belonging to subfamily Sericinae of Scarabaeidae, *viz*. *Maladera silviae* Sreedevi and Ahrens sp. nov., *Maladera judithae* Sreedevi and Ahrens sp.

Paraputo blackmani

nov., *M. thandigudiensis* Sreedevi and Ahrens sp. nov. *M.* (*Hemiserica*) *subinaequalis* Sreedevi and Ahrens sp. nov. *Neoserica berlineri* Sreedevi and Ahrens sp. nov. *Selaserica peechi* Sreedevi and Ahrens sp. nov. have been discovered.

Two New Scarab Beetles Discovered in Northeast India: In a significant scientific breakthrough, researchers have discovered two new scarab beetle species—*Cyphochilus kukriana* Sreedevi, Sahoo and Sabatinelli, 2025, from Arunachal Pradesh, and *Cyphochilus pentaphysia* Sreedevi, Sahoo and Sabatinelli, 2025, from Mizoram, Nagaland, and Tripura. The study also reports India's first record of *C. tenzingyatsoi* and resolves a 100-year-old taxonomic puzzle by merging multiple species under *C. niveosquamosus*. The findings underscore North-east India's status as a biodiversity hotspot and raise new questions about the beetles' potential impact on key crops like maize and kiwi.

Curculionidae: A new genus of Ceutorhynchinae (Mescysmoderini), *Spathaspina* was described and illustrated with one new species, *Spathaspina noohi* from north-eastern India. Two new genera of Acalyptini were identified for the first time in India: *Imera* Pascoe and *Orsophagous* Roelofs, with descriptions of two new species. *Imera setauropsis* was recorded in the Jawadhu Hills, and *Orsophagous indicus* in the Vellimalai and Kalrayan Hills of Tamil Nadu. The new aquatic weevil species *Bagous obrieni* was identified and described. It was collected from the aquatic weed *Nymphoides indica* in a lake near Savandurga in Karnataka. A new species, *Alcidodes erosa* Mithun was described from Kerala. This species is one of the most important pests of the critically endangered tree species *Hopea erosa* (Bedd.) Slooten (Dipterocarpaceae), which is endemic to the Western Ghats.

Revision of the genus *Hirsutopes* was carried out, providing a detailed description of the known species and the new species collected from the Andaman Islands. Only three species were previously known in the genus *Hirsutopes* Pajni, which is endemic to the Andaman Islands in India. A new species, *Hirsutopes saddlensis* was described, and two species, *H. andamanensis* Pajni and *H. megaoculatus* Pajni, were re-described. A key to the species of the genus is also provided.

Hymenoptera: Discovered, described and published 12 new species of parasitic Hymenoptera: *Rogasodes indicus, Wesmaelia indoflavus, Chrysopophthorus indicus, Tuberidelus indicus, Aulacocentrum hunliensis, Aulacocentrum parotisae, Diolcogaster pseudandamanensis, Diolcogaster confusus, Canalirogas multinigratus, Canalirogas subtransversus, Canalirogas oblongus* and *Canalirogas omninopallidus*.

Tephritidae : Three new species of fruit flies described from India *viz*., *Acroceratitis sachini, Oedaspis freidbergi* and *Rhochmopterum malaviyai.*

Pentatomidae: Five new species of pentatomidae bugs discovered *viz. Axiagastus chandrashekarai, Axiagastus luteipes, Axiagastus prathapani, Axiagastus votypkai* and *Axiagastus yeshwanthi*.

Thripidae: Two species of Scirtothrips viz. S. *donumdei* and *S. lami* were collected on the leaves of *Senegalia pennata* (Fabaceae) and an unidentified weed (Asteraceae) were described new to science from Karnataka. In addition, *Rhamphothrips laterocurvidentatus* was identified as new species.

Scirtothrips donumdei

Scirtothrips lami

Cicadelidae: Two New genus published and four new species *Shanaya spatulata, Shanaya abeeri, Ramya longiprocessus* and *Ramya megatrium* were discovered

First records from India: *Neohydatothrips flavicingulus; Scirtothrips machili; Thrips hanifahi; Thrips razanii ; Thrips sumatrensis*

Viruses: First report of *Hibiscus latent Fort Pierce* virus (HLFPV) from India, as well as the first recorded insect association of the virus with the mealybug *Maconellicoccus hirsutus* (Green).

Five new records of Tephritids from India: a) *Bactrocera gombokensis* Drew & Hancock*;* b) *Chaetellipsis alternata* (Zia)*;* c) *Goniurellia persignata* Freidberg*:* d) *Actinoptera reticulata Ito :* e) *Terellia serratulae* (Linnaeus)

Entomopathogenic nematodes: Described *Steinernema keralense* n. sp from India. Shatpada-high temperature tolerant *Steiner shori* NBAIRS80 for the management of insect pests was identified and characterized.

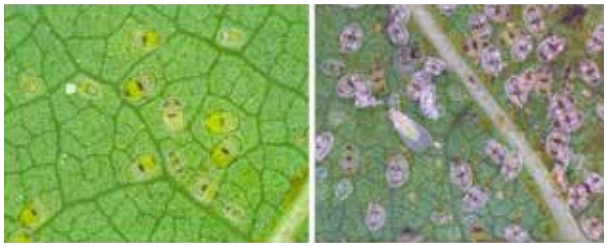
New distributional records: Five armoured scale insect species, *viz*. *Duplaspidiotus claviger* (Cockerell), *Lepidosaphes laterochitinosa* Green, Kuwanaspis *howardi* (Cooley), *Rutherfordia maloti* (Rutherford) and *Aulacaspis alisiana* Takagi were reported in Hemiptera.

Duplaspidiotus claviger

Lepidosaphes laterochitinosa

New host plant/host insect records: Four thrips species were newly recorded as pests of *Magnolia champaka,* including *Psephenothrips machili, Thrips florum, Thrips hawaiiensis* and *Thrips orientalis.*

New invasive whitefly, *Aleurotrachelus anonae*: An invasive whitefly, *Aleurotrachelus anonae* (Corbett) along with its parasitoids was documented for the first time from India on custard apple and *Canna indica*. A potential parasitoid, *Encarsia cubensis* on *Aleurothrixus floccosus* and *Aleurotrachelus trachoides* was recorded for the first time from India.



Life stages of *Aleurotrachelus anonae* on custard apple

A new bipartite begomovirus in butterfly pea: *Clitoria ternatea* L. (butterfly pea), a perennial vine of the Fabaceae family, showed yellow mosaic disease (YMD) symptoms suspected to be caused by a begomovirus. The virus is proposed as *Begomovirus clitoriasis*, commonly named butterfly pea yellow mosaic virus (BpYMV). *Clitoria ternatea* has been also identified and characterized as an alternate host of MYMIV for the first time.

Yellow mosaic disease symptoms in *Clitoria ternatea*

Role in PGR Policy at Global Level: ICAR-NBPGR provided leadership in the area of global negotiations on the enhancement of the multilateral system of access and benefit sharing under Plant Treaty.

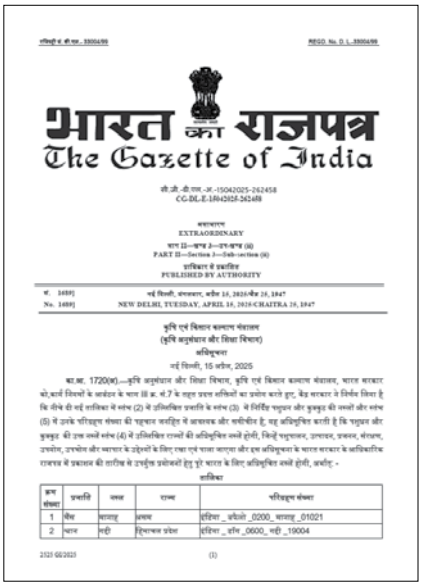
Germplasm characterization/evaluation: Five *Musa* species, *M. beccarii* N.W. Simmonds, *M. velutina* H. Wendl. & Drude, *M. cheesmanii* N.W. Simmonds, *M. haekkinenii* N.S. Lý & Haev, and *M. itinerans* Cheesman were collected from the Malabar Botanical Garden & Institute for Plant Sciences, Kozhikode, Kerala and added to the field genebank. New accessions of pomegranate were collected from Uttarakhand (50), Karnal, Haryana (2), and Jammu & Kashmir (8) for enriching the national gene pool. About 30 Coconut accessions native to Islands (A&N and Lakshadweep) and Coastal (Kerala) ecosystems have been characterized at Research Centre, Kidu. Among these, Champin Micro Tall, with high nut and copra yielding potential, has been identified for further studies. Efforts to enhance the population of novel sweet-kernel coconut types (Ratnagiri's Mohacho narel sweet kernel) have been undertaken. Thirty one cocoa genotypes, including 21 hybrids and 10 elite clones, were assessed and classified based on leaf, flower, fruit and bean traits, as well as fat content (using multiscale scores). Two hundred sixty wild mushroom germplasms were collected from various natural habitats, 160 germplasms were identified at the genus level, and 100 were characterized up to the species level. Major species among the collection include *Calvatia cythiformis*, *Stropharia atroferruginea*, *Agaricus augustus*, *Ganoderma lucidum*, *Clitocybe nuda*, *Cordyceps militaris*, *Cyclocybe aegerita*, and *Morchella* spp.

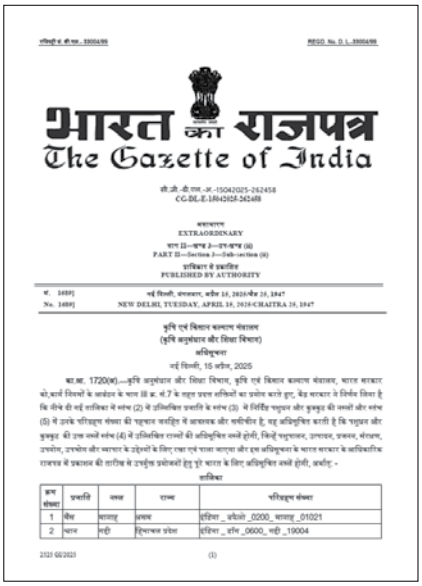
DNA fingerprinting and Genome sequencing in coconut: The 'Kalpa Genome Resource' a comprehensive genomics platform for the dwarf coconut variety 'Chowghat Green Dwarf' (CGD), integrating transcriptome and fingerprinting data has been hosted allowing users to access genome and transcriptome resources.

***De novo* genome assembly of *Xanthomonas phaseoli* pv. *dieffenbachiae* - India:** *De novo* Genome assembly was performed using the PATRIC tool from the bacterial and viral Bioinformatics Centre BV-BRC. The deciphered genome showed highest similarity to *Xanthomonas phaseoli* pv. *dieffenbachiae* strain D182 with 1575 unique fragments mapped to this reference. Genome length is approximately 5 MB (5032865 bp) and an average of 64.95% G + C content. The phylogenetic analysis showed clustering of *Xanthomonas* genome clearly along with other *Xanthomnadacae* members.

Germplasm Registration: East Indian Arrowroot accession CTCRI-CA-PM-1 (IC641835) was registered with ICAR-NBPGR (INGR25038) for its unique/economic traits, *viz*. lengthy primary finger and high starch. ICAR-IIOPR, Pedavegi has registered oil palm dura genotype, Palm No. 35 (IOPPV002966 / INGR24039) with high oil content (24.53%). Three elite potato genetic stocks have been registered with

ICAR-NBPGR, New Delhi. Two Farmers' varieties, namely, Neykadali from Kanyakumari, Tamil Nadu and Chavaniyankal Poovan from Kottayam, Kerala and 'Agraha'-Jack-fruit (2024/0077) from Hes saraghatta, Village, Karnataka. Have been registered with PPV&FRA, New Delhi. The *Pandanus amaryllisfolius* Roxb. accession was registered as a high foliage production accession (INGR 24069). The *Maccaranga nicobarica* accession was registered as a high foliage production accession (INGR 24083).


भारत का राजपत्र
The Gazette of India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The Gazette of India

Animal Genetic Resources (AnGR)

Breed Registration and Gazette Notification: ICAR-National Bureau of Animal Genetic Resources (ICAR-NBAGR), Karnal registered ten new indigenous breeds, *viz*. Manah buffalo from Assam, Gaddi dog from Himachal Pradesh, Tripureswari duck from Tripura, Chaugarkha goat from Uttarakhand, Bundelkhandi goat from Uttar Pradesh and Madhya Pradesh, Karkambi pig from Maharashtra, Kheri sheep from Rajasthan, Changkhi dog, Ladakhi donkey, and Ladakhi yak from Ladakh (UT) based on the recommendation of Breed Registration Committee (BRC) of ICAR. After registration of these breeds, indigenous animal breeds are now 53 for cattle, 21 for buffalo, 41 for goat, 46 for sheep, 8 for horses and ponies, 9 for camel, 15 for pig, 4 for donkey, 5 for dog, 2 for yak, 20 for chicken, 4 for duck, and 1 for geese.

A total of 17 indigenous breeds and one synthetic breed (Frieswal cattle) were Gazette-notified by the Department of Agricultural Research and Education (DARE), Ministry of Agriculture & Farmers Welfare, Government of India, during December 2024 and April 2025. These included Andamani goat, pig, and duck; Bhimthadi horse; Anjori goat; Macherla sheep; Aravali chicken; Frieswal cattle; Manah buffalo; Chaugarkha and Bundelkhandi goats; *Kheri* sheep; Karkambi pig; Ladakhi donkey; Ladakhi yak; Tripureswari duck; Gaddi dog; and Changkhi dog.

Hon'ble Prime Minister released Gau & Mahish chips

The NDDB developed the unified SNP chips for cattle and buffalo, after pooling the genomic data from the NBAGR, NDDB, BAIF and NIAB. Unified LD chip for cattle (Gau chip) with about 66,342 markers; which carried 12,871 SNPs exclusively from the LD chip of the cattle from NBAGR and rest from NDDB, BAIF, and few from public domain. Similarly, for the buffalo (Mahish Chip), with about 61,353 SNPs, 14,088 SNPs from NBAGR were included. These contributing markers from participating agencies added the robustness of the unified SNP chip, with their wider genomic distribution and increased polymorphism for indigenous cattle and buffalo populations. Both Gau chip and Mahish chip were released and dedicated to the Nation by the Hon'ble Prime Minister, Govt. of India on 5 October 2024 at Washim (Maharashtra).

Accession numbers of Newly registered animal breeds

S. No.	Species	Name of breed	Native tract	Accession Number
1	Buffalo	Manah	Assam	INDIA_BUFFALO_0200_MANAH_01021
2	Dog	Gaddi	Himachal Pradesh	INDIA_DOG_0600_GADDI_19004
3	Dog	Changkhi	Ladakh	INDIA_DOG_3800_CHANGKHI_19005
4	Donkey	Ladakhi	Ladakh	INDIA_DONKEY_3800_LADAKHI_05004
5	Duck	Tripureswari	Tripura	INDIA_DUCK_1900_TRIPURESWARI_11004
6	Goat	Chaugarkha	Uttarakhand	INDIA_GOAT_2400_CHAUGARKHA_06040
7	Goat	Bundelkhandi	Uttar Pradesh & Madhya Pradesh	INDIA_GOAT_2010_BUNDELKHANDI_06041
8	Pig	Karkambi	Maharashtra	INDIA_PIG_1100_KARKAMBI_09015
9	Sheep	Kheri	Rajasthan	INDIA_SHEEP_1700_KHERI_14046
10	Yak	Ladakhi	Ladakh	INDIA_YAK_3800_LADAKHI_16002

Characterization of indigenous livestock and poultry populations

NBAGR, is characterizing indigenous livestock, poultry and dog populations across the country through Network Program on Animal Genetic Resources. Currently, 33 Centres involving State AHDs, SAUs/ SVUs, ICAR institutions NGOs of 26 states/UTs are characterizing various populations in their respective states. During October 2024-Sept 2025, total 17 indigenous populations of indigenous livestock and poultry were characterized. These populations are - Gangavathi cattle (Karnataka), Melghati cattle (Maharashtra), Jammu Hill cattle (J&K), Periyar cattle (Kerala), Jharkhandi buffalo (Jharkhand), Ara goat (Bihar), Jaunpuri goat (Uttar Pradesh), Lakshadivi goat (Lakshadweep), Tirhuti goat (Bihar), Narainpuri goat (Chhattisgarh), Kow-Debar sheep (Uttarakhand), Gola pig (Odisha), Tyaji pony (West Bengal), Kashmir pony (J&K), Mala chicken (Jharkhand), Charkha chicken (Jharkhand), Kodo duck (Jharkhand), and Eki dog (Arunachal Pradesh),

Cryopreservation of germplasm of indigenous breeds

ICAR-NBAGR has been notified as a Germplasm Repository for safe custody of the genetic material of domesticated animals by the Government of India in 2008 under the Biological Diversity Act. Cryopreservation of germplasm is an important activity under the United Nation's Sustainable Development Goal (SDG) 2 (Zero Hunger). Under medium and long-term conservation of AnGR under (SDG) Indicator 2.5.1, the germplasm of a total of 21,500 semen doses of six indigenous cattle breeds and 1920 somatic cells vials of 24 indigenous breeds (8 cattle, 1 buffalo, 8 goat, 5 sheep, one each of horse and donkey) in the National Gene Bank of the Bureau during October 2024 to September 2025. Till September 2025, the germplasm in form of Semen of 63 -and Somatic cell of 109 breeds/populations have been cryopreserved at the National Gene Bank of the Bureau.

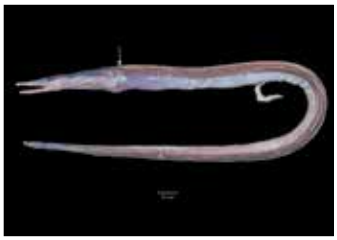
Germplasm production: Produced 1,06,536 semen doses of Frieswal and 15,358 doses of Sahiwal, totaling 1,21,894 high-quality semen doses. The cumulative stock reached 52.31 lakh doses (22.09 lakh Frieswal and 40,431 Sahiwal). Infrastructure was augmented with the establishment of Tissue Culture and Biochemistry Laboratories, a Veterinary Clinical Laboratory, and a Milk Processing-cum-Incubation Unit (FSSAI-registered). Cryobanking of somatic cells from Badri, Pullikulum, and Khariar cattle was initiated.

Fish Genetic Resources (FGR)

Fish and shellfish species wealth from the Indian waters

New records of fish species and distribution: Four new marine fish species, *viz*. *Facciolella smithi*, a deep-water nettastomatid eel from the Arabian Sea; *Ariosoma tamilicum*, Congrid eel off Thoothukudi coast, Tamil Nadu; *Apterichtus kanniyakumari*, a finless snake eel from Colachel, southwest coast of India; and *Johnius medidentatus*, moderate-toothed croaker from the Indian Ocean along both the east and west coasts of India were discovered. Three new freshwater fish species, *viz*. *Labeo uru, Labeo chekida* and *Horabagrus obscurus* were described from the rivers of the Western Ghats. Four fish species were reported for the first time from Indian waters, namely, *Gymnothorax sagmacephalus, Epigonus thai, Epigonus bispinosus* and *Ophidion muraenolepis*. The identity of *Labeo nigrescens* was revalidated taxonomically.

Ariosoma tamilicum



Facciolella smithi

Apterichtus kanniyakumari

Horabagrus obscurus

Labeo chekida

Labeo uru

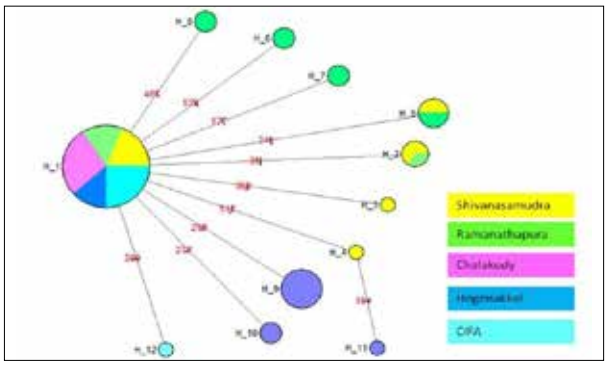
Johnius medidentatus

Cave fishes: Fish diversity was explored in two caves *viz*., Krem Tyngheng cave (25°25'28.8516" N and 92°32'22.0128" E) located near Samasi village and Krem Lymmit cave (25°25'51.312" N and 92°36'7.4484" E) located near Kseh village, East Jaintia Hills, Meghalaya. Eleven fish species belonging to 6 families were discovered. Among these occurred the high-valued ornamental fishes- *Channa aristonei* and *Channa gachua*, in Krem Lymmit cave.

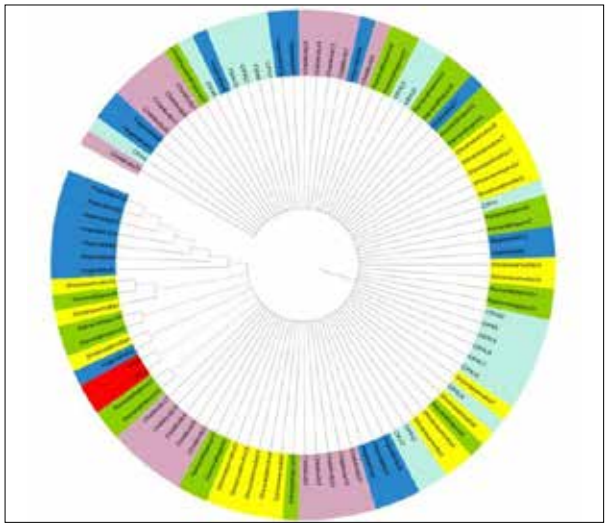
Genetic characterization

Population structure of *Barbodes carnaticus:* The population structure of *Barbodes carnaticus* species was assessed using the COI gene of mtDNA. Fish stocks were collected from their natural habitat of Cauvery River system in Karnataka (Ramanathapura and Shivanasamudra) and Tamil Nadu (Hogenakkal) and Chalakudy River in Kerala (Peringalkuthu). The domesticated stock was taken from ICAR-CIFA, Hesaraghatta fish farm. Studies revealed that *B. carnaticus* species has 12 haplotypes with an overall haplotype diversity of 0.451±0.062 and nucleotide diversity of 0.00097±0.00016. Further, Ramanathapura stock had high diversity, while the Chalakudy stock was made of only one haplotype. The haplotype network revealed differences in distributions and frequencies and H1 was the most common and extensively distributed haplotype. AMOVA analysis indicated a significant genetic variation within stock (89.74%), while between stocks variation was around 10.26%.

Barbodes carnaticus



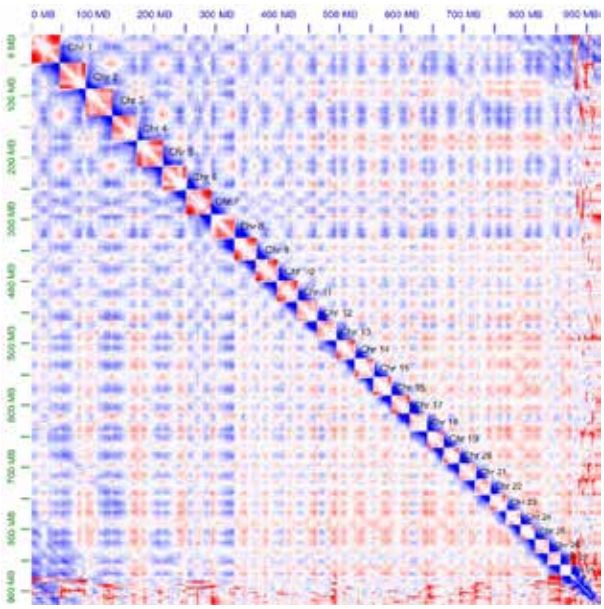
Haplotype median joining network
from sequences of COI of *Barbodes carnaticus*



Phylogenetic tree from sequences of COI of *Barbodes carnaticus*

Genome sequencing

Chromosome-level genome assembly of *Clarias dussumieri:* High-quality chromosome-level genome assembly of the near-threatened freshwater catfish, *Clarias dussumieri*, endemic to peninsular India, was generated for aquaculture and conservation research. Total genome size was 918.72 Mb with 95.23% completeness. It was characterised by 41.46% repeat elements, 1,174,725 simple sequence repeats (SSRs), and 25,369 predicted genes with functional annotations. Chromosome-level assembly comprised 28 chromosomes.



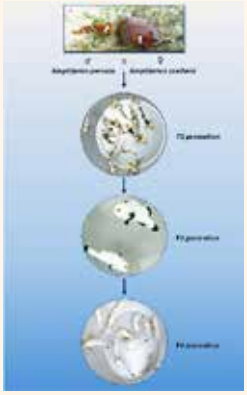
Hi-C Contact map of *Clarias dussumieri* genome assembly
(Log observed/expected normalized Hi-C data)

Molecular identification of *Clarias magur, C. gariepinus* and their hybrids: There is a constant threat from the invasive alien species *Clarias gariepinus* to the native species *C. magur*. Government of India has prohibited *C. gariepinus* for aquaculture, but there are frequent reports of *C. gariepinus* or its hybrids with *C. magur.* To differentiate and identify *Clarias magur*, *C. gariepinus* and their hybrids at any life stage (fry, fingerling, adults) or fish fillets, molecular method was developed.

***miRNA* expression profiling of *Clarias magur* muscle for growth:** Identified 557 *miRNAs* in muscle sample of *C. magur*, spanning 102 *miRNA* families. Differential expression analysis revealed that 77 *miRNAs*

SUCCESS STORIES

Developing Designer Clownfish through Selective Hybridisation



ICAR-NBFGR achieved a first-of-its-kind success in India, with the development of designer clownfish through a six-year selective hybridisation programme involving *Amphiprion percula* (male) and *Amphiprion ocellaris* (female). The programme successfully produced F_4 generation of hybrid progeny exhibiting striking and distinct colour variations. Molecular analyses revealed that the hybrids share a closer genetic affinity with *A. percula* while displaying enhanced visual appeal and adaptability.

Globally they are known in the ornamental/fish trade as Picasso, Platinum, Snowflake, Snowbrite, and Gladiator clownfish, these designer variants are highly sought after for their unique and vibrant colour patterns, commanding premium value in the aquarium market. The research was conducted at the Institute's hatchery facility located at the Coastal and Marine Biodiversity Centre, Airoli, Mumbai, with financial support from the Mangrove Foundation, Government of Maharashtra.

were differentially expressed, with 32 *miRNAs* being up-regulated and 45 down-regulated. Polo-like kinase 1 (*PLK1*) gene; regulating cell cycle progression, spindle assembly, chromosomal segregation, cytokinesis, DNA replication and DNA damage; was identified as the key regulator of growth. This was further validated by expression analysis through RT-PCR and transcriptome analysis.

Early sex determination in *Labeo rohita:* Early sex determination in Indian major carp, *Labeo rohita* was ascertained through identification of male-specific DNA marker and rapid Loop-Mediated Isothermal Amplification (LAMP) assay. The process involved identification of the male-specific genomic region on chromosome 25 and designing primers that amplify distinct male-specific PCR bands. This marker has been validated in 60 hatchery-bred and wild individuals, showing 100% concordance with phenotypic sex, confirming its reliability as a diagnostic tool. Further, it will enable hatchery professionals in maintaining optimal sex ratios, reducing inbreeding, and enhancing seed quality and production.

Establishment of new fish cell lines

Four new cell lines namely, *Osteobrama belangeri* and *Labeo rohita* fin and *Chitala chitala* muscle and gill were established by explant method. All cell lines were cryopreserved for long-term storage. *O. belangeri* fin and *C. chitala* gill cell lines were found useful for the study of viral diseases.

8.
Soil and Water Productivity

The integrated innovations in soil and water resource management, climate-smart agriculture, digital soil intelligence, and sustainable farming technologies implemented across diverse agro-ecological regions of India. Groundwater revitalization through the construction of 100 recharge shafts (6" diameter, ~6 m depth) in traditional dug wells of Nayagarh district, Odisha, resulted in a measurable post-monsoon rise in groundwater levels by 15–30 cm, improving rabi season water availability under an average annual rainfall of 1550 mm. Precision Fertilizer Recommendation System (PFRS), developed using digital soil maps and a target yield approach, achieved 97.3% of the targeted wheat yield (4,867 kg/ha against 5,000 kg/ha), validating its accuracy and field applicability. Conservation Agriculture (CA) practices enhanced crop productivity, soil health, and resource-use efficiency, supported by mechanized raised-bed operations and stress-mitigation strategies such as foliar KNO_3 application. National-scale digital assets including the first-ever Digital Soil Depth Map of India revealed that 52% of the country possesses very deep soils (up to 250 cm). The Groundwater Quality Map of India, based on 47,131 geo-tagged samples, indicated that 68.21% of irrigation water is of good quality, while saline water areas expanded from 12% in 1994 to 27% in recent assessments. The National Soil Spectral Library enabled >80% prediction accuracy for key soil properties using machine learning, supporting rapid soil health assessment. Biological interventions such as "Halo-Care" achieved up to 77% crop residue decomposition within 21 days, while "Mrida Sudharak" enabled 12.3% dissolution of native $CaCO_3$ in calcareous sodic soils. Climate-resilient cropping systems, including quinoa-chickpea intercropping, enhanced net returns (US$1015.52/ha) with significant water, energy, and carbon savings. Supplementary manual pollination in dragon fruit increased yields to 20–30 ton/ha. A large tunnel-type PV/thermal hybrid solar dryer (6.4 m × 3.0 m) demonstrated superior drying efficiency for ber and date palm, achieving moisture reduction to 18-19% within 8 days, with thermal and solar utilization efficiencies of 36.6% and 35.0%, respectively. An IoT-enabled bio-acoustic deterrent device effectively mitigated crop damage by wild animals, achieving up to 85% deterrence efficiency over 8–20 acres with a favourable cost-benefit ratio of 1:2.8. Geospatial analyses further supported aquaculture site selection in Kargil and revealed significant land use and mangrove cover changes in the Sundarbans, underscoring urgent sustainability challenges.

Revitalizing traditional dug wells through construction of recharge shafts

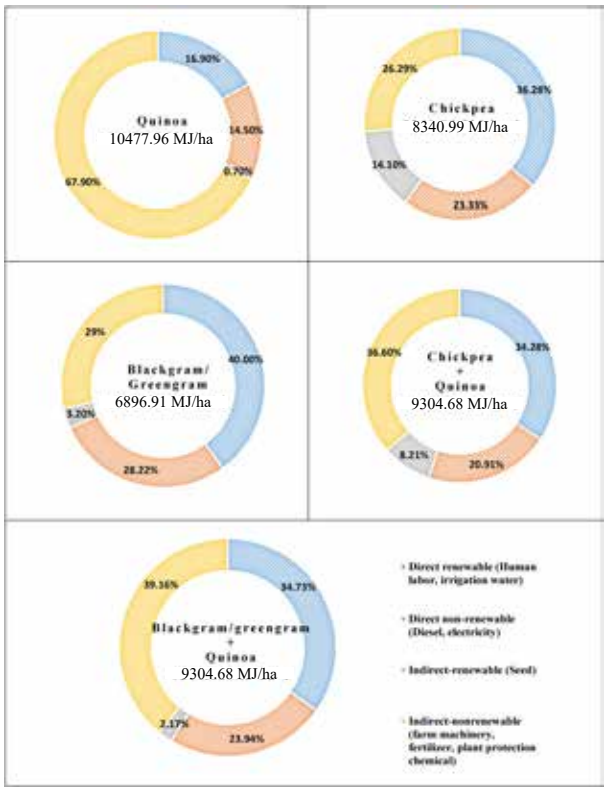
Interventions pertaining to construction of groundwater recharge shafts at 100 locations were taken up in *Nayagarh* and *Khandapada* blocks of Nayagarh district, Odisha. It was observed that, despite occurrence of about 1550 mm average annual rainfall with 70% of precipitation during monsoon season in these regions, there was limited groundwater availability during critical crop growth stages in the *rabi* season. Therefore, recharge shafts of 6" diameter were installed in the existing dug wells at an average depth of 6 m with perforations and packed with sand and gravel to enhance infiltration and prevent clogging. Hydrological monitoring at 15 days interval indicated a considerable rise in the water table depth after recharge interventions. Pre-monsoon groundwater levels ranged between 2–6 m below ground level (bgl), while post-monsoon levels improved to 0–4 m bgl, showing the recharge shaft induced rise of about 15–30 cm depth in each dug well .

(A) (B)

Depth of water table before (A) and after (B) construction of the recharge shaft in the dugwell located in the Melamba village, Nayagarh, Odisha

Inclusion of quinoa in cropping systems for ensuring food and nutrition security in drought prone semi-arid regions: An energy-water-carbon-food nexus approach

Intercropping quinoa (*Chenopodium quinoa* Willd.)



with chickpea enhanced productivity 2–5 times over conventional legumes, yielding US $1015.52/ha net returns and higher energy output (35,293.95 MJ/ha) with reduced specific energy (4.29 MJ/kg). The system saved 1–5 times water and 1–3 times carbon emissions, showing quinoa's strong potential for climate-smart and nutrition-sensitive cropping in semi-arid India.

Design, Development, and Performance Evaluation of a Large Tunnel-Type PV/Thermal Hybrid Solar Dryer

A large tunnel-type PV/thermal hybrid solar dryer (6.4 m × 3.0 m) with a UV-stabilized polycarbonate cover and MS-aluminium frame was developed for efficient drying of arid fruits and vegetables. Testing with ber (*Ziziphus mauritiana*) and date palm (*Phoenix dactylifera* L.) showed markedly higher efficiency than open sun drying. In the hybrid system, date palm moisture fell from 65% to 19% in 8 days (vs. 8 days to reach 25% in open drying), and ber from 80% to 18% in 8 days (vs. 25% in 8 days). The dryer achieved 36.6% thermal and 35.0% solar utilization efficiency, producing faster, more energy-efficient, and better-quality dried products suitable for arid-zone horticulture.

Performance Evaluation of a Large Tunnel-Type PV/Thermal Hybrid Solar Dryer for Date palm

IoT-Enabled Bio-Acoustic Deterrent Device for Mitigating Crop Damage by Wild Animals

An IoT-enabled bio-acoustic deterrent device was developed to prevent recurring crop losses from wild animals, birds, and rodents. The system emits alarm, distress, and predatory calls of target species, creating natural "danger" signals that repel them without harm. Operable manually or remotely via Bluetooth, Wi-Fi, GSM/GPRS, or RF, the solar/AC-powered, weatherproof unit protects 8–20 acres, featuring GPS, tamper alerts, and randomized sound sequences to avoid habituation. Field demonstrations recorded up to 85% effectiveness against wild boars and other animals, significantly reducing crop losses and human guarding needs. With a cost-benefit ratio of 1:2.8, farmers recover costs within one crop season. The device is non-lethal, eco-friendly, and scalable, offering a sustainable, adaptable solution for mitigating man–animal conflicts across agriculture, horticulture, aquaculture, storage, and wildlife-prone areas.

Development of a Precision Soil Fertilizer Recommendation System for Madhya Pradesh and Haryana State:

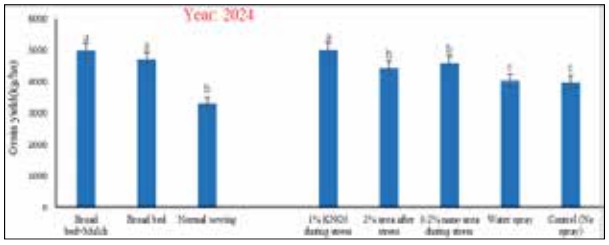
Precision Fertilizer Recommendation System (PFRS) is a data-driven tool that provides site-specific fertilizer recommendations using digital soil maps and a target yield approach to enhance soil health. By integrating real-time soil data with yield goals, it optimizes fertilizer use, preventing over-application and nutrient loss while improving productivity and long-term soil vitality, and is accessible through a user-friendly online platform (http://65.0.105.229:8080/pfrs/). It supports farmers, extension workers, and consultants in making informed, sustainable decisions. Field validation on wheat (target yield: 5,000 kg/ha) achieved an average yield of 4,867 kg/ha (97.3% of target), confirming the system's accuracy and potential to boost profitability and sustainability in crop production.

Precision fertilizer recommendation system (PFRS) developed by ICAR-IISS, Bhopal, Madhya Pradesh

Development and validation of Conservation Agriculture practices (CA) for rainfed systems

Adoption of all three CA principles consistently enhanced yields across cropping systems. Integrating complementary practices such as *in situ* moisture conservation, nutrient, and weed management further improved productivity in the maize–pigeon pea system. Long-term studies showed that CA practices enhanced resource-use efficiency, soil health, and carbon sequestration while reducing greenhouse gas emissions and soil nutrient losses. An autonomous platform for weeding and spraying in raised-bed systems was developed (bed width: 1 m; furrow top width: 35 cm; depth: 20 cm). Broad-bed sowing of maize with mulch and a 1% foliar spray of KNO_3 enabled faster crop recovery from moisture stress during dry spells.

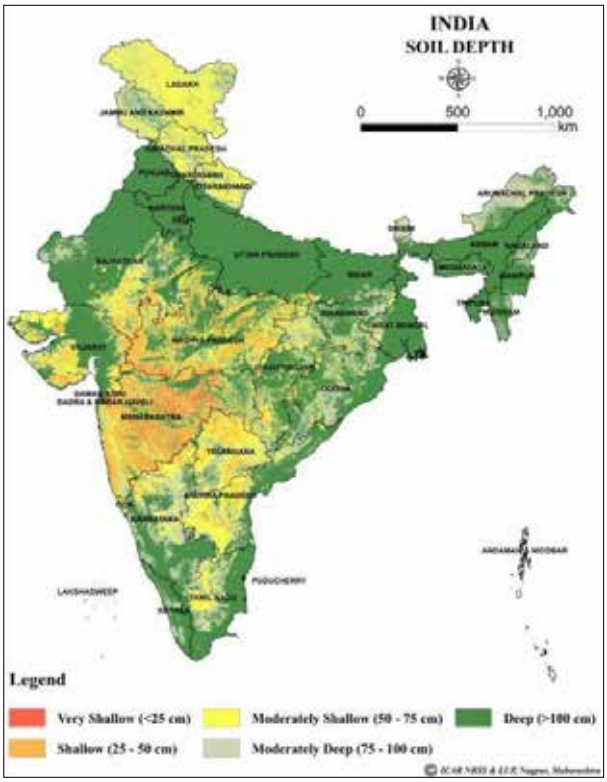
Autonomous platform for weeding and spraying in raised bed-planting system



Grain yield of maize in different planting method and foliar sprays

Digital Soil Depth Map of India: The first ever digital soil depth map of India, developed at 90 m resolution, provides a high-precision representation of soil depth variations across the country. Using data from 25,683 soil profiles collected over 45 years, and incorporating terrain, climate, and vegetation variables, the map was generated through advanced machine learning, with random forest delivering the best accuracy. Soil depths range from 6 cm to 250 cm, with uncertainty up to 187 cm. Notably, about 52% of India has very deep soils, while shallow soils are predominantly found in Maharashtra and Madhya Pradesh. This map is a key asset for national-scale land resource planning.

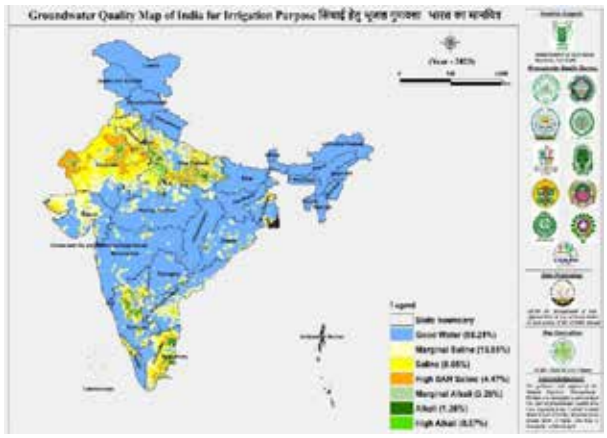
Groundwater Quality Map of India for Irrigation: The Groundwater Quality Map of India for Irrigation was developed by using primary water



High Resolution Digital Soil Depth Map of India

quality of AICRP on Management of Saline Water and Associated Salinization in Agriculture, covering 13 states, and supplemented with CGWB data for additional regions integrating data from 47,131 geo-tagged sites across 16 states, analyzing key parameters (EC, Na, Ca, Mg, CO_3, HCO_3) to derive SAR and RSC indices.

Spatial maps were generated using Inverse Distance Weighting (IDW) and Kriging techniques and validated by state experts before merging into a national composite with seven irrigation water quality classes. Results show that 68% of India has good-quality irrigation water, while saline and alkali waters prevail in parts of Gujarat, Rajasthan, Punjab, Haryana, Uttar Pradesh, Tamil Nadu, Andhra Pradesh, and Karnataka. The north-eastern and Himalayan regions largely possess good-quality water. Comparison with the 1994 CSSRI map reveals that saline water areas have more than doubled—from 12%



Groundwater quality map for irrigation in India

Sh. Shivraj Singh Chouhan, Hon'ble Union Minister of Agriculture and Farmers' Welfare along with Dr. M. L. Jat, Hon'ble Secretary DARE and Director General ICAR releasing Groundwater Quality Map of India

to 27%—over three decades, underscoring growing concerns over irrigation water quality.

National Soil Spectral Library (NSSL): The NSSL is a landmark initiative that houses hyperspectral reflectance data of soil samples from across India, along with their laboratory-analyzed physical and chemical properties. Each soil sample in the library is geo-tagged and linked with rich metadata, including location, sampling time, project name, and survey details. The NSSL is accessible through an interactive Geoportal/ Explorer, enabling visualization and retrieval of spectral and analytical data through any web browser. Leveraging this rich database, robust machine learning and deep learning models have been developed for predicting key soil properties. These models have achieved over 80.0% prediction accuracy for parameters such as pH, electrical conductivity, soil organic carbon, exchangeable cations (Ca^{2+}, Mg^{2+}, Na^{+}), calcium carbonate, clay, sand, silt, and cation exchange capacity (CEC), and over 60.0% accuracy for plant-available nutrients. An online prediction system now allows users to estimate soil properties directly from spectral inputs minimizing the need for wet chemistry and enabling real-time generation of soil health cards. The NSSL serves as a cornerstone for data-driven soil monitoring, supporting large-scale soil health assessments, precision farming, and the development of low-cost spectral instruments by startups. As the library continues to expand, it promises to transform soil resource assessment and management across India.

Sh. Devendra Fadnavis, Hon'ble Chief Minister of Maharashtra along with Sh. Shivraj Singh Chouhan, Hon'ble Union Minister of Agriculture and Farmers' Welfare and Dr. M.L. Jat, Hon'ble Secretary DARE and Director General ICAR dedicating National Soil Spectral Library to the nation

Microbially mediated crop residue decomposition to enhance soil nutrient recycling and soil health management

Liquid and powder-based consortia of efficient halophilic ligno-cellulolytic fungal isolates were developed using standardized carrier media for *in situ* and *ex situ* crop residue decomposition. The formulation, named "Halo-Care," effectively recycles carbon by accelerating the decomposition of paddy, wheat, and sugarcane residues, achieving a maximum decomposition rate of 72.6% within 21–24 days.

Multi-location trials confirmed its efficacy, particularly for paddy and sugarcane residues. In Uttar Pradesh (Unnao, Hardoi, Sitapur), Halo-Care reduced paddy residue dry weight by an average of 77% in 21 days. In Sitapur and Pratapgarh, stubble weight decreased from 118 g/m² to 66 g/m² within 20 days, compared to 97 g/m² in uninoculated plots. For sugarcane trash, weight reduction reached 43% in Biswan, Sitapur, versus 24% with water spray, and 61% at a farmer's site in Hardoi within 28 days.

The results demonstrate that microbially mediated in-situ decomposition using Halo-Care offers a viable, eco-friendly alternative to residue burning, promoting sustainable residue management in cereal-based systems.

Bioformulation 'Halo-CaRe'

Developed "Mrida Sudharak" for amelioration of calcareous sodic soils

The calcareous sodic soils are dominant in Samastipur and Muzaffarpur district of Bihar and some parts of eastern Uttar Pradesh affecting crop yields. To ameliorate these soils for enhancing crop production, the potential calcite dissolving bacteria were isolated, screened and characterized for their growth pattern in the liquid media. Based on the traits and growth pattern, three potential isolates were tested for their compatibility to form consortia. Liquid based formulation prepared "Halo-Mrida Sudharak" Liquid carrier media was tested

along with their shelf life. The standardized media with satisfactory shelf life for mass multiplication and widespread testing in different locations. It was found effective for promoting *in situ* dissolution of native $CaCO_3$ in calcareous sodic soils for self-reclamation and plant growth promotion under these stress condition. It was observed that the formulation enabled dissolution of $CaCO_3$ to the maximum of 12.3% thereby providing substantial free Ca for reducing soil *p*H and enhancing crop growth under salt stress.

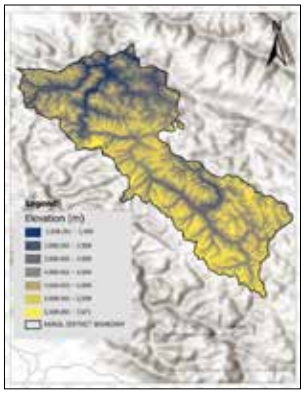
Liquid bioformulation "Halo-Mrida Sudharak" for calcareous sodic soils

Supplementary Manual Pollination for Dragon Fruit

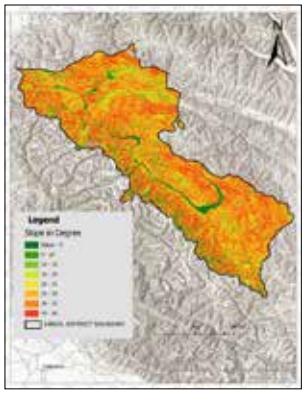
Dragon fruit productivity in India (5–10 t/ha) is far below that of Asian countries (25–35 t/ha) due to poor and uneven pollination. A simple supplementary manual pollination method-both self and cross, including post-rainy pollination was developed to counter pollen washout and improve fruit uniformity. Adoption of this practice enhances yields (20–30 t/ha) and profitability (₹4–8 lakh/ha), offering an effective approach for expanding dragon fruit cultivation in India.

Mapping of aquatic resources

***Geospatial decision-support framework*:** Developed geospatial decision-support framework for coldwater aquaculture site selection in Kargil. Thematic maps were generated taking into consideration the topographical characteristics- elevation, slope aspect, and land use/ land cover pattern; soil parameters- texture, *p*H, organic carbon content, depth, and erosion; and infrastructure-related factors- road networks, market accessibility, farm locations, and government institutions. High-resolution satellite imagery, GIS-based analysis, and thematic mapping enabled the precise identification of suitable sites, supporting the sustainable expansion of aquaculture and livelihood enhancement in high-altitude regions.



Spatial distribution of elevation classes of Kargil



Spatial distribution of slope classes of Kargil

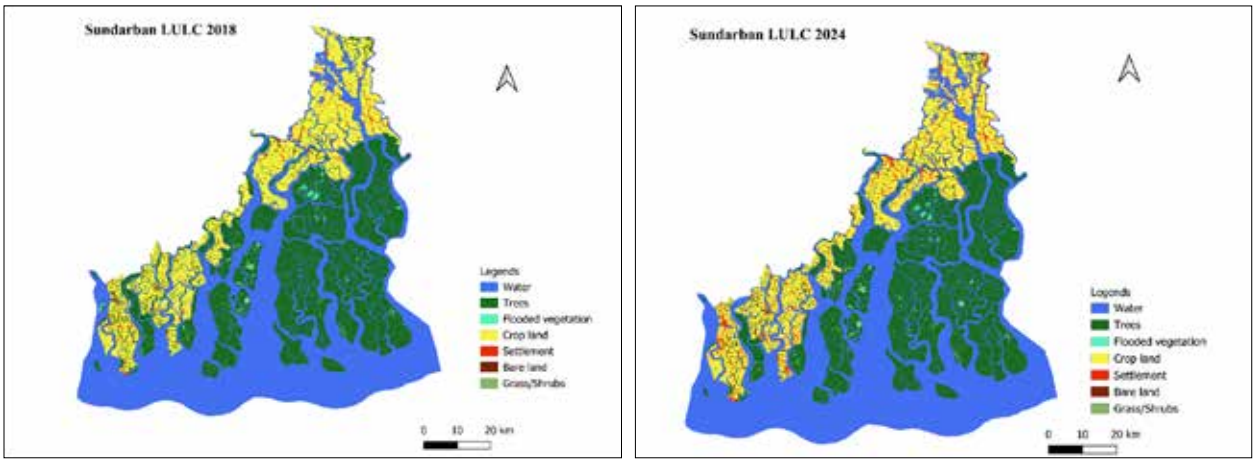
Pollen collection during night hours in the traditional method

Pollination with emasculation (both cross and self-pollination)

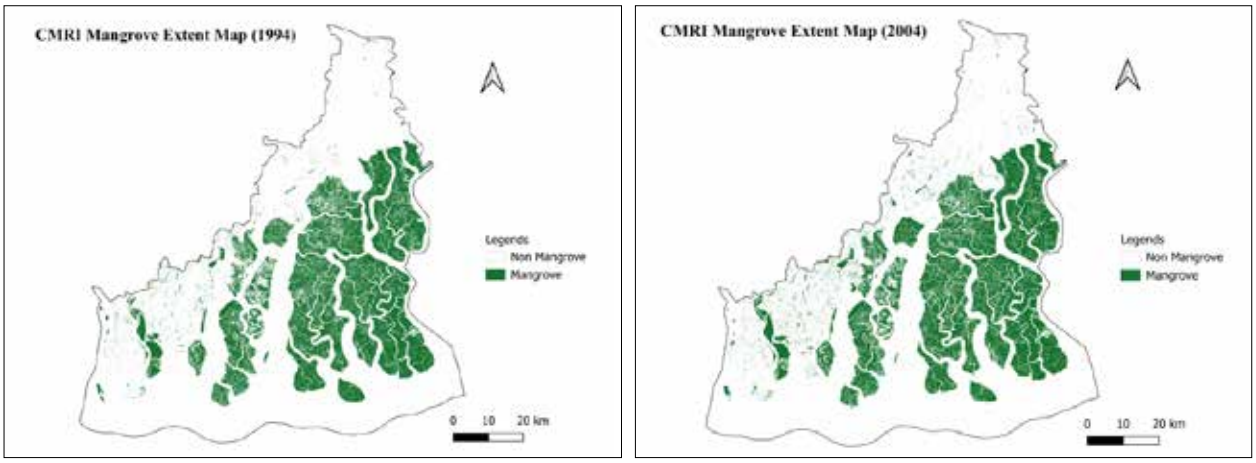
Self-pollination without emasculation

Fruit size in natural and manual pollination

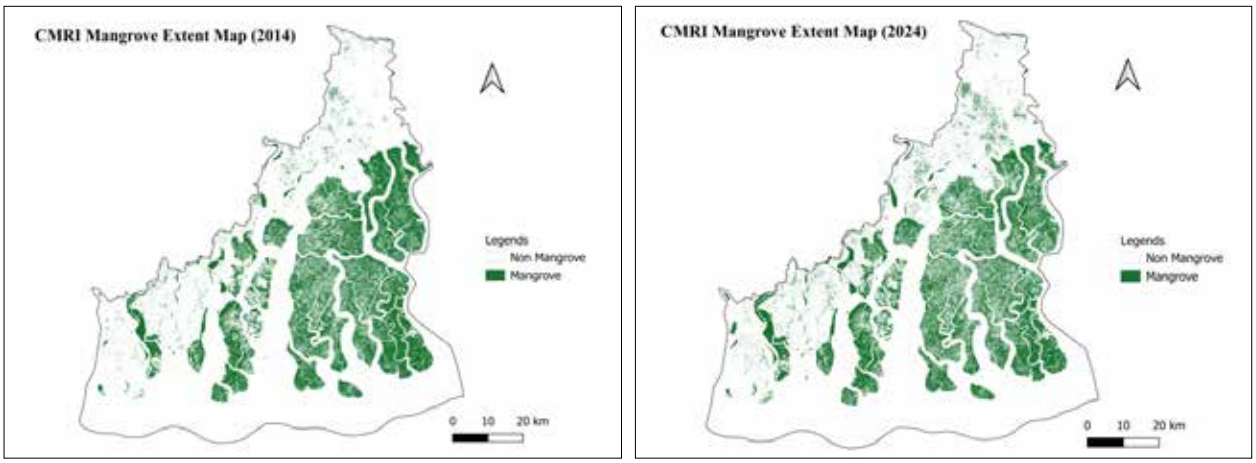
***Land use, land cover changes*:** Land use land cover maps prepared for the Sundarbans area with Sentinel-2 imageries for the period 2018–2024 revealed an increase in water area from 3359.08 km^2 to 3424.39 km^2; reduced tree cover from 2128.5 km^2 to 2026.4 km^2; significantly increased human settlement area by 96.3 km^2 during the period. Further, mangrove extent maps for the years 1994, 2004, 2014 and 2024 prepared using Combine Mangrove Recognition Index (CMRI), exhibited modest



Land use land cover (LULC) of Sunderbans during the years 2018 and 2024



CMRI of Sunderbans indicating increase in mangrove area from the year 1994 and 2004



CMRI of Sunderbans indicating substantial decline in mangrove area during the years 2014 and 2024

increase of 51.6 km^2 in mangrove area between 1994 and 2004 and substantial decline of 266 km^2 from 2004 to 2024, suggesting increasing negative impact of human activities on Sundarbans ecosystem.

9. Mechanization and Energy Management

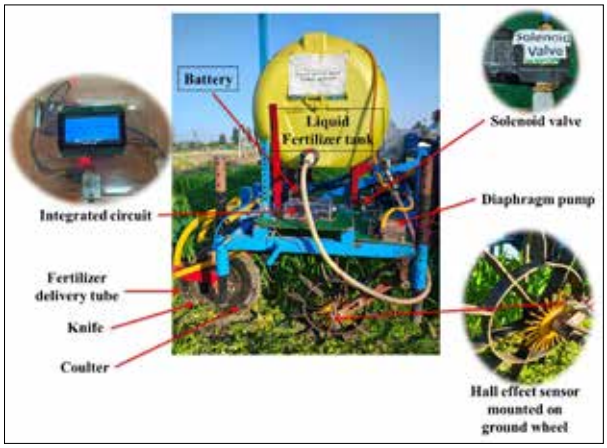
Recent advancements in agricultural mechanization and energy management have focused on improving operational efficiency, optimizing resource use, and minimizing environmental impact in agricultural production system. A wide range of manually operated, tractor-mounted, robotic, and renewable energy-based technologies were developed and evaluated across diverse crops and farming systems. Ergonomic hand tools such as weed thinning devices, nursery cutters, and kiwi vine pruners reduced risk significantly, lowering REBA/RULA scores from 7–8 to 3 while improving work rates by 40–45%. Mechanized planters and seeders, including potato planters, spice seed planters, and multi-crop dibble seeders, achieved field capacities up to 0.4 ha/h with cost savings of 47% and missing rates below 3%. Precision input delivery systems using sensors, IoT, and AI enabled substantial input savings: variable rate nitrogen applicators and assessment devices reduced fertilizer use by 8–38% while improving nitrogen use efficiency by up to 28.6% and yields by 7.6%. Detection-based and telerobotic pesticide sprayers achieved 24–25% chemical savings, eliminated operator exposure, and ensured droplet sizes within the recommended 140–200 µm range. Energy-efficient tillage and drainage tools reduced fuel consumption by 31–37% and emissions by over 40%. Renewable energy solutions, including solar weeders, LPG and heat-pump based curing systems, and solar thermal storage units, reduced energy consumption by approximately 25–50% while eliminating wood fuel and associated emissions. Collectively, these technologies demonstrate a strong potential to enhance farm productivity, sustainability, safety, and energy efficiency, particularly for small and medium-scale farming systems across agroclimatic zones of the country.

Weed thinning device for row crops: An ergonomically designed and manually guided weed thinning device has been developed for row crops. The device includes two DC motors powered by a 12 V battery, a limit switch, and a rotary cutting element mounted on a mild steel frame with rubber wheels. The operator guides the device to the target plant, and the cutting element removes the extra plants. The equipment has been tested in maize crop. It was operated at a depth of 20–35 mm. Thinning capacity of the device was 3–5 plants per minute. The device significantly reduced postural risks, achieving a low Rapid Entire Body Assessment (REBA) score of 3, as compared to 8 in traditional method.

Ground wheel-mounted two-row belt cup type potato planter:A tractor operated two row belt cup type potato planter has been modified to overcome the issues of low forward speed, non-uniform height of ridge and uneven germination. The modified machine has the provision of ground wheel for maintaining the forward speed and uniform height of ridge along with compaction discs for solving the issue of ridge compaction. The average speed of operation varied between 3.8–4.0 km/h with row to row spacing of 710 mm. Depth of planting with the machine varied from 60–80 mm. The plant to plant spacing varied from 230–480 mm. The average

field capacity of the modified planter is 0.4 ha/h with an average fuel consumption of 5.5–6.3 L/h.

Speed-synchronized liquid fertilizer delivery system using proportional control valve: The speed-synchronized liquid fertilizer delivery system was developed to optimize application through precise, automated control using an Arduino-based micro-controller. The system adjusts the discharge rate proportionally to the real-time ground speed of the tractor using a control algorithm, ensuring that when the speed reaches zero, the calculated discharge rate also becomes zero. This ensures operators maintain full visibility and control over the application process.



Detection-based pesticide sprayer: A detection-based pesticide sprayer system was developed as an attachment to an unmanned track-type vehicle. The ultrasonic sensors detect trees on both sides of the vehicle and send signals to the electronic control unit (ECU). The programmed ECU processes the signals from ultrasonic sensor and activates the corresponding DC water pump. Each pump, mounted on the main frame, draws pesticide from the tank and delivers it to the spray lances and nozzles, ensuring targeted spraying. The developed system was evaluated in field at an operating speed of 2 km/h. The system accurately detects tree canopies and achieves a droplet size (VMD) within the recommended range of 140–200 µm, with a spray coverage of 30–40%.

Tractor operated spade plough with disc harrow: A tractor-operated spade plough with a disc harrow has been developed. The primary function of the spading

plough is to break compacted soil and turn it over using a set of rotating spades. This mechanism cuts and lifts the soil, creating a loose, aerated layer ideal for planting. The disc harrow is attached behind the spade plough. Together, this combination allows for deep and thorough soil tillage. The effective field capacity of the machine was observed to be 0.39 ha/h.

Tractor operated orchard grass cutter: A tractor-operated orchard grass cutter has been developed to address the need for an efficient weed management in fruit orchards. A key design requirement was the development of an adjustable working width to suit various row-to-row spacings. The orchard grass cutter features cutting blades with two movable drums. The machine is operated by PTO through a gearbox that rotates the shafts and blades mounted on adjustable drums. This mechanism allows for adaptable working width tailored to specific orchard layouts. The effective field capacity of the machine is 0.6 ha/h.

Study on work fatigue analysis of agricultural workers to improve working efficiency: A study was undertaken to address the intense physical strain experienced by agricultural farm workers, particularly women, during paddy transplanting. The study on paddy transplanting revealed severe physical strain among farm workers, especially women. Using Body Part Discomfort Score (BPDS), Overall Discomfort Rating (ODR) and

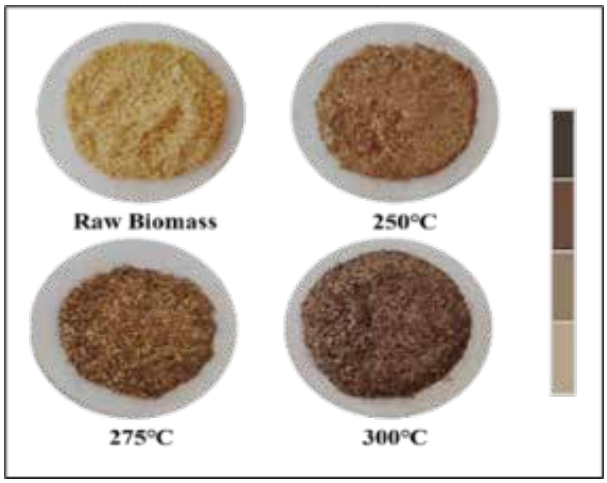
Nordic Musculoskeletal Questionnaire (NMQ) ratings, 100% reported lower back pain, 96.6% knee pain, and 91.6% shoulder pain within a day, with over 93% experiencing chronic back pain. Based on analysis of data, a schedule of 35 min work, 5 minutes rest, plus a lunch break was recommended to reduce fatigue and improve efficiency.

Variable rate nitrogen applicator: A variable rate fertilizers applicator has been developed using digital imaging systems for precise nitrogen application based on specific field requirements. The AlexNet model was deployed on a Raspberry Pi (.h5 format) to control the system. A microcontroller using a Sabertooth DC motor driver, adjusting the fertilizer feed shaft speed (Low, Medium, High) based on nitrogen stress levels. During field testing, the variable rate fertilizer application operated at 2.0 km/h in a wheat field and average percentage N fertilizer saving under VRA as compared to traditional technique was 37.53%.

Walk-behind solar powered weeder: Walk-behind solar powered weeder was developed and tested for row crops. It is a gender friendly walk-behind type machinery and well suitable for small farm holdings. The unit consists of two solar panels (50Wp), lithium-ion battery (60 Ah, 24.0 V), BLDC motor (0.5 hp), charge controller (20A), worm gear box, support wheel, rotor blades and accessories.

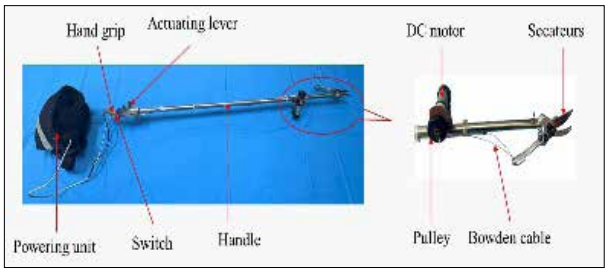
Tractor operated pelleting machine: A tractor operated pelleting machine has been developed. The capacity of the machine portable flat-die-type pelleting machine was found to be 110 kg/h. A small tractor (18–28 hp) was found suitable for operating the feeding, mixing, and pelleting units. The size of the pellets was found to be 8.10 mm, prepared from a mixture of paddy straw and safflower de-oiled cake. The combination of 70:30 (paddy straw: safflower de-oiled cake) produced pellets with a good texture. The PTO-operated pelleting machine, suitable for on-site pellet production, helps save time and transportation costs, and produces cost-effective densified fuel in the field itself.

Pilot scale torrefaction unit: A pilot scale continuous torrefaction system for agricultural crop residues was developed. The system addresses challenges associated with conventional torrefaction reactors, including inefficient management of volatiles and environmental pollution. The biomass handling capacity of 30 kg/h. The



system incorporates the re-use of volatile compounds released during the torrefaction process, redirecting them as a heat source to enhance energy efficiency and sustainability. The system was operated at temperatures of 250°C, 275°C, and 300°C, with a total residence time of 12 min and an effective residence time of 8 min.

Manual kiwi vines pruner: Kiwi is grown in trenches and vines are required to cut at a height of 1.8 m to 3.2 m from the ground. In order to reduce drudgery and probability of accidents, a long-handle kiwi vine pruner (800 g) was developed operated manually or with a DC motor with battery. The developed pruner reduced the worker discomfort from RULA score of 7–3 as compared to existing tools. The number of kiwi vines cut per min were 44.6% higher than by conventional method. This improved pruner is currently in use and 120 pruners have been sold to the farmers of Arunachal Pradesh.



Manual Nursery Cutter for mat type paddy nursery: A ergonomic designed manual nursery cutter has been developed for operator comfort and safety.

Performance evaluation showed that the cutter achieved a cutting capacity of 325–425 nursery mats per hour. The cost of operation was only ₹71.00–89.00 for cutting mat for one hectare, compared to ₹162.00–202.00 when using a sickle/knife and ₹146.00–172.00 with an indigenous cutter.

Pesticide sprayer for greenhouse and open field: To avoid exposure and drudgery of operator in the green house, a telerobotic target-specific pesticide applicator (120 kg) has been developed for real-time application of chemicals based on the presence of canopy in the greenhouse and open field. The it was tested for tomato crop in greenhouse of 60 m × 25 m (1500 m^2) area, with a plant-to-plant and row-to-row spacing of 0.5 and 1.0 m, respectively. The telerobotic unit save about 24% pesticide. As the unit can be operated remotely, the operator is not exposed to chemicals.

Battery-operated manual spice seed planter: A battery-operated two row planter was developed to enhance sowing precision and reduce labor in seed spice cultivation. The planter comprises a traction wheel drive, motor, seed metering unit, and furrow openers, specifically designed to accommodate the physical characteristics of cumin seeds for optimal placement. The field capacity of planter was 0.078 ha/h. The planter reduced sowing costs by 47% as compared to conventional method of sowing.

Three row animal drawn multi-crop precision dibble seeder: The animal-drawn three-row dibble

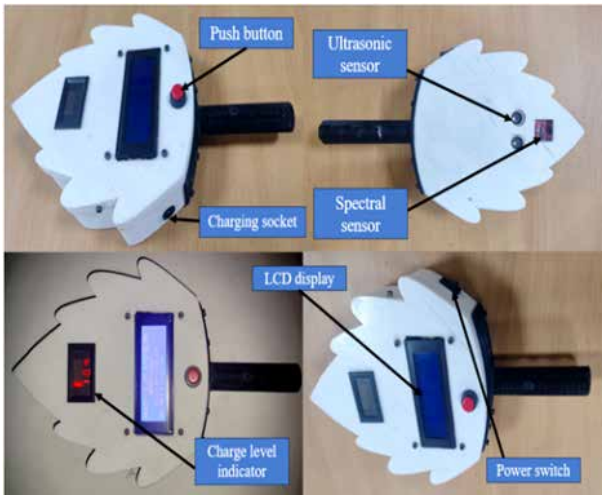
seeder was developed. The dibble seeder was operated at a speed of 2.8 km/h at planting depth of 31.25 mm. The draft requirement to pull the dibble seeder was 245 N and 197 N for paddy and okra seeds in the *Kharif* and *Rabi* seasons, respectively. The actual field capacity was 0.178 ha/h for dibbling paddy and it was 0.27 ha/h for dibbling okra seeds. The operational cost for planting of paddy and okra seed was ₹978/ha and ₹589/ha, respectively.

Energy efficient mole plough: The energy-efficient floating beam mole plough has been developed for making mole drainage. At 300 mm depth of operation, floating beam mole plough saved 36.7% of fuel in lower speed range and 31.8% in higher speed range due to reduced draft requirement. The saving in fuel consumption led the reduction in emissions by 41.7% in mole making operation using floating beam mole plough as compared to traditional fixed beam mole plough.

Liquid fertilizer injector applicator: A tractor operated liquid fertilizer applicator was developed to enhance nitrogen use efficiency. The tank acts as a reservoir, ensuring a steady supply of liquid fertilizer during field operation, while the tractor provides power to both pump and implement movement. The unit saves 33–44% fertilizer and reduces 16–21% CO_2-equivalent emissions in cultivation practice without effecting yield. Apart from wheat, the technology has strong potential for wide-row crops and can be adapted for foliar applications.

Telerobotic target-specific pesticide applicator: A real-time chemical application system was developed to target canopy presence in greenhouses and open fields, reducing pesticide use by 24.95%. It achieved field capacities of 0.15 ha/h (greenhouse) and 0.22 ha/h (open field) with 75% efficiency. The robot eliminated dermal exposure and improved ergonomic metrics, enhancing operator safety and comfort.

Pusa Nitrogen assessment and prescription device: A multi-vegetation index (NDVI, NDRE, and RVI) based device was developed for growth specific nitrogen assessment and prescription in direct seeded rice (DSR). The fertilizer application based on device prescribed recommendation resulted in N fertilizer savings of 8.48% and 23.84% during first and second top dressings, respectively in comparison to conventional recommended dose of nitrogen (RDN) application. Also, the respective advantage in nitrogen



use efficiency (NUE) and yield was 28.59% and 7.63%. In comparison to RDN, the device also achieved a cost saving of 8.07% through its precise growth specific fertilization recommendation. With its high precision, accuracy, and a total development cost of about $ 60, the device represents a promising, cost-effective option for improving nitrogen management in rice cultivation.

Tobacco seedling transplanter: ICAR-NIRCA in collaboration with ICAR-CIAE developed "Tobacco Transplanter". The row to row spacing and plant to plant spacing can be adjusted. Both the seedling dropping mechanism and watering mechanism can be actuated through cam arrangement fitted in the transmission system. The field capacity of the equipment is 0.2–0.3 ha/h and the missing percentage is to the tune of 2–3 percent at a working speed of 1.5 km/h. The quantity of water applied per plant is 200–250 mL.

Tobacco leaf stringing machine: ICAR-NIRCA in collaboration with ICAR-Central Institute for Agricultural Engineering (CIAE), Bhopal, developed leaf stringing machine. The chain stitches hold the leaves properly and prevent the dropping of dried leaves in the curing process. Stringing operations take 20 seconds/ stick (4 kg of fresh leaf weight/stick). The stringing capacity is 180 ±10 no. sticks per hour.

Seedling Transplanter

Leaf Stringing machine

Energy Management

Liquid petroleum gas as a source of energy fuel for FCV tobacco leaf curing: Technology using liquid petroleum gas as a green energy source for curing the FCV tobacco leaf to totally replace the wood fuel was developed and evaluated in collaboration with Indian Oil Corporation Limited at three situations i.e rainfed, irrigated and farmer field conditions. System of better heat energy re-circulation with recuperator technique was successfully developed and demonstrated. Gas consumption was brought from 1.09 kg per cured leaf to 0.43 kg per cured leaf. It was found that curing was uniform in gas barn compared to wood curing barn with good physical and chemical quality of the cured leaf was achieved.

Air energy heat pump technology (electrical)-based curing of FCV tobacco system was developed to replace the wood fuel totally and to reduce carbon footprints and comply with the ESG norms in tobacco production system in India. The results indicated that the AEHP e-barn system is successfully curing the leaf in the standard curing phases of the cycles. The curing was uniform with better colour. The time of the curing cycle was reduced by 46–48 h compared to the traditional wood fuel barn. The consumption of electrical energy was 450–500 units per curing cycle of four days. It has the advantage of better fuel efficiency, very less labour requirement for operation and no carbon footprints.

Development and evaluation of automated fruit washing machine for mango: To mitigate the removal of stubborn black spots of sooty mould from mango peel, CISH-Fruitwash formulation has been developed as a detergent-based washing solution that effectively loosens sooty mould from mango surfaces. A mechanized mango fruit cleaning system was designed, integrating detergent-assisted washing with mechanical brushing to remove superficial fungal deposits without damaging the fruit epidermis. This system restores the fruit's natural sheen, maintains its internal quality and benefits domestic trade and export.

3-in-1 Cashew nut separator, pulp extractor and fibrous material separating machine: A versatile machine was developed to perform three operations, viz. nut separation, pulp extraction, and fibrous material separation. This fully automatic machine can achieve an average separation capacity of 307 kg/h (RCN) with a separation efficiency of >99%. Additionally, the nut damage was remarkably low at just <1.0%, highlighting

its suitability for large-scale cashew processing operations. Saving in cost upto: 82.50%. Saving in time: 96.0%. Power source: 6.0 hp (petrol engine), fuel consumption: 0.75-1.0 L/h, output capacity: up to 300 kg of RCN/h, cost of operation: 340 ₹/h.

Cashew apple and nut separator: A prototype pedal-operated cashew nut and fruit separator was designed and developed. Performance evaluations showed that the pedal-operated separator has an average separation capacity of 15.0 kg/h (RCN) with a separation efficiency of 82.74%. The nut damage was found to be less than 5%, making it an effective and farmer-friendly, eco-friendly and cost-effective solution. Similarly a portable semi-automatic cashew apple and nut separator prototype was developed, featuring a twisting mechanism. Performance evaluations revealed an average separation capacity of 35.0 kg/h with a separation efficiency of 91.45%, Saving in cost: 23.0% and Saving in time: 66.0%. It performs non-destructive nut separation, energy smart, zero emissions, portable and reduced noise pollution.

Portable pedal-operated cashew nut and fruit separator

3-in-1 Cashew nut separator

Semi-automatic cashew apple and nut separator

3-in-1 Moisture meter for cashew: The EMCON 3-in-1 Cashew moisture meter, developed by EMCON, Cochin in collaboration with ICAR–Directorate of Cashew Research, Puttur, Karnataka is a capacitance-based sensor for accurately determining moisture content in raw cashew nuts, unpeeled, and peeled kernels. The device offers non-destructive, simple, and reliable measurement with ±0.5% accuracy and high repeatability.

AI and ML based grading system for oil palm bunches: ICAR–IIOPR, Pedavegi, Eluru, Andhra Pradesh has developed an AI- and ML-based grading prototype for oil palm fresh fruit bunches using image processing and CNN algorithms to classify ripeness and quality based on colour, texture, and surface features. The system enables rapid, objective, non-destructive grading, reducing manual dependence and ensuring uniform harvest quality.

Machine vision based grading system for sweet potato: A vision-based sweet potato grader was developed to classify tubers by diameter and length using machine vision technology. The system enables fast, accurate, and consistent grading with a capacity of 500 kg/h, reducing labour costs, human error, and enhancing productivity and quality control in commercial operations.

Portable self-propelled cassava sett cutter: A portable self-propelled cassava sett cutter was developed to replace labour-intensive manual cutting. Powered by a 2 HP petrol engine with a 12 inch rotary blade rotating at 2,500 rpm, it produces uniform setts of adjustable lengths at a capacity of 5,000 setts per hour with 98% efficiency and only 0.45% damage. The machine saves 85% labour and 90% cost, reducing production cost from ₹4,000 to ₹400/h, with a fuel use of 0.6 L/h.

Machine for sweet potato chips production

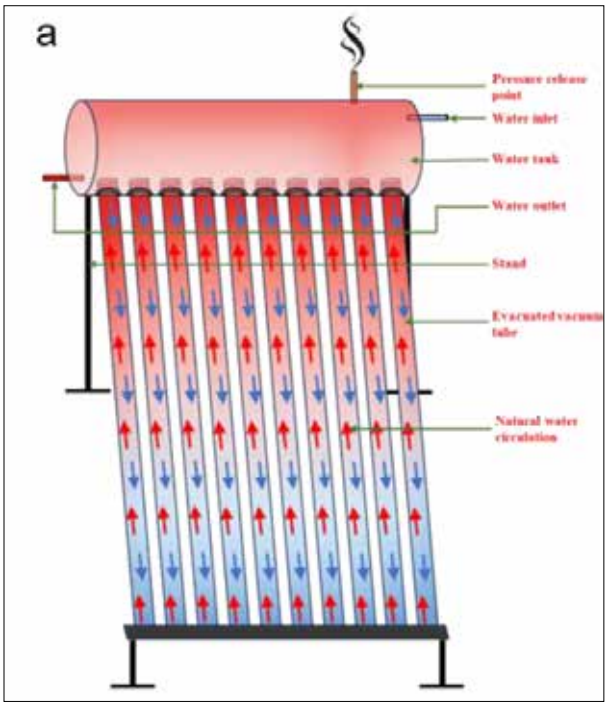
Portable self-propelled cassava sett cutter

Development of magnetic induction based milk heating system for paneer: A laboratory scale magnetic induction-based milk heating unit with inbuilt agitator was developed. The unit was evaluated for its performance in heating milk from 4 °C–90 °C and compared against conventional heating methods, including an LPG stove, an electric heating coil, and an induction cooktop. The results demonstrated that the developed system required the least amount of energy among all tested methods to achieve the target temperature. Specifically, an energy saving of approximately 25% was observed in comparison to the LPG stove. Additionally, the total heating time was significantly lower in the fabricated

Magnetic Induction based Milk Heating System

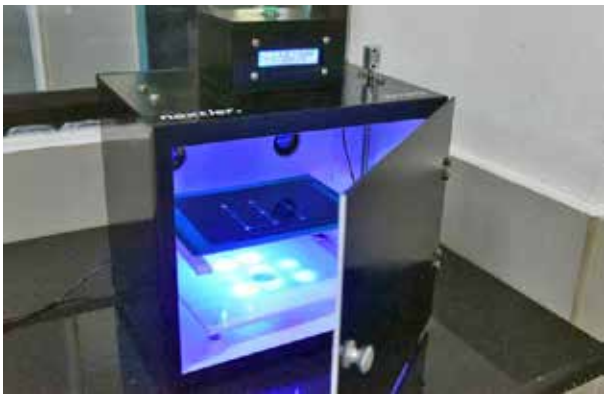
unit. The system also exhibited negligible milk fouling or deposit formation after heating up to 90°C. Moreover, unlike conventional methods, the developed unit does not require steam or water as a heat transfer medium, as electrical energy is directly converted into thermal energy through eddy currents.

Design of evacuated tube-type solar water heater to supply thermal energy to PCM based energy storage module: A solar hybrid and thermal storage equipment have been developed by utilizing the latent heat of phase change material (PCM) for indoor fermentation unit. An evacuated tube-type solar water heater (SWH)



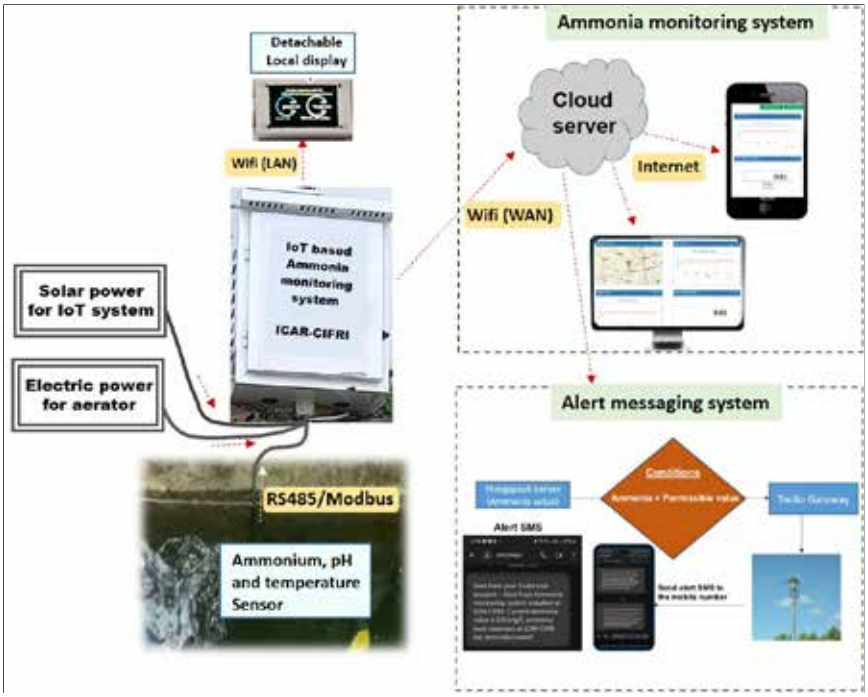
is designed to supply thermal energy to PCM based energy storage module from which the energy will supply to yogurt fermentation unit for incubation process. The evacuated tube-type collector was specifically chosen over flat plate collectors because flat plate systems require an external pump for water circulation and have been shown to exhibit lower thermal efficiency compared to evacuated tube systems in multiple studies, particularly under variable climatic conditions. The capacity of the SWH is of a 100 L insulated storage tank coupled with ten evacuated glass vacuum tubes. The system has been mounted on a slightly elevated platform to maximize incident solar radiation, enabling optimal heating performance throughout the day. The solar water heater consistently supplied hot water for the indoor fermentation chamber, which significantly reduced the energy consumption (up to ~25%) of the dahi/yoghurt processing.

IoT-based LED light chamber system for antibacterial photodynamic inactivation: An IoT-based LED light chamber system was designed and



fabricated by ICAR-CIFT for antibacterial photodynamic inactivation (aPDI). This Internet of Things (IoT)-based LED light chamber system comprises enclosed light chamber, illumination holder, height-adjustable unit, temperature regulation unit, plurality of sensors, microcontroller, display unit, and web platform. The device can read irradiance, wavelength, temperature and height. An initial study with low levels of *Moringa oleifera* extract, as a photosensitizer, significantly reduced the bacterial load of methicillin-resistant *Staphylococcus aureus* (MRSA) and *Pseudomonas aeruginosa* in water.

IOT based systems for monitoring water quality parameters: Developed ammonia nitrogen (NH_4^+-N) sensor based water ammonia monitoring; and fiber optic



turbidity sensor based water turbidity monitoring systems to measure in real-time with high levels of accuracy, reliability, and efficiency. The IoT system is based on microcontroller attached with ammonium (NH_4^+) and temperature sensors. The integrated automated messaging system sends real-time alert message to the farm manager in high ammonia/ turbidity conditions.

Handheld portable NIR device for onsite seafood evaluation: A portable hand-held NIR device has been developed by ICAR-CIFT for on-site authentication of species identity of commercially important shrimps in a non-destructive manner. With machine learning technique created a Support Vector Machine-Linear (SVM-L) model which could predict the species identity with over 99% accuracy.

Solar-powered fish feed dispenser: A solar-powered automatic fish feed dispenser that can dispense feed in a fish farm of up to 1500 m^2 and spread 10 kg of feed in 5 minutes has been developed.

Hybrid electrical-diesel fishing boat: A hybrid electric fishing boat featuring 20 HP electric outboard motor and a 23 kW lithium-ion battery pack, supported by a 12 kVA diesel generator and a 48 V/300 Ah battery system, was fabricated. It is equipped with a 10 kW electric propulsion motor for continuous operation.

10. Post-harvest Management and Value-addition

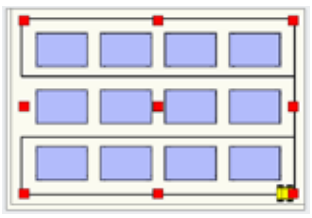
Recent innovations across post-harvest management, processing, value addition, quality assessment, sustainability, and agri-based entrepreneurship, aimed at reducing losses, improving product quality, and enhancing farmer and MSME income. Advanced post-harvest technologies include an infrared-UV-C grain disinfestation system that achieved 100% insect mortality and zero egg hatchability in wheat and chickpea, ensuring safe storage for up to one year. Non-destructive X-ray imaging of Alphonso mango enabled real-time detection of spongy tissue and seed weevil infestation at 1 t/h, with deep learning (Xception) achieving 84.9% accuracy. Mechanization and digital tools such as a line-following cold-room monitoring robot improved temperature-humidity surveillance, while portable cotton colour meters and fibre strength testers enabled rapid on-field quality grading. Miniature spinning machinery processed 100–300 kg/day of lignocellulosic fibres, saving 15–18% labour and 16–17% energy. Value-addition technologies emphasized sustainability and nutrition. Nanocellulose-reinforced biocomposite films (40–50 µm) exhibited enhanced water vapour barrier properties comparable to Linear Low-Density Polyethylene (LDPE). Edible soy-based cutlery degraded within 5–6 days, resisted 100 N fracture load, and contained ~40% protein. Agro-waste valorisation produced xylitol (10.57 g/100 g biomass) from banana pseudostem and vinegar/bacterial cellulose from coconut water. Functional foods included millet, tuber, cashew, potato, dairy, meat and egg based products with high protein (up to 17.4%), fibre (6–7%), antioxidants, and shelf-life up to 6 months. Sustainable crop and livestock interventions reduced pesticide sprays, carbon emissions and improved yields. Precision diagnostics using LC–MS/MS, Raman spectroscopy, VOC profiling, and immunoassays strengthened food safety.

System for Infrared-UV-based surface disinfestation of food grains: An infrared (IR) and ultraviolet (UV-C) based system was developed for surface disinfestation of food grains before storage or handling. Using synchronized screw conveyors and a reciprocating deck, grains are uniformly exposed to UV-C and IR radiation, destroying insect eggs and adults. Tested on chickpea and wheat at 0.7 km/h and a 6.36% deck slope, it achieved 100% insect mortality and zero egg hatchability, with treated grains remaining safe for up to one year.

X-ray imaging and processing for internal quality assessment of mango: An X-ray imaging system was developed for non-destructive detection of spongy tissue and seed weevil infestation in Alphonso mangoes. Operating optimally at 40–50 kV and 20 mAs, the system uses an 85 µm resolution detector with a 130 × 120 mm tunnel to process up to 1 t/h. A push-out rejection mechanism enables automated sorting of defective fruits. Image processing and deep learning (Xception model: 84.9% accuracy, AUC 0.95) ensure precise classification, demonstrating effective real-time quality assessment.

Robot for monitoring temperature and humidity in a cold room: A 4-wheel line-following robot was developed to monitor temperature and humidity in cold rooms. Built on Arduino Uno with L293D motor drivers, it uses a 6-line IR sensor for path tracking and an ultrasonic sensor for obstacle detection. Compact (180 × 180 × 130 mm) and battery-powered, it records data to an SD card with real-time access via Wi-Fi and a mobile app. Automated monitoring reduces human exposure, maintains stable temperatures, and ensures efficient cold room operation.

Mini Robot

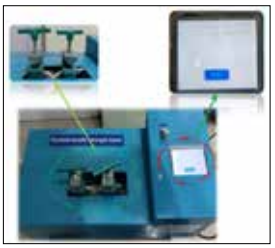


Robot path in cold storage

Portable instrument for measuring the colour grade of cotton: A portable device was developed to measure cotton colour using optical reflection. It determines whiteness (Rd) and yellowness (+b) by comparing photodiode readings with standards.

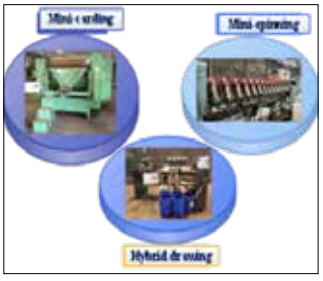
Comprising a light source, photodiodes, detectors, and filters, it provides quick, reliable, on-field assessment, helping the ginning and textile industry make informed quality and pricing decisions.

Portable digital bundle strength tester: A low-cost, portable electronic tester was developed for measuring lignocellulosic fibre strength in constant rate of loading (CRL) mode. It features a mechanical fibre-breaking unit and an Arduino Mega 2560-based system with a load cell (HX711), motor driver, and limit switch. Powered by a 24 V, 16 A battery, it operates up to 6 hours. Compact, lightweight, and BIS-compliant (IS: 7032 2024), the device is commercialized by JCI, Kolkata.



Portable colour meter: A battery-powered portable colour meter was developed to measure the whiteness of lignocellulosic fibers using photo-reflectance. It comprises LEDs for uniform illumination, BPW34 photodiode sensors, a microcontroller, display, and battery with booster. Reflected light is converted to voltage and calibrated for colour values. The instrument developed adheres to BIS standards (IS: 7032 (2024) and can be ideal for conducting experiments in the field, remote locations, and laboratories.

Miniature spinning machinery for processing of lignocellulosic fibres: Developed a miniature spinning machinery system with processing capacity of 100–300 kg/day of lignocellulosic fibres like jute, mesta, banana fibres with technical support from M/s. Bhowmick Calculators, Kolkata and the machinery cost will be ₹40 lakhs. This system can save 15–18% labours, 10–12% time and 16–17% energy for processing the small amount of fibre as compared to the commercially available machines.



Bionanocomposite films: An eco-friendly alternative to synthetic packaging: Nanocellulose-reinforced biocomposite films were developed using melt compounding and blown film extrusion, combining tapioca starch, biopolymers, and cotton-linter nanocellulose. Twin-screw extrusion and grafting agents ensured uniform NC dispersion. The 40–50 µm blown films showed enhanced elasticity and water vapour barrier properties while maintaining tensile strength comparable to synthetic films like LDPE, offering a sustainable packaging solution.

Manufacturing of bionanocomposite films using blown film extrusion

Soft and bulk jute yarn for making knitted apparel and home textiles: Jute fibre was modified with alkali for developing the yarn with desirable softness and bulkiness and 20% extension at break. Modified jute yarn can be bleached and dyed in conventional methods and used for knitted apparel fabrics and home textile products.

Automatic deep-groove forming machine for double roller ginning rolls: An automatic machine was developed to form deep spiral grooves on ginning rolls, addressing wear and frequent re-grooving of conventional chrome leather rollers. It produces uniform grooves up to 25 mm, reducing downtime and labour while maintaining lint quality. Fully programmable and operable by a single operator, the machine is compatible with all chrome leather roller ginning machines, enhancing productivity and efficiency in cotton processing.

Coir-composite cube-reinforced concrete with improved strength: Coir composite cubes have been incorporated as a partial replacement for coarse aggregates to enhance the compressive strength of conventional concrete. Optimal performance was achieved with a 28% fibre volume fraction (coir fibre to resin) and 18% replacement of coarse aggregates. The resulting concrete exhibited a compressive strength of 34 MPa, which is 17% higher than conventional concrete. This demonstrates the potential of coir composite cubes as a sustainable and effective

Coir composite cube

Coir composite cube extracted from concrete after compression strength test

alternative to traditional coarse aggregates in concrete construction.

Portable and streamlined Nutrient Film Technique (NFT) aquaponic system: A pilot-scale NFT aquaponic system integrates fish and plant production using fish waste as nutrients. Each unit includes a 2,800 L fish tank, 95 L biofilter, and 3.6 m² hydroponic bed. Tested for 90 days with pangas and marigold, it produced 2,143 g fish and 384 ± 21 flowers per replicate, with 79.8 ± 3.36 mm diameter and 16.67 ± 0.93 g weight. The biofilter reduced total ammonia nitrogen by 61.97% at 3.68 LPM. One 8 m² unit generated a net profit of ₹714 (~$9.8), with scalability enhancing farmer income. Made of lightweight FRP, the system is portable, eco-friendly, and suitable for small-scale, sustainable food production.

Jackfruit De-Seeder: A power-operated jackfruit de-seeder was developed to overcome processing challenges caused by sticky latex and complex fruit structure. It features two counter-rotating rollers with adjustable clearance, driven by a 0.5 hp motor, to separate seeds through shear force. The machine achieves 86% de-seeding efficiency with a capacity of 60 kg/h, suitable for small-scale processing units.

Cashew nut separator and pulp extractor: This machine has three main assemblies, viz. cashew nut separator, pulp separator and fibrous material separator. The capacity of the machine is 250–300 kg/h with separation efficiency of more than 99% and nut damage of less than 1.0%. The saving in cost of operation and time is 82.50% and 96%, respectively.

Multi-millet de-husker: A de-hulling machine for minor millets like kodo and kutki was developed using a pair of counter-rotating rubber rollers that provide shearing and crushing actions. Powered by a 1.5 kW single-phase motor at 400 rpm, the machine achieves 70–75% dehulling efficiency in a single pass, effectively addressing the challenge of small, tightly bound millet kernels.

Soy-based cutlery: Edible cutlery made from deoiled soybean flour offers a sustainable, fully compostable alternative to conventional utensils, degrading within 5–6 days. Bowls provide ~40% protein, maintain stability for 40 min in boiling water, and resist fractures up to 100 N. Sensory tests showed high consumer acceptance, demonstrating its practicality and eco-friendly potential.

Development of continuous edible film-making machine: A continuous machine was developed for the scalable production of edible films from biopolymers (CMC, starch, pectin, gelatin) using the casting method. It forms uniform films up to 0.6 m wide at 3 m/h, with IR (85°C, 20 cm) and hot-air (60°C) drying at 0.05 m/min conveyor speed. CMC films showed tensile strength 21.78 MPa, elongation 23.45%, and water vapour permeability 1.49 $\times 10^{-10}$ g/m·Pa·s, suitable for food packaging, e.g. muffins.

Biomacromolecule-based encapsulation of curcumin for enhancement of its stability and bioavailability: Curcuminoids from Lakadong turmeric were encapsulated using shellac and biopolymer gums (carrageenan, agar, gellan) via *p*H-induced coacervation and heat-induced gelation, achieving high encapsulation efficiencies (up to 86%) and enhanced stability. Gellan

(a) Carrageenan encapsulated curcumin (b) Gellan encapsulated curcumin

(c) Shellac encapsulated curcumin (d) Agar encapsulated curcumin

SUCCESS STORIES

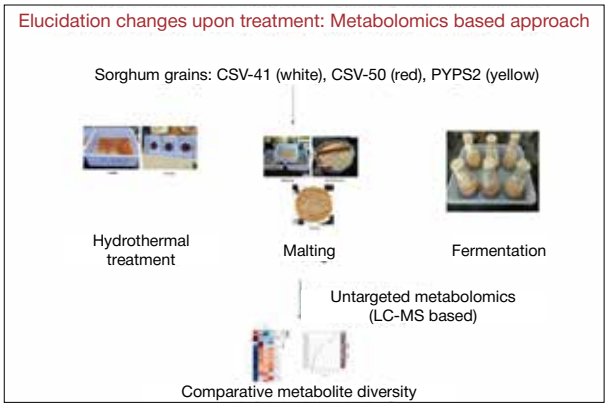
Success Story of Amrit Lakra: From Daily Wage Worker to Successful Lac Farmer

Amrit Lakra from Jerki Toli, Jharkhand, transformed from a daily wage labourer earning ₹10,000/month to a successful Lac farmer. Starting in 2022 with just a few Kusum and Ber trees and 15 kg of brood Lac, he earned ₹15,000 from his first harvest. In 2023, he expanded operations by leasing more trees and planting 6,000 *Flemingia semialata* seedlings, investing ₹40,000. Despite some setbacks like a forest fire, he earned ₹75,000 from Lac harvest. Training by ICAR-NISA enhanced his scientific Lac farming skills, leading to improved yields and income. By 2025, his application of advanced techniques yielded 2.5 quintals of Ari Lac, earning over ₹2 lakh and total earnings near ₹3 lakh through direct market sales. His income grew significantly due to scientific practices and continuous support, exemplifying the power of training and perseverance in rural entrepreneurship. Before training, Amrit lacked knowledge of advanced farming, pest control, and marketing, and was unaware of Lac's true market value.

Lac ready for harvest in *Flemingia semialata* lac host plant

matrices provided superior protection under accelerated conditions, while release profiles were *p*H- and polymer-dependent, optimizing intestinal bioavailability. This biomacromolecule-based system effectively improves curcumin stability and controlled delivery for enhanced therapeutic potential.

Elucidation of changes upon processing in coloured sorghum grains: Untargeted metabolomics-based approach: In addition to its rich nutritional profile, sorghum grains house a plethora of phytochemical constituents including phenolic acids, flavonoids among others. These phytochemicals are majorly concentrated in the outer grain layers and to impart a range of health beneficial effects, viz. antidiabetic, cholesterol-lowering, and free-radical scavenging properties. Post-harvest processing significantly influence the nutritional quality of cereal grains by altering the nutrients, antinutrients and phytochemicals. A study was conducted to elucidate the biochemical changes upon hydrothermal treatment, malting and fermentation in three sorghum varieties, viz. CSV41 (white), CSV50 (red) and PYPS2 (yellow). In addition to assessing the nutritional, antinutritional constituents and antioxidant activity, comparative metabolite diversity upon processing in the coloured sorghum grains was assessed an untargeted metabolomics-based approach (LC-MS). The results revealed genotypic variation as well as processing mediated changes in the nutritional constituents of sorghum grains. The dietary fibre content was found to be reduced upon fermentation in all the three sorghum genotypes. The antinutrients, viz. tannins and phytic acid reduced in the three sorghum genotypes upon all the three processing treatments in the red sorghum, CSV50.



The *in vitro* protein digestibility (IVPD) was found to be reduced upon hydrothermal treatment in all the sorghum genotypes while malting as well as fermentation improved IVPD. For instance, in CSV50, the IVPD of the hydrothermally treated, malted and fermented samples were 34.8%, 71.03% and 46.8% respectively while raw CSV50 recorded an IVPD of 41.9%. Further, the total phenolic content (TPC) of the studied sorghum genotypes (including the treated samples) ranged from 0.82–9.43 mg/g gallic acid equivalents (GAE) (db) with hydrothermal treatment reducing the TPC of the grains as compared to the corresponding raw grains of each genotype. Also, antioxidant activity in terms of reducing power varied among the treated grains and corresponding control with hydrothermal treatment decreasing the reducing power in all the studied sorghum genotypes. The comparative metabolite diversity of sorghum grains as obtained by the LC-MS analysis and the downstream analysis in Metaboanalyst 6.0 revealed that the treatments caused significant changes in metabolites including the phenolic and flavonoid compounds that impart bioactivities to these grains as evidenced by multivariate analyses. The data generated in this study would help nutritionists and food industry in choosing the processing methods for formulating sorghum based functional foods.

Pre-harvest fruit bagging in mango for environmental sustainability: Pre-harvest fruit bagging proved to be a climate-smart, sustainable practice that improved mango quality, while reducing chemical use and environmental impact. Bagging cut pesticide use (<0.2 vs. >3 sprays), carbon emissions (161–208 vs. 1200–1400 kg CE/ha) and energy inputs (120–145 vs. 2800–3700 MJ/ha). It enhanced peel colour, firmness, shelf-life, and marketable yield (~94% vs. 82%) nearly

Fruit bagging in mango at ICAR-CISH Lucknow

eliminating pest and disease incidence. The practice effectively boosts fruit quality, sustainability, and profitability through, export-oriented mango production.

Identification of ripening stage of mango through changes in volatile organic compounds (VOCs): Short shelf-life and lack of non-destructive methods to monitor ripening is major impediment in the long distance trade and export of mango. Volatile fingerprints were obtained during different ripening stages to identify ripening parameters. At initial ripening stage, compounds like hydrocarbons, alcohols, aldehydes and ketones were found to be main contributors, whereas with the progress of ripening, short chain ester and lactones were found to be the main volatiles in the head space.

Sustainable xylitol from banana pseudostem scutcher biomass: Xylitol, a low-calorie, anti-carcinogenic and a sweetener, was produced from banana pseudostem scutcher biomass, a largely underutilized lignocellulosic by-product, through microbial fermentation. Valorization of banana pseudostem scutcher waste for xylitol production was taken up. *Candida tropicalis* strain showed the highest yield, followed by *Saccharomycopsis fibuligera* and *Pichia kudriavzevii*. Mass balance revealed 10.57 g of xylitol produced from 100 g of dry biomass. Xylitol serves as a healthy sugar substitute with wide applications in food, pharmaceuticals, and oral care.

Technology for chemically induced harvesting of clove: The package of technology for harvesting clove through chemical induction has got the advantages viz. reduced cost of harvest and labour cost by 75% and 50%, respectively, reduces the duration of harvest by 75%. Removes alternate bearing habit of clove due to nutrient application, increases yield up to 25% in the first year and 10–15 % in the consecutive years.

Post-harvest pest management in okra and bitter gourd: The hot water treatment resulted in 100% mortality of thrips, *Thrips palmi* eggs at 55°C for 8 min on bitter gourd, and at 50°C for 6 min on okra. The treatment of CO_2 @95% + N_2 @5% resulted in 100% mortality of nymphs, 48 h after treatment.

VOCs and VOC producing microbes for post-harvest disease management in mango fruits: Pre-harvest application combined with post-harvest exposure to *Hanseniospora opuntiae* (VOCs producing yeast) was found effective against anthracnose but not stem end rot of mango. *Bacillus amyloliquefaciens* was found effective as post-harvest exposure in mango. Commercially available compounds, viz. caproic acid, palmitic acid, isovaleric acid and n-butyric acid were found effective against post-harvest pathogens of grapes and strawberry too.

Value-addition in coconut: A protocol was developed for producing ready-to-serve coconut flakes infused with coconut *neera* syrup. Among various drying methods tested – Infrared Drying (IRD), Infrared-Assisted Hot Air Drying (IRHAD), and conventional Hot Air Drying (HAD) – IRHAD at 65°C yielded flakes with superior nutritional quality, faster drying, and better physical properties. The technique also enhanced copra quality, with IRHAD at 60°C preserving high fat content (68.4%) essential for improved oil extraction. Additionally, a biodegradable composite paper was created from tender coconut husk and plant-based starch. The material showed ~70% degradation within 20 days.

Dried coconut flakes

Value-added products from cashew: Cashew apple jaggery is a nutrient-rich, value-added product containing potassium, zinc, iron, soluble fibre, and antioxidants, with a moderate glycemic index (58.3) and a shelf-life of over one year. Its unique sugar profile makes it a natural alternative to high-fructose corn syrup and liquid glucose. Cashew sprout cookies, fortified with green gram, finger millet, and horse gram sprouts, contain 10–12% protein, high fibre, and essential minerals like potassium, calcium, and magnesium, addressing malnutrition concerns. Made from low-cost, sustainable cashew apple raw material, these products are free from preservatives, refined sugar, refined flour, and eggs. They are rich in polyphenols (620.23 mg/100 g), antioxidants (312.45 µmol trolox/g), and essential minerals, supporting immune health. With distinct flavour, low fat, and a 6-month shelf-life, both innovations offer healthy, natural alternatives for functional food and confectionery industries. Diet cashew apple muffin was also prepared from cashew apple juice and jaggery with low fat.

Potato-based value-added products: Potato-black gram *boondi* was formulated by replacing up to 75.5% of Bengal gram flour with a blend of potato flour, arrowroot starch, and black gram flour, with a 3-month shelf-life under controlled storage. Potato-Kodo millet cookies were created using 37.5% kodo flour and 62.5% potato flour, yielding high dietary fibre (6.7%), calcium (39 mg/100 g), and potassium (270 mg/100 g). These gluten-free cookies suit celiac and wheat-allergic consumers and can be stored for up to 4 months. Additionally,

Potato-Bengal Gram Based boondi for raita

Potato swirls Value-added products from tropical tuber crops

potato-based swirls resembling traditional *murukku* were developed using 80% potato flour and tapioca starch, showing superior crispiness and lower hardness (27.9 N) compared to commercial samples.

Value-added products from tropical tuber crops: Frozen desserts from purple and orange-fleshed sweet potato purees retained high anthocyanin, (30.45 mg/100 g) and β-carotene (12.41 mg/100 g) levels, with probiotic viability up to 10 days under refrigeration. Sweet potato purees were also used to develop antioxidant-rich pectin and gelatin gummies, with pectin versions showing superior colour and antioxidant activity. Additionally, optimized air-fried sweet potato chips and vegan *kulfi* formulations demonstrated high fibre and phenolic-linked antioxidant potential, promoting healthy, functional food innovations having good consumer acceptability.

Gummy confections from biofortified sweet potatoes

Orange sweet potato and cashew milk based kulfi

Synthesis of food grade succinylated cassava distarch phosphate: Succinylated cassava distarch phosphate, produced by esterifying cassava starch with succinic anhydride and crosslinking with sodium trimetaphosphate, functions as a fat substitute and emulsifier. The modified starch showed higher water-binding capacity, porosity, oil absorption capacity (OAC), swelling power, paste viscosity, and stability compared to native starch, with reduced syneresis ideal for refrigerated foods. It was effectively used to prepare no-fat eggless mayonnaise, closely resembling commercial mayonnaise but with significantly lower fat (5.2%) and sugar (3.7%) content for vegan consumers.

***p*H Sensing cassava starch films (bio-sensor) for food spoilage detection:** Cassava starch-based indicator films were developed to detect food spoilage through *p*H-induced colour changes caused by gases released during decay. Native and modified cassava starches, including starch-PVA composites, were used as supports with natural dyes anthocyanins and curcumin. The films showed distinct colour transitions-yellow to red for curcumin and purple to dark olive for anthocyanins-when tested with foods like cabbage, mushrooms, and fish.

Spice-flavoured jaggery cubes: Spice-flavoured jaggery-based products are instantly soluble in water, convenient in size and available in consumer-friendly form. The product has improved active ingredient content with a longer shelf-life and is devoid of any chemical preservatives. The key benefits of the technology are – it is available in different flavour variants of the spices, rich in total phenolics and flavonoids, improved antioxidant properties, good storage stability for up to 8 months under ambient conditions. The spice flavoured jaggery cubes offer a distinctive flavour profile that enhances the taste of beverages like tea and coffee, while also serving as a health-conscious sweetener.

RTS (Ready-to-serve) beverage from rose: ICAR-DFR, Pune developed rose RTS that is rich in natural antioxidants, having unique rose floral aroma and flavour profile. The RTS has hydration and added functional properties.

Rose RTS drink

Vegan meat patty from mushroom mycelium

Development of vegan meat analogue using mushroom mycelium: A vegan meat analogue has been developed using *Pleurotus ostreatus* var. florida mycelium. The final formulation, incorporating mycelium, gluten, soy chunks, and gram flour, exhibited superior sensory quality along with higher fibre, moisture, fat, and antioxidant activity compared to chicken *kebab*, indicating good functional potential despite slightly lower protein content.

Waste-to-wealth from coconut water: Technology to convert mature coconut water (liquid endosperm), which is wasted in huge quantities from coconut kernel processing industries, to vinegar, 'nata'/ bacterial cellulose (BC), has been standardized using indigenous bacteria isolated from coconut vinegar. Maximum BC production was obtained in the *p*H range of 4–5 for all the isolates except BC4, in which maximum BC production was obtained in a wider *p*H range of 5–10.

Cassava stem-based particle boards: Cassava stem-based particle boards were developed using urea formaldehyde and other resins under varying temperatures and pressures, yielding strong boards with good density, moisture resistance, and mechanical properties. Hot water blanching (85–95°C) and coir pith composites improved strength, while optimal cassava stem-coir pith/rice husk ratios enhanced performance with different resin types.

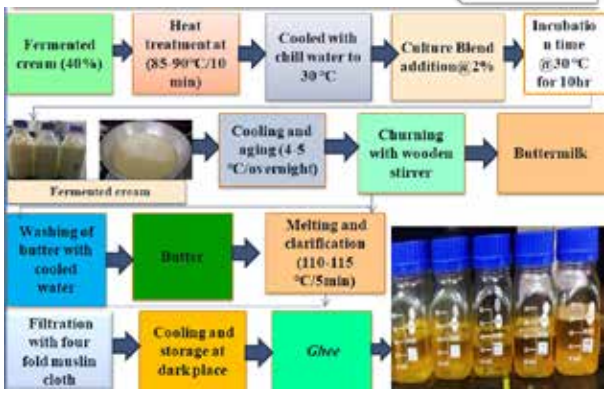
Analysis of pesticide residues in litchi fruits: The pesticide residues in litchi fruits from different sources using validated LC-MSMS and GC-MSMS methods were analyzed. Results showed that most pesticide

residues were concentrated in the fruit peel, with pulp residues generally below the limit of quantification. Copper oxychloride and carbendazim residues were detected in the pulp, while Novaluron, Thiacloprid, and Lambda cyhalothrin had notable levels in peel, especially when applied closer to harvest. Control samples showed negligible residues.

Residue analysis of pesticides in vegetable crops: A sensitive LC-MS/MS method was developed for simultaneous detection of 35 pesticide residues in tomato, brinjal, chilli, and okra, using modified QuEChERS extraction, positive ESI, and MRM. The method showed excellent linearity (R^2 = 0.993–0.999), 80–90% recoveries with RSD <20%, minimal matrix effects (6.42–19.52%), and a quantification limit of 0.01 mg/kg. This robust technique enables accurate, rapid multi-residue monitoring for food safety and regulatory compliance.

VALUE ADDITION

Development of mesophilic direct-vat-set starter culture blend to improve flavour profiles in ripened cow cream ghee



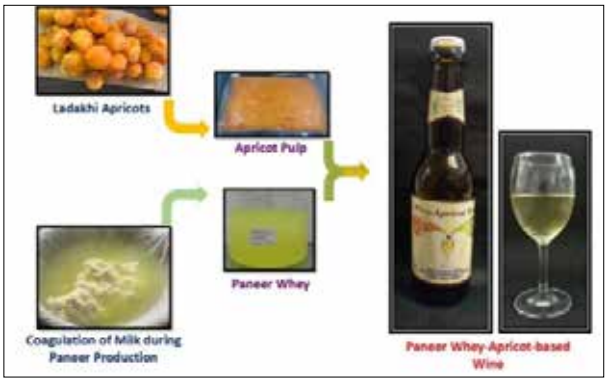
Process for enhancing the flavour profile of ghee using mesophilic liquid DVS Starter Culture Blend

Development of technology for 3D printing of traditional dairy products

3D printing was applied to digitize burfi production, enabling customized food aesthetics through layer-by-layer deposition. The optimal formulation for shape stability and visual quality was 60% total solids (khoa) and 20% sugar, achieving around 97.5% dimension accuracy factor

3D Printed Burfi Samples

Paneer whey-apricot-based wine: A novel fermented beverage (whey-apricot wine) was developed using paneer whey and apricot pulp for sustainable dairy by-product utilization. Pre- and post-fermentation treatments (defatting, deproteinizing, and clarification) of the whey improved the final product's sensory appeal and clarity. The wine, fermented at 28°C for 7 days using a mixed yeast culture, achieved approximately 13% ethanol and met regulatory standards of fruit wines. This demonstrates a successful, value-added beverage production from paneer whey that is both sensorily appealing and cost-effective.



Detection of adulteration in ghee using Raman Spectroscopy: Raman spectroscopy combined with chemometrics (PCA, PLS, PCR, SIMCA) was employed to rapidly and sensitively detect (mineral oil, palmolein, groundnut oil, cottonseed oil, and lard) adulteration in cow ghee by various oils (0–100%). Specific spectral regions were identified for each adulterant, and the models achieved high predictive accuracy (R^2: 0.871–0.984), confirming the method's effectiveness for authenticity testing.

Goat milk-millet based food supplement: Freeze dried Goat milk powder (54%), Fermented millet powder (24%), Un-ripened banana powder (8%), Date powder (6%), Cocoa powder (2%) and Stevia was used in the developed formulation. In comparison to a market product of the same category, a remarkably higher protein (17.43%) and dietary fibre content (6.06%) was recorded in developed product along with higher proportion of some of the important minerals (P, Ca, Mg, Zn) with very low sodium content. The protein digestibility of developed product was 86.04%.

Development of strip based immunological method for differentiation of fresh and frozen chicken meat: Strip based rapid immunoassay technique used to differentiate between fresh and frozen thawed chicken meat has been developed. The strip utilizes the reaction based on tagged antibodies produced against a suitable biomarker enzyme which produces specific colored line when the particular analyte is present in the sample that can be read with naked eyes.

Developed IndPOtrace platform

IndPOtrace stands for 'Indian Pork Traceability' and

this digital platform (www.indpotrace.in) has distinct components for 'traceability' as well as 'real time meat inspection' to cater the specific needs of stakeholders.

CARI developed two novel products-CARI Whole Egg Drink and CARI Egg Albumin Drink—providing 7–9 g of high-quality protein per serving with a shelf life of up to 15 days. These functional beverages cater to health-conscious consumers and promote diversified egg utilization. The institute also commercialized CARI Multi-Grain Egg Biscuits and Functional Chicken Seekh Kebabs.

Goat milk and meat-based products: CIRG standardized several goat milk- and meat-based products such as Chevre, Kaladhi, Gouda cheese, mango-fortified yoghurt, multi-millet cookies, nuggets, and sausages. Designer goat milk and meat enriched with minerals were commercialized. Plastic-based two-tier goat housing and hanging feeders were licensed for field adoption.

DPR introduced Duck Meat Popcorn and developed a composite feed formulation (Azolla, Moringa, broken rice, earthworm meal) that improved duck egg production, fertility, and feed efficiency.

Natural alternative of antibiotic: A nano-emulsion formulated from *Mentha longifolia* and basil essential oils was developed as a natural alternative to antibiotic growth promoters. Supplementation at 50 µl/kg feed significantly improved broiler growth, gut health, and meat antioxidant capacity while reducing harmful microbes. Unlike antibiotic-treated birds, *E. coli* isolates from nano-emulsion-fed groups retained full antibiotic sensitivity, indicating its potential for sustainable and safe broiler production.

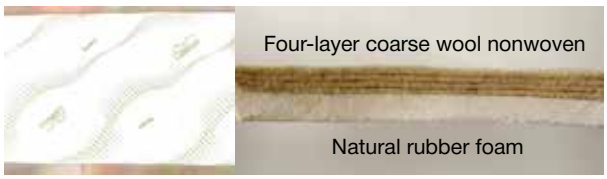
Herbal feed: CSWRI focused on herbal feed supplementation to improve growth and reproductive performance in sheep. Feeding a herbal blend rich in antioxidants and essential oils advanced puberty and elevated testosterone levels in lambs. Studies on Toll-like receptor (TLR) gene expression revealed genotype-specific immune responses to *Haemonchus contortus* infection in resistant lines.

Commercial herbal and biological products: At CIRG, health surveillance of goats revealed minimal brucellosis positivity (0%) and moderate incidence of gastrointestinal parasites. Commercial herbal and biological products such as Alquit®, Diarrionex-HS®, and Wormolex® were standardized for field use. A multi-epitope vaccine for *Clostridium perfringens* was designed and tested for high protective efficacy.

Sustainable coarse wool rose flower and its bouquet: A novel sustainable wool-based rose flower handicraft product was developed by integrating eco-friendly raw materials, bio-based coatings, and advanced felting techniques to enhance durability, aesthetics, and market viability. A key feature of this innovation was the infusion of rose aroma through spray coating, which enabled the fragrance to last up to 30 days. This rose flower handicraft presented a transformative approach to sustainable textile handicraft production, providing artisans with innovative tools to create high-quality, eco-conscious products. By overcoming the limitations of traditional handicrafts, this invention contributes to environmental sustainability while preserving cultural heritage and empowering artisans.

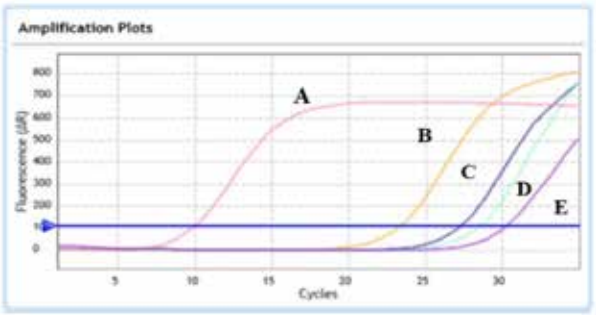
Coarse wool rose flower and its bouquet

Coarse wool - natural rubber foam dual-purpose bed: An eco-friendly, natural rubber-coarse wool based hybrid mattress was fabricated as a sustainable substitute for polyurethane foam-based mattresses. The specifications of developed mattress were 6 feet length, 4 feet width, 4 cm thickness (2 cm each of natural rubber foam and wool non-woven) and 4 layers of wool non-woven layers. The thermal insulation properties of two mattress types (rubber and felt facing) reveals that the rubber-faced mattress provides superior insulation performance. With the same thickness of 0.045 m, the felt-faced variant exhibits a lower thermal conductivity (0.012 W/mK) and a higher thermal resistance (3.83 m^2K/W) than the rubber-faced one (thermal conductivity: 0.019 W/m·K; thermal resistance: 2.41 m^2K/W). This indicates that a felt-facing mattress more effectively reduces heat transfer, making it a better choice for applications where thermal insulation is critical. This result implies that material selection significantly affects heat flow behaviour even when the thickness remains constant.



Natrual rubber latex foam-coarse wool dual side matress

Detection of pathogenic microaerophilic *Arcobacter butzleri* in seafood: A novel detection method based on a miniaturized MPN protocol combined with real-time PCR for detection and enumeration of *Arcobacter* spp. was developed. More than 300 isolates of pathogenic Arcobacters belonging to *Arcobacter butzleri, A. skirrowii, A. cryaerophilus* and *A. cibarius* were isolated from samples obtained from various landing centers and markets in Mumbai. This miniaturized method makes it cheaper and convenient to



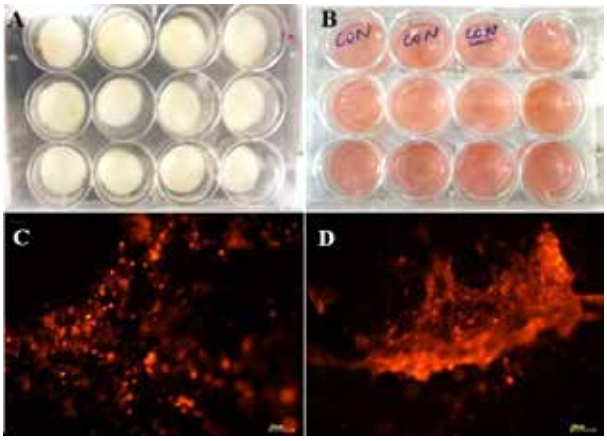
Detection of *Arcobacter butzleri* by MPN-qRT PCR in broth containing 100 (B), 10 (C), 1 (D) and <1 (E) bacterial cells. A is positive control

be used for testing field/market samples.

Violacein ZnO-NP chitosan ointment for wound healing: The antibacterial activity of ZnO-Nanoparticles (ZnO-NP) could be successfully enhanced by doping with violacein pigment produced by the bacteria, *Chromobacterium violaceum.* Wound healing was faster in Violacein-doped ZnO-NP.

Cadalmin™ GreenRex: A nutraceutical product- Cadalmin™ GreenRex, was developed and commercialized by ICAR-CMFRI. The product is a unique blend of natural bioactive ingredients extracted from seaweeds with ecofriendly green technology, to improve liver health and combat non-alcoholic fatty liver disease (NAFLD). It inhibits hydroxymethyl glutaryl reductase and other pleotropic target receptors associated with dyslipidemia and physiopathologies leading to NAFLD. The administration of Cadalmin™ GreenRex resulted in significant improvement in liver health along with reduction in deposition of fatty substances and maintained other liver/lipid parameters within the clinically acceptable limits. The pre-clinical trial showed no test substance-related general organ or systemic toxicity following its long term oral administration.

Smart proteins as alternative food source: ICAR-CIFE has developed and characterized muscle cell lines



2D-scaffold before cell seeding (A) and after cell seeding (B). Fluorescent microscopic image of LRM cells stained with phalloidin E at day 3 (C) and day 4 (D)

from commercially important fish species such as rohu, magur, seabass and pearlspot. This primary muscle cell lines will be useful as critical inputs for cultivated seafood development. Genomic and proteomic characterisations of the cell line have provided new insights for understanding myogenic and adipogenic process towards lab-grown fish meat development.

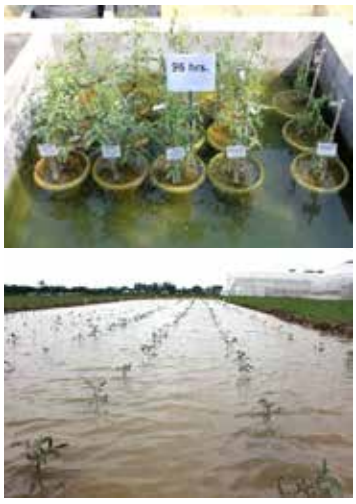
11.
Climate Resilient Agriculture

Climate-resilient and data-driven agricultural innovations are critical for sustaining productivity under increasing climatic variability. This brief synthesizes multi-disciplinary interventions spanning crop improvement, climate mitigation, precision management, and system-based approaches. A newly released drought-tolerant rice variety, NICRA Aerobic Dhan 2, matures in 117 days and yields 5.3 t/ha, showing 10.8–36.1% yield superiority over national, zonal, and local checks across eastern and northern India, along with tolerance to major pests and diseases. Climate mitigation is addressed through a methanotroph bio-formulation, which reduced methane emissions by 8–12% while enhancing rice yields by 7–10% in multi-location trials. Stress-resilient vegetable production was achieved via grafting technologies. Tomato grafting on eggplant rootstocks mitigated waterlogging stress (72–96 h), preventing crop mortality and enabling full recovery, while drought-resilient grafts recorded yields up to 3.13 kg/plant, exceeding irrigated controls by 7.3%. Advanced ecosystem monitoring using eddy covariance in high-altitude tea plantations revealed Gross Primary Production (GPP) of 74.8–174.3 g C/m/month and peak Water Use Efficiency (WUE) >2.0 g C/kg H_2O during post-monsoon periods. A climate-smart Integrated Farming System (IFS) model on 1.38 ha generated ₹5.5 lakh annual net returns, B:C ratio of 3.42, and 34% higher employment, demonstrating strong economic and ecological resilience. Complementary insights from machine-learning-based land-use analysis in the Sundarbans revealed 36.5 km² net land loss and a projected 5% rise in soil salinity by 2049, guiding adaptive planning. Collectively, these data-driven innovations demonstrate scalable pathways for enhancing productivity, reducing emissions, optimizing resources, and strengthening resilience across agro climatic zones.

Climate resilient variety: A moderately drought-tolerant, high-yielding, medium-early rice variety NICRA Aerobic Dhan 2 with tall, erect, non-lodging and non-shattering plants released in 2024. It was derived from a cross between Hakuchuk-1 and Naveen using the Single Seed Descent (SSD) method. The variety matures in 117 days, producing 5.3 t/ha during *kharif* and *boro* seasons in Tripura. It has long bold white grains (6.0 mm × 2.4 mm; L/B = 2.5), 21.8% amylose, ASV 7.0, GC 24 mm, minimal chalkiness, and good milling (68.8%) and head rice recovery (64.6%). Yield superiority was 10.8% over the national check, 14.7% over the zonal, and 5.9% over the local check (3-year mean). In Bihar, yields exceeded checks by 17.5%, 8.0%, and 5.3%, and in Haryana by 18.6%, 36.1%, and 30.6%, respectively. The variety shows tolerance to major diseases (false smut, brown spot, leaf blast, sheath rot) and pests (BPH, WBPH, LF).

Methanotroph formulation to reduce methane emissions in rice: A plant-based carrier formulation of solid methanotrophs (*Methylobacterium radiotolerans*) was developed by ICAR–CRRI, Cuttack for mitigating methane emissions from rice fields. The strain MT-22 is registered with NCBI (MZ683316) and NBAIM (NAIMCC-SB-0157). Applied at 1 kg/acre on the 7th and 21st days after transplanting or 28th and 45th days after direct seeding, the formulation is broadcasted after mixing with 9–11 kg dry sand under <2 cm ponded water, avoiding rainfall and weeds. Irrigation is recommended 2–3 days post-application. The product has a 6-month shelf life at room temperature (25°C) or 4°C storage and should be opened just before use. Patented in India (No. 557795) with PCT clearance for Indonesia, Thailand, and Vietnam, the formulation reduced methane emissions by 8–12% and increased rice yield by 7–10% in multi-location field trials.

Mitigation of waterlogging stress through grafting technology: Grafting technology in tomato was evaluated using eggplant rootstocks (IC-354557, IC-111056, IC-374873, and CHBR-2) under waterlogging stress for 72 and 96 hours during both vegetative and reproductive stages. Grafted plants showed no leaf chlorosis or wilting and only a slight reduction in chlorophyll content



Demonstration of water logging tolerance in tomato

(CCI) and chlorophyll fluorescence (Fv/Fm), unlike non-grafted plants, which exhibited 39.6–41% reduction in Fv/Fm and 41–100% reduction in CCI after 96 hours. Non-grafted plants wilted and died 4–7 days after stress removal, whereas grafted plants fully recovered within 7–10 days. Grafting tomato onto eggplant rootstocks IC-354557 and IC-111056 significantly enhances waterlogging tolerance (72–96 h), making it highly suitable for rainy-season tomato cultivation (July–August transplanting) in Uttar Pradesh and adjoining states.

Mitigation of moisture deficit stress through grafting technology

A total of 14 tomato and eggplant rootstocks grafted onto the tomato scion 'Kashi Aman' were evaluated under water deficit stress (no irrigation for 60 days during November–December) along with non-grafted

Demonstration of grafted tomato in field under water deficit condition

controls during the *rabi* season. The grafts *S. torvum* + Kashi Aman, *S. incanum* + Kashi Aman, and *S. pimpinellifolium* + Kashi Aman performed best under both moisture stress and irrigated conditions. *S. torvum* + Kashi Aman recorded the highest fruit yield (3.13 kg/plant) under stress, exceeding the control yield (2.91 kg/plant under irrigation) by 7.3%, with good TSS (4.80 vs. 4.64). *S. incanum* + Kashi Aman produced comparable yields under both conditions (2.76 and 2.74 kg/plant, respectively), demonstrating strong drought tolerance and yield stability.

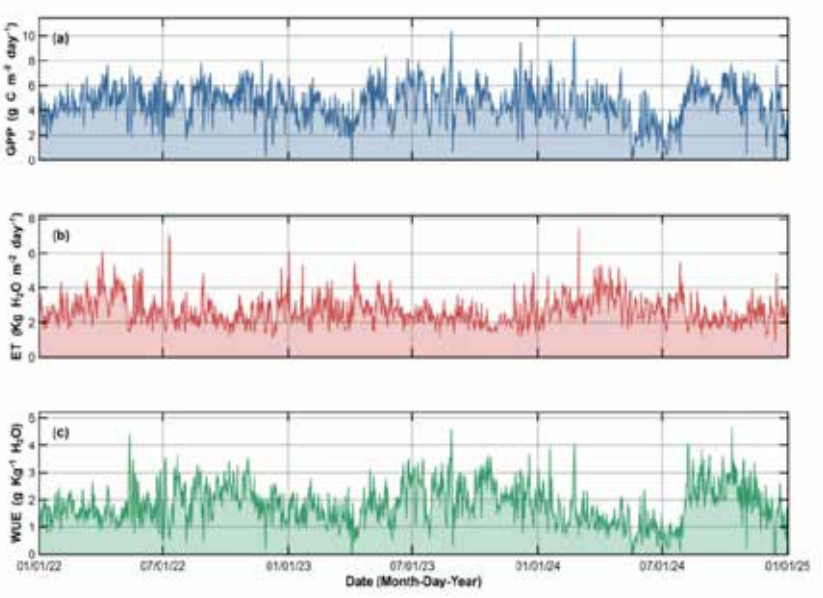
CFD and organic disease management in potato: Study on Carbon Fraction Dynamics (CFD) and temperature effects in potato soils showed that a 3°C rise reduced tuber yield, significantly in vermicompost and control plots, but not with paddy straw incorporation. Elevated temperatures also affected disease incidence and pest populations. Early sowings faced higher aphid and whitefly infestations, while mid- to late-sown crops had lower pest densities. Organic disease management at CPRS, Modipuram found neem oil (6%) to be most effective against late blight, and cow urine (100%) was best for black scurf control, followed by *Jeevamrit*, neem kernel, and diluted cow urine. *Neemazal* and *Pongamia* soap effectively managed whiteflies and aphids under natural farming systems.

Screening method for moisture deficit tolerance in tomato: A recombinant inbred line (RIL) population of 113 from a cross between 3125A (sensitive) and RF4A (tolerant) tomato was evaluated for moisture deficit tolerance using 18% PEG8000. Tolerant lines showed lower reduction in biomass, photosynthesis, and fruit weight, along with higher water use efficiency. They also exhibited increased antioxidant and osmo-protectant activity. Priming further enhanced tolerance to severe stress.

Abiotic stress tolerance in seed spices: Evaluation of salt stress tolerance in fennel and cumin genotypes under controlled and field conditions, revealing declines in growth, yield, and oil content at higher salinity levels. AF-1 fennel and GC-4 cumin showed greater resilience compared to AF-48 fennel and RZ-19 cumin, highlighting their potential for cultivation in saline environments.

Eddy covariance insights into climate resilience and water use efficiency of high-altitude tea plantations

Using the eddy covariance technique, the study quantified Gross Primary Production (GPP), Evapotranspiration (ET), and Water Use Efficiency (WUE) to assess how tea plantations respond to seasonal



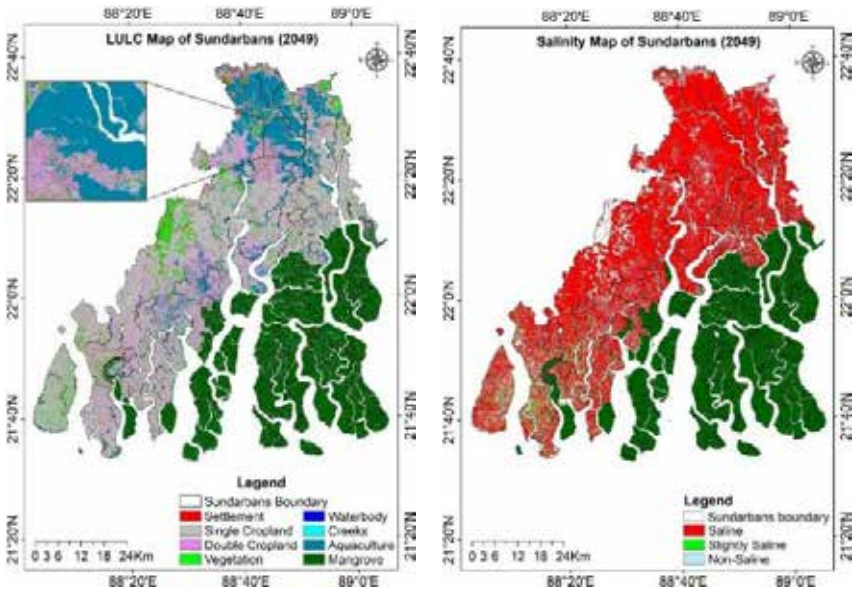
Time series analysis of Water Use Efficiency (WUE) using the Gross Primary Productivity (GPP) & Evapotranspiration (ET) in tea plantation using the eddy covariance technique at ICAR - IISWC, Research Centre, Udhagamandalam during the period 2022-24

View of different modules of IFS Model

and interannual climate variability under monsoon-dominated rainfall. GPP ranged from 74.75–174.33 g C/m/month, ET from 60.72–144.31 kg H_2O/m/month, and WUE from 0.77–2.69 g C/kg H_2O. The highest WUE (>2.0 g C/kg H_2O) occurred during the post-monsoon period (October–November), when reduced cloud cover enhanced photosynthetic efficiency, indicating the plantation's strong carbon assimilation with minimal water use. These findings highlight the carbon-water dynamics of tea agro-ecosystems and provide a framework for developing climate-resilient management strategies in high-altitude plantations across the Western Ghats and similar regions.

Sustainable resource management with climate smart IFS: An Integrated Farming System (IFS) model was developed on a 1.38 ha area for marginal farmers in Western Uttar Pradesh, aiming to address ecological and economic viability under climate change conditions. The key objectives of the model included identifying region-specific, climate-resilient farming enterprises; resource budgeting with a systems perspective focusing on soil, water, nutrients, and energy; evaluating low-carbon production modules; and exploring avenues for secondary agriculture to engage rural youth. The IFS model integrated multiple components: crops, dairy, horticulture, aquaculture, mushroom cultivation and boundary plantations, emphasizing resource recycling and economic viability. The model demonstrated a high sugarcane equivalent yield (264.1 tonnes/year), with contributions from crops (43%), dairy (29%), horticulture (15%), and fisheries (7%), achieving net annual returns of ₹5,50,090 and a benefit-cost ratio of 3.42. The model also generated 34 per cent higher man-days (774) of annual employment, reducing seasonal unemployment. The IFS approach enhanced food and nutritional security by fulfilling household needs and generating marketable surpluses of cereals, fruits, milk, fish and mushrooms. Notably, marketable surpluses were recorded for cereals (92.8%), fruits (94.6%), and milk (93.7%). This comprehensive system provides a sustainable solution to the challenges of monocropping, boosting both income and resilience for farm households .

Coastal erosion and soil salinization in the Sundarbans: Coastal lands worldwide have undergone rapid transformation due to intense human activity and climate change, making quantitative assessment vital for sustainable management. This study analyzed land use and land cover (LULC) changes, erosion, and accretion in the Sundarbans region of coastal West



Projected LULC and salinity map of Indian Sundarbans for 2049 based on CA-ANN model

Bengal from 1973–2022 using Landsat imagery. Over five decades, the area experienced 305.6 km² erosion and 269.1 km² accretion, resulting in a net land loss of 36.5 km². Shoreline analysis showed 5643 km under erosion and 5394 km under accretion, with only 12.4% stable, highlighting the region's dynamic nature. While single cropping remained dominant, settlements and aquaculture expanded 7-fold and 2.4-fold, respectively, and double-cropped area increased by 75.8%. Mangrove cover remained stable due to conservation efforts. Soil salinity in arable land rose from 2246 km² (1989) to 2669 km² (2019). Forecasting with a CA–ANN model under the SSP585 scenario predicts by 2049 a 58 km² rise in settlements, 140 km² increase in aquaculture, 55 km² decline in vegetation, and a 5% increase in salinity. These insights support sustainable land use planning, resource management, and climate adaptation strategies for the vulnerable Sundarbans region.

Smart Techno-Receptive Orchard Management System: The ICAR-CISH, Lucknow has developed a Smart Techno-Receptive Orchard Management System for mango that integrates IoT, sensors, weather forecasting, and automation for real-time monitoring of soil moisture, canopy health, pests, microclimate, and irrigation. Sensor-based optimization of canopy and input management reduced water and fertilizer use by 20–30% and increased fruit yield by 30%. Fruit bagging further improved fruit quality, producing export-grade mangoes with a 40–50% higher market value. The model is suitable for high-density and rejuvenated orchards, enhances climate resilience, and supports sustainable, data-driven farming through real-time decision-making.

Drought stress tolerance in banana: Field evaluations for drought stress tolerance on selected banana genotypes (AAB and ABB) indicated that some of the ABB genotypes, specifically 'Kaitkhullung,' 'Kachkel,' 'Nutepong,' and 'Kechulepa', as well as the AAB genotype 'Dasaman,' exhibited resilience to soil moisture deficit during the critical flowering stage. Reductions in yield and yield parameters for these tolerant genotypes were contained within a narrow range of 1.75–5.65%, demonstrating superior performance compared to susceptible genotypes, which suffered higher yield losses (27.75–36.25%).

Efficient irrigation system in grapes: Subsurface irrigation with moderated fertigation identified as watersaving without yield loss in Crimson Seedless grape. The use of soil moisture sensors in conjunction with ET and pan evaporation led to irrigation water saving of 17.67 and 36.15%, respectively, over currently recommended irrigation schedule based upon pan evaporation and crop growth stage for Thompson Seedless. Soil moisture sensor as a tool to improve water use efficiency in grapes was developed in collaboration with TIH-IIT, Mumbai.

A MaxEnt model-based assessment of coconut: A MaxEnt model-based assessment of habitat suitability for coconut cultivation under future climatic conditions revealed that the bioclimatic variables, namely temperature seasonality, temperature annual range and precipitation, are the major contributors that determine climate suitability for coconuts in India. Projections suggest that some current coconut cultivation regions will become unsuitable (plains of South interior Karnataka and Tamil Nadu), requiring a crop change, while other areas will require adaptations in genotypic or agronomic management (east coast and the south interior plains). In other regions, the climatic suitability for growing coconut will increase (west coast).

12. Agricultural Education

The Agricultural Education Division of the Indian Council of Agricultural Research (ICAR) continued to play a pivotal role in strengthening India's agricultural human resource base during the reporting year through strategic interventions in higher education, quality assurance, digital transformation, and innovation-led capacity building. Under the flagship scheme Strengthening and Development of Higher Agricultural Education in India, financial and academic support was extended to 77 ICAR-accredited institutions, encompassing State Agricultural Universities (SAUs), Central Agricultural Universities, ICAR-Deemed Universities, and Central Universities with agriculture faculties. Quality assurance remained a cornerstone, with the National Agricultural Education Accreditation Board (NAEAB) conducting 35 peer reviews in 2025, resulting in accreditation approval for 23 institutions. Concurrently, experiential and field-oriented learning was reinforced through the Student READY programme, under which 19,852 undergraduate students completed RAWE training and 545 Experiential Learning Modules were operational, including 50 newly added modules focusing on agri-entrepreneurship and sustainable farming practices. Attracting and nurturing talent continued through transparent national-level admissions and scholarship mechanisms. The CUET-UG and ICAR entrance examinations facilitated admissions to UG, PG, and PhD programmes, drawing over 1.8 lakh applicants across levels. During the year, 3,970 UG and 2,899 PG students received National Talent Scholarships, while 1,046 ICAR-PG scholarships and 623 JRF/SRF awards were conferred. International academic cooperation was strengthened through ASEAN–India and BIMSTEC fellowship programmes. Significant investments were made in infrastructure development, with ₹246 crore allocated for modernization of teaching and learning facilities, including new hostels, examination halls, smart classrooms, and laboratory upgradation. Targeted support under DAPST/TSP, SCSP, and NEH components ensured inclusive growth, benefitting over 50,000 stakeholders through skill development programmes, demonstrations, scholarships, and livelihood interventions. Digital knowledge dissemination was scaled up through Krishikosh, which now hosts over 3.25 lakh digital items comprising more than 55 million pages. Capacity building of faculty and scientists was strengthened through 62 academic training programmes and 27 CAFT initiatives. ICAR-NAARM emerged as a national hub for research management, policy advocacy, digital learning, and agri-entrepreneurship, delivering 88 training programmes, publishing 62 research papers, and supporting high-impact startups through its a-IDEA incubator. Collectively, these efforts underscore ICAR's commitment to developing a skilled, innovative, and socially inclusive agricultural workforce aligned with national priorities of sustainability, food security, and rural transformation.

Agricultural Human Resource Development

The ICAR, through its Agricultural Education Division, implemented the scheme "Strengthening and Development of Higher Agricultural Education in India" to enhance the quality of agricultural education nationwide. The programme offers financial support to ICAR-accredited agricultural universities, including 66 State Agricultural Universities (SAUs), 4 ICAR-Deemed Universities, 3 Central Agricultural Universities (CAUs), and 4 Central Universities with agriculture faculties. Its core objectives include upgrading infrastructure, modernizing learning environments, and fostering student and faculty development to attract young talent to agriculture.

The scheme promotes a holistic educational approach by integrating theory with hands-on experience through Experiential Learning Modules, encouraging innovation and entrepreneurship among students. Sustainability is another key focus-training under the programme equips future professionals to promote food security, adopt climate-resilient practices, and support rural development.

However, the sector still faces challenges that must be addressed to enhance agricultural productivity, encourage environmentally friendly practices, and improve rural livelihoods. The National Agricultural Education and Research System (NARES) plays a crucial role in this, linking education with research and extension services to drive innovation and long-term sustainability in Indian agriculture.

Quality assurance of higher agricultural education: Accreditation is a continuous process

conducted by the National Agricultural Education Accreditation Board (NAEAB) of ICAR, based on requests from eligible universities offering agricultural degree programmes. In 2025, a total of 35 peer reviews of Higher Agricultural Educational Institutions were conducted to assess and accredit universities as per Deans' Committee reports, BSMA recommendations, the ICAR Model Act, and Board guidelines developed over the past 25 years. Of these, 23 universities (including appeals and ATRs) were approved for accreditation, while 12 were not approved. The Board also received 10 appeals, of which 4 were approved. From January 2025, 34 applications were received for Institutional Eligibility of Accreditation. 14 PRTs have been/are being constituted and SSR verifications are underway. The remaining 20 applications were returned to universities for quality improvement and resubmission as per ICAR recommendations.

Student READY: Rural Agricultural Work Experience (RAWE) and Experiential Learning Modules (ELMs) are key components of the undergraduate agriculture curriculum, typically conducted in the 7th semester under the Student READY programme. These initiatives expose students to real-world rural challenges, enabling them to apply multidisciplinary and participatory approaches to field issues. An online portal supports data recording for better monitoring. Students engage directly with farmers, sharing knowledge on new technologies, crop protection, and other advancements. Practical experience includes managing commercial farms, visiting progressive farmers, and exploring agri-industries to understand business operations. These hands-on activities bridge theory and practice, tailored to discipline-specific needs. To enhance communication, students also participate in regular presentations and interactions. In the previous year, 19,852 students completed RAWE training. Currently, 545 Experiential Learning Modules are active, with 50 new ones added last year. These ELMs have been supported in various profitable areas of processing, bee keeping and honey processing, natural farming, vermicomposting, mushroom production, etc. These efforts promote sustainable agriculture while enhancing student skills and rural engagement.

Common University Entrance Test (CUET) for Admission to Undergraduate programmes: Admission to 12 undergraduate (UG) degree programmes for 5,842 ICAR All India Quota (AIQ) seats and for the Award of National Talent Scholarship (NTS) was held through the Common University Entrance Test (CUET) conducted by the National Testing Agency (NTA). CUET-UG attracted 1,35,656 applications of which the number of female and male candidates were 70,143 and 65,513, respectively. Among the categories, OBC (NCL) candidates were highest (62,346) followed by General (38,096), SC (14,907), General-EWS (12,198) and ST (8,109). For admission to 4896 ICAR AIQ seats in 81 PG programmes and for award of ICAR-PG scholarship and NTS, a total of 30,514 applicants (14,924 Female + 15,590 Male) appeared in the 29th AIEEA (PG)-2024. Among the categories, OBC (NCL) candidates were highest (12,017) followed by General (9,040), SC (4,518), ST (2,658) and EWS (2,281). Admission to 2,298 ICAR AIQ seats in 80 PhD programmes was through 29th AICE-JRF/SRF (PhD)-2024. A total of 15,938 applicants (8,501 Female + 7,435 Male) of different categories, OBC (NCL)-5,750, General-5,057, SC-2,619, ST-1,299 and EWS-1,213 participated in the AICE.

During the year 2024, NTS was provided to 3,970 new UG and 2,899 new PG students; and 600 and 299 students were awarded ICAR PGS and ICAR JRF/SRF for Master's and Doctoral studies, respectively.

Award of Fellowships and Promotion of Excellence: ICAR's fellowship schemes continued to nurture scientific talent at all academic levels. To recognize academic merit and promote higher agricultural education, ICAR awarded ICAR-PG Scholarships, JRF/

Milk processing unit and products | Students learning apiculture | Apparel production

SRF (PGS) to postgraduate and doctoral students in various disciplines of agriculture and allied sciences. During 2025-26, 1,046 students were awarded ICAR–PG Scholarships and 623 students received ICAR–JRF/SRF (PGS) for Master's and Doctoral studies. In addition, Internship Allowance was provided to 1,434 Veterinary graduates trained by Agricultural/Veterinary Universities.

National Talent Scholarship (NTS): Merit-based National Talent Scholarships (NTS) were provided to undergraduates and postgraduates admitted to Agricultural Universities through ICAR's All India Entrance Examination (AIEEA). During the year, 5,999 UG and 2,879 PG students received NTS awards.

BIMSTEC Scholarship: Under the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) framework, India offers six scholarships each for Master's and PhD programmes in Agriculture. During the period, two students from Myanmar were selected for the Master's degree programme.

ICAR National Professor/National Fellow/ Emeritus Scientist/Emeritus Professor: To promote excellence in agricultural research and education, ICAR supported five National Professors and four National Fellows during the reporting period. Additionally, 26 Emeritus Scientists and 36 Emeritus Professors contributed to advanced teaching, student mentorship, research guidance, and development of instructional materials and e-learning resources.

Capacity Building: A total of 62 Summer/Winter Schools and Short Courses (37 long-term and 25 short-term) and 27 CAFT programmes were organized at ICAR institutes and SAUs, training 2,047 faculty members (1,368 Male and 679 Female). All training activities were monitored through the online workflow-based management system.

Digitization of Resources

E-Granth: Krishikosh (https://krishikosh.egranth.ac.in/) is a national digital repository developed to capture, preserve, archive, and provide policy-based access to the intellectual output of the Indian National Agricultural Research and Education System (NARES). It serves as a unique platform for knowledge in agriculture and allied sciences, hosting a vast collection of theses, old and valuable books, institutional publications, technical bulletins, project reports, lectures, preprints, reprints, records, and other important documents from Research Institutions and State Agricultural Universities (SAUs) across India. The repository allows NARES institutions to upload and manage their own content in compliance with the open access policy of ICAR. As of September 2025, Krishikosh houses over 55 million digitized pages across more than 3.25 lakh digital items, including over 2.15 lakh theses from various NARES institutes and SAUs. Between April and September 2025 alone, more than 4,600 theses were uploaded by different institutes, contributing to a total of 35.5 million website hits since April 2018, with 4.5 million hits recorded during April-September 2025. Krishikosh provides a single, unified platform for exposing and sharing the intellectual outputs of NARES, offering researchers seamless access to diverse media types, thereby making information search and retrieval much easier and faster.

Strengthening and Modernizing teaching and learning facilities in agricultural universities: The financial assistance of ₹246 crore was provided under the component 'Development and Strengthening of AUs' during the year. The financial assistance was provided for one auditorium, 24 new hostels (4 boys, 3 international and 17 Girls), and 5 examination halls. The financial assistance was also provided for modernization and upgradation of the infrastructure pertaining to teaching and learning. Teaching facilities have been further enhanced with additional support for 70 smart classrooms. Undergraduate and postgraduate laboratories were strengthened with necessary minor/ major equipments for enhancing the practical experience of students as well as research.

Development of Action Plant on Scheduled Tribe (DAPST)/ Tribal sub Plan (TSP):

Twenty four Agricultural Universities were supported with financial assistance of ₹3,175.83 lakh under this component. Several activities were conducted by the Agricultural universities, viz. 320 Capacity Building/ Skill Development programmes on sericulture, backyard poultry, value added products from waste, biofertilizer production, duckery, piggery, mushroom cultivation, processing and marketing, vegetable gardens, etc. In addition, 550 demonstrations, awareness camps, exposure visit, and On Farm Trial (OFTs) were conducted along with distribution of inputs as a starting

Educating farmers on stem borer damage symptoms

Women Self Help group – Tribal Society

Adoption of Trenching and Mulching practices

Training programme on skill enhancement of farm women for employment generation

Training programme on livestock rearing and animal health camp

Turmeric processing

material. Services/ Facilitation like, Animal Health Camps, Testing samples of soil, plant, water, feed, fodder, and livestock, etc. and distribution of Literature were undertaken for over 12000 beneficiaries. 1,834 ST students awarded stipend under READY component.

Support under Scheduled Caste Sub Plan (SCSP): Support under the SCSP component was provided to 36 agricultural universities, with a total fund of ₹5,029 lakhs released in 2024-25. This assistance targets Scheduled Castes in identified clusters, focusing on training and capacity building. Activities included 415 skill development programmes, 21 frontline demonstrations/ on-farm trials, 65 tutorial classes benefiting 666 students, and 128 awareness camps/exposure visits. 3,776 SC students were awarded scholarship and stipend under READY component.

Inputs like seeds, nursery management, bio-fertilizers, poultry, plant protection chemicals, animal feed, medicines during animal health camps, etc. were distributed. Infrastructure improvements included aquaculture ponds, vermicomposting setups, and health camps. Livelihood programmes covered fisheries, piggery, integrated farming, beekeeping, mushroom cultivation, nutrigardens, FPOs, and custom hiring centers. Additionally, funds were provided for books and e-resources for Scheduled Caste beneficiaries at the university level. The total beneficiaries numbered 20,000.

Support under North Eastern Hill Region (NEH): During the year 2024-25, ICAR through its scheme of Agricultural Education Division supported the agricultural universities established in NEH Region for infrastructural development and also for new civil works with ₹3,820.00 lakh. Among new civil works, 3 new girls hostels, and 10 smart classrooms have been supported. Undergraduate and Post graduate laboratories have been modernized/upgraded and equipped with new minor equipments. Support was also provided for training and capacity building programmes, viz. Tutorial and competitive classes, holistic development of students, library strengthening with additional print books, reference books, e-books, ICT tools and accessories and other logistics has helped in better learning and advanced research. 1,548 students awarded scholarships/Fellowships/stipend under this component.

Coordination with AUs: To provide an opportunity to the Vice-Chancellors of AUs to interact with each other and develop strategy for effective functioning in order to maintain quality standards in higher agricultural education in the country as well as for effective implementation of the newer initiatives, the Conference of Vice Chancellors', Directors and Industries was held on, 20 May 2025. Meeting of Nodal Officers of Agricultural Education Division was held on 7 February 2025 at AAU, Assam, and Comptroller meet on 12 February 2025 in UAS, Bangalore.

ICAR-National Academy of Agricultural Research Management (NAARM)

ICAR-NAARM continues to serve as a leading institution driving excellence in research management, academic innovation, digital learning, and entrepreneurship development — reinforcing its pivotal role in shaping India's agricultural transformation and knowledge ecosystem. The academy contributed significantly to research, training, academic excellence, and entrepreneurship promotion within the National Agricultural Research and Education System (NARES).

Research and Policy Advocacy: Under its Think-Tank Policy mandate, NAARM produced a series of policy papers and reports on themes of national importance, including agriculture's role in Achieving Net-Zero Emissions by 2070, Viksit Goa 2047, Enabling Women Agripreneurs in India, Global Best Practices for Agricultural Universities, and Promotion and Regulation of Agro-Eco-Tourism in Goa. During the year, the academy published 62 research papers, 20 book chapters, 10 books, 13 technical bulletins/training manuals, and 8 popular articles, while two copyrights were filed and registered.

The 29th Institute Research Council (IRC) meeting was held on 5–6 November 2024, reviewing the progress of 30 in-house and 9 extra-mural projects. The 65th and 66th Institute Management Committee (IMC) meetings, chaired by Dr. Gopal Lal, were conducted on 20 January 2025 and 25 August 2025, respectively.

A FOCARS Syllabus Review Committee, chaired by Dr. P.L. Gautam, was constituted by ICAR to revise the Foundation Course for Agricultural Research Service (FOCARS). The committee met thrice between April and May 2025, aligning the programme with emerging scientific and organizational needs. The updated syllabus has been implemented for the 114th and 115th FOCARS batches.

Training and Capacity Building: NAARM organized 88 capacity-building programmes, benefitting 5,685 participants from ICAR institutes, agricultural universities, and other organizations. These programmes covered research management, leadership, administrative efficiency, and student sensitization. Two Foundation Courses for Agricultural Research Service (114th and 115th batches) were conducted with 107 and 105 scientists, respectively.

Major training programmes included the XXXIII Management Development Programme on Leadership Development (Dec 2024), Short Course on Strategic Science Communication (Jan-Feb 2025), Foundation Course for Administrative and Finance Officers (Mar-Apr 2025), and Pre-RMP Leadership Programme (June 2025). A Brainstorming Session with Deans of Agricultural Universities (27–28 May 2025) promoted dialogue on future academic collaborations and research leadership.

Academic Achievements: The two-year PGDM-ABM programme, approved by AICTE and accredited by NBA with MBA equivalence from AIU, continues to strengthen NAARM's academic standing. The academy secured a position in the 101–125 band in NIRF 2025 (Management category) among 1,026 institutions.

The 15th batch (2023-25) of PGDM-ABM completed its programme with 100% placement across 30 reputed agribusiness companies, offering packages between ₹10.84–16.42 lpa (average ₹11.05 lpa). The 16th batch (57 students) completed internships in 22 companies, while the 17th batch (62 students) commenced coursework. The V Graduation Ceremony (26 April 2025) awarded certificates to 176 graduates, presided over by Padma Bhushan Dr. R.S. Paroda, former Secretary (DARE) and DG (ICAR). NAARM also hosted its national B-fest "SANKALP 10.0" on 27–28 September 2025, showcasing student innovation and industry interface.

Digital Initiatives: Through the Centre of Lifelong Learning in Agricultural Education (COLLAgE), NAARM advanced digital education and content development. 96 educational videos were produced on diverse themes, including food packaging, teaching management, and educational technology. Three MOOCs on Digital Assessment Methods, Artificial Intelligence in Agriculture, and Milk Processing and Value Addition benefitted 6,824 learners nationwide. A new teleprompter system was installed to improve the quality and professionalism of recorded lectures.

Start-ups and Agri-preneurship: The Academy's Technology Business Incubator, a-IDEA, reinforced its leadership as a national platform for agri-entrepreneurship. It organized the National Conference on "Building Sustainable Agricultural Start-ups in India" (12–13 Nov 2024) and launched Agri Gativardhan, an FPO Accelerator Programme to strengthen productivity, governance, and market linkages.

Key initiatives included rural startup training, export readiness workshops, entrepreneurship development, and international knowledge exchanges such as the Train-the-Trainers Workshop with BIRAC and FCDO. The flagship accelerator AGRI UDAAN 7.0 shortlisted 21 startups, while Demo Day connected 105 investors and ecosystem partners. Funding support was channelled through NIDHI PRAYAS, BIRAC BIG, NABARD Catalytic Capital Fund, and DPIIT-SISF programmes.

a-IDEA-supported startups gained national and international recognition through awards, investor funding, and global showcases including CII CIES ICONN, Startup Mahakumbh, and the Millet Stakeholders Summit. The incubator continues to drive rural transformation through farmer-startup partnerships, leadership programmes for FPO CEOs, and capacity-building collaborations with NABARD and BIRAC.

A visit by Shri P. Prasad, Minister of Agriculture, Kerala (17 Oct 2024) strengthened policy-level engagements to support startup linkages for Kerala's agri-ecosystem.

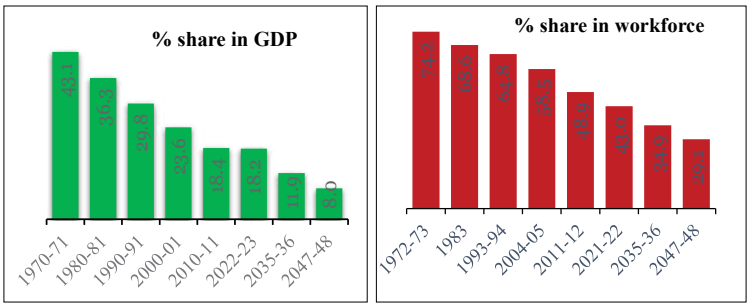
Collaborations and Partnerships: To strengthen academic and entrepreneurial linkages, NAARM signed MoUs with four universities — Acharya N. G. Ranga Agricultural University (4 Oct 2024), Vignan's Foundation for Science, Technology and Research (23 Oct 2024), Professor Jayashankar Telangana Agricultural University (6 Mar 2025), and Janardan Rai Nagar Rajasthan Vidyapeeth (15 Aug 2025). a-IDEA also entered a tri-partite agreement with ICAR-IIOR and Isaayu Agritech (23 Oct 2024) to promote oilseed innovations and an MoU with Impact Hub Hyderabad (6 May 2025) to facilitate international fundraising and global scaling of startups. These partnerships aim to enhance postgraduate research, entrepreneurship, and faculty development.

13.
Social Sciences

India's pathway toward becoming a developed nation by 2047 will involve profound transformations in its agricultural sector, shaped by economic restructuring, demographic shifts, technological innovations, and evolving food systems. The share of agriculture in net domestic product is projected to decline from about 18% in 2022-23 to nearly 8% by 2047, while its workforce share is expected to reduce from 43% to 29%, intensifying urbanization and altering patterns of food demand in coming future. At the same time, food requirements are projected to at least double, especially for horticultural and animal-based products, even as average landholding size contracts to around 0.6 hectare, placing stress on land and water resources in different agroclimatic regions. Changing consumption patterns, marked by higher intake of processed and animal-source foods, demand realignment of agricultural policies to balance economic opportunities with public health risks. India also faces a complex nutritional challenge, with declining child undernutrition but rising overweight and obesity among women; intra-household double burden of malnutrition increased from 5.96% to 7.57% between 2015-16 and 2019-21. Public investment in agriculture has grown eightfold in real terms since 1990-91, reaching ₹4,415 billion in 2022-23, although expenditure shares have fluctuated. Irrigation infrastructure has expanded significantly, with net irrigated area rising to 79 million hectares, supported by renewed growth in canal irrigation after 2015-16 under PMKSY. Renewable energy options, particularly the conversion of bovine dung into biogas and bio-CNG, demonstrate strong potential for energy security, capable of producing up to 21.8 million tonnes of bio-CNG alongside organic fertilizers. Farmer Producer Organizations (FPO) are emerging as key institutional mechanisms, though their sustainability depends on extended support, improved governance, and enhanced access to credit. Digital and scientific initiatives, including Food Loss Index integration, eLISS livestock surveys, and genomic and bioinformatics platforms, highlight the growing role of data-driven innovation in ensuring productivity, sustainability, and resilience of Indian agriculture production system by 2047.

Agriculture Economic Policies for Enhancing Agricultural Productivity (ICAR-NAIP, New Delhi)

Indian Agriculture to 2047: India's vision of achieving the status of a developed nation by 2047 will be characterized by significant structural changes in its economy and demographics. The share of the agricultural sector in the net domestic product is projected to decrease from approximately 18% in 2022-23 to 8% . Its share in the workforce is expected to decline from 43% to 29%. Such a transition is likely to spur urbanization. Given the economic and demographic shifts, India's food demand is projected to at least double, particularly for horticultural and animal products.

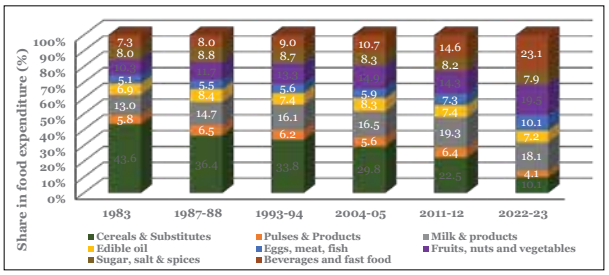


Share in GDP and workforce

While producing more food remains as urgent as ever, agriculture may face a confluence of biotic and abiotic pressures. Urbanization and industrialization are expected to exert significant pressure on land and water resources. By 2047, the average landholding size is anticipated to decrease to 0.6 hectare from the current one hectare. Other significant challenges include low efficiency of fertilizer and water use, lock of funds for agricultural research and underdeveloped value chains.

Realigning agricultural policies to evolving consumer preferences: Over the past four decades, India's food consumption patterns have undergone a significant transformation, shifting from a diet predominantly based on cereals to one enriched with nutrients owing to rapid economic growth and urbanization. This shift is particularly evident in the increased consumption of animal-source foods, horticultural products, beverages and fast foods.

These evolving consumption patterns indicate restructuring of agriculture and agriculture policies to align with changing demand. The growing demand for processed

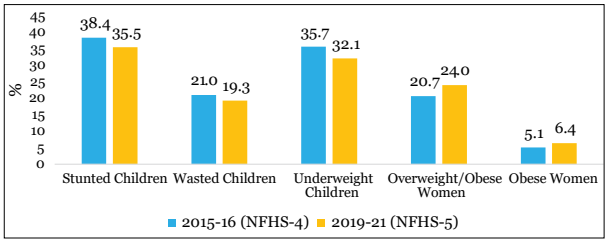


Changes in household food consumption patterns in India
Source: Authors' estimates based on National Sample Survey - Consumption Expenditure Surveys data

foods in India presents both opportunities and challenges. While it may drive economic growth in the food processing industry and generate new employment opportunities, it also raises concerns about its potential impact on public health.

India's intra-household dual burden of malnutrition: Malnutrition in India remains a complex and multifaceted issue, with both undernutrition and overnutrition posing significant challenges for public health. Between 2015-16 and 2019-21 there has been a reduction in child malnutrition, particularly in terms of underweight and stunting, while not much in wasting. At the same time , there has been a troubling increase in overweight and obesity among women, with the prevalence of overweight or obesity rising by 3.3 percentage points and obesity by 1.3 percentage points between 2015-16 and 2019-21.

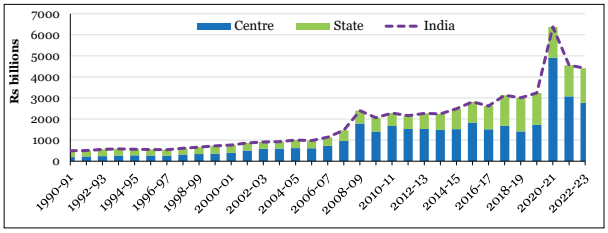
Furthermore, the intra-household double burden of



Prevalence of malnutrition (%) in India
Source: National Family Health Survey Round-4 (2015-16) and Round-5 (2019-21).

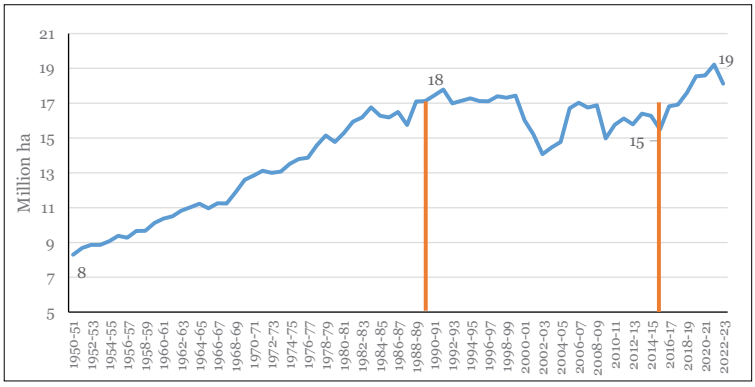
malnutrition (DBM) has become a significant concern, characterized by the concurrent presence of different forms of malnutrition in a household. The most prevalent manifestation of DBM is overweight or obese mothers with stunted children (OWOBM-SC), which increased by 1.15 percentage points between 2015-16 and 2019-21. The prevalence of other forms of DBM, such as overweight or obese mothers with underweight children (OWOBM-UC) and wasted children (OWOBM-WC), has also increased. The overall prevalence of intra-household DBM among mother-child pairs, encompassing all forms of child malnutrition, increased from 5.96% to 7.57%.

Public investment in Indian agriculture: Since 1990-91, inflation-adjusted public investment in the agricultural sector and for the agricultural sector in India has increased eightfold from ₹498 billion to ₹4,415 billion in 2022-23. This increase has been accompanied by a notable shift in the contributions of the central and state governments. In the early 1990s, their contributions were nearly equal; however, over time, the central government's share has increased substantially, exceeding 60% in the last decade. This reflects the central government's increasing focus on agricultural development in recent years. However, the proportion of public expenditure allocated to agriculture has varied over time. It declined from an average of 5.4% between 1990-91 and 2002-03 to 2.7% during 2003-04 to 2007-08. A resurgence occurred in 2020-21, with the allocation rising to 5.28% before settling at 4.22% in 2022-23.



Public investment in agriculture and allied activities (at 2011-12 prices)
Source: GoI (Government of India); State Finances: A Study of Budgets, Reserve Bank of India (RBI).

Performance of irrigation infrastructure: The expansion of irrigation in India has been remarkable, with the net irrigated area increasing 3.7 times from 21 million hectares in 1950-51 to 79 million hectares in 2022-23. This led to an increase in irrigation coverage from 17.6% to 56.4%. groundwater has the greater stability than canal irrigation. Irrigation intensity has also improved. A significant development in the irrigation sector is the reversal of prolonged stagnation in the canal-irrigated area. Following a notable increase from 8 million hectares in 1950-51 to 18 million hectares in 1990-91, the canal-irrigated area decreased to 15 million hectares by 2015-16. However, post-2015-16,



Trend in the canal irrigated area in India
Source: Land Use Statistics, Ministry of Agriculture & Farmers' Welfare (MoA&FW), GoI

the canal-irrigated area began to expand, reaching 19 million hectares in 2021-22. These positive changes are attributed to the convergence approach in implementing irrigation schemes under the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) in 2015-16.

Potential of dung for energy security and sustainable agriculture: Bovine dung has long been recognized as a source of renewable energy for domestic purposes and organic fertilizers for crop production. However, a new perspective has emerged on the utility of dung as biogas and bio-compressed natural gas (CNG), while maintaining its traditional use as an organic fertilizer. India produces approximately 1,271 million tons of wet dung, of which 35% is converted into cakes for domestic fuel use, while the remaining 65% is used as manure in crop production. This utilization pattern yields 6.28 million tons of fertilizer. In an alternative scenario, where 65% of the dung manure is converted into biogas and subsequently into bio-CNG, it may yield 14.20 million tonnes of bio-CNG, in addition to 6.28 million tons of fertilizer. If the entire dung available were to be converted into bio-CNG, it could generate 9.66 million tons of fertilizer and 21.80 million tons of bio-CNG.

Potential of dung as a source of bio-CNG and fertilizers

Particulars	Dung use scenarios		
	65%: manure, 35%: cake	65%: bio-CNG, 35%: cake	100%: bio-CNG
Biogas produced (billion m^3)	--	30.98	47.70
Bio methane/Bio-CNG produced (million tonnes)	--	14.20	21.80
Fertilizer nutrients (NPK) (million tonnes)	6.28	6.28	9.66

Performance of Farmer Producer Organizations (FPOs): FPOs have emerged as crucial instruments for agricultural development in India with government support. These organizations play a significant role in various aspects of the agricultural value chain, from production to marketing, and their impact is apparent. However, a large number of FPOs face challenges in improving their economic viability due to several economic and organizational factors, including maturity level, membership size, spatial coverage, equity, access to institutional credit, and good governance.

The current three-year support period for FPOs is inadequate and should be extended to at least eight years to ensure sufficient financial and technical assistance. To achieve economies of scale and enhance their bargaining power, FPOs should target a minimum membership of one thousand farmers and an equity capital of at least Rs 1.8 million. Access to credit is another crucial factor, and it is recommended that FPOs secure Rs 7.5 million, which is at least three times the current average. The governance structure of FPOs should be streamlined for efficiency while ensuring inclusivity, particularly for marginalized groups, such as small and marginal farmers, women, and scheduled castes.

Statistical Designs for Agriculture (ICAR-IASRI, New Delhi)

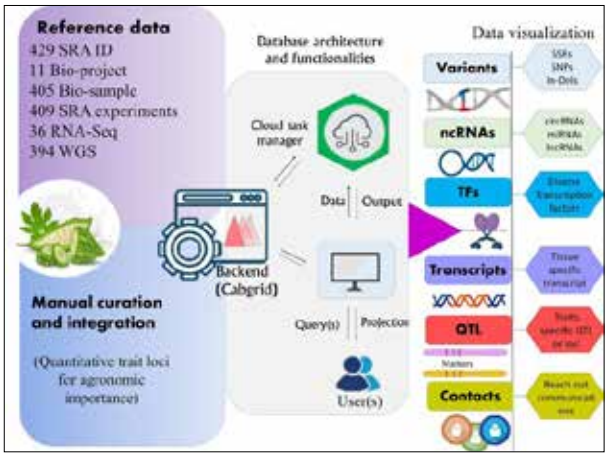
Food Loss Index (FLI) for India for inclusion of the SDG indicator 12.3.1 in the National Indicator Framework of India: The Food Loss Index (FLI) for India was compiled by ICAR-IASRI using the FAO's methodology and ICAR-IASRI's year-wise estimation method developed under the FAO-funded study "Reviewing the FLI Estimates for India and Preparing Assessment Report for Inclusion of SDG Indicator 12.3.1 in the National Indicator Framework (NIF) of India,". The FLI compilation is based on three national post-harvest loss (PHL) surveys conducted using a methodology jointly developed by ICAR-IASRI and ICAR-CIPHET, Ludhiana. Two alternative FLI variants were produced: (i) Country FLI with 2005 as the base year and (ii) FLI with 2015 as the base year for SDG monitoring and international comparison. The High-Level Steering Committee (HLSC), MoSPI, approved the inclusion on 9 May 2025 (MoM dated 19 May 2025). Accordingly, SDG Indicator 12.3.1a "Food Loss Index" has been officially included in India's National Indicator Framework 2025, with the Ministry of Food Processing Industries (MoFPI) designated as the data source and reporting periodicity set at five years.

Integrated Sample Survey Solution for major Livestock Products: eLISS has achieved several transformative milestones in advancing digital transformation, data security, and operational efficiency in livestock statistics management across India. To ensure scalability, reliability, and uninterrupted nationwide operations, the eLISS End-to-End Solution was successfully migrated to the AWS infrastructure. During this migration, more than 5.42 crore records pertaining to various Integrated Sample Survey (ISS) schedules, data from 57,000 commercial poultry farms, and over 03 crore records from the 20th Livestock Census were restored with complete data integrity.

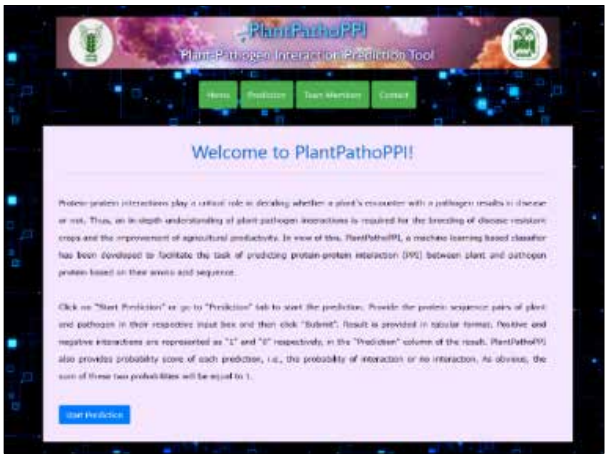
Presently, more than 18 versions of the eLISS Data Collection App have been released on the Google Play Store, incorporating numerous feature enhancements, security improvements, and monitoring functionalities. Using the eLISS end-to-end solution, National/State/UT/District-level estimates for the number of animals and production of major livestock products i.e. milk, meat, egg, and wool were successfully generated for the year 2023–24. The system has achieved remarkable operational coverage, with more than 3.58 crore households/enterprises surveyed across over 2.12 lakh villages/urban wards. Additionally, more than 61,000 commercial poultry farms and 1,900 slaughterhouses have been recorded and surveyed through eLISS. At present, 36 State/UT officials and 758 district officials are actively overseeing survey operations, supported by over 19,000 active enumerators and 8,100 active supervisors who are utilizing the eLISS End-to-End Solution in real time across the country.

Database Developed: Natural Products Database for Crop Protection (NatProCP) database has been developed which is a curated repository of plant-derived natural products reported in scientific literature. The database contains 262 plant species of 5,281 compounds, collected through text mining approaches. DPNP database provides 3D structures of all the compounds as well as physiochemical properties, ADMET (absorption, distribution, metabolism, excretion, and toxicity) and drug-likeness properties of the compounds. Additionally, the DPNP database provides library of these compounds in single files (SDF and PDB file formats) for use in virtual screening.

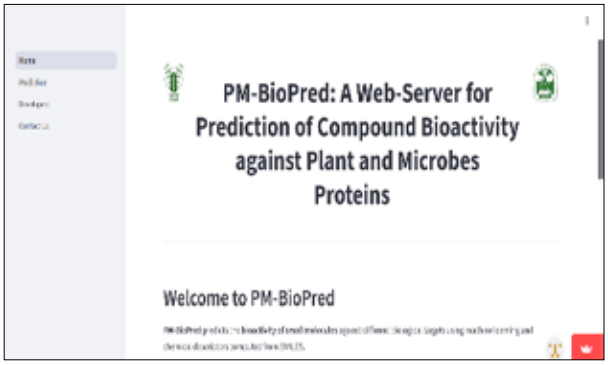
BgDB: a comprehensive genomic resource information system of bitter gourd for accelerated breeding programme: Development of BgDB, a comprehensive genomic resource database for bitter gourd (*Momordica charantia* L.) designed to accelerate breeding programs for this medicinal vegetable. BgDB consolidates scattered genomic information into a user-friendly platform, providing extensive data on 114,598 transcripts, 4,914 differentially expressed genes, 32,570 simple sequence repeat markers, 162,850 primers, and numerous molecular variants including SNPs, indels, noncoding RNAs, and transcription factors. It also integrates manually curated quantitative trait loci (QTL) linked to key agronomic traits. The database facilitates in-depth molecular characterization, genetic diversity analysis, and trait fine-tuning, aiding breeders and researchers in developing improved bitter gourd varieties with enhanced productivity and valued traits. Validation through SSR marker amplification confirmed the database's reliability for molecular genetics studies. It is freely accessible online to support global scientific and breeding efforts.



PlantPathoPPI (Protein-Protein Prediction between Plant and Pathogen): It is a novel ML-based model to predict plant-pathogen protein–protein interactions (PPIs). It achieved ~97% accuracy in PPI prediction, outperforming existing computational tools. It is freely available as a web tool at https://plantpathoppi.onrender.com/ alongside a Python package on https://pypi.org/project/plantpathoppi-ml/ to support crop protection strategies. This research contributes significantly to the field by offering an efficient tool for predicting PPIs in plant-pathogen systems, providing valuable insights into plant diseases and supporting hypothesis-driven research.



A Web-Application for Prediction of Compound Bioactivity against Plant and Microbes Target Proteins: PM-BioPred is designed to predict the bioactivity of compounds against specific plant and microbial target proteins. The project involves sourcing bioactivity data, represented by IC50 values, from the ChEMBL database. The data encompasses interactions with proteins from plants, bacteria, fungi, and viruses. Compounds are categorized as active or inactive based on their IC50 values. The study converts molecular data into computational formats using SMILES notation and



extracts molecular descriptors to predict bioactivity. Various machine learning algorithms, such as Random Forest (RF), SVM, KNN, and AdaBoost, are employed to develop predictive models. RF is identified as the most effective model, with high accuracy across all categories. The optimal RF model is implemented in the web application, which predicts bioactivity for compounds in plants and microbes. This work contributes to computational biology by providing a tool for predicting the bioactivity of compounds, aiding in the identification of potential inhibitors or activators in plant and microbial research. PhytoMicroBioPred is made freely accessible in the form of web-application which is available at https://pmbiopred.streamlit.app/.

14.
Basic and Strategic Research

The National Agricultural Science Fund (NASF) continued to strengthen India's basic and strategic agricultural research ecosystem through high-impact, data-driven interventions across crops, animals, fisheries, natural resources, and social sciences. During 2024-25, NASF supported 60 ongoing projects, generating ~80 peer-reviewed publications, eight patents, and four technologies, reflecting strong research productivity and translational outcomes. Landmark achievements included the development of the world's first genome-edited rice varieties, DRR Dhan 100 (Kamala) with 35% higher yield and Pusa Rice DST1 with enhanced drought and salinity tolerance, alongside MSTN gene edited sheep, demonstrating 30% higher growth rates. Strategic advances were achieved in stress resilience, precision agriculture, and digital innovation, including AI-enabled wheat disease datasets comprising 26,561 images, Taluka-scale crop yield prediction models with up to 84% accuracy, and IoT-based smart veterinary and aquaculture systems. Sustainable resource-use technologies such as minimal-water jute retting reducing water use by 87.5%, PEGylated nano-sulphur enhancing oilseed yields by up to 20.4%, and eco-friendly botanical acaricides achieving 87.5% tick reduction were validated under field conditions. Breakthrough diagnostics included paper-strip sensors for ESBL-resistant E. coli, nano biosensors detecting antibiotic residues below regulatory limits, and molecular tools for plant and animal disease surveillance. In 2025-26, nine new projects were approved under Call XI, with a total outlay of ₹8.10 crore, addressing frontier areas such as pan-genomics, multi-omics stress tolerance, recombinant vaccines, visual pathogen detection, and nutrient-efficient mulching systems. Collectively, NASF research outcomes underscore a strong convergence of fundamental science, innovation, and sustainability, directly contributing to national priorities of food security, climate resilience, and farmer-centric technologies.

The 'National Agricultural Science Fund' (NASF) supports basic, strategic and applied agricultural research including Scientific Utilization through Research Augmentation- Prime Products/ Panchagavya from Indigenous Cows (SUTRA-PIC) and Extra Mural Research (EMR). Since inception, NASF has effectively implemented 282 projects involving about 282 lead centres and 531 cooperating centres located at different parts of the country. NASF is directly and indirectly involved in creating a stronger ecosystem and cohesion across the agricultural science research, generating more diverse outcomes, driving the nation's commitment towards sustainable and national development goals. During 2024-25, there were sixty ongoing projects. In 2025-26, out of fifteen proposals recommended by the Expert Committees, nine new projects were awarded under Call XI to nine lead centres and fourteen cooperating centres with a total budget of ₹8.10 crore, under six strategic areas covering novel aspects like pan-genome analysis in common bean and ginger, genome wide association analysis for drought and salinity in Dinanath grass, enhancing nutrient use efficiency in oilseeds, development of recombinant multivalent porcine viral vaccine, diagnostic tools for Nipah virus control in pigs, and development of visual detection method for bacterial pathogens in seafood.

Hon'ble Union Minister for Agriculture and Farmers' Welfare releasing the genome edited rice varieties

Salient achievements

During 2024-25, besides having around eighty research publications in reputed journals, NASF projects led to eight patents and four technologies. The research highlights of some selected projects are as follows:

Development of genome edited (CRISPR-Cas9/ Cpf1) rice varieties: The world's first pioneering

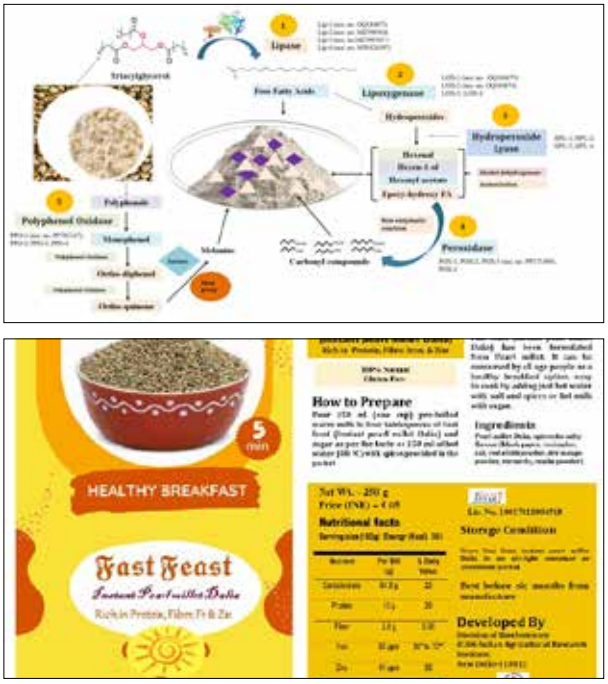
New Projects approved under Call XI of NASF during 2025-26

Title of the project	Centre	Budget (₹ in lakhs)	Total Cost (₹ in lakhs)
Harnessing genetic potential of underutilized wheat germplasm through pre-breeding for biotic stress resilience	*CSKHPKV, Palampur	49.096	100.0873
	*PAU, Ludhiana	25.7023	
	ICAR-NBPGR, New Delhi	16.90	
	#ICAR-VPKAS, Almora	8.389	
Pan-genome analysis of common bean (*Phaseolus vulgaris* L.) genotypes from the Northern Himalayan Region for enhanced disease resistance and agronomic performance	#SKUAST, Jammu	53.312	98.143
	#SKUAST, Kashmir	22.911	
	*#ICAR-VPKAS, Almora	21.92	
Pan-genome delineation and genome-wide association studies for NLRome and structural variation for seed sterility mapping in ginger (*Zingiber officinale Roscoe*)	ICAR- IISR, Kozhikode	65.46	99.858
	AICRP on Spices, CARS, Raigarh (IGKV), Raipur	16.695	
	ICAR-NIPGR, New Delhi	17.703	
Novel gene(s) discovery for drought and salinity tolerance using genome-wide association analysis and multi-omics studies in Dinanath grass (*Pennisetum pedicellatum*)	ICAR-IGFRI, Jhansi	58.26	96.47
	ICAR-NIASM, Baramati	27.56	
	ICAR-IIAB, Ranchi	10.65	
Deciphering the candidate genes and molecular mechanisms underlying for high tillering ability and dwarfness in Samundchini rice Mutant-S49 through integrated omic approaches	IGKV, Raipur	45.947	45.947
	BARC, Mumbai	0.00	
Development and validation of recombinant multivalent porcine viral vaccine and DIVA diagnostics	#CAU (Imphal), Aizawl	85.488	173.33693
	*NIAB, Hyderabad	39.33	
	TANUVAS, Chennai	48.51893	
Advancing Nipah virus control: combined surveillance and diagnostic tool development for pigs	#ICAR-NRC on Pig, Guwahati	52.36	92.113
	ICMR-NIV, Pune	39.753	
Development and application of recombinase polymerase amplification (RPA)-based visual detection method for zero-tolerant bacterial pathogens in commercially important seafood	*ICAR-CIFE, Mumbai	48.004	48.004
Preformed sprayable biopolymeric mulch to enhance nutrient use efficiency in oilseed crops	ICAR-IIOR, Hyderabad	50.96	56.21
	BITS-Pilani, Hyderabad Campus	5.25	

** Women PIs; # Centres of Northeast/Tribal/Hilly Area*

genome-edited rice varieties, *DRR Dhan 100 (Kamala)* and *Pusa Rice DST1*, have been developed. *DRR Dhan 100 (Kamala)*, a genome-edited version of the Samba Mahsuri variety, offers a 35% increase in grain yield. It is characterized by stronger stems, early maturity, vigorous growth, and enhanced photosynthetic efficiency. *Pusa Rice DST1* is a drought and salt tolerant variety derived from *MTU1010*, demonstrating significantly higher grain yield and overall productivity. The varieties were released by Hon'ble Union Minister of Agriculture and Farmers' Welfare, Shri Shivraj Singh Chouhan on 4 May 2025.

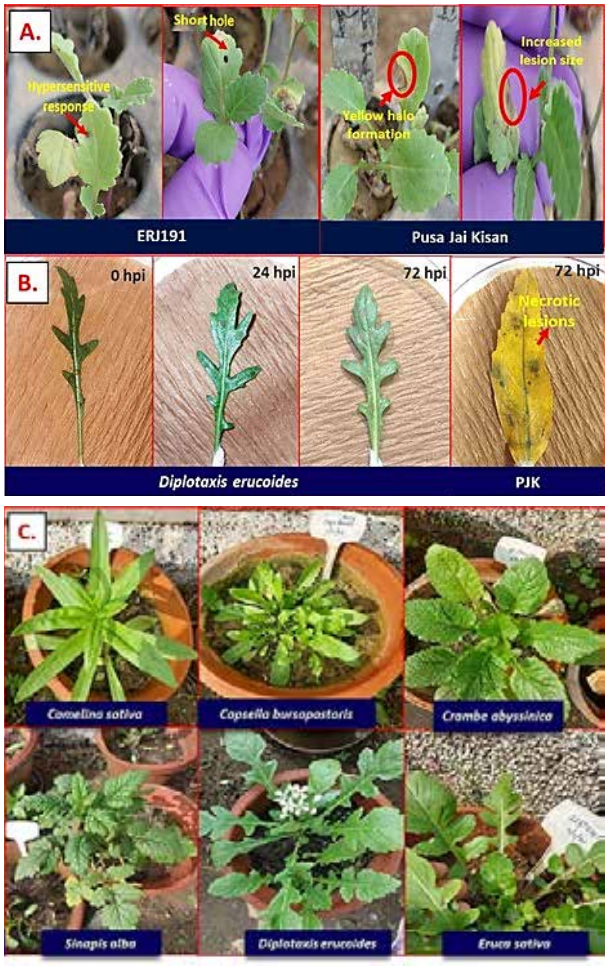
Identification of rancidity-associated genes in pearl millet and development of nutri-rich functional products: Transcriptome analysis of landraces and cultivars of pearl millet identified over 250 rancidity-related transcripts, with seven key genes cloned. Expression studies highlighted *Lip-1, Lip-2, Lip-4, LOX-3, POX-4,* and *PPO-3* as major contributors to rancidity. The *lipase* gene (~66 kDa) was partially purified (14.5-fold), and integration of transcriptome, proteome, and metabolome data mapped the rancidity pathway. Using these insights, "Divine Dough" with low glycemic index and high iron, zinc, and fibre was developed, along with



Development process of pearl millet-based dough with low glycemic index

pearl millet dalia with high fibre, resistant starch, and Fe/Zn, which was commercialized by Melwach Pvt. Ltd., New Delhi.

Management of major biotic (*Orobanche* and *Alternaria*) stresses in Indian mustard: Screening mustard germplasm for resistance to *Alternaria* blight revealed that 47 genotypes exhibited high resistance to *Alternaria*, with 25 resistant, 18 moderately resistant, and four susceptible. Six introgressed lines and two *Brassica juncea* genotypes with promising resistance to *Alternaria* were identified. Additionally, novel herbicide formulations, particularly metsulfuron methyl, were successfully tested for controlling *Orobanche* under hot-spot conditions in Rajasthan, improving weed control and seed yield. Biochemical analysis of resistant genotypes indicated higher antioxidant enzyme activity, supporting their resistance. Whole-genome resequencing of selected germplasm is ongoing to map resistance genes for future breeding efforts. The findings contribute to developing sustainable strategies for managing major biotic stresses in mustard.



Screening of *Brassica* germplasm and resistant responses against *Alternaria* blight disease under (A) *in-vitro* conditions, (B) detached leaf assay and (C) net-house conditions at ICAR-NIPB, New Delhi

Enhancement of abiotic stress tolerance in wheat and pearl millet: The research focused on wheat and pearl millet, addressing heat stress and evaluating the impact of melatonin seed priming and genetic diversity by epigenetic, physiological and molecular interventions. In wheat, melatonin priming improved plant architecture, germination, and oxidative stress mitigation under heat stress. All genotypes performed well post-priming, with the heat-tolerant variety RAJ-3765 showing the best results. Transcriptome data from melatonin-treated plants identified several heat stress-related genes. In pearl millet, the impact of heat was assessed on yield and nutritional parameters. The morpho-physiological observations and cytotoxicity, anti-diabetes, and anti-inflammatory assays were performed on selected varieties such as Dhanshakti, HHB299, and 86M86. The SSR markers were used for molecular diversity and association mapping studies.

Development of Artificial Intelligence enabled stress detection and mobile application for wheat health monitoring: A comprehensive multi-disease, multi-severity Wheat Image Dataset was created, which comprised of 26,561 images that document a range of wheat diseases, insect pests, and various growth stages. At the vegetative stage, nearly 17,000 images were collected under natural field conditions, including both symptomatic and healthy wheat leaves, standardized at a distance of 15–20 cm. The dataset covers multiple disease types, severity levels, and pest infestations, laying the groundwork for the development of CNN-based disease detection models. Controlled glasshouse trials were also conducted, focusing on brown and black rust seedling responses. At advanced stages, 5,411 images were captured, including 1,136 images of high-severity Stripe Rust, 75 of Brown Rust, 2,632 of Fusarium Head Blight images, and 442 of Aphid infestations. Additionally, 1,370 images of healthy wheat spikes and 656 healthy stems were documented as reference standards. Early-stage pathogenesis was captured in 2,509 images of

A curated multi-disease, multi-severity wheat image dataset

diseases like Brown Rust, Black Rust, and Yellow Rust co-occurring with powdery mildew. The dataset also features detailed phenotyping for stripe rust resistance, with categories including Resistant, Moderately Resistant, and Moderately Susceptible. This rich dataset will enhance precision wheat health monitoring and support the development of advanced disease and pest detection systems for sustainable agriculture.

Development of a minimal water retting technology of jute: A minimal water retting technology was developed using a pectino-xylanolytic bacterial strain (TNA 15), decorticated jute ribbon, and a Green Accelerator (GA). The retting process, when treated with TNA 15 and GA, was completed in just 12 days, compared to the control (water and ribbon alone), which took significantly longer. The optimal treatment of a 1:2.5 water ratio and a 2% bacterial inoculum produced high-quality jute fibre (TD3+65% grade) while using 87.5% less water. This optimized retting formulation was further tested in the field, where a retting bed was constructed for on-farm trials. Over five trials across three locations, the technology successfully produced high-grade jute fibre, much faster than the traditional method, with a significant reduction in water usage. The minimal water retting technology demonstrated not only environmental benefits but also improved efficiency in fibre production for jute farmers.

Fabrication of farmers' level retting tank for Minimal Water Retting (MWRT)

Development of diagnostics, and transcriptome profiling for apple mosaic disease in the north-western Himalayas: Apple mosaic disease (AMD), caused by Apple necrotic mosaic virus (ApNMV), poses a major threat to apple production, causing chlorotic and necrotic leaf symptoms and significant yield loss. A survey in Jammu & Kashmir, Himachal Pradesh, and Uttarakhand showed disease incidences were high with Golden Delicious being most susceptible, followed by Red Delicious and Red Gold. RT-PCR amplification of the ApNMV replicase gene (470 bp) confirmed viral presence in 32 samples. Coat protein (CP) sequencing showed 95–99% similarity with known Indian ApNMV isolates, and phylogenetic analysis grouped them with global strains. RNA sequencing of infected vs. healthy leaves revealed altered expression in genes linked to photosynthesis, transport, defense, and oxidative stress, providing insights into AMD pathogenesis and aiding the development of diagnostic and management strategies.

Symptomatic diversity observed on different apple varieties during course of survey

Development and evaluation of robotic harvester for grape bunches: A vision-based grape ripeness detection system was developed and validated using YOLO models across three grape varieties: Panner, Thompson Seedless, and Crimson Seedless. The system demonstrated a strong precision-recall balance, with YOLOv8 performing exceptionally well for Panner and Crimson Seedless varieties. However, YOLOv11 delivered the highest accuracy, achieving an impressive mAP@50 of 0.980 for Thompson Seedless. A battery-powered unmanned vehicle was also designed and fabricated to ensure stable operation within the vineyard. The vehicle is equipped with a robotic arm and tray provisions, controlled by an ECU with a 12-channel remote architecture. This innovative design is poised for integration into a robotic grape harvesting system, enabling efficient operations under real vineyard conditions.

Robotic harvester for grape bunches

Impact of abiotic and biotic factors on secondary metabolite profiles of *Rauvolfia serpentina* and *Tribulus terrestris*: The morphological similarities between *Tribulus terrestris* and its closely related species *Tribulus subramanyamii* often lead to misidentification and adulteration in herbal raw drugs. To address this issue, DNA barcoding was employed for species-level identification, ensuring the accurate molecular authentication of these species. This approach guarantees the reliability, safety, and therapeutic efficacy of herbal

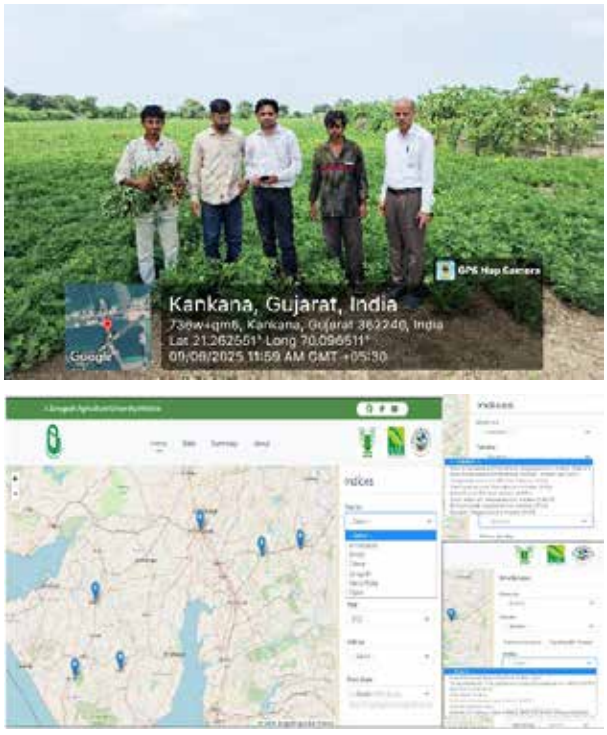
formulations. *T. terrestris* and *T. subramanyamii* were analyzed using four DNA barcoding loci: *rbcL, matK, psbA-trnH,* and *ITS2.* Amplification was successfully achieved with the *rbcL,* psbA-trnH, and *ITS2* loci, whereas the *matK* gene did not amplify in either species. The powdered and tablet samples from market yielded relatively high-quality DNA and showed successful amplification at the *ITS2* locus. The study highlighted the potential of DNA barcoding as a reliable tool for ensuring the authenticity of herbal products and preventing adulteration in the market.

Development of bio-nano sulphur formulation of methanotrophs for decarbonization and disease resistance in rice-oilseed systems: Three sulphur nanoparticle types were synthesized via chemical, PEGylation, and green methods. PEGylated nano-sulphur (~43.4 nm) showed optimal size and stability, making it suitable for foliar and root-dip applications. It exhibited strong environmental persistence. Among 25 methanotroph isolates, strains MT-14 and MT-22 showed the highest methane oxidation. Uptake studies revealed that rice roots absorbed hydrophilic nano-sulphur more efficiently than hydrophobic or commercial forms, while PEGylated nano-sulphur uptake began within 9 h in sesame, groundnut, and mustard. Field trials confirmed PEGylated nano-sulphur's efficacy at 200 mg/L, increasing yield of groundnut pod and kernel, and sesame seed significantly. In rice-mustard systems, combining it with half-dose of elemental sulphur boosted mustard yield up to 20.4%, demonstrating its potential to enhance crop productivity and nutrient use efficiency.

PEGylated nano-sulphur treatment in sesame and groundnut

Development and optimization of microbial and botanical pesticides for managing ticks: The acaricidal properties of three essential oils, Holy Basil (*Ocimum tenuiflorum*), Lemon Grass (*Cymbopogon flexuosus*), and Mugwort (*Artemisia vulgaris*) were evaluated against multi-acaricide-resistant *Rhipicephalus microplus* ticks (IVRI-strain V) using the Adult Immersion Test (AIT). Holy Basil oil showed the highest efficacy with the lowest LC50 and LC99 values, followed by Lemon Grass and Mugwort oils. The combination of Holy Basil + Lemon Grass and Holy Basil + Mugwort at specific concentrations achieved high mortality. Preliminary trials on infected animals showed an 87.5% reduction in tick populations after treatment with Holy Basil + Mugwort. These findings suggest that essential Oils combinations could be an effective, eco-friendly anti-tick solution.

Development of Taluka scale precise crop yield prediction application for selected districts of Gujarat using remote sensing, AI and machine learning: Comprehensive datasets on drought and agriculture in the Saurashtra region (1990-2023) were created using Google Earth Engine, incorporating meteorological and satellite-based indices like NDVI and VCI. These datasets offer insights into drought impacts on crops, aiding early yield predictions and farmer advisories. Advanced machine learning models developed from soil and irrigation data of *kharif* 2024 and 2025 showed 84% accuracy for groundnut and 72% for cotton acreage estimation, providing reliable tools for crop condition monitoring and timely interventions. A web-based platform has been successfully implemented, offering a user-friendly interface for public access.



Crop yield prediction application for Gujarat

Production of CRISPR edited farm animals: The research in animal genome editing targeted the *Myostatin* (MSTN) gene, a known inhibitor of muscle growth.

India's first gene-edited sheep at SKUAST, Kashmir

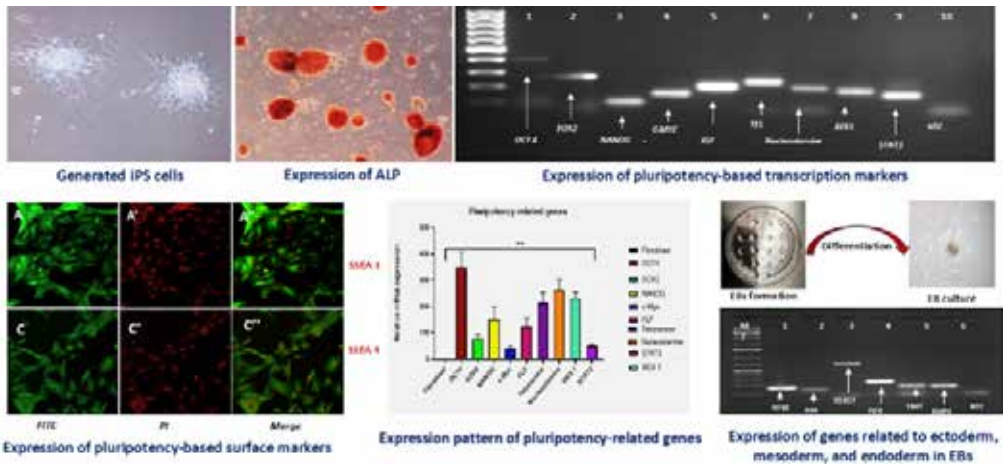
India's first *MSTN* gene-edited buffalo calf, exhibiting an enhanced muscle phenotype and larger muscle fibres compared to controls, was developed using CRISPR/Cas9 system combined with somatic cell nuclear transfer. India's first *MSTN* gene-edited sheep, was also developed which demonstrated a 30% higher growth rate. A dual guide RNA strategy was implemented to edit the *MSTN* gene in sheep fibroblasts, achieving bi-allelic gene disruption. A modified handmade cloning (mHMC) technique significantly improved blastocyst development rate. Microinjection of CRISPR plasmids into *invivo* derived zygotes enhanced embryo development efficiency.

***In vitro* production of oocyte- and spermatozoa-like cells from pluripotent stem cells of farm animals:** Induced pluripotent stem (iPS) cells were generated from cattle and buffalo using lentiviral or piggyBac-based vectors, showing a morphological shift from spindle-shaped fibroblasts to epithelial-like polygonal cells. Cultured in KO-DMEM, KOSR, LIF, and bFGF media, the iPS cells were maintained through gentle passaging. At passages 3 and 6, pluripotency was confirmed by high expression of OCT4, SOX2, NANOG, and surface markers SSEA1, SSEA4, TRA 1-60. The cells formed embryoid bodies expressing markers of all three germ layers—ectoderm (NF60, ASA), mesoderm (SOX17, FOX), and endoderm (TBXT, BMP4)—demonstrating true pluripotency. These findings underscore the potential of bovine iPS cells in regenerative medicine and livestock improvement.

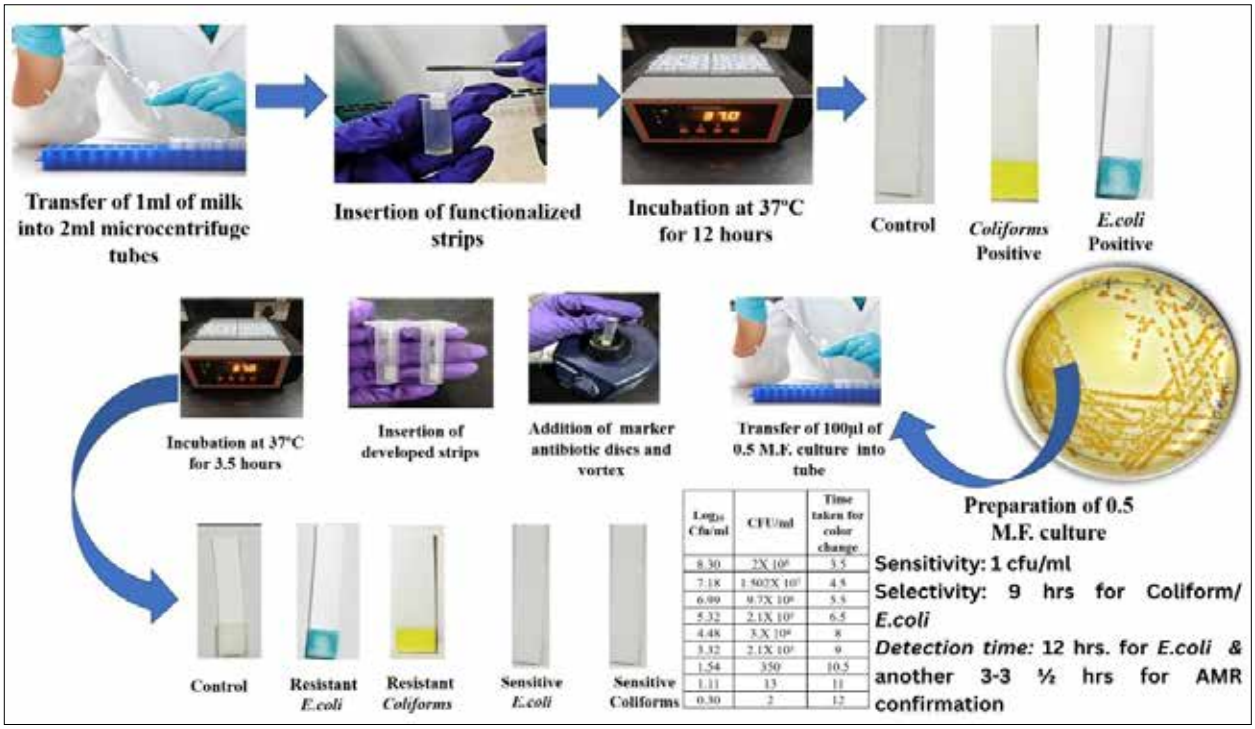
Development of artificial intelligence & IoT based smart vet ecosystem for animal health, patient care & precision livestock farming: Advanced AI and digital tools have been developed for improving animal husbandry and veterinary applications. Key innovations

Smart Weighing Scale© for small ruminants and IoT based flock productivity management

included the AI Smart Vet EMR Technology System, an IoT-integrated digital ECG for remote health monitoring, and a smart alert system for fever and heat stress in animals. Several AI-driven systems have also been developed such as the skin health scanner, smartphone-based weighing scale, and the FMD tracker for disease management. IoT-based systems were created for milk testing, weight tracking, and healthy udder monitoring in dairy cows and small ruminants. A facial muzzle image-based digital identification system was developed, utilizing advanced AI models



Generation and characterization of Induced pluripotent stem (iPS) cells



Paper-based strip sensor technology for detecting ESBL-resistant *E. coli*

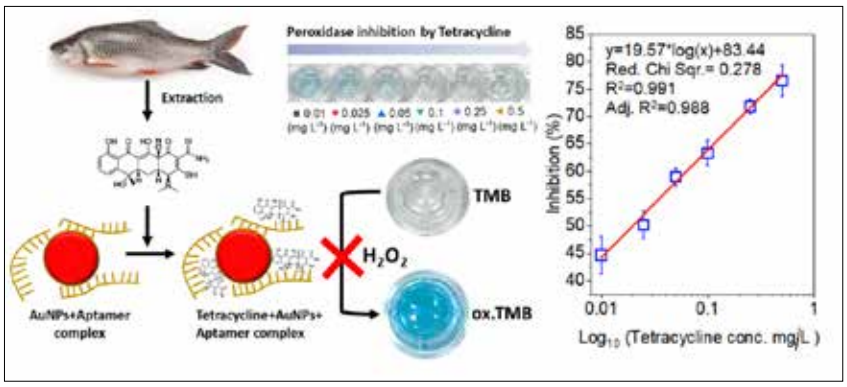
to classify animal breeds like Sahiwal, Tharparkar, and Vrindavani. The electronic veterinary medical records, milk productivity management system, and e-vaccination records system to streamline animal health monitoring aim to enhance animal care, improve productivity, and facilitate better veterinary practices through AI and IoT technologies.

Paper-based strip sensor for detecting pathogens in dairy and poultry animals: A rapid paper strip sensor for detecting ESBL-resistant *E. coli* was developed and successfully evaluated under field conditions using 641 diverse samples (milk, rectal, and cloacal swabs) from livestock and poultry in Haryana. The sensor detected *E. coli* within 6–12 h at 37°C, correctly identifying 73 ESBL-resistant isolates. This validation demonstrated the sensor's reliability, rapidity, and applicability for on-site detection of antimicrobial-resistant *E. coli* in dairy and poultry production systems. A peptide-zinc oxide nanoparticle conjugate (ZnONPC) was also developed and improved biocompatibility, demonstrating strong potential as a safe and rapid antimicrobial formulation.

Environmental and nutritional interventions for farming *Penaeus vannamei* in low saline water: Mapping and ionic profiling of Inland Saline Groundwater (ISGW) across five Maharashtra districts, Amravati, Akola, Buldhana, Sangli, and Satara was assessed for salinity, *p*H, TDS, conductivity, hardness, and mineral content for improving aquaculture production. Preliminary trials showed *Penaeus vannamei* shrimp had >50% survival in potassium-treated water from Lonagara (Akola). In a 90-day lab trial using Gandhigram (Akola) water with 5 ppt salinity, shrimp reached 30.03 ± 0.75 g with 93.3 ± 0.01% survival at 30 shrimp/m³. The balanced Ca:Mg:K ratio (288:306:288 mg/L) minimized stress, reflected by low SOD activity (32.96 ± 0.12 µmol/mg/min) indicating that properly mineral-balanced ISGW in these regions can effectively support high-yield shrimp aquaculture.

Development of molecular mechanisms of reproduction in *Clarias dussumieri* and induced spawning of *Clarias magur*: The study explored the reproductive mechanisms of *Clarias dussumieri* and *Clarias magur*, focusing on hormonal profiles, gene expression, and gut microbiome differences between wild and captive fish. In *Clarias dussumieri*, higher levels of Luteinizing Hormone (LH) and Gonadotropin-Releasing Hormone (GnRH) were observed during spawning, while Follicle-Stimulating Hormone (FSH) and 17β-Estradiol (E2) peaked in the pre-spawning season. In *Clarias magur*, metagenomic profiling revealed that wild fish had greater microbial diversity, with beneficial bacteria like *Lactobacillus*, *Prevotella*, and *Rhodobacter*, which correlated with better gut health. Captive fish exhibited higher levels of α-amylase and acid phosphatase (ACP), indicating feed adaptation and inflammation. Microbial diversity analysis confirmed that wild fish had more diverse microbiomes. Isolation of gut bacteria from wild fish led to the identification of four probiotic bacterial strains, providing potential insights for improving gut health in both wild and captive species offering insights into potential probiotic applications for enhancing gut health in both wild and captive *C. dussumieri* and *C. magur*.

Development of ECP-based on IoT and sensor technologies for rearing *Labeo catla*: An environmentally controlled facility (ECP) has been



Detection mechanism of tetracycline in fish muscle by inhibition of peroxidase mimic properties of aptamer loaded AuNPs

developed using a specialized software programme for environmental monitoring and notification, incorporating IoT and sensor technologies. In this system, the light intensity (LUX) is automatically adjusted based on the timings of sunrise and sunset within the rearing environment. Critical parameters like *p*H, dissolved oxygen, alkalinity, and temperature are continuously monitored in real-time, with alerts sent directly to mobile phones for timely notifications. This system offers significant potential for use in experimental fish rearing systems in aquaculture. Currently, the system is functioning effectively and is undergoing validation to ensure its reliability and accuracy in practical applications.

Development of point of care nanobiosensors for antibiotic residue detection in fish: A colorimetric apta sensor was developed for detecting tetracycline residues in fish muscle using a peroxidase-mimicking gold Nano Zyme. The method overcame inhibitory effects of the aptamer buffer by optimizing reaction conditions, allowing accurate detection. The AuNP–aptamer probe showed peroxidase activity selectively inhibited by tetracycline adsorption. The sensor displayed a logarithmic response (R^2 = 0.99) within 0.01–0.5 mg/L and a detection limit of 0.017 mg/L, below the EU/FSSAI limit (0.1 mg/L). It achieved 111–115% recovery in fish muscle, confirming high accuracy. A portable image-based device is being developed for rapid, on-site tetracycline detection, supporting enhanced food safety monitoring.

Environment controlled facility using ECP developed at ICAR-CIFA, Bhubaneswar

Study on value addition of crop residues in NEH region for sustainable livelihood: A comprehensive study across Meghalaya, Central Assam, and the Lower Brahmaputra Zone surveyed 350 farmers on crop residue availability and utilization in pineapple, banana, and okra systems. Ten awareness programmes highlighted value addition from residues. Over 120 kg of biomass (okra stalks, banana pseudo-stems, pineapple leaves) was processed for prototype development. Retting optimization improved okra and banana fibre quality, and bio-softeners were tested for eco-friendly processing. Union fabric and handmade paper from banana and pineapple fibres were produced, along with three prototypes i.e. woven fabric, handmade paper, and biochar. Using a moving bed reactor, biochar showed a calorific value of 6000–7200 cal/g. The study demonstrated sustainable conversion of agro-residues into value-added products.

Analysis of global value chain of India's plantation crops and food safety standards: A comprehensive field study focussing on value-added products like coconut oil, virgin cocnut oil, milk, chips, and byproducts was conducted across fifty coconut manufacturing and export units in Kerala and Karnataka which identified Kerala's competitive advantage with the "Malabar" tag, but challenges such as high production costs and competition from cheaper exporters like Indonesia and Sri Lanka remained. In Karnataka, most units operate at capacities of 5–50 tonnes day, with 90-95% sales within India, while exports to the Middle East, USA, and Russia are limited (5–10%). Profit margins are highest for virgin coconut oil (up to 30%). Food safety issues like *Salmonella* in desiccated coconut, sulphite content in copra, and *E. coli* in grated coconut led to consignment rejections. The high cost of safety certification is a significant barrier for small-scale entrepreneurs, excluding them from global value chains. A database tracking food safety standard for coconut exports was developed, alongside a documented global value chain model for coconut products. In the coffee sector, a similar study assessed food safety across the value chain, with a database on international food safety standards compiled. A manual for coffee exports focusing on food safety standards is under development. ❑

15.
Information and Communication Technology (ICT) and Digital Resources

The Information and Communication Technology (ICT) initiatives of ICAR demonstrate a comprehensive digital transformation covering human resource management, governance, agricultural extension, precision agriculture, and decision support systems. The e-HRMS 2.0 platform provides end-to-end, paperless HR services and is operational across ICAR Headquarters and all institutes, with 15,104 active employees using modules for leave, APAR/IPR, reimbursements, training, and pay-related services. Performance appraisal management has been strengthened through SPARROW, which generated 15,817 Performance Appraisal Reports (PARs) during 2024-25 for all category of staff of ICAR. Administrative efficiency has improved through ICAR e-Office, implemented in 115 institutes, with 3.69 lakh electronic files created and 3.47 lakh files processed in this reporting period, ensuring transparent and faster decision-making. Monitoring and evaluation of programmes is enabled by the ICAR-DARPAN Dashboard, tracking 65 KPIs across 20 project categories, including dynamic extension and advisory activities. Payroll digitization under the SAMARTH system has been successfully implemented in 86 ICAR institutes, supported by extensive capacity-building programmes. Farmer-centric digital outreach has been significantly scaled through Kisan Sarathi, with over 2.75 crore registered farmers, addition of 60 lakh farmers during the reporting period, dissemination of nearly 4 crore advisory messages annually, and onboarding of 7,000 agricultural experts. The platform played a pivotal role in Viksit Krishi Sankalp Abhiyan, digitally reporting 60,917 programmes across 1.4 lakh villages and reaching 1.35 crore farmers. Advanced ICT-led research outputs under the Network Programme on Precision Agriculture include near real-time crop monitoring (PUSA-eCMS), hyperspectral soil analytics (VASUDHA), IoT-based aquaculture and irrigation systems, AI-enabled pest surveillance, and digital platforms for soil and orchard health monitoring.

ICT Systems for Operations and Management of ICAR Activities

Electronic Human Resource (HR) Management System (e-HRMS 2.0): The e-HRMS 2.0 is an online platform designed to provide comprehensive, end-to-end HR services in a transparent, user-friendly, and paperless manner to the employees of an organization. It is currently being implemented across various Ministries, Departments, and Organizations (MDOs). Through this system, employees can conveniently manage services such as leave/tour requests, reimbursements, vigilance, APAR/IPR, pay-related matters, i-GOT trainings, Organogram, profile updates, and other common HR functions with real-time application tracking and personalized prompts. e-HRMS 2.0 can be accessed online at https://e-hrms.gov.in using NIC email credentials through the Parichay platform. e-HRMS 2.0 has been implemented at ICAR Headquarters and across its all institutes as well. Overall, 15,104 employees of ICAR are active on e-HRMS.

Smart Performance Appraisal Report Recording Window (SPARROW): SPARROW is an online system developed to facilitate the performance appraisal process for government employees by maintaining comprehensive appraisal records for each individual. SPARROW has been effectively implemented in ICAR for all employee categories, including Scientific, Technical, Administrative, and Supporting staff. The scientific APAR in this system was specially designed for ICAR scientists. The system is hosted on NIC authorized cloud. A total of 15,817 PARs has been generated during the year 2024-25.

ICAR e-Office: The e-Office developed by National Informatics Centre (NIC) has been implemented across 114 ICAR institutes along with their regional station/ sub-stations and hosted at NIC authorized cloud after migration of e-Office from the ICAR data centre. The Status of eFiles in ICAR till date are as follows:

Electronic Files (E)				
Created	Closed	Active		
		In Movement	Parked	Total
3,69,338	6,326	2,84,896	62,043	3,46,939

ICAR-DARPAN Dashboard: The ICAR Darpan Dashboard, a customized version of DARPAN developed by NIC, is designed to transform complex government data into clear and compelling visuals. It can be assessed online at http://icar.dashboard.nic.in. An integrated dashboard is being used to track the progress of all ICAR

ICAR- DARPAN Dashboard showing 20 major project categories

schemes, which are categorized into 20 major project categories, encompassing a total of 65 Key Performance Indicators (KPIs). Among these, 11 projects related to mobile agro-advisories, farmer training, and extension activities are dynamic in nature.

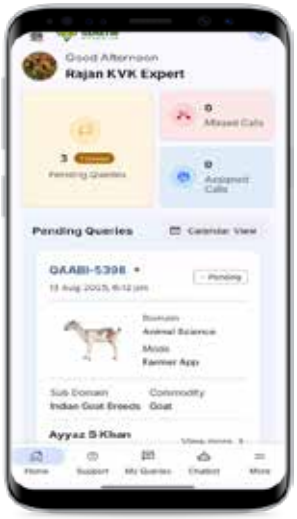
SAMARTH System: The "Samarth" portal i.e. "**Smart Automated Management of Academic Resources for Transforming Higher Education"** is a centralized, web-based platform designed to streamline and automate various administrative and academic functions within Higher Education Institutions (HEIs) in India. It's a digital framework to manage tasks like admissions, examination management, human resource management, finance, payroll and more. The payroll module of SAMARTH is being implemented in ICAR for generating pay slips of employees in ICAR institutes. At present, it has been successfully implemented at 86 institutes of ICAR including ICAR Hqs. A number of training sessions for smooth implementation were conducted for dealing hands of all ICAR institutes on payroll generation, income tax calculation, NPS calculation, DA arrear configuration, etc.

Kisan Sarathi: Kisan Sarathi is a system of Agri-information Resources Auto-transmission and Technology Hub Interface. During the reporting period, the Kisan Sarathi platform saw significant expansion in both reach and functionality. Over 60 lakh farmers were added during this period. Currently, more than 2.75 crore farmers are registered on this portal. The onboarding of ICAR Institutes and SAUs on this platform is in progress. The total onboarding agricultural expert network of 7,000+ specialists has been done for enabling more robust advisory services. The system also disseminated nearly 4 crore informational messages to farmers from this portal annually.

A major development during this period was the pilot launch of Kisan Sarathi 2.0, which introduced a three-tier advisory system integrating the Kisan Call Center (KCC) and Common Service Centre (CSC) as the first point of contact. This was implemented in Uttar Pradesh and West Bengal on pilot basis. This model ensures seamless routing, escalation, and expert scheduling for farmer queries.

Two new mobile applications-the **Kisan Sarathi App** for farmers and the **KS-Expert App** for scientists-were released as beta version. The Kisan Sarathi App supports 13 Indian languages, multimedia queries, voice features, and video calling. These apps significantly improved accessibility and real-time advisory capabilities.

Kisan Sarathi App



KS-Expert App

The Krishi **e-Nidanshala** initiative was launched on a pilot scale, integrating Common Service Centres (CSCs) to provide assisted advisory services through 14 KVKs across 11 ATARIs. Additionally, the newly developed framework of **Kisan Sarathi-Kosh**, a

Krishi e-Nidanshala

centralized agricultural advisory repository to strengthen content creation and standardization of contents within ICAR, is being implemented by dedicated domain specific workshops. The first workshop, titled "*Creation of Agricultural Advisories using Kisan Sarathi Kosh*", was conducted at ICAR-IARI, New Delhi on 23 September 2025 for the Scientists from the Crop Science and Natural Resource Management Divisions of ICAR. A total of 75 participants participated in this training for creation and management of field crop advisories.

Viksit Krishi Sankalp Abhiyan (VKSA) and PM-KISAN Samman Nidhi 20th Release: The Kisan Sarathi platform played a central digital role in the nationwide Viksit Krishi Sankalp Abhiyan (VKSA), enabling real-time reporting for 60,917 programmes across 1.4 lakh villages. The campaign reached to 1.35 crore farmers, capturing large-scale participation data, multimedia documentation, and field-level issues for further action. Over 77,000 photos and 30,000 videos, along with more than 1.2 lakh social media posts, were consolidated on the portal, contributing to 5.5 crore digital reach. The platform also documented over 500 field issues and more than 300 farmer-led innovations to provide structured escalation to research institutions for action. This customized portal supported reporting by more than 1,000 agricultural organizations, aggregating data from 2.74 lakh+ participants during PM-KISAN Samman Nidhi 20th Release.

ICAR- Network Programme on Precision Agriculture (NePPA): It is a programme of national importance designed to meet the emerging needs of Indian agriculture by leveraging cutting-edge technologies such as remote sensing, wireless sensor networks, IoT systems, drones, ICT tools, Variable Rate Technologies (VRTs), and big data analytics for precision agriculture operation since September 2021 with 16 ICAR research institutes led by ICAR-Indian Agricultural Research Institute under co-ordination and support ICT Unit of ICAR. Some of the significant achievements during period under report are briefly given.

PUSA-eCMS: Pusa eCMS is an in-house remote-sensing platform that enables near real-time and large-scale crop health monitoring using high-resolution satellite and drone data. It automates field assessment, reducing labour and time while providing data-driven insights through 120 spectral indices, machine-learning models, and Google Earth Engine integration. The system generates key biophysical parameters such as LAI, chlorophyll, nitrogen, soil moisture, and a Crop Health Index, and supports applications like soil moisture mapping, paddy identification, and flood assessment. With TRL-8 and a filed copyright (SW-31350/2025-CO), the technology is ready for commercialization.

VASUDHA: Visualisation and Assessment Software Using Digital Hyperspectral Analytics (VASUDHA) is an advanced hyperspectral soil analytics software that enables rapid, non-invasive estimation of key soil properties such as organic carbon, nitrogen, phosphorus, potassium, *p*H and EC using VNIR–SWIR and MIR spectra. With real-time data processing, machine learning-based classification, and an easy-to-use interface aligned with the Soil Health Card scheme, it supports cost-effective and sustainable soil management. Portable and sensor-integrated, the tool provides instant soil fertility assessment and has reached an advanced readiness stage, officially released during the 97th ICAR Foundation Day.

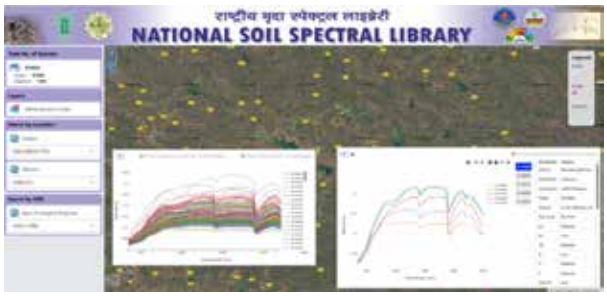
Mechanical-cum-biological drum filter: The mechanical-cum-biological drum filter is an advanced water-treatment system that combines fine mechanical filtration with bio ball-based biological purification to remove solids and convert ammonia to nitrate in real time. Its automated, low-water-use operation delivers consistently clean water for aquaculture and industrial applications while reducing energy and freshwater consumption. Successfully deployed at ICAR-CIFE since 2023, it has achieved over 90% solid removal and 40–50% backwash water savings. Now commercialized through SHARP Engineering Associates and protected under ICAR's IPR at TRL-9, it is available for farms,

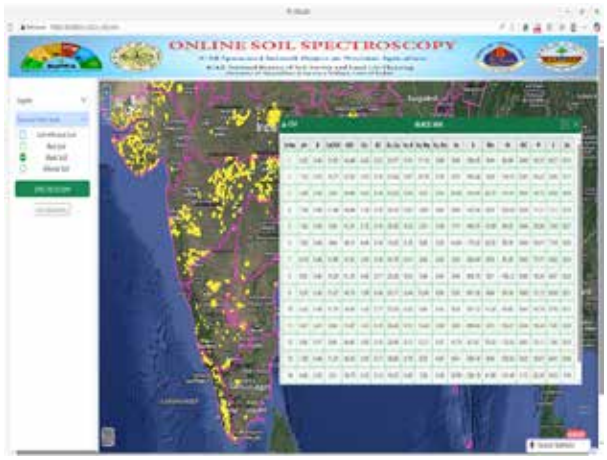

Drum filter


Technology Certificate

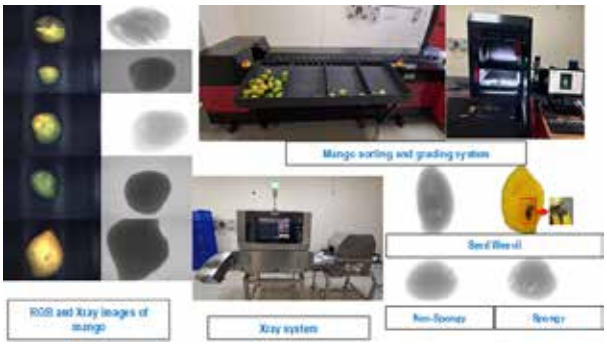
hatcheries, industries, and government agencies, with further scaling and training support expected to boost wider adoption.

National Soil Spectral Library Geoportal: The National Soil Spectral Library (NSSL) is India's first national web-geoportal combining Vis–NIR and MIR soil spectra with spatially linked laboratory data to enable rapid, low-cost prediction of soil properties. It currently houses 33,664 spectra from diverse soil types and is designed for scalable, large-volume data management. Released on 18 May 2025 at the Vikasit Krishi Sankalp Abhiyan, the platform has achieved TRL-8 and is ready for broad institutional use. By providing high-quality spectral and analytical datasets, the NSSL supports research, sensor development, and real-time soil nutrient assessment. As a Government-mandated national repository, its continued expansion will rely on systematic dataset contributions, with ICAR facilitating outreach and community-wide compliance.





X-Ray and Vision System for Mango Sorting and Grading: The integrated RGB–X-ray mango sorting and grading system automates the detection of external and internal defects—such as spongy tissue and seed-weevil damage to improve quality control, reduce post-harvest losses, and support fair, standardized grading. Using deep learning models (MobileNetV3, Xception) and advanced imaging techniques, it identifies defects invisible to the naked eye and increases efficiency across the supply chain. A prototype tested on major mango varieties has shown reliable defect detection, with supporting physico-chemical measurements validating results. Having proven effective under laboratory conditions, the system is undergoing refinement to



enhance accuracy and prepare it for field deployment.

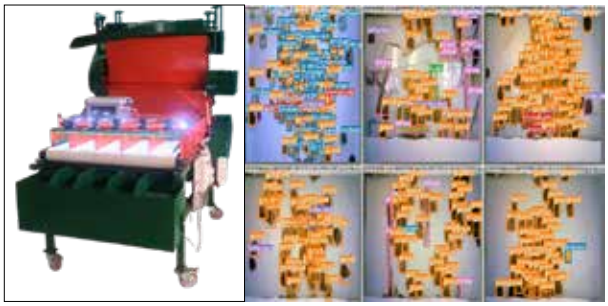
IoT based real-time Dissolved Oxygen (DO) Monitoring and Management System in Fisheries System: The IoT-based DO monitoring and management system automates real-time DO regulation in intensive aquaculture through continuous sensing, cloud connectivity, and remote access via web and mobile dashboards. Its automated aerator control module activates or deactivates aerators based on pre-set DO levels, reducing energy use, labour, and fish mortality. Successfully deployed across ponds, RAS units, cage culture systems, and commercial shrimp farms, the system received an ICAR Technology Certificate and is supported by a patent application. With proven field performance and ongoing economic assessments, it is now ready for commercialization as a scalable solution for efficient, technology-driven aquaculture management.

Portable Low-Cost Water Flow Meter for water flow monitoring: The portable low-cost flow meter is a compact, field-ready device that measures real-time water flow along with GPS coordinates, storing data for later analysis. Designed for rivers, canals, wetlands, and aquaculture systems, it offers an affordable and reliable

tool for researchers and resource managers to assess ecosystem conditions that influence fish behaviour and habitat quality. Successfully tested in West Bengal's rivers and wetlands, the technology is validated for routine field use, with a patent application underway and benefit-cost assessments planned as additional field data are collected.

Ethylene Sensitive Chemo indicator for Banana Ripening: The chemo-sensitive, colourimetric intelligent ripening indicator provides a non-destructive and reliable way to track ripening stages of red bananas, where visual cues are often unclear. Using a biodegradable starch-based label infused with palladium sulphate, it reacts to ethylene and displays clear colour changes that accurately correspond to ripening stages. Validated through laboratory and pilot-scale tests, the indicator consistently matches key ripening indices. A patent application is being prepared, and the technology is expected to cut postharvest losses by 15–20%, improve fruit quality, and raise net returns by 20–25%. Wider adoption will require ICAR-supported partnerships for large-scale, cost-effective manufacturing and integration into packaging systems.

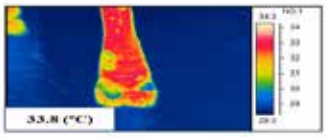
Sensor-based Multi-pass Cleaner for Pulse/ Legume Grains: The Sensor-Based Multi-Pass Cleaner for Pulses is an affordable, AI-driven grain cleaning system that automates the removal of dust, husks, and foreign materials with high accuracy. Using sensors, a multi-stage cleaning mechanism, and a YOLOv7 deep learning model running on a Raspberry Pi, it offers a low-cost alternative to conventional ₹40–45 lakh sorting machines, costing only about ₹2 lakhs. A complete prototype has been built and validated using a curated dataset of 3,000 images, achieving strong model performance (94.2% mAP, 90.8% precision, 93.7% recall). Optimized to operate at 0.06 m/s belt speed, the system delivers 82% cleaning efficiency and reliable real-time operation across integrated mechanical and control components.



Use of Infrared Thermographic Image Processing for Early Detection of Lameness in Dairy Animals: A proof-of-concept system combining pedometer data with infrared thermography was developed to detect lameness early in crossbred cows. By integrating step count and hoof temperature patterns into a deep learning model, the approach achieved 98% accuracy, precision, and recall. Lame cows showed markedly lower mobility, taking about 76 steps compared to 162 in healthy cows. This AI-driven method offers strong potential for on-farm precision monitoring and timely intervention to reduce lameness-related losses.


Lame cow image-showing change of back posture and locomotion


Pedometer attached to animal

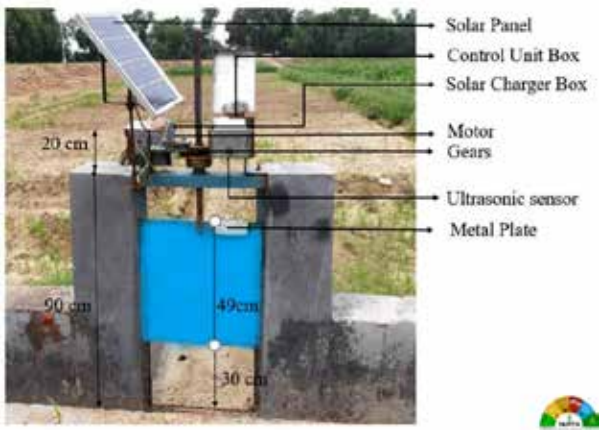


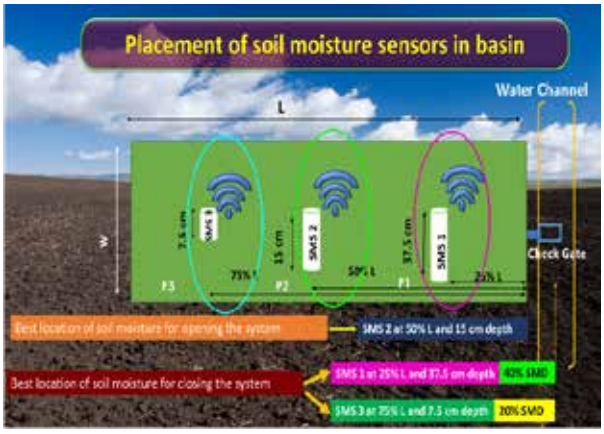
IRT image of hoof

AI Smart Trap for Monitoring Pink Bollworm in Cotton: The AI Smart Pheromone Trap is an automated pest-monitoring system that captures and analyzes insect images with built-in machine learning, sending real-time pest and weather data to a remote server for timely, location-specific advisories. Deployed across three districts in Punjab, it has enabled large-scale monitoring of pink bollworm and delivered voice-based GSM alerts to over 28,000 cotton farmers when pest levels exceeded ETL. Released in May 2025 and supported by a patent application, the system has achieved significant impact—reducing pesticide use by 38.61%, cutting costs

by 34.2%, and increasing cotton yield by 18.54%—showing strong economic and practical benefits for widespread adoption.

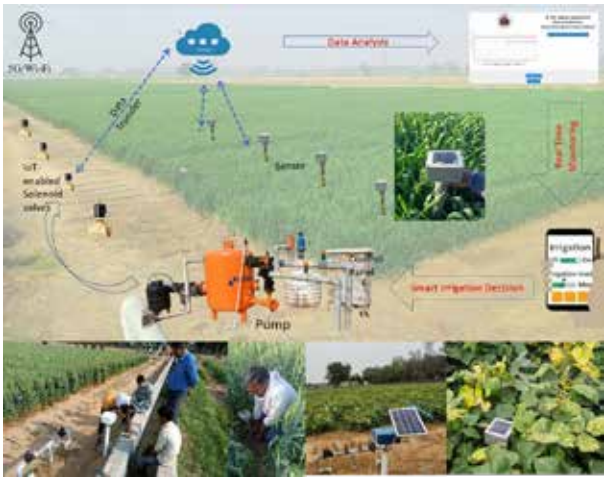
Soil Moisture Sensor-Based Automatic Basin Irrigation System: A sensor-based automatic irrigation system—integrating a low-cost capacitance soil-moisture sensor, microcontroller, solar-powered control unit, and LoRa/GSM communication—was developed and tested on wheat at the IARI research farm. By triggering irrigation based on real-time soil-moisture data, the system achieved 25% water savings compared to conventional manual irrigation.





IoT based Sub-surface Drip Irrigation Automation in Cereal based Cropping System: Automatic sub-surface drip irrigation system having dripper installed at 20 cm depth, fertigation system, electric water pump, soil moisture sensor (SMS), solenoid valve enabled with solar panel and cloud server with a simple smartphone interface for soil moisture monitoring and irrigation scheduling was done in IARI field. Due to the sub-surface drip system, water application efficiency achieved >95%, water saving 30–40%, nutrient saving 40–50%, crop yield increased by 25% and B:C ratio: 1.85–2.1.

CitriHub Mobile App, a digital platform supporting startups and



entrepreneurs in citrus agribusiness, developed by the ICAR-CCRI Agribusiness Incubation Centre, facilitates information sharing and business incubation. The platform offers mentorship, technical guidance, funding and business development services. The app is available on Google Play Store.

Digital Orchard Health Card (DOHC): ICAR-CISH, Lucknow has developed the DOHC for mango, a multispectral imaging and data-driven platform for monitoring orchard health and performance. It provides tree-specific data and recommendations for canopy, nutrient, pest, and irrigation management, enabling precise, scientific orchard practices. The mobile-based system offers real-time monitoring, an interactive dashboard, and supports yield forecasting, traceability, quality assurance, and income enhancement for farmers by ICAR-CPCRI, Kasaragod.

Assessment of potential risk regions to coconut diseases: Spatial studies and assessment of potential risk regions to major coconut diseases were conducted for Tamil Nadu, Kerala, Karnataka and Andhra Pradesh states of India. The Basal stem rot of coconut severity rates were higher in Thanjavur, Pudukkottai and Thiruvarur districts of Tamil Nadu and also some areas adjacent to the East Godavari and West Godavari of

Andhra Pradesh. A statistical study revealed that the timing of fungicidal application based on the monsoon period provides better control of FRD of arecanut than an application based on the developmental stages of fruit under field conditions.

Cashew Farmers Tracking System (CFTS): The Cashew Farmers Tracking System (CFTS), developed by ICAR-Directorate of Cashew Research, Puttur, is a software with a QR-based system for farmers and a data analytics module for tracking planting locations and varieties. Each purchase bill carries a QR code that provides variety details (yield, nut weight, fruit traits, etc.) and a feedback option. Farmers can save the code for later use. CFTS enables village-level data generation on variety distribution and helps assess the institute's impact.

16.

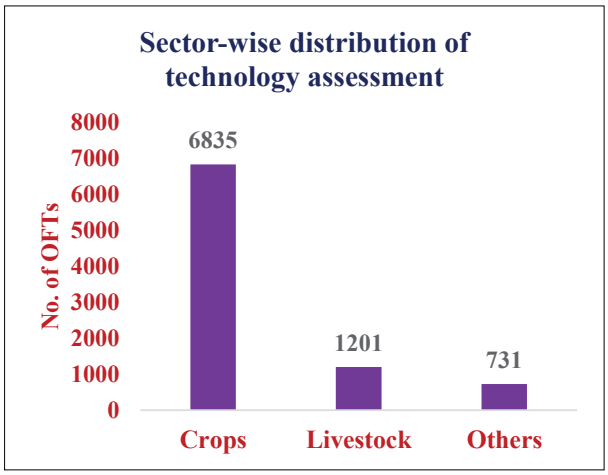
Technology Assessment, Demonstration and Capacity Development

The frontline extension system of the Indian Council of Agricultural Research (ICAR), operationalized through a network of 731 Krishi Vigyan Kendras (KVKs) and 11 ATARIs, continues to play a critical role in translating research outputs into field-level gains technology assessment, demonstration, capacity development, and other extension activities. KVKs conducted 8,767 On-Farm Testing (OFT) trials to assess location-specific technologies, dominated by crop-based interventions (6,835), followed by livestock (1,201) and other enterprises (731). These assessments strengthened farmer confidence by validating improved varieties, integrated nutrient and pest management practices, resource-conservation technologies, and value-addition options under real farm conditions. KVKs up-scaled validated technologies through 1.77 lakh Frontline Demonstrations (FLDs), of which 1.22 lakh focused on crop production and farm management, 19,995 on animal science and fisheries, 26,312 on enterprise diversification, and 8,778 on farm mechanization. Cluster Frontline Demonstrations (CFLDs) on pulses and oilseeds recorded notable productivity gains, with 37,102 demonstrations in pulses and 2.22 lakh in oilseeds, resulting in average yield increases of 28.9% and 27.7%, respectively; chickpea (61.6%) and niger (42.8%) showed the highest crop-specific improvements. Establishment of 130 Model Pulse Villages and 174 Model Oilseed Village Clusters further strengthened area-based scaling strategies. Capacity development remained a cornerstone activity, with 73,063 training programmes benefitting 23.92 lakh participants, including farmers, rural youth, and extension personnel, with women constituting 34.8% of trainees. Extension activities reached 2.20 crore farmers through campaigns, fairs, and advisories, while mobile-based agro-advisories were delivered to 4.39 crore farmers, enhancing timely decision-making. KVKs also supported input security by producing two lakh quintals of quality seed, 503 lakh planting materials, and significant quantities of bio-products and livestock inputs. Special initiatives such as ARYA, NICRA, Farmer FIRST Programme, Crop Residue Management, Natural Farming, etc. demonstrated measurable impacts in youth entrepreneurship, climate resilience, residue-burning reduction (over 85% decline in North-West India), and participatory problem identification. Large-scale national campaigns such as the Viksit Krishi Sankalp Abhiyan (VKSA) demonstrated the power of convergence, covering more than 1.35 crore farmers belonging to order 1.40 lakh villages in 728 districts under the banner of "One Nation-One Agriculture-One Team". The campaign successfully documented farmer-led innovations and identified over 500 researchable extension oriented and policy-relevant issues, strengthening demand-driven research-extension feedback loops. Collectively, these integrated interventions underscore the effectiveness of the KVK-led extension ecosystem in enhancing productivity, resilience, sustainability, and livelihoods across diverse agro-ecological regions of India during different seasons.

The frontline extension system plays a pivotal role in bridging the gap between agricultural research and farmers, by disseminating scientific knowledge, technical guidance, and innovative practices to enhance productivity and income at the grassroots level. The Agricultural Extension Division of ICAR operates through 731 *Krishi Vigyan Kendras* (KVKs) monitored by 11 ICAR-Agricultural Technology Application Research Institutes (ATARIs) located across India. KVKs serve as knowledge and capacity development hubs, conducting technology assessment, demonstrations, and training, ensuring the "*Lab-to-Land*" transfer of innovations. KVKs work in convergence with Central Ministries/ Departments and collaborate with ICAR institutes, Agricultural Universities (AUs), while enabling effective implementation of government programmes and technology-led agricultural advancement nationwide. Through integrated research-extension linkages, participatory approaches, and technology-driven programmes, this division continues to strengthen farm productivity, resilience, and livelihoods nationwide.

Technology Assessment

KVKs carried out 8,767 On-Farm Testing (OFT) to assess the performance and adaptability of various agricultural technologies. Of these, crop-based OFTs constituted the majority (6,835), followed by livestock-based interventions (1,201), and other enterprises (731). These assessments enabled location-specific validation and dissemination of improved varieties, integrated pest and nutrient management practices, resource-conservation techniques, processing and value-



addition technologies, etc. Collectively, testing of these technologies strengthened farmers' confidence and facilitated the localized adoption of such innovations.

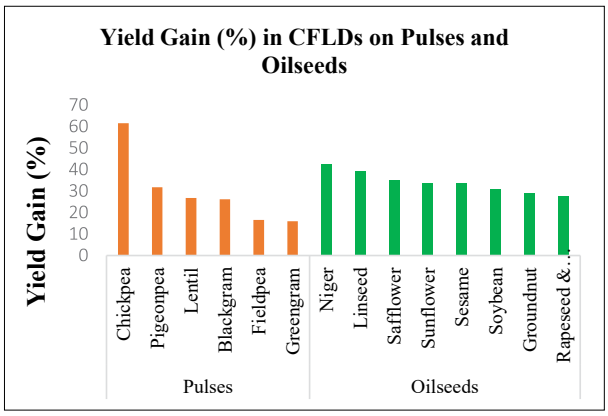
Frontline Demonstrations (FLDs)

Successful and scientifically validated technologies are demonstrated through Frontline Demonstrations (FLDs) at farmers' fields to showcase their production potential under real farm conditions. FLDs enable farmers to directly observe the performance, economic viability, and risk-reducing advantages of improved technologies and practices in comparison to existing practices, thereby facilitating faster adoption and wider horizontal dissemination.

During the year, KVKs conducted a total of 1.77 lakh FLDs encompassing a wide spectrum of technologies related to crop production, livestock, fisheries, enterprises, and farm mechanization. Out of the total FLDs, 1.22 lakh demonstrations focused on crop production and farm management technologies, reflecting the primary emphasis on enhancing crop productivity and resource-use efficiency. In addition, 19,995 FLDs were organized on animal science related technologies, including livestock, fisheries, poultry, etc. KVKs also conducted 26,312 FLDs on enterprise-based technologies aimed at promoting diversification, value addition, and income enhancement. Further, 8,778 FLDs were laid out on farm machinery and implements to facilitate mechanization and improve operational efficiency at the farm level.

Cluster Frontline Demonstrations on pulses and oilseeds

In alignment with the national priority to promote area under pulses and oilseeds, Cluster Frontline Demonstrations (CFLDs) were designed and implemented by the ICAR, in collaboration with Department of Agriculture and Farmers Welfare, Govt. of India, at strategic locations for scaling the bundles of technologies suitable for pulses and oilseeds during the *Kharif*, *Rabi* and Summer seasons to showcase improved technologies/practices. A total of 37,102 demonstrations in pulses and 2,22,579 demonstrations in oilseeds were conducted. The interventions led to substantial yield



enhancements of 28.9 per cent in pulses and 27.7 per cent in oilseeds. Among pulses, chickpea recorded the highest yield improvement (61.6%), while niger showed the maximum yield increase (42.8%) among oilseeds.

During these demonstrations, activities, such as field days, *Kisan Goshthi*, exposure visits, etc. were conducted to create a multiplier effect among farmers and stakeholders.

Additionally, 130 Model Pulse Villages and 174 Model Oilseeds Village Clusters (564 villages) were established in 65 and 174 districts, respectively to augment the productivity of pulse and oilseed crops.

Capacity Development

Capacity development of diverse stakeholders is one of the key mandated activities of KVKs to enhance efficiency in taking decision in agriculture and to build *Community of Practices* (CoPs). A total of 73,063 training programmes benefitted 23.92 lakh participants, comprising 19.14 lakh farmers, 3.09 lakh rural youths, and 1.69 lakh extension personnel. Notably, 34.8 per cent of farmer participants were women. These trainings were more focused on latest technologies of crop production, horticulture, integrated nutrient and pest management, animal husbandry, and climate-resilience. Besides, trainings were also conducted for farm women, while giving specific emphasis on issues like nutri-sensitive agriculture, drudgery reduction, farm resource management, etc.

Extension Programmes

KVKs conducted various extension activities, such as *Kisan Mela*, *Kisan Goshthi*, awareness programmes, special campaigns of national importance, etc. covering 2.20 crore farmers and 6.65 lakh extension personnel. Through Kisan Mobile Advisory Services, agro-advisories in the form of messages on crops, weather, livestock, and markets were sent to 4.39 crore farmers. The access of timely agri-information improved farmers' decision-making ability.

Production of Technological Products: In order to provide quality seeds, planting materials and other critical inputs for the purpose of catalyzing support of technological advancement, KVKs produced two lakh quintals of improved seeds, 503 lakh quality planting

materials, 0.34 lakh quintals of bio-products, besides 210.54 lakh of fingerlings, livestock, poultry, etc.

Soil, Water and Plant Analysis: During the period under report, KVKs conducted extensive analyses of soil, water, and plant samples to promote scientific nutrient and water management practices among farmers. A total of 4,68,029 samples of soil, plant, and water were analyzed, benefiting 4,11,964 farmers.

Technology Backstopping: Directorates of Extension of 55 Agricultural Universities conducted 560 workshops and made 80,520 visits to strengthen KVK's performance during the period of report. Also, 3,025 FPOs received technological support from KVKs through 1,443 training programmes, thereby benefitting more than 56,000 farmers.

Special Programmes and Projects

Attracting and Retaining Youth in Agriculture (ARYA): During the reporting period, a total of 16,028 rural youth (8,688 males and 7,340 females) were trained through structured capacity-building programmes, reflecting wide outreach and balanced participation. As a direct outcome, trained youths successfully established 3,873 agro-based entrepreneurial units across the country. Overall, the project significantly strengthened rural youth engagement in agriculture and allied sectors, with notable and growing participation of women in agri-preneurship.

National Innovations on Climate Resilient Agriculture (NICRA): National Innovations on Climate Resilient Agriculture (NICRA) programme is being implemented in 151 highly climate-vulnerable districts through the Technology Demonstration Component (TDC). Under the programme, 448 villages have been adopted and developed as climate-resilient hubs. The NICRA has demonstrated nationwide impact across all agro-ecological zones, covering natural resource management, crop production, livestock and fisheries, and human capacity development. A total of 8,695 NRM demonstrations, 23,491 crop production demonstrations and 8,729 livestock and fisheries demonstrations were conducted. These field interventions were supported by 1,877 capacity-building programmes that trained 50,081 farmers and organized 2,848 extension activities of resilient practices, which benefitted 78,305 farmers. Zone-wise performance shows balanced adoption across rainfed, coastal, hill, arid and island ecosystems. Overall, the programme reaffirms NICRA-TDC role as a national flagship for translating climate-resilient technologies into measurable field-level outcomes and strengthening farmers' adaptive capacity at scale. In fact, this model has the potential to be replicated in *PM-DDKY* districts to upscale productivity, cropping intensity and resilience.

Farmer FIRST Programme: During the year, the programme implemented a total of 62,387 demonstrations and programmes, engaging 1,40,939 farm families and farmers across different thematic areas. Overall, these aggregate figures reflect the extensive outreach, diversified interventions, and strong farmer participation achieved under the Farmer FIRST Programme at the national level.

Physical achievements under Farmer FIRST Programme

S. No.	Name of Module	No. of Demonstrations/ Programmes	No. of Farm families / Farmers involved
1	NRM module	3,294	4,785
2	Crop module	18,377	21,851
3	Horticulture module	13,996	12,946
4	Livestock & Poultry	18,852	39,492
5	IFS Model	1,535	6,995
6	Extension Activities	6,333	54,870
	Total	62,387	1,40,939

Crop Residue Management (CRM) Project: KVKs in Punjab, Haryana, Uttar Pradesh, and the NCT of Delhi implemented an extensive Information, Education, and Communication (IEC) activities during the reporting period. A total of over 44,500 farmers were mobilized through 356 awareness camps, 13 *Kisan Melas*, 60 exposure visits, and 43 field/harvest days, facilitating large-scale outreach and experiential learning. To strengthen farmers' capacities in scientific residue management, 136 training programmes of 5-day each were organized, benefitting 3,492 farmers. Field-level adoption was promoted through 5,522 demonstrations using CRM machinery and 240 demonstrations on decomposer technology, strategically conducted at farmers' fields. In addition, 217 sensitisation programmes were organized in schools and colleges, reaching 24,795 students to raise awareness on the adverse impacts of residue burning. Collectively, these IEC interventions contributed to a significant level of consistent decline in stubble burning in the north-western region, with an overall reduction of more than 85 per cent in 2025, as compared to the year 2020. Notably, Punjab alone recorded over 93 per cent reduction in stubble-burning incidents during the same period.

- Knowledge System and Home-Based Agricultural Management in Tribal Areas (KSHAMTA) improved nutrition and income for more than 48,000 tribal families.
- Schedule Caste Sub Plan (SCSP) & Tribal Sub Plan (TSP) benefitted more than 10 lakh farmers through trainings, demonstrations, and access to critical inputs.
- National Mission on Natural Farming (NMNF) is being implemented across 530 KVKs, wherein 75,460 farmers and 11,460 *Krishi Sakhis* were trained; and 1,899 model natural farms were developed.
- Agri-Drone Project conducted 19,737 demonstrations covering an area of 23,225 ha under precision farming.

Viksit Krishi Sankalp Abhiyan (VKSA)

To bridge knowledge and capacity gaps and to integrate farmers' feedback into demand-driven research, ICAR in collaboration with the Department of Agriculture & Farmers' Welfare (DA&FW), State Government Departments, and Agricultural Universities, organized **VKSA** from **29 May to 12 June 2025**.

To promote Lab to Land (L2L) in true spirit, the VKSA adopted a **"One Nation-One Agriculture-One Team"** convergence approach with the following major objectives:

- To enhance farmers' awareness and understanding of improved agricultural technologies and relevant Central and State Government schemes and policies for agricultural development.
- To facilitate reciprocal learning by engaging the scientific fraternity and systematically documenting grassroots insights, local needs, and farmers' feedback on improved technologies and innovations to strengthen agricultural research.

A robust and methodologically sound approach was used to identify key challenges faced by farmers through 11,477 Focused Group Discussion (FGDs) involving over 1.63 lakh farmers. The data generated through these FGDs were statistically analyzed and visualized using violin and box plots to clearly depict the distribution and variability of responses.

Major achievements of VKSA across India

Teams formed (No.)	:	**2,170**
Programmes organized (No.)	:	**60,917**
Villages covered (No.)	:	**1,40,107**
Districts covered (No.)	:	**728**
Farmers (men) participated	:	**95,69,693**
Farm women participated	:	**39,72,412**
Total participants	:	**1,35,42,105**

Major achievements (Tribal districts)

Teams formed (No.)	:	**504**
Programmes organized (No.)	:	**15,445**
Villages covered (No.)	:	**31,048**
Districts covered (No.)	:	**176**
Farmers (men) participated	:	**15,41,712**
Farm women participated	:	**10,10,404**
Total participants	:	**25,52,116**

Major achievements (Aspirational districts)

Teams formed (No.)	:	**325**
Programmes organized (No.)	:	**9,864**
Villages covered (No.)	:	**23,483**
Districts covered (No.)	:	**112**
Farmers (men) participated	:	**13,34,204**
Farm women participated	:	**6,55,466**
Total participants	:	**19,89,670**

Salient Outcome of VKSA

- Identified more than 500 researchable, extension-oriented, and policy-relevant issues with direct implications for agricultural development and farmer welfare.
- Documented more than 300 farmer-led innovations, among these, over 100 strong potentials for validation, refinement, and scaling through research-extension partnerships to generate wider and sustainable benefits for farming communities.

Release of *Kharif* Agro-Advisory 2025 for farmers

Women participated in VKSA at Dima Hasao, Assam

Hon'ble Minister of Agriculture and Farmers' Welfare visited ATARI, Hyderabad during VKSA

Direct Interaction with Farmers by Hon'ble Minister of Agriculture and Farmers' Welfare

MoS-Women Participation during VKSA

SUCCESS STORIES

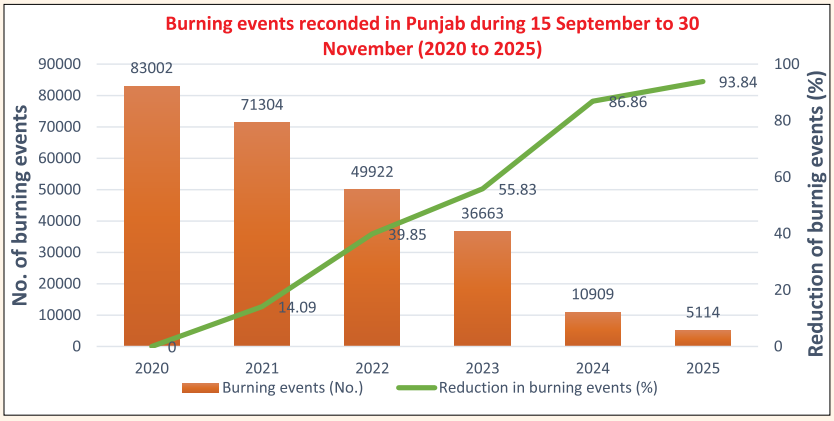
Punjab shows the Pathways to 'Mission Zero Burning'

Crop residue burning has long posed a serious environmental and agricultural challenge across north-west India, especially in Punjab. To tackle this issue, the Ministry of Agriculture and Farmers' Welfare, launched a Central Sector Scheme on *In situ* Crop Residue Management (CRM). In this scheme, KVKs played a pivotal role in promoting sustainable alternatives to stubble burning by integrating technology demonstration, community mobilization, and Capacity building. During 2024-25, KVKs demonstrated CRM technologies on 3,244 ha, engaging over 3,200 farmers and mobilizing another 6,000 through exposure visits and field events. Intensive outreach efforts included 206 awareness programmes reaching 17,000 farmers, 40 training programmes for 1,684 farmers and machine operators, and several *Kisan Melas* attended by more than 1,50,000 participants. Student engagement was also prioritized, with 82 school and college events sensitizing more than 13,000 students to sustainable residue management practices. A multi-channel communication campaign amplified the message through 91 newspaper ads, 67 scientific articles, 298 hoardings, 1,255 posters/banners, 674 wall writings, and 70,000 pamphlets. Media outreach included 16 TV programmes and extensive digital engagement via 92 WhatsApp groups, m-Kisan advisories to 37,251 subscribers, and YouTube videos with over 22,000 views.

This integrated "*Push-Pull-Enforcement*" strategy–combining field demonstrations, capacity building, and communication yielded transformative results. The north-west region witnessed an 85% reduction in stubble-burning incidents (2025 vs. 2020), with Punjab alone achieving over 93% decline (2025 vs. 2023).

In 2024-25, Punjab's *in situ* CRM efforts resulted in ₹538 crore savings in cultivation costs; ₹495 crore worth of nutrients retained in the soil; and 571 million cubic metres (MCM) of groundwater saved through reduced irrigation needs.

The "*Mission Zero Burning*" experience in Punjab demonstrated that sustained awareness, technological support, and community participation can drive large-scale behavioural change. The success has positioned Punjab as a national model for sustainable crop residue management, proving that a clean, productive, and climate-resilient agriculture is achievable through coordinated action.



CASE STUDIES/SUCCESS STORIES

Silent Revolution through Mechanized Paddy Transplanting

Punjab, cultivates paddy on over 31 lakh hectares annually. Until recently, over 99% of this area relied on manual transplanting, heavily dependent on migrant labour during June-July, with labour costs rising to ₹4,000–₹5,000/acre. This not only made cultivation costly but also intensified groundwater depletion due to puddling, leading to 76% of Punjab's blocks being classified as *over-exploited*.

To overcome these challenges, mechanical paddy transplanting can be a sustainable alternative. Adoption increased from 0.03 lakh ha (2015) to 0.37 lakh ha (1.1%) by 2024. Various transplanter models self-propelled single-wheel and walk-behind four-wheel ensured uniform planting, optimal density, and improved crop performance.

A key innovation enabling this shift was the mat-type nursery system, requiring only 50 m² of nursery area per hectare. The Punjab Agricultural University (PAU) developed a tractor-operated nursery seeder, which prepares seedbeds and sows seeds in a single pass. The machine can establish nurseries for 55–60 hectares per day, reducing labour by 90% and costs by 60%, with an additional 40% government subsidy enhancing affordability.

Last year, KVKs took lead in demonstrating this technology across six districts of Punjab, namely: Hoshiarpur, Sangrur, Jalandhar, Kapurthala, Ludhiana, and Ferozepur; and it showed that mechanical transplanting by using 25-day-old mat-type seedlings achieved better plant establishment, resource efficiency, and profitability than traditional manual transplanting with 30-day-old seedlings.

The introduction of mat-type nurseries and mechanized transplanting marks a transformative step in Punjab's paddy cultivation. It addresses labour shortages, reduces groundwater extraction, and lowers production costs while sustaining productivity. This mechanization-driven shift exemplifies Punjab's leadership in promoting climate-smart, resource-efficient, and economically viable rice farming, ensuring both environmental sustainability and farmer prosperity.

Mechanized transplanting marks a transformative step in Punjab's paddy cultivation

Diversification with Oranges: Vadji Village of Maharashtra showed the Pathway

Vadji, a small village in Risod taluka, Washim district, Maharashtra traditionally relied on low-income crops such as soybean, pigeon pea, chickpea and wheat, with limited employment opportunities. In 2018, Krishi Vigyan Kendra (KVK) Washim, in collaboration with the Horticulture Department adopted Vadji as a model village to introduce modern agricultural interventions. A group of 11 progressive farmers, led by Shri Rajesh Borkar, implemented scientific orange cultivation practices including the use of improved saplings from Panjabrao Deshmukh Krishi Vidyapeeth, Nagpur, drip irrigation and farm ponds with a total storage capacity of 7.50 crore litres. Training and technical guidance on orchard management, pest control, nutrient management, pruning and early fruiting were provided through regular field visits and workshops.

The interventions resulted in significant economic gains. Farmers achieved average yields of 40–42 t/ha, generating net profits of ₹15.00–18.00 lakh/ha, with the village earning ₹3.50–4.00 crore in the current year. The success led to the expansion of the collective farming initiative from 11 to 104 farmers, covering 150 ha. Additionally, farmers diversified into turmeric, custard apple, mango, and onions and established a community managed *Goshala*, promoting integrated farming systems. Vadji's transformation demonstrates the impact of collective farming, scientific interventions, and mentorship in enhancing productivity, profitability, and rural livelihoods. The model highlights the potential of technology-driven, community-oriented agriculture to create sustainable economic empowerment; and it serves as a replicable framework for other rural regions.

Successful Orange cultivation model through scientific interventions

Ridge & Furrow Method proved Resilient for cultivation of Pigeon Pea in Kalaburagi District of Karnataka

Kalaburagi district in Karnataka's north-eastern dry zone depends heavily on monsoon rains and often faces erratic rainfall, delayed onset, dry spells, and heavy downpours, leading to severe crop losses—especially in pigeon pea and other rainfed crops grown on vertisols, which are prone to water-logging and cracking in drier conditions.

To address these issues, KVK Kalaburagi introduced the Ridges and Furrows land configuration technology in 2017-18 on an area of 10 ha, demonstrating its ability to conserve moisture and improve drainage. Crops are sown on ridges while furrows act as drainage channels during rains and moisture reserves during dry periods, enhancing resilience and yield.

Farmers reported 30–40% higher yields, better plant stand, and reduced mortality during heavy rains. Encouraged by results, the KVK expanded demonstrations and training programmes with the Department of Agriculture, leading to rapid adoption - from 10 ha (initially) to over 2,000 ha (by 2025).

Given frequent monsoon-related losses (e.g. ₹250.97 crore compensation to 3.26 lakh farmers in 2025-26 and ₹575.1 crore insurance payouts in 2024-25), this system offers a climate-smart, cost-effective solution that reduces vulnerability, stabilizes yields, and enhances farm-level resilience. Success of this technology underscores its scalability across an area of 6 lakh ha of cultivated land in Kalaburagi.

Spicing Up Prosperity: The Green Vivo Agro Story from Kerala

Green Vivo Agro Producer Company Ltd. is an active *Farmer Producer Organization* (FPO) based in Idukki, Kerala, primarily involved in the cultivation and trade of spice crops. KVK Idukki motivated the farmers involved in '*Spice Value Chain'* to establish a FPO for the purpose of facilitation in processing and marketing of spices; and accordingly, this FPO was established in the year 2016. Since then, this FPO has been serving its farmer-members by providing essential agro-inputs and market linkages, while supporting spice-growing farmers in the Idukki region, which is famous for spice cultivation, but in traditional method. Its activities generally involve providing agricultural support and related services. The FPO's major operations include the cardamom processing unit, grading and inputs-based outlet. Green Vivo Cardamom Processing Unit consists of five cardamom processing machines, which are highly sophisticated and has processing capacity of 3.2 tonnes per day. Farmers can store the produce in the warehouse provided by FPO until they fetch a better price in market. KVK Idukki provides technical and capacity-building support to this FPO. At present, FPO has 300 active members; and it has accounted an annual turnover of more than ₹ 2 crores.

Cardamom Processing Unit

Collective Strength, Shared Success: The Puthari FPO Model from Karnataka

Puthari FPO (*Puthari Farmers Producer Company Limited*) is a farmer-owned company in Kodagu,

Promoting Paddy transplanting

Karnataka, which promotes collective farming and business activities for its members. NABARD has provided financial support, while KVK Kodagu provided technical and capacity-building support. This FPO was established in the year 2017 with 1200 active members; and it provides its services for its farmer members involved in cultivation of coffee, pepper and paddy. It also provides essential farm inputs at cheaper rates than the general market, including manures, fertilizers, plant protection chemicals, seeds, and farm machinery. The FPO assists farmers with market linkages for their produce, including coffee and pepper, under its own brand "*Jamma*". It also operates a "*Rural Mart*" for selling various agricultural products, including fresh fruits, vegetables, and groceries. By supplying inputs directly and efficiently, the FPO has helped farmers reduce their cost of cultivation by an estimated 20–25 per cent. Collective action and wisdom have promoted this FPO, whose annal turnover is more than ₹6 crores.

Labourer to Agri-Entrepreneur: A Champion from Champaran

Once earning just ₹10,000 per month as a daily wage labourer, Mr. Atul Vats from West Champaran, Bihar, aspired to build a more stable and dignified livelihood. His opportunity came in 2021, when he enrolled in the KVK West Champaran under ARYA (*Attracting and Retaining Youth in Agriculture*) programme. Under ARYA, Atul received hands-on training in button mushroom cultivation, along with technical guidance, input support, and continuous mentoring from KVK experts. With this support, he established the "*Hare Krishna Mushroom Farm*", initially on 700 m^2 of land, focusing on scientific methods of production, hygiene management, and efficient marketing.

Within a short span, Atul's enterprise grew to produce 10–12 tonnes of button mushrooms annually. Initially facing marketing challenges, he diversified sales through local markets, mandis, exhibitions, Kisan Melas, and direct supply to restaurants, achieving business stability. Today, his farm generates an impressive net annual income of ₹7–8 lakh with a B:C ratio of 2.0–3.3, demonstrating high profitability and scalability.

Successful agri-entrepreneur model for rural youth empowerment

The ARYA initiative empowered Atul to transition from a daily wage labourer to a successful agri-entrepreneur, establishing a sustainable and replicable business model. His journey stands as a beacon of rural youth empowerment, proving that with the right training, innovation, and institutional support, agriculture can be both profitable and aspirational.

Sweet Revolution through Strawberry in hot semi-arid Magadh

Mr. Brij Kishore Mehta, a small farmer from Chilkhi village of Kutumba block from Aurangabad district of Magadh division in Bihar, owned 1.2 ha of land; and used it for traditional rice and wheat cultivation, earning about ₹4 lakhs annually. Seeking better income, he attended a training programme conducted by KVK Aurangabad on diversified agriculture; and subsequently, he decided to try strawberry cultivation.

The KVK provided scientific guidance, training, frontline demonstrations, and exposure visits to successful farms and ICAR-IIVR, Varanasi, helping Mr. Mehta adopt modern cultivation techniques. Subsequently, he decided to cultivate strawberry, initially on an area of 0.8 ha; and, as a result of it, his annual income rose to ₹15 lakh. Later on, he expanded the area under strawberry cultivation up to 3 ha; and now his annual income exceeds ₹75 lakh through scientific strawberry farming.

Inspired by his success, over 250 farmers from 10 villages have adopted strawberry cultivation under KVK supervision, covering 120 ha and earning ₹18–20 lakh/ha annually, making Aurangabad a promising hub for high-value fruit cultivation.

Strawberry cultivation through diversified agriculture

Pothar Konya: Daughter of the Field Blossomed

Ms. Nabanita Das, fondly known as "*Pothar Konya*" (Daughter of the Field), hails from Potia Gaon, Jorhat district, Assam. A progressive woman farmer, she has transformed her two ha farm into a flourishing floriculture-based enterprise, cultivating marigold, gerbera, and anthurium with remarkable success.

With technical guidance and handholding from KVK Jorhat, She received training in floriculture, nursery management, soil health, vermicomposting, and scientific poultry farming. She diversified her enterprise

by setting up a vermicompost unit, a poultry unit with breeds like *Kadaknath* and Silkie, and a floriculture nursery on an additional 0.5 ha.

Today, her integrated farm produces and markets annually 500 kg of flowers, 1.5 lakh flower stems, and 35,000 seedlings along with 20 quintals of vermicompost, 1,500 eggs, and 200 poultry birds.

All products are sold locally, generating an annual turnover of ₹25–30 lakh. Her enterprise also provides employment to 10 full-time and 15 seasonal workers, making her a key contributor to the village economy. Ms. Das's journey exemplifies women-led agricultural entrepreneurship. Her success, powered by scientific intervention and local innovation, has inspired several neighbouring farmers to adopt floriculture and integrated farming. Popularly celebrated as "*Pothar Konya*", she symbolizes how knowledge, persistence, and institutional support can cultivate both prosperity and social change in rural Assam.


Floriculture with scientific poultry farming

Daily Wager turned Entrepreneur: Saga of Success from Manipur

Shri Thongam Rabichand, a 26-year-old graduate from *Leimaram Heinoubok*, Bishnupur district, Manipur, exemplifies how determination and institutional support can turn hardship into entrepreneurship. After graduating in 2017, he worked as a wage-based electrician, earning barely ₹90,000 annually, which was insufficient to sustain his family. Seeking a more stable livelihood, he decided to utilize his 0.5 ha of land for farming.

Diversified cultivation of vegetables

With technical support and hands-on training from KVK Bishnupur, Shri Rabichand learnetd scientific cultivation of watermelon and other high-value crops through off-campus horticultural programmes. Encouraged by the results, he diversified into tomato, French bean, maize, broad bean, garden pea, cabbage, and rajma. KVK supplied quality seeds and seedlings—notably French bean (Arka Sukomal, Ayoka), pea (Kashi Ageti, Arkel), and tomato (NS-501)—and provided continuous field supervision. He further enhanced his skills through CAU Imphal's training programmes and workshops by the Department of Horticulture and Soil Conservation. Through adoption of modern scientific practices, Shri Rabichand earned a net income of ₹3.52 lakh, enabling him to purchase a Honda Activa and a diesel autorickshaw, improving his family's mobility and livelihood security. His wife and mother now actively participate in the enterprise, as his mother markets the produce locally, while his wife supports on-farm operations.

Today, Shri Rabichand stands as a role model for rural youth, inspiring others to adopt scientific farming for self-employment. His success showcases how training, perseverance, and institutional support can transform a daily wage earner into a successful agripreneur, strengthening rural economies and fostering youth-led agricultural entrepreneurship in Manipur.

17.
Research for Tribal and Hill Regions

Agriculture in tribal and hill regions of India is constrained by fragile ecosystems, rainfed conditions, low-input farming, limited market, and high vulnerability to climate variability during different seasons. Traditional low-yielding cultivars, discrete seed systems, and limited adoption of improved technologies have resulted in low productivity and farm incomes, particularly in the North-Western Himalayas and North-Eastern Hill (NEH) regions. Multi-location field demonstrations, breeder and nucleus seed production, farmer-scientist interactions, and participatory seed dissemination were conducted across tribal districts of Uttarakhand, Jammu & Kashmir, Arunachal Pradesh, and other NEH states. Improved the varieties of cereals, millets, pulses, plantation crops, spices, and horticultural crops were evaluated under farmers' field conditions. Socio-economic and productivity impacts were assessed using yield comparisons, adoption coverage, and farmer feedback. A total of 18.54 tonne breeder seed and 1.15 tonne nucleus seed of 38 varieties across 13 crops were produced, strengthening the regional seed systems. Improved finger millet variety VL Mandua 376 recorded 38.8% higher yield (12.5 q/ha) than local cultivars and matured 3–4 weeks earlier, benefiting 525 households over 430 ha. Maize hybrid yielded 40.2–58.4 q/ha, while improved rice varieties in Rajouri showed significant superiority over local varieties. Ginger, wheat, pulses, and horticultural interventions improved productivity, reduced labour cost, and enhanced income, with cost-benefit ratios reaching 1:3.50 in value-added enterprises. With technical support from ICAR-CICFR, the Union Territory of Ladakh is progressing towards self-reliance in rainbow trout seed production through establishment and upgradation of hatcheries, farmer-level advisory services, capacity building, and large-scale distribution of quality eyed ova and high-performance feed for tribal farmers. ICAR-CIFRI promoted community-based aquaculture in drought-prone areas of Purulia district, West Bengal, by bringing 16 community-managed rainfed waterbodies under aquaculture, benefiting 481 tribal women organized into SHGs through capacity building, input support, and livelihood diversification including ornamental fish culture. Integrated, location-specific interventions combining improved varieties, quality seed production, and farmer capacity building significantly enhanced agricultural productivity, climate resilience, and livelihoods in tribal and hill regions.

North West Himalayas

Breeder seed production: During the period under report, 18.54 tonne breeder seed of 38 released varieties/ inbreds of 13 crops were produced.

Quality seed production: Around 1.15 tonne nucleus seed of 38 released varieties of 13 crops were also produced following standard methods of maintaining genetic purity. In addition to this, 0.75 tonne Truthfully Labeled seed of 13 varieties of nine crops were produced.

Crop Varieties released and notified: Eleven varieties including rice (2), maize (5), amaranth (1), finger millet (2) and barnyard millet (1) have been developed for tribal areas and hilly region of the country.

North Eastern Hills (NEH) programme

As a part of varietal evaluation and dissemination efforts, six new sweet orange varieties (TM-33, Cutter Valencia, Pera, Natal, Westin and Valencia) were identified and recommended for cultivation under the agro-climatic conditions of Assam and other North-Eastern states.

Field days, demonstrations and farmer-scientist interactions: Finger millet field days and farmer-scientist interaction programmes were organized at Phomeng and Khleteng villages under Lungla circle of District Tawang, Arunachal Pradesh. A total of 99 farmers participated in the programmes.

Finger millet field day and farmer-scientist interaction programmes were organized at Old Sapoung and Pampoli in East Kameng district, Arunachal

Pradesh. The programme was attended by 30 farmers of the district. It was informed that VL Mandua 376 yields more and matures more than two months earlier than the local cultivar.

Capacity Building Programme on Avocado for Sikkim farmers: A capacity building programme was organized at Tadong, Sikkim by ICAR-IIHR on 5 October 2024. Important aspects such as organic production of horticultural crops, value-addition, marketing, cultivation of avocado and environmental protection were highlighted. About 4000 fruit plants (avocado, guava, jackfruit, pummelo and passion fruit), vegetable seeds, microbial cultures and papaya seeds were distributed to over 1500 farmers.

In the Northeast's tribal and hilly areas, where rainfed paddy dominates, crop diversification offers better income and sustainability. ICAR-IIVR, Varanasi identified pre-*kharif* chilli and leguminous vegetables (Indian bean, lima bean, velvet bean, winged bean) as profitable and soil-improving alternatives. Common systems include paddy-vegetables in valleys' ginger-turmeric-vegetables in mid-hills, and mixed cropping in *Jhum* lands. Tomato and cabbage emerged as the most profitable crops in warm- and cool-season systems, respectively, with tomato-cabbage and brinjal-cabbage combinations being most economical. Legume-cucurbit systems and short-duration leafy vegetables also enhanced the farm productivity and resources.

Demonstration of maize varieties and field days: FLDs of maize hybrids VLQPMH 45, VLQPMH 59 and VL *Vita* were conducted on 2.5 ha each in Kwanu and Dhanpau cluster of Dehradun district of Uttarakhand. The yield of the hybrids ranged from 40.2–58.4 q/ha and matured a week early than the local cultivar. A Maize Field Day was conducted on 3 September 2025. A total of 30 farmers participated in the programme. Besides, FLDs of maize hybrids VLQPMH 45, VLQPMH 59 and VL *Vita* were organized on 2.5 ha each in Rajauri and Srinagar in Jammu & Kashmir. Field days on maize and farmers-scientist interactions were organized on 19 September and 21 September 2025, respectively.

Demonstration of improved rice varieties in Rajouri: Three improved varieties of rice, *viz*. VL *Dhan* 68, VL *Dhan* 69 and VL *Dhan* 70 were demonstrated in the farmers' field of Rajouri, Jammu region among 47 farmers in about 12.0 ha area with the help of Regional Agricultural Research Station (RARS) Rajouri, SKUAST-Jammu. The performance of improved cultivar has been found excellent and showed significant yield superiority over the local cultivars K-39, K-343 and Giza 14. These results highlighted the potential of improved varieties to enhance productivity and ensure better returns for farmers in the region.

Ginger FLDs and field day: FLDs of ginger variety

Sirmaur Local were conducted in 5 ha in the cluster during *kharif* 2024. A Ginger Field Day was conducted in Dhanpau village on 16 September 2025. Farmers appreciated the performance of the variety in terms of vigour and disease resistance. Farmers were explained about the precautions to be taken during the harvest and storage of ginger. It was attended by 26 farmers.

Pre-*rabi Goshthi* and wheat seed distribution: A total of 140 q seed of different wheat varieties were distributed in the Dhanpau-Lakhwad village cluster, Kwanu cluster, and Jammu and Kashmir. Front-line demonstrations for a total of 10 wheat varieties, *i.e.* VL *Gehun 829*, VL *Gehun 907*, VL *Gehun 953*, VL *Gehun* 967, VL *Gehun 2014*, VL *Gehun 3004*, VL *Gehun 2015*, VL *Gehun 2028*, VL *Gehun 3010*, and *VL Cookies* were conducted in these tribal areas. A pre-*rabi goshti* on '*Agrim pankti pradarshanon hetu gehun beej vitran-buwai poorva shivir*' was organized in village Majhgaon of Kwanu cluster. During the *goshti*, information on important characters of VL wheat varieties and their package of practices was shared with the farmers. Four VL varieties (VL *Gehun* 953, VL *Gehun* 967, VL *Gehun* 2014 and VL *Gehun* 2028) were distributed among the farmers. The programme was attended by 46 farmers.

Popularization of Finger Millet Variety VL *Mandua* 376 in Tawang: Enhancing Farmers' Profitability and Livelihoods

Tawang district, with 1,260 ha area dedicated to finger millet cultivation and a production of 990 metric tonnes, is the largest finger millet producing district in Arunachal Pradesh. Integral to their social, cultural, and religious practices, finger millet is consumed in various forms, with *zan* (ragi balls) being the most popular. It is also used for preparation of local beverages – *apong* and *chhang.* However, the average productivity of finger millet in the district (780 kg/ha) falls much short of the national average of 1,747 kg/ha, primarily due to the low-yielding local cultivars. The traditional practice of transplanting presents significant opportunities for boosting productivity through the adoption of appropriate technological interventions.

The initiative introduced Early-maturing, high-yielding varieties and VL Millet Thresher-cum-Pearler to enhance quality and to reduce post-harvest labour. Initial trials identified VL *Mandua* 376 as the most promising variety, which was selected for wider dissemination.

Awareness campaigns emphasized the importance of millets for regional food security and their growing global significance through farmers' fairs and field days organized with KVK Tawang with full support from the district administration.

In frontline demonstrations conducted across Tawang district during *kharif* 2025, VL *Mandua* 376 yielded 38.8% more (12.5 q/ha) than the local finger millet cultivar (9.0 q/ha). It also matures 3–4 weeks earlier, earning the name '*teen mahine ka mandua*'.

Additionally, VL *Mandua* 376 has a higher grain-to-chaff ratio compared to the local variety.

Due to the rising demand for VL *Mandua* 376 among the farmers, farmer participatory seed production of VL *Mandua* 376 was initiated in Bletteng in the year 2022 and 2 q of seed was procured, which increased to 20 q in 2024. The procurement target for 2025 is 25 q. The seed procured was distributed to farmers in other villages and blocks for further dissemination.

Due to active efforts by the institute with KVK Tawang coupled with farmer-to-farmer exchange of seed and involvement of State Agriculture department, VL *Mandua* 376 is estimated to have grown in more than 45 villages covering more than 430 ha area and benefiting 525 households during *kharif* 2025. VL Millet Thresher-cum-Pearler significantly improved finger millet threshing efficiency (500 kg in 10 man hours) compared to the manual threshing efficiency (500 kg grain in 45 man hours). It reduced women's drudgery by saving 77.7% of time, easing posture and reducing discomfort by 56%, while also lowering exposure to organic dust.

Distribution of VL Millet Thresher-cum-Pearler to farmers groups at Tawang

Status of Women Empowerment in Agriculture In Hill Regions of Uttarakhand: Status of women's empowerment in agriculture in hills was examined across three agro-ecological zones, i.e. low, mid and high hills. Women in the mid hills (77.51%) face the most significant empowerment challenges, while those in the high hills (38.18%) show relatively better outcomes. This suggests region-specific barriers and opportunities that should inform targeted interventions. Even among disempowered women, the high hills region showed relatively better achievement across empowerment domains. In contrast, low hills women not only face disempowerment but also deeper inadequacies in key areas like decision-making, asset control, and leadership. Time use (32.54%) and input in productive decisions (23.08%) were top contributors to disempowerment, leadership (16.57%) and control over income (15.38%) were moderate and asset ownership (0.73%) was least, highlighting a critical gap in resource control among women. Multiple regression analysis showed that economic access (irrigation, inputs) and household factors (size, dietary diversity) play a critical role in enhancing women's agricultural agency. Access-oriented interventions (irrigation, inputs, nutrition) appear more impactful than education or expenditure alone.

Finger Millet-Based Adaptation Model for Climate-Resilient Hill Agriculture: A finger millet-based adaptation model for promoting climate-resilient agriculture in the North-Western Himalayan region has been developed and validated. Using a fixed-effects regression model on long-term district-level data from 2000 to 2021, the study demonstrated the superior climatic resilience of finger millet compared to rice and maize. The adoption of high-yielding varieties like VL *Mandua* 379, along with improved practices such as transplanting, can significantly boost yields (up to 35%) and enhance farmers' income.

Transforming Non-Cropped Land into Productive Organic Farming- The Journey of Mrs. E. Tasing: Mrs. E Tasing, a 32-year-old progressive farmer from Oyan village in East Siang district, Arunachal Pradesh, has set a remarkable example by converting one hectare of non-cropped land into a thriving organic farming system. With only a 12th pass qualification, her dedication and openness to innovation led her to adopt the interventions introduced under the project "Promotion of Pulses in NE Region" under IIPR-NER Component. In 2024-25, she implemented an intercropping system of high-yielding variety of greengram (SBC-40) with dragon fruit on her land, which was previously uncultivated. Utilizing Integrated Pest Management (IPM) and Integrated Disease Management (IDM) technologies, including

Rhizobium and *Trichoderma*, she achieved a yield of 12 q/ha from greengram in the very first year, with dragon fruit plants are in their pre-bearing stage. This conversion not only brought barren land under cultivation but also demonstrated the viability of sustainable and integrated farming practices. Her venture resulted in a cost-benefit ratio of 1:2.50, indicating significant economic returns. Mrs. Tasing's success serves as an inspiring model for women and smallholder farmers across the region, proving that with the right support and innovation, organic pulse cultivation can thrive even in non-traditional areas.

Empowering Rural Women through Pulse-based Enterprises - The Journey of Mirbuk Ane SHGs, Pasighat: The Mirbuk Ane Self Help Groups (SHGs) from Pasighat, Arunachal Pradesh, have emerged as a powerful example of women-led value addition and rural entrepreneurship under the "Promotion of Pulses in NEH Region" initiative. Leveraging locally available pulses such as blackgram and greengram, the SHG members have been trained and empowered to produce a variety of value-added food products, including bhujia, besan, and cookies. These products, processed and packaged with quality and hygiene standards, have not only gained popularity in local markets but also created a sustainable source of income for the women involved. Through collective effort, skill development, and market-oriented processing, the SHGs have transformed traditional farming into a profitable enterprise. The economic impact has been substantial, with the group achieving an impressive cost-benefit ratio of 1:3.50, showcasing the profitability of agro-based micro-enterprises when supported by capacity building and value-chain integration. This initiative has not only improved livelihoods but also enhanced the confidence and social standing of women farmers, reinforcing the role of SHGs as engines of economic empowerment in the region.

Progressive Farming of Walnut

Shri Suneel Singh, an ex-serviceman from Kishtwar, Jammu & Kashmir, transformed his passion for walnut farming into a successful enterprise with the support from ICAR-CITH, Srinagar. The institute provided elite varieties, propagation, canopy training, pollination and orchard management guidance, and support for nursery establishment and varietal registration. With this mentorship, he established mother blocks for elite germplasm and developed technical expertise, turning his small venture into a model walnut enterprise. He established mother block on 2 ha land of superior walnut selections, produced 25,000 grafted/ budded plants

Walnut nursery developed

during last three years and supplied planting material to the walnut growers of Jammu and Kashmir, Uttarakhand, Himachal Pradesh, Nagaland, Manipur and Mizoram. Shri Suneel Singh is earning ₹2.00–3.50 lakh per annum (2021). Now he generates an annual income of ₹15–20 lakh per annum from nursery (90%) and walnut sales (10%).

Rainbow Diet Campaign Project in Odisha: The ICAR-CTCRI in collaboration with District Horticulture Department, Keonjhar, Odisha and with funding support from DMF, Keonjhar has initiated Rainbow Diet Campaign project to combat malnutrition among Juang tribes in Banspal block of Keonjhar district. As a part of the programme, orange-fleshed sweet potato variety SP 95/4 has been introduced in Mukuna, Nuagaon, Sendkap villages of Sadar block in 6.5 ha area. The sample harvest conducted by ICAR-CTCRI at Nuagaon village showed bumper yield of sweet potato tubers 35–40 tonnes/ha, which is higher than the national average of 10.58 t/ha.

Rainbow Diet Campaign Project in Odisha

Convergence for Sustainability: A Case Study of Tribal Watershed in Panchmahal District of Gujarat

The Bhadroli Khurd-Karada watershed (659.85 ha) in the semi-arid zone of Kalol taluka, Panchmahal District, Gujarat, has been developed under the Tribal Sub-Plan (TSP) by ICAR-IISWC, Research Centre, Vesad, since 2020-21. The interventions focused on enhancing water availability, crop productivity, and livelihood opportunities in a drought-prone, migration-affected area. De-siltation and repair of local check dams and village ponds increased the water storage capacity by 95,850 m^3. A lift irrigation system with a 3,600 m underground pipeline and 8 hp diesel pump was installed to irrigate 20 ha of farmland. The Water Users' Association (WUA) was established for equitable water

management and system maintenance. These efforts improved groundwater levels (water table rose from 45 m to 24 m), increased *rabi* cropping intensity by 40%, and raised the average farmer income from ₹35,000 to ₹55,000–₹65,000/season. Enhanced water availability also encouraged tribal women's participation in crop planning, kitchen gardening, and agri-based micro-enterprises. The harvested water was also utilized for Delhi–Mumbai Expressway construction, showcasing a successful convergence model linking rural development and infrastructure growth. The initiative demonstrates a replicable model of sustainable watershed development integrating resource conservation, livelihood improvement, and inclusive tribal empowerment.

De-silted water harvesting structure in the watershed

Repair of inlet and outlets of the water harvesting structure

Circular Farming Model Integrating Mushroom Cultivation for Sustainable Vegetable Production in the Temperate Western Ghats

A circular agriculture model integrating white button mushroom (*Agaricus bisporus*) cultivation with a French bean-potato cropping sequence was developed by the ICAR-Indian Institute of Soil and Water Conservation, Research Centre, Udhagamandalam, The Nigliris under the temperate conditions of the Western Ghats, Tamil Nadu. The model aimed to enhance productivity and reduce the carbon footprint/emission from crop production by recycling spent mushroom substrate (SMS) as an organic input. Mushroom cultivation recorded a mean biological efficiency of 16.41%, and the generated SMS was effectively reused in subsequent field crops, offering a sustainable substitute for animal-based manures. Among the tested treatments, Circular Farming System-II (Mushroom cultivation – Recycling of SMS with rock phosphate enrichment – French beans – potato) achieved the highest system productivity (193.98 kg/ha/day), supported by French bean and potato yields of 11.71 t/ha and 14.51 t/ha, respectively. Life cycle assessment revealed a notable reduction in the overall

Mushroom integrated circular economy model for vegetable cultivation developed by ICAR-IISWC, Research Centre, Udhagamandalam, The Nilgiris, Tamil Nadu

carbon footprint by adopting the with Circular Farming System-II at 5788 kg CO_2 eq./ha and 0.23 kg CO_2 eq./kg/ production of economic output, indicating higher carbon-use efficiency. Overall, the study findings demonstrated that circular farming significantly improves resource efficiency, soil carbon resilience, and climate-smart, low-emission food production in temperate highlands.

Potential Crops and varieties released/identified: Two high yielding perilla varieties Poorvottar perilla 3 [yield potential of 1.0 t/ha with oil content (37.88%) and protein content (18.21%)] and Poorvottar perilla 4 [yield potential of 1.0 t/ha with oil content (36.79%) and protein content (18.52%], two Job's tear varieties Poorvottar Job's tear 1 [2.3 t/ha with oil content (9.03%) and protein content (12.67%), antioxidant activity (% inhibition at 1 mg/mL)- 70.30, Fe (mg/100g)-9.42, Zn (mg/100g)-2.09, Mg (mg/100g)-186.81] and Poorvottar Job's tear 2 [yield potential of 2.2 t/ha with oil content (9.63%) and protein content (13.18%), antioxidant activity (% inhibition at 1mg/mL)- 68.07, Fe (mg/100g)-11.66, Zn (mg/100g)-2.46, Mg (mg/100g-209.31] and two Fababean varieties Poorvottar Fababean 1 [yield potential of 1.6 t/ha) with protein content (21.66%), Vicine Convicine (%)- 0.81, Phenol content (%)-0.21, Methionine (g/16 g N)-0.93] and Poorvottar Fababean 2 [yield potential of 1.5 t/ha) with protein content (21.99%), Vicine Convicine (%)-0.84, Phenol content (%)-0.24, Methionine (g/16 g N)-0.79)], were identified for release and notification by varietal identification committee (VIC), AICRN on Potential Crops for Northern Hill Zone and North Eastern Hill Zone.

Release of semi-dwarf black rice *Chakhao* variety, RC Manichakhao 1: *Oryza sativa* L. 'Chakhao', the black scented rice of Manipur, India, is known for its mild, nutty taste and a special aroma, turns a deep purple

colour upon cooking. Traditional *chakhao* varieties are rich in anthocyanin, while relatively low yielder, typically ranging from 2,000–2500 kg/ha. They are tall and highly prone to lodging. Therefore, the first semi-dwarf HYV, RC Manichakhao 1 has been developed offering a 56% and 36% yield increase over *Chakhao Poireiton* and *Chakhao Amubi*, respectively. It has improved amylose content to 11% and ASV of above 5, notably requiring a shorter cooking duration, while maintaining aroma and anthocyanin content of 326.48 mg/100g. This HYV offers a yield potential of 4500–5000 kg/ha, effectively doubling the yield of traditional landraces. This development aligns with increasing market demand potentially enhancing the livelihoods of local farmers and capitalizing the benefits of its GI tag.

PRAYAS Project: The Participatory Research Application for Year-round Income and Agricultural Sustainability (PRAYAS) project continued to advance sustainable farming and rural livelihoods across seven Eastern Indian states-Bihar, West Bengal, Assam, Jharkhand, Chhattisgarh, Odisha, and Eastern Uttar Pradesh. Adopting an inclusive, integrated approach focused on Scheduled Caste (SC) and Scheduled Tribe (ST) farmers, the project combines training, input support, field demonstrations, and infrastructure development to promote climate-resilient, income-generating farming systems. During the reporting period, PRAYAS implemented multiple initiatives to strengthen farmers' skills and diversify income sources. A notable highlight was a five-day tailoring training held in September 2025 for SC women in Malda, West Bengal, where participants learnet garment design, stitching, and machine operation enabling small-scale enterprise development and reducing dependence on farm labour.

Across Gaya, Patna, Ramgarh, and Malda, 10 farmer-oriented programmes on rice fallow management, power tiller operation, tailoring, and crop management benefited 559 farmers (371 men, 188 women). The project distributed 1,300 kg of paddy seed and 360 kg of pigeon pea seed in Gaya and organized awareness events for 219 participants. A virtual address by the Hon'ble Prime Minister to 60 SC farmers served as an inspirational milestone.

To enhance livestock productivity, 19 animal health camps benefited 611 farmers, with 163 availing AI and vaccination services, and 46 tonnes of livestock feed were distributed. Infrastructure support included nursery establishment, seed farm development, and land reclamation over one hectare. Additionally, 55 Integrated Farming Systems (IFS), Nutri-gardens, and Natural Farming models were promoted at 156 sites, improving climate resilience, sustainability, and resource efficiency across project areas.

Empowering tribal women through community-based aquaculture: Tribal women of Chota Nagpur plateau in western West Bengal's Purulia district, remain among the most disadvantaged, facing poverty and entrenched gender barriers. ICAR-CIFRI initiated community-based aquaculture in the drought-affected areas of Manbazar, Puncha, and Hura blocks to support the tribal women of these regions and improve their livelihood. The available rainfed waterbodies *(bandhs)* in the area were selected and about 16 community-managed *bandhs* spanning over 140 acres were brought under aquaculture. This initiative directly benefited around 481 tribal women, organized in 48 Self-Help Groups (SHGs). The operation was strengthened

Training programme for SC women farmers on Upscaling the Production Technology through IFS

Awareness programme and distribution of fish seeds

Capacity building in ornamental fish culture

through imparting training in scientific fish farming and distribution of 1,620 kg of quality fish seed and 22 tonnes of CIFRI CageGrow fish feed. For diversification and generating additional source of income, 30 women beneficiaries were also trained in ornamental fish culture. Further, they were also given FRP tanks and ornamental fish culture kits.

Ladakh nearing self-reliance in rainbow trout seed production

Union Territory of Ladakh with assistance of ICAR-CICFR is edging to achieve self-reliance in rainbow trout seed production. ICAR-CICFR extended technical guidance and input support for establishment of conventional flow-through rainbow trout hatchery at Government Trout Farm, Wakha, Kargil; and setting-up

Demonstration of flow-through rainbow trout hatchery operation and eyed ova rearing at Drass, Union Territory of Ladakh

vertical incubator-based rainbow trout hatcheries, one each in two of the farmers' farms in Nubra region of Leh. Offered services to rainbow trout hatcheries at farmers' farm in Drass and Leh region. Provided advisory to improve Recirculating Aquaculture System (RAS) based rainbow trout hatchery operation and biofilter function at Chuchot Government Fish Farm, Leh. Further, organized training programmes benefitting 75 tribal farmers and Fisheries Department Officials of Leh and Kargil districts. Distributed 2,75,000 rainbow trout eyed ova and 9,000 kg of ICAR-CICFR high performance rainbow trout grower feed to 50 tribal farmers of Ladakh.

18.
Organization and Management

The Department of Agricultural Research and Education (DARE), established in 1973 under the Ministry of Agriculture and Farmers' Welfare, Government of India, plays a key role in coordinating and strengthening agricultural research and education across the country. The Indian Council of Agricultural Research (ICAR) is an autonomous organization under the DARE, Ministry of Agriculture and Farmers' Welfare, Government of India, was established on 16 July 1929 as a registered society under the Societies Registration Act, 1860 in pursuance of the report of the Royal Commission on Agriculture. The ICAR has its headquarters at New Delhi. The Council is the apex body for co-ordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences with 115 institutes, including 77 Research Institutes, 13 National Research Centres (NRCs), 6 National Bureaux, 8 Directorates/Project Directorates, and 11 Agricultural Technology Application Research Institutes (ATARIs), along with 80 Agricultural Universities comprising 69 State Agricultural Universities (SAUs), 3 Central Agricultural Universities, 4 Deemed Universities, and 4 Central Universities with Faculties of Agriculture spread across the country. The Agricultural Scientists Recruitment Board (ASRB) recruits scientific and technical manpower for ICAR under DARE. The Directorate of Knowledge Management in Agriculture (DKMA) promotes ICT-enabled, efficient dissemination of agricultural information. Agrinnovate India Limited (AgIn), ICAR's commercial arm, facilitates the transfer and adoption of agricultural innovations by strengthening linkages between ICAR, industry, and stakeholders for the benefit of farmers and agribusiness. The Co-ordination (Technical) Section and Award Cell undertake responsibilities, including preparation of Cabinet summaries, organization of Directors' Conferences and Regional Committee meetings, management of ICAR Awards, implementation of Swachh Bharat Mission activities, and handling parliamentary matters. During reporting time, ICAR organized the Directors' Conference and Annual Conference of Vice-Chancellors, focusing on climate-smart agriculture, carbon farming, artificial intelligence, genomics, robotics, and digital technologies for agricultural transformation. Regional Committee meetings held across multiple zones between February 2024 and February 2025 strengthened coordination among ICAR institutes. The 97th ICAR Foundation Day showcased new agricultural technologies, with participation of around 500 farmers and senior officials. Financial and administrative efficiency was reinforced through timely parliamentary reporting, financial support to 46 scientific societies for journal publication, and assistance to 61 national and international conferences. Under the Swachhta Action Plan, ₹ 400 lakh was allocated in 2024-25 and 2025-26 for sustainable waste management. Additionally, 60 Umbrella Memorandums of Understanding (UMoU) were signed to strengthen collaborative research, while significant progress was achieved in human resource management through promotions, direct recruitment, and MACP financial upgradation of 23 personnel. Overall, ICAR's organizational and managerial initiatives underscore its commitment to transparent governance, scientific excellence, and sustainable agricultural production system in India.

Department of Agricultural Research and Education

The Department of Agricultural Research and Education (DARE) was established in the Ministry of Agriculture, Government of India in December 1973 to coordinate and promote agricultural research and education in the country. DARE provides necessary government linkages for the Indian Council of Agricultural Research (ICAR), the premier research organization for coordinating, guiding and managing research in areas including crop science, horticulture science, natural resource management, agricultural engineering, animal science, fisheries science, agricultural education and agricultural extension in the entire country. With 115 ICAR institutions and 80 agricultural universities spread across the country, this is one of the largest national agricultural research systems in the world. Apart from ICAR, DARE has other autonomous bodies, viz. Agricultural Scientists Recruitment Board (ASRB), the Central Agricultural Universities (CAUs) at Imphal (Manipur), Jhansi (Uttar Pradesh), and Pusa (Bihar); Agrinnovate India Limited (AgIn), established in 2011 under the DARE as the commercial wing of the ICAR, aims to foster innovation in agriculture. AgIn serves as a bridge between ICAR and stakeholders,

promoting sustainable technologies from the National Agricultural Research and Education System (NARES) to enhance agribusiness and agricultural practices. It also strengthened collaborations with private industries and entrepreneurs, accelerating the adoption of agricultural technologies to benefit farmers and the agricultural sector at large.

Indian Council of Agricultural Research

The Indian Council of Agricultural Research is an autonomous organization under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers' Welfare, Government of India. Formerly known as the Imperial Council of Agricultural Research, it was established on 16 July 1929 as a registered society under the Societies Registration Act, 1860 on the recommendations of the Royal Commission of Agriculture. It was reorganized in 1965 and again in 1973, with its Headquarters located in Krishi Bhawan, New Delhi, with support facilities in Krishi Anusandhan Bhawan (KAB) 1 and 2 and NASC Complex, Pusa, New Delhi. The Union Minister of Agriculture and Farmers' Welfare is the President of the ICAR. The Principal Executive Officer of the ICAR is the Director General, who also functions as Secretary, DARE, Government of India. The General Body of the ICAR Society, headed by the Union Minister of Agriculture and Farmers' Welfare is the supreme authority of the ICAR. Its members include; Ministers for Agriculture, Animal Husbandry and Fisheries, and the senior officers of the various state governments, Members of Parliament and the representatives from industry, research institutes, scientific organizations and farming community. The Governing Body headed by the Director General (DG), who is also the Secretary, DARE is the Chief Executive and decision making authority of the ICAR. The Governing Body consists of eminent agricultural scientists, educationist, public representatives and representatives of the farmers. It is assisted by the Accreditation Board, Regional Committees, Policy and Planning Committee, several Scientific Panels and Publications Committee. In scientific matters, the DG is assisted by 8 Deputy Directors General (DDGs), one each in (i) Crop Science, (ii) Horticulture Science, (iii) Natural Resource Management, (iv) Animal Science, (v) Agricultural Engineering, (vi) Fisheries Science, (vii) Agricultural Education, and (viii) Agricultural Extension, who are also assisted by Assistant Directors General (ADGs), and are the Heads of their Subject Matter Division (SMDs) for the entire country. SMDs are responsible for extending all technical and financial guidance and support to the Research Institutes, National Research Centres and the Project Directorates within their respective Divisions. In addition, ADGs of National Agricultural Science Fund (NASF), Coordination, Plan Implementation and Monitoring, Intellectual Property and Technology Management and Human Resource Management also assist the Director General in their respective job roles. The research set up of the ICAR include 115: 77 Research Institutes, 6 National Bureaux, 19 Project Directorates and Agricultural Technology Application Research Institutes (ATARIs), 13 National Research Centres. The Agricultural Scientists Recruitment Board (ASRB) is a premier recruitment agency under the DARE, Ministry of Agriculture and Farmers' Welfare. ASRB is responsible for recruiting scientists and other officers for the ICAR. The Directorate of Knowledge Management in Agriculture (DKMA) is committed to promote Information & Communication Technology (ICT) driven technology and information dissemination system for quick, effectual and cost-effective delivery of messages to all the stakeholders in agriculture Production system. In addition, Directorate is delivering and showcasing ICAR technologies, policies and other activities through print, electronic mode. The ICAR promotes research, education and frontline extension activities in 80 Agricultural Universities, which include 69 State Agricultural Universities, 4 Deemed Universities, 3 Central Agricultural Universities, and 4 Central Universities with agricultural faculty by giving financial assistance in different forms.

Technical Co-ordination

The mandates of Co-ordination (Technical) Section and Award Cell:- Preparation of Monthly Cabinet Summary for Cabinet Secretary, Organizing meeting of 'Standing Committee' for grant of financial assistance to Scientific Societies and Academic Institutions for holding of National/ International Conferences/ Seminars etc. and publication of Scientific Journals, Organizing Directors Conference, coordinating and organizing the ICAR Regional Committee Meetings, Collaboration with Department of Science and Technology, Department of Biotechnology, Department of Scientific and Industrial Research, CSIR, ICMR, Bureau of Indian Standards etc., dealing with the reference received from Prime Minister's Office, President's Secretariat, Members of Parliament and VIPs etc., laying of ICAR Annual Report and Audited Accounts in the Parliament, formulation and submission of Parliament Questions of inter-divisional nature, Nodal point for e-Samiksha portal for DARE/ ICAR, Revision of guidelines for Awards from time to time, Releasing funds for Award from time to time, Releasing funds for Lal Bahadur Shastri (LBS) and Norman Borlaug Award projects, handle and promote the Swachhta Action Plan (SAP): releasing of funds, uploading of approved quarterly report on SAP Portal. Organization of Swachhta Pakhwada/Swachhta Hi Sewa, Collecting and compiling the Swachhta Pakhwada Daily reports and uploading on the portal, handling the "Swachh Bharat Mission": Organizing of Review Meetings of ICAR Institutes by Hon'ble Agriculture Minister/Hon'ble DG, ICAR to review the ICAR Institutes.

To collect, compile and provide the agenda to the Ministry of Home Affairs for Zonal Council Meetings, Arranging the Review Meetings of ICAR Institutes under the Chairmanship of Hon'ble Agriculture

Minister, Various Campaigns from Government of India, Inter-ministerial assignments, Convergence of various Central Government Schemes and Organization of various important events, viz. Foundation Day and Award Ceremony and all matter related to ICAR Awards including revision of guidelines for Awards.

ICAR Director's Conference and Annual Conference of Vice Chancellors

ICAR Director's Conference and Annual Conference of Vice Chancellors was organized on 20th May, 2025 at Bharat Ratna Dr. C Subramanian Auditorium, NASC Complex, Pusa, New Delhi. The Conference was organized in Physical mode and inaugurated by Secretary (DARE) and DG (ICAR) Dr. M.L. Jat, all the DDGs, and other officers and directors of ICAR institutes participated. In his opening remarks, Dr. M.L. Jat briefed the dignitaries and delegates about the theme of the Conference and urged them to engage in action-oriented discussions. He emphasized the need to improve the quality of agricultural education in universities and allied institutes, and to make appropriate use of available technology and resources to deliver the best possible outcomes for the progress of agriculture in the country. Climate-smart Agriculture, Carbon Farming, and suggested to encourage investment in sectors discussed. Also, discussion about areas like Artificial intelligence, modern tools and machinery, genomics, robotics, Internet of Things (TOT), blockchain, etc. for development in agriculture sector.

Regional Committee

The Regional Committee held once every two years, provide an ideal platform for reviewing the status of agricultural research, education and extension in the mandated states and union territories. The Committee provides a forum for liaison and coordination among the institutes of the Indian Council of Agricultural Research (ICAR), State Agricultural Universities (SAUs) and State Departments of Agriculture, Horticulture, and Animal Husbandry and Fisheries. Secretaries of State Department, Members of ICAR Governing Body, Senior Officials from ICAR Headquarters and State Departments, Vice-Chancellors of SAUs, Directors and Scientists of ICAR Institutes in the region participate in the meeting, which is chaired by Secretary DARE & DG, ICAR. The problems being faced by the states in the areas of agriculture and related fields and the technology options/potential solutions available to be developed by the NARS system were discussed threadbare and actionable points were identified and assigned to the respective institutes/ universities/ KVKs to be resolved in a targeted time frame. The action taken on the issues raised in the previous Regional Committee Meetings were also reviewed. Meetings of ICAR Regional were also reviewed. 28th meeting of ICAR Regional Committee NO. VIII held on 16 February 2024, at ICAR-CIBA, Chennai, 28 meeting of ICAR Regional Committee NO. II held on 23rd August 2024 at ICAR-NRRI, Cuttack and 28th meeting of ICAR Regional Committee NO. V held on 18 February, 2025 at NASC Complex, New Delhi by ICAR-IIVR, Varanasi through Physical/ Hybrid Mode. These meetings were inaugurated by Secretary (DARE) & DG, ICAR. Hon'ble Agriculture Minister, Hon'ble Minister for Animal Husbandry, Dairying and Fisheries and Hon'ble Minister of State for Agriculture (ICAR) also gave their valuable suggestions in the meetings by video conferencing.

ICAR Foundation Day

The 97th Foundation Day and Technology Day of ICAR was celebrated during 15-16 July 2025. During the occasion, certificates for 5 new technologies per SMDs along with the release of related products and books. During the celebration, around 500 farmers and senior officers of ICAR and other departments, visited the exhibition on 16 July, 2025. Sh. Shivraj Singh Chauhan, the Hon'ble Union Minister of Agriculture and Farmers' Welfare and president of the ICAR Society, extended congratulations to ICAR and the dignitaries on this significant occasion. Union Minister of State for Agriculture and Farmers' Welfare Shri Bhagirath Chaudhary, Shri Devesh Chaturvedi, Secretary, Department of Agriculture and Farmers' Welfare and Shri Puneet Agarwal, Additional Secretary & Financial Adviser, DARE/ICAR were also present on the occasion.

ICAR 97th Foundation Day and Technology Day 2025

Support to Scientific Societies

During the Fiscal year 2025-2026, the Council provided financial support to 46 societies for the publication of Scientific Journals. In addition, Societies/ associations/universities were supported for holding National Seminars/Symposia/Conferences (41 Nos) and International Seminars/Symposia/Conferences (20 Nos).

Reporting to Parliament and Ministries

The Annual Report of ICAR for the 2024-25 along with review statement was laid on the tables of Lok Sabha on 12-08-2025 and Rajya Sabha on 08-08-2025. The Annual Account and Audited Report of ICAR for the 2023-24 along with the review statement was also laid on the table of the Lok Sabha and Rajya Sabha on 30-07-2024 and 02-08-2024, respectively (well before time).

Under Swachh Bharat Mission, Swachhta Action Plan (SAP) activities, viz. (i) Microbial-based Agricultural Waste Management using vermicomposting at Krishi Vigyan Kendras adopted villages, (ii) Management and Commercial Utilization of Fish Waste in 10 Fish Markets (in Urban locations) and (iii) Phytoremediation for cleansing sewerage water for agricultural application to be replaced at different locations have been undertaken by various units of ICAR. SAP activity-wise progress reports for three quarters have been compiled and uploaded on the SAP Portal. An amount of ₹ 400 lakhs was given for undertaking the SAP activities during the financial year 2024-25 and an amount of ₹ 400 lakhs has also been earmarked for the current financial year 2025-26. Apart from this, date-wise Action Plan for Swachhta Pakhwada (From 16-31 December) was prepared and regularly uploaded on the designated Portal of the Ministry of Jal Shakti, Department of Drinking Water and Sanitation. Besides this Special Campaign 4.0 disposal of pending matter from 2 October 2025 to 31 October 2025 was conducted successfully at the Council Headquarter as well as at all the Institutes of ICAR spread across India.

Memorandums of Understanding

The Umbrella Memorandums of Understanding (UMoU) were signed between the ICAR and the Host Institutions, i.e. Central Universities/ Central Agricultural Universities/States Agricultural Universities to co-operate in conducting research through all India Coordinated Research Projects (AICRPs) and any other such schemes funded/ sanctioned by the Council to the Host Institution from time to time at specified location(s) under the specified Supervisor/Principal Investigator/ Leader of the Host Institution. A total 60 such UMoUs have been signed with the Central Universities/Central Agricultural Universities/ States Agricultural Universities.

Administration

Filling up of vacant posts

During the period, following posts were filled up in ICAR under the promotion quota: 3 Joint Secretary/ Jt Director (A), 2 JS (Finance)/ Sr Comptroller, 5 Director/ CAO (Senior Grade), 14 Deputy Director (F)/CFAO, 1 Deputy Secretary/CAO, 20 Senior Finance and Accounts Offrcer, 3 Under Secretary, 21 Senior Administrative Officer, 21 Administrative Officer, 7 Finance and Accounts Offrcer, 9 Principal Private Secretary, 9 Section Officer,2 AFAO at ICAR Hqrs, 7 Private Secretary, 5 Personal Assistant, 9 Assistant at ICAR Hqrs and 2 UDC at ICAR Hqrs.

Under the direct recruitment quota, 9 posts of AO and 4 posts of FAO were filled up from reserve panel of examination conducted by ASRB.

Financial upgradation granted under MACP Scheme

During the period under report, 23 eligible officers and staff of ICAR were granted the benefits of financial upgradation under the Modified Assured Career Progression (MACP Scheme) at ICAR HQs.

Finance

For the financial year 2025-26, the Budget Estimates (BE) was ₹ 9,645.05 crore to the ICAR and ₹ 821.34 crore to the DARE. Overall, the total allocation for ICAR and DARE together was ₹ 10,466.39 crore as per the Budget Estimates for 2025-26.

19. Intellectual Property and Technology Management

ICAR significantly strengthened its innovation, intellectual property, and technology commercialization ecosystem under the National Agriculture Innovation Fund (NAIF). A total of 145 new patent applications were filed across agricultural science domains, raising the cumulative filings to 1,851, while 55 patents were granted, taking the total granted patents to 733, with contributions from 50 ICAR institutes. In plant variety protection, 103 applications were filed and 165 varieties were granted registration, increasing the cumulative applications to 1,649. Further, 396 copyrights, 67 designs, and 94 trademark applications were filed, reflecting a broad-based approach to safeguarding innovations. Capacity building remained a major focus, with 320 awareness and training programmes organized by 80 institutes, benefitting over 20,000 stakeholders, alongside advanced exposure of more than 300 personnel through national and international platforms. Strategic initiatives such as SAMIKSHA, World IP Day 2025, and the Maitri 2.0 Indo-Brazil Cross-Border Incubation Programme enhanced institutional review, global collaboration, and startup ecosystem integration. Technology transfer activities recorded strong momentum with 792 licensing agreements executed about 600 partners, facilitating the commercialization of 475 technologies across diverse agricultural disciplines, including 284 IP-protected technologies. Under the Incubation Fund, 50 Agri-Business Incubation Centres supported 532 stakeholders, enabled 274 start-ups and enterprises, conducted 334 Entrepreneur Development Programmes, and engaged 5,689 technology seekers and delegates. Collectively, these outcomes demonstrate ICAR's growing impact in translating research into protected, scalable, and market-ready agricultural innovations.

Innovation Fund

Intellectual Property Protection

Patents: During the period under report, 145 new Patent Applications were filed in different subject domain of agricultural sciences at Indian Patent Office (IPO). The cumulative figure of patent applications at ICAR has now risen to 1,851 applications. IPO had granted the 55 patent applications in the area of Crop Science (20); Animal Science (13); Agricultural Engineering and Horticulture Sciences (eight each), Fisheries Sciences (3); Natural Resource Management (2); and one in allied sciences, which made ICAR's cumulative number of granted patents to 733. In this process, 50 ICAR institutes were involved to protect their innovations.

Plant Variety: To protect the Plant Varieties, 103 varieties (96 extant; EDV 01 and 06 new varieties) were filed at Plant Varieties and Farmers' Rights Authority (PPV&FRA). For applications filed earlier, 165 varieties (130 extant and 35 new) were granted registration certificates during this period. The cumulative total for plant variety protection applications rose to 1,649.

Copyrights: During the period under report, 396 applications were filed by 59 ICAR institutes. A total of 1,100 plus filed copyrights have been thus recorded from different ICAR institutes.

Designs: 67 applications were filed by 29 ICAR institutes, which raised the cumulative figure to 292. The highest applications were filed in the area of agricultural and forest machinery class.

Trademarks: 94 trademark applications were filed by 28 ICAR institutes for different products and processes. Till date, a total of 438 trademark applications has been filed.

Capacity Building activities

To create awareness in the subject area of innovation management and technology transfer, different ICAR institutes have organized various capacity building programmes at institute/ zonal/ national level. In this process, 80 ICAR institutes organized 320 awareness generation programmes/ interface/ product-specific meets/ workshops/ seminars, wherein 20,000 plus scientists/ researchers/ business professionals/ farmers/ social workers were benefited. In order to expose the scientific and technical staff to specific nuances of intellectual property and technology management issues, more than 300 personnel were deputed to attend capacity building programmes organized by different public and private organizations viz. DoF, MoFAHD, New Delhi; NFDB, Hyderabad; IPIC, Rourkela; Confederation of Indian Textile Industry (CII); FAO; DPIIT; FICCI; ASSOCHAM; NASSCOM, TiE; SIDBI; FICCI, New Delhi; KSCST, Kerala; WIPO Academy; Mangalayatan University, Jabalpur; Assam Agricultural University, Jorhat, etc.

World IP Day: All the ICAR institutes had celebrated World Intellectual Property Day on 26 April

2025 with the theme set by World Intellectual Property Organization (WIPO) for 2025: *"IP and Music: Feel the Beat of IP"*. The programme provided an opportunity for scientists, technical staff and administrative personnel across the Council to deepen their understanding of how patents, trademarks, designs, copyrights and plant variety protections support innovation and creativity. Expert-led sessions were held at institute level-either physically or virtually-highlighting how intellectual property rights enable creators and inventors to translate ideas into assets and contribute to vibrant creative sectors. By aligning with the global theme, the Council strengthened awareness of IP's role not only in agriculture and research but also in broader creative ecosystems.

SAMIKSHA: Under the SAMIKSHA framework, ZTMC-wise Quarterly Review Meetings (QRMs) were organized in virtual mode by the Intellectual Property and Technology Management (IP&TM) Unit, ICAR Headquarters from 3 February to 19 February 2025, in coordination with the respective ZTMCs and with participation from all institutes under their zonal jurisdiction. These review sessions focused on assessing the progress of NAIF–Innovation Fund activities, evaluating budget requirements and need-based allocations, reviewing institute-wise targets, and identifying way forward for enhancing IP creation and outreach initiatives.

Maitri 2.0: The Maitri 2.0 Programme was organized by IP&TM Unit of ICAR at its Agri-Business Incubation (ABI) Centers [ICAR-Indian Agriculture Research Institute (*Pusa Krishi*), New Delhi; and ICAR-National Institute of Veterinary Epidemiology and Disease Informatics (*NaaViC*), Bengaluru], and Brazilian Embassy through their Agri-Tech Incubators from 22 September to 2 October 2025. This programme was the follow-up programme of Matri-1, which was

organized by ICAR-IARI with the Embassy of Brazil in 2019-20. To enhance bilateral collaboration and foster innovation-led growth in agriculture, this Cross-Border Incubators Programme was organized with the objectives to exchange the best practices in incubation, agri-innovation, and star-tup ecosystem development, to promote co-incubation and start-up exchange for agri-tech start-ups, and to enable knowledge transfer in sustainable agriculture and digital technologies.

Incubators are the engines that drive innovation into action. Through Maitri 2.0, Council is bringing its own incubators with SAUs, and leading Brazilian organizations into one network. This programme will provide opportunities for cross-learning and exchange between incubators, a platform for startups to showcase innovations in areas like agri-biotech, digital agriculture, climate-smart solutions, and food processing, and pathways to build joint ventures, technology transfer models, and collaborative research.

Technology Transfer/Commercialization

The period also witnessed increasing involvement of ICAR institutes in agribusiness activities with public and

SUCCESS STORIES

ICAR-NRC on Banana Supported Banana Value-Addition Entrepreneurs

Mrs. K. Savitha, M/s. Jeevitham Enterprises (Sri Banana Plus), Erode, Tamil Nadu
Mrs. K. Savitha successfully runs **Sri Banana Plus**, producing banana flower–based value-added products using ICAR-NRCB's processing technologies. Her clean-label products, viz. banana flower malt, *thokku, vadagam*, and health powders, etc. convert underutilized banana parts into nutritious foods. She sources directly from farmers, reducing waste and improving farmer, income. With 600 kg/month production and ₹1.5 lakh/month revenue, she is becoming an example of rural agri-entrepreneurship.
Website: *https://sribananaplus.com/*

M/s. Aaptam Foods LLP, Sirsi, Karnataka
AAPTAM Foods LLP promotes banana value addition through minimally processed, health-focused products like banana powder and dehydrated ripe banana. Using farmer-friendly methods aligned with ICAR-NRCB's vision, the company turns green bananas and flowers into high-value products. Their clean-label approach and local sourcing support farmers while generating ₹ 1 lakh/month revenue.
Website: *https://aaptamfoods.com/*

Mrs. Shanthi Nandakumar, M/s. Mridula Handmade Creations, Bengaluru, Karnataka
Mrs. Shanthi Nandakumar incorporates banana-based ingredients into handcrafted food and wellness products with ICAR-NRCB's technology support. Using raw and ripe banana powder and pseudo stem-based processes, she develops natural, plant-based products marketed through **Guhaya Products**. Her enterprise earns ₹ 1 lakh/month, showcasing sustainable value addition.
Website: *https://guhayaproducts.com/*

private sector organizations for partnerships in research and technology commercialization.

Technology Licensing: This year, 792 such partnership agreements were developed with 600 plus public and private organizations and farmers/ entrepreneurs. In this process, 66 ICAR institutes were involved from different Subject Matter Divisions, and transferred 475 technologies in different disciplines including Animal Production Technologies; Crop Production Technologies; Farm Machinery and Tools; Fish Farming and Processes; Food Processing Technologies; Plant Protection Technologies; Seed and Planting Material; Textile Process; and few technologies from allied sectors. The highest number of technologies were developed by the IARI, New Delhi followed by IIHR, Bengaluru; CPCRI, Kasaragod; NRC Banana, Trichy; IISR, Kozhikode; CARI, Izatnagar, and others.

Out of 792 licensing agreements, 284 were signed with IP protected technologies (i.e. protection under Design/ Patents/ Trademark/ Copyright/ PPV&FR registry).

Incubation Fund

To strengthen the agri-business ecosystem within the Council, 50 Agri-Business Incubation Centres (ABICs) have been established across various institutes to support entrepreneurs, innovators, scholars, and start-ups. During the reporting period, these centres facilitated

532 stakeholders through business incubation activities. As a result of these efforts, 274 entrepreneurs and start-ups successfully initiated their own enterprises. In order to enhance capacity building and awareness in the field of agri-business, 334 Entrepreneur Development Programmes (EDPs) were organized, benefitting a wide range of participants. To further promote collaboration and partnerships with public and private organizations, a total of 1,043 meetings, negotiations, and technology discussions were convened. Additionally, these centres witnessed encouraging outreach and visibility, with visits from 5,689 technology seekers, innovators, business profession, VIPs/ VVIPs, and international delegates, reflecting the growing recognition and impact of the Council's incubation ecosystem in fostering innovation and entrepreneurship in agriculture.

20. Partnership and Linkages

The International Relations (IR) Division plays a lead role in strengthening global engagement of ICAR/DARE through strategic bilateral and multilateral collaborations aimed at advancing agricultural research, education, and innovation in agriculture sector. During 2025, the Division facilitated partnerships through Memorandum of Understanding (MoUs), operational Work Plans, participation in international forums, and coordination of foreign delegations, thereby enhancing India's global agricultural footprint. Under bilateral cooperation, six MoUs were signed with leading international institutions from Morocco, Brazil, Australia, Togo, USA, and Russia, focusing on collaborative research, capacity building, and technology exchange. In addition, five Work Plans were operationalized with reputed organizations including CABI, IFDC, IFPRI, Western Sydney University, and INTA, Argentina, providing structured mechanisms for joint research programmes, expert exchange, and dissemination of sustainable agricultural technologies. On the multilateral front, the Division contributed to key global platforms such as G-20, ASEAN, BRICS, BIMSTEC, SAARC, QUAD, and APAARI. Key achievements include the implementation of seven research projects under the QUAD AI-Engage Initiative, emphasizing precision agriculture through artificial intelligence and robotics, and participation in the BIMSTEC Workshop on Mountain Agriculture Technology in the context of climate change and food system transformation. Furthermore, the IR Division coordinated 108 international delegation visits to ICAR headquarters and research institutes, involving high-level representatives from diverse countries across Europe, USA, Africa and Asia. These visits promoted scientific cooperation, facilitated knowledge and technology transfer, expanded trade and market linkages, and reinforced diplomatic relations. Overall, the Division significantly contributed to promote international partnerships, advancing agricultural innovation, and positioning ICAR as a key global player in sustainable agricultural production system.

The International Relations (IR) Division oversees bilateral and multilateral collaborations, facilitating partnerships through Memorandum of Understanding (MoU), joint research projects, and work plans with global institutions. During the year, under bilateral cooperation, MoUs/Workplans were signed across multiple countries. The division also reviewed the research progress of Consultative Group on International Agricultural Research (CGIAR), and facilitated multilateral cooperation through participation in global forums such as G-20, ASEAN, BRICS, BIMSTEC, SAARC, QUAD, APAARI, and ASEAN–India Fellowship for agricultural education and the AI-ENGAGE initiative under QUAD, focusing on precision agriculture using artificial intelligence and robotics.

Bilateral Cooperation

ICAR/DARE continued to strengthen international cooperation in agricultural research and education through bilateral engagements facilitated under Government of India provisions. During the year 2025, following MoU and Work Plans were signed by ICAR with leading international institutions and organizations to promote collaborative research, capacity building, and technology exchange:

- African Plant Nutrition Institute (APNI), Morocco (5 August, 2025).
- Brazilian Agricultural Research Corporation (EMBRAPA), Brazil (8 August, 2025).
- Murdoch University, Australia (30 June, 2025).
- Togolese Institute of Agronomic Research (ITRA), Togo (11 September, 2025).
- The Pennsylvania State University, USA (4 December, 2025).
- The Federal State-Financed Institution "Federal Centre for Animal Health" (FGBI "ARRIAH"), Vladimir, Russia (4 December, 2025).

ICAR operationalized collaborations through the signing of the following Work Plans during 2025:

- Centre for Agriculture and Bioscience International-CABI (14 February, 2025).
- International Fertilizer Development Centre (IFDC), USA (17 October, 2025).
- Addendum to the Work Plan (2024–2029) between ICAR and Western Sydney University (WSU), Australia (17 November, 2025).
- International Food Policy Research Institute (IFPRI), Washington DC, USA (8 December, 2025).
- National Institute of Agricultural Technology (INTA), Argentina (10 December, 2025).

The Work Plan between ICAR and National Institute of Agricultural Technology (INTA), Argentina, signed in December 2025 in the presence of Hon'ble Ambassador of Argentina Ambassador Mariano A. Caucino

An Ethiopian Delegation led by Dr. Mohammed Usman Darasa, President, Samara University met Dr. M.L. Jat, Secretary DARE & DG ICAR to discuss collaboration opportunities in December 2025

These Work Plans provide a structured framework for implementing collaborative research programmes, exchange of scientific expertise, joint capacity-building initiatives, and sharing of technologies relevant to sustainable agricultural development.

Multilateral Cooperation

Multilateral cooperation was facilitated through forums such as G-20, ASEAN, BIMSTEC, SAARC, BRICS, QUAD, and APAARI. The significant achievements include (i) implementation of 7 research projects under the QUAD AI-Engage Initiative, and (ii) participation of ICAR officials in the BIMSTEC Workshop on Mountain Agriculture Technology in the context of Climate Change and Food System Transformation in June 2025.

International Delegation Visits

The IR & Protocol Division coordinated 108 foreign delegation visits to ICAR Headquarters and it's research institutes across India in 2025. Delegations included leaders, diplomats, advisors, vice-chancellors, and scientific experts from countries such as the European Union, USA, UK, South Africa, Brazil, Argentina, Trinidad and Tobago, Australia, New Zealand, France, Italy, Malaysia, Nepal, and others. These visits strengthened international collaboration, facilitated knowledge and technology exchange, supported joint research, enhanced trade and market access, and reinforced diplomatic ties.

21.
Training and Capacity Building

Capacity Building Unit (CBU) of DARE/ICAR is formulating Annual Capacity Building Plan (ACBP) since 2023-24 and implementing it for training and capacity building of all categories of DARE/ICAR employees. About 9,400 employees of ICAR HQs and Institutes have been on-boarded on the i-got platform, and 2,998 employees have completed online course(s) from April 2024 to March 2025. Six specialized online/offline training programmes, viz. Leveraging AI and AR/VR Technologies in agriculture and day-to-day life of human beings for scientific staff of ICAR HQs, domestic component of Executive Development Programmes for Newly Recruited Research Managers, training programme for Vigilance Officers, national training programme on "प्रशासन में राजभाषा समन्वयन" for Administrative staff, and identification and diagnosis of plant parasitic nematodes and nematode disease of crops" for scientific and technical staff were organized by four ICAR-Institutes. In these need-based competency programmes, 212 employees of various categories participated. DARE/ICAR celebrated National Learning Week during 22-25 October 2024, and organized Orientation Workshop on "Mission Karmayogi" on 28 February, 2025 as per directions of Capacity Building Commission, GoI. During the reporting period, 1,283, 664, 715 and 131 Scientists, Technical, Administrative including Finance, and MTS were trained, respectively constituting a total of 2,793 employees. Compared to 2013-14, there was considerable improvement in number of employees undergone trainings where improvement was 79.5, 18.0 and 227.5% in Technical, Administrative including Finance staff and MTS, respectively with overall improvement of 15.9% during 2024-25. Maximum number of employees were trained in Crop Science Division (641) followed by Horticultural Science Division (589), out of 2,793 employees trained in the ICAR system. The training programmes organized for Scientists, Technical, Administrative including Finance, and MTS were 237, 86, 34 and 16, respectively with 373 total number of training programmes. Under various categories, 244 employees attended the under training and capacity building programmes organized by various ICAR/ non ICAR-Institutes.

The highlights of Training and Capacity Building of ICAR employees of all categories undertaken and coordinated by HRM Unit, Ag. Education Division, ICAR HQs during 2024-25 are enumerated below.

Formulation and implementation of Annual Capacity Building Plan (ACBP) of DARE/ICAR for 2024-25

Capacity Building Unit (CBU) of DARE/ICAR is formulating Annual Capacity Building Plan (ACBP) of DARE/ICAR since 2023-24 and implementing for training and capacity building of all categories of DARE/ICAR employees to fulfil the vision of Mission *Karmayogi* as an integral part of CBC's mandate. Various activities, viz. On-boarding of ICAR employees, National Learning Week and Orientation Workshops were organized.

Online on-boarding of DARE/ICAR employees on Mission *Karmayogi* Platform and course completion status

As a part of new initiatives of GoI, User account of DARE and ICAR have been created at the Digital Learning Framework "i-GOT *Karmayogi*" (Integrated Government Online Training *Karmayogi* Platform) under Mission *Karmayogi*, Department of Personnel and Training, Government of India, New Delhi with the aim for developing functional, behavioural and domain competencies and to create a professional, well-trained and future-looking employees of DARE/ICAR for meeting the aspirations of Mission *Karmayogi* as a part of an on-going reform process in public Human Resource Management and governance.

As of March 2025, approximately 9,400 employees from ICAR Headquarters and its Institutes have been successfully on-boarded onto the *Integrated Government Online Training* (i-GOT) *Karmayogi Platform*, developed by the Department of Personnel and Training (DoPT), New Delhi. Of these, 2,998 employees have completed one or more online courses during the period April 2024 to March 2025, reflecting encouraging participation and commitment towards continuous learning and capacity building under the Mission *Karmayogi* framework.

Designed, developed and organized training programme

A training programme was designed, developed and organized by ICAR-IASRI, New Delhi in coordination with HRM Unit, ICAR HQs on "Leveraging AI and AR/VR Technologies in agriculture and day-to-day life of human beings" for scientific staff of ICAR HQs in which 42 Scientists have participated in two batches during 2024-25. The main objectives of the programme

were to enhance participants' understanding of AI and AR/VR technologies, build practical skills for applying these tools in agricultural research and daily professional tasks, and promote their integration into innovative, technology-driven solutions within ICAR.

Coordinated organization of Executive Development Programme (EDP) for Newly Recruited Research Managers

ICAR-NAARM, Hyderabad organized domestic component of Executive Development Programme (EDP) on "Leadership Development" for Newly Recruited Research Managers in coordination with HRM Unit, ICAR HQs in which 13 RMPs (ADGs, Directors and Joint Directors) participated during 26-31 August, 2024. The programme was envisaged to enhance leadership capacities, competence, skills of newly joined research managers to improve the organizational efficiency.

Coordinated the organization of training programme for Vigilance Officers of ICAR

A training programme for Vigilance Officers of ICAR was organized by ICAR-NAARM, Hyderabad in coordination with HRM Unit, ICAR HQs in which 28 Vigilance Officers participated during 06-08 November, 2024. The programme aimed to strengthen participants' knowledge of vigilance procedures, conduct rules, and preventive vigilance mechanisms within the organization. It also focused on enhancing their capacity to handle disciplinary matters effectively and to promote transparency and accountability in administrative processes. Through expert sessions, case studies, and interactive discussions, the training provided practical insights to improve vigilance functioning across ICAR Institutes.

Coordinated the organization of training programmes

A national training programme on *"प्रशासन में राजभाषा समन्वयन"* for Administrative staff of ICAR was organized by ICAR-NBPGR, New Delhi in coordination with HRM Unit, ICAR HQs during 05-08 February, 2025 in which 85 Administrative staff of ICAR HQs and Institutes participated. The programme focused on enhancing the implementation and coordination of Rajbhasha (Hindi) in administrative work and strengthening officials' proficiency in using Hindi effectively in official communication. It also aimed to promote greater compliance with Rajbhasha policies and encourage a culture of bilingual working across ICAR organizations.

A training programme on "Identification and diagnosis of plant parasitic nematodes and nematode disease of crops" for Technical staff was organized by ICAR-IARI, New Delhi in coordination with HRM Unit, ICAR HQs in which 24 Technical staff participated during 05-07 March 2025. The programme aimed to enhance participants' skills in nematode detection, sample handling, and laboratory diagnostic techniques. It further focused on strengthening their understanding of nematode-associated crop diseases to support effective management strategies.

Another training programme on "Identification and diagnosis of plant parasitic nematodes and nematode disease of crops" for Scientific staff was organized by ICAR-IARI, New Delhi in coordination with HRM Unit, ICAR HQs in which 20 Scientists participated during 10-12 March 2025.

Celebration of National Learning Week by DARE/ICAR

The Capacity Building Unit of DARE/ICAR organized four webinars on i-GOT *Karmayogi* platform from 22-25 October 2024 during National Learning Week as per direction of Capacity Building Commission of GoI in which 1,294 employees of DARE/ICAR/ASRB/NAARM participated as details given below.

Organized Orientation Workshop

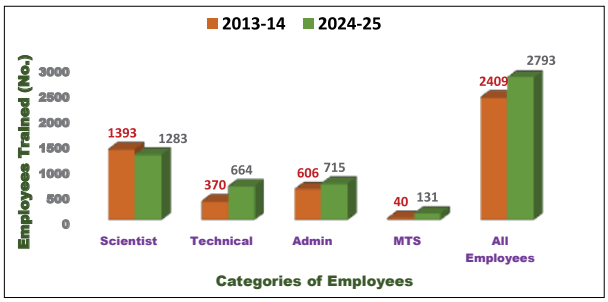
Capacity Building Unit of DARE/ICAR successfully organized Orientation Workshop on "Mission *Karmayogi*" at NASC complex, New Delhi on 28 February 2025 in which about 1,150 employees of DARE/ICAR/ASRB participated through online and offline mode. During the workshop, the officials/officers of ICAR HQs/DARE/ASRB/NAARM who attended highest number of online training programme(s) (monthly and yearly basis) were given appreciation certificate(s) as per the ranking (First and second positions).

Nomination of Scientists of ICAR-IARI hubs in specialized training programmes

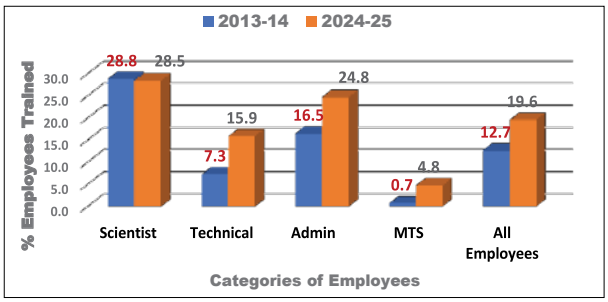
The training programmes on "Enhancing Pedagogical Competencies for Agricultural Education" organized by NAAS, New Delhi in three batches during 2024-25, was attended by 129 scientists working in ICAR-IARI hubs.

S. No.	Batch	Duration	Attended (No.)
1	I	01-05 April 2024	44
2	II	29 April-03 May 2024	47
3	III	27 January-01 February 2025	38
	Total		129

Webinar	Topic	Speaker(s)	Date	Participants (Nos)
1	Mission *Karmayogi* @ICAR	Dr. S.K. Sharma, ADG (HRM), New Delhi	22.10.2024	254
2	Time Management	Mr. Tirmal Reddy, L & D Professionals, Hyderabad	23.10.2024	237
3	*Viksit Bharat* @Agriculture	Dr. Himanshu Pathak, Secretary, DARE & DG, ICAR	24.10.2024	594
4	Climate change, Agriculture and Indian economy	Dr. Ch. Srinivasa Rao, Director, ICAR-NAARM, Hyderabad	25.10.2024	209
	Total			1,294



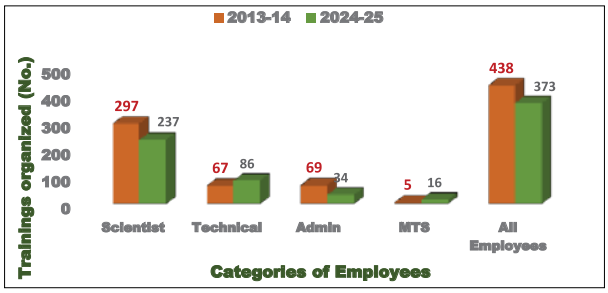
Improvement in Capacity Building of ICAR Employees with the Creation of HRM Unit



Per cent Employees Undergone Training with the Creation of HRM Unit

Nomination of employees in various Training Programmes/ conferences/seminars/symposium, etc.

Training and capacity building programmes organized by ISTM, New Delhi; AJNIFM, Faridabad; IIM, Ahmedabad; IIPA, New Delhi; ASCI, Hyderabad; ICAR-IASRI, New Delhi and ICAR-NAARM, Hyderabad were attended by 115 nominated officers/ officials of the Council. Apart from this, Council also nominated 28 Scientists/RMPs of ICAR HQs for participation in seminar/symposium/conference.



Trainings Organized by Various ICAR-Institutes

Employees Trained

Manpower Trained (In Terms of Number)

During the reporting period, 2,793 employees were undergone various types of training and capacity building programmes, out of which Scientists, Technical, Administrative including Finance, and Multi-tasking Staff (MTS) were 1,283, 664, 715 and 131, respectively. Compared to 2013-14, there was considerable improvement in number of employees undergone trainings where improvement was 79.5, 18.0 and 227.5% in Technical, Administrative including Finance staff and MTS, respectively with overall improvement of 15.9% during 2024-25.

During the reporting period, Crop Science division deputed highest number of Scientists (314) and Technical staff (179), while highest numbers of Administrative including Finance staff and MTS were deputed by Horticultural Science (191) and Fisheries Science divisions (52), respectively for various capacity building programmes. Thus, overall, maximum number of employees were trained in Crop Science division (641) followed by Horticultural Science division (589), out of 2,793 employees trained in the ICAR system.

In terms of per cent employees trained under each category, Scientists (28.5%), Technical (15.9%), Administrative including Finance (24.8%) and MTS (4.8%) were trained in various aspects as per their training needs during 2024-25 with overall 19.6% employees across the categories got opportunities for capacity building. This is evident that 8.6, 8.3 and 4.1% more Technical, Administrative including Finance staff and MTS, respectively got training opportunities during 2024-25 as compared to 2013-14 with overall improvement of 6.9% in capacity building of all the categories of employees.

The training programmes organized for Scientists, Technical, Administrative including Finance, and MTS were 237, 86, 34 and 16, respectively with a total of 373 training programmes. Crop Science division organised maximum number of trainings for Scientists (57), Ag. Extension division for Technical staff (19), and Horticultural Science division for Administrative staff (13) and MTS (08). Moreover, maximum number of training programmes for all employees were organized by Crop Science division (73) and was followed by Ag. Education division (71).

22.
Gender Budgeting

Gender budgeting within the Indian Council of Agricultural Research (ICAR) has emerged as a strategic instrument for mainstreaming gender in agricultural research, extension, and innovation with a core focus on enhancing women's participation in the agricultural economy. ICAR-Central Institute for Women in Agriculture (ICAR-CIWA), functioning across 12 states in collaboration with 13 Agricultural Universities, plays a main role in empowering gender-responsive interventions through targeted research and capacity-building programmes. Gender-sensitive climate-resilient agriculture interventions demonstrated substantial economic and social gains for farm women. Crop diversification in rice-fallow systems rose from 77 to 275 acres, and adoption of green manuring increased from 23 to 85 women farmers. These practices led to an improvement in soil organic carbon from 0.42% to 0.64%, indicating enhanced ecological sustainability. Capacity building efforts expanded outreach from 86 to 350 trained women, and technology access improved from 28% to 93%. Nutrition and income security initiatives further reinforced women's empowerment. Under the "Shree Anna (Millet) Gram" project, high-yielding finger millet variety VL-376 recorded yields of 2.83–3.16 t/ha, significantly outperforming local varieties and improving household food availability. The JANANI Nutri-garden model, implemented on 100 m² landholdings, generated 315–325 kg of vegetables annually, along with 100–115 kg of mushrooms enabling year-round food supply and supplementary income for rural women. In livestock and aquaculture systems, gender-responsive homestead interventions increased fish yields by 95% (3.22 t/ha/yr) and net income to ₹1.57 lakh/ha/yr, while per household fish availability rose from 15.2 kg to 45 kg annually. Empowerment indicators revealed a 37% increase in women's access to quality inputs, 42% improvement in access to credit and subsidies, and 39% growth in participation in household-level decision-making. Digital literacy programmes showed that although 77.85% of women owned mobile phones, only 39.2% used advanced digital agricultural apps, highlighting the need for sustained gender budgeting in digital capacity-building. Overall, ICAR's gender budgeting framework has significantly strengthened women's economic roles, improved livelihood resilience, and contributed to inclusive growth in India's agricultural economy.

Fundamentals of Gender Budgeting

Gender budgeting is a strategic approach that integrates a gender perspective into budgetary processes with the objective of promoting gender equality. It involves a systematic analysis of government budgets through a gender lens to ensure that public expenditure, revenue policies, and resource allocation effectively address gender disparities in different sectors such as health, education, and labour. This approach not only advances gender equity but also enhances economic efficiency and policy effectiveness by recognizing and responding to gender-specific needs and constraints. Furthermore, gender budgeting contributes to social justice by facilitating a more equitable distribution of resources and supports the achievement of international commitments, particularly the Sustainable Development Goals (SDGs) related to gender equality. By promoting equitable access to public services and economic opportunities, gender budgeting plays a vital role in reducing inequalities in healthcare, education, and employment outcomes.

In this context, the Gender Budget Cell in DARE-ICAR has been established to strengthen Gender Responsive Budgeting (GRB) initiatives. The primary objective of the Cell is to influence and reform ministerial policies and programmes in order to address gender imbalances, promote gender equality, and ensure that public resources are allocated and utilized in a gender-sensitive manner. The Cell also seeks to mainstream gender concerns within agricultural policies, research programmes, and development initiatives so that the diverse roles, needs, and challenges of both men and women in agriculture are adequately recognized. The ICAR-CIWA, Bhubaneswar, allocates 100 per cent of its budget towards research and development activities focused on gender issues in agriculture and allied sectors, while other ICAR schemes incorporate gender components to varying extents within their overall budgetary provisions.

Empowering Women in Agriculture through Innovative Technology Development and Adoption

The ICAR-Central Institute for Women in Agriculture (ICAR-CIWA) is devoted to research on women in agriculture. It envisions to become a premier center

for gender- research, serving as a catalyst for gender mainstreaming and women empowerment in agriculture. With the aim of enhancing agricultural productivity and sustainability with women's active participation and contribution, the institute undertakes diverse research initiatives addressing gender issues in agriculture and allied fields across 12 states, in collaboration with 13 Agricultural Universities under the AICRP on Women in Agriculture. Additionally, the institute also hosts an AICRP Centre on Ergonomics and Safety in Agriculture (ESA).

Gender sensitive climate resilient agriculture through technological interventions in field crops

ICAR-CIWA introduced women-friendly, climate-smart agricultural technologies in seven minor irrigation projects across 20 villages in Keonjhar district, Odisha. A range of climate-resilient and gender-responsive interventions were implemented, resulting in significant improvements. A major improvement was observed in access to critical inputs i.e. climate resilient seeds, where the number of farm women receiving climate-resilient varieties increased from 62 in the pre-project phase to 452 in the post-project period, reflecting a significant expansion in outreach and adoption. This improved input access directly translated into enhanced area coverage under climate-resilient crops. The area under resilient stress tolerant rice cultivation increased from 50 to 300 acres. Crop diversification efforts were further strengthened by increasing the area under oilseeds and pulses in rice-fallow systems from 77 to 275 acres, indicating a strong shift towards resilient and income-enhancing cropping systems led by women farmers. Adoption of sustainable soil management practices also improved considerably, as the number of farm women practicing green manuring increased from 23 to 85, contributing to improved soil fertility and reduced dependence on chemical inputs. This is corroborated by improvements in soil health indicators, particularly soil organic carbon, which increased from 0.42% to 0.64%, reflecting the positive long-term ecological impact of climate-smart practices promoted under the project.

Capacity building played a crucial role in facilitating these outcomes. The number of farm women trained increased from 86 to 350, strengthening their technical knowledge, confidence, and decision-making ability related to climate-resilient agriculture. Enhanced capacity directly supported improved access to technology, with the proportion of farm women having access to climate-smart technologies rising sharply from 28% to 93% out of the total 450 beneficiaries. This indicates successful technology dissemination, institutional support, and convergence with extension services. Beyond productivity gains, the project significantly influenced women's leadership and empowerment. The number of women-led Custom Hiring Centres (CHCs) increased from 6 to 18, reflecting strengthened leadership, entrepreneurship, and collective action among farm women. Overall, the combined improvements across input access, diversified cropping, soil health, capacity building, technology access, and leadership clearly demonstrated that climate-resilient technologies not only enhanced agricultural performance but also contributed to the socio-economic empowerment and resilience of farm women under the project.

Shree Anna (Millet) Gram: A New Vista for Nutritional Security and Women Empowerment

The project "Shree Anna (Millet) Gram" was implemented in four villages—Maniabindha and

Use of machines by farm women

A view of Custom Hiring Centre

Climate resilient paddy demonstration

Farm women with HYV seeds

Nuagaon in Keonjhar district, and Srirampur and Amanakud in Khordha district of Odisha to promote millet-based nutrition and address challenges faced by farming communities, particularly women. Preliminary data were collected on household characteristics, millet production, and consumption patterns to identify opportunities for enhancing nutritional security and livelihood resilience. Based on socio-economic status and agro-climatic conditions, 120 On-Farm Trials (OFTs) were conducted using the Finger Millet variety VL-376. The statistical analysis of Finger Millet HYV VL-376, compared to local varieties across the four locations, revealed significant yield advantages. The improved variety consistently produced higher yields, ranging from 2.83–3.16 t/ha, with statistical significance at both 5% and 1% levels. These findings validate the superiority of VL-376 as a high-yielding and climate-resilient option, contributing to improved food and nutritional security as well as higher farm income.

Additionally, an ergonomic assessment involving 30 agricultural workers was conducted to evaluate the physical and physiological challenges in traditional farming practices. Results showed that 93.3% of participants suffered from musculoskeletal disorders, while 86.6% lacked knowledge of improved tools. Physiological and family-related stress affected 73.3%, and 70% faced environmental challenges during work. Introduction of improved tools markedly reduced drudgery. The Drudgery Index (DI) decreased by 52.27% with a battery-operated sprayer replacing manual broadcasting, 52.10% with a dryland weeder replacing sickle use, and 44.81% with a pulverizer replacing domestic chakki. Among the improved tools, the battery-operated sprayer recorded the highest improvement in Body Part Discomfort Score (BPDS) at 2.46, followed by the dryland weeder (2.38) and pulverizer (2.15). The interventions effectively reduced physical strain, enhanced efficiency, and promoted women's health, empowerment, and sustainable agricultural practices.

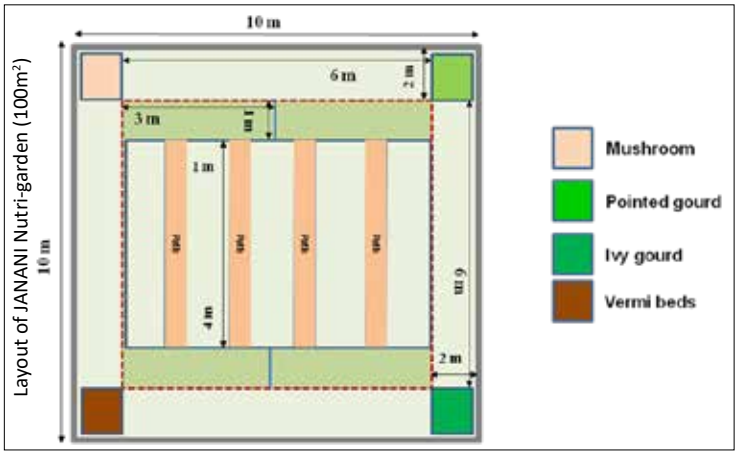
Gender-based constraints in organic farming of horticultural crops

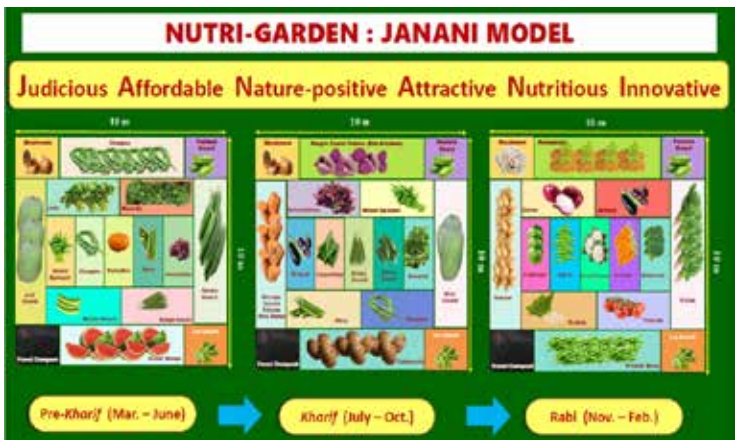
The gender-based responses towards constraints in organic farming of horticultural crops were assessed in six aspects, viz. Physical, Cultural, Social, Economic, Institutional and Technological constraints. The constraints like 'poor social coherence, organic agri-input, higher input cost, production constraints of organic agri-inputs, challenges in supply chain of agri-inputs, insufficient initial funds and poor post-harvest management' were the prioritized constraints by both men and women. Additionally, the constraints like 'declining local varieties, drudgery, gender disparities, land constraints and poor post harvest infrastructure' were more reported in case of female respondents. Based upon the predominant clusters of constraints and highlighted gender-specific nuances, a framework to promote agripreneurship of farm women in organic horticulture was developed with targeted interventions. The framework primarily aims at creating income earning avenues for landless farmers and rural women, potentially through the establishment of bio-input resource production units at village level. These units can serve as early-stage businesses points aimed at solving problems in the agri-value chain with indigenous solutions. The framework primarily comprises of three distinct phases. The first phase comprises of formulating Women Farmers' Interest Group (FIG) and identification of potential production clusters in the village. The second phase will comprise of establishment of women-led Bio-Resource Production Units (BRUs). These units will primarily aim at producing various organic agri-inputs such as *jeevamrut, ghanajeevamrut, amritpani, neemastra, bramhastra, agniastra,* etc. which are essentially used in natural farming. The third and the last phase emphasizes on 'cluster based chemical free production of horticultural produce and sale of organic produce in organic haats (local markets) by farm women. Additionally, this phase also proposes the establishment of Custom Hiring Centres in processing

and value addition of horticultural crops for additional farm income. The framework can be implemented through a multi-stakeholder approach involving research institutions, NGOs, government bodies, and private sector partners.

JANANI Nutri-garden: Gender Responsive Multi-Commodity Intensive Farming Model

A multi-commodity based intensive farming system (JANANI Nutri-garden) model for integration of diversified crops and enterprises including vegetables, bio-fortified tuber crops, vermicomposting, mushroom farming, bee keeping and poultry farming in a very small area/land size (100 m^2) throughout the year was developed. The JANANI stands for J- Judicious, A- Affordable, N- Nature-positive, A- Attractive, N- Nutritious, I- Innovative. The model has total 13 beds for year round cultivation of annual and perennial vegetable including bio-fortified tuber crops like sweet potato and potato. Depending upon the location and crop varieties, around 315–325 kg of vegetables can be harvested from the area. From the mushroom unit, approximately 100–115 kg of paddy straw mushroom and oyster mushroom can be obtained with proper management practices. In the vermicomposting unit, either permanent structure or portable vermi beds can be used and around one tonne vermicompost can be obtained which is sufficient for the area.





JANANI Nutri-garden Model

Livelihood Vulnerability Index of women livestock farmers across five states

The study assessed the Livelihood Vulnerability Index of Women Livestock Farmers (LLVI) across five Indian states such as Odisha, Andhra Pradesh, Bihar, Rajasthan, and Gujarat to understand regional disparities in vulnerability and adaptive capacity. A total of 200 women livestock farmers from each state were interviewed using a semi-structured interview schedule to evaluate their socio-economic status, access to resources, adaptive capacity, and exposure to climatic and livelihood stresses. The LLVI values for women livestock farmers for Odisha, Andhra Pradesh, Bihar, Rajasthan, and Gujarat were 0.445, 0.469, 0.524, 0.403, and 0.357, respectively. The LLVI values indicated that Bihar (0.524) had relatively higher vulnerability, reflecting higher exposure and poor institutional support while Gujarat exhibited lower vulnerability levels, reflecting stronger adaptive mechanisms and institutional support in mitigating livelihood risks among women livestock farmers.

Gender responsive Climate resilient aqua-horticulture for rural livelihood and nutrition

Gender-responsive and climate-resilient homestead aquaculture and horticultural practices were introduced and the impact on income, nutrition and women empowerment was assessed through community mobilization and participatory research in 58 households across five flood-prone villages of Puri and Bhadrak districts, Odisha. Expert elicitation on the climate resilience of selected freshwater aquaculture, harvest, and post-harvest practices as well as horticultural practices that can be popularized in flood prone coastal areas with an abundance of homestead pond resources was done for selecting the practices. It employed a qualitative survey methodology using Google Form as the primary research instrument. Average area of the homestead pond was 0.28 acre (0.112 ha). Gender inclusive trainings on the different climate resilient aquaculture and horticultural practices were organized (20 nos.) to improve their knowledge and skill in the different aquaculture and horticultural practices. Two Women Farmer Interest Groups (FIGs) and two Custom Hiring Centres, managed by these Women FIGs, have been established in the villages. The women farmers have provided with processing equipment like

solar cabinet dryer, pulverizer, feed pelletizing machine, water pump, small tools so that they can utilize these machines for engaging in alternate income generating activities and also could be hired by fellow villagers with a nominal hiring charges. Grow out farming of advanced fingerlings of Indian Major Carps during the post flood month of October enabled the farmers to avoid the loss of crop during flood season. The farmers (both men and women) were given trainings on pre-stocking and post-stocking management. With the establishment of the community fish nursery in the villages, the farmers were able to adopt the Multiple Stocking Multiple Harvesting (MSMH) procedures with advanced fish fingerlings. With the adoption of the practices, Fish yields rose by 95% (3.22 t/ha/yr) with a net income of ₹1.57 lakh/ha/yr. Multiple stocking and harvesting boosted per household fish availability from 15.2 kg to 45 kg per annum. Polyculture of short term species like *Puntius gonionotus* with Indian Major Carps helped the farm families to earn and additional average yield of 446 kg/acre. A vegetable garden of size 150 m^2 was recommended to a farmer household of 5 members to be integrated with homestead pond which ensured supply of 230 g of vegetables per person daily and generating ₹12,000 annually by the sale of surplus vegetables. Paddy straw mushroom cultivation provided an additional income of ₹460/day emerging as profitable alternate livelihood option. These interventions improved women's income, nutrition security, and decision-making roles at both household and community levels.

The empowerment of women with respect to access to resources and decision making was assessed.

Women harvesting fish from their homestead pond

Community fish nursery managed by Women FIG

As per the response from the women farmers, there was a 37% increase in access to good quality fish and vegetable seeds. This could be attributed to the establishment of community fish nursery in the villages which helped them to replenish the fish stock in their ponds regularly. Also the convergence/linkage that was established with the respective KVK and State Fisheries Department, hatcheries helped the farmers to procure fish seed in times of need. There was a 42% increase in access to loan/subsidies to the farmers. This could be mainly because of the increase in awareness about the Govt. schemes and programmes which favoured the increased access. There was a 31% increase in access to timely skill trainings because of the project interventions. Through their involvement in gender-inclusive, climate-resilient homestead aqua-horticulture, women farmers experienced a 39% increase in decision-making participation regarding how much of their farm produce should be retained for household consumption versus sold. With improved access to resources, women enhanced their capacity to manage new farming and processing techniques and adopt new fish species (25%), engage in value addition to farm produce for higher returns (33%), and independently procure inputs, tools, and implements (26%).

Gender Mainstreaming through Government Schemes in Animal Husbandry sector for Empowering Farm Women

Gender inclusiveness in government schemes in the animal husbandry sector can play a crucial role in empowering farm women by enhancing their access to resources, training, and income-generating opportunities. A total of 428 government schemes implemented across the country were evaluated for the gender inclusiveness. Among these schemes, 103 of them were women-prioritized, 30 were women-specific, and 101 had scope for women's empowerment. Central schemes such as the Rashtriya Gokul Mission, National Programme for Dairy Development, and Dairy Infrastructure Development Fund enhanced milk production and women's participation, with 69% of smallholder milk producers being women. NDDB facilitated 19 Milk Producer Companies (MPC), including 12 all-women MPCs, while OMFED registered 6,641 societies with 1.18 lakh women members. State-level analyses showed strong inclusion efforts- 35% female beneficiaries in Kerala, 26.5% in Madhya Pradesh, and 43.5% under Odisha's MKUY, where 90.5% female ownership was recorded. Women's participation was highest in goatery (79.2%), poultry (62.5%), and dairy (37%) sectors, with initiatives like Mission Shakti in Odisha promoting awareness and access to schemes. However, women still faced barriers including limited decision-making (10.84%), marketing constraints (29.71%), family burden (25.47%), and inadequate credit access (8.4%). The study underscores the need for strengthened gender-responsive planning, follow-up, and capacity building to ensure equitable participation and empowerment of farm women through animal husbandry schemes.

Digital Literacy among Women Farmers

A comprehensive data analysis was conducted among 600 farm women to evaluate their access to, and proficiency in using digital tools for agricultural purposes. The results revealed that although mobile phone ownership (77.85%) is widespread, actual digital literacy and the ability to use advanced digital applications vary considerably. Most participants were comfortable with basic phone functions such as calling (83.2%) and messaging (58.96%), while fewer women used applications like Whatsapp or conducted internet searches (44.97%). Only a small proportion (39.20%) utilized specialized digital agricultural apps or e-finance tools. Despite these gaps, there was a strong willingness among the women to enhance their digital knowledge and skills, provided suitable training and institutional support are available. Secondary data compiled from ten government reports and publications, including those from the Ministry of Information Technology, reaffirm these findings. These reports indicate persistent gender and regional disparities in digital access but emphasize the high enthusiasm among rural women to strengthen their digital competencies. Overall, the analysis suggests that while device ownership is no longer a major barrier, focused, locally relevant training programmes and community-based digital support systems are essential to bridge the digital divide and empower farm women in the agricultural sector. Drone demonstrations were organized for women farmers to showcase its applications in crop monitoring, fertilizer spraying, and precision agriculture, enhancing their awareness of modern, technology-driven farming practices. A total of 40 drone technology demonstrations have been conducted in 30 villages benefitting more than 6,000 women farmers and other stakeholders.

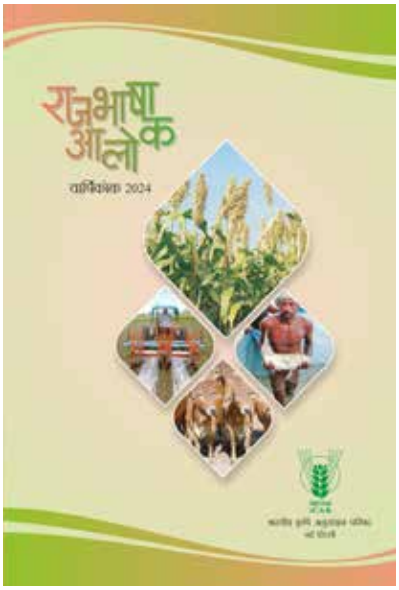
23.
Promotion of Hindi as Official Language

In order to promote the use of Hindi in official work, ICAR ensured compliance with the Official Languages Act, 1963 and related instructions/directives issued by the Govt of India, Ministry of Home Affairs, Department of Official Language from time to time. Several initiatives were implemented to encourage the progressive use of Hindi across ICAR and its Institutes. Programmes for farmers and the public were organized in Hindi and regional languages and material on Agricultural Sciences, Animal and Fisheries Sciences, and Horticultural Sciences were regularly published in these languages. The monthly Hindi magazine 'Kheti' and the inhouse publication 'Rajbhasha Aalok' were consistently released, featuring scientific topics, government schemes, and updates on ICAR's activities. Four Official Language Implementation Committee (OLIC) meetings were held at ICAR Headquarters with similar committees operating regularly at its Institutes. Quarterly progress reports were submitted to the Regional Implementation Office and feedback was provided to enhance policy implementation. ICAR and its constituent units also participated in Town Official Language Implementation Committee (TOLIC) meetings and conducted Hindi workshops in every quarter. Events like Hindi Pakhwara were organized with competitions and messages promoting the use of Hindi in official work. Cash awards were presented to employees excelling in Hindi usage. Inspections, including Parliamentary Committee on Official Language, ensured compliance of the Official Language policy. Bilingual preparation of parliamentary documents was maintained. During the reporting period, ICAR has ensured compliance with the provisions of the Official Languages Act, 1963 and the rules framed thereunder. Accordingly, resolutions, general orders, notifications, administrative reports and press communiques, etc. were issued in bilingual form (Hindi-English). Additionally, various directives and instructions issued by the Department of Official Language regarding the progressive use of Hindi for official purposes have been implemented in the ICAR and its Institutes.

Progressive use of Hindi

The Council and its constituent units organized several programmes in Hindi and regional languages to benefit the public and farmers. Activities, including agricultural extension services by KVKs in Hindi-speaking regions, were conducted in Hindi. The Council and its Institutes regularly published materials on diverse topics, such as Agricultural Science, Animal and Fisheries Sciences, and Horticultural Sciences, in Hindi and regional languages. To disseminate agricultural technologies and enhance their reach, the monthly Hindi magazine *'Kheti'* was published consistently. The in-house Hindi magazine of the ICAR headquarters, *'Rajbhasha Aalok'*, was also published regularly. This magazine featured articles on scientific topics, government schemes written in simple Hindi, and reports on various initiatives and programmes organized by the Council and its Institutes.

During the reporting period, four meetings of the Official Language Implementation Committee (OLIC) were held. Most ICAR institutes and centers have formed their own OLICs, which also convene meetings regularly. ICAR actively participates in the meetings of the Town Official Language Implementation Committee (TOLIC). Quarterly progress reports from the ICAR headquarters are submitted online to the Regional Implementation Office of the Department of Official Language, Government of India, located in Delhi. The progress reports received from various Institutes of the Council are also reviewed, and feedback is provided to them to enhance the effective implementation of the Official Language Policy. Four Hindi workshops were organized during this period at the Council's Headquarters.



As in previous years, *Rajbhasha Pakhwara* was organized at the Council's Headquarters and its Institutes. At the Headquarters, various *Rajbhasha* competitions were held during *Hindi Pakhwara,* which was commenced on 14 September, 2025. On this




occasion, inspiring messages from the Hon'ble Union Minister of Agriculture and Farmers' Welfare were shared. The Director General of ICAR also issued an appeal, encouraging all officers and employees to carry out their official work predominantly in Hindi. A total of 46 Prizes were given to the winners.

Under the Cash Award Scheme of Official Language being implemented at the ICAR headquarters, 10 personnel were given cash awards for doing their maximum work in Hindi during 2024-25.

In accordance with the directives of the Department of Official Language, Ministry of Home Affairs, various ICAR Institutes were inspected during the reporting period to evaluate their progress in implementation of Hindi as Official Language. Recommendations were provided to address the shortcomings identified during these inspections, including those conducted by the Parliamentary Committee on Official Language. Furthermore, all documents presented in Parliament, including material related to the Annual Plan, Demand for Grants, Governing Body meetings and the Parliamentary standing Committee of the Ministry of Agriculture as well as the Annual General Body meetings of the ICAR Society, were prepared bilingually in Hindi and English. During these meetings, the Hon'ble Agriculture and Farmers' Welfare Minister and other senior officials delivered their addresses in the Official Language Hindi.

Hindi Fortnight Celebration

Hindi Fortnight was celebrated at the Council Headquarters from 14 to 30 September, 2025. During this period, various competitions and programmes were organized at the Headquarters. To felicitate the winners of the competitions organized during Hindi Fortnight, the Annual Hindi Award Distribution Ceremony was held at the Council Headquarters on 22 December, 2025. On this occasion, certificates were presented to the prize winners. The ceremony was chaired by Shri Sandeep Sarkar, Additional Secretary and Financial Adviser, DARE/ICAR. During the same event, the 2024 issue of the Council's annual Hindi magazine "*Rajbhasha Alok*" was also released.

Hindi Workshops

To maintain the momentum of Official Language implementation and to resolve difficulties encountered from time to time, Hindi workshops was organized at the Headquarters. Accordingly, during the period under report, Hindi workshops were conducted for officers and staff of various categories at the Council Headquarters.

Meetings of the Official Language Implementation Committee

During the period under report, meetings of the Joint Official Language Implementation Committee of the Council, including DARE, were held regularly every quarter under the chairmanship of the Secretary.

Official Language Inspections

To review the progress of Hindi implementation in the institutions under the Council Headquarters, inspections of subordinate offices were carried out during the period under report, and suggestions were given to

address the shortcomings observed. During 2025, some institutions/centres of the Council were inspected by the Parliamentary Committee on Official Language. The inspection exercises were largely successful, and both appreciation and constructive criticism helped strengthen the implementation of Official Language policies.

Incentive Scheme for Original Work in Hindi

To encourage the conduct of official work originally in Hindi, a cash award scheme is implemented at the Council Headquarters. Under this scheme, 10 employees who carried out maximum work in Hindi were awarded.

Review of Quarterly Progress Reports on Hindi

All institutions/centres under the Council are required to submit quarterly progress reports on Official Language implementation at the end of each quarter. As in previous years, the quarterly progress reports for this year were reviewed, and necessary suggestions were provided for the effective implementation of the Government of India's Official Language Policy.

Other Activities in the Field of Official Language Implementation

- Reports relating to assurances given by institutions/centres during inspections conducted by the Second Sub-Committee of the Parliamentary Committee on Official Language during this period were submitted to the Parliamentary Committee Secretariat within the stipulated time after approval by the competent authority.
- Various tasks relating to Parliamentary Questions, reports to be laid in Parliament, Cabinet Notes, etc., were completed during the Parliament sessions in this period.
- All translation work of technical and administrative nature received from various divisions/sections of the Council was completed on time.
- Materials/statements/speeches received from the offices of the Hon'ble Agriculture Minister and Minister of State for Agriculture were translated within the prescribed time frame.

24.
Publication, Social media and Public Relations

The Directorate of Knowledge Management in Agriculture (DKMA) of the ICAR plays a major role in strengthening India's agricultural knowledge dissemination system by ensuring timely, and wide-reaching communication of scientific innovative research outputs. ICAR-DKMA continued to enhance access, quality and global visibility of agricultural knowledge through a diversified portfolio of research journals, popular periodicals, digital platforms and outreach initiatives. The ICAR e-publications platform hosted over 45,000 articles from more than 60 scientific journals and periodicals, serving researchers, students, extension personnel and policymakers. Three flagship research journals- The Indian Journal of Agricultural Sciences (IJAgS), The Indian Journal of Animal Sciences (IJAnS) and Indian Journal of Fisheries Sciences (IJFS) are being published in open-access mode. In 2025, IJAgS published 12 issues with 249 articles from 3,194 submissions, recording 29,867 users with an impact factor of 0.7 and an h-index of 36. IJAnS also published 12 issues with 132 articles from 1,058 submissions, attracting 15,519 users with an impact factor of 0.3 and an h-index of 29. IJFS published four issues, with 80 articles from 331 submissions, achieving an impact factor of 0.4 and an h-index of 22. Popular periodicals 'Kheti' and 'Phalphul' continued to bridge the research and farmer interface, publishing 18 issues including four special issues focused on climate resilience, pulses, saline ecosystems and floriculture. Additionally, three books, including two e-books, were published to support farmer empowerment and agricultural innovative knowledge. ICAR website enhanced real-time information dissemination by updating 5,131 pages and recorded 4,156,458 page views from users in over 200 countries. ICAR maintained a strong social media presence, averaging three posts per day across platforms, with 255K Facebook followers, 262.9K on X, 85,815 YouTube subscribers, and 36,700 Instagram followers. A major highlight was ICAR's leadership of the 15-day Viksit Krishi Sankalp Abhiyan which significantly enhanced the visibility of ICAR's agricultural research and innovation through extensive social media outreach. ICAR participated in 63 exhibitions across the country to showcase its research innovations and technologies. These platforms facilitated effective dissemination of climate-resilient practices, value-added technologies, and research outputs.

Directorate of Knowledge Management in Agriculture (DKMA), a vital arm of the Indian Council of Agricultural Research (ICAR) is dedicated to promoting knowledge-driven agricultural development in India. ICAR-DKMA plays a central role in disseminating scientific and technical information to farmers, researchers, policymakers, and the wider public. By documenting and communicating new innovations from India's National Agricultural Research System (NARS), DKMA ensures that research outcomes translate into real-world impact. DKMA work spans a wide range of activities-including the publication of research journals and hand books, multimedia outreach, digital content creation, press and media coordination, and technology transfer communication. DKMA is committed to strengthening the agricultural knowledge ecosystem through timely, reliable and accessible communication. To enhance the accessibility of research, ICAR's e-publications platform hosts over 45,000+ articles from 60+ journals and popular periodicals. For improving quality of publication, ICAR has introduced key quality assurance measures such as the assignment of Digital Object Identifiers (DOIs) and the use of plagiarism-checking software. These services are being extended to on-boarded ICAR Society journals at a nominal cost, thereby supporting standardization, ethical publishing practices, and wider visibility.

Research Journals

The Indian Journal of Animal Sciences (IJAnS) focuses on animal breeding, health, nutrition, production, and fisheries; The Indian Journal of Agricultural Sciences (IJAgS) covers overall agriculture; and Indian Journal of Fisheries (IJF) specifically targets fish/aquaculture science, genetics, biodiversity, and conservation. The monthly research journals, are available in open-access mode besides availability of in-house journals on ICAR website. IJAgS published 12 issues in 2025, receiving 3,194 submissions and publishing 249 articles, with 29,867 users achieving an impact factor of 0.7, and an h-index of 36. IJAnS also released 12 issues, received 1,058 submissions, and published 132 articles, attracting 15,519 users with an impact factor of 0.3 and an h-index of 29. IJFS published 4 issues, received 331 submissions,

Metrics of three research journals published by ICAR (Nov. 2024-Oct. 2025)

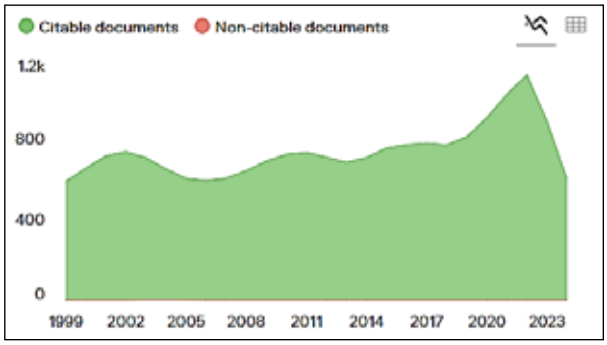
Journal	Issues published	Submissions received	Articles published	Users	Impact factor (2024)	h-index (2024)
IJAgS	12	3194	249	29,867	0.7	36
IJAnS	12	1058	132	15,519	0.3	29
IJFS	04	331	80	11,553	0.4	22
IF		261	179	6,439		
IH		141	114	3,624		

and published 80 articles, reaching 11,553 users with an impact factor of 0.4 and an h-index of 22. The journals are being indexed in Scopus, Web of Science, CABI, DOAJ, Crossref, Google scholar etc. which helps in improving the global visibility of publication.

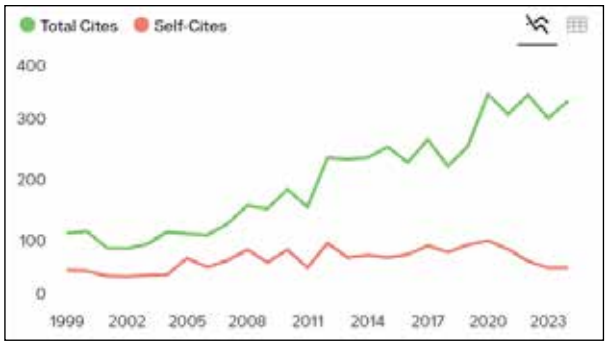
Popular periodicals

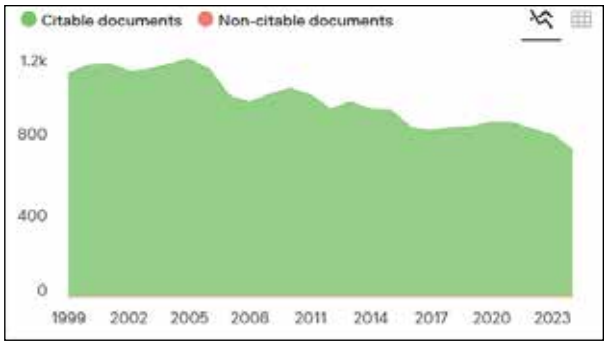
Two farmer-oriented periodicals, Indian Farming (IF) and Indian Horticulture (IH), are being published

Citations metrics of The Indian Journal of Agricultural Sciences

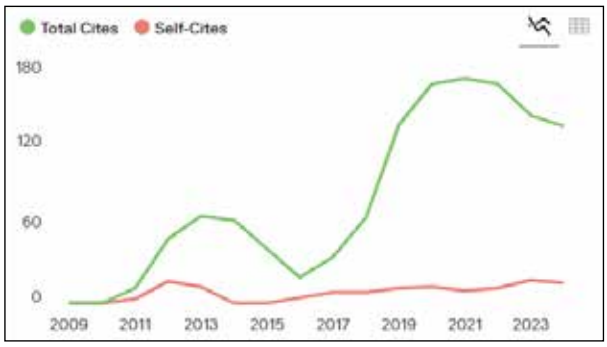


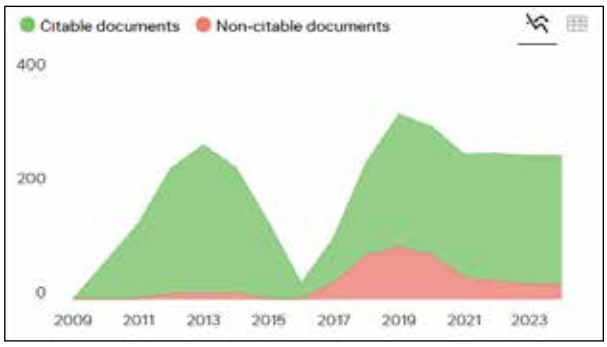
Citations metrics of The Indian Journal of Animal Sciences





Citations metrics of The Indian Journal of Fisheries



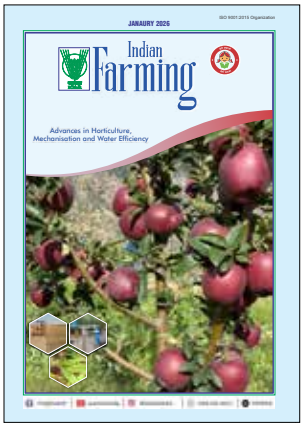


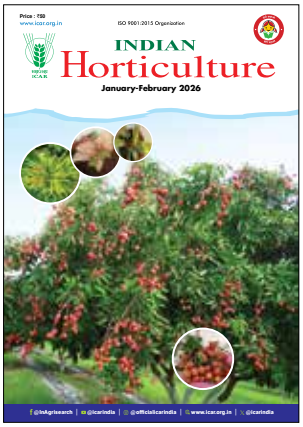
Global visibility of e-Pubs

Plot rows | Search... | Rows per page: 10 | Go to: 1 | 1-10 of 194

		Country	Active users	New users	Engaged sessions	Engagement rate	Engaged sessions per active user	Average engagement time per active user	Event count All events	Key events All events	User key event rate All events
☑		Total	2,03,548 100% of total	1,91,544 100% of total	2,51,400 100% of total	65.07% Avg 0%	1.24 Avg 0%	2m 12s Avg 0%	31,70,482 100% of total	13,964.00 100% of total	1.81% Avg 0%
☑	1	India	1,34,410 (66.02%)	1,24,216 (64.9%)	1,89,603 (75.45%)	68.02%	1.41	2m 32s	23,66,637 (75.27%)	10,932.00 (78.29%)	2.21%
☑	2	United States	8,765 (4.31%)	8,755 (4.57%)	3,843 (1.53%)	36.06%	0.44	35s	52,135 (1.6%)	49.00 (0.35%)	0.25%
☑	3	China	8,565 (4.21%)	8,385 (4.38%)	2,561 (1.02%)	26.83%	0.30	21s	47,857 (1.5%)	243.00 (1.74%)	0.44%
☑	4	Indonesia	4,850 (2.38%)	4,678 (2.44%)	5,906 (2.35%)	67.08%	1.22	1m 54s	69,782 (2.2%)	148.00 (1.06%)	0.8%
☑	5	Philippines	3,955 (1.94%)	3,856 (2.01%)	3,836 (1.55%)	64.64%	0.99	1m 04s	35,472 (1.12%)	99.00 (0.71%)	0.53%
☐	6	Algeria	3,454 (1.7%)	3,339 (1.74%)	5,304 (2.11%)	64.02%	1.54	4m 49s	86,424 (2.73%)	596.00 (4.27%)	3.97%
☐	7	Brazil	1,785 (0.88%)	1,739 (0.91%)	1,853 (0.74%)	69.14%	1.04	1m 10s	18,439 (0.58%)	31.00 (0.22%)	0.17%
☐	8	Bangladesh	1,732 (0.85%)	1,640 (0.86%)	2,309 (0.8%)	71.72%	1.16	2m 12s	24,575 (0.78%)	59.00 (0.42%)	1.15%
☐	9	Iraq	1,669 (0.82%)	1,589 (0.83%)	2,693 (0.99%)	68.47%	1.49	3m 32s	31,656 (1%)	241.00 (1.73%)	3.95%
☐	10	Egypt	1,628 (0.8%)	1,560 (0.81%)	1,768 (0.7%)	71.81%	1.09	1m 56s	20,422 (0.64%)	145.00 (1.04%)	1.47%

to translate scientific research into practical knowledge for farmers and other stakeholders. During 2025, Indian Farming received 261 manuscripts, of which 179 were published, and recorded 6,439 active users. Indian Horticulture received 141 submissions, with 114 articles published, and engaged 3,624 active users.

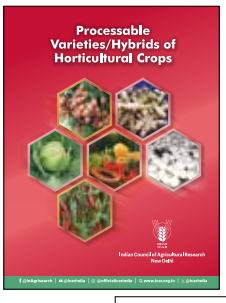


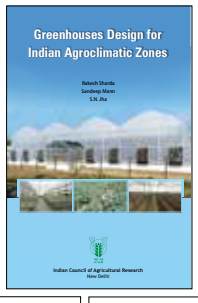


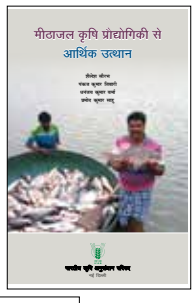
The ICAR flagship Hindi monthly journal *'Kheti'* and bimonthly horticulture-based journal *'Phalphul'* are being published by Hindi Editorial Unit (HEU) timely on regular basis. The mandate of these journals is to inform and motivate the farmers, agriculture students, extension workers, agro-entrepreneurs and related industries regarding adoption benefits of latest scientific development in agriculture. During the reported period, three special issues of *Kheti* were published namely-*'Dalahan par vishesh saamagree'*, *'Lavaneey paaristhitikee tantr punah sthaapana hetu prabandhan praudyogikee par visheshaank'* and *'Vaishvik jalavaayu parivartan ke sandarbh mein khaady utpaadan pranaaliyon ka roopaatanran'*. One special issue of *'Phalphul'* namely *'Pushp visheshaank'* was published during this duration.

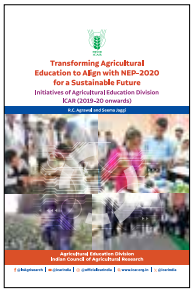
Each issue of both journals contains the articles based on new technologies, innovative farming systems and the climate resilient agro practices apart from Animal Husbandry, Agro Engineering, Natural Resources Management, fisheries and the Govt. schemes. In addition to that, regular Column outlining the agriculture activities of forthcoming month is also incorporated in each issue of the both journals which are very much appreciated amongst the farmers.

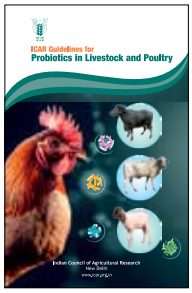
During this period, three books were published











Participation of ICAR-DKMA in exhibitions for showcasing ICAR publications

S. No.	Event	Date and Venue
1.	India International Trade Fair (IITF)	14-27 November 2024 at Pragati Maidan, New Delhi
2.	"Caring Soils Beyond Food Security-climate Mitigation & Ecosystem Services" organized by the Indian Society of Soil Science (ISSS)	19-22 November 2024 at NASC, New Delhi
3.	3rd Prafulla Chandra Roy Smarak Vigyan Mela O Pradarshani	26-29 December 2024 at Belgachia, Kolkata
4.	Destination Goa 2025-3rd in series focussing "Naya Bharat Vikshit Bharat-Aatma Nirbhar Bharat"	23-25 January 2025 at Panjim, Goa
5.	Rise in India 2025	20-22 February 2025 at Ghaziabad, UP
6.	Pusa Krishi Vigyan Mela	24-26 February 2025 at IARI, New Delhi
7.	"International Agriculture, Horticulture & Organic Expo, Indian Dairy Indistry & Fisheries Expo and Food & Technology Expo"	21-23 June 2025 at Pragati Maidan, New Delhi
8.	"28th National Agriculture Exhibition" on theme of "Pledge to make India a golden Nation"	21-24th August 2025 at Central Park Maidan, Salt Lake City, Kolkata

'*Meethaajal krishi praudyogikee se jalakrshakon ka aarthik utthaan'*, *'Krishi Rahasy*' and '*Krishi Vani*'. Among these '*Krishi rahasy*' and *'Krishi vani'* were published in digital format as e-book.

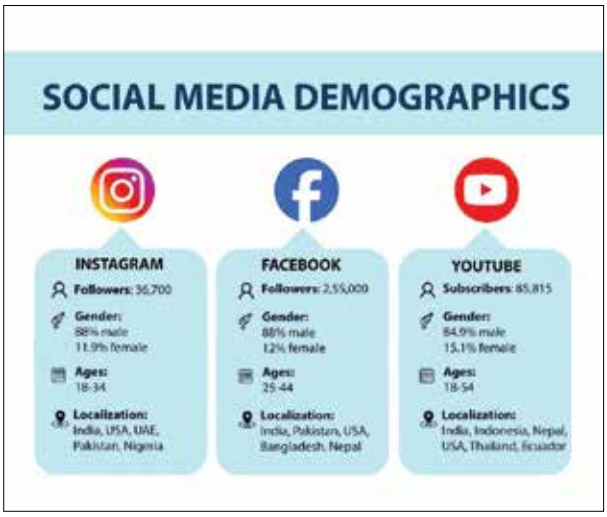
Revenue and outreach

ICAR-DKMA plays vital role in generating revenue through the sale of various publications. November 2024 to October 2025, a revenue of ₹99.00 lakhs has been generated from the sale of ICAR Publications. ICAR-DKMA also participated in eight exhibitions in different parts of the country for enhancing visibility of innovative research and technologies for improving Indian agriculture system.

ICAR Website and Social Media

To facilitate real-time information dissemination, the ICAR website was regularly updated, with a total of 5,131 pages refreshed during the reporting period. The website recorded 4,156,458 page views from over 200 countries, reflecting its global reach. The top five countries accessing the site were India, the United States, the United Kingdom, the United Arab Emirates, and Nepal.

On social media, ICAR maintained an active presence. The ICAR Facebook page averaged three posts per day and amassed 255K followers. Similarly, the ICAR Twitter handle posted an average of three tweets daily, gaining over 262.9K followers. ICAR's YouTube channel, featuring video films, animations, lectures, interviews with dignitaries and eminent scientists, and recordings of national and international events, attracted 85,815 subscribers. ICAR's Instagram averaged three posts per day and amassed 36,700 followers.



Marking a significant milestone, ICAR led the 15-

Participants at the workshop "Science Speaks: Communicate Your Research with Impact

day "Viksit Krishi Sankalp Abhiyan" (29 May-12 June 2025), a nationwide initiative aimed at strengthening agricultural development through collective action, innovation dissemination, and farmer empowerment. During this campaign, ICAR's social media platforms (Facebook, X, and Instagram) showcased "Abhiyan" activity so this initiative substantially increased the visibility of ICAR's achievements and contributions to agricultural research and innovation.

ICAR-DKMA organized a workshop titled "Science Speaks: Communicate Your Research with Impact" on September 16–17, 2025, at Basmati Hall, NAAS Complex, New Delhi. The workshop aimed to enhance the communication skills of nodal officers and editors from various ICAR institutes through expert-led sessions on science communication, media engagement, ethical publishing, and digital tools. Participants actively took part in interactive sessions, hands-on exercises, and discussions.

Publicity, Public Relations and Media

During the reporting period, ICAR actively participated in 63 national and international exhibitions, expos, fairs, and conferences across diverse regions of the country. These platforms were effectively utilized to showcase ICAR's latest agricultural technologies, research innovations, climate-resilient practices, value-added products, and farmer-centric solutions. Participation involved ICAR institutes, ATARIs, KVKs, and research centres, facilitating wide outreach, stakeholder engagement and technology dissemination. The exhibitions significantly enhanced ICAR's visibility, strengthened linkages with farmers, entrepreneurs, industry, and state agencies, and contributed to promoting sustainable agricultural development in the country.

Print and electronic media

The Directorate is showcasing ICAR technologies, policies and other activities through print, electronic and web mode. The editorial units help in development of content in value added information products in print, electronic and web mode.

During the reporting year, ICAR published three key policy documents: 'Research Data Management Policy' to strengthen data governance and enable advanced analytics; 'Communication Policy and Strategy' to enhance effective dissemination of scientific knowledge, and 'Gender Strategy for National Agricultural Research, Education and Extension System' to promote inclusivity and gender responsiveness across the agricultural research system.

APPENDIX 1

ACTIVITY PROGRAMME CLASSIFICATION

Budget Estimates (BE) and Revised Estimates (RE) for the year 2024-25 and BE 2025-26 in r/o DARE Secretariat, Contribution, AP Cess, CAUs and NAAS and IAUA are given in Table 1.

Table 1. Budget Estimates and Revised Estimates of DARE

(Rupees in lakh)

Item		Budget Estimates	Revised Estimates	Budget Estimates
		2024-25	2024-25	2025-26
		Unified Budget	Unified Budget	Unified Budget
Major Head '3451'				
090	**Secretariat-Economic Services**	1611.00	793.00	1247.00
091	**Agricultural Scientists' Recruitment Board**	2787.00	2056.00	2255.00
Major Head '2415'				
80	**General**			
80.120	**Assistance to other institutions**			
01	**Grant-in-Aid Central Agricultural University, Imphal**			
010031	Grants in Aid General	0.00	0.00	0.00
010035	Grants for creation of Capital Assets	0.00	0.00	0.00
010036	Grants in Aid Salaries	0.00	0.00	0.00
02	**Grant-in-Aid Central Agricultural University, Bundelkhand**			
020031	Grants in Aid General	1300.00	1300.00	1300.00
020035	Grants for creation of Capital Assets	12500.00	12500.00	13500.00
020036	Grants in Aid Salaries	1800.00	2800.00	2800.00
03	**Grant-in-Aid Central Agricultural University, Bihar**			
030031	Grants in Aid General	2000.00	2000.00	2975.00
030035	Grants for creation of Capital Assets	5409.00	5409.00	5200.00
030036	Grants in Aid Salaries	18417.00	18417.00	18417.00
05	**Grants-in-Aids to National Academy of Agricultural Sciences and Indian Agricultural Universities Association**			
050031	Grants in Aid General	31.00	31.00	0.00
050035	Grants for creation of Capital Assets	0.00	0.00	0.00
050036	Grants in Aid Salaries	0.00	0.00	0.00
06	**Agricultural Scientists' Recruitment Board**			
060031	Grants in Aid General	0.00	0.00	0.00
060035	Grants for creation of Capital Assets	0.00	0.00	0.00
060036	Grants in Aid Salaries	0.00	0.00	0.00
80.798	**International Co-operation (Minor Head)**			
01	**India's Membership Contribution to Commonwealth Agricultural Bureau**			
010032	Contribution	65.00	65.00	65.00
02	**India's Membership Contribution to Consultative Group on International Agricultural Research**			
020032	Contribution	635.00	635.00	650.00
04	**Asia Pacific Association of Agricultural Research Institutions**			
040032	Contribution	10.00	10.00	10.00

Contd..

(Concluded)

Item		Budget Estimates	Revised Estimates	Budget Estimates
		2024-25	2024-25	2025-26
		Unified Budget	Unified Budget	Unified Budget
05	**N.A.C.A.**			
050032	Contribution	50.00	50.00	51.00
07	**International Seed Testing Association, Zurich, Switzerland**			
070032	Contribtion	6.00	6.00	6.00
08	**International Society for Horticulture Science, Belgium**			
080032	Contribution	0.00	0.00	0.00
Major Head '2552' North Eastern Areas				
259	General (Agri. Res. & Edn. Schemes) (Minor Head)			
01	**Grants-in-Aid-General to Central Agricultural University, Imphal**			
010031	Grants in Aid General	3929.00	3929.00	4500.00
010035	Grants for creation of Capital Assets	7200.00	7200.00	8925.00
010036	Grants in Aid Salaries	19800.00	19800.00	19800.00
5475	**Capital Outlay on other General Economic Services**			
01	**Secretariat**			
06	**DARE**			
06.52	Machine and Equipment	6.00	6.00	8.00
06.71	Information Computers Telecommunication Equipment	20.00	18.00	25.00
06.74	Furniture and Fixtures	4.00	4.00	6.00
02	**ASRB (Detailed head)**			
02.51	Motor Vehicles	0.00	0.00	0.00
02.52	Machinery and Equipment	20.00	14.00	16.00
02.71	Information Computers Telecommunication Equipment	220.00	90.00	80.00
02.72	Building and Structures	200.00	200.00	240.00
02.74	Furniture and Fixtures	150.00	45.00	50.00
02.77	Other Fixed Assets	30.00	5.00	8.00
	Total-ASRB (Sub-Head)	**620.00**	**354.00**	**394.00**
	Total	**78200.00**	**77383.00**	**82134.00**

ACTIVITY PROGRAMME CLASSIFICATION

MINISTRY OF AGRICULTURE AND FARMERS WELFARE

DEMAND NO. 2

Department of Agricultural Research and Education

A. The Budget allocations, net of recoveries, are given below: (Rupees in crore)

	Actual 2023-2024			Budget 2024-2025			Revised 2024-2025			Budget 2025-2026		
	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total
Gross	9801.00	3.39	9804.39	9934.59	6.50	9941.09	10152.53	3.82	10156.35	10462.06	4.33	10466.39
Recoveries	-13.61	...	-13.61	...	...	...	...	...	...	...	...	...
Receipts	...	...	...	...	...	...	...	...	...	...	...	...
Net	**9787.39**	**3.39**	**9790.78**	**9934.59**	**6.50**	**9941.09**	**10152.53**	**3.82**	**10156.35**	**10462.06**	**4.33**	**10466.39**
A. The Budget allocations, net of recoveries, are given below:												
CENTRE'S EXPENDITURE												
Establishment Expenditure of the Centre												
1. Secretariat	31.54	3.39	34.93	51.64	6.50	58.14	36.15	3.82	39.97	42.84	4.33	47.17
Central Sector Schemes/Projects												
Agricultural Education												
2. National Agricultural Higher Education Project (EAP)	54.60	...	54.60	...	...	...	...	...	...	...	...	...
3. Strengthening of Krishi Vigyan Kendras (KVKs)	249.91	...	249.91	234.89	...	234.89	234.89	...	234.89	204.23	...	204.23
4. Agricultural Production and Post-Production Mechanization Augmented with Innovative Technologies for Sustainable Agriculture Development	70.09	...	70.09	91.24	...	91.24	91.24	...	91.24	95.74	...	95.74
5. Natural Resource Management	239.97	...	239.97	252.16	...	252.16	252.16	...	252.16	229.09	...	229.09
6. Crop Science for Food and Nutritional Security	930.95	...	930.95	930.22	...	930.22	930.22	...	930.22	965.46	...	965.46
7. Technology based support in improvement and management of horticulture crops towards enhanced and sustainable productivity for nutritional security (Horticultural Science)	210.19	...	210.19	257.07	...	257.07	257.07	...	257.07	318.91	...	318.91
8. Research, Education and Technology Development for Sustainable Livestock Health and Production towards Nutritional Security	304.22	...	304.22	415.15	...	415.15	415.15	...	415.15	504.04	...	504.04
9. Fisheries and Aquaculture for Sustainable Development	150.00	...	150.00	200.92	...	200.92	200.92	...	200.92	192.81	...	192.81

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(Continued)

	Actual 2023-2024			Budget 2024-2025			Revised 2024-2025			Budget 2025-2026		
	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total
10. Strengthening Agricultural Education, Management & Social Sciences	322.67	...	322.67	398.74	...	398.74	630.17	...	630.17	708.94	...	708.94
Total- Central Sector Schemes/Projects	**2532.60**	**...**	**2532.60**	**2780.39**	**...**	**2780.39**	**3011.82**	**...**	**3011.82**	**3219.22**	**...**	**3219.22**
Other Central Sector Expenditure												
Autonomous Bodies												
11. ICAR Headquarters	6569.83	...	6569.83	6378.70	...	6378.70	6370.70	...	6370.70	6425.83	...	6425.83
12. Central Agricultural Universities	666.27	...	666.27	723.55	...	723.55	733.55	...	733.55	774.17	...	774.17
13. National Academy of Agricultural Sciences	0.76	...	0.76	0.31	...	0.31	0.31	...	0.31	...	...	...
Total- Autonomous Bodies	**7236.86**	**...**	**7236.86**	**7102.56**	**...**	**7102.56**	**7104.56**	**...**	**7104.56**	**7200.00**	**...**	**7200.00**
Others												
14. Actual Recoveries	-13.61	...	-13.61	...	...	...	...	...	...	...	...	...
Total- Other Central Sector Expenditure	**7223.25**	**...**	**7223.25**	**7102.56**	**...**	**7102.56**	**7104.56**	**...**	**7104.56**	**7200.00**	**...**	**7200.00**
Grand Total	**9787.39**	**3.39**	**9790.78**	**9934.59**	**6.50**	**9941.09**	**10152.53**	**3.82**	**10156.35**	**10462.06**	**4.33**	**10466.39**
B. Developmental Heads												
Economic Services												
1. Agricultural Research and Education	9763.44	...	9763.44	9303.22	...	9303.22	9513.56	...	9513.56	9772.86	...	9772.86
2. Secretariat- Economic Services	23.95	...	23.95	43.98	...	43.98	28.49	...	28.49	35.02	...	35.02
3. Capital Outlay on Other General Economic Services	...	3.39	3.39	...	6.50	6.50	...	3.82	3.82	...	4.33	4.33
Total- Economic Services	**9787.39**	**3.39**	**9790.78**	**9347.20**	**6.50**	**9353.70**	**9542.05**	**3.82**	**9545.87**	**9807.88**	**4.33**	**9812.21**
Others												
4. North Eastern Areas	...	...	...	587.39	...	587.39	610.48	...	610.48	654.18	...	654.18
Total- Others	**...**	**...**	**...**	**587.39**	**...**	**587.39**	**610.48**	**...**	**610.48**	**654.18**	**...**	**654.18**
Grand Total	**9787.39**	**3.39**	**9790.78**	**9934.59**	**6.50**	**9941.09**	**10152.53**	**3.82**	**10156.35**	**10462.06**	**4.33**	**10466.39**
	Budget Support	**IEBR**	**Total**	**Budget Support**	**IEBR**	**Total**	**Budget Support**	**IEBR**	**Total**	**Budget Support**	**IEBR**	**Total**
C. Investment in Public Enterprises												
1. Agrinnovate India Limited	...	7.40	7.40	...	20.00	20.00	...	10.00	10.00	...	10.00	10.00
Total	**...**	**7.40**	**7.40**	**...**	**20.00**	**20.00**	**...**	**10.00**	**10.00**	**...**	**10.00**	**10.00**

1. **Secretariat:** The provision is for the expenditure on salary and establishment expenditure of Department and Agricultural Scientists Recruitment Board(ASRB). ASRB is an attached office of DARE.

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2. **National Agricultural Higher Education Project (EAP):** It is an externally aided project funded by World Bank and the Government. The provision is for the externally aided component of the National Agricultural Higher Education Project (NAHEP) which aims to develop resources and mechanism for supporting infrastructure, faculty and student advancement, providing means for better governance and management of agricultural universities, so that a holistic model can be developed to raise the standard of current agricultural education system that provides more jobs and is entrepreneurship oriented on par with global agricultural standards.
3. **Strengthening of Krishi Vigyan Kendras (KVKs):** The provision is for the activities to reach out to the farmers at grass root level through Krishi Vigyan Kendras to demonstrate, disseminate and refine front-line agricultural technologies. It includes demonstration of technologies, training of farmers and extension personnel on local technologies, distribution of seed, planting materials, testing of soil and water samples etc.
4. **Agricultural Production and Post-Production Mechanization Augmented with Innovative Technologies for Sustainable Agriculture Development:** The provision is for research, development and refinement of farm equipment, process and value addition protocols.
5. **Natural Resource Management:** The provision is for conducting research to address low farm productivity and profitability, land degradation, low water productivity, soil health deterioration and low nutrient use efficiency, deterioration in ecosystem services, abiotic stresses, etc. It is necessary to encounter deteriorating natural resource base for long-term sustainability of agricultural development.
6. **Crop Science for Food and Nutritional Security:** Research provision is to develop trait-specific high yielding field crop varieties/hybrids having tolerance to pest and diseases and bio-fortification, besides various abiotic stresses. The quality attributes are also given due importance with no yield penalty. The All India Coordinated Research Project (AICRPs)/Network Research Projects with active collaboration with State Agricultural Universities (SAUs) are engaged in the development of improved crop varieties/ hybrids, cost-effective production and environment-friendly protection technologies in different agro-climatic regions.
7. **Technology based support in improvement and management of horticulture crops towards enhanced and sustainable productivity for nutritional security (Horticultural Science):** The provision is to address thrust areas of enrichment of horticultural genetic resources, development of new cultivation with resistance mechanism to biotic and abiotic stresses, appropriate production technology and health management system of horticultural and vegetable crops.
8. **Research, Education and Technology Development for Sustainable Livestock Health and Production towards Nutritional Security:** The provision is to develop new technologies to support production enhancement, profitability, competitiveness and sustainability of livestock and poultry sector for food and nutritional security. It will facilitate need based priority research in livestock and poultry sector in on-going and new emerging areas to support productivity increase, thereby reducing the gap between potential and actual yield.
9. **Fisheries and Aquaculture for Sustainable Development:** The provision is to implement research and academic programmes in fisheries and aquaculture. It also provides technical, training, analytical, advisory support and consultancy services in the field of fisheries resources assessment and management, standardization of aquaculture hatchery and grow-out culture technologies, responsible fishing system and species diversification and utilization of inland saline soils for aquaculture, fish health monitoring, etc.
10. **Strengthening Agricultural Education, Management & Social Sciences:** The provision will provide financial support to all the agricultural universities in the country comprising State Agricultural Universities (SAUs), Deemed Universities (DUs) and Central Universities (CUs) with Agriculture Faculty. The scheme is also responsible for maintenance and improvement of standard of agricultural education through:(i) accreditation of educational institutions, (ii) providing International/national fellowships both at post and undergraduate levels, (iii) Organization of training and capacity building programmes for the scientists/faculty of National Agricultural Research System in cutting-edge areas.
11. **ICAR Headquarters:** Provision is primarily for the salaries, pensions, expenses on administrative and logistic support to different schemes under ICAR in order to implement them efficiently.
12. **Central Agricultural Universities:** The provision is to strengthen the regional education, research and extension capabilities based on local agro-climatic situation.
13. **National Academy of Agricultural Sciences:** The provision is to provide a forum to Agricultural Scientists to deliberate on important issues of agricultural research, education, extension and present views of the scientific community as policy inputs to planners and decision/opinion makers at various levels.

APPENDIX 2

LIST OF THE MEMBERS OF THE GENERAL BODY OF THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH SOCIETY

4(i) Minister-in-charge of the portfolio of Agriculture & Farmers Welfare in the Union Cabinet- President of the Society.

President

1. Shri Shivraj Singh Chouhan — Ex-officio
Minister of Agriculture & Farmers Welfare and Rural Development, Government of India, Krishi Bhavan, New Delhi 110 001

4(ii) Minister of State in the Union Ministry of Agriculture & Farmers Welfare dealing with ICAR- Vice President of the Society

Vice President

2. Shri Bhagirath Choudhary — Ex-officio
Minister of State for Agriculture & Farmers Welfare, Government of India, Krishi Bhavan, New Delhi 110 001

4(iii) Union Ministers holding charge of Finance, Planning, Science & Technology, Education and Commerce (in case the Prime Minister is holding any of these portfolios, the Minister of State in the Ministry / Department concerned).

3. Smt. Nirmala Sitharaman — Ex-officio
Minister of Finance and Corporate Affairs, Government of India, North Block, New Delhi 110 001

4. Shri Piyush Goyal — Ex-officio
Minister of Commerce & Industry, Government of India, Room No. 501, Vanijya Bhavan, New Delhi 110 001

5. Shri Dharmendra Pradhan — Ex-officio
Minister of Education, Government of India, Shastri Bhavan, New Delhi 110 001

6. Dr. Jitendra Singh — Ex-officio
Minister of State (IC) of the Ministry of Science & Technology and Ministry of Earth Sciences, Government of India, CSIR Building, 2 Rafi Marg, New Delhi 110 001

7. Shri Rao Inderjit Singh — Ex-officio
Minister of State (IC) of the Ministry of Planning and Ministry of Statistics & Programme Implementation, Government of India, Room No. 132, NITI Aayog, New Delhi 110 001

4(iv) Other Ministers in the Union Ministry of Agriculture & Farmers Welfare.

8. Shri Ram Nath Thakur — Ex-officio
Minister of State for Agriculture & Farmers Welfare, Government of India, Krishi Bhavan, New Delhi 110 001

4(v) Union Minister and Minister of State(s) in the Union Ministry of Fisheries, Animal Husbandry & Dairying
*Union Minister of Fisheries, Animal Husbandry & Dairying will be the Senior Vice-President.

Sr. Vice-President

9. Shri Rajiv Ranjan Singh alias Lalan Singh — Ex-officio
Minister of Fisheries, Animal Husbandry & Dairying and Panchayati Raj, Government of India, Krishi Bhavan, New Delhi 110 001

10. Prof. S. P. Singh Baghel — Ex-officio
Minister of State for Fisheries, Animal Husbandry & Dairying and Panchayati Raj, Government of India, Krishi Bhavan, New Delhi 110 001

11. Shri George Kurian — Ex-officio
Minister of State for Fisheries, Animal Husbandry & Dairying and Minority Affairs, Government of India, Krishi Bhavan, New Delhi 110 001

4(vi) Ministers in the States in-charge of Agriculture/ Horticulture/ Animal Husbandry/ Fisheries

ANDHRA PRADESH

12. Shri Kinjarapu Atchannaidu — Ex-officio
Minister for Agriculture, Co-Operation, Marketing, Animal Husbandry, Dairy Development & Fisheries, Government of Andhra Pradesh, Room No. 130, Ground Floor, bulding No. 4, Velagapudi, Amaravathi, Andhra Pradesh 522 503

ARUNACHAL PRADESH

13. Shri Gabriel Denwang Wangsu — Ex-officio
Minister for Agriculture, Animal Husbandry & Veterinary, Horticulture & Fisheries, Government of Arunachal Pradesh, Room No-308, Block-II, Civil Secretariat, Itanagar, Arunachal Pradesh 791 111

ASSAM

14. Shri Atul Bora — Ex-officio
Minister for Agriculture, Horticulture, Animal Husbandry & Veterinary, Government of Assam, Block-C, Ground Floor, Janata Bhawan, Assam Secretariat, Dispur, Guwahati, Assam 781 006

BIHAR

15. Shri Ram Kripal Yadav — Ex-officio
Minister for Agriculture, Government of Bihar, Vikas Bhavan, New Secretariat, Bailey Road, Patna, Bihar 800 015

16. Shri Surendra Mehta — Ex-officio
Minister for Animal & Fisheries Resources, Government of Bihar, Vikas Bhavan, New Secretariat, Bailey Road, Patna, Bihar 800 015

CHHATISGARH

17. Shri Ramvichar Netam — Ex-officio
Minister of Agriculture Development and Farmers Welfare, Government of Chhattisgarh, Mahanadi Bhawan, Mantralaya, Naya Raipur, Chhattisgarh 492 002

18. Shri Vishnu Deo Sai — Ex-officio
Chief Minister and Minister of Fisheries and Minister of Livestock Development, Government of Chhattisgarh, 4th Floor, Block-B, Indravati Bhawan, Nava Raipur Atal Nagar, Raipur, Chhattisgarh 492 101

DELHI

19. Shri Kapil Mishra — Ex-officio
Minister of Law & justice, Labour, Employment, Development, Art, Culture & Language, Tourism, Government of Delhi, Room No. 802, 8th Floor, A-Wing, Delhi Secretariat, IP Estate, New Delhi 110 002

GOA

20. Minister of Agriculture, Government of Goa, Secretariat, Porvorim, Goa 403 521

21. Shri Nilkanth Halarnkar — Ex-officio
Minister of Animal husbandry & Veterinary Services and Minister of Fisheries, Government of Goa, Secretariat, Porvorim, Goa 403 521

GUJARAT

22. Shri Jitubhai Savjibhai Vaghani — Ex-officio
Minister for Agriculture and Farmers Welfare, Animal Husbandry, Fisheries, Government of Gujarat, Swarnim Sankul-1, 1st Floor Sachivalaya, Sector – 10, Gandhinagar, Gujarat 382 010

HARYANA

23. Shri Shyam Singh Rana — Ex-officio
Minister for Agriculture and Farmers Welfare, Animal Husbandry & dairying, Fisheries and Horticulture, Government of Haryana, Room No. 47, 8th Floor, Haryana Civil Secretariat, Chandigarh, Haryana 160 001

HIMACHAL PRADESH

24. Shri Chander Kumar — Ex-officio
Minister for Agriculture & Animal Husbandry, Government of Himachal Pradesh, H.P. Secretariat, Shimla, Himachal Pradesh 171 002

25. Shri Jagat Singh Negi — Ex-officio
Minister for Horticulture, Government of Himachal Pradesh, H.P. Secretariat, Shimla, Himachal Pradesh 171 002

JAMMU AND KASHMIR

26. Shri Javid Ahmad Dar — Ex-officio
Minister for Agriculture Production, Government of Jammu and Kashmir, R. No. 1/38-39, 1st, Civil Secretariat, Jammu 180 001

JHARKHAND

27. Smt. Shilpi Neha Tirkey — Ex-officio
Minister of Agriculture, Animal Husbandry & Co-operative, Government of Jharkhand, Nepal House, Doranda, Ranchi, Jharkhand 834 002

KARNATAKA

28. Shri N. Chaluvaraya Swamy — Ex-officio
Minister for Agriculture, Government of Karnataka, Vikasa Soudha, Bangaluru, Karnataka 560 001

29. Shri S.S. Mallikarjun — Ex-officio
Minister for Horticulture, Government of Karnataka, Vikasa Soudha, Bangaluru, Karnataka 560 001

30. Shri K. Venkatesh — Ex-officio
Minister of Animal Husbandry, Government of Karnataka, Vidhan Soudha, Bangaluru, Karnataka 560 001

31. Shri Mankal Vaidya — Ex-officio
Minister of Fisheries, Government of Karnataka, Vidhan Soudha, Bangaluru, Karnataka 560 001

KERALA

32. Shri P. Prasad — Ex-officio
Minister of Agriculture, Government of Kerala, Government Secretariat Annexe- 2, Thiruvananthapuram, Kerala 695 001

33. Smt. J. Chinchu Rani — Ex-officio
Minister of Animal Husbandry & Dairy Development, Government of Kerala, Government Secretariat Annexe-2, Thiruvananthapuram, Kerala 695 001

34. Shri Saji Cherian — Ex-officio
Minister of Fisheries, Government of Kerala, Government Secretariat Annexe-1, Thiruvananthapuram, Kerala 695 001

MADHYA PRADESH

35. Shri Adal Singh Kansana — Ex-officio
Minister for Farmers Welfare and Agriculture Development, Government of Madhya Pradesh, Room No. B-106, VB-II, Mantralaya, Vallabh Bhavan, Bhopal, Madhya Pradesh 462 004

36. Shri Lakhan Singh Patel — Ex-officio
Minister of State (Independent Charge) for Animal Husbandry and Dairying, Government of Madhya Pradesh, Room No. E-205, VB-III, Mantralaya, Vallabh Bhavan, Bhopal, Madhya Pradesh 462 004

37. Shri Narayan Singh Panwar — Ex-officio
Minister of State (Independent Charge) for Fishermen Welfare and Fisheries Development, Room No. D-507, VB-III, Mantralaya, Vallabh Bhavan, Bhopal, Madhya Pradesh 462 004

38. Shri Narayan Singh Kushwah — Ex-officio
Minister for Horticulture and Food Processing, Government of Madhya Pradesh, Room No. B-427, VB-II, Mantralaya, Vallabh Bhavan, Bhopal, Madhya Pradesh 462 004

MAHARASHTRA

39. Shri Dattatray Girijabai Vithoba Bharane — Ex-officio
Minister for Agriculture, Government of Maharashtra, Room No. 203, 2nd Floor, Mantralaya Main Building, Mumbai, Maharashtra 400 032

40. Shri Bharatsheth Vithabai Maruti Gogawale — Ex-officio
Minister for Horticulture, Government of Maharashtra, Mantralaya, Mumbai, Maharashtra 400 032

41. Ms. Pankaja Munde — Ex-officio
Minister for Animal Husbandry, Government of Maharashtra, Room No. 403, 4th Floor, Mantralaya Main Building, Mumbai, Maharashtra 400 032

42. Shri Nitesh Neelam Narayan Rane — Ex-officio
Minister for Fisheries, Government of Maharashtra, Mantralaya, Mumbai, Maharashtra 400 032

MANIPUR

Under President Rule

MEGHALAYA

43. Shri Timothy D. Shira — Ex-officio
Minister for Agriculture & Farmers' Welfare and Fisheries, Government of Meghalaya, Room No. 524, Yojana Bhawan, Meghalaya Secretariat, Shillong, Meghalaya 793 001

44. Shri Sanbor Shullai — Ex-officio
Minister for Animal Husbandry & Veterinary, Government of Meghalaya, Room No. 401, Yojana Bhavan, Meghalaya Secretariat, Shillong, Meghalaya 793 001

MIZORAM

45. Shri C. Lalsawivunga — Ex-officio
Minister for Animal Husbandry & Veterinary Deptt., Horticulture, Government of Mizoram, Mizoram Secretariat, MINECO, Khatla, Aizawl, Mizoram 796 001

46. Shri P. C. Vanlalruata — Ex-officio
Minister for Agriculture, Government of Mizoram, Mizoram Secretariat, MINECO, Khatla, Aizawl, Mizoram 796 001

47. Shri Lalthansanga — Ex-officio
Minister for Fisheries, Government of Mizoram, Mizoram Secretariat, MINECO, Khatla, Aizawl, Mizoram 796 001

NAGALAND

48. Shri Mhathung Yanthan — Ex-officio
MLA and Advisor to the Department of Agriculture, Government of Nagaland, New Secretariat Complex, Kohima, Nagaland 797 001
49. Shri A. Pangjung Jamir — Ex-officio
MLA and Advisor to the Department of Fisheries & Aquatic resources, Government of Nagaland, New Secretariat Complex, Kohima, Nagaland 797 001
50. Shri Kazheto Kinini — Ex-officio
MLA and Advisor to the Department of Animal Husbandry & Veterinary Services, Government of Nagaland, New Secretariat Complex, Kohima, Nagaland 797 001
51. Smt. Salhoutuonuo Kruse — Ex-officio
Minister for Horticulture, Government of Nagaland, New Secretariat Complex, Kohima, Nagaland 797 001

ODISHA

52. Shri K. V. Singh Deo — Ex-officio
Dy. Chief Minister, Agriculture and Farmers Empowerment Department, Government of Odisha, Odisha Secretariat, Bhubaneswar, Odisha 751 001

53. Shri Gokulananda Mallik — Ex-officio
Minister of State (Independent Charge) for Fisheries & Animal Resources Development Department, Government of Odisha, Odisha Secretariat, Bhubaneswar, Odisha 751 001

PUNJAB

54. Shri Gurmeet Singh Khudian — Ex-officio
Minister of Agriculture & Farmers Welfare, Animal husbandry, Fisheries and Dairy Development, Government of Punjab, Punjab Civil Secretariat-1, Chandigarh, Punjab 160 001

55. Shri Mohinder Bhagat — Ex-officio
Minister of Horticulture, Government of Punjab, Punjab Civil Secretariat-1, Chandigarh, Punjab 160 001

PUDUCHERRY

56. Shri C. Djeacoumar — Ex-officio
Minister of Agriculture, Animal Husbandry & Animal Welfare, Government of Puducherry, Puducherry 605 001

57. Shri K. Lakshminarayanan — Ex-officio
Minister of Fisheries and Fishermen Welfare, Government of Puducherry, Puducherry 605 001

RAJASTHAN

58. Shri Kirodi Lal Meena — Ex-officio
Minister for Agriculture & Horticulture, Government of Rajasthan, Rajasthan Secretariat, Mantralaya Bhawan, Jaipur, Rajasthan 302 005

59. Shri Joraram Kumawat — Ex-officio
Minister for Animal Husbandry & Dairy, Government of Rajasthan, Rajasthan Secretariat, Mantralaya Bhawan, Jaipur, Rajasthan 302 005

SIKKIM

60. Shri Puran Kumar Gurung — Ex-officio
Minister for Agriculture, Animal Husbandry & Veterinary Services, Horticulture & Fisheries, Government of Sikkim, New Secretariat, Development Area, Gangtok, Sikkim 737 101

TAMIL NADU

61. Shri M.R.K. Panneerselvam — Ex-officio
Minister for Agriculture & Farmers Welfare, Horticulture, Government of Tamil Nadu, Chennai, Tamil Nadu 600 009
62. Shri Anitha R. Radhakrishnan — Ex-officio
Minister for Fisheries, Fisheries Development Corporation and Animal Husbandry, Government of Tamil Nadu, Chennai, Tamil Nadu 600 009

TELANGANA

63. Shri Tummala Nageswara Rao — Ex-officio
Minister of Agriculture, Government of Telangana, Haka Bhawan, 2nd Floor, Nampally, Telangana Secretariat, Hyderabad, Telangana 500 004

64. Shri Vakiti Srihari — Ex-officio
Minister of Animal Husbandry, Dairy Dev. & Fisheries, Government of Telangana, Room No. 33, 2nd Floor, Dr. B. R. Ambedkar Telangana Secretariat, Hyderabad, Telangana 500 022

TRIPURA

65. Shri Ratan Lal Nath — Ex-officio
Minister for Agriculture & Farmers Welfare, Government of Tripura, Civil Secretariat, Agartala, Tripura 799 001

66. Shri Sudhangshu Das — Ex-officio
Minister for Animal Resource Development and Fisheries, Government of Tripura, Civil Secretariat, Agartala, Tripura 799 001

UTTARAKHAND

67. Shri Ganesh Joshi — Ex-officio
Minister for Agriculture, Government of Uttarakhand, Uttarakhand Vidhan Sabha Bhawan, Dehradun, Uttarakhand 248 001

68. Shri Saurabh Bahuguna — Ex-officio
Minister for Animal Husbandry & Fisheries, Government of Uttarakhand, Uttarakhand Vidhan Sabha Bhawan, Dehradun, Uttarakhand 248 001

UTTAR PRADESH

69. Shri Surya Pratap Shahi — Ex-officio
Minister of Agriculture, Agricultural Education & Agricultural Research, Government of Uttar Pradesh, UP Civil Secretariat, Lucknow, Uttar Pradesh 226 001

70. Shri Dharmpal Singh — Ex-officio
Minister of Animal Husbandry & Dairy Development, Government of Uttar Pradesh, UP Civil Secretariat, Lucknow, Uttar Pradesh 226 001

71. Shri Sanjay Nishad — Ex-officio
Minister of Fisheries, Government of Uttar Pradesh, Room No. 89, Vidhan Sabha, Main Building, UP Civil Secretariat, Lucknow, Uttar Pradesh 226 001

72. Shri Dinesh Pratap Singh — Ex-officio
Minister of State (IC), Horticulture & Food Processing Department, Government of Uttar Pradesh, Udhyan Bhawan, 2-Sapru Marg, Lucknow, Uttar Pradesh 226 001

WEST BENGAL

73. Shri Sobhandeb Chattopadhyay — Ex-officio
Minister for Agriculture, Government of West Bengal, Nabanna, 3rd Floor, 325, Sarat Chatterjee Road, Mandirtala, Shibpur, Howrah, West Bengal 711 102

74. Shri Swapan Debnath — Ex-officio
Minister of Animal Resources Development, Government of West Bengal, Prani Sampad Bhavan, LB-2, Sector-III, Salt Lake City, Kolkata, West Bengal 700 106

75. Shri Biplab Roy Chowdhury — Ex-officio
Minister of State (IC) for Fisheries, Government of West Bengal, Benfish Tower, 8th Floor, 31 GN Block, Salt Lake, Sector-V, Kolkata, West Bengal 700 091

76. Shri Arup Roy — Ex-officio
Minister for Horticulture, Government of West Bengal, Benfish Tower, 4th Floor, GN Block, Sector V, Salt Lake City, Kolkata, West Bengal 700 091

4(vii) Member, NITI Ayog, In-charge of Agriculture.

77. Prof. Ramesh Chand — Ex-officio
Member (Agriculture) NITI Aayog, Niti Bhawan, New Delhi 110 001

4(viii) Six members of Parliament—four elected by Lok Sabha and two elected by Rajya Sabha.

78. VACANT (due to office of profit)

79. VACANT -do-

80. VACANT -do-

81. VACANT -do-

82. VACANT -do-

83. VACANT -do-

4(ix) Director-General, Indian Council of Agricultural Research.

84. Dr. Mangi Lal Jat — Ex-officio
Secretary (DARE) & DG(ICAR), Krishi Bhavan, New Delhi 110 001

4(x) All Secretaries in the Ministry of Agriculture & Farmers Welfare.

85. Shri Devesh Chaturvedi — Ex-officio
Secretary, Deptt. of Agriculture & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Krishi Bhavan, New Delhi 110 001

4(xi) All Secretaries in the Ministry of Fisheries, Animal Husbandry & Dairying.

86. Dr. Abhilaksh Likhi — Ex-officio
Secretary, Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India, Krishi Bhavan, New Delhi 110 001

87. Shri Naresh Pal Gangwar — Ex-officio
Secretary, Department of Animal Husbandry and Dairying, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India, Krishi Bhavan, New Delhi 110 001

4(xii) CEO, NITI Ayog

88. Shri B.V.R. Subrahmanyam — Ex-officio
CEO, Niti Aayog, Yojana Bhavan, Sansad Marg, New Delhi 110 001

4(xiii) Secretary, Department of Bio-Technology.

89. Dr. Rajesh S. Gokhale — Ex-officio
Secretary, Department of Biotechnology, Block 2, 7th Floor, CGO Complex, Lodhi Road, New Delhi 110 003

4(xiv) Director-General, Council of Scientific and Industrial Research

90. Dr. (Mrs.) N. Kalaiselvi — Ex-officio
Director General, Council of Scientific and Industrial Research, Anusandhan Bhavan, 2-Rafi Marg, New Delhi 110 001

4(xv) Chairman, University Grants Commission.

91. Dr. Vineet Joshi — Ex-officio
Chairman, University Grants Commission, Bahadur Shah Zafar Marg, New Delhi 110 002

4(xvi) Chairman, Atomic Energy Commission (or Director, Bhabha Atomic Research Centre, if nominated by the Chairman, Atomic Energy Commission)

92. Dr. Ajit Kumar Mohanty — Ex-officio
Chairman, Atomic Energy Commission, Department of Atomic Energy, Anushakti Bhavan, Chhatrapati Shivaji Maharaj Marg, Mumbai 400 001

4(xvii) Member, Finance (Secretary/ Additional Secretary) in the Ministry of Finance, Government of India. Alternative member for ministry of Finance-AS & FA (DARE/ICAR)

93. Shri Vumlunmang Vualnam — Ex-officio
Secretary (Expenditure), Department of Expenditure, Room No. 16102, Kartavya Bhawan-I, New Delhi

Alternative member for ministry of Finance-AS & FA (DARE/ICAR)

94. Shri Sandeep Sarkar — Ex-officio
Addl. Secy & FA (DARE/ICAR), Krishi Bhavan, New Delhi 110 001

4(xviii) Five Vice-Chancellors of Agricultural Universities, nominated by the President.

95. Dr. S. C. Dubey — 15-04-2027
Vice Chancellor, Birsa Agricultural University, Ranchi, Jharkhand 834 006

96. Dr. Ch. Srinivasa Rao — 22.06.2028
Director & Vice Chancellor, Indian Agricultural Research Institute, Pusa, New Delhi 110 012

97. Dr. Inderjeet Singh — 22.06.2028
Vice Chancellor, Bihar Animal Sciences University, Bihar Veterinary College Campus, Patna, Bihar 800 014

98. Vacant

99. Vacant

4(xix) Five technical representatives, namely Agricultural Commissioner, Horticultural Commissioner, Animal Husbandry Commissioner and Fisheries Development Commissioner from Union Ministries of Agriculture & Farmers Welfare/Fisheries, Animal Husbandry & Dairying and Inspector-General of Forests, Government of India.

100. Dr. Praveen Kumar Singh — Ex-officio
Agriculture Commissioner, Dept. of Agriculture & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Krishi Bhavan, New Delhi 110 001

101. Dr. Prabhat Kumar — Ex-officio
Horticulture Commissioner, Dept. of Agriculture & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Krishi Bhavan, New Delhi 110 001

102. Dr. Praveen Malik — Ex-officio
Animal Husbandry Commissioner, Dept. of Animal Husbandry & Dairying, Ministry of Fisheries, Animal Husbandry & Dairying, Chander Lok Building, Janpath, New Delhi 110 001

103. Dr. K. Mohammed Koya — Ex-officio
Fisheries Development Commissioner, Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, Krishi Bhavan, New Delhi 110 001

104. Ms. V L Roui Kullai — Ex-officio
Inspector General of Forests (NAEB), Ministry of Environment & Forests,Paryavaran Bhawan, B-Block, CGO Complex, Lodi Road, New Delhi 110 003

4(xx) Fifteen scientists from within and outside the Council including one representative from the Indian Council of Medical Research, nominated by the President

105. Vacant

106. Vacant

107. Vacant

108. Vacant

109. Vacant

110. Vacant

111. Vacant

112. Vacant

113. Vacant

114. Vacant

115. Vacant

116. Vacant

117. Vacant

118. Vacant

Representative from the Indian Council of Medical Research

119. Vacant

4(xxi) Three representatives of commerce and industry, nominated by the President.

120. Shri Lokendra Singh — 13-07-2026
Salwa, Tehsil Badnagar, Ujjain, Madhya Pradesh 456 313

121. Shri Arun Mandal — 13-07-2026
S/O-Dinesh Ch. Mandal, Vill-Sahadargachh, PO-Bidhannagar, PS-Phansidewa, Dist-Darjeeling, West Bengal 734 426

122. Dr. Kernel Singh Risam — 13-07-2026
171/7, Nanak Nagar, Jammu 180 004

4(xxii) One farmer from each region of the country as mentioned in Rule 60(a) and four representatives of rural interests, nominated by the President.

(Representative of Region- I)

123. Vacant

(Representative of Region- II)

124. Dr. Bhaskar Naik Karamsi — 13.07.2026
Door No. 11-2-380, Naik Nagar, Beside Marremma Temple, Ananthapuramu, Andhra Pradesh 515 001

(Representative of Region- III)

125. Prof. (Dr.) Kishore Kumar Baruah — 13.07.2026
Sai Sai Villa, Kanaklata Road, Narayan Nagar, Kumarpara, PO Bharalumukh, Guwahati, Assam 781 009

(Representative of Region- IV)

126. VACANT

(Representative of Region- V)

127. Shri R. K. Sangwan — 13.07.2026
H. No. 108B, South City-2, Gurugram, Haryana 122 018

(Representative of Region- VI)

128. VACANT

(Representative of Region- VII)

129. Shri Rahul Manikrao Shinde — 13.07.2026
C-603, Sapphire Park, Nr Wisdom World School Park Street, Wakad, Pune, Maharashtra 411 057

(Representative of Region- VIII)

130. VACANT — --
Four Representatives of Rural Interests, nominated by the President.

131. VACANT

132. VACANT

133. VACANT

134. VACANT

4(xxiii) Four Directors of the Indian Council of Agricultural Research Institutes, nominated by the President.

135. Dr. Dheer Singh — 15.04.2027
Director, ICAR-National Dairy Research Institute, Karnal, Haryana 132 001

136. Dr. Maganti Sheshu Madhav — 15.04.2027
Director, ICAR- National Institute for Research on Commercial Agriculture (NIRCA), Bhaskar Nagar, Rajahmundry, Andhra Pradesh 533 105

137. Dr. (Mrs.) Tara Satyavathi Chellapilla — 22.07.2028
Director, ICAR- Indian Institute of Millets Research, Rajendranagar, Hyderabad, Telangana 500 030

138. Dr. Baldev Raj Gulati — 22.07.2028
Director, ICAR-National Institute of Veterinary Epidemiology and Disease Informatics, Ramagondanahalli, Post Box No. 6450, Yelahanka, Bengaluru 560 119

4(xxiv) Four representatives of State Governments to be nominated zone-wise on a rotational basis by Director General, ICAR

139. Dr. Surendra Narayan Pandey — 23.07.2026
Secretary Agriculture & Farmers Welfare, Department of Agriculture, Government of Uttarakhand, 4-Subhash Road, Vishwakarma Building, Uttarakhand Secretariat, Dehradun, Uttarakhand 248 001

140. Smt. Aruna Rajoria — 23.07.2026
Commissioner & Secretary, Agriculture Department, Government of Assam, D-Block, 3rd Floor Janata Bhawan, Dispur, Guwahati, Assam 781 006

141. 23.07.2026
Additional Chief Secretary
Agriculture & Horticulture, Department of Agriculture & Farmers Welfare, Government of Haryana, Room No. 102, 1st Floor, New Civil Secretariat, Sector- 17, Chandigarh 160 017

142. Shri Ashok Barnwal 23.07.2026
Agriculture Production Commissioner,
Department of Farmer Welfare & Agriculture Development, Government of Madhya Pradesh, 2nd Floor, C- Wing, Vindhyachal Bhawan, Arera Hills, Bhopal, Madhya Pradesh 462 004

4(xxv) One representative of Agro and Agro-Processing Industries, nominated by President

143. Vacant --

4(xxvi) One representative from a distinguished Non-Governmental Organization dealing with Agriculture/Extension, nominated by President

144. Mrs. Sushma Singh 10-07-2026
6/127, 2nd Floor, Vineet Khand (Opposite Water Tank), Near Husadiya Chauraha, Gomti Nagar, Lucknow, Uttar Pradesh 226 010

Postal Address: -
Mrs. Sushma Singh
Flat No.-1602 / Tower No.-01,
Sunworld Vanallika Apartments,
Sector 107, Noida,
Uttar Pradesh 201 304

4(xxvii) Secretary, Indian Council of Agricultural Research

145. Ex-officio
Member Secretary,
Addl. Secy. (DARE) & Secy. (ICAR), Krishi Bhavan, New Delhi 110 001

APPENDIX 3

LIST OF MEMBERS OF THE GOVERNING BODY OF THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH SOCIETY

Rule 35(i)
Chairman

1. Dr. Mangi Lal Jat — Ex-Officio
   Secretary (DARE) & Director-General, Indian Council of Agricultural Research, Krishi Bhawan, New Delhi 110 001

Ex-Officio Members
Rule 35(ii)
Member, Finance, Alternate member -Financial Adviser (DARE/ICAR)

2. Shri Vumlunmang Vualnam — Ex-Officio
   Secretary (Expenditure), Department of Expenditure, 129-A, North Block, Ministry of Finance, North Block, New Delhi 110 001

Alternate member-Financial Adviser (DARE/ICAR)

Shri Sandeep Sarkar — Ex-Officio
Addl. Secretary & Financial Advisor (DARE/ICAR), Krishi Bhawan, New Delhi 110 001

Rule 35(iii)
Chief Executive Officer, National Institution for Transforming India (NITI Aayog) or representative (not lower than the rank of Joint Secretary)

3. Shri B.V.R. Subrahmanyam — Ex-Officio
   CEO, NITI Aayog, Yojana Bhawan, Sansad Marg, New Delhi 110 001

Rule 35(iv)
Secretary, Department of Agriculture Cooperation & Farmers Welfare

4. Shri Devesh Chaturvedi — Ex-Officio
   Secretary, Department of Agriculture & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Krishi Bhawan, New Delhi 110 001

Rule 35(v)
Secretary, Department of Animal Husbandry and Dairying, Ministry of Fisheries, Animal Husbandry and Dairying

5. Shri Naresh Pal Gangwar — Ex-Officio
   Secretary, Department of Animal Husbandry and Dairying, Ministry of Fisheries, Animal Husbandry and Dairying, Krishi Bhawan, New Delhi 110 001

Rule 35(vi)
Secretary, Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying

6. Dr. Abhilaksh Likhi — Ex-Officio
   Secretary, Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, Krishi Bhawan, New Delhi 110 001

Rule35(vii)
Three Scientists including one management expert from outside ICAR nominated by the President

7. Vacant
8. Vacant
9. Vacant

Rule 35 (viii)
Five Vice-Chancellors of Agricultural Universities-nominated by the President

10. Dr. S. C. Dubey — 15.04.2027
    Vice Chancellor, Birsa Agricultural University, Ranchi, Jharkhand 834 006
11. Dr. Ch. Srinivasa Rao — 22.06.2028
    Director & Vice Chancellor, Indian Agricultural Research Institute, Pusa, New Delhi 110 012
12. Dr. Inderjeet Singh — 22.06.2028
    Vice Chancellor, Bihar Animal Sciences University, Bihar Veterinary College Campus, Patna, Bihar 800 014
13. Vacant
14. Vacant

Rule 35(ix)
Three Members of Parliament nominated by the President- (Two from Lok Sabha and one from Rajya Sabha)

15. Vacant
16. Vacant
17. Vacant

Rule 35(x)
Four Farmers/Representatives of Rural Areas nominated by the President

18. Shri R. K. Sangwan — 13.07.2026
    H. No. 108B, South City-2, Gurugram, Haryana 122 018
19. Vacant
20. Vacant
21. Vacant

Rule 35(xi)
Three Directors of Research Institutes of the Council nominated by the President

22. Dr. Dheer Singh — 15.04.2027
    Director, ICAR- National Dairy Research Institute, Karnal, Haryana 132 001
23. Dr. Maganti Sheshu Madhav — 15.04.2027
    Director, ICAR- National Institute for Research on Commercial Agriculture (NIRCA), Bhaskar Nagar, Rajahmundry, Andhra Pradesh 533 105
24. Dr. (Mrs.) Tara Satyavathi Chellapilla — 22.07.2028
    Director, ICAR- Indian Institute of Millets Research, Rajendranagar, Hyderabad, Telangana 500 030

Rule 35(xii)
Four representatives of State Governments to be nominated zone-wise on a rotational basis by Director General, ICAR

25. Dr. Surendra Narayan Pandey 23.07.2026
Secretary Agriculture & Farmers Welfare, Department of Agriculture, Government of Uttarakhand, 4-Subhash Road, Vishwakarma Building, Uttarakhand Secretariat, Dehradun, Uttarakhand 248 001

26. Smt. Aruna Rajoria 23.07.2026
Commissioner & Secretary, Agriculture Department, Government of Assam, D-Block, 3rd Floor Janata Bhawan, Dispur, Guwahati, Assam 781 006

27. 23.07.2026
Additional Chief Secretary
Agriculture & Horticulture,
Department of Agriculture & Farmers Welfare,
Government of Haryana, Room No. 102, 1st Floor,
New Civil Secretariat, Sector- 17, Chandigarh 160 017

28. Shri Ashok Barnwal 23.07.2026
Agriculture Production Commissioner, Department of Farmer Welfare & Agriculture Development, Government of Madhya Pradesh, 2nd Floor, C- Wing, Vindhyachal Bhawan, Arera Hills, Bhopal, Madhya Pradesh 462 004

Rule 35(xiii)
One representative of Agro and Agro-Processing Industries to be nominated by President

29. Vacant

Rule 35(xiv)
One representative from a distinguished Non-Governmental Organization dealing with Agriculture/ Extension nominated by President

30. Mrs. Sushma Singh 10.07.2026
6/127, 2nd Floor, Vineet Khand (Opposite Water Tank),
Near Husadiya Chauraha, Gomti Nagar,
Lucknow, Uttar Pradesh 226 010

Rule 35(xv)
Secretary, ICAR-
Member Secretary

31. Ex-Officio
Additional Secretary, DARE & Secretary, ICAR,
Krishi Bhawan, New Delhi 110 001

APPENDIX 4

SENIOR OFFICERS AT THE HEADQUARTERS OF THE ICAR AS ON 12 FEB 2026

1. **Dr. Mangi Lal Jat**
   Director General, ICAR and Secretary to the Government of India, Department of Agricultural Research and Education
2. **Vacant**
   Secretary, ICAR and Additional Secretary to Government of India, Department of Agricultural Research and Education
3. **Mr. Sandeep Sarkar**
   Financial Adviser, DARE/ICAR and Additional Secretary to Government of India, Department of Agricultural Research and Education

Deputy Directors Generals

1. Dr. Joykrushna Jena (Fisheries Science)
2. Dr. Sanjay Kumar Singh (Horticulture Science)
3. Dr. Amresh Kumar Nayak (Natural Resource Management)
4. Dr. Raghevendra Bhatta (Animal Science)
5. Dr. Devendra Kumar Yadava (Crop Science)
6. Dr. Rajbir Singh (Agril. Extension)
7. Dr. Shyam Narayan Jha (Agricultural Engineering)
8. (Agricultural Education)- Vacant {Acting charge to Dr. Joykrushna Jena, DDG (Fisheries)}

Assistant Directors Generals

Crop Science

1. Dr. Prasanta Kumar Dash (CC)
2. Dr. Sanjeev Gupta (OP)
3. Dr. Poonam Jasrotia (PP&B)
4. Dr. Sharat Kumar Pradhan (FFC)
5. ADG (Seed)- Vacant {Acting charge to Dr. Sanjeev Gupta, ADG (O&P)}

Horticultural Science

1. Dr. Vishaw Bandhu Patel (FPC HS-I)
2. Dr. Sudhakar Pandey (FVS&MP) (HS-II)

Natural Resource Management

1. Dr. A. Velmurugan (S&WM)
2. ADG (AAF&CC)- VACANT (Acting charge to Dr. Rakesh Kumar, Principal Scientist)

Agricultural Engineering

1. Dr. Kairam Narsaiah (PE)
2. Dr. Krishna Pratap Singh (FE)
3. Dr. Anil Rai (ICT)

Animal Science

1. Dr. Ashis Kumar Samanta (AN&P)
2. Dr. Divakar Hemadri (AH)
3. ADG (APSB)- VACANT (Acting charge to Dr. Harvinder Kumar Narula, Principal Scientist)

Fisheries Science

1. Dr. Devika Pillai (IF)
2. Dr. Shubhadeep Ghosh (MF)

Agricultural Extension

1. Dr. Rajarshi Roy Burman (AE)
2. Dr. Ranjay Kumar Singh (AE)

Agricultural Education

1. Dr. (Mrs.) Seema Jaggi, ADG (HRD)
2. Dr. Shanti Kumar Sharma (HRM)
3. Dr. Ajit Singh Yadav (EQAR)
4. ADG (EP&HS) - Vacant {Acting charge to Dr. Shanti Kumar Sharma, ADG (HRM)}

Other ADGs of independent Units

1. Dr. Neeru Bhooshan (IPTM&PME)
2. Dr. Anil Kumar Dixit (PIM)
3. ADG (IR)- VACANT (Acting charge to Dr. Bhagwati Prasad Bhatt, Principal Scientist)
4. Dr. Anil Kumar (TC)

National Agricultural Science Fund (NASF)

1. ADG (NASF)- VACANT {Acting charge to Dr. Sharat Kumar Pradhan, ADG (Food & Fodder Crops)}

Principal Scientists

Crop Science

1. Dr. Sanjeev Kumar Jha
2. Dr. Partha Ray Choudhury
3. Dr. Renu
4. Dr. Karambir Singh Hooda
5. Dr. Pawan Kumar Sharma

Horticultural Science

1. Dr. Vikramaditya Pandey
2. Dr. Anup Kumar Bhattacharjee
3. Dr. Prakash Chandra Tripathi

Natural Resource Management

1. Dr. Adlul Islam
2. Dr. Lekh Chand
3. Dr. Ram Swaroop Yadav
4. Dr. Rakesh Kumar

Agricultural Education

1. Dr. (Mrs.) Vanita Jain
2. Dr. Kanhiya Prasad Tripathi
3. Dr. Rameshwar Lal Meena
4. Dr. Sita Ram Sharma
5. Dr. Dinesh Chand
6. Dr. Sudhir Pal Ahlawat

Fisheries Science

1. Dr. (Mrs.) Yasmeen Basade

2. Dr. Prem Kumar

Agricultural Engineering

1. Dr. Devinder Dhingra
2. Dr. Abhay Kumar Thakur
3. Dr. Panna Lal Singh
4. Dr. Rajendra Prasad
5. Dr. A. P. Ruhil (ICT)
6. Dr. Krishan Pal Singh (ICT)

Animal Sciences

1. Dr. Harvinder Kumar Narula
2. Dr. Rajneesh Rana
3. Dr. Keshab Barman

Agri. Extension

1. Dr. Keshava
2. Dr. Sujeet Kumar Jha
3. Dr. Arvind Kumar

Others Units

1. Dr. Manoj Kumar Tripathi (PIM)
2. Dr. Basant Kumar Kandpal (PIM)
3. Dr. Manoj Kumar (PIM)
4. Dr. Ananda Shekhar Mishra (Tech. Cdn.)
5. Dr. Sanjeev Panwar (Tech. Cdn.)
6. Dr. Jyoti, (Tech. Cdn.)
7. Dr. Shiv Datt (IPTM)
8. Dr. Vikram Singh (IPTM)
9. Dr. (Mrs.) Manju Gerard (NASF)
10. Dr. Ashok Kumar (NASF)
11. Dr. Anup Kumar Misra (IR)
12. Dr. Anjani Kumar Jha (DKMA)
13. Dr. (Miss) Anu Rahal (DKMA)
14. Dr. Bhagwati Prasad Bhatt (DG Office)
15. Dr. Praveen Malik (DG Office/Agrinnovate)

Project Coordinators under ICAR Hqrs. strength

1. Dr. Sachin Suroshe (HBP)
2. Dr. Anand Kumar Vishwakarma
3. Dr. R. Madhusudhana

Agricultural Scientists' Recruitment Board

1. Member (AS & FS)- VACANT
2. VACANT (PS)
3. VACANT (NRM)

APPENDIX 5

ICAR INSTITUTES AND THEIR DIRECTORS/PROJECT DIRECTORS AS ON 12 FEB 2026

1. Dr. Ch. Srinivasarao
   Indian Agricultural Research Institute, New Delhi 110 012
2. Dr. Raghvendra Bhatt (Acting)
   Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh 243 122
3. Dr. Dheer Singh
   National Dairy Research Institute, Karnal, Haryana 132 001
4. Dr. N.P. Sahu (Acting)
   Central Institute of Fisheries Education, Jaiprakash Road, Seven Bungalow (Versova), Mumbai, Maharashtra 400 061
5. Dr. Gopal Lal (Acting)
   National Academy of Agricultural Research Management, Rajendranagar, Hyderabad, Andhra Pradesh 500 030
6. Dr. Kotha Sammi Reddy
   National Institute of Abiotic Stress Management, Malegaon, Baramati, Pune, Maharashtra 413 115
7. Dr. Sujay Rakshit
   Indian Institute of Agricultural Biotechnology, Ranchi, Jharkhand 834 010
8. Dr. Pramod Kumar Rai
   National Institute of Biotic Stress Management, Baronda, Raipur, Chhattisgarh 493 225
9. Dr. Jai Sunder (Acting)
   Central Island Agricultural Research Institute, Post Box No. 181, Port Blair, Andaman & Nicobar Islands 744 101
10. Dr. Suresh Pal Singh Tanwar (Acting)
    Central Arid Zone Research Institute, Jodhpur, Rajasthan 342 003
11. Dr. Champat Raj Mehta
    Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal, Madhya Pradesh 462 038
12. Dr. Jagadish Sadanand Rane
    Central Institute of Arid Horticulture, Bikaner, Rajasthan 334 006
13. Dr. Vijay Nemdeo Waghmare
    Central Institute for Cotton Research, Post Bag No. 2, Shankar Nagar P.O., Nagpur, Maharashtra 440 010
14. Dr. Damodaran Thukkaram
    Central Institute for Sub-tropical Horticulture, Rehmankhera, PO Kakori, Lucknow, Uttar Pradesh 227 107
15. Dr. Mahendra Kumar Verma
    Central Institute of Temperate Horticulture, Old Air Field, Rangreth, Jammu & Kashmir 190 007
16. Dr. Nachiket Kotwaliwale (Acting)
    Central Institute of Post-Harvest Engineering and Technology, P.O. PAU Campus, Ludhiana, Punjab 141 004
17. Dr. Sujeet Kumar Shukla
    Central Institute for Research on Cotton Technology, Adenwala Road, Matunga, Mumbai, Maharashtra 400 019
18. Dr. K. Balachandra Hebbar
    Central Plantation Crops Research Institute, Kasaragod, Kerala 671 124
19. Dr. Brajesh Singh
    Central Potato Research Institute, Shimla, Himachal Pradesh 171 001
20. Dr. Vinod Kumar Singh (Acting)
    Central Research Institute for Dryland Agriculture, Santoshnagar, Saidabad P.O., Hyderabad, Telangana 500 059
21. Dr. Dinesh Babu Shakyawar (Acting)
    National Institute of Natural Fibre Engineering & Technology,12, Regent Park, Kolkata, West Bengal 700 040
22. Dr. G.A.K Kumar (Acting)
    National Rice Research Institute, Cuttack, Orissa 753 006
23. Dr. Rajender Kumar Yadav
    Central Soil Salinity Research Institute, Zarifa Farm, Kachhwa Road, Karnal, Haryana 132 001
24. Dr. M. Madhu
    Indian Institute of Soil & Water Conservation, 218, Kaulagarh Road, Dehradun, Uttarakhand 248 195
25. Dr. Maganti Sheshu Madhav
    National Institute for Research on Commercial Agriculture, Rajahmundry, Andhra Pradesh 533 105
26. Dr. G. Byju
    Central Tuber Crops Research Institute, Sreekariyam, Thiruvananthapuram, Kerala 695 017
27. Dr. Parveen Kumar
    Central Coastal Agricultural Research Institute, Ela, Old Goa, North Goa, Goa 403 402
28. Dr. Anup Das
    ICAR Research Complex for Eastern Region, ICAR Parisar, P.O. Bihar Veterinary College, Patna, Bihar 800 014
29. Dr. Sandeep Ghatak (Acting)
    ICAR Research Complex for NEH Region, Umroi Road, Umiam, Ri-Bhoi, Meghalaya 793 103
30. Dr. Kairam Narsaiah (Acting)
    Indian Agricultural Statistics Research Institute, Library Avenue, Pusa Campus, New Delhi 110 0012
31. Dr. Pankaj Kaushal
    Indian Grassland & Fodder Research Institute, Pahuj Dam, Gwalior Road, Jhansi, Uttar Pradesh 284 003
32. Dr. Tusar Kanti Behera
    Indian Institute of Horticultural Research, Hessaraghatta Lake Post, Bengaluru, Karnataka 560 089

33. Dr. Girish Prasad Dixit
Indian Institute of Pulses Research, Kanpur,
Uttar Pradesh 208 024

34. Dr. Monoranjan Mohanty
Indian Institute of Soil Sciences, Nabi Bagh, Berasia Road, Bhopal, Madhya Pradesh 462 038

35. Dr. Dinesh
Indian Institute of Spices Research, Marikunnu P.O., Kozhikode, Kerala 673 012

36. Dr. Dinesh Singh (Acting)
Indian Sugarcane Research Institute, Rai Bareilly Road, P.O. Dilkusha, Lucknow, Uttar Pradesh 226 002

37. Dr. Abhijit Kar
National Institute of Secondary Agricultural, Namkum, Ranchi, Jharkhand 834 010

38. Dr. Rajesh Kumar
Indian Institute of Vegetable Research, PB No. 01, PO Jakhini, Shahanshapur, Varanasi,
Uttar Pradesh 221 005

39. Dr. P. Govindaraj
Sugarcane Breeding Institute, Coimbatore,
Tamil Nadu 641 007

40. Dr. Lakshmi Kant
Vivekanand Parvatiya Krishi Anusandhan Sansthan, Almora, Uttrakhand 263 601

41. Dr. Gouranga Kar
Central Research Institute for Jute & Allied Fibres, Barrackpore, Kolkata, West Bengal 700 120

42. Dr. Sunil Kumar
Indian Institute of Farming System Research, Modipuram, Meerut, Uttar Pradesh 250 110

43. Dr. Kancherla Suresh
Indian Institute of Oil Palm Research,
Pedavegi, West Godavari, Andhra Pradesh 534 450

44. Dr. Ravi Kumar Mathur
Indian Institute of Oilseeds Research, Rajendranagar, Hyderabad, Telangana 500 030

45. Dr. Raman Meenakshi Sundaram
Indian Institute of Rice Research, Rajendranagar, Hyderabad, Telangana 500 030

46. Dr. Ratan Tiwari
Indian Institute for Wheat & Barley Research,
P. Box No. 158, Agrasain Marg, Karnal, Haryana 132 001

47. Dr. Arjamadutta Sarangi
Indian Institute of Water Management, Opposite Rail Vihar, Chandersekharpur, Bhubaneshwar, Orissa 751 023

48. Dr. Mridula Devi
Central Institute for Women in Agriculture, Plot No.50, Mauza-Jokalandi, P.O. Baramunda, Bhubaneswar, Orissa 751 003

49. Dr. Ayyandar Arunachalam (Acting)
Central Agro-Forestry Research Institute, Near Pahuj Dam, Jhansi, Uttar Pradesh 284 003

50. Dr. Dilip Kumar Ghosh
Central Citrus Research Institute, P.B. No. 464, Shankar Nagar P.O., Amravati Road, Nagpur,
Maharashtra 440 010

51. Dr. Shiv Kumar (Acting)
National Institute of Agricultural Economics & Policy Research, P.B. No. 11305, DPS Marg, Pusa,
New Delhi 110 012

52. Dr. A. Anandan (Acting)
National Institute of Seed Science and Technology, P.B. No. 11, Kusmaur, P.O. Kaithauli,
Mau Nath Bhanjan, Uttar Pradesh 275 101

53. Dr. (Mrs.) Tara Satyavathi Chellapilla
Indian Institute of Millets Research, Rajendranagar, Hyderabad, Telangana 500 030

54. Dr. Kunwar Harendra Singh
National Soyabean Research Institute, Khandwa Road, Indore, Madhya Pradesh 452 017

55. Dr. Ramcharan Bhattacharya
ICAR-National Institute for Plant Biotechnology, LBS Centre, Pusa Campus, New Delhi 110 012.

56. Dr. Raman Thangavelu
National Research Institute of Integrated Pest Management, LBS Building, New Delhi 110012.

57. Dr. Sushil Kumar Purbey (Acting)
Mahatma Gandhi Integrated Farming Research Institute, Piprakothi, Motihari, East Champaran,
Bihar 845 429.

58. Dr. Jagbir Singh Tyagi (Acting)
Central Avian Research Institute,
Izatnagar, Bareilly, Uttar Pradesh 243 122

59. Dr. Tarun Kumar Bhattacharya
Central Institute for Research on Buffaloes, Sirsa Road, Hisar, Haryana 125 001

60. Dr. Manish Kumar Chatli
Central Institute for Research on Goats, Makhdoom, Mathura, Uttar Pradesh 281 122

61. Dr. Basant Kumar Das
Central Inland Fisheries Research Institute, Barrackpore, West Bengal 700 120

62. Dr. Kuldeep Kumar Lal
Central Institute of Brackishwater Aquaculture, 75, Santhome High Road, Raja Annamalai Puram, Chennai, Tamil Nadu 600 028

63. Dr. George Ninan
Central Institute of Fisheries Technology, Willingdon Island, Matsyapuri P.O., Kochi, Kerala 682 029

64. Dr. Pramoda Kumar Sahoo
Central Institute of Freshwater Aquaculture, Kausalyaganga, Bhubaneshwar,
Khurda, Orissa 751 002

65. Dr. Grinson George
Central Marine Fisheries Research Institute, P.B. No. 1603, Ernakulam North P.O., Kochi, Kerala 682 018

66. Dr. Arun Kumar (Acting)
Central Sheep & Wool Research Institute, Avikanagar, Distt. Tonk, Rajasthan 304 501

67. Artabandhu Sahoo
National Institute of Animal Nutrition & Physiology, Adugodi, Bangaluru, Karnataka 560 030

68. Dr. Aniket Sanyal
National Institute of High Security Animal Diseases, Anand Nagar, Bhopal, Madhya Pradesh 462 021

69. Dr. Ashok Kumar Mohanty
Central Institute for Research on Cattle, P.B. No. 17, Grass Farm Road, Meerut Cantt., Uttar Pradesh 250 001

70. Dr. Hanuman Sahay Jat
Indian Institute of Maize Research, PAU Campus, Ludhiana, Punjab 141 004

71. Dr. Sukhadeo Baliram Barbuddhe (Acting)
National Meat Research Institute, Chengicherla, P.B. No. 19, Uppal PO, Hyderabad, Andhra Pradesh 500 039

72. Dr. Pothula Srinivasa Brahmanand
Project Director, Water Technology Centre, IARI Campus, Pusa, New Delhi 110 012

73. Dr. Vijay Veer Singh
Indian Institute of Rapeseed-Mustard Research, Sewar, Bharatpur, Rajasthan 321 303

74. Dr. Amit Pande (Acting)
Central Institute of Coldwater Fisheries Research, Anusandhan Bhawan, Industrial Area, Bhimtal, Uttarakhand 263 136

75. Dr. Baldev Raj Gulati
National Institute of Veterinary Epidemiology and Disease Informatics, H.A. Farm Post, Hebbal, Bengaluru, Karnataka 560 024

76. Dr. Rabindra Prasad Singh (Acting)
National Institute on Foot and Mouth Disease, Bhubaneshwar, Odisha 752 050

77. Dr. Sandip Kumar Bera
Indian Institute of Groundnut Research post Box. , Ivnagar Road, Junagadh, Gujarat 362 001

APPENDIX 6

NATIONAL BUREAUX AND THEIR DIRECTORS AS ON 12 FEB 2026

1. Dr. Satya Nand Sushil
   National Bureau of Agricultural Insect Resources, P.B. No. 2491, H.A. Farm Post, Bengaluru, Karnataka 560 024

2. Dr. Alok Kumar Srivastava
   National Bureau of Agriculturally- Important Micro-organisms, P.B. No. 6, Kusmaur, Maunath Bhanjan, Uttar Pradesh 275 101

3. Dr. Gyanendra Pratap Singh
   National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi 110 012

4. Dr. Nitin Gorakh Patil
   National Bureau of Soil Survey and Land Use Planning, Shankar Nagar P.O., Amravati Road, Nagpur, Maharashtra 440 010

5. Dr. Mohan N.H.
   National Bureau of Animal Genetic Resources, P.B. No. 129, G.T. Road Bye Pass, Karnal, Haryana 132 001

6. Dr. Kajal Chakrabarty
   National Bureau of Fish Genetic Resources, Canal Ring Road, P.O. Dilkusha, Lucknow, Uttar Pradesh 226 002

APPENDIX 7

DIRECTORATES, PROJECT DIRECTORATES, AGRICULTURAL TECHNOLOGY APPLICATION RESEARCH INSTITUTES AND THEIR DIRECTORS AS ON 12 FEB 2026

1. Dr. Anuradha Agrawal
   Project Director (DKMA), Directorate of Knowledge Management in Agriculture, Krishi Anusandhan Bhawan-I, Pusa, New Delhi 110 012

2. Dr. Janki Sharan Mishra (Acting)
   Directorate of Weed Science Research, Maharajpur, Adhartal, Jabalpur, Madhya Pradesh 482 004

3. Dr. Jamboor Dinakara Adiga
   Directorate of Cashew Research, Darbe, P.O. Puttur, Dakshina Kannada, Karnataka 574 202

4. Dr. Kuchimanchi Venkataramana Prasad
   Directorate of Floriculture Research, Pune, Maharashtra 144 016

5. Dr. Manish Das
   Directorate of Medicinal & Aromatic Plants Research, Boriavi, Anand, Gujarat 387 310

6. Dr. Brij Lal Attri (Acting)
   Directorate of Mushroom Research, Chambaghat, Solan, Himachal Pradesh 173 213

7. Dr. Vijay Mahajan
   Directorate on Onion & Garlic Research, Rajgurunagar, Pune, Maharashtra 410 505

8. Dr. Rudra Nath Chatterjee
   Directorate of Poultry Research, Rajendranagar, Hyderabad, Andhra Pradesh 500 030

Agricultural Technology Application Research Institutes

9. Dr. Parvender
   Agricultural Technology Application Research Institute, Zone-I, PAU Campus, Ludhiana, Punjab 141 004

10. Dr. Subrata Kumar Roy
    ICAR-Agricultural Technology Application Research Institute (ATARI), Zone VIII, Pune, Maharashtra 411 005

11. Dr. Amulya Kumar Mohanty
    Agricultural Technology Application Research Institute, Zone-VII, TOP, Umroi Road, Barapani, Meghalaya 793 103

12. Dr. Raghavendra Singh (Acting)
    Agricultural Technology Application Research Institute, Zone-III, G.T. Road, Rawatpura, Near Vikas Bhawan, Kanpur, Uttar Pradesh 208 002

13. Dr. Nagulameera Shaik
    Agricultural Technology Application Research Institute, Zone-X, CRIDA Complex, Santosh Nagar, Hyderabad, Andhra Pradesh 500 059

14. Dr. Jai Prakash Mishra
    Agricultural Technology Application Research Institute, Zone-II, CAZRI Campus, Jodhpur, Rajasthan 342 003

15. Dr. Shyam Ranjan Kumar Singh
    Agricultural Technology Application Research Institute, Zone-IX, JNKVV Campus, Jabalpur, Madhya Pradesh 484 002

16. Dr. V. Venkatasubramanian (Acting)
    Agricultural Technology Application Research Institute, Zone-XI, ICAR Transfer of Technology Project, MRS HA Farm Post, Hebbal, Bengaluru, Karnataka 560 030

17. Dr. Anjani Kumar
    Agricultural Technology Application Research Institute, Zone-IV, Garbhuchak, Jagdeopath, Patna, Bihar 800 014

18. Dr. Pradip Dey
    ICAR- Agricultural Technology Application Research Institute, Kolkata, Zone V, Bhumi Vihar Complex, Block GB, Sector II, Salt Lake City, Kolkata, West Bengal 700 097

19. Dr. Kadirvel Govindasamy
    Agricultural Technology Application Research Institute, Zone VI (Near St.Claret School and Opposite of Arunachal Orchid Guest House), Kahikuchi, Guhawati, Assam 781 017

APPENDIX 8

NATIONAL RESEARCH CENTRES AND THEIR DIRECTORS AS ON 12 FEB 2026

1. Dr. Selvarajan
   National Research Centre for Banana,
   Thogamalai Road, Thayanur Post,
   Thiruchirapalli, Tamil Nadu 620 102
2. Dr. Kaushik Banerjee
   National Research Centre for Grapes,
   P.B. No. 3, Manjri Farm Post,
   Solapur Road, Pune, Maharashtra 412 307
3. Dr. Bikas Das
   National Research Centre for Litchi,
   Mushahari Farm, Mushahari,
   Muzaffarpur, Bihar 842 002
4. Dr. Sankar Prasad Das
   National Research Centre for Orchids, Pakyong,
   Gangtok, Sikkim 737 106
5. Dr. Rajiv Arvind Marathe
   National Research Centre on Pomegranate,
   NH-9, Bye pass Road, Shelgi,
   Sholapur, Maharashtra 413 006
6. Dr. Vinay Bhardwaj
   National Research Centre on Seed Spices,
   Tabiji, Ajmer, Rajasthan 305 206
7. Dr. Anil Kumar Puniya
   National Research Centre on Camel,
   Jorbeer, P.B. No. 07, Bikaner, Rajasthan 334 001
8. Dr. Tarun Kumar Bhattacharya
   National Research Centre for Equines,
   Hisar, Haryana 125 001
9. Dr. Girish Patil S
   National Research Centre for Mithun, Jharnapani, P.O.
   Medziphema, Nagaland 797 106
10. Dr. Vivek Kumar Gupta
    National Research Centre on Pig,
    Rani, Guwahati, Assam 781 131
11. Dr. Mihir Sarkar
    National Research Centre on Yak,
    Dirang, West Kameng, Arunachal Pradesh 790 101
12. ICAR- National Research Centre for Makhana (NRCM),
    Darbhanga, Bihar 846 005

APPENDIX 9

ALL INDIA CO-ORDINATED RESEARCH PROJECT (AICRP)/ALL INDIA NETWORK PROJECT (AINP)

AICRPs

1. AICRP on Rice, IIRR, Hyderabad
2. AICRP on Wheat & Barley, IIWBR, Karnal
3. AICRP on Maize, IIMR, Ludhiana
4. AICRP Sorghum and Small millets, IIMR, Hyderabad
5. AICRP on Pearl millet, IIMR RS on Pearl millet, Gudamalani, Barmer
6. AICRP on Forage Crops and Utilization, IGFRI, Jhansi
7. AICRP on Rabi Pulses (chickpea, lentil, fieldpea), IIPR, Kanpur
8. AICRP on Khrarif Pulses (Pigeonpea, mubgbean, urdbean, lathyrus, rajmash, cowpea arid legumes), IIPR, Kanpur
9. AICRP on Groundnut, IIGR, Junagarh
10. AICRP on Soybean, NISR, Indore
11. AICRP on Rapeseed & Mustard, IIRMR, Bharatpur
12. AICRP on Oilseeds (Sunflower, Safflower, Castor, Linseed), IIOR, Hyderabad
13. AICRP on Sesame and Niger, JNKVV, Jabalpur
14. AICRP on Sugarcane, ISRI, Lucknow
15. AICRP on Cotton, CICR, Nagpur
16. AICRP on Seed (Crops) including ICAR Seed Project, IISS, Mau
17. AICRP on Biocontrol of Crop Pests, Bengaluru
18. AICRP on Nematodes in Cropping System, IARI, New Delhi
19. AICRP on Honeybees and Pollinators, IARI, New Delhi
20. AICRP on Crop Pest Management (Soil arthropod, Agri Acarology, Vertebrate Pest management), NRIIPM, New Delhi
21. AICRP on Cattle, CIRC, Meerut
22. AICRP on Nutritional & Physiological Intervention for Enhancing Reproductive Performance in Animals, Bengaluru
23. AICRP on Goat Improvement, CIRG, Makhdoom
24. AICRP on Poultry Breeding, DPR, Hyderabad
25. AICRP on Pig, NRCP, Guwahati
26. AICRP on Tropical and Sub Tropical Fruits, Bengaluru
27. AICRP on Potato, Shimla
28. AICRP on Tuber Crops, Thiruvanthapuram
29. AICRP on Arid Zone Fruits, Bikaner
30. AICRP on Vegetable Crops, Varanasi
31. AICRP on Floriculture, Pune
32. AICRP on Mushroom, Solan
33. AICRP on Plantation Crops, Kasaragod
34. AICRP on Medicinal and Aromatic Plants and Betel vine, Anand
35. AICRP on Spices, Calicut
36. AICRP on Cashew, Puttur
37. AICRP on Micro and Secondary Nutrients and Pollutant Elements in Soils and Plants, IISS, Bhopal
38. AICRP on Soil Test Crop Response, IISS, Bhopal
39. AICRP on Long Term Fertilizer Experiments to study changing in Soil Quality, crop productivity and sustainability, IISS, Bhopal
40. AICRP on Salt Affected Soils and Use of Saline Water in Agriculture, CSSRI, Karnal
41. AICRP on Irrigation Water Management, IIWM, Bhubaneshwar
42. AICRP for Dryland Agriculture, CRIDA, Hyderabad
43. AICRP on Agrometeorology, CRIDA, Hyderabad
44. AICRP on Integrated Farming System, IIFSR, Modipuram
45. AICRP on Agroforestry, CAFRI, Jhansi
46. AICRP on Weed Management, DWR, Jabalpur
47. AICRP on Farm Implements and Machinery (FIM), Bhopal
48. AICRP on Mechanisation of Animal Husbandry (MAH), Bhopal
49. AICRP on Energy in Agriculture and Agro based Industries (EAAI), Bhopal
50. AICRP on Ergonomics and Safety in Agriculture and Allied Sector (ESAAS), Bhopal
51. AICRP on Plasticulture Engineering in Agriculture Structure and Environment Management (PEASEM), Ludhiana
52. AICRP on Post Harvest Engineering and Technology (PHET), Ludhiana
53. AICRP Home Science, Bhubaneshwar

AINPs

1. AINP on Emerging Pests, IARI, New Delhi
2. AINP on Natural Fibres, CRIJAF, Barrackpore
3. AINP on Pesticides Residues and Contaminants, IARI, New Delhi
4. AINP on Tobacco, Rajahmundry
5. AINP on Potential Crops, NBPGR, New Delhi
6. AINP on Biotech Crops, NIPB, New Delhi
7. AINP on Livestock and Poultry Product Safety, IVRI, Izatnagar
8. AINP on Challenging and Emerging Diseases of Animals, IVRI, Izatnagar
9. AINP on Diagnostic Imaging for Management of Surgical Conditions in Animals, IVRI, Izatnagar
10. AINP on Ethno-Veterinary Medicine, IVRI, Izatnagar
11. AINP on Genome Editing Technology for Improvement in Livestock Health & Production, IVRI, Izatnagar
12. AINP on One Health approach to Zoonotic Diseases, IVRI, Izatnagar
13. Network Project on Sheep Improvement, CSWRI, Avikanagar
14. Network Project on Animal Genetic Resources, NBAGR, Karnal
15. Network Project on Buffalo Improvement, CIRB, Hisar
16. AINP on Advance Research Project on Canine, IVRI, Izatnagar
17. AINP on Onion and Garlic, Pune
18. AINP on Natural Farming, IIFSR, Modipuram
19. AINP on Soil Biodiversity, Biofertilizers, IISS, Bhopal
20. AINP Mariculture, ICAR-CMFRI, Kochi
21. AINP on Antimicrobial Resistance, ICAR-NBFGR, Lucknow

22. AINP on Fish Health, ICAR-CIBA, Chennai
23. AINP on Ornamental Fish Culture, ICAR-CMFRI, Kochi
24. AINP on Conservation of Lac Insect Genetic Resources (CLIGR), Ranchi
25. AINP on Harvesting, Processing and Value Addition of Natural Resins and Gums (HPVA-NRG), Ranchi

CRPs

1. Consortium Research Project (CRP) on Agrobiodiversity, NBPGR, New Delhi
2. CRP on Biofortification, IIRR, Hyderabad
3. CRP on Hybrid Technology, IARI, New Delhi
4. CRP on Molecular Breeding, New Delhi
5. CRP on Vaccines and Diagnostics, ICAR-IVRI Regional Station, Bengaluru
6. CRP on Conservation Agriculture, IISS, Bhopal
7. CRP on Water, IIWM, Bhubaneshwar
8. CRP on Genomics, ICAR-NBFGR, Lucknow
9. CRP on Energy from Agriculture (EA), Bhopal
10. CRP on Precision Farming & Micro Irrigation Systems (PF-MIS), Bhopal
11. CRP on Nature Fibre (NF), Mumbai
12. CRP on Secondary Agriculture (SA), Ludhiana

Others

1. Application of Micro-organisms in Agriculture and Allied Sectors (AMAAS), NBAIM, Mau
2. Enhancing Climate Resilience and Ensuring Food Security with Genome Editing tool, IARI, New Delhi
3. Global R&D Hub for millets in India, IIMR, Hyderabad
4. Incentivising Research in Agriculture, CRRI, Cuttack
5. Translational Genomics in Crop Plants (TGCP), NIPB, New Delhi
6. National Centre for Veterinary Type Culture Collection, Hisar

APPENDIX 10

TOTAL NUMBER OF EMPLOYEES IN THE ICAR AND IT'S RESEARCH INSTITUTES AND NUMBER OF EMPLOYEES OF SCHEDULED CASTES, SCHEDULED TRIBES AND OTHER BACKWARD CLASSES AND PWD EMPLOYEES

Administrative												
	Total Posts Sanctioned	Total Employees in Position	SC Employees	% to Total Employees	ST Employees	% to Total Employees	OBC Employees	% to Total Employees	PwBD Employees	% to Total Employees	EWS Employees	% to Total Employees
Group-A	587	463	66	14.25	28	6.05	61	13.17	12	2.59	3	0.65
Group-B	3045	1849	283	15.31	124	6.71	350	18.93	41	2.22	40	2.16
Group-C	1236	624	123	19.71	63	10.10	158	25.32	5	0.80	0	0.00
Gross Total	4868	2936	472	16.08	215	7.32	569	19.38	58	1.98	43	1.46
Multi Tasking Staff												
Total	4889	2355	627	26.62	294	12.48	526	22.34	22	0.93	1	0.04
Technical Cadre												
Technical Posts	Total Posts Sanctioned	Total Employees	SC Employees	% to Total Employees	ST Employees	% to Total Employees	OBC Employees	% to Total Employees	PwD Employees	% to Total Employees	EWS Employees	% to Total Employees
Category-1	3650	2641	433	16.4	253	9.58	568	21.51	39	1.48	86	3.26
Category-II	2575	1196	177	14.8	120	10.03	295	24.67	18	1.51	1	0.08
Category-III	721	422	49	11.61	43	10.19	110	26.07	7	1.66	22	5.21
Gross Total	6946	4259	659	15.47	416	9.77	973	22.85	64	1.50	109	2.56
Scientific Cadre												
Scientific Posts	Total Posts Sanctioned	Total Employees in position	SC Employees	% to Total Employees	ST Employees	% to Total Employees	OBC Employees	% to Total Employees	PwD Employees	% to Total Employees	EWS Employees	% to Total Employees
Scientist	4451	3805	563	14.796	242	6.36	1188	31.222	28	0.736	27	0.7096
Sr. Scientist	1295	1064	72	6.767	22	2.068	157	14.756	1	0.094	0	0
Pr. Scientist	665	578	37	6.401	8	1.384	65	11.246	1	0.173	0	0
RMP	175	138	5	3.425	0	0	7	4.795	0	0	0	0
Gross Total	6586	5593	677	12.10	272	4.86	1417	25.34	30	0.54	27	0.48

APPENDIX 11

LIST OF STATE WISE AGRICULTURAL UNIVERSITIES

S.No.	State	Name of the University
1	Andhra Paresh	Acharya NG Ranga Agricultural University, Guntur
2	Andhra Paresh	Sri Venkateswara Veterinary University, Tirupati
3	Andhra Paresh	Dr. YSR Horticulture University, Venkataramannagudem
4	Andhra Pradesh	Andhra Pradesh Fisheries University, Narasapur, West Godavari
5	Assam	Assam Agricultural University, Jorhat
6	Assam	Assam Veterinary and Fishery University, Khanapara, Guwahati
7	Bihar	Bihar Agricultural University, Sabour, Bhagalpur
8	Bihar	Dr. RP Central Agricultural University, Pusa, Samstipur, Bihar
9	Bihar	Bihar Animal Sciences University, Patna
10	Chattishgharh	Indira Gandhi Krishi Vishwavidyalaya, Raipur
11	Chattishgharh	Chhattisgarh Kamdhenu Vishwavidyalaya, Durg
12	Chattishgharh	Mahatma Gandhi Udyanikee Evam Vanikee Viswavidyalaya, Durg
13	Delhi	Indian Agricultural Research Institute, New Delhi
14	Gujarat	Anand Agricultural University, Anand
15	Gujarat	Junagadh Agricultural University, Junagadh
16	Gujarat	Sardar Krushinagar Dantiwada Agricultural University, Dantiwada
17	Gujarat	Gujrat Natural Farming Sciences University, Sultan purava, Gujarat
18	Gujarat	Navsari Agricultural University, Navsari
19	Gujarat	Kamdhenu University, Amreli
20	Haryana	Chaudhary Charan Singh Haryana Agricultural University, Hisar
21	Haryana	Lala Lajpat Rai University of Veterinary & Animal Sciences, Hisar
22	Haryana	National Dairy Research Institute, Karnal
23	Haryana	Haryana State University of Horticultural Sciences, Karnal
24	Himachal Pradesh	Ch. Sarwan Kumar Himachal Pradesh Krishi Vishwavidyalaya, Palampur
25	Himachal Pradesh	Dr. Yaswant Singh Parmar University of Horticulture & Forestry, Solan
26	Jammu & Kashmir	Sher-e-Kashmir University of Agricultural Science & Technology, Jammu
27	Jammu & Kashmir	Sher-e-Kashmir University of Agricultural Science & Technology, Srinagar
28	Jharkhand	Birsa Agricultural University, Ranchi
29	Karnataka	University of Agricultural Sciences, Bengaluru
30	Karnataka	University of Agricultural Sciences, Raichur
31	Karnataka	University of Agricultural Sciences, Dharwad
32	Karnataka	University of Agriculture & Horticulture Sciences, Shivamogga
33	Karnataka	Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar
34	Karnataka	University of Horticulture Sciences, Bagalkot
35	Karnataka	University of Agricultural Sciences, Mandya
36	Kerala	Kerala Agricultural University, Thrissur
37	Kerala	Kerala Veterinary and Animal Sciences University, Pookode, Wayanand
38	Kerala	Kerala University of Fisheries and Ocean Studies, Panangad, Kochi
39	Madhya Pradesh	Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur
40	Madhya Pradesh	Rajmata Vijayaraje Scindia Krishi Vishwavidyalaya, Gwalior
41	Madhya Pradesh	Nanaji Deshmukh Pashu Chikitsa Vishwavidyalaya, Jabalpur
42	Maharashtra	Mahatama Phule Krishi Vidyapeeth, Rahuri

S.No.	State	Name of the University
43	Maharashtra	Dr. Punjabrao Deshmukh Krishi Viswavidyalaya, Akola
44	Maharashtra	Dr. Balaesahib Sawant Kokan Krishi Vidyapeeth, Dapoli
45	Maharashtra	Maharastra Animal & Fishery Sciences University, Nagpur
46	Maharashtra	Central Institute of Fisheries Education, Mumbai
47	Maharashtra	Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani
48	Manipur	Central Agricultural University, Imphal
49	Nagaland	Nagaland University, Medziphema
50	Orissa	Orissa University of Agriculturel & Technology, Bhubaneswar
51	Punjab	Punjab Agricultural University, Ludhiana
52	Punjab	Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana
53	Rajasthan	Agriculture University, Kota
54	Rajasthan	Maharana Pratap University of Agriculture & Technology, Udaipur
55	Rajasthan	Swami Keshwanand Rajasthan Agriculturel University, Bikaner
56	Rajasthan	SKN Agriculture University, Jobner
57	Rajasthan	Agriculture University, Jodhpur
58	Rajasthan	Rajasthan University of Veterinary & Animal Sciences, Bikaner
59	Rajasthan	Rajasthan University of Veterinary & Animal Sciences, Jobner, Jaipur
60	Tamil Nadu	Tamil Nadu Agricultural University, Coimbatore
61	Tamil Nadu	Tamil Nadu Veterinary & Animal Sciences University, Chennai
62	Tamil Nadu	Tamil Nadu Dr J Jayalalithaa Fisheries University , Nagapattinam
63	Telangana	Professor Jayashankar Telangana State Agricultural University, Hyderabad
64	Telangana	Sri PV Narsimha Rao Telangana Veterinary University, Hyderabad
65	Telangana	Sri Konda Laxman Telangana State Horticultural University, Hyderabad
66	Uttar Pradesh	Chandra Shekhar Azad University of Agricultural & Technology, Kanpur
67	Uttar Pradesh	Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut
68	Uttar Pradesh	Rani Laxami Bai Central Agricultural University, Jhansi
69	Uttar Pradesh	Acharya Narendra Deva University of Agriculture & Technology, Ayodhya
70	Uttar Pradesh	Banda University of Agriculturel and Technology, Banda
71	Uttar Pradesh	Aligarh Muslim University, Aligarh
72	Uttar Pradesh	Banaras Hindu University, Varanasi
73	Uttar Pradesh	UP Pt. Deen Dayal Upadhyaya Pashu Chikitsa VishwaVidhyalaya Evem Go Anusandhan Sansthan, Mathura
74	Uttar Pradesh	Indian Veterinary Research Institute, Bareilly
75	Uttarakhand	GB Pant University of Agriculture & Technology, Pantnagar
76	Uttarakhand	VCSG Uttarakhand University of Horticulture & Forestry, Bharsar
77	West Bengal	Uttar Banga Krishi Vishwavidyalaya, Cooch Behar
78	West Bengal	Bidhan Chandra Krishi Vishwavidyalaya, Mohanpur
79	West Bengal	Vishva Bharti, Sriniketan
80	West Bengal	West Bengal University of Animal & Fishery Sciences, Kolkata

Acronyms

ABICs	: Agri-Business Incubation Centres
AgIn	: Agrinnovate India Limited
AI	: Artificial Inseminations
AICRPs	: All India Coordinated Research Projects
AIT	: Adult Immersion Test
AM	: Arbuscular-Mycorrhizal
AMD	: Apple Mosaic Disease
ARYA	: Attracting and Retaining Youth in Agriculture
ASF	: African Swine Fever
ASRB	: Agricultural Scientists Recruitment Board
BGL	: Below Ground Level
BLB	: Bacterial Leaf Blight
BPDS	: Body Part Discomfort Score
BPH	: Brown Planthopper
CA	: Conservation Agriculture
CAUs	: Central Agricultural Universities
CBU	: Capacity Building Unit
CEC	: Cation Exchange Capacity
CFD	: Carbon Fraction Dynamics
CFLDs	: Cluster Frontline Demonstrations
CHCs	: Custom Hiring Centres
CMRI	: Combine Mangrove Recognition Index
CNNs	: Convolutional Neural Networks
CoPs	: Community of Practices
CRL	: Constant Rate of Loading
CRM	: Crop Residue Management
CT	: Conventional-tilled
DARE	: Department of Agricultural Research and Education
DAS	: Days After Sowing
DOIs	: Digital Object Identifiers
DoPT	: Department of Personnel and Training
DSR	: Direct Seeded Rice
DST	: Drought and Salt Tolerance
EDF	: Estimated Dose of Fertilizer
EDPs	: Entrepreneur Development Programmes
EEZ	: Exclusive Economic Zone
EMR	: Extra Mural Research
ET	: Evapotranspiration
FCV	: Flue-cured Virginia
FGDs	: Focused Group Discussion
FGR	: Fish Genetic Resources
FLDs	: Frontline Demonstrations
FOCARS	: Foundation Course for Agricultural Research Service
FPO	: Farmer Producer Organization
FYM	: Farmyard Manure
GAE	: Gallic Acid Equivalents
GBS	: Genotyping By-sequencing
GMO	: Genetically Modified Organism
GPP	: Gross Primary Production
GRB	: Gender Responsive Budgeting
GWAS	: Genome Wide Association Studies
HAD	: Hot Air Drying
HDMSCS	: High Density Multi-Species Cropping System
HDP	: High Density Planting
ICBR	: Incremental Cost-Benefit Ratio
ICT	: Information and Communication Technology
IDW	: Inverse Distance Weighting
IFS	: Integrated Farming System
i-GOT	: Integrated Government Online Training
INLEAD	: National Livestock Epidemiology and Disease Modelling
IPO	: Indian Patent Office
IR	: Infrared
IRD	: Infrared Drying
IRHAD	: Infrared-Assisted Hot Air Drying
ISS	: Integrated Sample Survey
ISSR	: Inter-Simple Sequence Repeat
IVPD	: *In Vitro* Protein Digestibility
KSHAMTA	: Knowledge System and Home-Based Agricultural Management in Tribal Areas
KVKs	: Krishi Vigyan Kendras
L2L	: Lab to Land
LIRU	: Live Insect Repository Unit
LSDV	: Lumpy Skin Disease Virus
LULC	: Land Use and Land Cover
MoU	: Memorandum of Understanding
MPC	: Milk Producer Companies
NABARD	: National Bank for Agriculture and Rural Development
NADRES	: National Animal Disease Referral Expert System
NASF	: National Agricultural Science Fund'
NCBI	: National Center for Biotechnology Information
NEH	: North Eastern Hill
NFT	: Nutrient Film Technique
NHCP	: National Herbarium of Cultivated Plants
NIC	: National Informatics Centre
NICRA	: National Innovations on Climate Resilient Agriculture
NIF	: National Indicator Framework
NIFF	: Native Indian Freshwater Fish
NIL	: Near Isogenic Line
NMNF	: National Mission in Natural Farming
NMQ	: Nordic Musculoskeletal Questionnaire
NRRS	: Nematode-responsive and Root Specific
NSSL	: National Soil Spectral Library
NUE	: Nitrogen Use Efficiency

NWPSI : Network Project on Sheep Improvement
OBW : Oat Brewery Waste
OFTs : On Farm Trial
OLIC : Official Language Implementation Committee
PBW : Pink Bollworm
PCM : Phase Change Material
PCR : Polymerase Chain Reaction
PFRS : Precision Fertilizer Recommendation System
PLK1 : Polo-like kinase 1
PRAYAS : Participatory Research Application for Year-round Income and Agricultural
pVOC : Plant Volatile Organic Compounds
qPCR : Quantitative PCR
QRMs : Quarterly Review Meetings
RAS : Recirculating Aquaculture System
RDF : Recommended Dose of Fertilizers
RDN : Recommended Dose of Nitrogen
REBA : Rapid Entire Body Assessment
RIL : Recombinant Inbred Line
RLWC : Relative Leaf Water Content
RT-qPCR : Reverse Transcription Real-time PCR
RTS : Ready-to-serve
SCSP : Scheduled Caste Sub Plan
SDGs : Sustainable Development Goals
SDN1 : Site-Directed Nuclease 1
SERV : Somatic Embryogenesis Regeneration Vessels
SHGs : Self Help Groups
SSD : Single Seed Descent
ssGBLUP : Single-step Genomic BLUP
SWH : Solar Water Heater
TGE : Transmissible Gastroenteritis
TLR : Toll Like Receptor
TPC : Total Phenolic Content
TSP : Tribal Sub-Plan
TSS : Total Soluble Solids
VOCs : Volatile Organic Compounds
WBNV : Watermelon Bud Necrosis Virus
WHO : World Health Organization
WUE : Water Use Efficiency
ZnO-NP : ZnO Nanoparticles

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INDIAN COUNCIL OF AGRICULTURAL RESEARCH

Agricultural Universities

*Map not to scale

- 69 State Agricultural Universities (SAUs)
- 3 Central Agricultural Universities
- 4 Deemed Universities
- 4 Central Universities having Faculty of Agriculture

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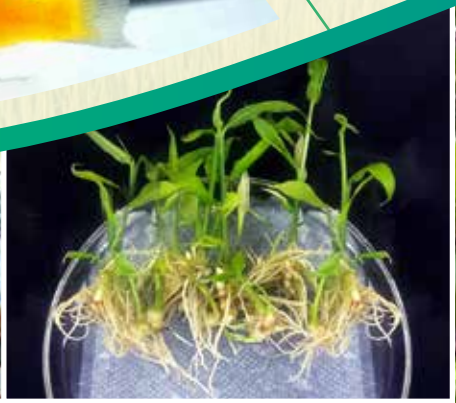






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