वार्षिक प्रतिवेदन
Annual Report
2023

INTERNATIONAL YEAR OF MILLETS 2023

भा.कृ.अनु.प. - भारतीय कृषि जैवप्रौद्योगिकी संस्थान
ICAR - Indian Institute of Agricultural Biotechnology

गढखटंगा, राँची - 834 003 (झारखण्ड)
Garhkhatanga, Ranchi - 834 003 (Jharkhand)

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Preface

Agriculture and its allied sectors play a pivotal role in providing livelihood for more than half of Indian population and contribute significantly to the socio-economic fabric of the country. Although we have witnessed unprecedented progress in different sectors of agricultural production systems, there are multilateral challenges, *viz.*, climate change and associated biotic/abiotic stress, land and water degradation, decline in factor productivity, depletion of natural resources etc. which may jeopardize the sustainable growth in near future. Despite these challenges, India has huge advantage in terms of its rich biodiversity, climatic variability and vast skilled human resources. ICAR-Indian Institute of Agricultural Biotechnology (ICAR-IIAB), Ranchi, an institution of excellence, is committed to bring knowledge and innovation driven agricultural growth in holistic manner by basic and translational biotechnological research encompassing plants, animals, fishes and microbes in an integrated manner. As a part of IARI Mega University, the institute is developing skilled human resources in the frontier areas of agricultural biotechnology through imparting education at undergraduate, post-graduate, doctoral and post-doctoral level. As coordinating institute at Ranchi Hub, ICAR-IIAB is playing a pivotal role in expanding education horizon of ICAR.

Sate of the art infrastructure required for basic & strategic research and education are being created at ICAR-IIAB, Ranchi. Facilities such as Crop Research and Training Centre (CRTC), Livestock Research and Training Centre (LRTC) and Fisheries Research and Training Centre (FRTC) for field & laboratory research and two hostels and mess for students are already established. As per availability of expertise and with modest facilities at the institute, research is focused on developing genomic resources and identification of genes/genomic regions underlying the traits of value in potential crops such as winged bean, faba bean, grain amaranth besides rice. Efforts are underway for improving drought tolerance, nutrient use efficiency and blast resistance in rice by pyramiding known effective QTLs/genes, developing climate resilient farming system models for ensuring food and nutritional security, studies on soil mictobiome etc. Efforts are also being made for development of cell surface biomarkers of cattle spermatozoa for sex-specific sperm segregation. Initial results in both nano-inspired degradation of jute retting waste-water and use of Calcium Oxide nanoparticles as soil acid neutralizing agent are encouraging. Metagenomic approach is being used for profiling of microbial diversity of coal void reservoir for possibility of getting novel genes and microbes for research and commercial application.

A total of 11 M.Sc. Students (six in Molecular Biology and Biotechnology; five in Genetics and Plant Breeding) have completed their degree during the period and majority of students have qualified CSIR-UGC, DBT JRF/NET examinations and achieved high ranks in ICAR SRF and Ph.D. entrance examinations.

I would like to express my sincere thanks to all our scientific, administrative and financial staff, students, research fellows and contractual supporting staff of ICAR-IIAB, Ranchi for their hard work and contributions in various institute activities. I also express my appreciation to the annual report editorial team for timely bringing out the publication.

I express my gratitude to Dr. Himanshu Pathak, Director General, ICAR and Secretary, DARE for his inspiring guidance and all out support to our Institute. I would also like to thank Dr. T. R. Sharma, DDG (Crop Science), ICAR and Dr. D. K. Yadava, ADG (Seeds), ICAR for their continuous guidance and encouragements and acknowledge the cooperation from all collaborators and support.

Ranchi
February, 2024

(Sujay Rakshit)
Director, ICAR-IIAB

प्रस्तावना

कृषि और इससे संबंधित क्षेत्र भारतीय जनसंख्या के अधिकांश हिस्से को जीविका प्रदान करने और देश के सामाजिक-आर्थिक संरचना में योगदान करने की दृष्टि से महत्वपूर्ण हैं। यद्यपि हमने कृषि उत्पादन प्रणालियों के विभिन्न क्षेत्रों में अभूतपूर्व प्रगति की है, परन्तु इसके साथ ही विभिन्न तरह की नई चुनोतियाँ भी उत्पन्न हुई हैं जैसे कि जलवायु परिवर्तन और संबंधित जीवाणु/अजीव/अप्राण तन, भूमि और जल की क्षय, कारक उत्पादकता में कमी, प्राकृतिक संसाधनों की कमी इत्यादि। इन सब चुनौतियों के बावजूद, भारतीय कृषि अपनी बृहद जैव विविधता, जलवायु विविधता और विशाल कुशल मानव संसाधनों से परिपूर्ण है और देश की अर्थव्यवस्था में अपना बहुमूल्य योगदान दे रही है। भारतीय कृषि जैवप्रोद्योगिकी संस्थान, रांची, एक उच्च कोटि का संस्थान है जोकि कृषि विकास के क्षेत्र में अपनी बुनियादी और सृजनात्मक भूमिका के लिए प्रतिबद्ध है। इस संस्थान का मुख्य उद्देश्य पौधों, पशुओं, मछलियों और कीटाणुओं के समृद्धि को सामरिक दृष्टिकोण से बढ़ावा देने के लिए कृषि जगत के बुनियादी और अनुवादात्मक शोध में कार्य करना है। इसके साथ यह संस्थान उच्च शैक्षिक स्नातक, स्नातकोत्तर, डॉक्टर ऑफ़ फिलोसफी और पोस्ट-डॉक्टरेट स्तर पर शिक्षा प्रदान करके कृषि जैव प्रोद्योगिकी के अग्रणी क्षेत्रों में कुशल मानव संसाधनों को विकसित करने में महत्वपूर्ण भूमिका निभा रहा है। संस्थान अनुसंधान में भी बुनियादी और सामरिक अनुसंधान के क्षेत्रों में भी महत्वपूर्ण योगदान दे रहा है। इस संस्थान में कृषि अनुसंधान के लिए विभिन्न तरह के प्रशिक्षण केंद्र जैसे कि फसल अनुसन्धान एवं प्रशिक्षण केंद्र (सी.आर.टी.सी.), पशुधन अनुसंधान एवं प्रशिक्षण केंद्र (एल.आर.टी.सी.), और मत्स्य अनुसंधान एवं प्रशिक्षण केंद्र (एफ.आर.टी.सी.) जैसी सुविधाएं बनाई हैं। यहाँ पर संस्थान ने विभिन्न अनुसंधान केंद्रों के माध्यम से विशेषज्ञता के आधार पर विभिन्न फसलों में मौजूद गुणों का आणविक मूल्यांकन और पहचान करने का काम किया जा रहा है। इसमें चावल की फसल में सूखे के प्रति सहिष्णुता, पोषण उपयोग क्षमता, और झुलसा रोग हेतु प्रतिरोध को बढ़ाने के लिए पहचाने गए ज्ञात प्रभावी QTL/जीनों के एकत्रिकण के लिए प्रयास जारी हैं। इसके अलावा, पशु अनुसंधान के क्षेत्र में लिंगीकृत वीर्य के उत्पादन के लिए कोशिका सतह बायोमार्कर्स का विकास किया जा रहा है, जो पशु उत्पादन में अमूल्य योगदान प्रदान करने में सहायक होंगे। | पर्यावरणीय क्षेत्रों में संस्थान, जूट रेटिंग वेस्ट-वॉटर के नैनो-प्रेरित क्षय और कार्बन डाइऑक्साइड नैनोपार्टिकल्स का उपयोग भूमि अम्ल न्यूट्रलाइजिंग कारक के रूप में और अनुपयोगी कोयला खदानों में बने जलाशयों में माइक्रोबायोम की प्रोफाइलिंग के लिए मेटाजेनोमिक दृष्टिकोण शामिल हैं।

इसके अतिरिक्त संस्थान से गत वर्ष में कुल 11 परास्नातक छात्रों (आणविक जीवविज्ञान एवं जैवप्रोद्योगिकी में 6; आनुवंशिकी एवं पादप प्रजनन में 5 छात्र) ने संस्थान से अपनी उपाधि पूर्ण करके विभिन्न राष्ट्रीय परीक्षाओ जैसे कि सी.एस.आई.आर.-यू.जी.सी., डी.बी.टी. जे.आर.एफ./नेट को पास एवं उच्च स्थान प्राप्त किया हैं।

इन सभी उपलब्धियों के लिए मैं हमारे सभी वैज्ञानिको, प्रशासनिक और वित्तीय कर्मचारियों, छात्रों, वरिष्ठ अनुसंधान सहायको और संबंधित सहायक कर्मचारियों के द्वारा संस्थान के विकास हेतु की गई कड़ी मेहनत और योगदान के लिए उनका ह्रदय से आभारी हूं। मैं समय पर प्रकाशन निकालने के लिए वार्षिक रिपोर्ट संपादन टीम के लिए भी अपनी कृतज्ञता व्यक्त करता हूं।

मैं डॉ. हिमांशु पाठक, सचिव (कृषि अनुसंधान एवं शिक्षा विभाग) सह महानिदेशक (भारतीय कृषि अनुसंधान परिषद) के प्रेरणादायक मार्गदर्शन और हमारे संस्थान के लिए उनके द्वारा दिए गए सहयोग हेतु अपनी कृतज्ञता व्यक्त करता हूँ। मैं डॉ टी. आर. शर्मा, उप-महानिदेशक (फसल विज्ञान), और डॉ. डी.के. यादवा, सहायक महानिदेशक (बीज), का उनके द्वारा दिए गए सतत मार्गदर्शन और प्रेरणा हेतु अपना आभार व्यक्त करता हूँ।

राँची
फरवरी, 2024

(सुजय राक्षित)
निदेशक, भा.कृ.अनु.प.-भा.कृ.जै.सं.

भाकृअनुप
ICAR

भारतीय कृषि जैवप्रौद्योगिकी संस्थान
Indian Institute of Agricultural Biotechnology
भा कृ जै सं
IIAB

About the Institute

The ICAR-Indian Institute of Agricultural Biotechnology (ICAR-IIAB), Ranchi, established under the Indian Council of Agricultural Research (ICAR), stands as a national institute dedicated to advancing agricultural biotechnology. Its overarching goal is to harness the vast potential of advanced technologies in all facets of agricultural biotechnology, aiming to enhance agricultural productivity and contribute to the growth of the country. The institute operates at the interface of plant, animal, fish and microbial biotechnology, conducting high-quality basic and applied research, while also focusing on academic excellence. The major mandate of ICAR-IIAB encompasses basic and strategic research in agricultural biotechnology, with a commitment to improving the quality of human resources through academic programmes. The institute offers teaching and training at master's, doctoral and post-doctoral levels in plant, animal, fish and microbial biotechnology and allied areas. Its mission involves integrating both basic and applied research to achieve revolutionary advancements in agricultural development through the application of modern scientific tools and techniques.

ICAR-IIAB is responsive to the dynamic challenges in agriculture, conducting need-based research to address constraints in the field. The research agenda includes marker-assisted selection, identification of novel genes/alleles and promoters or cis-regulatory regions of genes from diverse biological resources in the country. Genetic engineering of crops with novel traits for tolerance or resistance to biotic and abiotic stresses enhanced productivity and nutrient-use efficiency is a significant focus. The institute also engages in the development of molecular diagnostics for identifying diseases in plants, animals and fish, along with prophylactic measures for disease management. The year 2021 marked a significant milestone for ICAR-IIAB as it shifted to its new sprawling campus located at Garhkhatanga, on Ranchi Ring Road. In the pursuit of its objectives, the institute explores the potential of nanotechnology for developing detection systems for pests and nano-delivery of pesticides, vaccines, nutrients, hormones and genes. It also plays a crucial role as a biotech hub under the National Agricultural Research and Education System (NARES), providing technical support and services in biotechnology, sequencing, bioinformatics, database management, safety studies, products and knowledge. Looking forward, ICAR-IIAB is on a trajectory of continued growth and development. As Ranchi Hub coordinator of IARI Mega University, the institute expanded its academic activities, introducing Under Graduate (UG), Post Graduate (PG) and Ph.D. programmes. Accompanying this expansion, hostels for both boys and girls were completed, enhancing the residential facilities for students. The main building of the institute is poised to become functional in the upcoming months, further solidifying its infrastructure. The strength of both scientific and administrative staff has increased, fortifying the institute's capacity for transformative research initiatives. Additionally, collaborations and Memoranda of Understandings (MOUs) have proliferated, strengthening the institute's ties with external partners and organizations. ICAR-IIAB remains steadfast in its commitment to address agricultural challenges, fostering self-sufficiency in food production and contributing to the advancement of agricultural biotechnology in India.

Vision

Harnessing the potential of biotechnology for accelerated agricultural growth.

Mission

Strengthening basic and applied research and human resource capacity building in the frontier areas of agricultural growth.

Mandates

Basic and strategic research in agricultural biotechnology.

Development of quality human resources for academic excellence in agricultural biotechnology and policy support.

कार्यकारी सारांश
Executive Summary

१. व्यापक मूल्यांकन और चयन प्रक्रियाओं के माध्यम से, *Pup1* और qDTYs के बीच सकारात्मक संयोजन के साथ धान की विभिन्न विकासों की पहचान की गई, जिससे यह स्पष्ट होता है कि वर्षा और कम उपयोग की स्थितियों में धान की उत्पादन क्षमता में सुधार की संभावना है।

२. सत्ताईस (27) उम्मीदवार जीन आधारित एसएसआर मार्करों का उपयोग करके नाइट्रोजन उपयोग दक्षता और फास्फोरस उपयोग दक्षता के लिए छियानवे (96) चावल जीनोटाइप का लक्षण वर्णन किया गया था। तीन जीनोटाइप CAUS 124, IRCTN-91-84, और तुलसीफुल आशाजनक पाए गए।

३. कृषि-रूपात्मक लक्षण वर्णन से 75 हॉर्स ग्राम परिग्रहणों के प्रति क्लस्टर फलियों की संख्या, प्रति पौधा बीज उपज, 100 बीज वजन और प्रति पौधा फली समूहों की संख्या के लिए उच्च स्तर की आनुवंशिक परिवर्तनशीलता का पता चला। इन लक्षणों का चयन आनुवंशिक सुधार के लिए भविष्य में फायदेमंद होगा।

४. 24 तरह के विभन्न एस.एस.आर. मार्करों का उपयोग करके 75 हॉर्स ग्राम परिग्रहणों में कुल 59 एलील्स का पता लगाया गया। अध्ययन में पाया गया है कि हॉर्स ग्राम में एलील्स की संख्या 2 से 4 तक है एवं प्रति लोकस पर औसतन 2.5 एलील्स पाए गए हैं। जनसंख्या संरचना अध्ययन में हॉर्स ग्राम में महत्वपूर्ण आनुवंशिक मिश्रण देखा गया।

५. विंग्ड बीन के कृषि-रूपात्मक विवरणकों के माध्यम से एम2 जनसंख्या की स्क्रीनिंग से विभिन्न गुणात्मक और मात्रात्मक लक्षणों के लिए अलग-अलग भिन्नता का पता चला है।

६. विंग्ड बीन (151 के.बी. आकार) के संपूर्ण क्लोरोप्लास्ट जीनोम को अनुक्रमित किया गया है। इसमें एक विशिष्ट चतुर्भुज संरचना है जो 130 जीन और महत्वपूर्ण एसएसआर विविधताओं को प्रकट करती है। फलीदार फसल प्रजातियों के क्लोरोप्लास्ट जीनोम के फ़ाइलोजेनिक विश्लेषण से पता चला है कि विंग्ड बीन फ़ाइलोजेनी में एक अद्वितीय क्लैड द्वारा बनाई गई है क्योंकि यह दलहनी फसल प्रजातियों में एक पैतृक प्रजाति हो सकती है।

७. फैबा बीन एंटी-पार्किंसंस बीमारी के लिए असरदार दवा *L-DOPA* का एक समृद्ध स्रोत है। मेटाबोलाइट प्रोफाइलिंग से पता चला है कि *L-DOPA* का आंतरिक संचय ऊतक प्रकार और परिपक्वता के

1. Through extensive evaluations and selection processes, rice varieties with positive synergy between *Pup1* and qDTYs were identified, indicating the potential for enhancing rice yield in rainfed low-input conditions.

2. Characterizations of ninety-six (96) rice genotypes were done for Nitrogen Use Efficiency and Phosphorus Use Efficiency using twenty-seven (27) candidate gene based SSR markers. Three genotypes CAUS 124, IRCTN-91-84 and Tulsiphul were found promising.

3. Agro-morphological characterization of seventy five (75) horse gram accessions revealed high level of genetic variability for number of pods per cluster, seed yield per plant, 100 seed weight and number of pod clusters per plant. Selection of these traits would be rewarding for genetic improvement horse gram.

4. A total of fifty-nine (59) alleles were detected in seventy five (75) horse gram accessions by using 24 SSR markers. Number of alleles ranged from two to four, with an average of 2.5 alleles per locus. In population structure studies significant genetic admixing observed in horse gram accessions.

5. Screening of M2 population though agro-morphological descriptors of winged bean revealed distinguishable variation for various qualitative and quantitative traits.

6. The complete chloroplast genome of winged bean (151 kb size) has been sequenced. It has a typical quadripartite structure revealing one thirty (130) genes and significant SSR variations. The phylogenic analysis of the chloroplast genome of legume species revealed that the winged bean is formed by a unique clade in the phylogeny as it may be an ancestral species in the legume.

7. Faba bean is a rich source of L-3,4-dihydroxyphenylalanine (*L-DOPA*), the gold standard anti-Parkinson drug. Metabolite profiling showed that differential accumulation of *L-DOPA* depended on tissue type and stage of maturity.

चरण पर निर्भर करता है। पत्ती और फूलों के ऊतकों में पी.पी.ओ. के जीन अभिव्यक्ति विश्लेषण से पी.पी.ओ. जीन परिवार के सदस्यों के चयनात्मक प्रेरण का पता चला है।

८. स्पाइक की उच्च सघनता और यूट्रिकल्स के मध्य रेखा के साथ विलंबित विच्छेदन जैसे रूपात्मक लक्षण, ऐमारैंथस में बीज-बिखरने की सहनशीलता में योगदान करते हैं। सूक्ष्म अध्ययन के माध्यम से, यह पाया गया कि IC-042277 (बीज-बिखरने के प्रति सहनशील) IC-21923 (बीज-बिखरने के प्रति संवेदनशील) की तुलना में लंबी अवधि तक विघटन का विरोध करते हैं।

९. हरे-संश्लेषित कॉपर ऑक्साइड नैनोकणों (500पीपीएम CuO NPs) ने चने में फ्यूसेरियम ऑक्सीस्पोरम-प्रेरित विल्ट रोग को संबोधित करने में पारंपरिक कॉपर सल्फेट से बेहतर प्रदर्शन करते हुए आशाजनक प्रभावकारिता प्रदर्शित की। यह अध्ययन चने की खेती में प्रभावी उकठा रोग प्रबंधन के लिए पर्यावरण के अनुकूल विकल्प के रूप में CuO NPs की क्षमता को प्रदर्शित करता है।

१०. स्वदेशी नसल के नर सांड के एक्स- और वाई-स्पर्माटोजोआ के ट्रांसक्रिप्टोम का विश्लेषण किया गया है, साथ ही विभिन्न ट्रांसक्रिप्ट्स की पहचान और सत्यापन भी किया गया है, जोकि बैल स्पर्माटोजोआ में लिंग चयन हस्ताक्षरों के लिए प्रोटियोजेनॉमिक्स दृष्टिकोण का पथ प्रशस्त करते हैं।

११. संश्लेषित ZnO नैनोकणों (NPs) के माध्यम से लाख डाई के फोटोकैटलिटिक क्षरण की जांच करने वाले प्रयोग में 250 पीपीएम ZnO NPs के साथ उपचारित समाधान में लाख डाई के 85.02% क्षरण का प्रदर्शन देखा गया, इसके विपरीत नियंत्रण समाधान (बिना ZnO NPs) में केवल 4.54% लैक डाई का क्षरण दर्ज किया गया।

१२. कोयला खानों क्षेत्रों में पाले गए नील तिलापिया पर एक अध्ययन में उच्च माइक्रोबियल भार, मछली की मांसपेशियों में भारी धातु के स्तर में वृद्धि और आंत माइक्रोबायोटा संरचना में परिवर्तन का पता चला, जिससे मछली के स्वास्थ्य पर पर्यावरणीय प्रभाव को समझने और स्थायी जलीय कृषि प्रथाओं को भविष्य में बढ़ावा देने की आवश्यकता पर बल मिला है।

१३. रांची हब आईसीएआर-आईएआरआई के साथ संबद्धता में बी.टेक बायोटेक्नोलॉजी कार्यक्रम शुरू करने वाला पहला केंद्र है। यह कार्यक्रम शैक्षणिक वर्ष 2022-23 में जनवरी महीने से ऑनलाइन मोड में और अप्रैल से ऑफ़लाइन मोड में शुरू हो गया था। देश के

The gene expression analysis of Polyphenol Oxidases (*PPOs*) in leaf and flower tissues revealed the selective induction of members of PPO gene family.

8. Morphological traits such as the high compactness of the spike and the delayed abscission along the utricles' equator, contribute to seed-shattering tolerance in Amaranthus. Through microscopic study, it was found that the seed-bearing utricles in IC-042277 (seed-shattering tolerant) resist the dehiscence for a longer period compared to that in IC-21923 (seed-shattering susceptible).

9. Green-synthesized Copper Oxide nanoparticles (CuO NPs) at a 500ppm dose exhibited promising efficacy in addressing *Fusarium oxysporum*-induced wilt disease in chickpeas, outperforming conventional copper sulfate. The study demonstrates the potential of CuO NPs as an environmentally friendly alternative for effective wilt disease management in chickpea cultivation.

10. The transcriptomes of X- and Y-spermatozoa of *Bos indicus* cattle have been deciphered along with identification and validation of the differential transcripts that pave the way for following a proteogenomics approach for sex selection signatures in bull spermatozoa.

11. The experiment investigating the photocatalytic degradation of lac dye through synthesized ZnO nanoparticles demonstrated an 85.02% degradation of lac dye in the solution treated with 250ppm ZnO NPs. In contrast, the control solution reported only 4.54% degradation of lac dye.

12. A study on Nile tilapia reared in coal void areas revealed higher microbial load, elevated heavy metal levels in fish muscles and alterations in gut microbiota composition, emphasizing the need for understanding the environmental impact on fish health and promoting sustainable aquaculture practices.

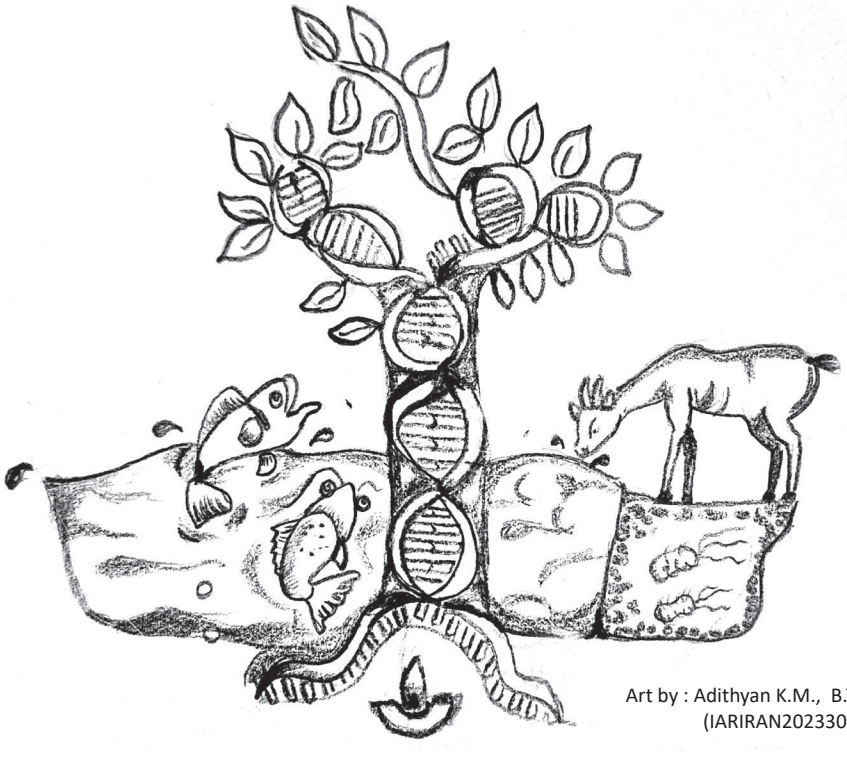
13. Ranchi Hub started B.Tech. Biotechnology programme in affiliation with ICAR-IARI in academic year 2022-23 from the month of January in online mode and from April onwards in offline mode. A total of twenty eight (28) students were admitted

विभिन्न हिस्सों का प्रतिनिधित्व करने वाले कुल 28 छात्रों को पहले सेमेस्टर में प्रवेश दिया गया था।

१४. रांची हब ने तीन विषयों में मास्टर और डॉक्टरेट कार्यक्रम भी शुरू किया है। शैक्षणिक सत्र 2023-24 के लिए स्वतंत्र रूप से आनुवंशिकी और पादप प्रजनन बिज्ञान, आणविक जीवविज्ञान एवँ जैव प्रद्योगिकी और जैवरसायनिक विज्ञान में वर्तमान में 26 स्नातकोत्तर और 7 डॉक्टर ऑफ फिलॉसफी छात्र हैं|

to the first semester representing different parts of the country.

14. The hub has also started masters and doctoral programmes in three disciplines, viz., Genetics & Plant Breeding, Molecular Biology & Biotechnology and Biochemistry independently for the Academic Session 2023-24. A total of 16 courses have been taught by the faculties of Ranchi Hub. Currently there are fourty seven (47) UG, twenty six (26) PG and seven (7) Ph.D. students pursuing their study.



Art by : Adithyan K.M., B.Tech 1st Year
(IARIRAN20233007)

Research Accomplishments

School of Genomics and Molecular Breeding

Molecular breeding for development of rice varieties with inbuilt tolerance to drought, low soil phosphorous and blast

Erratic monsoon patterns owing to climatic aberrations are leading to significant crop production losses in rainfed areas. Losses on account of crop failure due to severe drought episodes can be minimized by cultivating varieties of appropriate duration tolerant to drought and prevailing biotic stresses. Keeping in view the major production bottlenecks in rice under rainfed conditions, the project aims to breed rice cultivars suitable for direct seeding by introgressing major yield QTLs/genes under drought (qDTYs), for low soil phosphorus (P) tolerance (*Pup1*) and effective genes for imparting blast resistance (*Pi2, 9, 54*) using marker assisted selection (MAS). A total of 832 F_4 selections possessing different combinations of DTYs and *Pup1* were evaluated under direct seeded rainfed conditions during kharif 2023. Based on *per se* performance under direct seeded rainfed conditions 537 plants belonging to eight crosses were selected. A total of 4032 plants belonging to 170 complex crosses were selected based their performance from progenies of 4651 plants (F_3) pertaining to 326 crosses evaluated. Similarly, 114 F_2 populations segregating for QTLs for drought and low P tolerance and different blast resistant genes were also evaluated and 1802 plants possessing high yielding attributes were selected. In order to identify better performing low grain Phosphorous genotypes, 80 diverse rice genotypes were screened for phytic acid (PA) content. Minimum level of PA was recorded in BAU21802 (1.11 $mg.g^{-1}$), whereas GSRIR1-DQ186-Y2-D1 was found to possess maximum level of PA in grains (3.33 $mg.g^{-1}$). BAU21802 can potentially be utilized not only for breeding P use efficient varieties but also genotypes with improved nutritional quality.

Selected BC_1F_1s developed by crossing drought tolerant accession of *Oryza rufipogon* with recurrent parents namely, Swarna and Lalat were backcrossed with respective recurrent parents for developing BC_1F_2s. Four F3 populations developed involving MTU 1210, a high yielding lowland variety possessing drought tolerance, were advanced through single seed decent (SSD) method for developing recombinant inbred lines (RILs) for mapping of genomic regions conferring drought tolerance and their validation.

Deciphering and deploying low phosphorus tolerance and Nitrogen Use Efficiency in rice using targeted genomics approach

A total of 96 genotypes were characterized using 29 linked SSR markers. The genetic finger printing for Phosphorus Use Efficiency (PUE) was determined by using 12 primer pairs and remaining 17 primers were utilized for Nitrogen Use Efficiency (NUE). The details of the allelic information of the studied markers are given in **Table 1**. The allelic status for all genotypes were studied. After screening with 12 PUE linked markers, 10 in Karhani and nine in IRCTN-91-84, IIABL-6 and IET 30244 were prooved to be efficient markers in identifying genotypes with better PUE under low P conditions. Similarly, 14 linked markers in Tulsiphul; and 13 markers in CAUS 124, Pusa 1176, Chandanchoor and IET 29573 were found to be associated with NUE.

Table 1. Expected amplification sizes of the markers used to decipher low phospharus tolerance and Nitrogen Use Efficiency

Marker	Expected PCR amplicon size (bp)	Expected PCR product size (bp) in	
		Efficient line	Inefficient line
SSR primers linked with Phosphorus use efficiency			
K46-2	227/None	227	-
PR9-2	763/None	763	-
FR033-3	897/920	897	920
RM12550	300	300	-
RM12558	260/360	260	360
RD0203	459/360	459	360
HVSSR02-10	259/245	259	245
HVSSR02-14	292/270	292	270

Marker	Expected PCR amplicon size (bp)	Expected PCR product size (bp) in	
		Efficient line	Inefficient line
RM12557	160/150	160	150
RM12562	115/100	115	100
RM12568	170/150	170	150
RM12569	150/140	150	140
SSR primers linked with Nitrogen Use Efficiency			
RM169	144/155	144	155
RM18076	164/175	164	175
RM2998	238/200	238	200
RM455	140/130	140	130
RM1365	299/310	299	310
RM8044	196/160	196	160
RM271	101/115	101	115
RM5348	193/185	193	185
RM6207	198/210	198	210
RM413	84/110	84	110
RM495	178/160	178	160
RM118	156/170	156	170
RM507	270/258	270	258
RM6300	97/80	97	80
RM13209	285/255	285	255
RM13181	263/	263	-
RM13201	474/450	474	450

Improvement of rice yield under low light intensity condition

During *kharif* 2023, F_3 populations derived from the crosses (IRCTN 91-84 × ISM, IRCTN 91-84 × Rasi, IRCTN 91-84 × IIABR 48, IR 64 × Rhyllo Red, Danteshwari × MTU 1081, Danteshwari × MTU 1121, IRCTN 91-94 × Samba Mahsuri, MTU 1010 × IRCTN 91-84, MTU 1010 × Megha Rice-1, Rhyllo Red × Samba Mahsuri, Samba Mahsuri × IRCTN 91-94, Swarna × IRCTN 91-84, Swarna × Mahisugandha, Swarna × Rhyllo Red, Swarnprabha × MTU 1081 and Swarnprabha × MTU 1153) were planted along with parents **(Figure 1)** and single panicle were harvested from each individual for generation advancement. Single seed were collected from each individual plant from all above F_3 families for further generation advancement in next season for development of Recombinant Inbred Lines (RILs).

Figure 1. F_3 populations in low land field at Farm D, ICAR-IIAB, Ranchi

Genome analysis, linkage mapping and identification of gene(s)/QTLs for seed oil and protein content in winged bean (*Psophocarpus tetragonolobus* L.)

Sequencing of whole chloroplast genome of winged bean

Psophocarpus tetragonolobus (L.) commonly called as winged bean is an underutilized legume of the phaseoloid clade of the family Fabaceae. It is diploid (2n=2x=18) having a genome size of 710 Mb. Despite the huge potential to produce edible protein and oil, the winged bean crop remains underutilized and very few genomic resources available in this crop species. The cpDNA contains rich genetic information, which can be utilized for evolution studies and phylogenetic analysis of species. We have sequenced the whole

chloroplast genome (151 kb) of winged bean which enhanced our understanding of chloroplast biology, conservation, diversity and the genetic basis by which chloroplast transgenes can be engineered to enhance plant agronomic traits or to produce high-value agricultural or biomedical products.

Winged bean has a typical quadripartite structure, with the Cp genome divided into *LSC* and *SSC* of 82,736 bp and 17,777 bp in size, respectively and a pair of IRs of 25,529 bp. The GC content of the winged bean chloroplast genome has a 35.26% and the GC content of *LSC*, *SSC* and *IR* regions was 32.63, 28.55 and 41.86 %, respectively. A total of 130 genes were found in the winged bean Cp genome; among these 85 protein-coding genes, 37 tRNA genes and 8 rRNA genes. There are 61 protein-coding and 22 tRNA genes located in the *LSC* region, 12 protein-coding and one tRNA genes located in the SSC region, six protein-coding, seven *tRNA* and four *rRNA* genes located in the *IRA* region gene and a similar set of genes as present in IR-A is duplicated in IRB **(Figure 2)**. *ycf2* is the largest protein-coding gene having 6869 bp in size, while rps2 is the protein-coding smallest gene having 68 bp in size. *trnK-UUU* is the largest *tRNA* gene having 2657bp in size, while *trnC-GCA* is the smallest *tRNA* gene having 78bp in size. A total of 8 *rRNA* genes were present in the winged bean chloroplast and resided in the IR region of the Cp genome. *rrn23* is the largest *rRNA* gene of 2820 bp in size and is present in both *IRA* and *IRB* regions. A total of 14 protein-coding genes, eight tRNA genes and two *rRNA* genes possess introns. All the intron-containing genes have a single intron and two exons except pafI and *clpPI* contain two intron and three exons. A trans-spliced gene *rps12* is located at three positions of the Cp genome, 1st exon is located in the *LSC* region whereas 2nd and 3rd exon are located in duplicated copies in both the IRs. The phylogenic analysis of the chloroplast genome of legume species revealed that the winged bean is formed by a unique clade in the phylogeny as it may be an ancestral species in the legume **(Figure 3)**.

The SSR mining in the chloroplast genome was performed using Krait v. 1.3.3 software. Four types of genetic variation, such as perfect SSRs (pSSRs), compound SSRs (cSSRs), imperfect SSRs (iSSRs) and variable number tandem repeats (VNTRs), were analyzed. The parameters were set to default settings; SSR motif length corresponding to the minimum

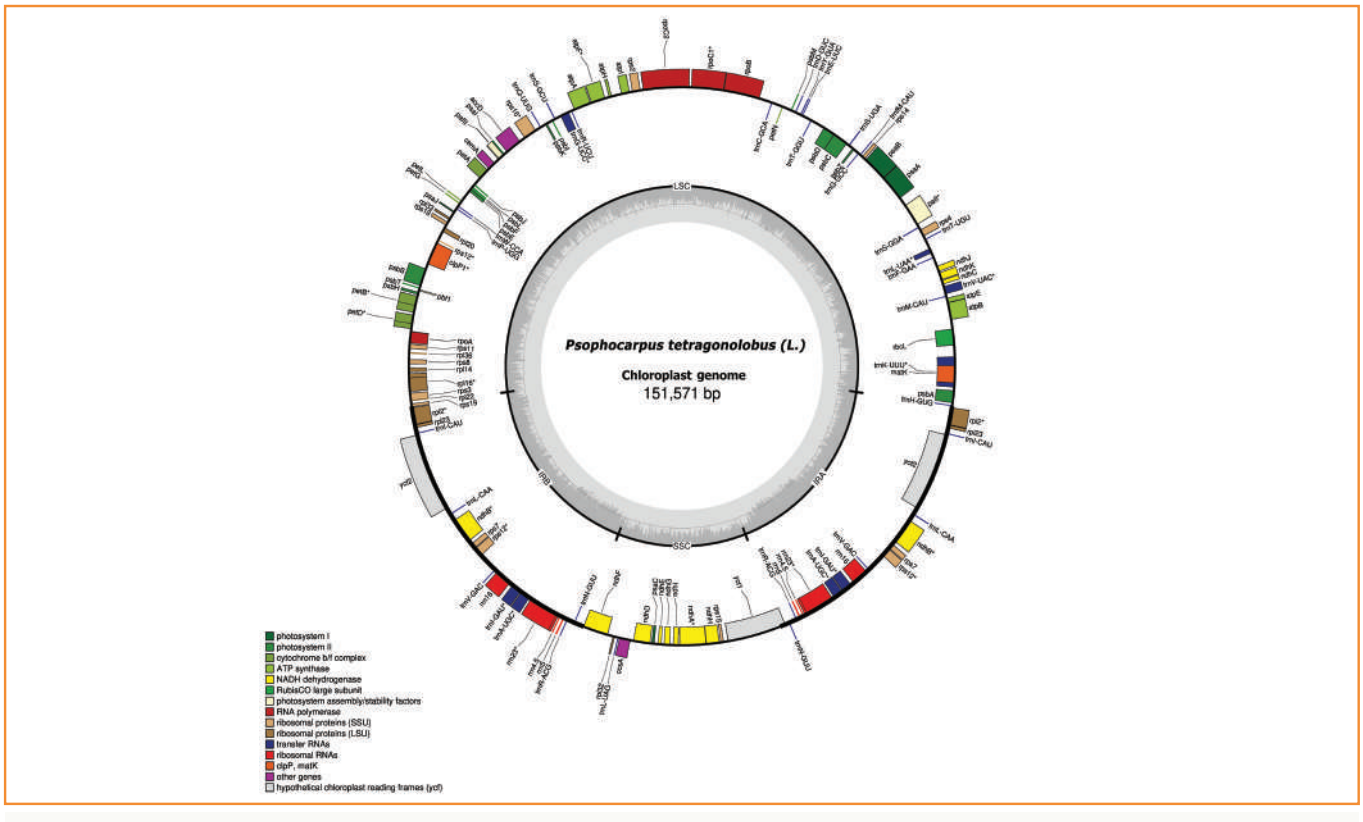


Figure 2. Map of *Psophocarpus tetragonolobus* (L.) plastid genome

Genes shown on the outside of the map are on the + strand, while the genes that are shown on the inside are on the complement strands. The innermost darker grey corresponds to GC content, whereas the lighter grey corresponds to AT content. *LSC*: large single copy region; *SSC*: small single copy region; and *IR*: inverted repeat. *Genes with introns.

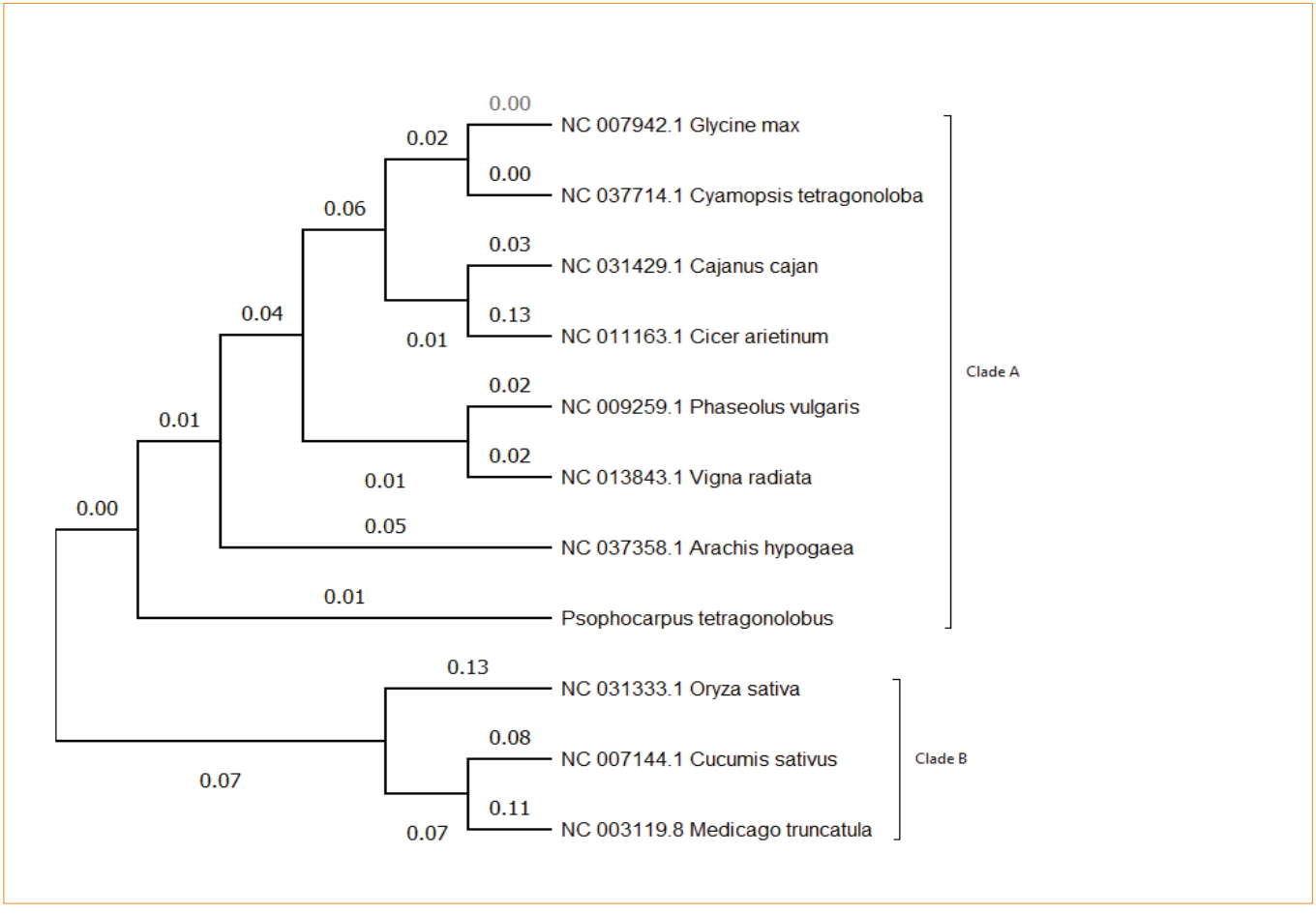


Figure 3. Phylogenetic analysis of winged bean chloroplast genome with other legume species

number of repetitions is 1–10, 2–5, 3–5, 4–4, 5–4, 6–4. When the distance between two microsatellites is <10 bp, two microsatellites were considered to form a compound microsatellite. A total of 84 perfect SSRs and two compound SRRs and 15 VNTRs were detected in chloroplast genome of winged bean. The number of mononucleotide repeats is the largest, totalling 49 (58.33%), of which A/T repeat motif accounts for 87.75%. Dinucleotide repeats contain two types of repeat motifs (AT/AT, AG/CT), in total 35, of which AT/AT accounts for 91.42%.

Molecular dissection of plant architecture traits in winged bean through mutagenesis and genomic approaches Generation of mutants in winged bean

Characterization of M_2 mutant population of winged bean through agro-morphological descriptors

Mutation breeding is one of the effective techniques used for improving desired traits such as yield quality and quantity in economic crops. The present study aims to induce variability for plant architecture traits **(Figure 4 & 5)** along with yield attributing traits in winged bean using gamma rays as a mutagen. A seed of genotype AKWB-1 was treated with gamma rays doses of 100, 150, 200 and 300 Gy (with the help of BARC, Trombay). A total of 147 mutant lines were selected in M_1 and advanced to M_2 generation. A total of 872 individual progenies of M2 population were further assessed based on 24 agro-morphological descriptors traits as per IBPGR, Rome 1982. 100 Gy of gamma

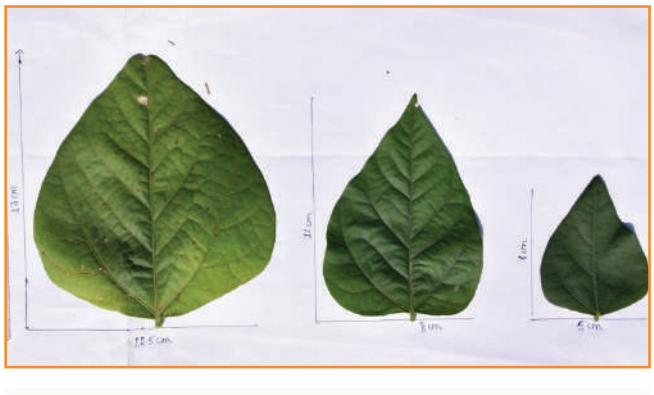


Figure 4. Variation of leaflet size in mutant population of winged bean

Figure 5. Variation of pod size in mutant population of winged bean

rays gave highest effect on days to 50% flowering and days to 85% pod maturity, while 200 Gy of gamma rays was more effective for number of branches per plant and increasing biomass and plant height. Overall, wide spectrum of variation was observed for different qualitative and quantitative traits. Based on observation on M2 generation, 105 outstanding lines were selected for raising M3 generation.

Understanding the biochemical and molecular regulation of *L-DOPA* and tannin biosynthesis in Faba bean (*Vicia faba* L.)

Spatio-temporal expression of polyphenol oxidase unveils the dynamics of *L-DOPA* accumulation in faba bean (*Vicia faba* L.)

Faba bean (*Vicia faba* L.) is a winter season grain legume and a rich source of the anti-Parkinson drug, L-3,4-dihydroxyphenylalanine (*L-DOPA*). The biosynthesis of *L-DOPA* in plants is not uniform and remains largely unexplored. While the hydroxylase activities of Tyrosine Hydroxylase (*TH*), the Cytochrome P450 (*CYP450*) class of enzymes and Polyphenol Oxidases (*PPOs*) on tyrosine substrate have been reported in plants, only the roles of *PPOs* in *L-DOPA* biosynthesis have been recently established in velvet bean (*Mucuna pruriens*). To understand the differential accumulation of *L-DOPA* in different tissues of faba bean, profiling of L-Tyrosine, *L-DOPA*, Tyramine and Dopamine in different tissues was performed. Differential accumulation of *L-DOPA* depended on tissue type and maturity **(Figure 6)**. Furthermore, dopamine biosynthesis through *L-DOPA* from L-Tyr was confirmed in faba bean. The expression analysis of *PPOs* in leaf and flower tissues revealed the selective induction of only four (*HePPO-2*, *HePPO-7*, *HePPO-8b* and *HePPO-10*) out of ten genes encoding different PPOs mined from the faba bean genome. Higher accumulation of *L-DOPA* in young leaves and flower buds than mature leaves and flowers was accompanied by significantly higher expression of *HePPO-10* and *HePPO-7*, respectively **(Figure 7)**. The role of various transcription factors contributing to such metabolite dynamics was also predicted. Further exploration of this mechanism using a multi-omics approach can provide meaningful insight and pave the way for enhancing *L-DOPA* content in crops.

Understanding the morpho-physiology and molecular mechanism of seed shattering in grain Amaranths (*Amaranthus* spp.)

Morphological Evaluation of grain amaranthus germplasm for seed shattering tolerance

Seed shattering tolerance refers to the plant's ability to retain their seed rather than releasing them easily. This trait is desirable in cultivation of grain amaranthus

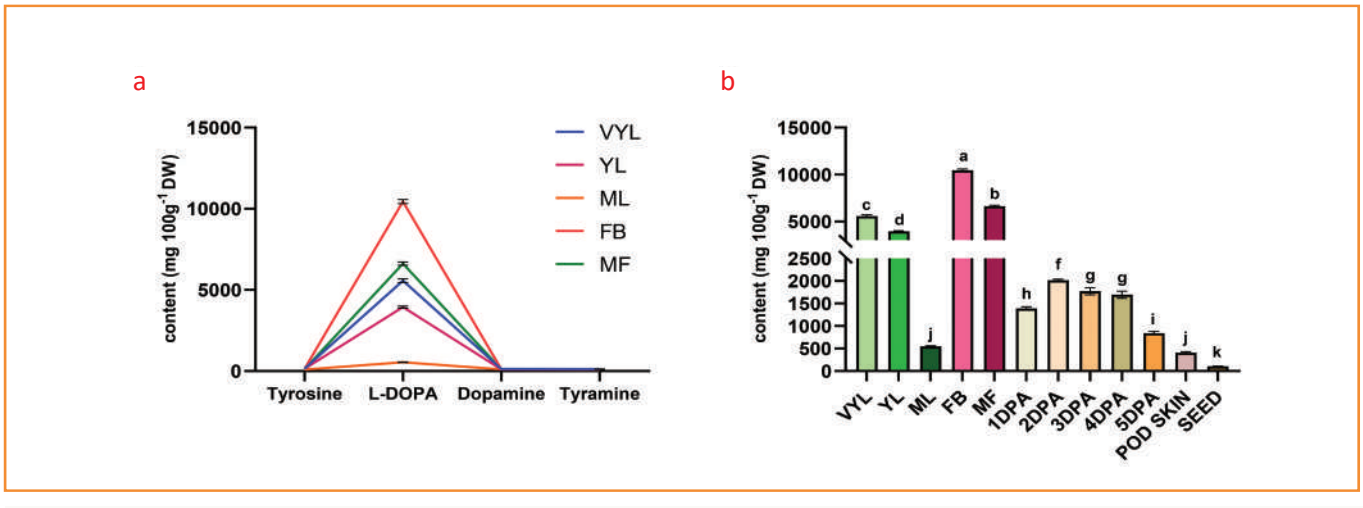


Figure 6. Graphical representation of (a) catecholamine content (100 mg.g^{-1} DW) in very young leaf (VYL), young leaf (YL), mature leaf (ML), flower bud (FB) and mature flower (MF) tissue of faba bean. (b) *L-DOPA* content in different faba bean tissues. DPA= Days post anthesis. Letters (a,b,c etc.) represent significance values obtained via Tukey's test in one-way ANOVA

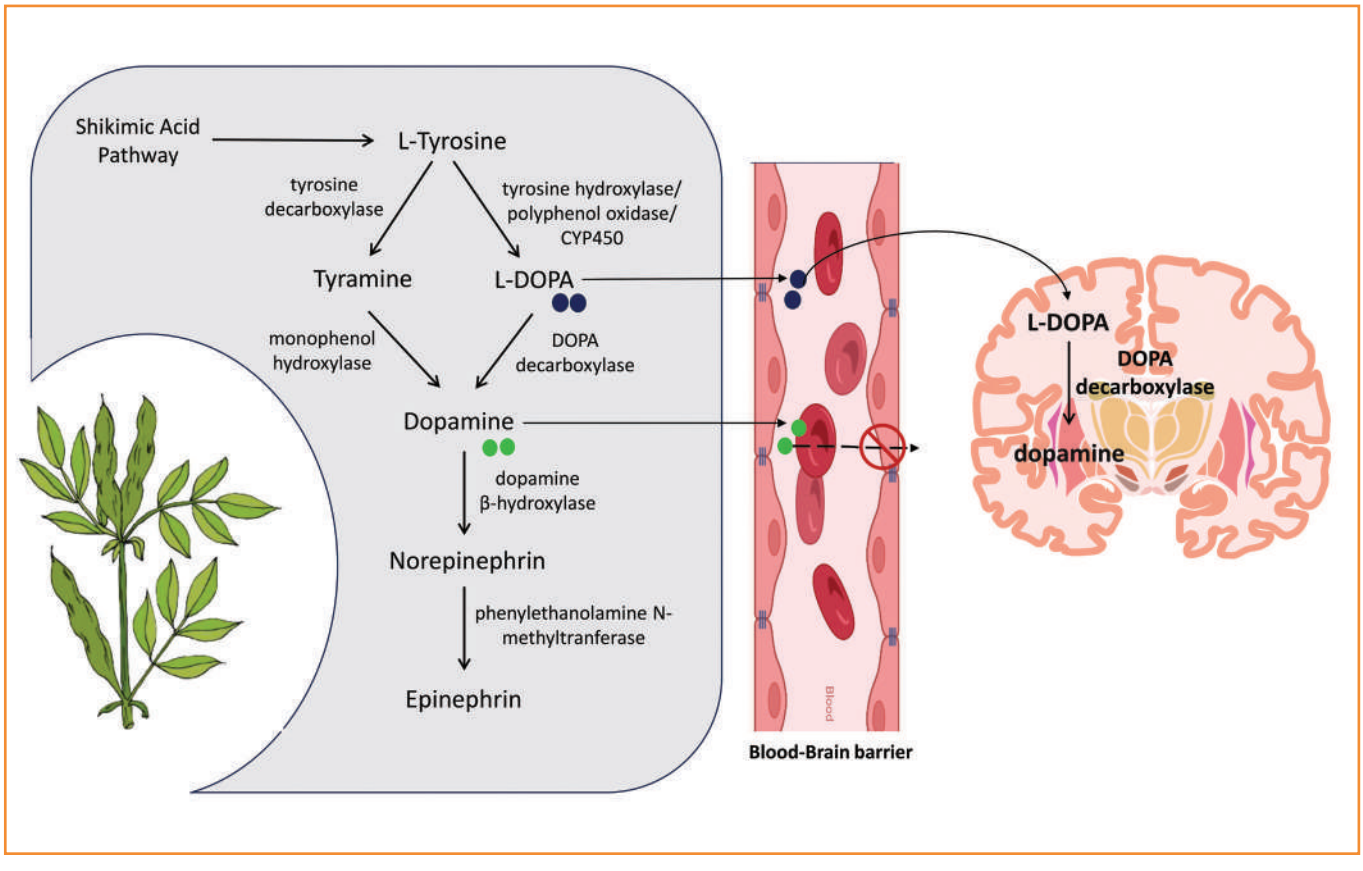


Figure 7. A graphical representation of the proposed Dopamine biosynthetic pathway in plants and the regulation of L-DOPA accumulation in Faba bean

for several reasons such as it simplifies the harvesting process so that farmers can use mechanical harvesters without the risk of losing a significant portion of the crop due to seed shattering. Therefore, seed-shattering tolerant genotypes allow farmers to plan and manage their operations during time of harvest more effectively. In this study, the morphological diversity was assessed in a grain amaranthus germplasms of sixty genotypes during Apr-May 2023. Various morphological traits influencing seed shattering were taken into consideration, such as spike compactness, spike length, plant height, stem thickness, seed shattering percentage and the opening/bursting of utricles after seed filling. In standard grain, each utricle has a seam that opens at maturity, enabling circumscissile abscission along the utricle's equator. In the present study, it was found that the bursting/splitting of mature utricles (seed-bearing papery structures) from the equator occurs during the early stage of maturity in most of the genotypes which results in higher seed shattering. However, the bursting of mature utricles delayed by about 7-10 days in an already identified seed-shattering tolerant genotype (IC-042277). The number of splitted utricles were found to be much less in IC-042277 (about 1-2 %) compared to the other susceptible genotypes such as IC-95291, IC-95302, IC-35621, IC-95333, IC-35546 (5-40 %) **(Figure 8)**. Based on the observations, the high compactness of the spike and the delayed abscission along the utricles' equator can be proposed as morphological markers linked to seed-shattering tolerance in the Amaranthus germplasm.

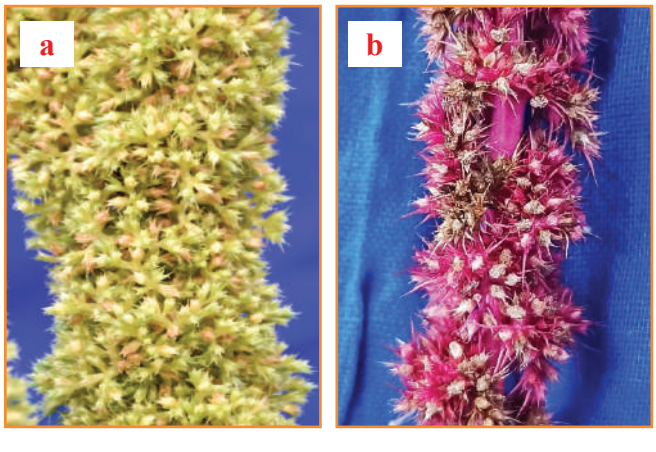


Figure 8. Variations in compactness of spike in Amaranthus (a) Higly campact spike (IC-042277), (b) Less campact spike (IC-21923)

Ideotype breeding in horse gram for Jharkhand region

Morphological and molecular characterization of horse gram

Morphological and molecular characterization of 75 horse gram (*Macrotyloma uniflorum*) genotypes along with 4 checks using ten agro-morphological traits and twenty-four polymorphic SSR markers was carried out. Morpho-agronomic traits used in the study are plant height, days to 50% flowering, days to 85% maturity, number of pods per plant, number of pod clusters per plant, pod length, number of seeds per pod, 100 seed weight and seed yield per plant. A wide range of variations was observed for various agronomic traits. ANOVA under augmented design showed significant and exploitable variation for all the traits under investigation. High to moderate estimates of PCV, GCV, heritability and genetic advance were observed for all the traits under the present study. At the phenotypic level, seed yield per plant had a significant and positive correlation with the number of pod clusters per plant, number of pods per plant, number of seeds per pod and plant height. The genotypes showing maximum seed yield per plant were observed for IC-23440, Indira Kulthi, IC-22431 and IC-120826. The genotypes IC-561031 and HPKM-317 were found to be early maturing as it takes fewer days to flowering and maturity. Total genotypes are grouped into 2 major clusters.

Twenty-four polymorphic SSR primers produced a total of 59 alleles and the number of alleles ranged from two to four, with an average of 2.5 alleles per locus. MUMS-10 was found to be the most informative marker with a PIC value of 0.55 and HUGMS-07 was found to be the least informative marker with a PIC value of 0.013.SSR profile for all 75 genotypes using MUMST-91 is presented in **Figure 9**. Neighbour joining dendrogram based on Nei's (1983) genetic distance, two major clusters were identified. Cluster I comprised 20 genotypes that includes horse gram germplasm accessions with one check HPKM-317. Cluster II comprised of 55 genotypes including checks Birsa kulthi-1, Dorma, Indira kulthi and a local cultivar Jalthanda **(Figure 10)**. The model-based clustering also clustered the 75-horse gram genotype in two clusters.

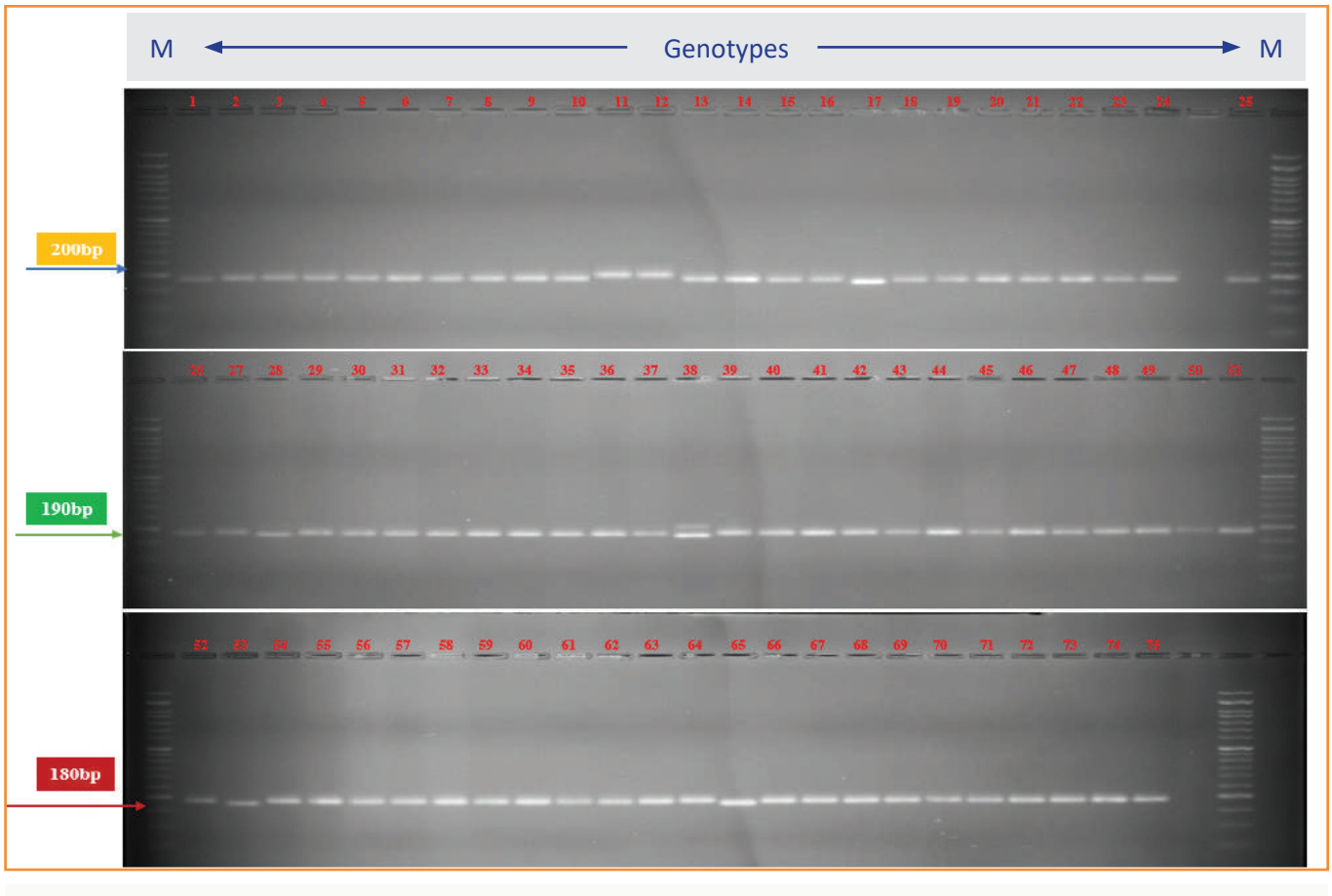


Figure 9. Polymorphism generated in 75 horse gram genotypes with primer MUMST-91 and M represents 50bp Ladder

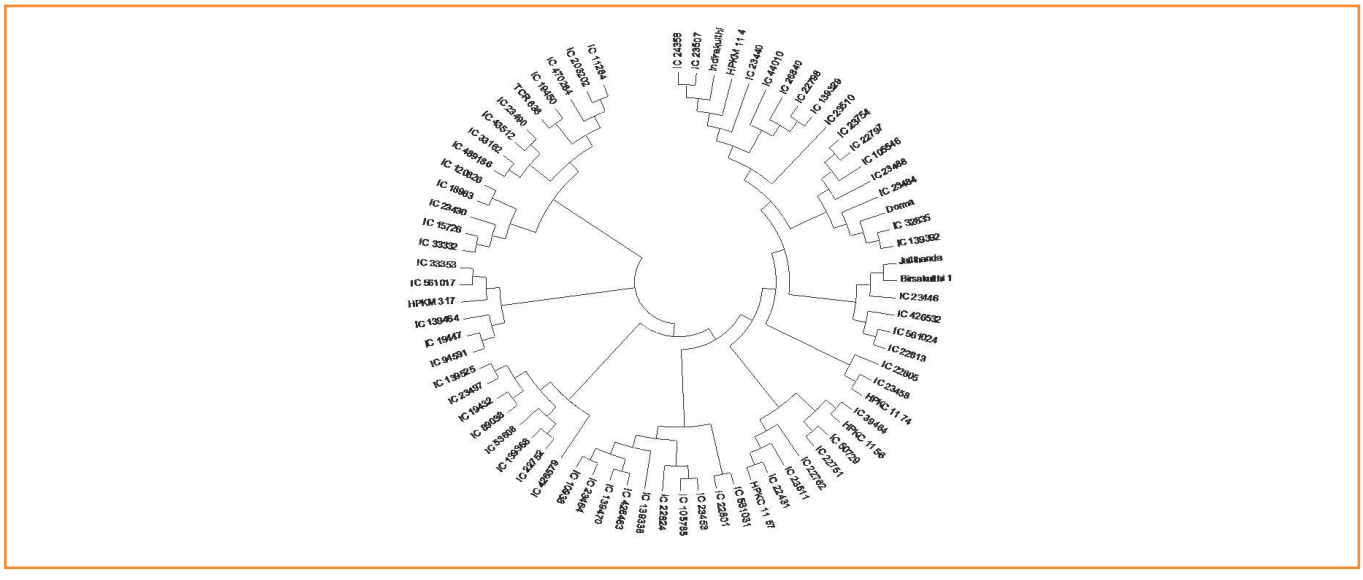


Figure 10. Cluster diagram based on molecular data of 75 horse gram genotypes

Eight genotypes shown high level of admixture. The high level of genetic diversity assessed in this study at both morphological and molecular level emphasized the importance for its conservation which can be further utilized in future breeding programme of horse gram.

School of Genetic Engineering

Investigating the role of purine degrading pathway genes of hemibiotroph fungal pathogens during host-pathogen interaction and their potential to confer disease resistance in maize

Two high yielding and commercially cultivated maize cultivar, DMRH 1301 and DMRH 1308 were evaluated for callus induction and plant regeneration. The callus induced from mature seed derived split nodal explants and maximum callus induction (79.1%) takes place in supplemented Murashige and Skoog medium (MS) containing 2.5 mg.L^{-1} 2,4-Dichlorophenoxyacetic acid (2,4-D). Moreover, the best regeneration efficiency (65%) obtained in regeneration media containing one mg.L^{-1} Kinetin and 0.5 mg.L^{-1} IAA **(Figure 11)**.

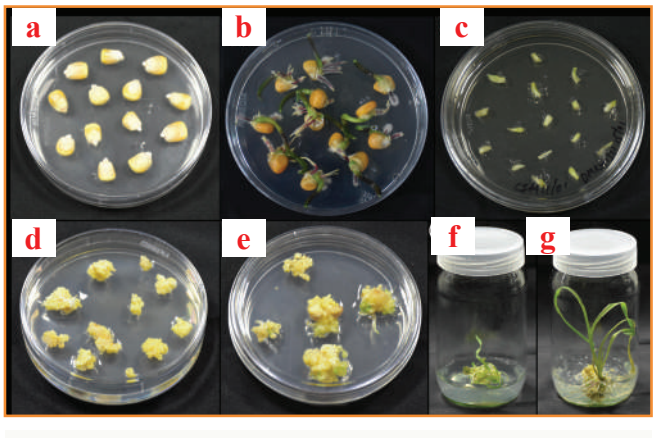


Figure 11. Schematic representation of various stages in callusing and plant regeneration in tropical maize (DMRH 1301 and DMRH 1308 using mature seed derived nodal explant. (a) mature seed (b) germinated nodal explant (c) split nodal explant (d) callus (e) regeneration (f) shooting (g) rooting

Exploring cell surface biomarkers of cattle spermatozoa for sex-specific segregation through proteomic and genomic approach

Spermatozoa is by large transcriptionally inactive; the RNA content is approx. 1/1,000 times of a typical mammalian somatic cells. It is further complicated by the frequent presence of spermatozoal DNA (spDNA) and RNA derived from somatic cells, leucocytes, epithelial cells etc. present in the semen. Thus, isolation of quality spermatozoal RNA (spRNA) for downstream applications is a formidable challenge. Through use of a cocktail of chaotropic agents, a protocol has been standardized that yields quality RNA for downstream applications. The quality of derived spRNA was ensured by different genetic markers like protamine one and 2two PTPRC, CDH1, KIT, etc. The spRNA yielded from the unsorted spermatozoa, X-spermatozoa and Y-spermatozoa of Bos indicus bulls were used for transcriptome sequencing using Illumina HiSeqX NGS Platform. The high-quality reads were aligned against NCBI Reference of *Bos indicus* (assembly Bos_indicus_1.0). The overall alignments were 80-83, 71-80 and 74-77% for unsorted spermatozoa, X-spermatozoa and Y-spermatozoa, respectively.

The mapped reads were further considered for transcript assembly and quantification of transcript abundance. For differential analysis, the transcript counts obtained from each sample were further used for analysis of differential expression of transcripts between alternate conditions. A p-value cut off of 0.05 and less was used to identify the significantly expressed transcripts and a log2 fold change cut-off of (+2) and higher for upregulated transcripts and (-2) and less for downregulated transcripts were used. Differential Gene Expression (DGE) and Gene Ontology (GO)-analysis were performed. The differential expression revealed up regulation of 737 transcripts and down regulation of 1,016 transcripts in Y-spermatozoa as compared to X-spermatozoa ($p<0.05$). The GO process clustered genes in three GO groups viz. Biological Processes (BP), Molecular Functions (MF) and Cellular Components (CC) along with KEGG pathway. The top significant GO terms have been selected by using p-value. The transcripts unique to X-spermatozoa have top GO annotations for cell and plasma membrane integrity, protein heterodimerization and transcription and histone packaging while the ones unique to Y-spermatozoa have top GO annotations for glucose metabolism and mitochondrial translation and cytochrome p450. This is very interesting vis-a-vis previous observation on comparative proteome between X- and Y-spermatozoa with special focus on membrane-associated proteins of cattle that revealed abundance of differential proteins in Y-spermatozoa which are presumed to support sperm capacitation and sperm migration velocity and differential abundance of X-specific proteins associated with structural molecule activity.

Among the transcripts which were found to be unique to X- and Y bearing spermatozoa of indicus cattle, 12 genes with respect to X (peroxiredoxin 3, exosome component 1, leptin receptor overlapping transcript like 1, leucine rich repeat transmembrane neuronal 3, olfactory receptor 8G2-like, histone H2A type 2-B, adducin 3, inositol 1,4,5-trisphosphate receptor interacting protein, beta-defensin 103A-like, DnaJ heat shock protein family (*Hsp40*) member C9, tachykinin receptor 2 and toll like receptor 7) and 16 genes with respect to Y (seminal plasma protein BSP-30 kDa, voltage dependent anion channel 1, spermatogenesis associated 6 like, *RAB27A*, member *RAS* oncogene family, ubiquitin specific peptidase 8, spermatogenesis associated 5 like 1, tubulin beta 1 class VI, *TUB* like protein 2, tubulin gamma-2 chain, spermatogenesis associated serine rich 1, carboxypeptidase A1, tubulin alpha-1C chain-like, Tektin 3, cyclin dependent kinase 7, *RAB6A*, member *RAS* oncogene family and *HOATZ* cilia and flagella associated protein) were selected for the validation by Qualitative PCR. The oligos were designed using the Primer-BLAST (NCBI). Upon evaluation of the results, no proper conclusion could be drawn about the unique expression of the selected genes in X and Y samples due to inconsistency. After DGE analysis, top 20 differentially expressed genes between X and Y spermatozoa were selected for validation using qPCR, namely uncharacterized *LOC109575461*, D-2-hydroxyglutarate dehydrogenase, MAP kinase activating death domain, G-patch domain containing 3, phosphatidylinositol glycan anchor biosynthesis class Q, Rho family GTPase 2, pyruvate kinase L/R, ubiquitin conjugating enzyme E2 G2, transmembrane protein 143, uncharacterized *LOC109570599*, jade family PHD finger 2, FYVE and coiled-coil domain autophagy adaptor 1, laminin subunit beta 3, *BAG* cochaperone 6, kinesin family member 6, heterogeneous nuclear ribonucleoprotein U like 1, transmembrane and coiled-coil domain family 1, *SH2B* adaptor protein 1, carbohydrate sulfotransferase 11 and *BCL6B* transcription repressor. These genes were selected on the basis of the log2 fold change obtained from the DGE analysis. The primers were designed for the selected genes and validated using SYBR Green chemistry. The log2 Fold change were calculated by using $2^{-\Delta\Delta Ct}$. The calculated log2 fold change values were in agreement with the DGE analysis data. Thus, the transcriptomes of X- and Y-spermatozoa of Bos indicus cattle have been deciphered along with identification and validation of the differential transcripts that pave the way for following a proteogenomic approach for sex selection signatures in bull spermatozoa.

Metagenomic profiling of gut microbial communities of *Oreochromis niloticus* reared in selected coal void area of Ramgarh, Jharkhand

Jharkhand has the highest coal reserves in India with an estimated 83,152 million tons of coal as per the recent economic survey. Ramgarh is one such coal-rich districts of Jharkhand which is blessed with an abundant coal deposit. The increased mining activities often create empty spaces, referred to as coal mine voids, many of which are usually abandoned. The vast majority of filled water in the abandoned mine voids holds potential benefits for promoting fish culture. The change in the physico-chemical properties of water in the coal void areas often result in the mobilization of heavy metals through aquatic food webs to the fishes that pose human health risks after consumption. The influx of heavy metals in turn alters or modulates the associated gut microbiota of cultured fish. Nile tilapia (*Oreochromis niloticus*) is one of commercially

important and hardy fishes that is widely cultured in coal void areas of Jharkhand. Knowledge pertaining to the metagenomic profiling of gut microbial communities of *Oreochromis niloticus* reared in heavy metal polluted coal void area of Ramgarh is lacking. Thus, a detailed understanding of the taxonomic composition of fish gut microbiota and its functional capabilities are crucial for optimum growth under captive conditions. Metals and metalloids profiling of tilapia muscles was done reared in cage culture of Ramgarh coal void (Test) and Getalsud reservoir (Control) through ICP-MS analysis. Comparative metagenomics of microbial communities in gut of *Oreochromis niloticus* from coal void and Getalsud cage was done using high throughput whole microbiome sequencing.

The highest quantity of microbial load was observed in fish samples of test sites i.e., 4.26 $\times 10^{-5}$ whereas the lowest value were obtained in control sites i.e., 2.24 $\times$ 10^{-5}. Heavy metals such as Li, B, V, Cr, Mn, Co, Ni, Cu, Zn, Se, Ag, Fe was found higher in the muscle of coal void collected fish muscle in comparison to control group. Bacteria was found to be the most abundant domain within the fish gut samples collected from the Control as well as Test (coal void). However, its proportion was markedly different between the two experimental areas. The bacterial groups, *PVC (Planctomycetota, Verrucomicrobiota, Chlamydiota)* bacteria were recognised as the dominating superphylum followed by *Proteobacteria* and *Terrabacteria*. The *Planctomycetes* bacteria were most abundant in fish gut samples collected from the control, while they were least abundant in the gut sample of test **(Figure 12)**. A major difference in the diversity was however, seen within the *Fusobacteria* which decreased to about 17% within the coal void area as compared to the control (40%). Apart from bacteria, other major domains obtained within the stool samples of fishes collected from the two areas, were viruses and eukaryote. The most dominant phylum in the virus domain was found to be *Duplodnaviridae*, in both groups. Apart from bacteria, other major domains obtained within the stool samples of fishes collected from the two areas, were viruses and eukaryote. The most dominant phylum in the virus domain was found to be *Duplodnaviridae*, in both groups. At genus level, *Cetobacterium* comprised of maximum number of OTU (38%) contribution in the fish gut sample collected from Control. At the phylum level, *Fusobacteria* found to be most abundant in the

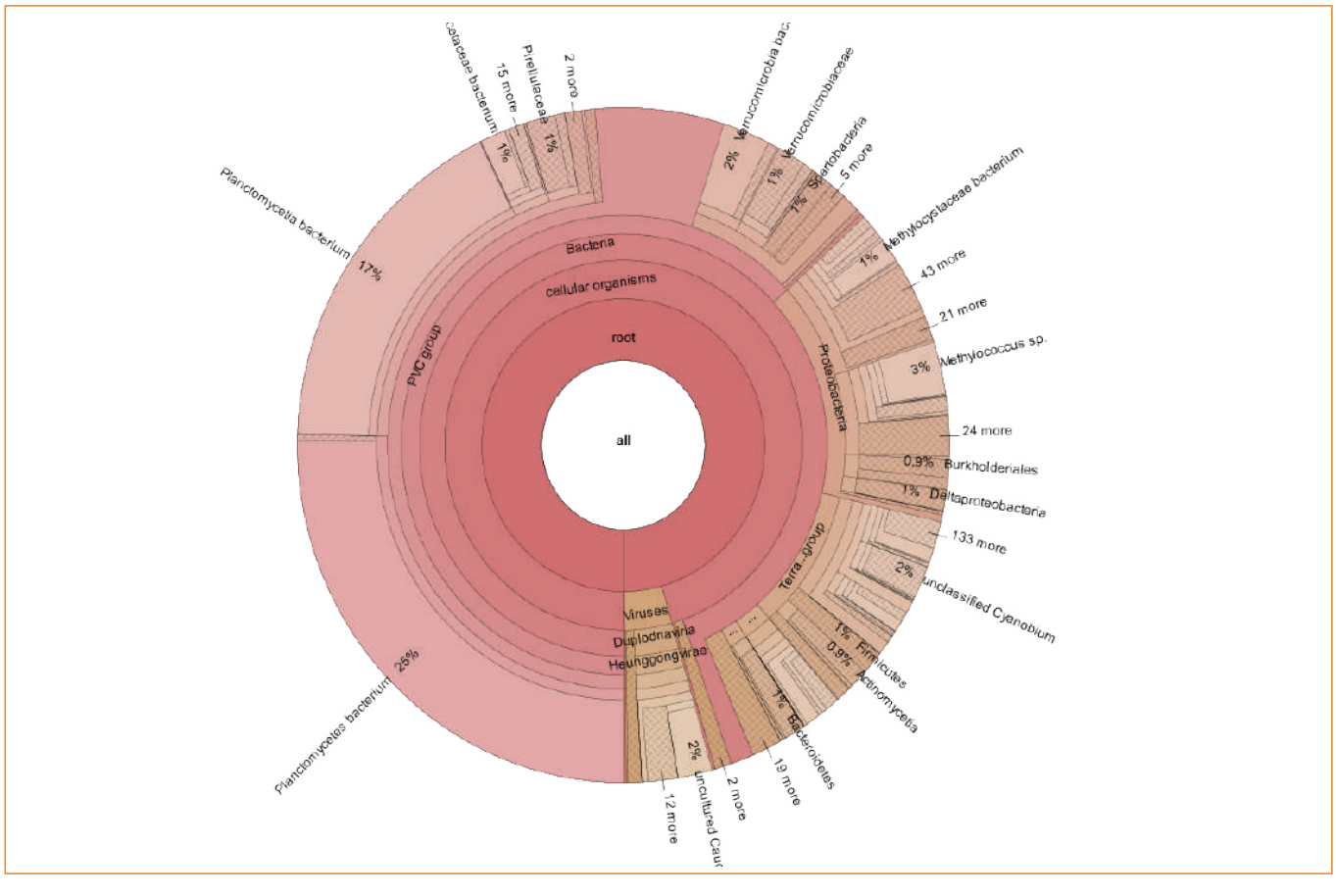


Figure 12. Krona chart displaying the major microbial community composition in the gut of tilapia

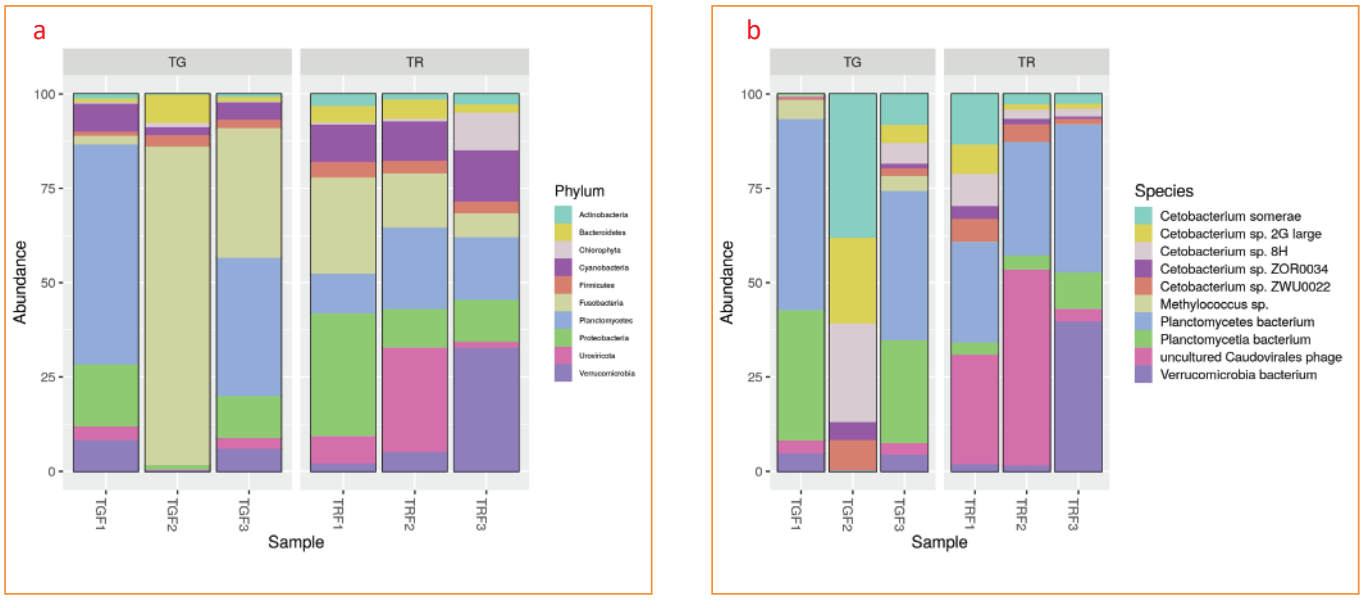


Figure 13. Phylum (a) and bacterial (b) abundance in the fish gut samples of tilapia

fish gut samples collected from control, followed by *Planctomycete* **(Figure 13)**. Significant effect on species richness in terms of Shannon and Simpson indices, whereas non-significant change in Fisher diversity index was deciphered. Also significantly enhanced serum immune biomarkers as well as upregulated expression levels of proinflammatory cytokine and down regulated expression of anti-inflammatory genes in different lymphoid organs were noticed. In future, a combination of metagenomics and meta-transcriptomics will be a useful strategy to decipher the exact role being played by bacterial community in the fish gut.

Evaluating the nano-inspired degradation of aquatic pollutants with special reference to lac dye and jute retting waste-water

Lac dye degradation using ZnO enrich nano particles

Lac dye is a red coloured natural dye obtained during washing of sticklac for preparing seedlac. During crushing and washing, the lac dye gets solubilized in water which in turn is processed to obtain the crystallized dye. Lac dye is a mixture of at least five closely related pure compounds all being anthraquinone derivatives designated as laccaic acid A, B, C, D and E. During the extraction process of lac dye, the proteinaceous material of the lac dye gets degraded and putrefied causing obnoxious smell and water pollution. The remediation of wash water from the lac processing industry is required to control the pollution. Current experiment was conducted for photocatalytic degradation of lac dye using synthesized zinc oxide (ZnO) nanoparticles (NPs) from the wash water. Four different concentrations of ZnO nanoparticle (50, 100, 200, 250 ppm ZnO NPs) was added in the wash water of the seedlac processing **(Figure 14)**. The ZnO NPs treated wash water contaminated with lac dye was exposed to sunlight for six hours. Sample of ZnO NPs treated wash water was collected after every one hour interval. The lac dye content in the ZnO NPs treated wash water were also estimated using UV-Vis spectroscopic method **(Figure 15)**. The results of the photodegradation of the lac dye using ZnO NPs revealed that degradation of 85.02% lac dye was obtained in 250 ppm ZnO NPs treated solution whereas the in the control solution (no ZnO NPs) only 4.54% lac dye degradation was reported **(Figure 16)**. To study the kinetics of the ZnO NPs mediated photocatalytic degradation kinetics the lac dye degradation data was fitted to first order kinetics **(Figure 17)**. The results of the degradation kinetics showed that the T_{50} (time required for 50% degradation of the initial concentration of lac dye) was

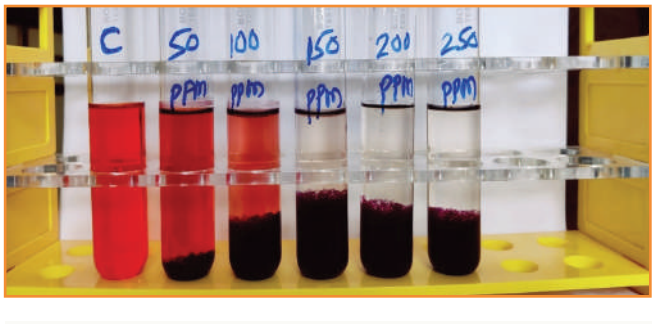


Figure 14. Treatment of lac dye contaminated water with different concentration of ZnO NPs

1.97 hrs for 250 ppm ZnO NPs treated water whereas T_{50} for 50 ppm ZnO NPs treated water was 20.11 hr. The study showed that the wash water from lac processing industry can be remediated by ZnO nanoparticle mediated photocatalytic degradation.

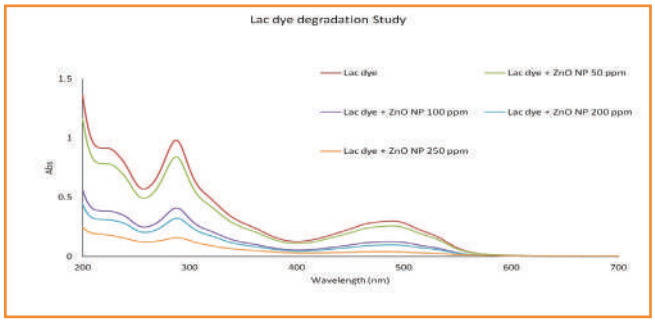


Figure 15. UV-Vis spectra of ZnO NPs treated wash water contaminated with lac dye

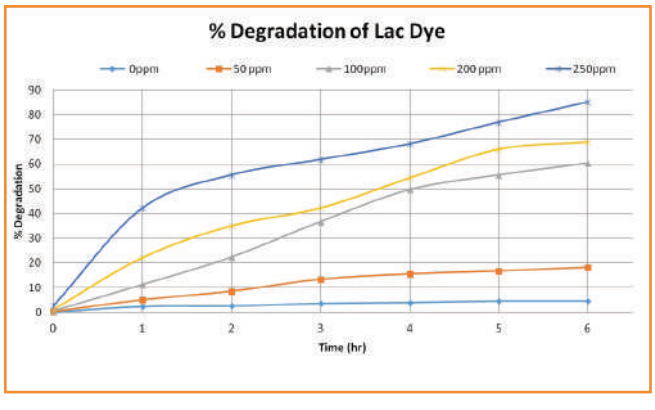


Figure 16. Extent of Lac dye degradation with time at different ZnO NPs doses

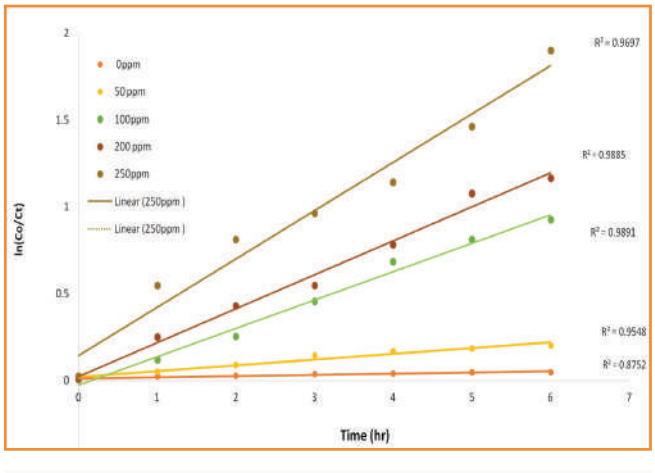


Figure 17. The first-order kinetics of lac dye degradation in the presence of ZnO NPs as catalyst

Molecular insight into the protective role of green copper nanoparticle against *Fusarium oxysporum* in chickpea (*Cicer arietinum*)

Fusarium oxysporum poses a major threat to chickpea cultivation causing significant economic losses through wilt disease with yield reductions ranging from 10% to 100%. Conventional methods like crop rotation and chemical pesticides are ineffective and environmentally concerning. While copper is commonly used as protective measures, its efficacy is limited. In this context, potentiality of copper oxide nanoparticles (CuO NPs) and its efficacy were evaluated as an alternative candidate in addressing

Figure 18. Effect of CuO NPs Treatments against the Chickpea Wilt

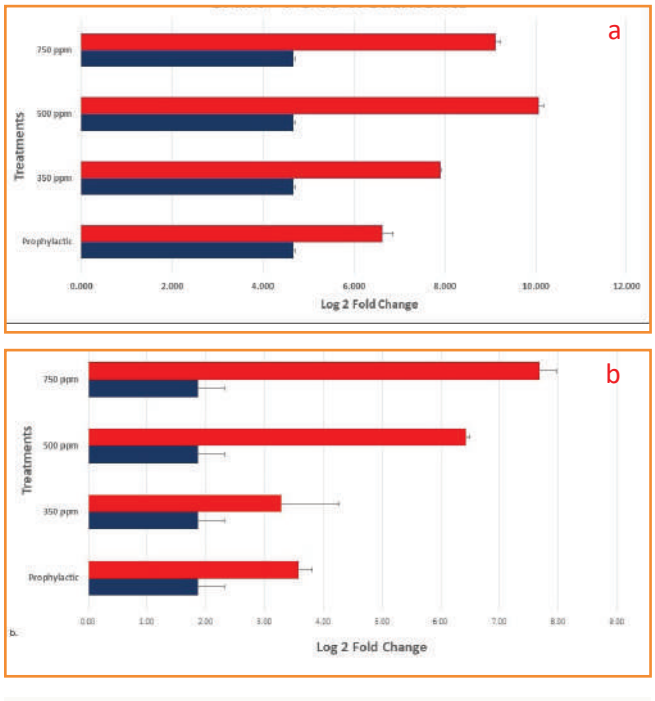


Figure 19. Upregulation of copper responsive defensive genes in the treatment groups compared with positive control against the chickpea wilt (a) GATA (b) CHI F

fungal wilt problems in chickpeas (*Cicer arietinum*). Green-synthesized CuO NPs exhibited UV absorption at 460 nm, electrophoretic light scattering charge at 23.2 mV and an average particle size of 93.05 nm. *In vitro* screening of various nano-copper doses (250 ppm, 350 ppm, 500 ppm, 750 ppm and 1000 ppm) against *F. oxysporum* was conducted using poisoned food technique **(Figure 18)**. Selected doses (500 ppm, 750 ppm and 1000 ppm) were further assessed *in vivo* with the 500ppm treatment demonstrating effective morpho-physiological outcomes supported by histological and FACS analysis. Molecular studies indicated that nano-copper at 500 ppm showed higher upregulation of copper-responsive defensive genes such as Chitinase F (CHI F), GATA against the *Fusarium oxysporum* in comparison with conventional copper sulphate **(Figure 19)**. Thus, CuO NPs at a 500ppm dose demonstrate promising alternative to conventional copper sulphate for preventing wilt diseases in chickpeas.

Development for nutrigarden for addressing malnutrition

A significant percentage of population in Jharkhand and adjoin areas are faced with several nutritional deficiency and associated health issues. Keeping the mind of agro-climatic situation of Chotanagpur plateau region, food habits, resource availability a nutritional

Figure 20. Different crops are being grown in nutrigarden in Farm B of ICAR-IIAB, Ranchi

crop cafeteria has been developed in Farm B of ICAR-IIAB **(Figure 20)**. The garden developed in 500 m^2 area with inclusion of different leafy vegetables (spinach, fenugreek, amaranthus, basella, leafy mustard, coriander etc.), pulses (chickepea, lentil), oilseed (mustard), cereals (wheat, millets), root vegetables (radish, beet root, carrot). A calendar for year-round growing of these nutricrops are being prepared with inclusion of legumes in cropping system mode (in intercropping or in crop sequence). Crop diversification and crop rotation have given major emphasis with organic management practices for growing year-round crops in this crop cafeterias. This nutrigarden not only gives student of IARI Mega university Ranchi hub practical lesson on cultivation of diverse crops, also be used demonstration sites for farmers for cultivating year-round crops (especially nutri rich vegetables and pulses) for achieving food and nutritional security and income generation.

Soil microbiome studies under different land use systems

There is a dire need to design and develop sustainable agricultural food production technologies that can potentially ensure household-level food security with a minimum environmental footprint. It was hypothesized that the farming system model which is an interdependent, interrelated production system and based on crops, fruits, vegetables, livestock, poultry, fish, multipurpose tree species and related subsidiary enterprises in such a way that maximizes the utilization of resources achieve profitable and sustained agricultural production of each component. Soil microbial communities are critical to soil function and contribute to healthy soils. Organic farming, for instance, typically requires tillage for weed control and residue management, but also includes diversified soil C inputs via the use of green and animal manures and crop rotational diversity. Recent studies have observed that bacterial and fungal biomass are higher under organic management compared to no-till or conventional system. However, there is lack of scientific studies on role of soil microbiome in enriching soil environment under different farming systems especially for Chotanagpur Plateau. The effect of different farming systems and organic/inorganic inputs on population and diversity of soil microorganisms will be studied in details. Majority areas of land of Jharkhand follow monocropping and significant areas remains fallow after harvesting of rice, maize, millets etc which can be brought under cultivation with suitable soil and water conservation practices. Efficient use of crop residues in the form of mulch, biochar, compost etc. along with adoption of proper crop rotation, legume inclusion in cropping system etc. sustain soil health and enhance system productivity. The institute being a multidisciplinary institute developing integrated farming system (IFS), integrated organic farming system (IOFS) and integrated natural farming system (INFS) model (one acre area each) for enhancing of cropping intensity, crop and livestock productivity, sustaining soil health and income of resource poor farmers.

Academic Activities of IARI Mega University, Ranchi Hub

Under "One ICAR" and the New Education Policy (NEP), ICAR has created Indian Agricultural Research Institute (IARI) Mega University in a Sun and Planet Concept, in which ICAR-IIAB, is the Nodal Institute of Ranchi Hub involving four ICAR Institutes namely IIAB, National Institute for Secondary Agriculture (NISA), Regional Centre of ICAR-Research Complex for Eastern Region (ICAR-RCER-FSRC), Plandu, Ranchi and Regional Station of National Bureau of Plant Genetic Resources (NBPGR RS), Bhusur, Ranchi **(Figure 21)**. Various programmes including B.Tech. Biotechnology; M.Sc. (Ag.) in four disciplines, *viz*., Genetics and Plant Breeding (GPB), Molecular Biology and Biotechnology (MBB), Agricultural Chemicals and Biochemistry; M.Tech. in Agricultural Processing and Food Engineering (APFE) and Ph.D. in GPB, MBB and Biochemistry are being offered. At present a total of 80 students (47 UG, 26 PG and seven Ph.D.) from all over the Country are enrolled in these programmes.

UG Programme

Ranchi Hub started B. Tech. Biotechnology degree programme in affiliation with ICAR-IARI. The programme started in academic year 2022-23 from the month of January in online mode and from April onwards in offline mode. A total of 28 students were admitted to the first Semester representing different parts of the country. The two semesters of the first year of UG programme have been completed successfully. A total of 21 courses including Biotechnology core courses (7), Deficiency/Remedial courses (4), General courses (4), Basic Science course (1) and Agricultural/ Animal Science Courses (5), have been undertaken successfully. In academic session 2023-24, a total of 19 students have been enrolled in B. Tech. Biotechnology programme.

Figure 21. Institutes in the IARI Mega university, Ranchi hub: (a) ICAR-IIAB (b) ICAR-NISA (c) ICAR-NBPGR (d) ICAR-RCER-FSRC

PG Programme

In the academic year 2022-23, 11 students (six in MBB and five in GPB) completed their M.Sc. programme **(Table 2).** In academic session of 2022-23, a total of 11 students (five in MBB, five in GPB and one in Biochemistry) have took admission in PG programme and their course works have been successfully completed. In 2023-24, altogether 15 students (three in MBB, six in GPB, one in Biochemistry, four in Agricultural Chemicals and one in APFE) have been enrolled in PG programme.

Table 2. Students of M.Sc. programme, research topics and major advisors

Academic Session 2022-23			
Sl. No.	**Name of the student**	**Research Topic**	**Major Advisor**
Molecular Biology and Biotechnology			
1.	Ms. Sradhanjali Jena	Understanding the biochemical and molecular basis of L-DOPA biosynthesis in Faba bean (*Vicia faba* L.)	Dr. Biplab Sarkar
2.	Mr. Sudheer Bishnoi	Investigating the molecular role of seed-coated nanoscale iron in chickpea	Dr. Biplab Sarkar
3.	Mr. Pratik Prasad Singh	Molecular insight into the protective role of green copper nanaoparticle against *Fusarium oxysporum* in chickpea	Dr. Biplab Sarkar
4.	Mr. Ankit Raj	Identification and characterization of long non-coding RNAs (Inc RNAs) related to pod and seed development in winged bean (*Psophocarpus tetragonolobus* L.)	Dr. Kishor U. Tribhuvan
5.	Mr. Shivakumaraswamy M.	Identification and characterization of salt – stress related IncRNAs in Indian Mustard (*Brassica juncea* L.)	Dr. Binay Kumar Singh
6.	Mr. Mustafa N.	Genome-wide identification and characterization of PEBP family genes in winged bean (*Psophocarpus tetragonolobus* L.)	Dr. Binay Kumar Singh
Genetics and Plant Breeding			
7.	Mr. Koppula Satya Sai Kumar	Molecular characterization of rice genotypes using candidate gene markers for NUE and PUE	Dr. Avinash Pandey
8.	Ms. Jaya Kothapelly	Genetic and molecular characterization of rice germplasm for yield and nutritional quality traits	Dr. Vijai Pal Bhadana
9.	Ms. Adepu Priyadarshini	Assessment of genetic diversity in Horse gram germplasm by using SSR markers	Dr. Sudhir Kumar
10.	Mr. Mukesh Raj	Development of SSR markers and their application in revealing genetic diversity in Adzuki bean (*Vigna angularis)*	Dr. Avinash Pandey
11	Ms. Olivia Nianglunhoih	Understanding the dose dependent impact of zinc oxide nanoparticles on the physiology and molecular response in chickpea	Dr. Biplab Sarkar

Seat matrix of IARI Mega University-Ranchi Hub

A total of 16 courses have been taught by the faculties of Ranchi Hub: IIAB, NISA, ICAR-RCER-FSRC and NBPGR-RS. Currently there are 47 UG and 26 PG and seven PhD students, as given in **Table 3.**

Table 3. Seat matrix of IARI Mega University-Ranchi Hub

Programme	Discipline	No. of Admission	Session/Batch
Undergraduate programs			
B.Tech	Biotechnology	28	2022-2026
	Biotechnology	19	2023-2027
Postgraduate programs			
M.Sc. (Agriculture)	Molecular Biology & Biotechnology	5	2022-2024
	Genetics & Plant Breeding	5	2022-2024
	Biochemistry	1	2022-2024
	Molecular Biology & Biotechnology	3	2023-2025
	Genetics & Plant Breeding	6	2023-2025
	Biochemistry	1	2023-2025
	Agricultural chemicals	4	2023-2025
M.Tech.	Agricultural processing and food engineering	1	2023-2025
Doctoral programs			
Ph.D.	Molecular Biology & Biotechnology	2	2023-2026
	Genetics & Plant Breeding	4	2023-2026
	Biochemistry	1	2023-2026

Placement of students

Graduates from our institute have achieved commendable success, secured placements and enrolled in prestigious institutes for higher studies. Many have excelled in competitive exams such as ICAR-SRF, DBT, CSIR-NET, ICMR and GATE. Notably, six students have been admitted to IARI for their Ph.D. studies. Mr. Sudheer Bishnoi, holding an M.Sc. in MBB, emerged as the top scorer in ICAR-JRF and is presently pursuing a Ph.D. at ICAR-IARI, New Delhi. Moreover, Mr. Rajarshri Sanyal, with an M.Sc. in Biochemistry, earned the IARI Merit Medal Award **(Figure 22)** and Mr. Pratik Prasad Singh (MBB) successfully qualified GATE, DBT-SRF and ICAR-SRF and is currently pursuing Ph.D. at IIT, Kharagpur.

Figure 22. Mr. Rajarshi Sanyal receiving IARI gold medal in Plant Biochemistry on 61st Convocation of IARI, New Delhi

Lab facilities

ICAR-IIAB is equipped with state-of-the-art laboratory facilities designed to support cutting-edge research in agricultural biotechnology **(Figure 23).** The institute boasts well-equipped molecular biology and genetics labs, where scientists and researchers engage in the study of plant genetics, genomics and molecular mechanisms. Advanced facilities such as HPLC, CASA, Zeita nalyzer and FTIR are integral components of these facilities **(Figure 24).**

Figure 23. Laboratory facility available at the institute for UG, PG and Ph.D. students

Figure 24. Instrumentation facilities procured and installed in the year, 2023 (a) Computer Assisted Semen Analyzer (b) Zeta Potential Analyzer and (c) Rotary evaporator

Outreach activities

Tribal Sub Plan (TSP)

Kisan Gosthi

The Kisan Gosthi organized by ICAR-IIAB is a noteworthy event aimed at facilitating direct communication between agricultural scientists and farmers. During the Kisan Gosthi, farmers gather to interact with experts from ICAR-IIAB to discuss and address various agricultural challenges, exchange knowledge and learn about innovative farming practices. Another Kisan Goshthi was organised under TSP on June 22, 2023 in which around tribal 500 farmers were participated. Mr. Pradeep Hazari, Special Secretary and Adviser, Department of Agriculture, Animal Husbandry and Cooperative, Govt. of Jharkhand presided the programme and distributed improved varieties of paddy seeds to the farmers. Kisan sangoshti was organized on September 20, 2023 in which around 250 farmers were participated. Hon'ble ICAR DG, Dr. Himanshu Pathak distributed several agricultural inputs on this occasion. On December 16, 2023 Hon'ble Minister, Agriculture and Farmers Welfare, Govt. of India, Sh. Arjun Munda along with Hon'ble MP Ranchi, Sh. Sanjay Seth during December, 2023 visited the institute. On this occasion, a Kisan Gosthi was organized (**Figure 25**). Around two-hundred farmers were provided with area-specific chelated mineral mixture for livestock and poultry under TSP on this occasion. Several other Kisan Gosthi's were also organized by the institute as mentioned in **Table 4**.

Table 4: List of Kisan Gosthi organized by ICAR-IIAB, Ranchi during the year 2023

Sl. No.	Activity	Date	No. of Participants
1	Millet Awareness Programme	Feb. 02	~150
2	Kisan Goshti under TSP	June 22	~500
3	Kisan Songoshti on millet awareness and input distribution under TSP	Sept. 20	~250
4	Kisan Goshti cum in-put distribution under TSP	Dec. 16	~250

Figure 25. Organization of Kisan Gosthi on visit of Hon'ble Minister, Agriculture and Farmers Welfare, Govt. of India, Sh. Arjun Munda on December 16, 2023

Training and Input distribution Programme

Distribution of seeds of high yielding varieties

In current year, ICAR-IIAB, Ranchi conferred wide activities and execution in TSP component encompassing distribution of high yielding seed varieties of rice and mustard, farm implements, development of animal sheds, natural farming systems, distribution of mango saplings, awareness as well as distribution of teaching and amusement modules to adjacent schools of ICAR-IIAB, Ranchi. These programmes were led and executed primarily by ICAR-IIAB, Ranchi in collaboration with Divyayan KVK, Ranchi, KVK East Singhbhum and ICAR-CISH, Lucknow. Some of the important events conducted by ICAR-IIAB, Ranchi can be enumerated under following narratives.

On June 21, 2023, paddy seeds distribution programme was held at ICAR-IIAB, Ranchi campus and it reached to 358 farmers participated in this event. Mr. Pradeep Hazari, Special Secretary and Advisor, Department of

Figure 26. Mr. Pradeep Hazari, Special Secretary and Advisor, Department of Agriculture, Animal Husbandry and Cooperative, Govt. of Jharkhand distributing paddy seeds to the tribal farmers

Figure 27. Hon'ble Union Minister for Agriculture and Farmers Welfare, Sh. Arjun Munda distributing seeds of improved varieties and animal feed under the TSP

Agriculture, Animal Husbandry and Cooperative, Govt. of Jharkhand graced the occasion as chief guest. A total of 8,840 kg high-yielding and drought-tolerant rice seeds were distributed among participating farmers **(Figure 26).** Besides distribution, farmer-scientist interaction and agri- exposure lectures were also shared to increase knowledge and awareness among the tribal farmers.

On December 16, 2023, Hon'ble Union Minister for Agriculture and Farmers Welfare, Sh. Arjun Munda visited ICAR-Indian Institute of Agricultural Biotechnology, Ranchi. Besides focusing on farmer's livelihood and income generation, minister emphasized the importance of trees for environmental protection and suggested for planting more trees in the institute premises. Dr. Sujay Rakshit, Director, ICAR-IIAB, Ranchi presented a comprehensive plan to increase cropping intensity, system productivity and farmer livelihoods in the region. Farmers received agricultural inputs like improved seeds, area-specific chelated mineral mixture, vermicompost and feed under the "Tribal Sub Plan" initiative **(Figure 27).**

Distribution of Kadaknath chicken and Poultry farming training

ICAR-IIAB, Ranchi organized a training and distribution programme for Kadaknath poultry farming on April 20 -21, 2023 supported by the ICAR-Indian Institute of Banking and Rural Development (ICAR-IIBR), Garhwa, Ranchi **(Figure 28).** A total of 152 tribal farming families residing in Chota Baru, Gajgavan, Siankel and Otoongora under Murhu and Khunti blocks in Khunti district were provided with ten Kadaknath chicks each and poultry feed. Farmers were given information on the management of poultry units, especially health care and disease prevention. The programme

Figure 28. Training and distribution programme for Kadaknath poultry farming

was organized in collaboration with Sini Tata Trust and Nav Bharat Jagriti Kendra. It was highlighted thatprogramme Kadaknath is an Indian poultry breed, also known as Kalimasi. It originated in Dhar and Jhabua districts of Madhya Pradesh and has received the Geographical Indication (GI) tag. Kadaknath is popular for its adaptability and dark-colored meat. The weight of the rooster can reach up to 2 kg, hens up to 1.5 kg and the eggsare of brown colour. Due to its widespread popularity, Kadaknath meat is relatively expensive, contributing to the increase in farmers' income. Sini Tata Trust, along with Mr. Somanath Das and Nav Bharat Jagriti Kendra, along with Mr. Mohit Purti and their teams, provided significant support for the programme.

Training on scientific aquaculture practises

A three-day training programme on "Enhancing livelihood and nutritional security of tribal farmers through scientific aquaculture practices" (February 21-23, 2023) under Tribal Sub Plan (TSP) for aqua farmers **(Figure 29).** The three-day training programme on "Enhancing Livelihood and Nutritional Security of Fish Farmers through Scientific Aquaculture Practices," organized by ICAR-IIAB, under the Tribal Sub-Plan (TSP),

Figure 29. Training programme on scientific aquaculture practices

witnessed active participation. In this programme, farmers were encouraged to adopt new techniques in fish farming through aquaculture. It was also highlighted that fish farming can bring revolutionary changes in the country and eastern region of India can play a leading role. During the training programme the importance of scientific fish farming and new technologies such as biofloc, Recirculatory Aquaculture System (RAS) and cage culture were highlighted.

Fish seed distribution programme under TSP

Under the TSP project, Fish seed distribution programme was organized on September 12, 2023. During the programme, local farmers of village Tetri, Kharsidag, Malti and Garhkhatanga were given advance fingerlings for stocking in their ponds **(Figure 30)**. Advanced fingerlings of Indian Major Carps (IMCs) namely, Catla (60%), Rohu (20%) and Mrigal (20%) were distributed among the beneficiary farmers who have prepared their ponds for stocking. The farmers were also trained on the role of balance nourishment and additional feeding for cultivation of fish. The farmers were impressed that good quality seed of IMCs not only offers improved growth to fish but also prevents the occurrence of infections triggered by weakened immunity.

Figure 30. Fish seed distribution programme to tribal fishermen

Farmer's Scientist Interaction meet cum fish feed distribution programme

A Fish feed distribution programmes was organized on December 16, 2023 for the 24 ST beneficiary of Jharkhand under TSP. On this occasion a Farmer's scientist interaction meet cum advisory programme for the scientific management of aquaculture was also organized for the local farmers of nearby villages of the institute. The programme aimed at capacity building of TSP farmers for improvement of their livelihood and income generation. During the programme, farmers were trained on the role of balance nutrition and supplementary feeding for aqua-culturable fish **(Figure 31).** It was highlighted that nutritionally supplemented feed , not only provides better development of the fish, but also prevents the incidence of diseases caused by weakened immunity.

Figure 31. Fish feed distribution to the tribal farmers

Distribution of cutting-edge teaching aids

ICAR-IIAB took an initiative to equip tribal-dominated schools with cutting-edge teaching aids (computers, television) for promoting their education system. A programme was held on September 20, 2023 and the DG, ICAR & Secretary, DARE, Dr. Himanshu Pathak handed over the teaching aids to Rajkiyakrit Utkramit Madhya Vidyalaya Kochbong, Namkum, Ranchi. The programme was also graced by Dr. D.K. Yadava, ADG (Seeds), ICAR and Dr. Anup Das, Director, ICAR-RCER, Patna along with scientists and school students. The teachers and students were made aware about agricultural sciences and use of advanced teaching aids to promote e-governance **(Figure 32)**. In another initiative, children amusement park, nutri-garden and floral beautification were developed to elate the educational environment in a nearby tribal-dominated school at Garkhatanga. To promote e-governance, multifunctional printer was also handed over to the local Panchayat Office.

Figure 32. Distribution of digital aids by Hon'ble DG, ICAR & Secretary DARE, Dr. Himanshu Pathak

Schedule Caste Sub Plan (SCSP)

During the year 2023, the institute worked with different organizations for implementation of beneficial agricultural interventions for the people/farmers belonging to SC community through technical and/or fund support. Some of the notable collaborators were WBUAFS Kolkata, KVK Kaimur, KVK Nawada, KVK Kalyan, KVK Angul, KVK Sambalpur (OUAT Bhubaneswar), Rathindra KVK Sriniketan (Visva Bharati, Santiniketan), KVK Malda (CISH Lucknow), CISH RRS Malda, Jagruk Mahila Farmer Producer Co. Ltd. (through CInI – TATA TRUSTS) and Divyayan KVK, Ranchi. Inputs in the forms of seeds and saplings, animals and animals feed, small agricultural tools, etc. were provided along with services like animal health camp and soil/water testing. Three Custom Hiring Centres (CHC) and one Demonstration cum Training Facility have been taken up and agricultural equipment like Tractor, Rotavator, Mill, etc. have been procured which were used by more than 900 beneficiaries. One CHC in KVK, Sonamukhi, Bankura, West Bengal was inaugurated by Hon'ble DG, ICAR & Secretary, DARE **(Figure 33),** during which he has also launched a programme on Livelihood improvement of SC farmers. A total of 68 trainings/ awareness camps/exposure visits/ On Farm Trials (OFTs) and Front-Line Demonstrations (FLDs) were organized that benefitted about 1,920 farmers. A total of 4,638 farmers got benefitted under SCSP during the reporting period (**Table 5**).

Table 5. Number of programmes/events organised under SCSP and number of beneficiaries

Particulars		Number of events/ programmes	Number of Beneficiaries
Trainings (Capacity building/ Skill Development etc.)		30	2270
Awareness camps, exposure visits etc.		18	770
Input Distribution			
1	Seeds (Field Crops)	12 tonnes	1750
2	Animals-small (pig, sheep, goat etc.)	100	33
3	small equipment's (upto Rs 2000)	3500	3500
4	Medium Equipment's/ machinery (upto Rs 25000)	70	140
5	Large Equipment's / machinery (> Rs. 25000)	1	20
6	Plant growth Promoter		580
7	Animal Feed	5.8 tonnes	
8	Animal Health Camps	2	250
9	Awareness camps and exposure visits	6	400
10	Other activities	5	50

Figure 33. Dr. Himanshu Pathak, Secretary DARE & DG, ICAR inaugurated the Custom Hiring Centre established at KVK Sonamukhi under SCSP with aid from ICAR-IIAB

Workshop on 'Implementable Technologies for Chotanagpur Plateau region of Eastern India'

ICAR-IIAB participated in Workshop on 'Implementable Technologies for Chotanagpur Plateau region of Eastern India', organized by ICAR-ATARI, Kolkata at KVK Kalyan, Purulia, West Bengal on May 22, 2023 which was chaired by the Hon'ble DG, ICAR & Secretary, DARE. Offer of support through SCSP and TSP on cow shed, AI in goats using liquid semen for conservation and promotion of Black Bengal goat, entrepreneurship development in poultry through handholding and providing support like hatchery, sourcing of quality eggs for breeding purpose, etc. were made. This has subsequently been followed up by online Review Meeting, organised by ICAR-ATARI, Kolkata on July 26,

2023. The KVKs located in Chotanagpur Plateau region have been supported under SCSP scheme for different modules of agriculture under this initiative.

North-Eastern Himalayan Component (NEH)

Under the NEH component, the institute has undertaken activities for biotechnological research on commodities of significance in the NEH region and the distribution of inputs among farmers to promote these commodities in a collaborative project mode with ICAR institutes situated in the NEH Region.

In this regard a collaborative project entitled "Designing and validation of a breed–specific customized SNP chip for Arunachali Yak" started in collaboration with ICAR-NRC on Yak, Arunachal Pradesh. Arunachali Yak is the only registered breed of yak in India to date. However, the population of Arunachali Yak is facing constant threats due to unscientific breeding practices like inbreeding, indiscriminate cross-breeding with cattle, etc. leading to a decline in effective population size and dilution of germplasm. The project includes activities like collecting blood samples from Arunachali Yak, DNA isolation, quantification and quality checks as initial steps. The collected blood and isolated DNA of Arunachali yak samples will act as a genomic bank for the precious germplasm in addition to its use in the project. The project will eventually help in exploiting the full genomic potential of this bovine by developing the ability to efficiently scan the genome-wide variations for diverse phenotypes in the Arunachali Yak population and genetic improvement of economic traits, thereby ensuring the long-term sustainability and conservation of the breed.

NEH region, home to about 850 orchid species, has always been considered a highly potential region for the promotion of orchid cultivation and trade, mainly due to the unique climatic suitability for growing highly priced temperate orchids, such as Cymbidium, Paphiopedilum, etc. However, the potential still needs to be realized in the region. Venturing into orchid cultivation and trade by small and marginal farmers in NEH suffers from the major bottlenecks of initial investment in polyhouses / structural requirements for growing orchids and procurement of tissue-cultured planting material by the orchid growers. Support in these two aspects can help the orchid growers/farmers in the region in a big way. Considering this potential, a project entitled "Promotion of Orchids in Sikkim for Enhanced Livelihood Security" started in collaboration with ICAR-NRC for Orchids, Pakyong, Sikkim. Under this project, twelve naturally ventilated polyhouses (100 sq m) and 8,000 tissue culture hardened plants of 1.5 years of age will be distributed among the farmer group, along with inputs in the form of nutrients / organic formulations for orchid culture.

Mera Gaon Mera Gaurav (MGMG)

To undertake Mera Gaon Mera Gaurav programme of the Govt. of India, two multidisciplinary teams were constituted involving scientists of ICAR-IIAB during 2023. Ten villages in two districts (Ranchi and Ramgarh) of Jharkhand were selected under the programme, to cover about 450 farmers. Under the programme, specific awareness programme was launched for "eco-friendly agriculture", *viz.*, organic farming and natural farming. General sensitization programme was done on crop diversification, double cropping, utilization of paddy fellow land, water conservation, soil conservation etc. Scientist from ICAR-IIAB Ranchi has provided the information to villagers regarding various GOI schemes, programmes and new initiatives for farmers. During the visit, scientists have highlighted the importance of growing high value crops under protected cultivation. Special campaign was launched on Swachhta Abhiyan programme in adopted villages. Under swachhta programme, Cleanliness and sanitation drive was done in Lalkhatanga and Garkhantanga villages involving village community. Demonstration cum sensitization programme was also organized for deworming of pigs, vaccination and artificial insemination in cattle. Special programme was organized for aquaculture, cage culture, ornamental fish farming and value addition of fish products. Technical supports being provided through meeting, discussions and mobile advisory on various aspect of agriculture & allied activities.

Figure 34. Swachhta Programme under Mera Gaon Mera Gaurav at Village Gharkhatanga

Other Institutional Activities

Institute Technology Management Unit (ITMU)

New Institute Technology Management committee (ITMC) was constituted on January, 2023 with a renewed focus on various technology management activities, i.e., IP awareness, plant varieties protection and patenting etc. In this year, ITMU unit organized several seminars and guest lectures on relevant topics. Dr. Pragyan Pushpanjali, Assistant Professor, Central University of Jharkhand delivered a lecture on “Women and IP: Accdoroting Innovation and Creativity” **(Figure 35)**. Dr. Santosh Kumar Prusty, Assistant Professor, Indian Institute of Management (IIM), Ranchi explored the essence of entrepreneurship in his deliberations emphasizing gap analysis, financial strategies for start-ups and the role of advertising. In this context, Mr. Manoj Prabhakar, Director, Better World Foundation, Ranchi discussed the connection between innovation and entrepreneurship in the context of agriculture and rural development. Protection of the institute’s logo is crucial for maintaining brand identity and preventing unauthorized use. ITMU took initiative and steps towards Trademark registration of Institute logo. Registering institutional literary works ensures ownership and proper classification within the publishing ecosystem. This initiative was also taken up in this year. This could facilitate wider distribution and visibility of the institute publications. Wide Patent-Art-search of institutional research database, copyright of some institutional publications and organizing seminar on Plant Variety Protection And Farmers Rights (PPVFR) are some of the other new targeted activities for the year 2024.

Figure 35. Dr. Pragyan Pushpanjali delivered a lecture on "Women and IP : Accelerating Innovation and Creativity"

Agri-Business Incubation Centre

The Agri-Business Incubation Centre Unit of ICAR-IIAB was inagurated by the Secretary, DARE and Director General, ICAR on Febraury 2, 2023 (**Figure 36**). It has been realised that adopting tissue culture techniques for strawberry and dragon fruit cultivation can revolutionize this sector in Jharkhand. Tissue culture enables the mass production of disease-free and genetically uniform plants, ensuring higher yields and superior quality fruits. This method not only accelerates the propagation process but also addresses the challenges of diseases that often hinder traditional cultivation. Accordingly, a protocol has been standardized for direct and indirect organogenesis in strawaberry and dragon fruit. The tissue cultured grown strawberry plantlets were transferred to the polyhouse where they are growing successfully (**Figure 37**). Attempts are being made for dragon fruits too. The developed protocol holds the potential to be comercialised.

Figure 36. Agri-Business Incubation Centre establishment (a) and its inauguration by the DG, ICAR & Secretary, DARE (b)

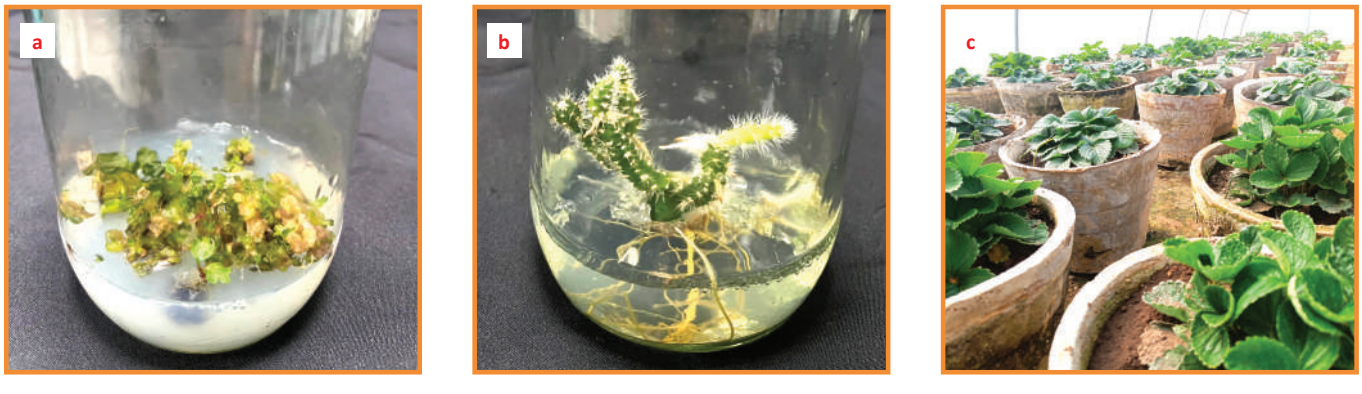


Figure 37. Micropropagation of strawberry (a) and dragon fruit (b) in tissue culture facility and successful growth of strawberry plants under polyhouse condition (c)

Important Institutional meetings

Research Advisory Committee (RAC)

The 10th meeting of the Research Advisory Committee (RAC) of the institute was held during February 2-3, 2023 under the chairmanship of Dr. Swapan Kumar Datta (former DDG Crop Science, ICAR) to review the progress of research programmes. Hon'ble Members, Dr. R. Srinivasan (Former Director, ICAR NRCPB), Dr. S.M. Deb (Former Director, ICAR NRC on Yak and Pr. Scientist & Head I/c, NDRI ERS), Prof. A.K. Pal (Former Joint Director, ICAR-CIFE), Dr. Sujay Rakshit, Director and scientific staff of the institute attended the meeting **(Figure 38).**

In his introductory remarks the Chairman explained that since the institute is a multicommodity institute, research works should be in an interface mode involving plant, animal and fisheries. Other members acknowledged the challenges of manpower and infrastructure requirement of the institute, however, stressed up on the need to intensify the research activities to meet the mandates. Thereafter, the Director briefly presented the salient achievements of the institute in both research and academics made during 2022. He emphasised the initiatives made by the institute towards human resource development as from current academic session (2022-23), the B.Tech. (Biotech.) course has been started with 30 seats besides the ongoing PG programme in MBB, Biochemistry and GPB. He further made a note that with only 11 scientific and five administrative staff, the scientists could able to publish in high impact journals of national and international repute along with significant progress in outreach activities. The Action Taken Report (ATR) on the recommendations made by the last RAC was presented by Dr. Madan Kumar, Member Secretary, for which the members conveyed their contentment. It was followed by the presentations made by head of schools about the detailed research accomplishments made by the respective scientists during 2022. Dr. V.P. Bhadana, PS and Joint Director (Academic I/c), presented the academic activities of the institute. The necessary suggestions made during the scientific interaction was recorded. The RAC committee also inspected the existing laboratories and field facilities; and made interaction with the students.

Institute Research Council (IRC)

The Institute Research Council (IRC) was held on July 22 and 29, 2023 under the chairmanship of the Director to review the progress of ongoing research projects in the institute. Dr. Shivendra Kumar, retired Head of ICAR-RCER-FSRC, Plandu, Ranchi, served as the external expert in the meeting. Presentations were made by the Project Investigators (PIs) from the SGMB on July 22, 2023 and from the SMDPN and SGE on July 29, 2023. In the meeting, the progress of ten institutional and one inter-institutional approved projects were reviewed. Overall, the chairman and the experts expressed satisfaction with the progress made in the projects and

Figure 38. Scientists interacting with RAC members

made appropriate suggestions and recommendations for improving the research projects. The Director encouraged the scientists to seek external funding for their research work and were advised to explore corporate social responsibility (CSR) funds from private entities/PSUs. Due to recent upgradation in institute's scientific strength, the house agreed to initiate interdisciplinary research at the interface of crop-animal-fisheries-microbes. The expert encouraged scientists to also initiate need-based studies such as rice-fallow management, land degradation, aluminium toxicity, etc. taking into account the agroclimatic conditions of Jharkhand and neighbouring states. He focused on the importance of pursuing research proposals related to cropping/farming systems mode for enhancing the livelihood, food and nutritional security of farmers. The member secretary of PME noted the important recommendation made during the meeting and proposed the vote of thanks.

Institute Management Committee (IMC)

The seventh meeting of the Institute Management Committee (IMC) of ICAR-IIAB, Ranchi was convened on May 4, 2023. Six members of the committee, including Dr. D. K. Yadav, ADG, ICAR, New Delhi; Sh. G.P. Sharma, JS (Finance), ICAR, New Delhi; Dr. A. K. Singh, Head, ICAR-RCER-FSRC, Ranchi; Dr. Soumen Ghoshal, PS, ICAR-NISA, Ranchi Dr. V.P. Bhadana, PS, ICAR-IIAB, Ranchi; and Dr. S.B. Choudhary, Head, ICAR-NBPGR, R.S., Ranchi and four invitees including school heads and CF&AO, of ICAR-IIAB attended the meeting. At the offset, Dr. Sujay Rakshit, Director and chairman of IMC, welcomed all the participants and made a brief account of scientific achievements, academic activities and infrastructural development accomplished at the Institute. The chairman further urged the members to offer suggestions for the overall development of the institute. Sh. B. K. Sinha, CAO(SG), ICAR-IIAB and Member Secretary of IMC presented the agenda of the meeting. He placed before the committee the approval of council's on the proceedings of the 6th IMC and the same was confirmed. Then discussion was made on different agenda items such as utilization of funds and procurement of equipment for the financial year 2022-23, staff position as on March 31, 2023. Proposals for the purchase of a new bus and leasing of 40,000 sq. ft. land for installation of 33/11KVA electricity substation to Jharkhand Bijli Vitaran Nigam Limited (JBVNL), Ranchi was agreed by the IMC. Dr. Yadava lauded the accomplishments of the institute made in recent times and called for the strengthening of scientific power and assured of desired support from the council. Sh. Sharma expressed satisfaction with the utilization of funds of the institute and emphasized the need for enhancing the internal revenue generation at the institute. All members appreciated the overall accomplishment of the institute.

Major Events

Millet Awareness Programme

ICAR-IIAB organised a one-day stakeholders' campaign on millets on January 22, 2023. The campaign sought to raise awareness about the nutritional benefits of millets and their role in ensuring food security in climate change conditions. Over 200 farmers, entrepreneurs, scientists from different institutes and students took part in this event. The campaign was chaired by Dr. Himanshu Pathak, DG, ICAR and Secretary, DARE. He inaugurated the first issue of कृषि ओमिकी, a hindi magazine published by the institute **(Figure 39)**. During his address to the gathering, he highlighted the significance of millets in diets, as well as their role in increasing farmers' income. The meeting was also attended by Dr. Swapan Datta, Ex-DDG (CS), ICAR who emphasized the role of scientists on encouraging Indian farmers to accept and cultivate millet grains. Addressing the gathering, Dr. Sujay Rakshit, Director, ICAR-IIAB informed the gathering about the involvement of the institute in popularizing millets among the rural mass in Jharkhand. He emphasized that the millets shall be an essential element in a typical cereal based diet suggesting the significance of millets in the prevention and treatment of prevalent human diseases. During this campaign, entrepreneurs and startups showcased their millet-based products, highlighting the possibilities for technical commercialization in industry.

Figure 39. Release of the first of issue of "कृषि ओमिकी", by Hon'ble DG, ICAR and Secretary, DARE

Meeting with NABARD for developing entrepreneurs in agricultural biotechnology

A team of 17 District Development Managers (DDMs) of National Bank for Agriculture and Rural Development (NABARD) Jharkhand had their exposure visit to ICAR-Indian Institute of Agricultural Biotechnology, Garhkhatanga, Ranchi on March 25, 2023. The NABARD team was led by Dr. MS Rao, Chief General Manager (CGM) and Er. Jay Nigam, Deputy General Manager (DGM). From IIAB Dr. V.P. Bhadana and Dr. Soumen Naskar coordinated the visit **(Figure 40)**. The DDMs had visit to various biotech labs and interacted with the scientists. On this occasion, a brainstorming session on the opportunities for collaboration, cooperation and convergence was held. In his welcome address Dr. Sujay Rakshit, Director, IIAB highlighted that the institute can contribute significantly in skill development among the youths to improve their employability or to turn them entrepreneurs. Few technologies like tissue culture propagation of strawberry, banana, papaya and bamboo, sex-sorted semen in cattle to increase female cattle population in milk and micro-vaccination centers for goat, pig and poultry for augmenting meat and egg production were shortlisted for possible upscaling at field level in the coming years using the network and capabilities of line departments, FPOs and Primary Agricultural Credit Society (PACS), where IIAB will be the knowledge partner. CGM NABARD, Dr. M.S. Rao offered specializations available with NABARD like consultancies for entrepreneurship building, mushroom production, micropropagation and biotechnology as services.

Figure 40. Brainstorming session on the opportunities for collaboration, cooperation and convergence between NABARD and ICAR-IIAB, staff

Fresher's welcome Programme

The Fresher's Welcome Program was a lively, vibrant and an engaging event organized on May 10, 2023 to welcome new students to the academic community of ICAR-IIAB (**Figure 41**). The program featured a mix of cultural performances, speeches by faculty and senior students and interactive sessions to help incoming students familiarize themselves with the institute's culture, facilities and academic expectations. The aim of the event was to create a warm and inclusive atmosphere, fostering a sense of belonging among the newcomers.

Figure 41. A glimpse of Freshers' Welcome Programme (BIOBLAST 2023)

Initiatives for igniting young minds

The institute hosted two exposure visits for girl students of Jawaharlal Nehru Vidyalay (JNV), Gumla and their teachers during March and November (**Figure 42**). The visits were organized by ICAR-IIAB as knowledge partner under Vigyan Jyoti programme promoted by Department of Science and Technology (DST), Govt. of India. The programme aims to bridge the gender gap in science, technology, engineering and mathematics (STEM). Dr. Soumen Naskar and Dr. Sujit Kumar Bishi of ICAR-IIAB coordinated the visit. Dr. Sujay Rakshit, Director, ICAR-IIAB invited the students to be inquisitive on everything around them and cultivate the habit of questioning any phenomenon to find the answer behind these. The students enthusiastically interacted with the faculties and research scholars of the Institute. Khushi Kumari (Class XI - Science), Nutan Kumari (Class IX), along with other students were jubilant with the opportunity to interact with the scientists and visit the biotechnology labs. In their words, "we saw a living and moving animal cell for first time" on seeing a spermatozoa of cattle under microscope, or "we have heard about this instrument a lot during COVID time, but we are seeing here it working" on demonstration of a real-time PCR.

On February 4, 2023, a total of 90 school teachers from Sacred Heart School, Huluhundu, Ranchi had the opportunity to explore the research and academic facilities at the institutes (**Figure 43**). During this visit, the teachers gained valuable insights into the institute's research activities, witnessing first-hand the advanced technologies and methodologies employed in agricultural biotechnology.

Figure 42. Vist of girl students and teachers of JNV, Gumla and their interaction with scientists

Figure 43. Visit by school teachers from the state of Jharkhand

On December 2, 2023, the institute welcomed 200 girl students again from Sacred Heart School, Huluhundu, Ranchi who not only toured the laboratories but also had the chance to interact directly with the scientists. This interactive session likely provided the students with a unique opportunity to ask questions, learn about ongoing research projects and gain inspiration for potential future careers in science.

International Yoga Day

On June 21, 2023, ICAR-IIAB celebrated International Yoga Day **(Figure 44)**. Professional yoga instructor, Sh. Rakesh Bhramar guided the participating staff and students, elucidating various Asanas, Pranayama and Mudras, emphasizing their positive impact on maintaining both physical and mental well-being in daily life. During the concluding ceremony, the Director, underscored the holistic benefits of yoga in promoting mental health, stress reduction and enhanced daily energy. He emphasized the significance of yoga for scientists and students for their personal and professional growth.

Figure 44. Staffs performing pranayama on International Yoga Day

World Environment Day

To commemorate the World Environment Day, on June 5, 2023 a mass plantation drive was organised at the institute. Sh. A. Siddiqui, IAS, Secretary Agriculture, Govt. of Jharkhand graced the occasion as chief guest and initiated the plantation drive by staff and students. More than one thousand saplings of different avenue trees, *viz*., Neem (*Azadirachta indica*), Jacaranda (*Jacaranda mimosifolia*), Ashoka (*Saraca asoca*), Gulmohar (*Delonix regia*), Kath Champa (*Plumeria* spp.), Amaltas (*Casia fistula*), Moulsiri (*Mimusops elengi*), Bottle palm (*Hyophorbe lagenicaulis*) etc. were planted in the institute campus **(Figure 45)**. While addressing the students, Mr. Siddiqui highlighted the importance of plantation and encouraged them to become environment friendly. He commended the outstanding work taken up by the institute to make the campus clean and green.

Figure 45: Plantations of different avenue trees in Farm B, ICAR-IIAB

Parthenium Awareness Week

The institute observed "18th Parthenium Awareness Week" during August 16-22, 2023. On this occassion, mass Parthenium (carrot weed/gajar grass) removal and awareness programme were organized. To create awareness about the harmful effect of Parthaniumposters and banners were displayed at different place. All faculties, administrative and supporting staffs along with B. Tech and M. Tech students of the institute participated in the programme **(Figure 46)**. Dr. Jayanta Layek, Sr. Scientist (Agronomy) spoke in details about the weed, its introduction in India, harmful effects, spread across the country and effective management strategies. Thereafter, all the staffs and students took active participation in the

uprooting of the weed from IIAB campus and safe disposal in the form of composting.


Figure 46. Faculty and students removing Parthenium from the campus

Knolwedge sharing through regular seminars

As a new initiative in academics, a special lecture series has been started for the updating knowledge among faculty and students. The inaugural lecture was delivered by the Director. As a part of this lecture series, experts from different fields including in house staff are invited to deliver talks in the are of expertise **(Figure 47; Table. 6).**

Table 6. List of speakers delivered lecture in regular seminars series

Sl. No.	Speaker	Date	Lecture topic
1	Dr. Sujay Rakshit, IIAB, Ranchi	August 29, 2023	How to publish research papers in high visibility Journals
2	Dr. Kishore Kumar Krishnani, IIAB, Ranchi	September 11, 2023	Current IPR regimes: Challenges and opportunities in technology development and commercialisation
3	Dr. Santosh Kumar Prusty, IIM, Ranchi	September 18, 2023	What are we talking when we talk about Entrepreneurship
4	Dr. Soumen Naskar, IIAB, Ranchi	November 28, 2023	National Education Policy
5	Dr. Jayanta Layek, IIAB, Ranchi	December 6, 2023	Farming System: Key to Success of Organic Agriculture
6	Dr. Gaurav Jha, KSU, USA	December 11, 2023	Precision Agriculture for Resilient and Sustainable Farming Practices

Figure 47. Lecture on "Precision Agriculture for Resilient and Sustainable Farming Practices" delivered by Dr. Gaurav Jha, Kansas State University, USA

Teacher's Day Celebration

On September 5, 2023, the institute commemorated Teachers' Day **(Figure 48)** in honour of Dr. Sarvepalli Radhakrishnan. On this occasion, renowned Professor P.K. Gupta, a distinguished scientist and accomplished educator was invited as the Chief Guest, Professor Gupta lauded the institute's efforts in introducing B.Tech. and M.Sc. programs at its campus. During his address, he highlighted the invaluable roles of teachers in shaping the minds of youth. The Director, expressed his appreciation for the contribution of faculties associated with the IARI-Mega University Ranchi Hub, which involves scientists from all ICAR institutes in Ranchi. Among the other invited guests, Dr. Abhijit Kar, Director of ICAR-NISA, Dr. A.K. Singh, Head of ICAR-RCER, FSRC, Plandu Ranchi, Dr. V.P. Bhadana, Joint Director (Research) at ICAR-IIAB and Dr. K.K. Krishnani, Joint Director (Academic) also addressed the gathering.

Figure 48. Teacher's Day Celebration of IARI Ranchi hub on 5th September, 2023

National Seminar on Biochar

Utilization of Biomass/Biochar is increasingly being considered as a promising potential source of fuel in the iron and steel industry, which may help in the decarbonization of steel sector. Several recent studies corroborate that biomass/biochar utilization has good potential for the partial replacement of fossil fuels and as reducing agents in metallurgical coke production, as carbonaceous fuel in iron ore sintering etc. Biochar can be made from surplus crop residues and used as alternative of coal/coke in steel industry, soil ameliorant & carbon sequestration. To have an in depth discussion on this, a national seminar was organized by the institute on "*Biochar- Greening of Steel through Agro-Based Products (BioS-2023)*" during September 15-16, 2023 in collaboration with R&D Centre for Iron & Steel (RDCIS), Steel Authority of India Ltd. (SAIL). Participants from IITs, steel plants, SAIL and many other ICAR institutes and private companies attended the meeting to discuss possible replacement of coal/ coke with biochar made from agricultural residues **(Figure 49**).

Figure 49. National seminar on "Biochar- Greening of Steel through Agro-Based Products (BioS-2023)"

Vigilance Awareness Week

The institute enthusiastically observed the "Vigilance Awareness Week" from October 30 to November 5, 2023, with the theme "Say no to corruption; commit to the Nation". The awareness week started with an "Oath-taking ceremony" on October 30. On this occasion, all staff members of the institute were administered the oath by Joint Director (Research) **(Figure 50).** During the week, various activities such as debate, collection of views etc., were under taken for bringing awareness among students and staff. On November 3, 2023 a panel discussion and debate on "Say no to corruption; commit to the Nation" was a great success where all the participants including students gave their independent views. The programme was chaired by Joint Director (Academic) of the institute, he stressed upon the need for self-introspection, discipline and integrity for total personal growth, which can ultimately contribute to moving the country closer to being a developed nation. The vigilance officer of the institute appreciated the participants for their valuable insights about eradicating corruption. Besides, he also underlined that employees must uphold their own personal integrity to prevent corruption.

Figure 50. Vigilance Oath taking ceremony at ICAR-IIAB, Ranchi

Constitution Day

On the occasion of National Constitution Day (November 26, 2023), the Director, ICAR-IIAB read out the "Preamble of the Constitution of India" before the institute staff. The occasion marked the delivery of a lecture on *"Our Constitution: Understanding the significance of the Indian Constitution"* by Ms. Anjali Bhadana, Advocate. Ms. Bhadana elaborated about the genesis of the Constitution, our fundamental rights and duties citing some real-life examples **(Figure 51).** The Director addressed the gathering virtually emphasizing the importance of the constitution of India. Both the Joint Directors (Research and Academic) also addressed the gathering on this occasion. Dr.

Sujit K. Bishi co-ordinated the overall programme and suggested students to maintain scientific temperament as suggested in Article 51 of the Indian Constitution. All the students, scientific and administrative staff joined on the occasion in hybrid mode, both online and offline. All the staff proactively took oath via portal and participated in the online quiz competition.

Figure 51. Invited speaker Ms. Anjali Bhadana delivering lectureon the occasion of Constitution day

World Soil Day

To highlight importance of soil in maintaining healthy ecosystem and human well-being among the farmers and students, "World Soil Day" was celebrated at the institute on December 5, 2023. The theme of this year's World Soil Day was "Soil and Water: A source of life". More than hundred participants including staffs and students of the institute and farmers of nearby villages attended the programme **(Figure 52).** Apart from highlighting the need of conserving the soil and water for sustainable agriculture, students and farmers were given practical training on soil sampling, crop reside recycling, vermicompost preparation and scientific cultivation of different crops in the farm. Students took active participation in furrow opening, application of compost in furrows, placement of seeds and covering with 2:1 soil: FYM mixture for different agricultural & horticultural crops.

Figure 52. World soil day celebration in Farm B

Participation in ICAR-Zonal Sports Tournament for Eastern Zone

Six member of sports contingent of ICAR-IIAB, Ranchi participated in the ICAR-Zonal sports Tournament for Eastern zone hosted by ICAR-NRRI, Cuttack during November 13-16, 2023 **(Figure 53)**. The team of ICAR-IIAB participated in the tournament with the coordination of Dr. Sujit K. Bishi was the Chief- De-Mission and Dr. Madan Kumar acted as Team Manager. This sporting extravaganza is set to witness over 500 players from 21 ICAR institutes across the Eastern Zone, showcasing their prowess in various sport events (Table tennis, Shuttle badminton, Athletics, Carrom and Chess). The Director congratulated the team of ICAR-IIAB for their sportsmanship spirit shown in the tournament.

Figure 53. Participation of ICAR-IIAB in ICAR-Zonal sports tournament for Eastern Zone

Swachh Bharat Abhiyan

Special campaign 3.0

The Special Campaign on Swachhata 3.0 was undertaken by ICAR-IIAB from September 15 to October 31, 2023. As per the plan, farm cleaning, laboratory and farm waste disposal, laboratory sanitization and other cleaning activities were conducted. Cleanliness drive and awareness campaign were also carried out in the nearby villages, public parks and community centres. During this period, an exposure visit to the institute was organised for the local school students and teachers. Scientists from different disciplines interacted with the students and sensitized about role of cleanliness in day-to-day life and at academic

institution. Also, these students were informed about laboratory waste segregation and disposal to avoid health and environmental hazard.

Swachhta Pakhwada

The Swachhta Pakhwada was organized by the ICAR-IIAB, Ranchi during December 16-31, 2023. Swachhta Pakhwada started with Swachhta pledge by Sh. Arjun Munda, Hon'ble Cabinet Agriculture & Farmers Welfare minister **(Figure 54)**. The scientists, staff andstudents tookn the Swachhta pledge. Efforts has been made to achieve Swachh Bharat in day-to-day Swachhta activities, special campaign 3.0 and Swachhta Pakhwada. During special campaign 3.0 and Swachhta Pakhwada, a cleanliness and awareness drive were organized in institute premises, nearby villages, public places. In the programme, students, youth and women were sensitized for maintaining hygiene and its impact on health and environment. Also, cleanling materials were distributed among villagers to clean their houses. To create awareness of Swachhta, a painting competition on "Swacch Bharat Mission" was also organized. Nodal officer, scientists, staff of institute and general public significantly contributed in cleanliness drive.

Figure 54. Swachhta Pledge being administered by Shri Arjun Munda, Hon'ble Union Minister of Agriculture & Farmers' Welfare, Govt. of India

Kisan Diwas

ICAR-Indian Institute of Agricultural Biotechnology, Ranchi organized an awareness workshop on the occasion of Farmer Day on December 23, 2023. The programme started with welcome speech by Dr. Shambhu K. Lal, Scientist and Swachhta Prabhari, ICAR-IIAB. He emphasized the role of agriculture and farming community in the economic growth. The Joint Director (Research) motivated the farmers on adoption of recent technology in agriculture and suggested to produce quality product to fetch high economic return from market **(Figure 55)**. Dr. Sudhir Kumar emphasized on the importance and needs of agriculture for feeding the nation as well as country development. In the programmes, other Scientists have suggested various measures to enhance agricultural productivity along with quality farm produce.

Figure 55. Scientist-farmers' interaction held on Kisaan Diwas

माननीय संसदीय राजभाषा समिति की दूसरी उपसमिति द्वारा संस्थान के राजभाषा कार्यों का निरिक्षण

माननीय संसदीय राजभाषा समिति की दूसरी उपसमिति ने 04.01.2023 को भा.कृ.अ.प.- भारतीय कृषि जैव प्रौद्योगिकी संस्थान रांची का राजभाषा सम्बन्धी कार्यों का निरीक्षण किया | यह निरीक्षण बैठक माननीय सांसद महोदया डॉ. रीता बहुगुणा जोशी जी की अध्यक्षता में हुई इस दौरान परिषद् से श्री राम दयाल शर्मा, उप निदेशक राजभाषा एवं श्री मनोज कुमार, मुख्य तकनीकी अधिकारी (राजभाषा) ने परिषद् मुख्यालय का प्रतिनिधित्व किया, संस्थान से डॉ. सुजय रक्षित, निदेशक एवं श्री परितोष कुमार गुप्ता, प्रभारी अधिकारी (राजभाषा) ने भाग लिया | निरीक्षण बैठक में समिति द्वारा संस्थान को राजभाषा सम्बन्धी मार्गदर्शन व विभिन्न सुझाव दिए, अंत में बैठक सफलता पूर्वक संपन्न हुई |

चित्र 56. संसदीय राजभाषा समिति ने 04.01.2023 को भा.कृ.अ.प.- भारतीय कृषि जैव प्रौद्योगिकी संस्थान रांची का राजभाषा निरीक्षण किया, जिसमें महोदया डॉ. रीता बहुगुणा जोशी ने अध्यक्षता की

हिंदी दिवस एवम् हिंदी पखवाड़ा

संस्थान में 14 सितंबर 2023 को हिंदी दिवस के उद्घाटन समारोह के साथ दिनांक 14 से 29 सितंबर 2023 की अवधि में हिंदी पखवाड़े का आयोजन किया गया, जिसमें संस्थान के निदेशक डॉ सुजय रक्षित, संयुक्त निदेशक

(अनुसंधान) डॉ विजयपाल बढ़ाना, संस्थान के सभी वैज्ञानिकगण, अधिकारीगण एवं सभी छात्र छात्राएं उपस्थित रहे (**चित्र:57**)। निदेशक महोदय डॉ. सुजय रक्षित ने अपने अभिवादन में सभा को संबोधित करते हुए सभी को हिंदी दिवस की बधाई दी एवं कार्यालय का अधिकतर काम हिंदी भाषा में करने के लिए प्रेरित किया। संयुक्त निदेशक (अनुसंधान) डॉ विजयपाल भडाना ने हिंदी दिवस एवं हिंदी भाषा के प्रचार प्रसार पर अपने विचार सभी के समक्ष साझा किए। राजभाषा प्रभारी डॉक्टर कार्तिक शर्मा ने हिंदी भाषा की महत्ता पर प्रकाश डाला एवं पखवाड़े में आयोजित होने वाली विभिन्न प्रतियोगिताओं के बारे में विस्तार से चर्चा की। संस्थान के विभिन्न विद्यार्थियों ने भी हिंदी दिवस पर भाषण एवं कविता पाठ का अनुसरण किया। पखवाड़े के दौरान विभिन्न प्रतियोगिताओं का आयोजन सफलतापूर्वक किया गया जिसमें हिंदी निबंध प्रतियोगिता, हिंदी श्रुतलेख, हिंदी शब्द अनुवाद, हिंदी सुलेख, हिंदी कविता एवम् हिंदी वाद विवाद जैसी प्रतियोगिताएं सम्मिलित हैं। समस्त पखवाड़े में संस्थान के सभी वैज्ञानिकगण, अधिकारीगण, कर्मचारीगण एवं सभी छात्र-छात्राओं ने बढ़-चढ़कर भाग लिया एवम् अपनी भागीदारी सुनिश्चित की। अंत में पखवाड़े के समापन अवसर पर पुरस्कार वितरण समारोह का आयोजन किया गया जिसमें निदेशक महोदय डॉ सुजय रक्षित ने अध्यक्ष व मुख्य अतिथि के तौर पर पखवाड़े के दौरान आयोजित विभिन्न प्रतियोगिताओं के विजेताओं को पारितोषिक देकर सम्मानित किया। समापन समारोह का संचालन डॉक्टर साक्षी कैथ एवं डॉ सोमजीत सरकार द्वारा किया गया।

चित्र 57. संस्थान में हिंदी दिवस का आयोजन

Training and Capacity Building

Sl. No.	Name	Subject Area	Duration	Host Institute
1	Dr. Soumen Naskar	Short-term course on "One Health: A Health Promotion Perspective"	December 15, 2022 to March 5, 2023	IIT, Kharagpur
2	Dr. Amit Kumar, Dr. Ekta Narwal, Dr. Ganesh N. Aderao Dr. Karthik Sharma, Dr. Nikhil K.C., Dr. Omkar M. Limbalkar, Dr. Ramya N., Dr. Sakshi Kaith Dr. Soumajit Sarkar and Mr. Sujay B. Kademani	Foundation course	April 11, to July 1, 2023	ICAR-NAARM, Hyderabad
3	Dr. Sujay Rakshit Dr. Soumen Naskar Dr. Biplab Sarkar	Workshop on "Implementable Technologies for Chotanagpur Plateau region of Eastern India"	May 22, 2023	KVK Kalyan, Purulia (West Bengal)
4	Mr. Sandeep Garai and Mr. Suryakant Manik	Foundation course	July 18 to October 17, 2023	ICAR-NAARM, Hyderabad
5	Dr. Soumen Naskar	Review Meeting of Workshop on "Implementable Technologies for Chotanagpur Plateau region of Eastern India"	July 26, 2023	ATARI, Kolkata
6	Dr. Shambhu K. Lal	Enhancing Pedagogical Competencies for Agricultural Education	July 31 to August 5, 2023	National Academy of Agricultural Sciences, New Delhi
7	Dr. Avinash Pandey	Analysis of Experimental Data using R	November 20-24, 2023	ICAR-NARRM, Hyderabad
8	Dr. Biplab Sarkar	Management Development Programme on Leadership Development (A pre-RMP programme)	December 11-22, 2023	ICAR-NAARM, Hyderabad
9	Dr. Sujit K. Bishi and Dr. Soumajit Sarkar	Enhancing Pedagogical Competencies for Agricultural Education	November 20-25, 2023	National Academy of Agricultural Sciences, New Delhi
10	Dr. Shambhu K. Lal	Plant Tissue Culture	December 14-15, 2023	APAARI, Bangkok
11	Dr. Sujit K. Bishi	One Day Regional Training-cum-Awareness Workshop on J-Gate@ CeRA	December 21, 2023	Anand Agricultural University, Anand (Gujarat)
Professional Attachment Training by newly joined Scientists				
12	Dr. Sujay B. Kademani	Farmer Producer Organisations in Karnataka: An Ecosystem Review	September 2 to December 5, 2023	Centre of Excellence on Farmer Producer Organisations, Vidyaranyapura, Bengaluru

Sl. No.	Name	Subject Area	Duration	Host Institute
13	Dr. Omkar M. Limbalkar	Cloning of gRNA for editing of Betaine Aldehyde Dehydrogenase 2 (*BADH2*) gene in Rice	September 6 to December 6, 2023	ICAR-Indian Institute of Rice Research (ICAR-IIRR), Hyderabad
14	Dr. Nikhil K. C.	Understand the molecular mechanisms of xenophagy	September 9 to December 12, 2023	Jawaharlal Nehru Centre for Advanced Scientific Research Jakkur, Bengaluru
15	Dr. Ekta Narwal	Effect of soil microbiome on seed vigour of different rice varieties and metagenomics analysis	September 18 to December 22, 2023	ICAR- Indian Agricultural Research Institute, New Delhi
16	Dr. Amit Kumar	Assisted Reproductive Technologies in Farm Animals	September 18 to December 17, 2023	ICAR-National Dairy Research Institute, Karnal
17	Dr. Karthik Sharma	Comparative performance analysis of IFS models in humid, sub-humid and semi-arid agro-ecological region and synthesis of IFS model for Jharkhand (eastern plateau region of Ranchi)	September 22 to December 21, 2023	ICAR- Indian Institute of Farming System Research, Modipuram
18	Dr. Ganesh N. Aderao	Evaluation of Synergistic impact of oral Nano-curcumin and Alpha-Linolenic Acid on maternal and fetal health in rat model of Preeclampsia	October 18, 2023 to January 19, 2024	ICMR- National Institute for Research in Reproductive and Child Health, Mumbai
19	Dr. Sakshi Kaith	Characterization of sheep wool proteins	October 31, 2023 to January 31, 2024	Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu
20	Dr. Suryakant Manik	Exploring the link between calcium signaling and sugar transport in the root endophytic mutualism of *Piriformospora indica* and *Arabidopsis thalian*	November 14, 2023 to February 14, 2024	ICAR- National Institute of Plant Genome Research, New Delhi
21	Dr. Sandip Garai	Metagenomic data analysis using Bioinformatics tools like QIIME etc.	November 13, 2023 to February 13, 2024	National Agri-Food Biotechnology Institute, Mohali

Trainings/ Awareness Camps/ Health Camps/ Demonstrations organized

Sl. No.	Name	Subject	Date	Audience
1	Dr. Sanjay Gupta	Enhancing livelihood and nutritional security of tribal farmers through scientific aquaculture practises	February 21-23, 2023	Tribal farmers of Jharkhand state
2	Dr. Soumen Naskar	Orientation Programme	April 28, 2023	UG/PG students of Ranchi Hub
3	Dr. Soumen Naskar	Organization of interaction programme of the Hon'ble Secretary DARE GoI & DG ICAR with the UG/PG students of Ranchi Hub	May 23, 2023	UG/PG students of Ranchi Hub
4	Dr. Soumen Naskar	Orientation programme for B.Tech Biotech and M.Sc.(Ag) students of 2nd Semester (Academic Year 2022-23) with participation of faculties of Ranchi Hub and its students.	June 22, 2023	UG/PG students of Ranchi Hub
5	Dr. Jayanta Layek	A National Seminar on "*Biochar-Greening of Steel through Agro-Based Products* (BioS-2023)" organized in collaboration with RDCIS, SAIL	September 15-16, 2023	Participants from IITs, Steel plants, SAIL, ICAR institutes, private companies
6	Dr. Shambu K. Lal, Dr. Soumen Naskar and Dr. Sakshi Kaith	Hands-on Training on Genome Editing: A Paradigm Shift in Agricultural Innovation	November 6-10, 2023	B.Tech., M.Sc. and Ph.D. students of ICAR-Deemed to be universities/SAUs/CAUs/ CUs/other UGC recognized Universities and Research Institutes
7	Dr. Soumen Naskar, Dr. Biplab Sarkar and Dr. Sujit K.Bishi	Organized the meeting of the faculties of Ranchi Hub. The courses to be offered to the students of Semester-I and Semester-III of B.Tech. (Biotech.) and different disciplines of Masters' and Doctoral Programmes for AY 2023-24 were discussed and the faculties were identified	November 09, 2023	Faculty of IARI Ranchi Hub
8	Dr. Soumen Naskar	Invited talk on "*Transforming the Livestock Sector in India*" on the occasion of 63rd Foundation Day of Ranchi Veterinary College (BAU), Kanke, Ranchi	November 30, 2023	Students and Faculty of Ranchi Veterinary College (BAU), Kanke, Ranchi

Conferences / Symposia attended

Sl. No.	Name	Subject Area	Duration	Host Institute
1	Dr. Shambu K. Lal	International Millet (Shree Anna Conference on "*Enhancing productivity and Value Addition in Millets*"	March 18-19, 2023	NAAS complex, ICAR-IARI, New Delhi
2	Dr. Sujit K. Bishi and Dr. Jayanta Layek	XVI Agricultural Science Congress (ASC) and ASC-Expo-2023	October 10-13, 2023	NAAS, New Delhi and ICAR-CMFRI, Kochi
3	Dr. Sujit K. Bishi and Mr. Suryakant Manik	International Conference on *"Biochemical and Biotechnological Approaches for Crop Improvement "*	October 30 to November 1, 2023	Division of Biochemistry, ICAR-IARI, CSIR- NBRI and ICAR-NIPB, New Delhi
4	Dr. Soumen Naskar and Dr. Kanaka K. K.	National Conference on "*Advances in Genetics and Genomics for Sustainable Livestock Transformation* & XVII Annual Convention"	November 16-17, 2023	ICAR-NBAGR, Karnal
5	Dr. Nikhil K. C.	VII Annual Convention of the SVBBI and International symposium on "*Multiomics to One Health: Challenges and Way Forward in Biomedical Research*"	December 14-15, 2023	ICAR- IVRI, Bareilly

Linkages and Collaborations

ICAR-IIAB signed MoUs with various government, semi-government and private organizations to facilitate collaborative efforts in research and teaching activities. These partnerships are aimed at fostering synergy between ICAR-IIAB and external entities to advance agricultural research, education and technological innovation. Name of the organisation with which MoUs were signed are as follows :

1. Birsa Agricultural University (BAU), Ranchi
2. Govind Ballabh Pant University of Agriculture and Technology (GBPUAT), Pantnagar
3. Indian Institute of Information Technology (IIIT), Ranchi
4. Central Agricultural University (CAU), Imphal, Manipur
5. Binod Bihari Mahto Koylanchal University, Dhanbad, Jharkhand

Figure 59. ICAR- IIAB, Ranchi signs MoU with Indian Institute of Information Technology (IIIT), Ranchi

Figure 58. ICAR- IIAB, Ranchi signs MoU with Binod Bihari Mahto Koyalanchal University, Dhanbhad

Figure 60. ICAR- IIAB, Ranchi signs MoU with Birsa Agricultural University (BAU), Ranchi

Awards / Achievements / Recognitions

Awards

Sl. No.	Award Name	Recipient
1	Fellow of National Academy of Science, India	Dr. Sujay Rakshit
2	NAAS Recognition Award	Dr. Sujay Rakshit
3	P. S. Deshmukh Young Agronomist award	Dr. Jayanta Layek
4	Best paper award in VII Annual Convention of SVBBI and International Symposium	Dr. Nikhil K.C.
5	ICAR Performance excellence award For Farmer FIRST Programme by Deputy Director General (Agril. Extension), ICAR	Dr. Sanjay K. Gupta and Dr. Soumen Naskar

Dr. Sujay Rakshit became fellow of National Academy of Science, India (NASI)

Dr Sujay Rakshit, received Recognition Award of National Academy of Agricultural Sciences (NAAS)

Dr. Jayanta Layek received P.S. Deshmukh Young Agronomist award by Indian Society of Agronomy (ISA), New Delhi

Dr. Nikhil K. C. awarded with best paper by the Society for veterinary Biochemists and Biotechnologists of India, Bareilly

Recognitions

a. Dr. Sujay Rakshit has joined the editorial board of agricultural journal of NAAS

b. Dr. Jayanta Layek edited special issues (as Guest Editor) on "Diversified agri-food production systems for nutritional security" in journals "*Frontiers in nutrition*" and "*Frontiers of Sustainable Food System*"

c. Dr. Soumen Naskar joined the Editorial Board of *'Indian Journal of Veterinary Public Health'* as Member

Publications

A. Research papers

Abedin, S.N., Baruah, A., Baruah, K.K., Bora, A., Dutta, D.J., Kadirvel, G., Katiyar, R., Doley, S., Das, S., Khargharia, G. and Sarkar, B. 2023. Zinc oxide and selenium nanoparticles can improve semen quality and heat shock protein expression in cryopreserved goat (*Capra hircus*) spermatozoa. *Journal of Trace Elements in Medicine and Biology*, 80, p.127296.

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Chakraborty, P., Krishnani, K.K., Mulchandani, A., Sarkar, D.J., Das, B.K., Paniprasad, K., Sawant, P.B., Kumar, N., Sarkar, B., Poojary, N. and Mallik, A. 2023. Toxicity assessment of poultry-waste biosynthesized nanosilver in *Anabas testudineus* (Bloch, 1792) for responsible and sustainable aquaculture development-A multi-biomarker approach. *Environmental Research*, 235, p.116648.

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D. Book Chapters

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G. Extension folders

डॉ. ओंकार म. लिंबाळकर, डॉ. किशोर यु. त्रिभुवन, डॉ. सुधीर कुमार, डॉ. खेला राम सोरेन एवं डॉ. अविनाश पांडेय (2023) झारखण्ड में सरसों की उन्नत खेती. आय.सी.ए.आर.-आय.आय.ए.बी. टेक्निकल फोल्डर नंबर - 08

डॉ. सुधीर कुमार, डॉ. किशोर यु. त्रिभुवन, डॉ. ओंकार म. लिंबाळकर, एवं डॉ. अविनाश पांडेय (2023) झारखण्ड में लीची की उन्नत खेती. आय.सी.ए.आर.-आय.आय.ए.बी. टेक्निकल फोल्डर नंबर - 09

डॉ. किशोर यु. त्रिभुवन, डॉ. सुधीर कुमार, डॉ. ओंकार म. लिंबाळकर, एवं डॉ. अविनाश पांडेय (2023) झारखण्ड में ड्रैगन फल की उन्नत खेती. आय.सी.ए.आर.-आय.आय.ए.बी. टेक्निकल फोल्डर नंबर -11

डॉ. किशोर यु. त्रिभुवन, डॉ. सुधीर कुमार, डॉ. ओंकार म. लिंबाळकर, एवं डॉ. अविनाश पांडेय (2023) झारखण्ड में स्ट्रॉबेरी की उन्नत खेती. आय.सी.ए.आर.-आय.आय.ए.बी. टेक्निकल फोल्डर नंबर - 10

डॉ. सुधीर कुमार, डॉ. किशोर यु. त्रिभुवन, डॉ. ओंकार म. लिंबाळकर, एवं डॉ. अविनाश पांडेय (2023) झारखण्ड में अमरुद की उन्नत खेती. आय.सी.ए.आर.-आय.आय.ए.बी. टेक्निकल फोल्डर नंबर – 12

डॉ. सुधीर कुमार, डॉ. किशोर यु. त्रिभुवन, डॉ. ओंकार म. लिंबाळकर, एवं डॉ. अविनाश पांडेय (2023) झारखण्ड में नींबू की उन्नत खेती. आय.सी.ए.आर.-आय.आय.ए.बी. टेक्निकल फोल्डर नंबर - 13

Ongoing Research Projects

Sl. No.	Project Title	Principle Investigator
Institute Funded		
1.	Molecular breeding for the development of rice varieties with inbuilt resistance/tolerance to drought, low soil P and blast	Dr. V.P. Bhadana
2.	Understanding the biochemical and molecular mechanism of L-DOPA and tannin biosynthesis in faba bean (*Vicia faba* L.)	Dr. Sujit K. Bishi
3.	Improvement of rice yield under low light intensity conditions	Dr. Avinash Pandey
4.	Molecular dissection of plant architecture traits in winged bean through mutagenesis and genomic approaches	Dr. Sudhir Kumar
5.	Understanding the morpho-physiological and molecular mechanism of seed shattering in grain amaranths (*Amaranthus spp*.)	Dr. Madan Kumar
6.	Genome analysis, linkage mapping and identification of gene(s) / QTLs for seed oil and protein content in winged bean (*Psophocarpus tetragonolobus* L.)	Dr. Kishor U. Tribhuvan
7.	Genetic mapping of gene(s)/QTLs for photoperiod sensitivity in winged bean (*Psophocarpus tetragonolobus* L.)	Dr. Kishor U. Tribhuvan
8.	Molecular characterization of the Major Histocompatibility Complex (MHC) genes of indigenous pig (*Sus scrofa*)	Dr. Soumen Naskar
9.	Investigating the role of purine degrading pathway genes of hemibiotroph fungal pathogens during host-pathogen interaction and their potential to confer disease resistance in maize	Dr. Shambu K. Lal
10.	Evaluating the nano-inspired degradation of aquatic pollutants with special reference to lac dye and jute retting wastewater	Dr. Biplab Sarkar
11.	Deciphering the role of the microbiome, including extremophiles in water bodies and surrounding phylloplane in coal mining areas in the perspective of intensive aquaculture, including biofloc system	Dr. Sanjay K. Gupta
Externally Funded		
1.	Gene editing and engineering of mediator subunit *Med15* to modulate grain size/weight trait *(DBT funded)*	Dr. V. P. Bhadana
2	Exploring cell surface biomarkers of cattle spermatozoa for sex-specific segregation through proteomic and genomic approach *(SERB funded)*	Dr. Soumen Naskar
3.	Design and development of novel magnetic nanoparticles and its employment for sex-sorting of bovine spermatozoa *(DST funded)*	Dr. Soumen Naskar
4.	Deciphering and deploying low phosphorus tolerance and Nitrogen Use Efficiency in rice using targeted genomics approach *(NASF funded)*	Dr. Avinash Pandey
5.	Pilot project for Crop Diversification *(IIFSR, Modipuram funded)*	Dr. Jayanta Layek

Budget Allocation, Utilization and Revenue generation

(Rs. in lakhs)

Head	RE 2022-23	Total Expenditure 2022-23	Total expenditure 2022-23 in percentage	BE 2023-24	Total Expenditure 2023-24 up to Dec. 2023	Total expenditure 2023-24 (up to Dec. 2023) in percentage
GIA General, Other than NEH, TSP & SCSP	225.00	225.00	100 .00	600.00	299.10	49.85
GIA Capital, Other than NEH, TSP & SCSP	1000.00	1000.00	100.00	2310.00	1481.74	64.14
GIA General, NEH	26.98	26.98	100.00	35.00	22.50	64.29
GIA Capital, NEH	0.00	0.00	0.00	30.00	26.25	87.50
GIA General, TSP	25.00	25.00	100.00	30.00	17.47	58.23
GIA Capital, TSP	0.00	0.00	0.00	92.00	63.44	68.96
GIA General, SCSP	56.81	56.81	100.00	200.00	100.00	50.00
GIA Capital, SCSP	100.00	100.00	100.00	120.00	90.00	75.00
Total	1433.79	1433.79	100.00	3417.00	2100.50	61.47

(Rs. in lakhs)

Head	FY 2022-23	FY 2023-24 (up to Dec.31, 2023)
Revenue Generation	6.02	10.01

Head	FY 2022-23	Utilization (%)	FY 2023-24 (up to Dec. 31, 2023)	Utilization (%)
Gem Purchase	229.90	85.15	256.83	54.97

Status of Developmental Works

Sl. No.	Name of the work	Estimated cost (Rs. in lakhs)	Present status
Civil works			
1	Shavitri Bai Phule Girls' Hostel	852.39	Inaugurated and operational
2	Dr. B.R. Ambedkar Boys' Hostel	852.39	Inaugurated and operational
3	Annapurna mess	352.22	Inaugurated and operational
4	Crop Research & Training centre	549.10	Inaugurated and operational
5	Livestock Research & Training centre	243.51	Inaugurated and operational
6	Fisheries Research & Training centre	99.28	Inaugurated and operational
7	Water treatment plant at farm A	49.30	Completed and functional
8	Administrative/ Institute building (First phase)	3584.99	Completed and now at finishing stage
9	Director residence	99.50	Completed and now at finishing stage
10	Administrative/ Institute building (Second phase)	1192.78	Structural work completed, laboratory furnishing work is under progress
11	Type-V quarters-six no.	630.88	60 % Completed
12	Boundary wall and security room of director's residence	19.98	50 % Completed
13	Internal roads Internal roads, drainage, street light and water pipeline	522.78	50 % Completed
14	Overhead water tank (2 lakh ltrs cap)	148.11	40 % Completed
15	Administrative/ Institute building (Third phase)	2542.00	20 % Completed
Electrical works			
16	LT feeder pillars, Generator and cable laying	510.41	50 % Completed
17	Installation and commissioning of lifts in hostels (4 no.)	78.81	Installation works started

Inauguration of New Facilities

Savitribai Phule Girls' Hostel

Dr. B.R. Ambedkar Boys' Hostel

Annapurna Mess

Crop Research & Training Centre

Livestock Research & Training Centre

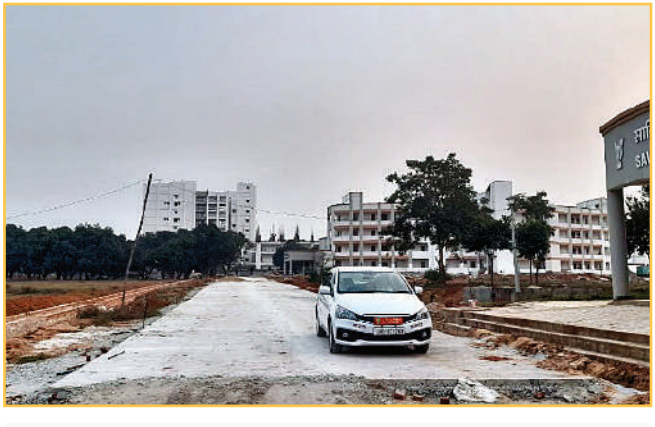
Fisheries Research & Training Centre

Infrastructure Development in Progress

Administrative building

Type-V quarters –Six no.

Director's residence



Internal roads, drainage, street light and water pipeline

Water treatment plant at Farm A

Important Committees

Quinquennial Review Team (QRT)

Chairman	Prof. Sudhir K. Sapory Emeritus Senior Scientist, ICGEB, New Delhi
Member	Dr. Kuldeep Singh, Former Director ICAR-NBPGR, New Delhi
	Dr. R.K. Singh, Former Director ICAR-IVRI, Izatnagar
	Dr. W.S. Lakra, Former Director ICAR-CIFE, Mumbai
	Prof. R. Ramakumar TISS, Mumbai
	Dr. Arvind Kapoor, Advisor Acsen Agriscience Pvt. Ltd., Gurgaon

Research Advisory Committee (RAC)

Chairman	Dr. S.K. Datta, Former DDG (Crop Science), ICAR, New Delhi
Member	Dr. R. Srinivasan, Former Director ICAR-NRCPB, New Delhi
	Dr. S.M. Deb, Former Director ICAR-NRC on Yak, Dirang, Arunachal Pradesh
	Dr. A.K. Pal, Former Jt. Director ICAR-CIFE, Mumbai
	Dr. Sujay Rakshit, Director ICAR-IIAB, Ranchi

Institute Management Committee (IMC)

Chairman	Dr. Sujay Rakshit, Director ICAR-IIAB, Ranchi
Member	Dr. D.K. Yadav, ADG (seed) ICAR, New Delhi
	Shri G.P. Sharma, JS (Finance) ICAR, New Delhi
	Dr. A.K. Singh, Head ICAR-RCER R.S. Ranchi
	Dr. Soumen Ghoshal, PS ICAR-NISA, Ranchi
	Dr. S.B. Choudhary, Head ICAR-NBPGR, R.S. Ranchi

Name of the Nodal Officers

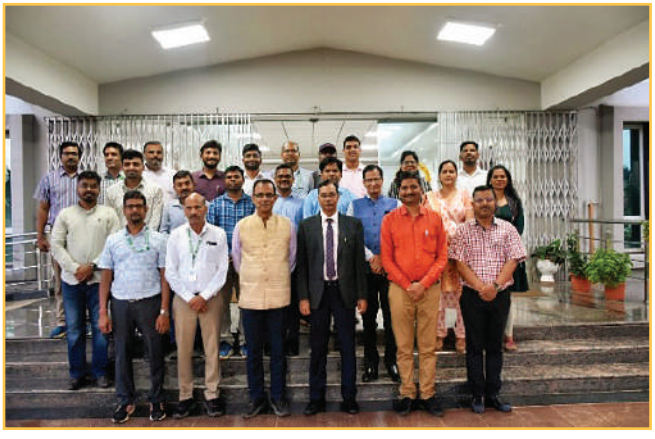
Sl. No.	Nodal officer	Responsibilities
1	Dr. Avinash Pandey	KRISHI Portal, NEH
2	Dr. Biplab Sarkar	TSP, ITMU
3	Dr. Kartik Sharma	Rajbhasha Implementation
4	Dr. Kishore Tribhuvan	ABI, Media Prabhari
5	Dr. Madan Kumar	RAC member Secretary
6	Dr. Sanjay Gupta	HRD
7	Dr. Shambhu K. Lal	Swachha Bharat Abhiyan
8	Dr. Soumen Naskar	SCSP, ICAR-MIS, ERP
9	Dr. Sudhir Kumar	AEBAS, MGMG, RTI
10	Dr. Sujit Kumar Bishi	ARMS, IRC Member Secretary, Library, PME, Vigilance
11	Shri. Shashi R. Singh	SPARROW
12	Shri. Paritosh Gupta	GeM Purchase, Stores

Distinguished Visitors

Visit of Hon'ble Union Minister of Tribal Affairs and Agriculture and Farmers' Welfare on December 16, 2023

Visit of Hon'ble Agriculture Minister Sh. Badal Patralekh, Govt. of Jharkhand on June 22, 2023

Hon'ble DG, ICAR & Secretary, DARE visited the institute on September 20, 2023 and inspected the research facilities



Visit of Dr. T. Mohapatra, Chairperson, Protection of Plant Varieties and Farmer's Rights Authority and Former DG, ICAR & Secretary, DARE on July 31, 2023

IARI QRT team visited the institute on October 31, 2023 and interacted with the staff

Visit of Hon'ble DDG (Agri Edu.) ICAR visited institute on June 27, 2023

Visit of Hon'ble DDG (NRM), ICAR on June 07, 2023

Dr. H.S. Gupta, DG BISA and Former Director, IARI visited the institute and interacted with faculty of Ranchi Hub

Staff Positions / Appointments / Promotions and Transfers

Staff Position

Scientific

Sl. No.	Catogory	Sanctioned	Filled	2023
1.	RMP	1+7	1+2	1+2
2.	Pr. Scientist	10	2	2
3.	Sr. Scientist	0	8	8
4.	Scientist	0	14	14
	Total	18	23 + 3	23 + 3

Administrative

Sl. No.	Catogery	Sanctioned	Filled	2023
1.	CAO (SG)	1	1	1
2.	CF&AO	1	1	1
3.	AAO	4	2+1*	2+1*
4.	Asst.	9	0	0
5.	Others (UDC, LDC, PS & PA)	23	0	0
	Total	39	4+1*	4+1*

*on deputation

Appointments

Dr. Vijai Pal Bhadana
joined as Joint Director (Research) on 05.08.23

Dr. Kishore K. Krishnani
joined as Joint Director (Academic) on 21.08.23

Dr. Jayant Layek
joined as Senior Scientist (Agronomy) on 27.07.23

Dr. Khela Ram Soren
joined as Senior Scientist (Agricultural Biotechnology) on 26.12.23

Dr. Suryakant Manik
joined as Scientist (Plant Pathology) on 11.04.23

Dr. Sandeep Garai
joined as Scientist (Agricultural Statistics) on 12.06.23

Dr. Amit Kumar
joined as Scientist (Animal Reproduction & Gynaecology) on 21.07.23

Dr. Sujay BK
joined as Scientist (Agricultural Extension) on 21.07.23

Dr. Kartik Sharma
joined as Scientist (Agronomy) on 21.07.23

Dr. Omkar M. Limbalkar
joined as Scientist (Genetics and Plant Breeding) on 21.07.23

Dr. Ganesh N. Aderao
joined as Scientist (Animal Nutrition) on 21.07.23

Dr. Nikhil KC
joined as Scientist (Animal Biochemistry) on 21.07.23

Dr. Ekta Narwal
joined as Scientist (Agricultural Microbiology) on 21.07.23

Dr. Ramya N
joined as Scientist (Agricultural Entomology) on 21.07.23

Dr. Sakshi Kaith
joined as Scientist (Animal Biotechnology) on 21.07.23

Dr. Soumajit Sarkar
joined as Scientist (Veterinary Microbiology) on 21.07.23

Dr. Kanaka KK
joined as Scientist (Animal Genetics and Breeding) on 03.10.23

Promotion

Dr. Sudhir Kumar
promoted as Senior Scientist (Genetics and Plant Breeding) on 15.12.22

Dr. Madan Kumar
promoted as Senior Scientist (Plant Physiology) on 27.04.23

Dr. Kishor U. Tribhuvan
promoted as Senior Scientist (Agricultural Biotechnology) on 01.01.23

Sh. Paritosh K. Gupta
promoted as A.A.O. on 07.09.23

Smt. Swati Kumari
promoted as A.A.O. on 07.09.23

Transfer under Promotion

Dr. Binay K. Singh
got selected as Head, Division of Crop Science, ICAR Research Complex for NEH Region, Umiam, Barapani on 10.07.23

Art by:
Barna Chakraborty and
Aadya Gautam, B.Tech First Year

भाकृअनुप
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भा.कृ.अनु.प. - भारतीय कृषि जैवप्रौद्योगिकी संस्थान
ICAR - Indian Institute of Agricultural Biotechnology

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