वार्षिक प्रतिवेदन
ANNUAL REPORT
2025

भाकृअनुप-राष्ट्रीय कृषि उच्चतर प्रसंस्करण संस्थान
ICAR-National Institute of Secondary Agriculture

नामकुम, राँची - 834 010 (झारखण्ड)
Namkum, Ranchi - 834 010 (Jharkhand)
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Preface

The year 2025 marked a period of growth, innovation, and institutional advancement for ICAR-National Institute of Secondary Agriculture (ICAR-NISA), Ranchi. Guided by our mandate to strengthen secondary agriculture and promote sustainable rural livelihoods, the Institute progressed steadily in research, capacity building, technology transfer, and stakeholder engagement.

Our scientific programmes continued to address national priorities related to circular economy. This year has witnessed several notable achievements, including the isolation of nanocellulose from water hyacinth and pea pods, DES-based extraction of essential oils from aromatic plants, encapsulation of curcuminoids from Lakadong turmeric, genome sequencing of lac insects, development of tamarind and natural resin-based pressure-sensitive adhesives, and a bigel-based intelligent indicator for real-time freshness monitoring of fish, to name a few. Research on shellac nanoparticles, guar gum derivatives, cinchona uprooting systems, and a melt filtration unit for button lac further demonstrated our ability to transform indigenous resources into eco-friendly technologies. Farmer-oriented innovations such as nylon net bagging for enhanced seed recovery in *Flemingia semialata* and the use of Metarhizium as an alternative to synthetic insecticides in lac cultivation directly supported lac growers. Our efforts to promote circular and nutrition-sensitive secondary agriculture through scientific honey bee and mushroom cultivation reflected our commitment to diversified and resilient farming systems.

Translational research and outreach expanded substantially during the year. Under the "Viksit Krishi Sankalp Abhiyan," ICAR-NISA teams reached more than 450 villages across Jharkhand and directly interacted with farmers, bringing science closer to underserved rural communities. Large-scale impact assessments have begun to measure the extent to which our technologies and training contribute to income enhancement, employment generation, and risk reduction at the grassroots level. In parallel, the Institute made effective use of digital platforms, recording over 60,000 online views of educational content on lac cultivation and secondary agriculture, thereby engaging students, young farmers, and agri-entrepreneurs.

Capacity building remained one of the Institute's strongest pillars. During the year, six master's students graduated across two disciplines, including four who secured top ranks in the ICAR JRF examination. A diverse range of training programmes, from scientific lac cultivation, beekeeping, and secondary agriculture enterprises to workshops on MATLAB, chemometrics, and data analytics, strengthened through collaboration with state departments, cooperatives, and private enterprises, benefited more than 3,500 participants, including farmers, students, extension personnel, and professionals.

Observances such as Vigilance Awareness Week, Rashtriya Ekta Diwas, International Yoga Day, International Women's Day, Foundation Day, and Hindi Pakhwada were celebrated with enthusiasm, reinforcing integrity, national unity, physical and mental well-being, gender equity, and linguistic creativity among staff and students.

The year was equally productive in terms of scientific output and recognition. Our researchers published extensively in reputed journals, contributed several book chapters, and filed patents on novel food and agro-based technologies, thereby broadening the intellectual property base of the Institute. ICAR-NISA scientists also earned recognition at national and international forums, reflecting the growing visibility and credibility of our work in secondary agriculture and allied domains.

Each achievement of 2025 stands as a testament to the dedication, creativity, and perseverance of our scientists, staff, and partners, including farmers, entrepreneurs, FPOs, cooperatives, government departments, and development agencies. Collectively, we continue to demonstrate that secondary agriculture is a powerful engine for rural employment, value creation, and environmental stewardship.

I extend my sincere appreciation and heartfelt congratulations to the entire ICAR–NISA family for their tireless efforts and unwavering commitment. It is with immense pride that I present this annual report, celebrating our shared accomplishments and the many new opportunities that lie ahead.

Abhijit Kar
Director ICAR-NISA

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EXECUTIVE SUMMARY

Annual Report 2025

Collection, conservation, improvement, and culture of sources of agro commodities

- **Pulse pod fly control in *Flemingia semialata***: Nylon net bagging (60 mesh) of inflorescence in *Flemingia semialata* significantly improved seed recovery from 10% to 85% by controlling pulse pod fly infestation.
- **Integration of apiculture with lac-based cropping systems**: Lac-based integrated cropping with honey bee (*Apis cerana*) enhanced pollination, increasing strawberry yield by up to 70% and improving seed set.
- **Mutation breeding in *Flemingia semialata***: Mutation breeding (M_2–M_3) in *Flemingia semialata* resulted in the identification of two superior treatments with higher yield up to 58%, supporting the development of high-yielding varieties.
- **Biopesticide-based IPM**: Biopesticide-based integrated pest management, particularly using *Beauveria bassiana* and *Metarhizium anisopliae*, effectively balanced pest suppression, brood lac yield, and honeybee safety, while Azadirachtin maximised *Flemingia semialata* seed production, indicating a strategic trade-off for crop management.
- **Intercropping strategies in lac-apiculture production systems**: Strategic intercropping in lac-apiculture systems enhanced honeybee resource availability, boosted pollination and intercrop yields (12–70%), and improved honey production, especially with *Apis cerana*, thereby supporting sustainable and diversified LIFS.
- **Survey, monitoring, and extension activities under NP CLIGR**: 49 districts were surveyed in 2025 by different network cooperating centres; of these, lac insect infestations were found in 24 districts. 721 districts were surveyed from 2014 to 2026; of these, the natural occurrence of lac insects was observed in 418 districts, accounting for 57.97% of the surveyed districts. In 2025, network centres conducted 42 training programmes on improved methods of lac cultivation, benefiting 1480 trainees.
- **Lac cultivation sub-centres in NE Region**: A total of 10 lac cultivation sub-centres were established under the Central Agricultural University, Imphal. Among these, 9 centres use *Malvaviscus penduliflorus* as the host plant, while one centre uses *Cajanus cajan*, covering a total area of 1 hectare.
- **Identification of climate-resilient lac strains**: Among the 13 lac strains collected, two strains, Gole Market and Cherni Pahari, were identified as climate-resilient by SKUAST, Jammu, based on the Climate Resilience Index.
- **Expansion of commercial lac cultivation**: Apart from Mysuru, commercial Kusmi lac cultivation on Ber and Flemingia was initiated in the Mandya, Davanagere, and Ballari districts of Karnataka. The lac insect species Kerria destructor was identified in Andhra Pradesh and Telangana, India.

Development of value-added products and process protocols

- **Extraction of nanocellulose from banana pseudostem:** A green and sustainable method using Deep Eutectic Solvents (DES) was developed for the extraction of cellulose and preparation of nanocellulose from the banana pseudostem. The optimised process yielded up to 23.13% cellulose, while ultrasonication reduced particle size to 271 nm.
- **Extraction of curcuminoids from Lakadong turmeric:** Curcuminoids were extracted and purified from Lakadong turmeric using solvent extraction and column chromatography, yielding 12.15 ± 1.12% purified curcuminoids with a recovery of 58.72%.
- **Natural resin-based pressure-sensitive adhesives:** Pressure-sensitive adhesive formulations were developed using natural

resin-based tackifiers with both drying and non-drying characteristics, exhibiting strong adhesion performance on paper and Sunmica surfaces. The formulations withstood forces up to 382.2 N without loss of adhesion, demonstrating their potential for high-strength adhesive applications.

- **Spectral fingerprinting for asafoetida authentication:** The spectroscopic analysis of different formulations made from 15 genuine asafoetida samples obtained from six countries, revealed distinct transmittance patterns, with the 300–1500 nm range showing maximum sensitivity to sample variations.
- **DES-assisted extraction of lemongrass essential oil:** DES-assisted hydro-distillation was standardised as a green method for the extraction of lemongrass essential oil, resulting in enhanced oil yield, reduced extraction time, and improved antioxidant activity compared to conventional hydro-distillation.
- **Development of lac dye-based freshness indicator:** A bigel-based intelligent freshness indicator using lac dye was developed for real-time monitoring of fish spoilage and successfully differentiated three freshness stages (fresh, use soon and spoiled) through visible colour change.
- **Extraction of cellulose from green pea pod waste:** Hydrothermal-assisted extraction of cellulose from green pea pod waste was standardised using aqueous and mild alkali treatments, achieving higher recovery with reduced chemical usage.
- **Edible coating for strawberry preservation:** Biopolymer-based edible coating formulations containing sodium alginate and lemongrass essential oil were developed for strawberry preservation, significantly reducing firmness loss and extending refrigerated shelf life up to 16 days.
- **Value-added product from strawberry:** Process parameters for the development of *Strawberry Bites*, a natural and sugar-free dried strawberry product, were optimised. The developed product retained acceptable quality during storage up to 8 months.
- **Tamarind kernel powder-based adhesive formulation:** A tamarind kernel powder (TKP)-based adhesive formulation was standardised for paper bonding applications. Formulations prepared using hot water at 80 °C (HW-80) and by cooking TKP at 90 °C (CK-90) exhibited superior adhesive and tensile strength, making them suitable for carton board and paper bonding applications.
- **Extraction of guar meal protein isolate:** Extraction of guar meal protein isolate (GMPI) was optimised using ultrasonication-assisted alkali extraction. Maximum protein recovery of 38.8% was achieved using 0.2 M NaOH with reduced guar meal particle size (<0.15 mm).
- **Ultrasonic-assisted recovery of lac dye:** Ultrasonic-assisted washing of scraped lac at 60 °C for 20 minutes yielded the maximum lac dye from the obtained wash water.
- **Development of natural gum-based edible ink:** A natural gum-based edible ink formulation containing rosin and lac dye was developed for direct printing on fruits and vegetables. The optimised formulation showed rapid drying (<5 s), good printability, and satisfactory rub resistance on guava, kiwi, bell pepper, zucchini, and apple surfaces.
- **Geographic authentication of gum Arabic:** To classify Gum Arabic samples based on geographical origin, samples were collected from different agro-climatic regions at ICAR-CAZRI, Jodhpur. Hyperspectral imaging coupled with multivariate statistical analysis achieved 75% classification accuracy for geographic authentication.
- **Guar gum-based functional beverage:** A sugarcane juice beverage incorporated with 0.5% guar gum and blended with 8% aonla juice was standardised at VNMKV, Parbhani. The developed beverage exhibited improved sensory quality, enhanced antioxidant activity, and storage stability up to 60 days under refrigerated conditions.
- **Extraction and food applications of tamarind seed gum:** Aqueous extraction of tamarind seed gum (TSG) was standardised at TNAU, Mettupalayam, with approximately 10% gum recovery. Tamarind seed gum-based yogurt, soft drinks, and gluten-free cakes

exhibited improved viscosity, texture, water-holding capacity, stability, and functional properties, demonstrating their potential as clean-label food ingredients.

- **Preclinical evaluation of Ailanthus oleoresin:** Preclinical evaluation of Ailanthus oleoresin at Kerala Agricultural University demonstrated safety in acute and sub-acute toxicity studies with LD_{50} > 2000 mg/kg. The Ailanthus oleoresin extract exhibited significant, dose-dependent anti-tumour activity, with approximately 70% tumour inhibition in animal models without causing mortality.

Development of prototypes and machinery

- **Melt-filtration unit for button lac production:** A melt-filtration unit of 5–10 kg/batch capacity for button lac production was developed and evaluated. The performance efficiency ranged from 82 to 87%, and energy consumption decreased with increasing melt-filtration temperature.

- **Continuous refractance window dryer for hydrogel:** A pilot-scale continuous refractance window (RW) dryer was designed and fabricated for continuous drying of gum-based hydrogels with precise control over belt movement and drying conditions.

- **Development of guar gum derivative pilot plant:** A guar gum derivative pilot plant was developed with 76.31% yield efficiency. The guar gum derivative produced had a pH of 7.29, a degree of substitution of 0.1728, and a viscosity of 700 cP.

- **Development of cinchona tree uprooting equipment:** Two prototypes for uprooting cinchona trees were developed, the vertical type suitable for plain regions and the horizontal type suitable for sloping lands.

Technology transfer, training, and capacity building

- **Capacity building and entrepreneurship development programmes:** During the year 2025, the institute organised a series of capacity building and entrepreneurship development programmes on scientific lac cultivation, processing, utilization, and beekeeping. A total of 15 farmers' training programmes, 39 exposure visits and orientation programmes, 4 entrepreneurship training programmes, 2 off-campus trainings, and 1 student training programme were conducted, benefiting 3,468 participants.

- **Organisation of Kisan Mela-cum-Agricultural Exhibition:** The Kisan Mela-cum-Agricultural Exhibition 2025 was organised on 20–21 February 2025, bringing together over 4,000 farmers, researchers, policymakers, entrepreneurs, and extension agencies to promote modern agricultural technologies, sustainable practices, and government initiatives. The event featured more than 65 exhibition stalls and technical sessions on lac cultivation, natural farming, crop diversification, animal husbandry, fisheries, and allied sectors.

- **Master trainers' training and outreach activities:** Four Master Trainers' Training Programmes trained 151 extension personnel. The institute also participated in 11 programs, melas, and exhibitions organised by other ICAR institutes and the state government's line departments benefiting 6,619 stakeholders.

Krishi Vigyan Kendra, Khunti

- In the year 2025, KVK Khunti organised seven on farm trials (OFT) and 174 demonstrations in 82.5 ha area. A total of 91 one-day training programs for farmers were organised, benefiting 2,818 participants (Male-1211, Female-1607). Additionally, 5 training programs for rural youth of 5 days' duration were organised benefitting 155 rural youths (Male-74, Female-81), three extension personnel trainings for 121 participants, 1 RAWE training program of 14 weeks for 21 students and one 15 days training for input deals benefiting 15 input dealers were also organised. For mass awareness, 316 other extension activities were organised, where 71019 (Male-36746 and Female-34273) farmers and extension personnel participated.

Academic Cell

- **Development of nanocellulose from water hyacinth:** The process for obtaining water hyacinth biomass-based stable nanocellulose (~93 nm) with enhanced crystallinity was developed using a DES-assisted ultrasonication process. The nanocellulose effectively stabilised β-carotene emulsions, exhibiting high encapsulation efficiency, pH-dependent release (up to 94.02%), and improved bioaccessibility during in-vitro digestion.
- **Encapsulation of curcuminoids from Lakadong turmeric:** Curcuminoids from Lakadong turmeric were successfully encapsulated in a shellac matrix using pH-induced coacervation, significantly improving their storage stability, with only 10–15% degradation at ambient temperature and maximum stability under refrigeration.
- **Shellac nanoparticles for postharvest disease management:** Optimised shellac nanoparticles (ShNPs) synthesised through anti-solvent precipitation produced stable nanoparticles of ~88 nm size with high colloidal stability (zeta potential –46.8 mV). In-vitro studies demonstrated strong antifungal activity against major papaya postharvest pathogens, achieving up to 91.48% inhibition at 80 ppm.
- **Slow-release rosemary oil formulation for pest control:** A biochar-based slow-release formulation of rosemary essential oil was developed and optimised, exhibiting controlled release and superior fumigation efficacy against *Callosobruchus maculatus*, achieving 100% adult mortality within 7 h.
- **RW drying technology for custard apple leather production:** Custard apple leather was developed using refractance window (RW) drying with process optimisation, demonstrating superior drying efficiency, improved retention of sugars and phenolics, lower colour change, and better overall product quality compared to conventional hot air drying.
- **Modeling of seedlac melt-filtration unit:** The melting behavior and thermo-rheological properties of seedlac were modeled to identify optimal melt-filtration conditions, leading to the development of a compact infrared heating-based melt-filtration unit with filtration efficiencies of up to 87.25%.
- **Prebiotic potential of natural gums and their hydrolysates:** The prebiotic potential of four natural gums and their partial hydrolysates was evaluated against six lactic acid bacterial strains, with partial hydrolysis significantly enhancing growth. Molecular studies revealed species-specific glycosidase activity, providing a mechanistic basis for designing targeted synbiotic formulations.

Publications

- In the year 2025, 25 research papers, 3 books, 3 technical bulletins, 23 book chapters, 3 extension folders, 41 popular articles and 3 patents were published.

Revenue generation

- Generated revenue of Total ₹ 88.02 lakh through training, exposure visit etc. (Farmers training & exposure visits, etc. ₹ 77.67 lakhs, Technology/Know-how transfer of process & products, KVK farm produce, etc. ₹ 10.35 lakhs)

Sl. No.		Particulars	Revenue Generation (₹ In Lakh)
1	Institute	Farmers training & exposure visits	77.67
2		Technology/Know-how transfer of process & products	1.95
3	Krishi Vigyan Kendra	Farm produces	8.4
Total			88.02

कार्यकारी सारांश
वार्षिक प्रतिवेदन 2025

कृषि वस्तुओं के स्रोतों का संग्रह, संरक्षण, सुधार और संवर्धन

- ***फ्लेमिंजिया सेमियालता* (*Flemingia semialata*) में पल्स पॉड फ्लाई (फली मक्खी) का नियंत्रण:** *फ्लेमिंजिया सेमियालता* में पुष्पक्रम (इनफ्लोरसेंस) की नायलॉन नेट बैगिंग (60 मेश) करने से पल्स पॉड फ्लाई के प्रकोप पर प्रभावी नियंत्रण पाया गया, जिससे बीज की प्राप्ति (रिकवरी) 10% से अत्यधिक बढ़कर 85% हो गई है।

- **लाख-आधारित फसल प्रणालियों के साथ मधुमक्खी पालन का एकीकरण:** लाख-आधारित एकीकृत फसल प्रणाली के साथ मधुमक्खी पालन (एपिस सेराना / Apis cerana) को जोड़ने से परागण (पोल्लिनेशन) में सुधार हुआ, जिससे स्ट्रॉबेरी की उपज में 70% तक की वृद्धि हुई और बीज तैयार होने/उत्पादन में भी सुधार देखा गया।

- ***फ्लेमिंजिया सेमियालता* में म्यूटेशन ब्रीडिंग (उत्परिवर्तन प्रजनन):** *फ्लेमिंजिया सेमियालता* में म्यूटेशन ब्रीडिंग (M_2–M_3) के परिणामस्वरूप दो उत्कृष्ट उपचारों (ट्रीटमेंट्स) की पहचान की गई, जिनमें उपज में 58% तक की वृद्धि देखी गई, जो उच्च उपज देने वाली किस्मों के विकास में सहायक है।

- **बायोपेस्टिसाइड-आधारित आईपीएम(IPM):** जैव-कीटनाशक आधारित एकीकृत कीट प्रबंधन, विशेष रूप से *ब्यूवेरिया बेसिआना* और *मेटारिज़ियम एनिसोप्ली* ने कीट नियंत्रण, ब्रूड लाख (बीज लाख) की उपज और मधुमक्खियों की सुरक्षा के बीच प्रभावी संतुलन बनाए रखा; जबकि अज़ाडिरैक्टीन (Azadirachtin) ने *फ्लेमिंजिया सेमियालता* के बीज उत्पादन को अधिकतम किया, जो फसल प्रबंधन के लिए एक रणनीतिक संतुलित (trade-off) का संकेत देता है।

- **लाख-मधुमक्खी पालन उत्पादन प्रणालियों में अंतःफसली (इंटरक्रोपिंग) रणनीतियाँ:** लाख-मधुमक्खी पालन प्रणालियों में रणनीतिक अंतःफसली खेती ने मधुमक्खियों के लिए संसाधनों की उपलब्धता को बढ़ाया, परागण और अंतःफसली उपज में (12-70%) की वृद्धि की, तथा शहद उत्पादन में सुधार किया (विशेष रूप से *एपिस सेराना* के साथ), जिससे सतत और विविध एलआईएफएस (LIFS) को बढ़ावा मिला।

- **एनपी क्लाइजर(NP CLIGR) के तहत सर्वेक्षण, निगरानी और विस्तार गतिविधियाँ:** वर्ष 2025 में विभिन्न नेटवर्क सहयोगी केंद्रों द्वारा 49 जिलों का सर्वेक्षण किया गया; इनमें से 24 जिलों में लाख के कीड़ों का प्रकोप पाया गया।वर्ष 2014 से 2026 तक कुल 721 जिलों का सर्वेक्षण किया गया; इनमें से 418 जिलों में लाख के कीड़ों की प्राकृतिक उपस्थिति देखी गई, जो सर्वेक्षण किए गए कुल जिलों का 57.97% है। वर्ष 2025 में, नेटवर्क केंद्रों ने लाख की खेती के उन्नत तरीकों पर 42 प्रशिक्षण कार्यक्रम आयोजित किए, जिससे 1480 प्रशिक्षुओं को लाभ हुआ।

- **पूर्वोत्तर (NE) क्षेत्र में लाख खेती उप-केंद्र:** केंद्रीय कृषि विश्वविद्यालय, इम्फाल के तहत कुल 10 लाख खेती उप-केंद्र स्थापित किए गए। इनमें से 9 केंद्र *माल्वाविस्कस पेंडुलिफ्लोरस* (*Malvaviscus penduliflorus*) को पोषक पौधे (host plant) के रूप में उपयोग करते हैं, जबकि 1 केंद्र *कैजानस कजान* (अरहर) का उपयोग करता है, जो कुल 1 हेक्टेयर क्षेत्र को कवर करता है।

- **जलवायु-अनुकूल लाख की किस्मों (स्ट्रेंस) की पहचान:** एकत्र की गई 13 लाख की किस्मों में से दो किस्मों, गोल मार्केट और चेरनी पहाड़ी को SKUAST, जम्मू द्वारा जलवायु सुदृढ़ता सूचकांक के आधार पर जलवायु-अनुकूल के रूप में पहचाना गया।

- **वाणिज्यिक लाख खेती का विस्तार:** मैसूरु के अलावा, कर्नाटक के मांड्या, दावणगेरे और बल्लारी जिलों में बेर और फ्लेमिंजिया पर वाणिज्यिक कुसमी लाख की खेती शुरू की गई। भारत के आंध्र प्रदेश और तेलंगाना में लाख के कीड़ों की प्रजाति *केरिया डिस्ट्रक्टर* (*Kerria destructor*) की पहचान की गई।

मूल्य वर्धित उत्पादों (वैल्यू एडेड प्रोडक्ट) और प्रक्रिया प्रोटोकॉल का विकास

- **केले के छद्म तने (स्यूडोस्टेम) से नैनोसेल्यूलोज का निष्कर्षण:** केले के स्यूडोस्टेम से सेल्यूलोज के निष्कर्षण और नैनोसेल्यूलोज तैयार करने के लिए डीप यूटेक्टिक सॉल्वेंट्स (DES) का उपयोग करके एक हरित और टिकाऊ तरीका

विकसित किया गया। इस अनुकूलित प्रक्रिया से 23.13% तक सेल्यूलोज प्राप्त हुआ, जबकि अल्ट्रासोनीकेशन ने कणों के आकार को घटाकर 271 nm कर दिया।

- **लाकाडोंग हल्दी से करक्यूमिनोइड्स का निष्कर्षण:** साल्वेंट निष्कर्षण और कॉलम क्रोमैटोग्राफी का उपयोग करके लाकाडोंग हल्दी से करक्यूमिनोइड्स को निकाला और शुद्ध किया गया, जिससे 58.72% की रिकवरी के साथ 12.15 ± 1.12% शुद्ध करक्यूमिनोइड्स प्राप्त हुए।

- **प्राकृतिक राल-आधारित प्रेशर-सेंसिटिव एडहेसिव (दाब-संवेदी गोंद):** सूखने और न सूखने वाले दोनों गुणों वाले प्राकृतिक राल-आधारित टैकिफायर का उपयोग करके दाब-संवेदी (प्रेशर-सेंसिटिव) एडहेसिव फॉर्मूलेशन विकसित किए गए, जिन्होंने कागज और सनमाइका की सतहों पर मजबूत पकड़ का प्रदर्शन किया। इन फॉर्मूलेशनों ने बिना अपनी चिपचिपाहट खोए 382.2 न्यूटन तक के बल को सहन किया, जो उच्च-शक्ति वाले एडहेसिव अनुप्रयोगों के लिए उनकी क्षमता को दर्शाता है।

- **हींग के प्रमाणीकरण के लिए स्पेक्ट्रल फिंगरप्रिंटिंग:** छह देशों से प्राप्त हींग के 15 वास्तविक नमूनों से बने विभिन्न फॉर्मूलेशन का स्पेक्ट्रोस्कोपिक विश्लेषण किया गया। इस अध्ययन से विशिष्ट ट्रांसमिटेंस पैटर्न का पता चला, जिसमें 300–1500 nm की रेंज ने नमूनों की विविधताओं के प्रति अधिकतम संवेदनशीलता दिखाई।

- **लेमनग्रास एसेंशियल ऑयल का DES-सहायता प्राप्त निष्कर्षण:** लेमनग्रास एसेंशियल ऑयल के निष्कर्षण के लिए एक हरित विधि के रूप में DES-सहायता प्राप्त हाइड्रो-डिस्टिलेशन को मानकीकृत किया गया, जिसके परिणामस्वरूप पारंपरिक हाइड्रो-डिस्टिलेशन की तुलना में तेल की उपज में वृद्धि, निष्कर्षण के समय में कमी और एंटीऑक्सीडेंट गतिविधि में सुधार हुआ।

- **लाख के रंग (लैक डाई) पर आधारित फ्रेशनेस इंडिकेटर का विकास:** मछली के खराब होने की वास्तविक समय (रियल-टाइम) में निगरानी के लिए लाख के रंग का उपयोग करके एक बाइजेल-आधारित इंटेलिजेंट फ्रेशनेस इंडिकेटर विकसित किया गया, जिसने प्रत्यक्ष रंग परिवर्तन (विज़िबल कलर चेंज)के माध्यम से ताजगी के तीन चरणों (ताजा, जल्द उपयोग करें और खराब) को सफलतापूर्वक अलग किया।

- **हरी मटर के छिलकों के कचरे से सेल्यूलोज का निष्कर्षण:** जलीय और हल्के क्षार उपचारों का उपयोग करके हरी मटर के छिलकों के कचरे से सेल्यूलोज के हाइड्रोथर्मल-सहायता प्राप्त निष्कर्षण को मानकीकृत किया गया, जिससे रसायनों के कम उपयोग के साथ उच्च रिकवरी हासिल हुई।

- **स्ट्रॉबेरी संरक्षण के लिए खाद्य कोटिंग (एडिबल कोटिंग):** स्ट्रॉबेरी संरक्षण के लिए सोडियम एल्गिनेट और लेमनग्रास एसेंशियल ऑयल से युक्त बायोपॉलीमर-आधारित खाद्य कोटिंग फॉर्मूलेशन विकसित किए गए, जिसने फल के कड़ेपन (firmness) के नुकसान को काफी कम कर दिया और रेफ्रिजेरेटेड अचल आयु को 16 दिनों तक बढ़ा दिया।

- **स्ट्रॉबेरी से मूल्य वर्धित उत्पाद:** 'स्ट्रॉबेरी बाइट्स' (एक प्राकृतिक और चीनी मुक्त सूखा स्ट्रॉबेरी उत्पाद) के विकास के लिए प्रक्रिया मापदंडों को अनुकूलित किया गया। विकसित उत्पाद ने 8 महीने तक के भंडारण के दौरान स्वीकार्य गुणवत्ता बनाए रखी।

- **इमली के बीज के पाउडर (TKP) आधारित एडहेसिव फॉर्मूलेशन:** कागज को चिपकाने वाले अनुप्रयोगों के लिए इमली के बीज के पाउडर आधारित एडहेसिव फॉर्मूलेशन को मानकीकृत किया गया। 80 °C (HW-80) पर गर्म पानी का उपयोग करके और 90 °C (CK-90) पर TKP को पकाकर तैयार किए गए फॉर्मूलेशन ने उत्कृष्ट एडहेसिव और तन्यता शक्ति प्रदर्शित की, जिससे वे कार्टन बोर्ड और पेपर बॉन्डिंग अनुप्रयोगों के लिए उपयुक्त बन गए।

- **ग्वार मील प्रोटीन आइसोलेट का निष्कर्षण:** अल्ट्रासोनीकेशन-सहायता प्राप्त क्षार निष्कर्षण का उपयोग करके ग्वार मील प्रोटीन आइसोलेट के निष्कर्षण को अनुकूलित किया गया। ग्वार मील के बारीक कणों, आकार (<0.15 मिमी) और 0.2 M NaOH का उपयोग करके 38.8% की अधिकतम प्रोटीन रिकवरी प्राप्त की गई।

- **प्राकृतिक गोंद-आधारित खाद्य स्याही (एडिबल इंक) का विकास:** फलों और सब्जियों पर सीधे छपाई के लिए रोसिन (rosin) और लाख के रंग से युक्त एक प्राकृतिक गोंद-आधारित खाद्य स्याही फॉर्मूलेशन विकसित किया गया। अनुकूलित फॉर्मूलेशन ने अमरूद, कीवी, शिमला मिर्च, जुकिनी (तोरई) और सेब की सतहों पर तेजी से सूखने (<5 सेकंड), अच्छी प्रिंटिंग क्षमता और संतोषजनक घिसने/रगड़ने से प्रतिरोध (रबरेज़िसटेंस) का प्रदर्शन किया।

- **लाख के रंग की अल्ट्रासोनिक-सहायता प्राप्त रिकवरी:** 20 मिनट के लिए 60 °C पर खुरचे हुए लाख की अल्ट्रासोनिक-सहायता प्राप्त धुलाई करने से प्राप्त धुलाई-जल से अधिकतम लाख का रंग प्राप्त हुआ।

- **गोंद अरेबिक (गम अराबिक) का भौगोलिक प्रमाणीकरण:** भौगोलिक मूल के आधार पर गोंद अरेबिक के नमूनों को वर्गीकृत करने के लिए, ICAR-CAZRI, जोधपुर में विभिन्न कृषि-जलवायु क्षेत्रों से नमूने एकत्र किए गए। हाइपरस्पेक्ट्रल इमेजिंग और मल्टीवेरिएट सांख्यिकीय के साथ के विश्लेषण ने भौगोलिक प्रमाणीकरण के लिए 75% वर्गीकरण सटीकता प्राप्त की।

- **गोंद उत्पादन बढ़ाने के लिए गोंद प्रेरण (गमइनडयूसमेंट):** *प्रोसोपिस सिनेरिया* (खेजड़ी), *मोरिंगा ओलीफेरा* (सहजन) और *अजाडिरैक्श इंडिका* (नीम) में गोंद प्रेरण अध्ययनों ने प्रेरक (इनड्यूसर) के अनुप्रयोग के कारण गोंद की उपज में महत्वपूर्ण वृद्धि प्रदर्शित की। राजस्थान में किसानों द्वारा CAZRI गोंद प्रेरक तकनीक को अपनाने के परिणामस्वरूप लगभग 4.12 टन गोंद अरेबिक का उत्पादन हुआ और वर्ष 2025–26 के दौरान लगभग ₹41.2 लाख का राजस्व प्राप्त हुआ।

- **ग्वार गोंद-आधारित कार्यात्मक पेय (फंक्शनल बेवरेज):** VNMKV, परभनी में 0.5% ग्वार गोंद और 8% आंवला रस मिश्रित गन्ने के रस के पेय को मानकीकृत किया गया। विकसित पेय ने बेहतर संवेदी (सेंसरी) गुणवत्ता, बढ़ी हुई एंटीऑक्सीडेंट गतिविधि और रेफ्रिजेरेटेड स्थितियों के तहत 60 दिनों तक भंडारण स्थिरता का प्रदर्शन किया।

- **इमली के बीज के गोंद का निष्कर्षण और खाद्य अनुप्रयोग:** TNAU, मेट्टूपलायम में इमली के बीज के गोंद के जलीय निष्कर्षण को मानकीकृत किया गया, जिसमें लगभग 10% गोंद रिकवरी हुई। इमली के बीज के गोंद-आधारित दही, सॉफ्ट ड्रिंक्स और ग्लूटेन-मुक्त केक ने बेहतर चिपचिपापन, बनावट, जल-धारण क्षमता, स्थिरता और कार्यात्मक गुण प्रदर्शित किए, जो क्लीन-लेबल खाद्य सामग्री के रूप में उनकी क्षमता को सिद्ध करते हैं।

- ***एलांथस* ओलियोरेसिन का प्रीक्लिनिकल (औषधीय) मूल्यांकन:** केरल कृषि विश्वविद्यालय में *एलांथस* ओलियोरेसिन के प्रीक्लिनिकल मूल्यांकन ने तीव्र और उप-तीव्र विषाक्तता अध्ययनों में LD_{50} > 2000 mg/kg के साथ सुरक्षा प्रदर्शित की। *एलांथस* ओलियोरेसिन अर्क ने पशु मॉडलों में बिना किसी मृत्यु दर के लगभग 70% ट्यूमर अवरोध के साथ महत्वपूर्ण, खुराक-निर्भर(doze dependent) एंटी-ट्यूमर गतिविधि का प्रदर्शन किया।

प्रटोटाइप और मशीनरी का विकास

- **बटन लाख उत्पादन के लिए मेल्ट-फिल्ट्रेशन यूनिट:** बटन लाख उत्पादन के लिए 5–10 kg/batch क्षमता की एक पिघल-छानने वाली (मेल्ट-फिल्ट्रेशन) यूनिट विकसित और मूल्यांकित की गई। इसकी कार्य संपादन दक्षता 82 से 87% के बीच रही, और मेल्ट-फिल्ट्रेशन तापमान बढ़ने के साथ ऊर्जा की खपत में कमी आई।

- **हाइड्रोजेल के लिए निरंतर अपवर्तन विंडो ड्रायर (Continuous Refractance Window Dryer):** गोंद-आधारित हाइड्रोजेल को लगातार सुखाने के लिए बेल्ट की गति और सुखाने की स्थितियों पर पूर्ण नियंत्रण के साथ एक पायलट-स्केल निरंतर अपवर्तन विंडो (RW) ड्रायर को डिजाइन और निर्मित किया गया।

- **ग्वार गोंद व्युत्पन्न (डेरीवेटिव) पायलट प्लांट का विकास:** 76.31% उपज दक्षता के साथ एक ग्वार गोंद व्युत्पन्न पायलट प्लांट विकसित किया गया। उत्पादित ग्वार गोंद व्युत्पन्न का pH 7.29, प्रतिस्थापन की डिग्री 0.1728 और विस्कोसिटी (चिपचिपापन) 700 cP थी।

- ***सिनकोना* पेड़ उखाड़ने के उपकरण का विकास:** सिनकोना के पेड़ों को उखाड़ने के लिए दो प्रोटोटाइप विकसित किए गए, जिनमें से उर्ध्वाधर (वर्टिकल) प्रकार मैदानी क्षेत्रों के लिए और क्षैतिज (हॉरिजॉन्टल) प्रकार ढलानी भूमि के लिए उपयुक्त है।

प्रौद्योगिकी हस्तांतरण, प्रशिक्षण और क्षमता निर्माण

- **क्षमता निर्माण और उद्यमिता विकास कार्यक्रम:** वर्ष 2025 के दौरान, संस्थान ने वैज्ञानिक लाख खेती, प्रसंस्करण, उपयोग और मधुमक्खी पालन पर क्षमता निर्माण और उद्यमिता विकास कार्यक्रमों की एक श्रृंखला आयोजित की। कुल 15 किसान प्रशिक्षण कार्यक्रम, 39 एक्सपोज़र विज़िट (भ्रमण) और अभिविन्यास कार्यक्रम, चार उद्यमिता प्रशिक्षण कार्यक्रम, दो ऑफ-कैंपस प्रशिक्षण और एक छात्र प्रशिक्षण कार्यक्रम आयोजित किए गए, जिससे 3,468 प्रतिभागी लाभान्वित हुए।

- **किसान मेला-सह-कृषि प्रदर्शनी का आयोजन:** आधुनिक कृषि तकनीकों, प्रचलित पद्दतियों और सरकारी पहलों को बढ़ावा देने के लिए 20–21 फरवरी 2025 को किसान मेला-सह-कृषि प्रदर्शनी 2025 का आयोजन किया गया, जिसमें 4,000 से अधिक किसानों, शोधकर्ताओं, नीति निर्माताओं, उद्यमियों और विस्तार एजेंसियों को एक साथ लाया गया। इस कार्यक्रम में 65 से अधिक प्रदर्शनी स्टॉल और लाख की खेती, प्राकृतिक खेती, फसल विविधीकरण, पशुपालन, मत्स्य पालन और संबद्ध क्षेत्रों पर तकनीकी सत्र शामिल थे।

- **मास्टर ट्रेनर्स का प्रशिक्षण और दूरस्थ पहुँच (आउटरीच) गतिविधियां:** इन कार्यक्रमों में 4 मास्टर ट्रेनर्स प्रशिक्षण कार्यक्रमों से 151 प्रसार कर्मियों को प्रशिक्षित किया। संस्थान ने अन्य भा.कृ.अनु.प के संस्थानों और राज्य सरकार के संबद्ध विभागों द्वारा आयोजित 11 कार्यक्रमों, मेलों और प्रदर्शनियों में भी भाग लिया। कुल मिलाकर, इन पहलों से 6,619 हितधारकों को लाभ हुआ और लाख तथा संबद्ध क्षेत्रों में प्रौद्योगिकी प्रसार, कौशल विकास और उद्यमिता को बल मिला।

कृषि विज्ञान केंद्र, खूंटी

- वर्ष 2025 में, केवीके खूँटी द्वारा 82.5 हेक्टेयर क्षेत्र में सात प्रक्षेत्र परीक्षण (OFT) तथा 174 प्रदर्शन आयोजित किए गए। किसानों के लिए कुल 91 एक-दिवसीय प्रशिक्षण कार्यक्रम आयोजित किए गए, जिनसे 2,818 प्रतिभागी (पुरुष-1211, महिला-1607) लाभान्वित हुए। इसके अतिरिक्त, ग्रामीण युवाओं के लिए 5 दिवसीय अवधि के 5 प्रशिक्षण कार्यक्रम आयोजित किए गए, जिनसे 155 ग्रामीण युवा (पुरुष-74, महिला-81) लाभान्वित हुए, विस्तार कार्मिकों के लिए 121 प्रतिभागियों हेतु तीन प्रशिक्षण, 21 छात्रों के लिए 14 सप्ताह का एक RAWE प्रशिक्षण कार्यक्रम तथा 15 इनपुट डीलरों को लाभान्वित करने वाला 15 दिवसीय एक प्रशिक्षण भी आयोजित किया गया। जन जागरूकता हेतु 316 अन्य विस्तार गतिविधियाँ आयोजित की गईं, जिनमें 71,019 (पुरुष-36,746 तथा महिला-34,273) किसान एवं विस्तार कार्मिकों ने भाग लिया।

शैक्षणिक इकाई

- **जलकुंभी (Water Hyacinth) से नैनोसेल्यूलोज का विकास:** DES-सहायता प्राप्त अल्ट्रासोनीकेशन प्रक्रिया का उपयोग करके जलकुंभी के बायोमास पर आधारित उन्नत क्रिस्टलीयता वाले स्थिर नैनोसेल्यूलोज (~93 nm) प्राप्त करने की प्रक्रिया विकसित की गई। इस नैनोसेल्यूलोज ने β-कैरोटीन इमल्शन को प्रभावी ढंग से स्थिर किया, उच्च एनकैप्सुलेशन दक्षता, pH-निर्भर रिलीज (94.02% तक) और इन-विट्रो पाचन के दौरान बेहतर जैव-पहुंच (बायो-एक्सेस्सिबिलिटी) का प्रदर्शन किया।

- **लाकाडोंग हल्दी से करक्यूमिनोइड्स का एनकैप्सुलेशन:** लाकाडोंग हल्दी से करक्यूमिनोइड्स को pH-प्रेरित कोएसर्वेषण का उपयोग करके शेलाक मैट्रिक्स में सफलतापूर्वक एनकैप्सुलेट किया गया, जिससे उनके भंडारण स्थिरता में महत्वपूर्ण सुधार हुआ; इसमें सामान्य तापमान पर केवल 10–15% गिरावट आई और जमने (रेफ्रिजरेशन) के तहत अधिकतम स्थिरता देखी गई।

- **कटाई के बाद रोग प्रबंधन के लिए शेलाक नैनोकण:** एंटी-सॉल्वेंट प्रीसिपिटेशन के माध्यम से संश्लेषित अनुकूलित शेलाक नैनोकणों (ShNPs) ने उच्च कोलाइडल स्थिरता (जेटा पोटेंशियल –46.8 mV) के साथ ~88 nm आकार के स्थिर नैनोकणों का उत्पादन किया। इन-विट्रो अध्ययनों ने पपीते के कटाई के बाद के प्रमुख रोगजनकों के खिलाफ मजबूत एंटिफंगल गतिविधि का प्रदर्शन किया, जिससे 80 ppm पर 91.48% तक अवरोध हासिल हुआ।

- **कीट नियंत्रण के लिए स्लो-रिलीज़ (धीमी गति से रिसने/निकलने वाले) रोज़मेरी तेल फॉर्मूलेशन:** रोज़मेरी आवश्यक तेल का एक बायोचार-आधारित स्लो-रिलीज़ फॉर्मूलेशन विकसित और अनुकूलित किया गया, जिसने *कैलोसोब्रुकस मैकुलेटस* (*Callosobruchus maculatus*) के खिलाफ नियंत्रित रिसाव (रिलीज) और उत्कृष्ट धूमन (fumigation) प्रभावकारिता का प्रदर्शन करते हुए 7 घंटे के भीतर 100% वयस्क कीट मृत्यु दर हासिल की।

- **शरीफा (Custard Apple) लेदर उत्पादन के लिए RW सुखाने का अनुकूलन:** प्रक्रिया अनुकूलन के साथ रिफ्रैक्टेंस विंडो (RW) सुखाने का उपयोग करके शरीफा लेदर विकसित किया गया, जिसने पारंपरिक गर्म हवा में सुखाने की तुलना में बेहतर सुखाने की दक्षता, शर्करा और फेनोलिक्स का बेहतर प्रतिधारण, कम रंग परिवर्तन और बेहतर समग्र उत्पाद गुणवत्ता प्रदर्शित की।

- **सीडलाख मेल्ट-फिल्ट्रेशन यूनिट की मॉडलिंग:** इष्टतम मेल्ट-फिल्ट्रेशन स्थितियों की पहचान करने के लिए सीडलाख के पिघलने के व्यवहार और थर्मो-रियोलॉजिकल गुणों का मॉडल तैयार किया गया, जिससे 87.25% तक की निस्पंदन (filtration) क्षमता वाली एक कॉम्पैक्ट इन्फ्रारेड हीटिंग-आधारित मेल्ट-फिल्ट्रेशन यूनिट का विकास हुआ।

- **प्राकृतिक गोंद और उनके हाइड्रोलाइजेट्स की प्रीबायोटिक क्षमता:** छह लैक्टिक एसिड बैक्टीरिया उपभेदों (strains) के खिलाफ चार प्राकृतिक गोंद और उनके आंशिक हाइड्रोलाइजेट्स की प्रीबायोटिक क्षमता का मूल्यांकन किया गया, जिसमें आंशिक हाइड्रोलिसिस ने बैक्टीरिया के विकास को महत्वपूर्ण रूप से बढ़ाया। आणविक अध्ययनों से प्रजाति-विशिष्ट ग्लाइकोसिडेस गतिविधि का पता चला, जो लक्षित सिनबायोटिक फॉर्मूलेशन तैयार करने के लिए एक यंत्रवत आधार प्रदान करता है।

प्रकाशन

- वर्ष 2025 में, 25 शोध पत्र, 3 पुस्तकें, 3 तकनीकी बुलेटिन, 23 पुस्तक अध्याय, 3 विस्तार फ़ोल्डर, 41 लोकप्रिय लेख और 3 पेटेंट प्रकाशित किए गए।

राजस्व सृजन

- प्रशिक्षण, एक्सपोज़र विज़िट आदि के माध्यम से कुल ₹ 88.02 लाख का राजस्व उत्पन्न हुआ (किसानों का प्रशिक्षण और एक्सपोज़र विज़िट आदि ₹ 77.67 लाख; प्रक्रियाओं और उत्पादों के प्रौद्योगिकी/सूचनाओं एवं जानकारियों के हस्तांतरण से, कृषि विज्ञान केन्द्र फार्म की उपज आदि ₹ 10.35 लाख)।

क्र. सं.	संस्थान/ केन्द्र	विवरण	राजस्व सृजन (₹ लाख में)
1	संस्थान	किसानों का प्रशिक्षण और एक्सपोज़र विज़िट	77.67
2		प्रक्रियाओं और उत्पादों के प्रौद्योगिकी/सूचनाओं एवं जानकारियों के हस्तांतरण से	1.95
3	कृषि विज्ञान केन्द्र	फार्म की उपज	8.4
कुल			**88.02**

INTRODUCTION

GENERAL INFORMATION

Following the recommendation of Lindsay-Harlow Committee constituted in 1920 to look into all aspects of the country's lac trade and its development, Indian Lac Research Institute, Ranchi was established on September 20, 1924, under Indian Lac Association for Research. Subsequently, on the recommendations of the Royal Commission on Agriculture, the Indian Lac Cess Committee (ILCC) was constituted, which took over the reins of the ILRI in 1931. The Institute became an integral part of the Indian Council of Agricultural Research (ICAR) from April 1, 1966. Till 2007, the Institute was devoted exclusively to research and technology development on lac, including its cultivation, processing, value addition, utilization and extension. Then, in September, 2007, the mandate was expanded to include other natural resins and gums under its purview, and the institute was renamed as the Indian Institute of Natural Resins and Gums (IINRG). In order to address the expanded mandate, without concomitant increase in manpower, two Network Projects were initiated under the Institute namely, Harvesting, Processing and Value Addition of Natural Resins and Gums (HPV on NRGs) with 10 centers and Conservation of Lac Insect Genetic Resources (CLIGR) with 11 centers across the country. Keeping in view the importance of secondary agriculture in order to substantially improve farmers' income and promote rural industrialization the institute was rechristened as National Institute of Secondary Agriculture (NISA) with effect from 27th September, 2022 and formally inaugurated by Honorable Secretary, DARE & Director General, ICAR on 2nd February, 2023.

Vision of ICAR-NISA

To become driving source for rural agro-industrialized economy and act as an international referral institute of Secondary Agriculture (SA).

Mission of ICAR-NISA

Bridging gaps in building rural industries and reducing imports through Secondary Agriculture.

Mandates of the Institute

I. Research on tertiary and higher level of processing and value addition to agri-produce including natural resins, gums and aqua produce.

II. Pilot plants, human resources and entrepreneurship development for high value products' production.

Objectives

I. To Augment the Agri-Bioresources and develop processes and machinery for pilot level production of their tertiary and quaternary level processed products.

II. To develop technology for converting non-food agri-biomass to food ingredients forms and manufacture foods using machine and tools.

III. To establish agri-business incubation centres, develop human resources and disseminate the technologies of secondary agriculture.

DIVISIONS/UNITS AND THEIR OBJECTIVES

The objective of Agri-Bioresources Augmentation (ABA) division is Identification, selection & conservation of agri and allied produces, agro-industrial by-products, crop residues, food waste and marine products. Agriculture Structure and Process Engineering (ASPE) division aims at the development of technologies and processing system for higher level of processing of agri-bioresources. Downstream Agro-Processing (DAP) division deals with the development of advanced processing, extraction, formulation, and delivery system from agri-bioproducts and co-products. The Automation and Plant Engineering (APE) division looks at the development of automation systems for processing and quality control. Agri-Business Development (ABD) unit thrives for Transfer of technology and entrepreneurship development.

Location

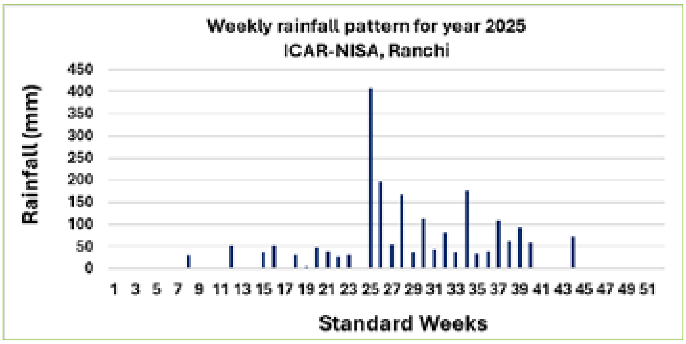
The Institute is situated 9 km south-east of Ranchi city, on the National Highway - 33 (Ranchi-Jamshedpur), at an altitude of 650 m above mean sea level between 23 ° 23' N latitude and 85 ° 23' longitude, with a mild and salubrious climate. It has 52.7 ha of land used for research, office and residential purposes. The major water sources are one bore well and 3 farm ponds. All the water sources are connected through an underground irrigation grid to irrigate 38.6 ha of farm area. The Institute also has a meteorological observatory, guest house facilities for 18 guests. The Research Workshop provides the facilities for fabrication of research prototypes. Advance/Full Text/Abstracts access of more than 3900 journals from several publishers has been made available online through Consortium for e-Resources in Agriculture (CeRA) to our scientists during the year. Our library is also connected with World e-Book Library (WEL) facility by National Digital Library (NDL), New Delhi from this year. All regular institute publications (Annual Reports/Newsletters/Lac-Resins-Gums Statistics/ Laksha/Dorothy Norris Lecture Series etc,.) since beginning and Research Article/ Bulletins are available in PDF form for the internal users. Annual Reports/Newsletters/Lac-Resins-Gums Statistics, Laksha, Dorothy Norris Lecture Series are also uploaded on ICAR-Krishi Portal. The library received 1 foreign, 4 national periodicals. The infrastructure created at the Institute caters to various research & development and technology transfer activities. In addition to the regular research and developmental activities, the Institute caters to the need for testing and certification of lac quality manufactured by industries through quality evaluation laboratory.

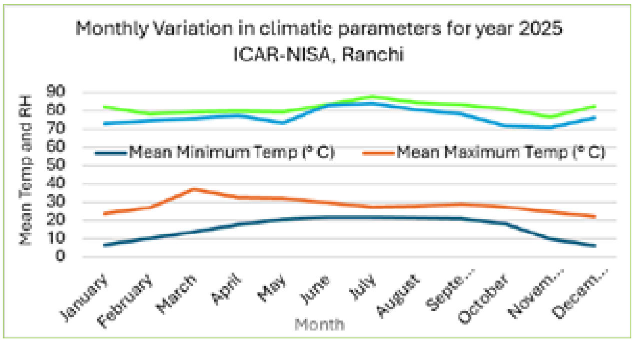
Over the years, the Institute has developed many successful technologies. Training and skill enrichment programs for different types of stake holders, viz., farmers, manufacturers, upcoming entrepreneurs, extension functionaries, teachers, students, etc., of either gender have been continuing for a long time. Display and demonstrations of technologies on appropriate platforms are also persisting. ICAR-NISA became a part of the IARI-Ranchi Hub for promoting higher education. ICAR-NISA is offering post graduate courses in "Process and Food Engineering" and "Agricultural Chemicals".

METEOROLOGICAL OBSERVATIONS

The Agro-meteorological observatory of the Institute is located at 85°23' E longitude, and 23°23' N latitude at an elevation of 650 m above mean sea level. Rainfall, minimum and maximum temperatures, and minimum and maximum relative humidity (RH) are recorded regularly at the observatory. Salient meteorological observations for 2025 are:

- Monsoon arrived on June 18, 2025, one week after its normal arrival date and withdrew on October 09, 2025. The year's highest rainfall (144 mm) was recorded on June 19, 2025. Annual rainfall of 2116.20 mm occurred on 119 rainy days during the year 2025.
- The maximum temperature of the year (37.4 °C) was recorded on April 22 and 25, 2025, while the minimum temperature (3.1 °C) was recorded on December 28, 2025.
- The monthly average Relative Humidity (RH) in the morning (7:30 AM) ranged from 76.47 to 87.68 per cent, while in the afternoon (2:30 PM) it ranged from 70.93 to 84.19 per cent.






ORGANOGRAM
Department of Agricultural Research and Education, Ministry of Agriculture & Farmer's Welfare
Indian Council of Agricultural Research
Subject Matter Division – Agricultural Engineering
ICAR–National Institute of Secondary Agriculture
Research Advisory Committee
Prioritization, Monitoring and Evaluation Cell
Academic Cell
Institute Management Committee
Institute Research Committee
Hindi Cell
Women's Cell
Central Facilities
Divisions
Research & Extension Centres
Administration, Audit and Accounts
• Guest House
• Dispensary
• Institute Research Farm
• Library
• Estate & Service Unit
• Museum
• Agri-Bioresources and Augmentation Division
• Agricultural Structures and Process Engineering
• Downstream Agro-Processing
• Automation & Plant Engineering
• Krishi Vigyan Kendra
• Agri-Business Development Unit

RESEARCH ACHIEVEMENTS

AGRO-BIORESOURCES AUGMENTATION DIVISION

Effect of nylon net bagging on seed recovery in *Flemingia semialata* under pulse pod fly infestation

Flemingia semialata, a bushy leguminous host crucial for lac cultivation, faces significant seed production losses due to severe infestation by the pulse pod fly (*Melanagromyza obtusa*), with limited scope for pesticide use owing to high honey bee activity during flowering. Each inflorescence bears approximately 60-100 pods, each with two seeds, yet open inflorescences show only about 10% seed set due to pest damage. To address this, a field trial was conducted using 60 mesh nylon net bagging on 30 inflorescences, compared with 30 unbagged controls. Results showed a substantial improvement in seed recovery. Bagged inflorescences yielded 136.2 ± 5.8 seeds per inflorescence (85% seed set), compared to 15.7 ± 4.3 seeds (10% seed set) in controls, with the difference being statistically significant. The bagging method effectively prevented pest infestation without adversely affecting pollinators, offering an eco-friendly, scalable, and pollinator-safe solution to enhance seed yield in lac host plantations.

Ecofriendly 60 mesh nylon net bagging for F. semialata seed production

Identification of honey bee forage-providing lac integrated cropping system model

Experiments at the Institute Research Farm of ICAR-NISA, Ranchi, aim to identify honey bee forage crops suitable for integration with lac cultivation. During the Rabi season, five crops—strawberry (Winter Down), sweet corn (Mithas), buckwheat (Takane Ruby and common buckwheat), mustard (Kalavati), ajwain (JK ajwain), and coriander (Green Aroma)—have been evaluated to assess potential synergies between lac culture and apiculture.

Honey bees visiting sweet corn for pollen

Preliminary results show that strawberry yield increased by up to 70% after introducing *Apis cerana* colonies at a density of two colonies per acre in the lac-based strawberry intercropping system. This intervention also increased bee visitation frequency on *F. semialata* plants by 65%, leading to reduced sooty mould incidence on lac and improved seed set in *F. semialata*. The study remains in progress.

Strawberry (variety-Winter Down) intercropped with F. semialata

Optimisation of inner tissue isolation method for *Tremella fusiformis* from wild fruiting bodies

Tremella fusiformis from iting bodies were collected from natural habitats. Several isolation methods like spore print isolation, surface swab method, dilution plate method and direct plating method, were evaluated for their efficiency in obtaining pure cultures and the best could be obtained by inner tissue isolation method. The method was optimised for the isolation of *Tremella fusiformis* with minor modification. Initially the fruiting bodies were surface-sterilised by immersing them in 70% ethanol for 30 seconds, followed by short exposed to 95% ethanol, and then rinsed thoroughly with sterile distilled water. A small inner tissue pieces were aseptically excised from the fleshy, sterile interior of the mushroom using a sterile scalpel under a laminar airflow cabinet. These tissue bits were carefully placed onto malt extract agar plates and incubated at 25 °C in darkness for 5 days. Emerging mycelial colonies exhibiting typical *T. fusiformis* characteristics slow-growing, white, and cottony were monitored and selected. The obtained colonies were subsequently sub-cultured onto fresh MEA plates to ensure purity and uniformity. The purified isolates were finally maintained on MEA slants under refrigerated conditions for further physiological and molecular studies.

Mycelium isolated from wild collected tremella fusiformis (snow mushroom)

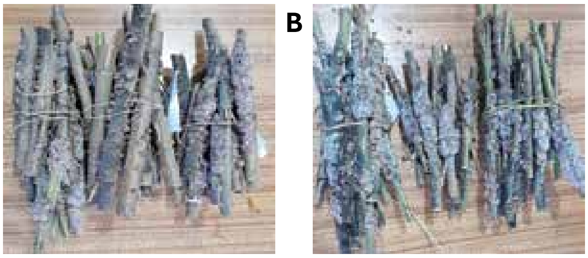
Lac yield as affected by topography, fertility levels and rest period in *palas*.

The lac yield ratio was 3.26 in lowland areas and 5.01 in upland areas, representing a decrease of approximately 34% in lowland environments. The proportion of males in the lac population was 25% in lowland areas and 19% in upland areas, which may account for the higher yield observed in upland conditions. Among soil fertility treatments, liming produced the highest lac yield ratio (5.49), compared to the control (3.17). Chemical fertiliser treatments resulted in yield ratios ranging from 3.3 to 4.6. Variations in male percentage and settlement density were not statistically significant. The lac yield ratio also differed significantly across rest periods. A longer rest period of 19 months yielded a higher yield ratio (4.8) than a shorter rest period of 7 months (3.47). The male proportion was 20% in the longer rest period and 23% in the shorter rest period.

Comparative efficacy of entomopathogenic bioagents and Indoxacarb on brood lac yield in *Flemingia semialata*

A field experiment has been conducted to assess the efficacy of the entomopathogenic fungi *Beauveria bassiana* and *Metarhizium anisopliae* compared with the synthetic insecticide Indoxacarb (commercially known as Isacarb) for enhancing brood lac production in *F. semialata*. The experimental design comprised three treatments (Isacarb, Beauveria, and Metarhizium) and an untreated control, with 10 plants per treatment. Fresh brood lac yield per plant was measured in grams. The mean ± standard error (SE) brood lac yields per plant were as follows: Isacarb, 55.00 ± 4.68 g; Metarhizium, 44.61 ± 4.44 g; Beauveria, 33.20 ± 3.61 g; and Control, 28.40 ± 2.88 g. All treatments produced higher yields than the control, with Isacarb yielding the greatest. One-way ANOVA indicated a significant difference among the four treatments ($F = 5.53$; $df = 3,36$; $P = 0.0032$), with the F-statistic exceeding the critical value ($F_{crit} = 2.87$). Although Indoxacarb produced the highest brood lac yield, *Metarhizium anisopliae* significantly outperformed the control and achieved yields statistically comparable to those of Isacarb, suggesting its potential as a sustainable and environmentally safer alternative. *Beauveria bassiana* also increased yields relative to the control, though to a lesser extent. These results highlight the potential of bioagents, particularly Metarhizium, as effective biocontrol alternatives to synthetic insecticides in lac cultivation.

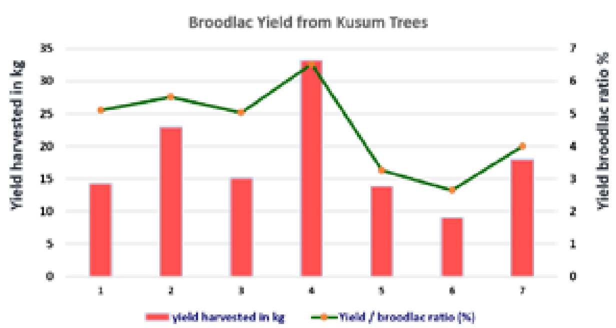
A B



(A) Broodlac from untreated control and (B) Broodlac from Metarhizium anisopliae treatment

Development of a broodlac self-sufficiency model using ber and kusum plant combination for kusmi lac production: first-year evaluation

The potential for self-sufficiency in broodlac production using Kusum (*Schleichera oleosa*) and Ber (*Ziziphus mauritiana*) host plants in a 1:8 ratio was evaluated to determine whether broodlac produced on a single Kusum tree during the summer lac crop could satisfy the inoculation requirements for 8 Ber trees in the subsequent winter crop. The study involved 20 Kusum trees and 160 Ber plants distributed across 20 plots, which were subdivided into three groups; only 7 Kusum trees were initially inoculated. Standard lac cultivation practices were consistently applied across all plots. Broodlac yield varied considerably among the plots, ranging from 9.0 to 33.25 kg, with an average yield of 18.06 kg per Kusum tree.



Broodlac yield from kusum trees of seven plots with kusum ber combination in 1:8 ratio

The amount of broodlac used for inoculation ranged from 2.8 to 5.1 kg, resulting in an average broodlac multiplication ratio of approximately 5.0. The total yield from the seven inoculated Kusum trees was 126.42 kg, produced from 27.2 kg of broodlac used for inoculation, yielding an overall multiplication ratio of 4.65. Of this yield, 80 kg of broodlac was used to inoculate all 160 Ber plants across the 20 plots, while the remaining 46 kg was allocated for other experiments. These findings indicate that the Kusum–Ber 1:8 host combination model is a viable approach to achieving broodlac self-sufficiency and highlight the potential to integrate Kusum and Ber plants into sustainable, economically viable lac cultivation systems.

Summer brood lac production on *Flemingia semialata*: a sustainable solution for new lac cultivation areas

Flemingia semialata is well known as an excellent host for winter Kusmi lac production, but its suitability for summer broodlac generation remains largely unexplored. A recent study demonstrated successful summer broodlac production on *F. semialata* during the January–June crop season using drip irrigation. This offers a valuable option for emerging lac cultivation regions. The experiment recorded an average broodlac yield of 55.00 ± 4.68 g per bush, lower than the typical 100–150 g obtained in winter but still significant as a breakthrough for summer cultivation. This reduced broodlac yield was partly compensated by simultaneous seed production, averaging 20.67 ± 7.46 g per bush, enhancing overall economic returns from each plant. These results are especially important for newly developing lac-growing areas where traditional large host trees such as Kusum (*Schleichera oleosa*) and Ber (*Ziziphus mauritiana*) are not readily available.

Broodlac harvested from summer lac crop on F. semialata

By adopting *F. semialata* as a dual-purpose host and allocating 60% of the area to winter commercial lac and 40% to summer broodlac, farmers can achieve self-sufficiency in broodlac supply and reduce dependence on long-distance procurement.

Demonstration of *Kusmi* and *Rangeeni* lac cultivation on *Calliandra calothyrsus* host plant

Kusmi and Rangeeni lac cultivation trials were conducted on Calliandra plants across different crop seasons during 2024–25, following recommended plant protection schedules. In the Aghani crop (2024–25), Kusmi broodlac was inoculated at 300 g per plant on 32 plants in July 2024. After spraying with Indoxacarb and Carbendazim, the crop harvested in February 2025 yielded 50 kg broodlac, of which 24.3 kg was scraped lac, achieving a yield ratio of 1:5. In the Jethwi crop (2025), Kusmi broodlac was inoculated at 200 g per plant on 10 plants in February 2025. The crop harvested in July 2025 produced 21.70 kg broodlac with an average yield of 2.2 kg per plant and a higher yield ratio of 1:10.9.

For Rangeeni lac, in the Baisakhi crop (2024–25), broodlac was inoculated at 500 g per plant on 18 plants in November 2024. After application of Fipronil and Carbendazim, harvesting in July 2025 resulted in 50 kg broodlac with an average yield of 2.8 kg per plant and a yield ratio of 1:5.5. In the Katki crop (2025), broodlac was inoculated at 450 g per plant on 20 plants in July 2025, but harvesting was completed from only 12 plants in October 2025. This yielded 12.3 kg broodlac with an average yield of 1.0 kg per plant and a comparatively lower yield ratio of 1:2.2. Overall, the results indicate better performance of Kusmi lac in the Jethwi crop and moderate to lower yields in Rangeeni crops, depending on season and plant utilisation.

Kusmi lac cultivation (Aghani crop: 2024-25) on Calliandra calothyrsus

Kusmi lac cultivation (Jethwi crop: 2025) on Calliandra calothyrsus

Rangeeni lac cultivation (Baisakhi crop:2024-25) on Calliandra calothyrsus

Rangeeni lac cultivation (Katki crop 2025) on Calliandra calothyrsus

Long-term potential in *F. semialata via* mutation breeding

In our M_2-M3 generation trials, chemical mutagenesis generated unprecedented variability in *Flemingia* architecture and significant variation beyond the natural genetic range. The M_2 generation was evaluated for six key morphological traits, as shown in the following table. Treatments NaN_3 2.0Mm + NMU 0.5Mm (T2) and NaN_3 0.75Mm + NMU 1.5Mm (T3) produced significantly higher values for all traits except lac incrustation diameter and length. They also yielded 58% and 45% more broodlac than the control, as shown in the following table.

Treatment mean comparison of various mutagenes for *F. semialata*

Treatment	Shoot number	Biomass (g)	Lac yield (g)	Incrustation diameter (mm)	Incrustation length (cm)	Plant height (cm)
Control	4.3	1688	367	23.5	34.1	193
T1 : NaN_3 2.0Mm + NMU 1.5Mm	6.5	1998	417	23.5	25.9	165*
T2 : NaN_3 2.0Mm + NMU 0.5Mm	7.5	2663*	579*	24.8	31.3	163*
T3 : NaN_3 0.75Mm + NMU 1.5Mm	5.8	2631*	534*	23.9	36.3	178
T4 : NaN_3 0.75Mm + NMU 0.5Mm	4.0	1129	211	22.8	20.6	151
CD 5%	1.25	350	65	ns	ns	24

Among treatments, T2 had the highest yield increase (+58%), followed by T3 (+45%) and T1 (+14%), while T4 caused a significant yield reduction (−42%). Correlation analysis shows a strong positive relationship between biomass and lac yield (r = 0.82), indicating biomass is a key determinant. Incrustation length also had a strong positive correlation (r = 0.76), and shoot number had a moderate positive effect (r = 0.63). Other traits, such as stem diameter and plant height, showed moderate correlations, suggesting a supportive but less dominant role in influencing lac yield.

The effects of different mutagenic treatments (T1–T4) on the morphological traits of *Flemingia semialata* were studied. Incrustation diameter remained stable across all treatments, showing mutagens had no significant effect on this trait. Incrustation length varied notably, with the highest value in T3, suggesting improved lac deposition. Plant height was greatest under T3, indicating enhanced vegetative vigour, while T4 showed comparatively low growth. Total shoots and leaf number increased significantly in T2 and T3, reflecting improved plant growth and photosynthetic potential. Stem diameter showed moderate improvement, especially in T3, highlighting its positive influence on plant morphology as shown in the following table.

Effect of mutagen on morphological traits in *F. semialata*

Trait	Control	T1	T2	T3	T4	Interpretation
Incrustation Diameter (mm)	22.1	22.5	22.5	22.5	22.5	Stable (Non-significant)
Incrustation Length	32.0	25.9	32.1	34.7	20.6	Highest in T3
Plant Height (cm)	~157	159–183	187–189	up to 222	low	Vigorous in T3
Total shoots	Moderate	↑	↑↑	↑↑	↓	Best in T2–T3
Leaf Number	Moderate	↑	↑↑	↑↑	↓	Photosynthetic gain
Stem Diameter	Variable	↑	↑	↑↑	variable	Moderate improvement

Based on the above findings, a Lac Yield Model was developed. Fresh weight and shoot number were key predictors of broodlac in *F. semialata*. The ideal plant type has a moderate height (± 160 cm), 8-9 shoots, a dense canopy (≥ 120 leaves), biomass ≥ 2500 g per plant, a long incrustation ≥ 40 cm, and a strong, robust architecture tolerant of the lac insect, as shown in the following table and figure.

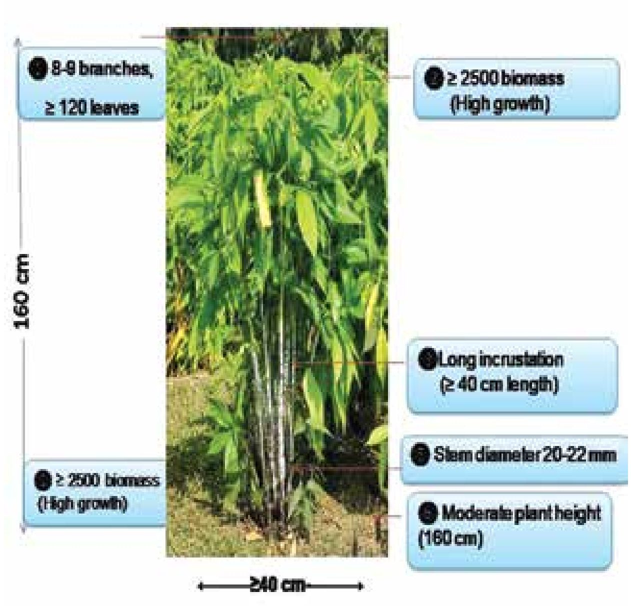
Thus, the lay yield model can be expressed as:

Yield = a + b1 + b2
(a = Intercept (Constant),
b1 = Regression coefficient for biomass,
b2 = Regression coefficient for branch number)

Ideal plant type: Based on observations in M2-M3 generation

The ideal plant type may be as-

1. Moderate Plant height = ± 160 cm
2. Branches (shoots) = 8-9
3. Dense canopy (≥ 120 leaves)
4. Biomass (high growth) ≥ 2500 g per plant
5. Long incrustation ≥40 cm length
6. Strong robust architecture (tolerance to lac insect)



Ideal plant type of F.semialata for High lac productivity

Promising treatments identified are T_2 (NaN_3 2.0 + NMU 0.5) with the highest foliage and stem thickness, making it most promising for lac yield; T_3 (NaN_3 0.75 + NMU 1.5) with high variability, useful for further selection; and T_4 (NaN_3 0.75

+ NMU 0.5) with bushy, structurally strong architecture. Lac yield enhancement in T_2 is 52% over control, and in T_3 is 45% over control. We have identified mutant lines with high potential for lac yield enhancement and will focus on stabilisation and preparation for field validation, aiming for varietal release by 2028-29.

Optimising ber varieties for lac cultivation

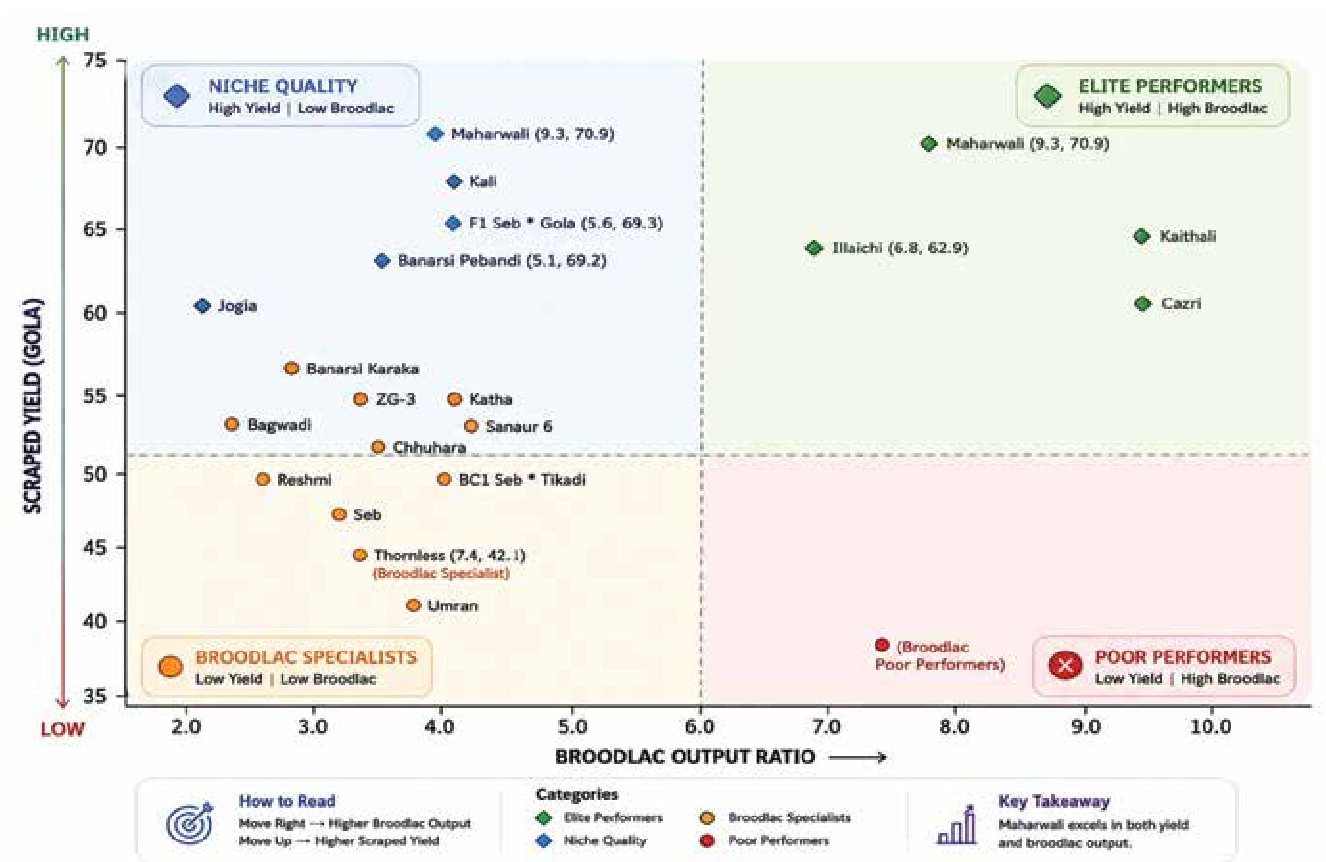
The long-term evaluation of fruit ber (*Ziziphus mauritiana*) varieties for winter kusmi lac production yielded a clear recommendation. Maharwali was the best performer, with a brood lac output ratio of 9.3 and a scraped lac yield of 70.9%. Other top priority varieties included F1 Seb, Gola, Banarsi Pebandi, Kali, Kaithali, Illaichi, Cazri Gola, and Mundia. Based on consistent performance, Maharwali and these varieties are recommended for commercial cultivation to maximise grower returns.

Priority	Varieties
TOP PRIORITY	Maharwali, F_1 Seb, Gola, Banarsi Pebandi, Kali, Kaithali, Illaichi, Cazri Gola, Mundia
SECONDARY	Jogia, Banarsi Karaka, Sanaur 6, ZG-3, Bagwadi, Katha, Chhuhara
SPECIALIST	Thornless (Broodlac focus)

Biointensive IPM module for pest management in *Flemingia semialata*-based lac integrated farming system

Effective pest management in *Flemingia semialata* (Roxb.)-based lac integrated farming requires controlling both host-plant pests and natural enemies of the lac insect *Kerria lacca* (Kerr), as predators and parasitoids cause significant crop loss. A field experiment at the ICAR-NISA Institute Research Farm, Namkum (Winter Kusmi lac crop cycle, June–July to January–February) evaluated four biopesticides—Azadirachtin (0.03% EC, 5 mL/L), *Beauveria bassiana* (10^8 cfu/mL WP, 5 g/L), *Metarhizium anisopliae* (10^8 cfu/mL, WP, 5 g/L), and

QUADRANT CHART: BROODLAC vs SCRAPED LAC %



Bacillus thuringiensis var. kurstaki (32,000 IU/mg, 2 g/L)—against Indoxacarb (14.5% SC, 0.5 mL/L) as a positive control and an unsprayed negative control. The study used a Randomised Complete Block design (6 treatments × 4 replications; 24 plots of 20 plants each). Outcomes measured included host-plant pest suppression, lac insect pest control, honeybee safety, brood lac yield, and *F. semialata* seed production. Lac insect pest control is the primary goal in lac IPM, as predators *Eublema amabilis* Wlk., *Pseudohypatopa pulverea* Meyr., and parasitoid *Aprostocetus purpureus* (Cameron) cause 30–60% crop losses. Indoxacarb was most effective, reducing lac predators by 88.4 ± 5.3% and the parasitoid by 78.6 ± 5.5% ($F_{5,15}$ = 58.3, $p < 0.001$). Among biopesticides, entomopathogenic fungi (EPF) provided strong natural enemy suppression: *B. bassiana* and *M. anisopliae* reduced lac predator populations by 62.3 ± 4.7% and 58.7 ± 5.3%, respectively (both $p < 0.01$ vs control). Bt kurstaki offered moderate predator suppression (44.8 ± 4.9%) during the first spray cycle. Azadirachtin produced only short-term, moderate suppression of lac predators, lasting 0–7 days after application (28.4 ± 3.1%; $F_{5,15}$ = 24.6, $p < 0.001$), with no significant effect thereafter. Its insect growth regulator (IGR) activity also caused a slight nontarget sublethal effect on lac crawler settlement and early instar survival, reducing its brood lac yield advantage despite effective pest control.

Treatment	Host-plant Pest Suppression (%)				Lac Pest Control (%)†		Honeybee Safety		Agronomic Yield	
	Whitefly % red.	Scale % red.	Defoliator % red.	Pod fly % red.	Lac pred. % red.†	Parasitoid % red.†	Bee visits /10 min	Bee mort. /m²	Brood lac (g/plant)	Seed yield (g/plant)
Azadirachtin	68.4 ±4.2	61.2 ±3.8	55.3 ±5.1	82.6 ±5.0	28.4 ±3.1	11.2 ±2.4	18.6 ±2.0	0.8 ±0.3	98.6 ±14.2	19.8 ±3.0
B. bassiana	74.1 ±4.4	69.8 ±4.2	38.2 ±4.8	41.5 ±5.0	62.3 ±4.7	18.4 ±3.1	19.2 ±2.1	0.6 ±0.2	124.7 ±16.2	8.2 ±1.2
M. anisopliae	71.6 ±4.5	67.3 ±4.0	34.7 ±4.3	38.9 ±4.6	58.7 ±5.3	14.6 ±2.8	18.9 ±3.1	0.7 ±0.2	122.3 ±15.9	7.6 ±1.1
Bt kurstaki	12.3 ±3.1	10.8 ±2.9	79.4 ±4.8	22.1 ±3.8	44.8 ±4.9	8.2 ±1.9	20.1 ±2.2	0.4 ±0.2	126.1 ±16.4	8.8 ±1.3
Indoxacarb (PC)	24.6 ±4.8	21.3 ±4.1	72.8 ±4.4	48.2 ±4.4	88.4 ±5.3	78.6 ±5.5	8.4 ±1.8	14.2 ±3.9	149.6 ±19.4	18.3 ±2.7
No spray (NC)	—	—	—	—	—	—	21.4 ±2.4	0.2 ±0.1	68.2 ±8.9	5.0 ±0.8

Host-plant Pest Suppression 0 – 100 %; Lac Pest Control (desirable↑) 0 – 100 %; Bee Visits 0 – 25 /10 min; Bee Mortality (lower = safer) 0 – 15 /m²; Brood Lac Yield 50 – 155 g/plant; Seed Yield 0 – 22 g/plant

Different superscript letters within a column indicate significant differences (Tukey HSD, p < 0.05; n = 4 blocks).

Comparative efficacy of different treatments for pest management in Flemingia semialata-based lac production system

For host-plant pest control, *B. bassiana* and *M. anisopliae* were most effective against sap-sucking pests: spiralling whitefly *Aleurodicus dispersus* Russell (74.1 ± 4.4% and 71.6 ± 4.5% reduction, respectively; $p < 0.01$) and the scale Icerya aegyptiaca Douglas (69.8 ± 4.2% and 67.3 ± 4.0%). Indoxacarb was less effective against these pests (24.6 ± 4.8% and 21.3 ± 4.1%; $p > 0.05$ vs negative control). Azadirachtin achieved the highest pod fly (*Melanagromyza obtusa* Malloch) suppression among biopesticides (82.6 ± 5.0%; $p < 0.001$), outperforming Indoxacarb (48.2 ± 4.4%). Bt kurstaki provided the strongest control of the defoliator *Hyposidra talaca* Walker (79.4 ± 4.8%; $p < 0.001$) but was ineffective against sap-sucking pests ($p > 0.05$). All biopesticide treatments were safe for honeybee foragers, with visit rates (18.6–20.1 per 10 min) and field mortality (≤0.8 dead bees/m^2) similar to the unsprayed control ($p > 0.05$). In contrast, Indoxacarb reduced forager visits to 8.4 ± 1.8 per 10 min and caused 14.2 ± 3.9 dead bees/m^2 ($p < 0.001$). Indoxacarb produced the highest broodlac yield (149.6 ± 19.4 g/plant), which was statistically similar to EPF and Bt treatments (122.3–126.1 g/plant; Tukey HSD, $p > 0.05$), and all were significantly higher than Azadirachtin (98.6 ±

14.2 g/plant; $p < 0.05$). The lower brood lac yield with Azadirachtin, despite moderate predator suppression, is due to its IGR-mediated nontarget sub-lethal effect on lac crawler settlement and early instar development. The unsprayed control had the lowest brood lac yield (68.2 ± 8.9 g/plant; $p < 0.001$ vs all treated plots), highlighting the importance of pest management. For *F. semialata* seed production, the unsprayed control suffered severe pod fly damage, yielding only 5.0 ± 0.8 g/plant. Azadirachtin-treated plots had the highest seed yield (19.8 ± 3.0 g/plant), statistically similar to Indoxacarb (18.3 ± 2.7 g/plant; $p > 0.05$), reflecting effective pod fly suppression and unaffected honeybee pollination. EPF and Bt treatments produced seed yields (7.6–8.8 g/plant) significantly higher than the unsprayed control ($p < 0.05$) but lower than Azadirachtin and Indoxacarb ($p < 0.01$), consistent with their limited dipteran toxicity. These results demonstrate a clear trade-off: EPF and Bt maximise brood lac yield by strongly suppressing lac pests but result in lower seed production. Azadirachtin maximises seed productivity and honeybee safety, with a moderate reduction in brood lac yield.

† High % reduction in lac predators (*Eublema amabilis*, *Pseudohypatopa pulverea*) and parasitoid (*Aprostocetus purpureus*) is agronomically desirable as these natural enemies cause 30–60% brood lac crop losses. % red. = Abbott's corrected population reduction vs. unsprayed negative control. Bee visits = forager visits per 100 flowers per 10-min transect. Bee mortality = dead bees/m^2 at 2 h post-spray. $F_{5,15}$ values for ANOVA ranged 14.3–68.7 (all $p < 0.001$). PC = Positive Control; NC = Negative Control; n = 4 blocks. Different superscript letters within a column indicate significant differences (Tukey HSD, $p < 0.05$).

Intercrop-mediated resource enhancement for honeybees in lac integrated farming systems (LIFS)

Lac cultivation (*Kerria lacca*) and apiculture are important sources of income for smallholder farmers, yet their integration is poorly understood. This study investigated whether strategic intercropping in lac-apiculture systems could enhance pollinator resource availability and colony performance while using honeybee-mediated honeydew harvesting. A split-plot randomised complete block design was implemented with five intercrop types (strawberry, coriander, mustard, sweet corn, and control) as main plots and three bee treatments (*Apis cerana, A. mellifera*, and no bees) as subplots across 45 plots over 180 days. The studied parameters include honeydew foraging behaviour, floral visitation patterns, pollen diversity, colony performance metrics, honey production and quality, pollination services, and intercrop yields.

Apis cerena actively foraging on lac secreted honey dew

Both *Apis cerana* and *Apis mellifera* foraged on lac insect honeydew, showing facultative honeydew-harvesting behaviour, with *Apis cerana* showing higher activity. Pollen analysis revealed diverse resource use, with 35-65% of pollen loads from intercrops and the rest from wild sources. Honey electrical conductivity measurements (0.46–0.68 mS/cm) indicated marginal honeydew incorporation.

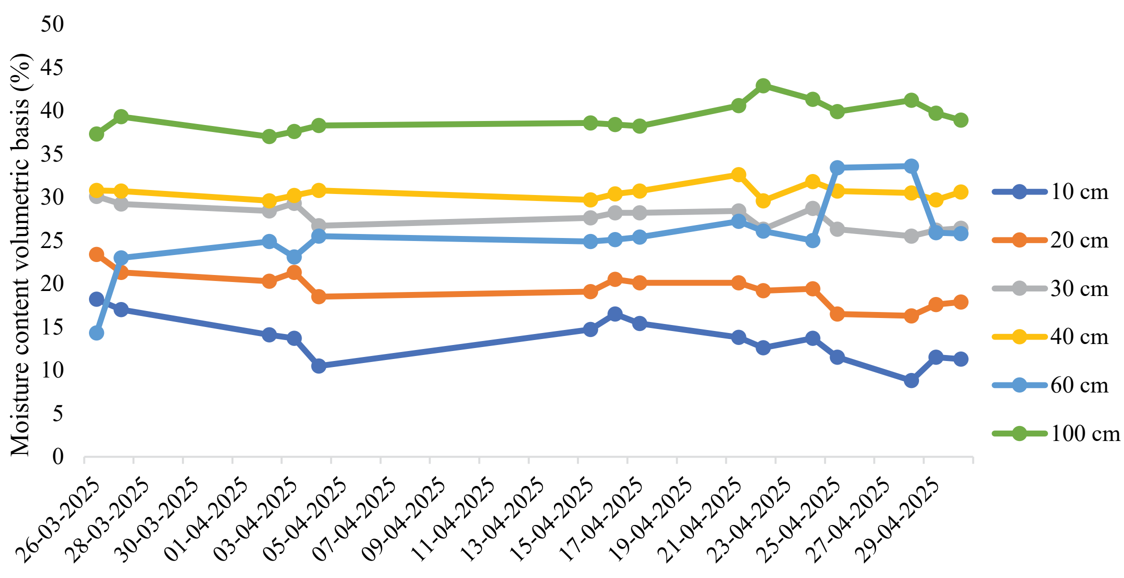
Apis cerena colony performance in strawberry intercrop plot

A. cerana colonies produced significantly more honey (2.65 ± 0.15 kg/colony) than *A. mellifera*

(1.84 ± 0.11 kg/colony; $p<0.05$). Bee presence increased strawberry fruit set from 54.4% (bagged) to 95.9% (open pollination). Intercrop yields rose 12-70% with bee presence, with strawberry showing the greatest response to bee pollination. Strategic intercropping in integrated apiculture-lac systems creates synergistic benefits through dual resource provision (honeydew and floral resources), enhanced pollination services, and diversified income streams. *A. cerana* showed superior performance in honey production and pollination services. This integration represents a novel agroecological approach to intensifying sustainable secondary agriculture.

Spatio-temporal variation of soil moisture patterns in a drip irrigated strawberry field

Crop growth and yield in a drip-irrigated field are often affected by variations in the availability, movement, and storage of soil water within the active root zone. PR2/6 sensor access tubes were installed at three locations in a drip-irrigated strawberry field (≈3 m spacing) of the IRF of the institute to assess spatial and vertical variations in soil moisture. Distinct depth-wise and site-specific differences were observed across the field. The selected sites have different soil hydrophysical properties. The experiment was conducted during the pre-monsoon season from March 26, 2025, to April 30, 2025. At site 1, mean soil moisture increased with depth from 16.64 ± 4.63% at 10 cm to 39.30 ± 1.47% at 100 cm. Site 2 showed a similar trend, ranging from 13.60 ± 2.59% at 10 cm to 39.30 ± 1.66% at 100 cm, with maximum moisture at 40 cm. Site 3 had lower moisture in the upper layers (6.10 ± 1.45% at 10 cm), gradually increasing toward deeper layers (35.63 ± 0.71% at 100 cm). Across all sites, the surface layer (10 cm) consistently showed the lowest moisture content, while the deepest layer (100 cm) had the highest (up to 42.9%), indicating downward movement of irrigation water and capillary rise. Moisture content at 30 cm generally exceeded that at 40 cm, except at site 2, suggesting greater water retention within the active strawberry root zone (~0–26 cm). The 60 cm layer showed the most variable moisture pattern, likely due to the combined effects of percolation and capillary forces. Temporal analysis indicated slightly elevated moisture on irrigation days. Peak moisture occurred at 30 cm for sites 1 and 3 and at 40 cm for site 2, followed by a decline at deeper layers. Overall, irrigation and rainfall mainly influenced soil moisture to a depth of 30 cm, while groundwater effects became more pronounced below this depth.



Daily soil moisture pattern for Site 2

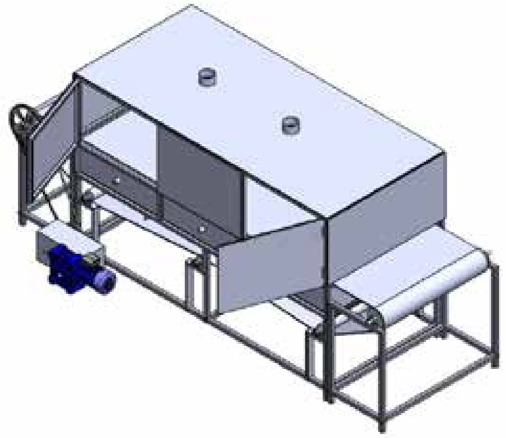
Development of a melt-filtration unit for button lac production

A melt-filtration unit with a targeted capacity of 5-10 kg/day has been developed, consisting of a filtration chamber, rod assembly, strip heaters, collector plate, handle, and power control unit. All components of the melt-filtration unit were made from stainless steel (SS 304).

Melt-filtration unit for button lac

Pilot-scale continuous type refractance window dryer

A pilot-scale continuous refractance window (RW) dryer has been designed and fabricated to efficiently dry gum-based hydrogel, combining mechanical robustness with precise process control. The system features a water trough made from 20-gauge SS 304 sheet (1 m × 2.5 m) that serves as the refractance window medium. It is supported by a main frame of SS 304 square pipes for structural stability and corrosion resistance. Driver and driven rollers (16 cm diameter, 6 mm thickness), along with idlers (6 mm diameter), guide the movement of a 250-micron-thick Mylar belt of 1 m width. This ensures uniform contact with the hydrogel layer for effective heat transfer. A speed reduction gearbox (1:2800) coupled with a power transmission unit enables smooth, controlled belt movement. Integrated water heaters and controllers regulate trough temperature and belt speed to maintain precise drying conditions. Designed for continuous operation, the system enables scalable hydrogel drying while ensuring product quality and uniformity.

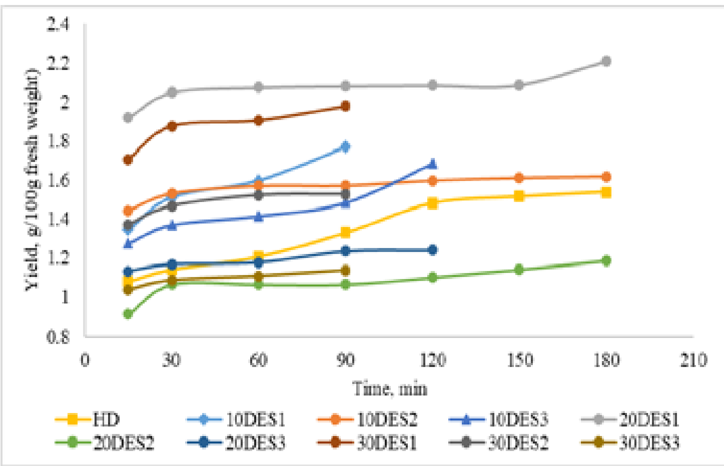


Conceptual design of continuous RW dryer

Development of energy efficient and high recovery process for extracting essential oils from aromatic plants

Essential oils (EO) are odorous, volatile, hydrophobic, and highly concentrated mixtures of secondary metabolites made of low-boiling-point phenylpropenes and terpenes. The green extraction of EOs using deep eutectic solvents (DESs) was explored as a novel, efficient alternative to conventional hydrodistillation. EO from lemongrass (*Cymbopogon citratus*) was extracted by conventional hydrodistillation (HD) and DES-assisted hydrodistillation to improve extraction efficiency. HD using a Clevenger apparatus yielded 1.54 g EO/ 100 g fresh sample. Three DES systems—choline chloride: urea (1:2), choline chloride: citric acid (1:1), and choline chloride: oxalic acid (1:1)—were prepared and characterised. All DES showed shear-thinning behaviour, with the highest viscosity in citric acid-based DES.

DES-assisted hydrodistillation was conducted at 10–30% concentration (v/v) and a 1:10 material-to-liquid ratio. EO yield ranged from 1.24 to 2.21 mL/100 g, with the highest yields observed with urea-based DES, especially at higher concentrations. Increasing DES concentration improved extraction efficiency, likely due to better cell wall disruption and solubilisation of oil components, and reduced extraction time compared to HD. Extraction time was cut by 25-75% with different DES concentrations compared to hydrodistillation. The extracted EO showed antibacterial activity against *Pseudomonas syringae* and *Staphylococcus aureus*. Antioxidant activity (DPPH assay) showed an IC_{50} of 1.62 mg/mL for HD, while DES-assisted extracts ranged from 0.58 to 2.821 mg/mL, indicating improved activity in selected DES systems. Overall, DES-assisted hydrodistillation proved to be an efficient and green alternative for EO extraction.

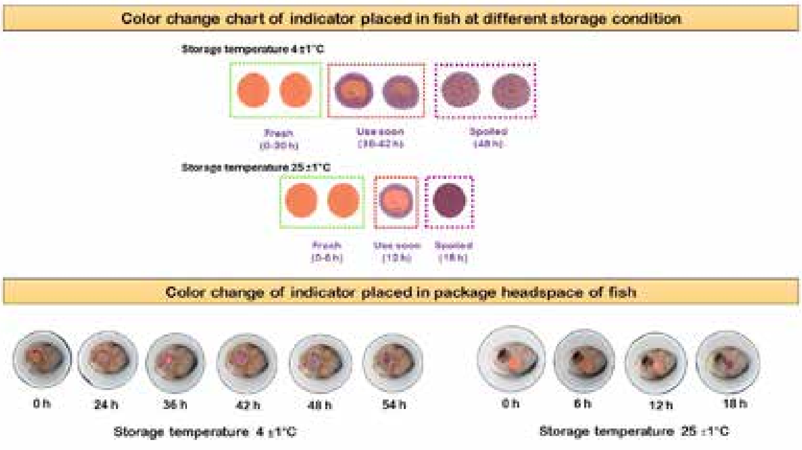


Extraction kinetic of lemongrass essential oil by different methods

Lemongrass EO extracted by (a) hydro-distillation, (b-d) DES assisted hydro-distillation

Bigel based intelligent indicator for real-time freshness monitoring of fish

A bigel-based composite system integrating oleogel and hydrogel phases has been developed and optimised for lac dye immobilisation to fabricate a paste-based, colourimetric freshness indicator for use as 3D printing ink. The oleogel phase was formulated with sunflower oil and beeswax, while the hydrogel phase consisted of guar gum and κ-carrageenan. Bigels with varying hydrogel-to-oleogel (H/O) ratios (80:20, 75:25, 70:30, and 77.5:22.5) were systematically evaluated to identify a formulation with optimal rheological performance and printability. Among the tested compositions, the 77.5:22.5 (H/O) ratio demonstrated superior structural integrity and extrusion stability and was selected as the optimised formulation.



Colour change chart of indicator placed in fish at different storage conditions

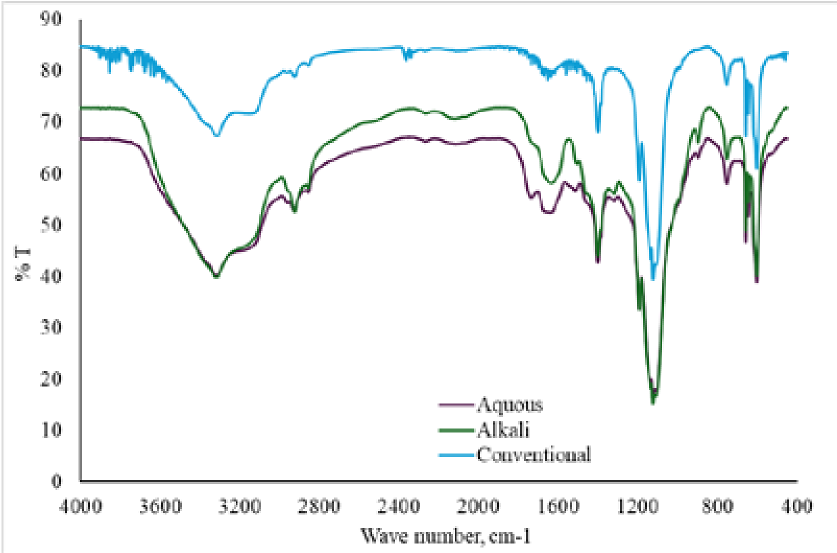
The optimised bigel exhibited shear-thinning behaviour, confirming its suitability for extrusion-based 3D printing. It showed excellent printability on polyethene and paper-based packaging substrates. Upon exposure to ammonia vapour, the immobilised lac dye showed a distinct, rapid colour transition from orange-red to purple, indicating high sensitivity to volatile basic compounds associated with food spoilage. The practical applicability of the developed indicator was validated for real-time monitoring of fish freshness in plastic containers sealed with shrink-wrap films stored under refrigerated (4 ± 1 °C) and ambient (25 ± 1 °C) conditions. The observed colour transition from orange-red to purple correlated strongly with deterioration in fish quality. This occurred when physicochemical parameters, such as pH, total viable count, and total volatile basic nitrogen (TVB-N), exceeded acceptable limits. Based on the distinct colour change, the indicator successfully differentiated three freshness stages: 'fresh', 'use soon', and 'spoiled'.

Extraction of cellulose from green pea pod waste using hydrothermal pretreatments

Green pea pods (*Pisum sativum*), an underutilised agro-processing waste, were explored as a sustainable cellulose source using conventional acid–alkali treatment and hydrothermal-assisted approaches. Dried and powdered pea pods were subjected to hydrothermal treatment at 120 °C for 1 h in distilled water and 2% NaOH, at solid-to-liquid ratios of 1:10, 1:20, and 1:30.

Hydrothermal treatments effectively removed non-cellulosic constituents, such as hemicellulose and lignin, yielding cellulose-rich residues with dry matter recovery of 20–45%, which is much higher than the 11.5% yield from conventional acid–alkali hydrolysis. This shows improved material recovery with fewer processing steps and less chemical use.

FTIR analysis confirmed the structural characteristics of the extracted cellulose. The reduction of the hemicellulose/lignin peak at ~1730 cm^{-1} was more pronounced in conventional and hydrothermal–alkali treatments, indicating effective delignification. In contrast, hydrothermally treated aqueous samples showed partial retention of amorphous components. Characteristic cellulose bands, including O–H stretching (3200–3400 cm^{-1}) and C–O–C stretching (1000–1200 cm^{-1}), were observed in all samples, confirming preservation of the cellulose backbone.

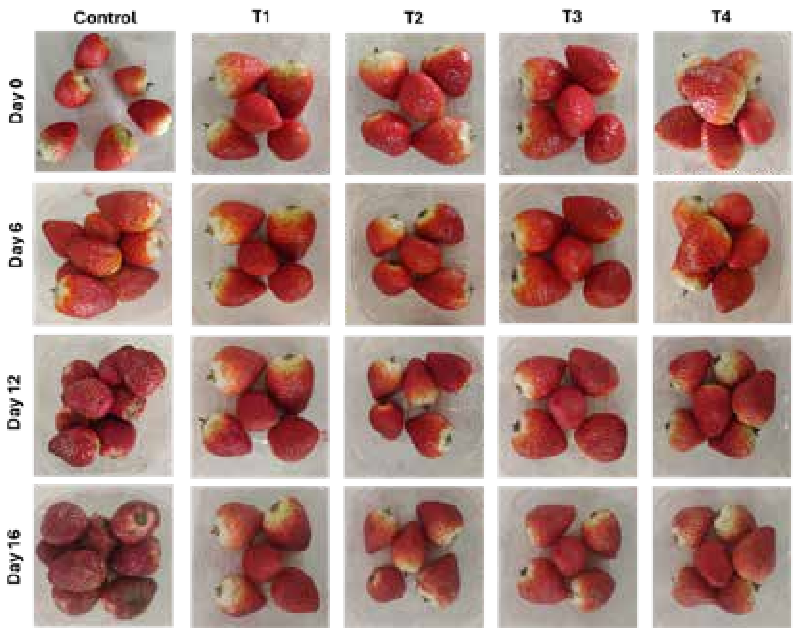


FTIR spectra of cellulose extracted by different methods

Overall, hydrothermal-assisted extraction, especially when combined with mild alkali, produced cellulose with structural properties comparable to those of the conventional method while offering higher recovery, reduced chemical use, and simpler processing. This approach shows strong potential for sustainable valorisation of agro-waste into value-added cellulose for industrial applications.

Enhancement of post-harvest storability of strawberry through coating technique

The effect of biopolymer-based coating formulation on the post-harvest shelf life of strawberries was evaluated. Coating formulations containing sodium alginate and calcium chloride, with lemongrass essential oil as the active agent, were prepared. Mature, uniform-sized strawberries collected from the Institute Research Farm were washed and disinfected with sodium hypochlorite solution. They were then dipped in the prepared formulation and dried in ambient air. The coated strawberries were refrigerated at 8 °C, and quality was evaluated every 4 days for up to 16 days. The coated fruits showed lower weight loss and maintained anthocyanin content and firmness compared with uncoated fruits. Firmness decreased by 69.4% in uncoated strawberries but only 5.8% in strawberries coated with 2% sodium alginate and 0.1% lemongrass essential oil during 16 days of storage.

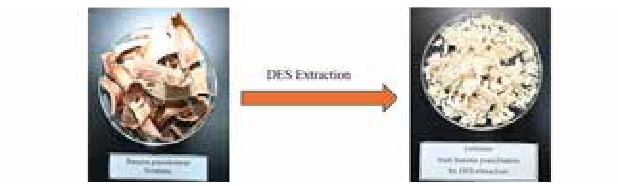


Uncoated and coated strawberries during refrigerated storage

DOWNSTREAM AGRO-PROCESSING DIVISION

Preparation of nanocellulose from banana pseudostem

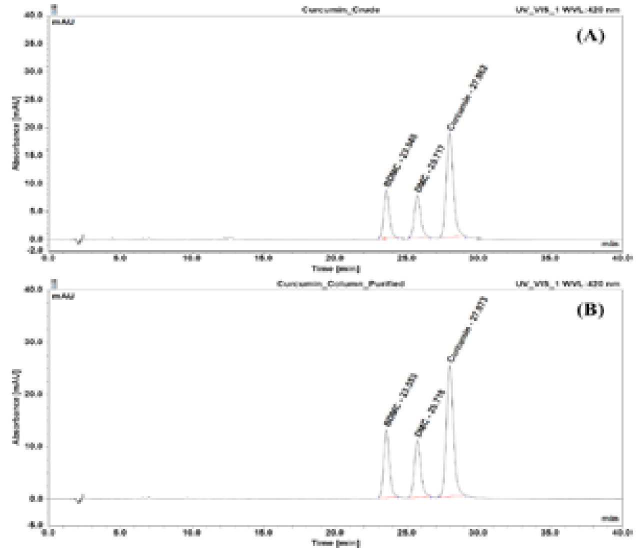
Nanocellulose from banana pseudostem has been prepared using a green method with Deep Eutectic Solvents (DES). Oxalic acid (OA) and choline chloride (ChCl) were combined at a 1:1 molar ratio to prepare OA-ChCl DES. The banana pseudostem biomass was dispersed in DES at different ratios (1:4, 1:6, 1:8, 1:10, and 1:12) to extract cellulose. The cellulose yield ranged from 21.07% to 23.13% depending on the DES ratio. The highest yield was obtained at the 1:8 ratio of banana pseudostem to DES. The extracted cellulose suspension was redispersed in aqueous solution and ultrasonicated for 10, 20, and 30 minutes to prepare nanocellulose. Particle size decreased from 743 nm to 271 nm after 30 minutes of ultrasonication. FT-IR spectra of the nanocellulose showed characteristic cellulose peaks.



Cellulose extraction from banana pseudostem using DES

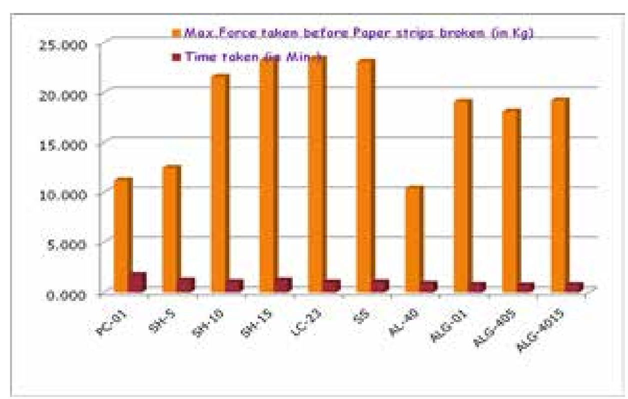
Extraction of curcuminoids from *Lakadong* turmeric

Curcuminoids were extracted from *Lakadong* turmeric using solvent extraction and purified through column chromatography. Exhaustive solvent extraction of *Lakadong* turmeric powder yielded 20.69 ± 1.92% of crude curcuminoids. HPLC analysis revealed that the crude extract contained 12.32% curcumin, 4.77% demethoxycurcumin (DMC) and 5.12% bisdemethoxycurcumin (BDMC) with a relative ratio of 1:0.39:0.42. Purification of the crude extract through column chromatography resulted in a yield of 12.15 ± 1.12% of purified curcuminoids from the turmeric powder. The purified extract contained 16.78%, 6.75%, and 7.49% of curcumin, DMC and BDMC, respectively, as estimated by HPLC (recovery of 58.72% of curcuminoids in purified form).



HPLC chromatograms of crude (A) and column-purified (B) extracts of curcuminoids

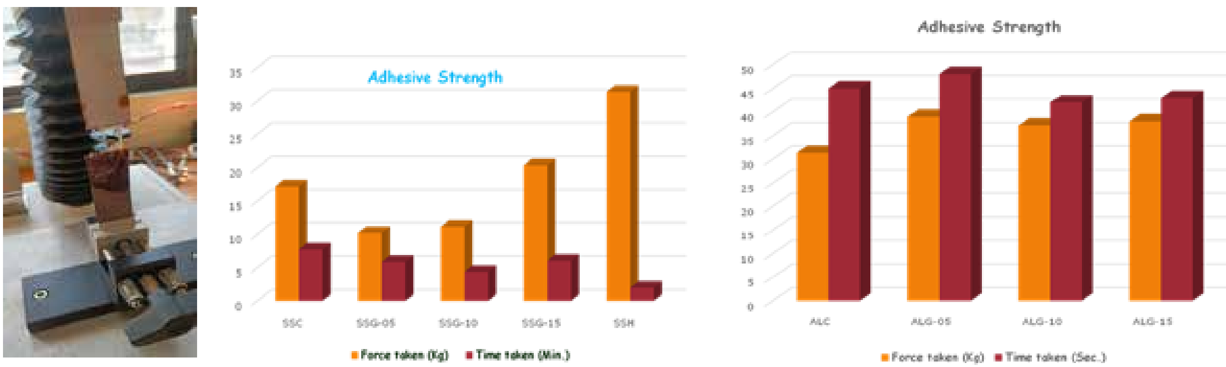
Development of pressure sensitive adhesive using natural resin-based tackifiers



Adhesive strength of the formulations on paper strips

Adhesive formulations have been prepared using natural resin-based tackifiers. One set of formulations exhibited a non-drying, sticky nature, while another set showed a drying characteristic. Adhesive strength was studied by pasting two sheets of craft paper with the developed formulations. Adhesive strength (zero peel) of the adhered papers (1” ×1”) was determined through the Texture Analyser. In another set of experiments, paper strips were adhered by applying heat and pressure. It was observed that paper strips were broken, but the adhesives did not lose adhesion. The maximum force exerted by the adhered paper strips was found to be in the range of 98-225.4 N. The Paper strip broke at approximately 107.8 N of force applied.

Sunmica strips were used to determine the strength of the formulations, as cohesive failure was observed on the paper strips. Adhesive strength (zero peel) was determined. Force taken to slide the sunmica strips was observed to be in the range of 98-225.4 N, and time taken for complete detachment of the strips was recorded to be 4-8 minutes in the case of solvent-based formulations. In aqueous formulations, it was observed that the adhered sun-mica strips did not slide but detached within 42-48 seconds. The maximum force taken by the strips was recorded in the range of 303.8-382.2 N.

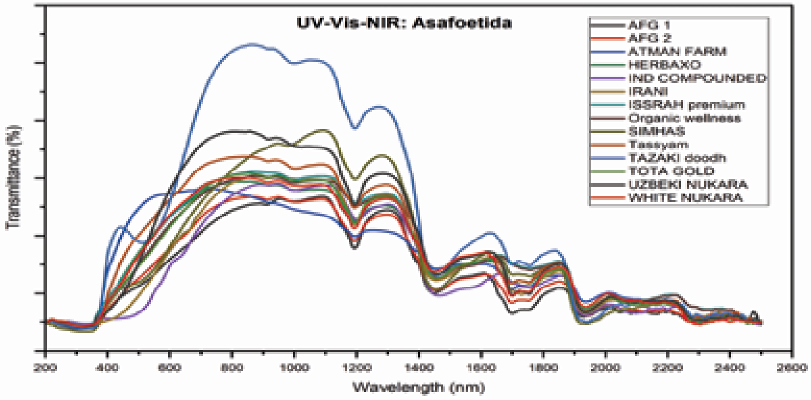


Pressure sensitive adhesives (a) Adhesive strength testing sunmica strips, (b) Adhesive strength of solvent-based formulations, and (c) Adhesive strength of aqueous formulations

Spectroscopic study of asafoetida

To study the spectral fingerprints of asafoetida (heeng), a total of 15 genuine samples, representing different production / source countries, including Tajikistan, Kazakhstan, Afghanistan, Uzbekistan, Iran, and India, were procured from various reliable sources. The asafoetida tears were cleaned to remove bark and impurities, air-dried, and powdered. The transmittance spectra of the asafoetida samples were recorded using a UV-Vis/NIR spectrophotometer with Spectra Manager software over 200-2500 nm, with a scan speed of 200 nm/min and bandwidths of 2.0 nm and 8.0 nm for the UV/Vis and NIR regions, respectively. The peaks and depressions in the spectra showed strong and weak transmittance characteristics of the asafoetida components, respectively, within the study range. Based on the transmittance pattern, a spectral range of 300 to 1500 nm was found to be responsive to sample variations. The relative values in the other regions of the spectra, however, varied from sample to sample, which might be due to source variations and differences in sample moisture content. The study offers insights into the spectral profiles of various asafoetida samples, which can aid in their quality control.

Different Asafoetida samples



UV-Vis-NIR spectra of Asafoetida samples

AUTOMATION & PLANT ENGINEERING DIVISION

Refinement of pilot plant for production of guar gum derivative

A plant for producing guar gum derivative has been developed. To improve the water heating for reaction purpose, the existing immersion rod type heating elements in the jacketed chamber of mixing-cum-reaction unit have been replaced with higher capacity similar type elements, with a stainless-steel water tank (200 L) and a temperature control mechanism including display unit, relay and thermocouple to maintain the desired water temperature. Experimentation on guar gum derivative manufacturing from guar gum powder along with reagents using the developed gum derivative pilot plant coupled with stainless steel water tank yielded 1526.2 kg guar gum derivative having 76.31% efficiency at 7.29 pH, 0.1728 degree of substitution and 700 cP viscosity.

Guar gum derivative plant

Fabricated water tank

Guar gum derivative (undried)

Mechanized solution for uprooting unproductive Cinchona trees in hilly terrains

Cinchona bark remains a critical natural source of alkaloids (quinine, quinidine, etc.) with important medicinal and industrial uses, and its synthetic production is still not achieved. India's Directorate of Cinchona & Other Medicinal Plants manages one of the world's largest cinchona estates, but plantations face declining commercial viability due to bark quality deterioration and limited adoption of modern cultivation and mechanization. At end of commercial life (7–10 years) uprooting is done manually—an exceptionally tedious task requiring six to eight workers to remove only three to four trees per day—making mechanization essential for economic sustainability.

To address this, ICAR–National Institute of Secondary Agriculture developed two prototype machines for steep, non motorable cinchona plantations: A vertical uprooting equipment (for near vertical planting) and a compact horizontal uprooting equipment (for sloped areas). Both use a hydraulic uprooting mechanism powered by a compact powerpack and lightweight petrol genset; the vertical model has a detachable frame and weighs 165 kg, while the horizontal frame is 50 kg and highly portable.

Field trials for trees 200–250 mm diameter showed improved efficiency. Using the vertical equipment, uprooting time fell from about 120 minutes (manual) to roughly 15 minutes, with assembly in 8 minutes, uprooting in 2 minutes, and a 4.5–5.5 tonne uprooting load; daily capacity rose ~87.5%, manpower halved, and per tree cost dropped ~88.7%. The horizontal equipment reduced per tree time from 120 to 7 minutes, cut manpower by 75%, and lowered cost by ~96.2% (excluding one time installation). Both machines eliminated or greatly reduced physical exertion and drudgery due to hydraulic operation.

These user friendly prototypes (suitable for men and women forest workers) markedly improve productivity, safety, and cost efficiency for uprooting unproductive cinchona stands in hilly, non motorable terrain, supporting the restoration of economic viability for cinchona cultivation.

(a) Vertical uprooting

(b). Uprooted tree (Vertical)

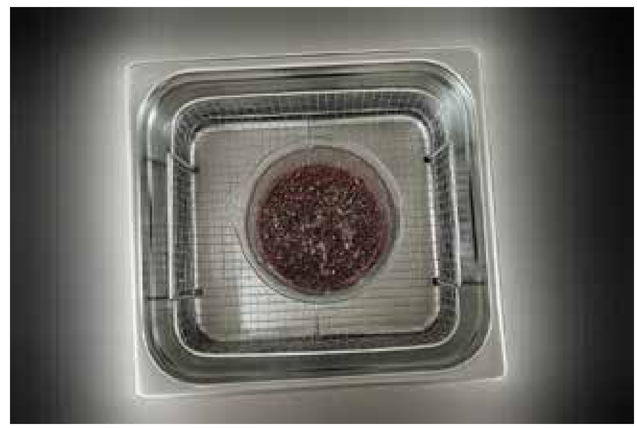
(c) Horizontal uprooting

(d) Uprooted tree (Horizontal)

Cinchona tree uprooting in progress and uprooted trees

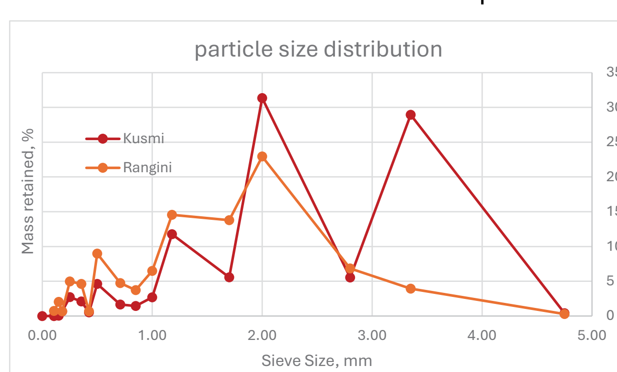
Ultrasound assisted washing for lac dye recovery

Natural colourants are garnering significant interest across diverse industries, particularly food, cosmetics, pharmaceuticals, and textiles, driven by rising consumer demand for environmentally sustainable, safer alternatives to synthetic dyes. Laccaic acid, a natural anthraquinone dye extracted from lac insects (*Kerria lacca*), stands out for its vibrant red colour and proven bioactive properties, and is conventionally extracted through a chemical process. Ultrasound has been used to improve the extraction of bioactive compounds and pigments from plant and animal cells. A study to improve lac dye recovery from lac wash water via ultrasound treatment has been conducted. The wash water obtained from the crushed, scraped lac was washed under ultrasonication at different temperatures (30, 40, 50, and 60 °C) and times (5, 10, 15, and 20 min) using a bath-type sonicator (110 W, 40 kHz). The wash water was analysed. Lac-dye content was determined using a UV-vis spectrophotometer, with pure lac dye as a standard. The highest lac-dye was obtained at 60 °C for a 20 min treatment under a half-cycle of ultrasonication.



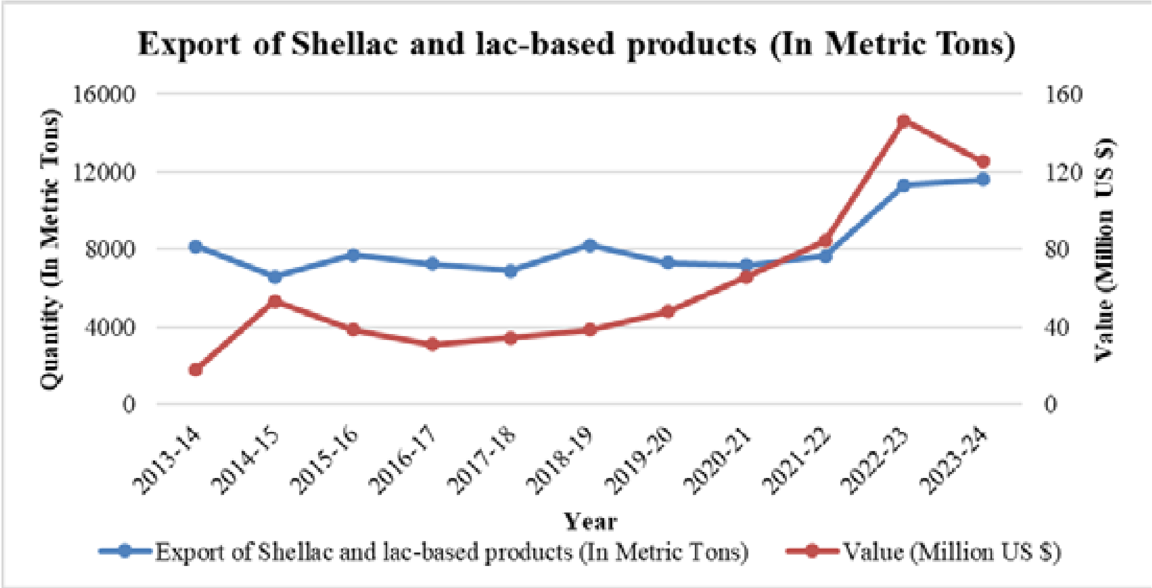
Proximate analysis of scrapped lac

Rangeeni and Kusmi lac harvested during Nov-Dec and Jan-Feb were collected from the Institute Research Farm of ICAR-NISA, evaluated, and a sieve analysis was conducted using the Tyler series of sieves, with sieve sizes ranging from 0.106 mm to 4.75 mm. The volume mean diameter and surface mean diameter of the Kusmi and Rangeeni scraped lac varied between 0.385 and 0.619 mm and 0.266 and 0.421 mm, respectively. The moisture content and lipid content of Kusmi and Rangeeni lac varied between 3.2-4% (wb) and 6-6.49% (wb), respectively. Resin was found to be partially soluble in chloroform, hence not suitable for wax content determination of scraped lac.



Translational research to promote secondary agriculture

Data on the export of shellac and lac-based products from 2013-14 to 2023-24 were compiled from secondary sources. The export of shellac and lac-based products exhibited fluctuating trends between 2013-14 and 2023-24. In 2013-14, exports totalled 8,158.11 metric tons, valued at $17.81 million. Although volume declined to 6,569.18 metric tons in 2014-15, value surged to $53.06 million, driven by increased global demand and rising prices. In 2015-16 and 2016-17, export volumes rose slightly, but values dropped to $38.5 million and $30.86 million, respectively, indicating possible price declines or market competition. From 2017-18 to 2021-22, export values steadily recovered, peaking at $84.44 million in 2021-22, despite stable volumes around 7,500 metric tons, driven by demand in cosmetics, textiles, and varnishes. A sharp rise occurred in 2022-23 and 2023-24, with volumes reaching 11,288.63 and 11,588.96 metric tons, and values at $146.35 million and $125.29 million, respectively. This surge is attributed to the post-pandemic global economic recovery, increased industrial demand, and higher prices for lac-based raw materials.



Export of Shellac and lac-based products from 2013-14 to 2023-24

Technology dissemination using social media platform

Sixteen short educational videos covering key aspects and technologies of scientific lac cultivation, processing, value addition, and secondary agricultural products were developed and disseminated through the institute's official social media platforms (YouTube, Twitter, Facebook, and Instagram). The topics included: (i) Brood lac dipping: Why, when, and how to use it?, (ii) Lacilyzer: A digital and smart solution for lac color indexing, (iii) Application of pesticides and fungicides in scientific lac cultivation: Why, when, and how to use them?, (iv) Lac cultivation through high density kusum planting, (v) Brood lac inoculation in *Flemingia semialata*, (vi) Brood lac inoculation in ber tree, (vii) Button lac production using electric bhatta, (viii) Nutrient management in *Flemingia semialata*, (ix) Shree Anna Saathi: A natural, gluten-free binder for millet flour, (x) Introduction to lac and its uses, (xi)lac insect life cycle, (xii) Activities involved in scientific lac cultivation, (xiii) lac cultivation in caliandra host plant, (xiv) lac cultivation in fruit bearing ber varieties (xv) Use of 60 Mesh nylon synthetic net in lac cultivation and (xvi) lac cultivation in *Flemengia semialata*. These videos aim to promote awareness and adoption of institute-developed technologies, highlight farmer-led innovations, and support stakeholders in improving lac productivity and quality.

Digital leap impact

Over three months, ICAR–NISA's digital extension efforts on its official YouTube and social media platforms (Facebook, Twitter, Instagram) generated 61,011 views, 97% of which were from India. Viewership also came from Nepal, Pakistan, the UAE, South Korea, and Bangladesh, reflecting regional interest in sustainable lac cultivation and value-added products. States such as Bihar, Madhya Pradesh, Maharashtra, and Uttar Pradesh showed the highest engagement. Notably, 67% of viewers were under 24, highlighting strong youth outreach. The initiative effectively enhanced technology dissemination, visibility of climate-resilient practices, and support for income enhancement among small and tribal farmers.

Policy support for lac-based agroforestry

Under MGNREGA's Birsa Harit Gram Yojana, the systematic plantation of lac hosts such as kusum (*Schleichera oleosa*) and *Flemingia semialata* is being promoted, with technical collaboration from ICAR–NISA. In Phase I, 300 small and marginal farmers (0.3–0.5 acres) are receiving technical guidance, inputs, and financial support to establish lac-based agroforestry models. The initiative enhances income security, generates rural employment, and strengthens climate-resilient livelihoods. ICAR–NISA is also contributing to policy guidelines, monitoring systems, and capacity-building modules aligned with national priorities in secondary agriculture.

SUCCESS STORIES

From Poverty to Prosperity: Joydeb Mahato's Lac Crusade

Born on 1st January 1962 in a mud-walled house in the remote village of Putidih in Purulia district of West Bengal, Shri Joydeb Mahato grew up in a joint family of twelve, surviving on marginal farming and daily wage labour. His childhood was marked by poverty, food scarcity and limited access to education. Despite these hardships, he developed a strong interest in traditional lac cultivation practised by his forefathers. After completing his secondary education at the age of 20, financial constraints forced him to work as a servant for a school teacher (1982–1986), earning only ₹ 250 per year. He later practised basic Ayurvedic healing (1986–1991) while supporting his growing family. With increasing responsibilities, he turned to lac cultivation for a stable livelihood. Encouraged by Shri Basudeb Acharia, he began cultivating lac on kusum (*Schleichera oleosa*), ber (*Zizyphus mauritiana*), and palas (*Butea monosperma*) using traditional methods. Starting with just nine kusum trees and 7.5 kg of brood lac, he earned ₹ 80,000 in his first year—an extraordinary achievement. Realising the limitations of traditional practices, he underwent scientific training at ICAR–Indian Lac Research Institute (now ICAR–National Institute of Secondary Agriculture, Ranchi) in 1994. This proved to be a turning point. Equipped with improved technologies on brood lac management, pest control, and scientific harvesting, he significantly enhanced productivity and quality. He expanded into contract lac cultivation across 10 villages in Jhalda block and mastered both kusumi and rangeeni strains between 1994 and 1998. His association with erhtswhile ICAR–Indian Institute of Natural Resins and Gums (IINRG) was strengthened through collaborative initiatives, including the "Forecast of Lac Emergence." Scientific backing improved yield stability, reduced crop losses, and enhanced market linkages, leading to steady income growth and wider adoption among farmers. In 2002, he received the prestigious Charan Singh Award. In 2000, he established the Jhalda Lac Growers and Processors Industrial Cooperative Society Limited and creating a platform for brood lac production, processing, value addition, and marketing. By 2008, his operations expanded across 55 villages in Purulia and Ranchi. His income, which ranged between ₹ 1–1.5 lakh annually during 1995–2010, rose dramatically in 2012 when he expanded cultivation to thousands of host trees, earning nearly ₹ 30 lakh in a single year. Beyond farming, he promoted lac cultivation among tribal communities across West Bengal, Jharkhand, and neighbouring states, collaborating with organisations like TRIFED, PRADAN, Ramakrishna Mission, ATMA, Forest Departments, and Tata Steel. In 2009, he received the Pusa Award, and in 2013, the Super Farmer Award for social impact and women's empowerment. He also initiated lac-based handicraft enterprises with 35 women self-help groups, strengthening rural livelihoods. In 2016, he established processing units for button lac and seed lac and, after receiving export training from the Indian Institute of Foreign Trade (IIFT), Kolkata, began exporting to Bangladesh and Nepal. Currently, he exports around 40 tonnes of button lac annually. His high-density kusum plantation model (2021) has further improved productivity and reduced crop cycles. Today, Shri Joydeb Mahato produces over 100 tonnes of lac annually with a turnover of nearly ₹ 6 crores. He provides year-round employment to 20 people and seasonally to 5,000–7,000, with over 40,000 farmers linked to his initiatives. Collaboration with ICAR–NISA/IINRG significantly enhanced productivity, reduced risks, and enabled value addition and market expansion. His model demonstrates how scientific intervention, institutional linkage, and collective action can transform traditional lac cultivation into a large-scale, income-generating rural enterprise. From poverty to becoming a national icon, his journey exemplifies the power of knowledge, perseverance, and inclusive development.

From Daily Wage Labourer to Lac Entrepreneur: The Inspiring Journey of Shri Chandan Beena

Shri Chandan Beena, a progressive farmer from Sogod village under Rajaulatu Panchayat in Namkum block of Ranchi district, Jharkhand, belongs to a family of nine members and is educated up to the Intermediate level. He owns 8 acres of land and currently practices integrated farming, including paddy, vegetables, cereals, and lac cultivation. Before 2016, his socio-economic condition was weak, and his livelihood depended on multiple low-income activities. He worked as a daily wage labourer, assisted in a seed and fertiliser shop, drove an auto, and sold vegetables in weekly markets. Despite owning more than 100 Kusum trees and 50–60 Ber trees, he lacked scientific knowledge and market awareness about lac cultivation. As a result, he leased out his host trees on a sharing basis and was cheated after harvest, receiving only 1 quintal 17 kg of lac against an actual production of 5 quintals 17 kg. This incident made him realise the importance of cultivating scientific lac. In 2016, he came into contact with Shri Shaktidhar Koiri, an experienced lac farmer, and received technical guidance from ICAR–NISA, Ranchi. With this support, he began independent lac cultivation by inoculating 2.5 kg of brood lac onto 1–2 host trees. Encouraged by the results, he expanded to 15 Kusum trees and earned around ₹ 60,000 in the initial phase. At present, he maintains more than 100 Kusum trees, 55–60 Ber trees, and about 800 *semialata* plants, all planted in 2021. He practices intercropping with vegetables such as French beans, tomatoes, and peas using drip irrigation, thereby improving farm productivity. He also generates employment by paying ₹ 25,000–30,000 annually as labour wages. From agriculture and allied activities such as paddy, vegetables, poultry, duckery, and goatery, he earns about ₹ 1.5 lakh annually. However, lac cultivation is his primary source of income, contributing ₹ 3–5 lakh per year. His total income has increased significantly from ₹ 1.2–1.5 lakh earlier to ₹ 5–6 lakh at present. In 2024–25, he harvested around 8 quintals of lac, selling part in Bengal, Sisai, and local markets, while retaining brood lac for the next season. Today, he is financially stable, constructing a pucca house, and ensuring quality education for his children. He stands as a role model, demonstrating how scientific lac cultivation can transform rural livelihoods.

From Small Landholding to Lac Leader: The Inspiring Journey of Shri Narayan Bediya

Shri Narayan Bediya, a progressive farmer from Tirla Kocha village under Rajadera Panchayat in Angara block of Ranchi district, Jharkhand, exemplifies how scientific knowledge, innovation, and dedication can transform a small landholding into a sustainable and profitable livelihood. With only about one acre of land, he has successfully developed a diversified income system based on scientific lac cultivation and organic vegetable farming. His journey began during 2011–12 with initial training at Ramakrishna Mission (RKM), where he learned the fundamentals of lac cultivation and host plant management. Recognising the economic potential of lac, he further enhanced his skills through advanced training at ICAR–National Institute of Secondary Agriculture (ICAR-NISA), Ranchi in 2016. These trainings equipped him with improved techniques of brood lac inoculation, crop management, pest control, and scientific harvesting practices. Currently, Shri Narayan Bediya owns around 35 Kusum trees, of which he utilises 8–10 trees per season for lac cultivation, producing an impressive 7–8 quintals annually. One of his Kusum trees yielded 2 quintals and 7 kg, demonstrating the effectiveness of his scientific management practices. Additionally, he owns 30–35 Ber plants, cultivating lac on 10–12 plants to obtain an additional 1.5–2 quintals of produce. To further expand his enterprise, he has adopted an innovative share-based cultivation model in the nearby villages of the Burmu block. Under this system, the produce is divided into three parts, with one share going to the tree owner and two shares retained by him. This strategy has enabled him to scale up production without investing in additional land, significantly enhancing his income. Through combined production from his own farm and share-based cultivation, he earns approximately ₹ 4–5 lakh annually from lac alone, making it the backbone of his household economy. In addition, he practices organic vegetable farming using compost prepared from farm residues, earning an additional ₹ 70,000 to ₹ 1,00,000 per year. He markets his produce in nearby local markets such as Jonha and Gundlipokhar, ensuring steady cash flow. Beyond his personal achievements, Shri Narayan Bediya serves as a community resource person. As a member of the Ramakrishna Mission and a Master Trainer with the ICICI Foundation, he regularly trains and motivates farmers to adopt scientific lac cultivation practices. His success story highlights that with proper training, innovation, and sustainable practices, even a small farm can generate substantial income and inspire broader rural development.

Philip Madki: A Success Story of Scientific Lac Cultivation

Mr Philip Madki, a progressive farmer from Baghiya village under Saude Panchayat in Rania block of Khunti district, Jharkhand, belongs to a small family of four and is educated up to the 12th standard. Farming has been his primary occupation. Prior to 2013, his agricultural practices were largely subsistence-oriented, focusing on crops such as paddy, ragi, and a few vegetables mainly for household consumption. Limited surplus produce, such as paddy, tamarind, and mahua, earned him only about ₹30,000 annually, which was insufficient to meet his family's needs. A major turning point came in 2013 when he received training in scientific lac cultivation at ICAR–National Institute of Secondary Agriculture (NISA), Ranchi, facilitated by Mahila Vikas Kendra, Torpa. This exposure transformed his outlook from subsistence farming to a diversified, income-oriented approach. He began integrating lac cultivation as a commercial enterprise alongside traditional agriculture. At the time, he had 15 ber and 13 kusum trees, of which he inoculated lac on 15 ber and 3 kusum trees. By adopting scientific practices, he harvested 6–7 quintals of lac, sold it at ₹ 400–500 per kg, and earned nearly ₹ 3 lakhs initially. By 2014, his income from brood lac alone reached ₹ 1,13,700, marking a significant improvement over his earlier earnings. Over the years (2013–2025), lac cultivation brought substantial economic and social transformation. His increased income enabled him to invest in his children's education and improve his living standards. He purchased a vehicle in 2016 and relocated to Rania town to access better educational facilities for his children. Currently, Philip owns 20 ber and 18 kusum trees and follows recommended scientific practices, including the coupe system, timely pruning, brood lac inoculation, pest management, and proper harvesting. Recently, he inoculated around 5 quintals of brood lac and harvested approximately 7 quintals of brood lac and 2 quintals of scraped lac. He sells his produce at ₹ 650–700 per kg in markets like Saude, Rania, and Hati Godi. Today, while his annual income from agriculture and allied activities is around ₹ 50,000–60,000, lac cultivation accounts for a major share of ₹ 5–6 lakh per year, making it his primary source of income. Philip's income increased nearly 15–20 times after adopting lac cultivation, shifting him from subsistence farming to a market-oriented enterprise. His case highlights the potential of lac as a high-value livelihood option, ensuring income stability, asset creation, and improved human capital through education. Beyond personal success, he now acts as a local resource person, motivating 8–10 farmers to adopt scientific lac cultivation, thereby contributing to wider rural economic development.

SALIENT ACHIEVEMENT UNDER NETWORK PROJECTS

NETWORK PROJECT ON CONSERVATION OF LAC INSECT GENETIC RESOURSES

"Centre-wise Report"

Lead and Co-operating Centers

1	ICAR-NISA Ranchi (Jharkhand) Lead Center	7	Kerala Forest Research Institute Thrissur (Kerala)
2	Assam Agricultural University Jorhat (Assam)	8	State Forest Research Institute Jabalpur (Madhya Pradesh)
3	Central Agricultural University Imphal (Manipur)	9	Acharya N.G. Ranga Agricultural University (Andhra Pradesh)
4	Sher-e-Kashmir University of Agricultural Sciences & Technology, Jammu (Jammu & Kashmir)	10	Krishi Vigyan Kendra, Sirsi (Karnataka)
5	Punjab Agricultural University Ludhiana (Punjab)	11	ICAR-Research Complex for Eastern Region, Patna (Bihar)
6	Maharana Pratap University of Agriculture & Technology Udaipur (Rajasthan)	12	ICAR- Central Agroforestry Research Institute, Jhansi (Uttar Pradesh)

Survey Conducted in 2025

49 districts were surveyed during 2025 by different cooperating centres, out of these, natural occurrence of lac insects were found in 24 districts.

Survey conducted by different centres under NP on CLIGR in 2025

Center	No. of districts surveyed	No. of districts where lac insect found	No. of districts where no lac insect found
AAU, Jorhat	Survey completed		
PAU, Ludhiana	Survey completed		
CAU, Imphal	02	00	02
SKUAST, Jammu	Survey completed		
ANGARU, Guntur	24	12	12
MPUAT, Udaipur	17	07	10
SFRI, Jabalpur	04	04	00
KFRI, Thrissur	02	01	01
KVK, Sirsi	Survey completed		
ICAR-RCER, Patna	Survey completed		
ICAR-NISA, Ranchi	Survey completed		
Total	**49**	**24**	**25**

Survey Conducted from 2014 to 2026

721 districts were surveyed from 2014 to 2026, out of these natural occurrence of lac insects were found in 418 districts of India, which accounts for 57.97% of surveyed districts.

Survey conducted under NP on CLIGR during 2014-2026

Center	No. of total districts surveyed	No. of districts where lac insect found	No. of districts where no lac insect found
AAU, Jorhat	54	19	35
PAU, Ludhiana	86	52	34
CAU, Imphal	82	29	53
SKUAST, Jammu	47	18	29
ANGARU, Guntur	59	43	16
MPUAT, Udaipur	88	68	20
SFRI, Jabalpur	125	106	19
KFRI, Thrissur	57	26	31
KVK, Sirsi	31	15	16
ICAR-RCER, Patna	54	29	25
ICAR-NISA, Ranchi	30	8	22
ICAR-CAFRI, Jhansi	08	05	03
Total	**721**	**418**	**303**
57.97 % districts where lac has been found			

Conservation of the biodiversity of local lac-insects / races and host plants at Regional Field Gene Banks

One of the objectives of the project is to conserve the biodiversity of local lac-insects/races and host plants identified during the survey in the Regional Gene Banks at the centres. The number of local lac-insects/races and host plants identified during the survey and conserved during 2014-24 at the Regional Gene Banks at the Centres is depicted below.

Detail of local lac-insects/ races and host plants conserved during 2014-24 at the Regional Gene Banks at the Centres

S. No.	Centre Name	Host Plant	Lac Insect species
1	ICAR-NISA, Ranchi	92 collections of 65 species	45 lac insect lines of 13 kerria species
2	KFRI, Thrissur	470 collections of 05 species	*Kerria lacca*
3	SFRI, Jabalpur	160 collections of 16 species	*Kerria lacca*
4	AAU, Jorhat	504 collections of 15 species	02 collections each of *Kerria chinensis* and *Kerria lacca*
5	PAU, Ludhiana	528 collections of 13 species	*Kerria lacca*
6	MPUAT Udaipur	809 collections of 12 species	*Kerria lacca*
7	CAU Imphal	276 collections of 16 species	*Kerria chinensis* and *Kerria lacca*
8	SKAUST, Jammu	152 collections of 11 species	13 collections of *Kerria lacca*

Suitable lac-insect-host plant combinations for higher and sustained yield

In the lac production system, conserving broodlac, a live lac insect on a suitable host tree, is important. Lac cultivation is mostly carried out by resource-constrained farmers, who find it difficult to purchase broodlac because it is costly. Therefore, it is essential to recommend a suitable lac host tree that produces broodlac year-round, so farmers do not need to buy it for the next crop season. Considering this, the network project centre has recommended suitable lac-insect-host plant combinations based on the availability of host plants in each region.

Suitable lac-insect-host plant combinations for different regions

S. No.	Centre	Region	Potential Lac Host-Plant
1	AAU, Jorhat	Humid Bengal – Assam Basin	Peepal (*Ficus religiosa*), Ber (*Zizuphus marutuiana*), Leea sp., *Flemingia semialata*, Arhar (*Cajanus cajan*), *Flemingia strobilifera*, *Calliandra haematocephala*
2	CAU, Imphal	Humid Eastern Himalayan Region and Bay Islands	*Malvaviscus penduliflorus*, *Litchi chinensis*, *Malvaviscus penduliflorus*, *Hibiscus* sp., *Ficus religiosa* and *Ficus glomerata*
3	KFRI, Thrissur	Humid to Semi-arid Western Ghats and Karnataka Plateau	Ber (*Z. mauritiana*), Rain Tree (*Albizia saman*) and *F. Semialata*
4	ICAR- KVK Sirsi		
5	MPUAT, Udaipur	Arid Western Plains	Peepal, Ber, Babool, Bargad, Custard apple, Palas, and Keekar
6	PAU, Ludhiana	Sub-humid Sutlej- Ganga Alluvial Plains	Ber (*Ziziphus mauritiana*) and Pipal (*Ficus religiosa*)
7	ICAR RCER, Patna		*Ficus religiosa* (Peepal), *Ficus rumphii* (Pakur)
8	ANGRAU, Guntur	Sub-humid to Humid Eastern and South-eastern Uplands	*Albizia saman*, *Ficus religiosa and Ficus benghalensis, Ficus amplissima, Conocarpus lancifolius*, Ber (*Ziziphus mauritiana*) and Palas (*Butea monosperma*)
9	SKUAST, Jammu	Humid Western Himalayan Region	*A. nilotica and Z. mauritiana, A. lebbeck* (summer broodlac)
10	SFRI, Jabalpur	Semi-arid Lava Plateau and Central Highlands	Palas, Ber, Kusum, *F. semialata*, Ghont, Gular, Pipal, Sitaphal
11	ICAR-CAFRI, Jhansi	--	Palas

Capacity building in lac cultivation through training of resource persons and farmers of network centers

A key project objective is to extend scientific lac cultivation methods to resource persons and farmers in target regions within the Network Centre. Details of the training delivered are given below. In 2025, Network Centres conducted 42 training programmes on improved lac cultivation methods, reaching 1,480 trainees.

Details of the training imparted to resource persons and farmers by Network Centres during 2025

S. No.	Centre	Number of trainings conducted in 2025	Number of beneficiaries
1	AAU, Jorhat	05	120
2	CAU, Imphal	07	160
3	KFRI, Thrissur	03	35
4	ICAR- KVK Sirsi	02	85
5	MPUAT, Udaipur	07	357
6	PAU, Ludhiana	06	115
7	ICAR RCER, Patna	00	00
8	ANGRAU, Guntur	04	244
9	SKUAST, Jammu	05	214
10	SFRI, Jabalpur	03	150
11	ICAR- CAFRI, Jhansi	0	0
	Total	**42**	**1480**

Glimpses of trainings conducted in 2025 by different centres under NPCLIGR

LEAD CENTRE: ICAR-NATIONAL INSTITUTE OF SECONDARY AGRICULTURE, RANCHI (JHARKHAND)

Isolation and identification of phloem sap endophytes from the lac host plants, *Flemingia spp*.

Plants harbour mutualistic endophytes, which are important for their growth and development. The lac host plant is the key factor determining lac yield, as lac insects depend on it for nutrition and shelter throughout their lives. Lac host endophytes may positively impact lac insects. This study explored the diversity of endophytic bacteria in the phloem sap of the host plants *Flemingia semialata* and *Flemingia macrophylla* and their role in nutrient supplementation. It revealed that isolates from *F. semialata* phloem sap were *Agrobacterium larrymoorei, Rhizobium sp., Sphingomonas sp.*, and *Priestia aryabhattai*. Isolates from *F. macrophylla* were *Brevundimonas albigilva* and *Bacillus australimaris*. The isolates also showed varied growth-promoting substance production and nutrient-solubilising ability.

Analysis of phloem sap from different lac host plants

The phloem sap carbohydrate from six lac host plants and a control plant was determined by UHPLC. The relative composition (% of total carbohydrates) observed was as follows. Sucrose accounted for approximately 73.3% of the total carbohydrate content. Fructose contributed about 21.9%, a moderate proportion among the detected sugars. Glucose represented the smallest fraction at approximately 4.8%.

Phloem sap carbohydrate composition from different lac host plants

Sl. No.	Lac Host Plant	Carbohydrates (ppm)		
		Fructose	Glucose	Sucrose
1	*F. semialata*	1,015	NA	17,206
2	*F. macrophylla*	3,440	NA	9,879
3	*S. oleosa*	NA	6,242	11,178
4	*Z. mauritiana*	5,104	3,492	30,940
5	*B. monosperma*	7,904	1,476	7,641
6	*C. calothyrsus*	2,708	NA	10,202
7	*Ashoka (Control)*	9,150	NA	27,558

Isolation and identification of endosymbionts from lac insects

A total of 33 endosymbiotic bacteria were isolated from kusmi and rangeeni lac insects grown on *Ziziphus mauritiana, Flemingia macrophylla,* and *Butea monosperma* using a culturing method. Surface-sterilised female insects were cultured on different media and incubated until colonies appeared. The colonies were sub-cultured and preserved as glycerol stocks. Genomic DNA was isolated from the cultures, and 16S rRNA was amplified and sequenced. Based on these sequences, the following bacterial species were identified from lac insects.

List of endosymbionts from *kusmi* and *rangeeni* lac insects

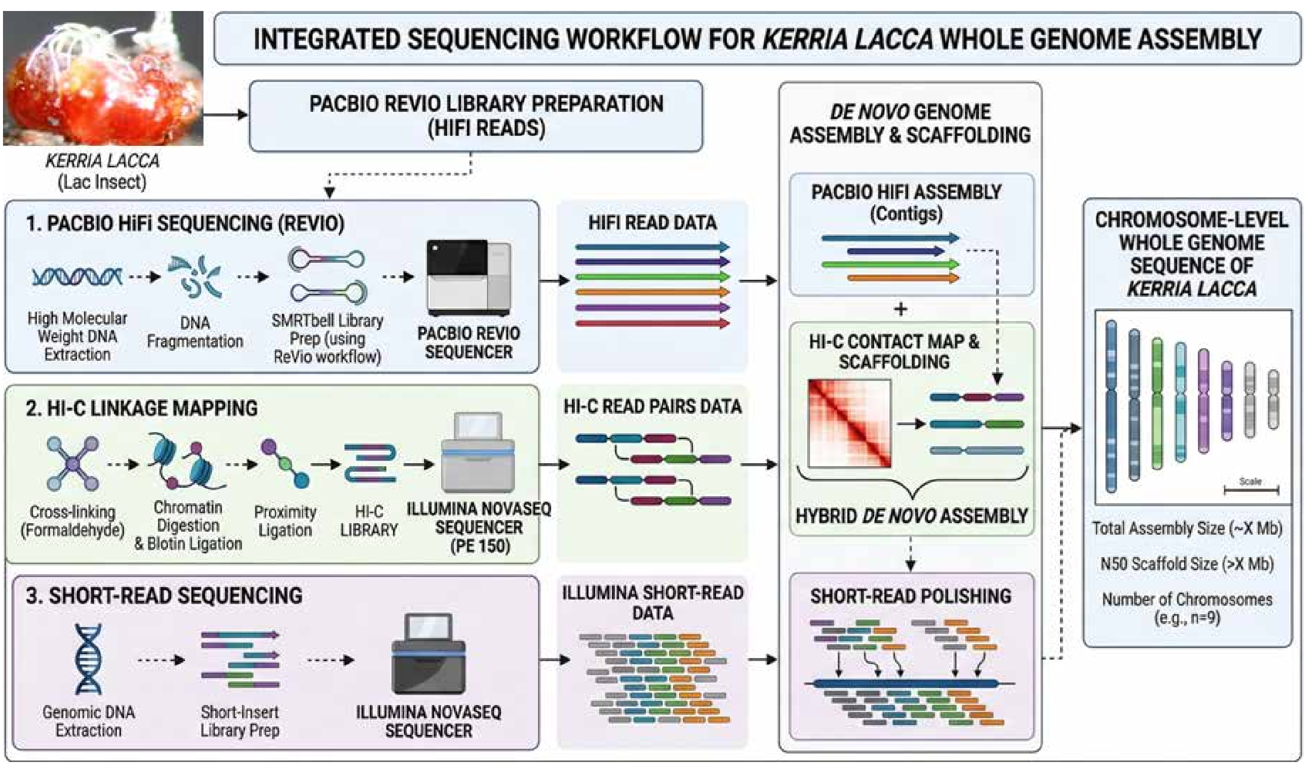
S. No.	Isolates	Host Plants	Species identity	Sequence length in bp	Accession Number	Closest match in GenBank	Accession no. of match	Percent identity
From Kusmi lac insects								
1	MKN3	*F. macrophylla*	*Moraxella osloensis*	1249	OQ661907	*Moraxella osloensis* strain 1910ICU156	MT225645.1	99.84
2	MKL5	*F. macrophylla*	*Acinetobacter baumannii*	1180	OQ661908	*Acinetobacter baumannii* strain W155	CP163039.1	99.83
3	MKL7	*F. macrophylla*	*Enterobacter cloacae*	1403	OQ661909	*Enterobacter cloacae* strain OsEp_Plm_30B10	MT367801.1	99.11
4	MKH11	*F. macrophylla*	*Staphylococcus haemolyticus*	1363	OQ661910	*Staphylococcus haemolyticus* strain MTCC 29970	MT569983.1	99.75
5	MKH12	*F. macrophylla*	*Pantoea dispersa*	1408	OQ661911	*Pantoea dispersa* strain SA004	MN725743.1	99.92
6	MKT21	*F. macrophylla*	*Priestia megaterium*	1406	OR294197	*Priestia megaterium* strain AK4	OR294197.1	100
7	MKH22	*F. macrophylla*	*Staphylococcus epidermidis*	1350	OR294198	*Staphylococcus epidermidis* strain 2322	MT604781.1	100
8	MKH23	*F. macrophylla*	*Staphylococcus haemolyticus*	1291	OR186654	*Staphylococcus haemolyticus*	MT569983.1	100
9	MKH24	*F. macrophylla*	*Staphylococcus epidermidis*	1308	OR186655	*Staphylococcus epidermidis strain H92*	KU922391.1	100
10	MKN26	*F. macrophylla*	*Microbacterium testaceum*	1218	OR186656	*Microbacterium testaceum strain C53*	OR122061.1	99.84
11	MKN29	*F. macrophylla*	*Microbacterium oleivorans*	1243	OR186657	*Microbacterium oleivorans strain MV19*	MK928455.1	100
12	KUOS	*F. semialata*	*Exiguobacterium indicum*	1276	PV576566	*Exiguobacterium indicum strain TTS-AB-A16*	MG694503	99.92

S. No.	Isolates	Host Plants	Species identity	Sequence length in bp	Accession Number	Closest match in GenBank	Accession no. of match	Percent identity
13	KUYS	*F. semialata*	*Exiguobacterium aestuarii*	1448	PV554893	*Exiguobacterium sp. XT-14*	KR063545.1	99.79
14	KBYS	*Z. mauritiana*	*Bacillus pumilus*		PV554891			
15	KBWS	*Z. mauritiana*	*Moraxella sp.*	1365	PV545302	*Moraxella sp. strain CREA4*	MT380814.1	99.93
16	KBWR	*Z. mauritiana*	*Microbacterium sp.*	1360	PV545299	*Microbacterium thalassium strain P-R2A55*	MT533899.1	99.93
17	MKL8	*F. macrophylla*	*Microvirga sp.*	1197	PV545298	*Microvigra sp. strain RX1*	OR578339.1	98.83
18	KUYR	*Z. mauritiana*	*Pseudomonas luteola*	1151	PV545297	*Pseudomonas sp. strain Cmu-C6*	PX396361.1	99.57
From Rangeeni lac insect								
19	MRH3	*F. macrophylla*	*Bacillus sp.*	1314	OQ661900	*Bacillus sp. (in: Bacteria) strain TJ-4*	MH484247.1	100
20	MRL6	*F. macrophylla*	*Psychrobacter alimentarius*	1199	OQ661901	*Psychrobacter alimentarius strain PdB7*	MN704556.1	90.73
21	MRH14	*F. macrophylla*	*Pantoea dispersa*	949	OR197589	*Pantoea dispersa strain AE5*	MT540024.1	96.62
22	MRH16	*F. macrophylla*	*Staphylococcus sp.*	1263	OQ661903	*Staphylococcus sp. strain BH1-3*	MT393663.1	99.37
23	MRH17	*F. macrophylla*	*Staphylococcus warneri*	1315	OQ661904	*Staphylococcus warneri strain CG10 a*	MT072204.1	99.85
24	MRT18	*F. macrophylla*	*Staphylococcus hominis*	1263	OQ661905	*Staphylococcus hominis strain FDAARGOS*	CP054883.1	98.97
25	MRT20	*F. macrophylla*	*Micrococcus luteus*	1187	OQ661906	*Micrococcus luteus strain NE2E1*	KM874397.1	99.66
26	MRT21	*F. macrophylla*	*Staphylococcus warneri*	1337	OR294196	*Staphylococcus warneri strain DK131*	MT642942.1	100
27	MRL22	*F. macrophylla*	*Priestia aryabhattai*	1383	OR186659	*Priestia aryabhattai strain CIFRI.BTL-54*	PP758805.1	100
28	MRH29	*F. macrophylla*	*Paenibacillus sp.*	919	OR186660	*Paenibacillus sp. 3LF14TD*	EU417658.1	100
29	PR3	*B. monosperma*	*Bacillus cereus*	1395	PV422769	*Bacillus cereus strain FJAT-46868*	MG651486.1	99.86

S. No.	Isolates	Host Plants	Species identity	Sequence length in bp	Accession Number	Closest match in GenBank	Accession no. of match	Percent identity
30	MRH2	*B. monosperma*	*Bacillus cereus*	1222	PV611827	*Bacillus cereus strain NR2 16S*	KM054690.1	99.76
31	RPYR	*B. monosperma*	*Exiguobacterium indicum*	1276	PV565655	*Exiguobacterium indicum TTS-AB-A16*	MG694503.1	99.92
32	RPYR2	*B. monosperma*	*Enterobacter cloacae*	1332	PV554892	*Enterobacter cloacae OsEp_Plm_30B10*	MT367801.1	99.63

Whole genome sequencing of *Kerria lacca* and *Kerria chinensis*

Estimation of the genome size of the Indian Lac insect *Kerria lacca* by Flow Cytometry revealed it to be 753.06 mega base pairs (Mbp; 2C). Lac insect samples were sent for whole-genome sequencing. Sequencing was carried out by PacBio, which provides long reads, and by Illumina NovaSeq, which provides short reads. A total of 133 and 294 contigs (>10000bp) were found for *K. chinensis* and *K. lacca*, respectively.



Integrated sequencing workflow for Kerria lacca whole genome assembly

ASSAM AGRICULTURAL UNIVERSITY, JORHAT (ASSAM)

Collection and conservation of lac insect genetic resources of Humid Bengal, Assam Basin of India

Surveys in Assam covered all 33 districts and 215 blocks. Lac insects were found in 7 districts. In West Bengal, all 23 assigned districts were surveyed. Detailed surveys in 2025 included 21 blocks in South 24 Parganas. Lac insects were observed in 10 districts of West Bengal. The Regional Field Gene Bank in Jorhat maintains 488 host plants from 15 species, along with four strains of lac insects: two strains of *Kerria chinensis* (Doloi: AAUK-20 and Langardang: AAUK-06) and two strains of *Kerria lacca* (Purulia: AAUK-03 and Howrah: AAUK-17). The surveys identified region-specific lac–host plant combinations for the Humid Bengal–Assam basin. *Flemingia semialata, Flemingia macrophylla, Flemingia strobilifera, Ziziphus mauritiana,* and *Cajanus cajan* are suitable hosts for both *Kerria lacca* and *Kerria chinensis*. *Ficus religiosa* and Leea species are particularly suitable for *Kerria chinensis* in hilly areas, while *Schleichera oleosa* and *Butea monosperma* are suitable for *Kerria lacca*.

Glimpses of survey work carried out in different districts of Assam & West Bengal

Need based and location specific studies on lac-insects and/or host plants

The *Kerria chinensis* accessions Doloi (AAUK-20) and Langardang (AAUK-06) recorded crop durations of 170-178 days and 164-176 days during the winter and summer seasons of 2025. The *Kerria lacca* accession Howrah (AAUK-17) showed trivoltinism with crop durations of 145 days in winter, 112 days in summer, and 103 days in the monsoon. The Namkum accession (AAUK-27) recorded a 150-day summer crop; its winter crop is ongoing.

On-farm trials on lac cultivation technologies

In 2025, 3.5 kg of *Flemingia semialata* seed and 18.08 kg of broodlac (1.5 kg *Kerria lacca* and 16.58 kg *Kerria chinensis*) were harvested from the Regional Field Gene Bank and supplied or re-inoculated in the field. Farmers also contributed: Mr Abubakar Siddiqui harvested 3 kg of *Flemingia semialata* seed, and 2 kg was obtained from Assam Agricultural University–SMAPRS, Buralikson. Mr Bhupen Pegu in Dhemaji harvested 22 kg of lac from ber (*Ziziphus mauritiana*). Additionally, 7 kg of *Flemingia semialata* seed was supplied to a lac farmer in Ranchi for cultivation as a host plant. Five trainings on 'Scientific Lac Cultivation' were conducted in 2025, benefiting 120 participants.

CENTRAL AGRICULTURE UNIVERSITY, IMPHAL (MANIPUR)

Collection and Conservation of biological diversity of the lac insect of the North Eastern Region

Surveys were conducted in Pakyong and Soreng districts of Sikkim. Live lac insects were found in Pakyong district along the Ranipool–Andheri Road on the Mesua species. This completed the survey of all Sikkim districts in 2025. Additional surveys were conducted across various blocks of Manipur. Four new host plants with live lac insect infestations were identified: Heibamana (*Ficus palmata* Forsk), Uyin (*Albizia odoratissima* Benth), Patchouli (*Pogostemon cablin*), and Mussaenda (*Mussaenda philippica*). To conserve local diversity, *Kerria manipurensis* was inoculated on 45 *Malvaviscus penduliflorus* plants at the Regional Field Gene Bank. Ten lac cultivation sub-centres were established under Central Agricultural University. Nine centres use *Malvaviscus penduliflorus* as the host plant, and one uses *Cajanus cajan*, covering a total area of 1 hectare.

Glimpses of survey work carried out in different districts of Sikkim

Different lac cultivation sub-centres established by CAU, Imphal centre at different locations

PUNJAB AGRICULTURAL UNIVERSITY, LUDHIANA (PUNJAB)

Collection and conservation of lac insect genetic resources

Surveys were conducted in 21 districts of Punjab, covering 40 blocks. A total of 8 lac insect samples were recorded on *Ziziphus mauritiana*, including 5 live and 3 dead samples. [DM1] In Delhi, surveys in North, Central, New, and South districts found no lac insect samples. In Uttar Pradesh, surveys in Gautam Buddha Nagar, Bulandshahr, Shamli, and Saharanpur covered 15 blocks. Three lakh insect samples were collected from *Ziziphus mauritiana*. Low to medium population levels were observed in Shamli district.

Ex-situ conservation/ brood multiplication at the regional field gene bank

The Regional Field Gene Bank maintains host plants including *Acacia nilotica, Cajanus cajan, Schleichera oleosa, Flemingia macrophylla, Flemingia semialata, Calliandra haematocephala, Litchi chinensis, Dalbergia sissoo, Ficus benjamina, Albizia lebbeck,* and *Ficus religiosa* for ex-situ conservation and broodlac multiplication. In 2025, 124.93 kg of broodlac were produced on various host plants. The Baisakhi crop yielded 72.0 kg in July 2025 from *Ziziphus mauritiana, Butea monosperma, Flemingia semialata*, and *Flemingia macrophylla*. The Katki crop yielded 52.93 kg in November 2025 from *Ziziphus mauritiana, Calliandra haematocephala, Flemingia semialata,* and *Flemingia macrophylla*. In November 2025, 88 host plants were inoculated with the Rangeeni strain for the Baisakhi crop. These included 80 *Flemingia semialata,* 3 *Ziziphus mauritiana,* 1 *Ficus religiosa,* 2 *Butea monosperma,* and 2 *Calliandra haematocephala*. For in-situ conservation, broodlac was inoculated on *Ziziphus mauritiana* at 19 locations in Moga, Ferozepur, Jalandhar, Barnala, and Ludhiana districts. Additionally, broodlac was inoculated on *Ziziphus mauritiana* and *Ficus bengalensis* at Krishi Vigyan Kendra (KVK), Moga, for farmer awareness and demonstration.

Glimpses of survey work carried out in different districts of Punjab

Studies on life cycle and productivity-linked parameters of lac insect on *Butea monosperma* (*Rangeeni* strain; *Baisakhi* crop) and *Calliandra haematocephala* (*Rangeeni* strain; *Katki* crop)

Biological and productivity parameters of the lac insect were assessed on two host plants, *Butea monosperma* (Rangeeni strain; Baisakhi crop) and *Calliandra haematocephala* (Rangeeni strain; Katki crop), at the Regional Field Gene Bank. The Baisakhi crop was studied from November 2024 to July 2025. The Katki crop was studied from July 2025 to November 2025. The results for biological and productivity parameters of the lac insect on *Butea monosperma* are summarised below:

The initial settlement density was 80.67±0.52 insects per cm^2, with a mortality rate of 4.65±0.36%. The mean duration of pre-sexual stages was 113.33±1.45 days (range 111–116 days). Male emergence began after 129.33±3.07 days (range 121–134 days), with a sex ratio of 21.43±0.50% males. The mean density of surviving female insects was 4.93±0.12 per cm^2. The Baisakhi crop duration on *Butea monosperma* ranged from 214 to 243 days under Punjab conditions. The mean female cell weight after crawler emergence was 8.71±0.25 mg (range 7.10–10.74 mg). Each female cell produced an average of 6.01±0.25 mg of resin (range 4.32–7.43 mg) after removal of the dead insect. The average number of offspring per female ranged from 121 to 165 (mean 139.43±4.05). The broodlac output ratio after harvest was 6.60±0.14.

Biological and productivity parameters of lac insect (*Rangeeni* strain; *Baisakhi* crop) on *Butea monosperma*

Parameters	Baisakhi	
	Range	Mean ± SE
Initial density of settlement (no./cm^2)	76-86	80.67±0.52
Final density of settlement (no./cm^2)	74-82	76.89±0.22
Mortality (%)	2.63-7.14	4.65±0.36
Sex-ratio (% male insects)	14.00-17.00	21.43±0.50
Density at crop maturity (no./cm^2)	4.66-5.33	4.93±0.12
Duration of pre-sexual stages (days)	111-116	113.33±1.45
Initiation of male emergence (days)	121-134	129.33±3.07
Longevity of female cell (days)	214-243	230.33±8.57
Female cell weight (mg)	7.10-10.74	8.71±0.25
Resin output (mg)	4.32-7.43	6.01±0.25
Fecundity/female (no.)	121-165	139.43±4.05
Broodlac output ratio	6.45-6.74	6.60±0.14

Biological and productivity parameters of lac insect (Rangeeni strain; Katki crop) on Calliandra haematocephala

Parameters	Katki	
	Range	Mean ± SE
Initial density of settlement (no./cm^2)	78-85	82.33±0.77
Final density of settlement (no./cm^2)	72-80	75.22±0.31
Mortality (%)	3.61-10.98	8.63±0.65
Sex-ratio (% male insects)	23.08-27.85	25.20±0.81
Density at crop maturity (no./cm^2)	4.67-5.67	5.00±0.21
Duration of pre-sexual stages (days)	46-49	47.33±0.88
Initiation of male emergence (days)	49-52	50.33±0.88
Longevity of female cell (days)	114-118	115.67±1.20
Female cell weight (mg)	7.22-11.78	9.04±0.27
Resin output (mg)	5.43-7.98	6.45±0.21
Fecundity/female (no.)	119-165	144.33±3.19
Broodlac output ratio	3.76-4.53	4.15±0.39

The initial settlement density was 82.33±0.77 insects per cm^2, with a mortality rate of 8.63±0.65%. The mean duration of pre-sexual stages was 47.33±0.88 days (range 46-49). Male emergence began after 50.33±0.88 days (range 49-52), with a sex ratio of 25.20±0.81% males. The mean density of surviving female lac insects was 5.00±0.21 per cm^2. The Katki crop (Rangeeni strain) duration on *Calliandra haematocephala* ranged from 114 to 118 days under Punjab conditions. The mean weight of a female cell after crawler emergence was 9.04±0.27 mg (range 7.22-11.78). Each female cell produced an average of 6.45±0.21 mg of resin (range 5.43-7.98) after removal of the dead insect body. The average number of young produced per female ranged from 119 to 165 (mean 144.33±3.19). The broodlac output ratio after crop harvest was 4.15±0.39 during the Katki crop.

Diversity of natural enemies associated with lac insects

Of the five *Trichogramma* species tested for parasitisation of *Eublemma* eggs, *Trichogramma pretiosum* had the highest rate at 73.33%. *Trichogramma achaeae* followed with 56.67%. *Trichogramma chilonis* and *Trichogramma evanescens* showed intermediate rates of 46.67% and 40.0%, respectively. *Trichogramma embryophagum* had the lowest rate at 22.22%.

MAHARANA PRATAP UNIVERSITY OF AGRICULTURE & TECHNOLOGY, UDAIPUR (RAJASTHAN)

Collection and conservation of lac insect genetic resources

In 2025–26, 76 blocks across 17 districts in Rajasthan, Gujarat, and Haryana were surveyed. This included 3 blocks in 2 districts of Rajasthan, 43 blocks in 7 districts of Gujarat, and 30 blocks in 8 districts of Haryana. The survey identified lac insects at 154 locations and recorded 9 host plant species supporting their presence. Lac insects were most commonly found on Peepal (*Ficus religiosa*), Ber (*Ziziphus mauritiana*), Babool (*Acacia nilotica*), and Bargad (*Ficus bengalensis*). Several initiatives supported in-situ conservation. These included collecting 30.58 kg of broodlac from natural hosts for inoculation in farmers' fields to encourage population growth. For ex-situ conservation, 20.50 kg of brood lac was collected and inoculated in the Regional Lac Insect Gene Bank in 2025.

KERALA FOREST RESEARCH INSTITUTE, THRISSUR (KERALA)

Collection and conservation of lac insect genetic resources

Lac insect surveys in Kanyakumari and Ranipet during March–April 2025 identified new populations, including significant infestations on Albizia saman. In Ranipet, two sites had dense colonies with an estimated live lac yield of 20 kg, harvested in June–July 2025.

Lakshadweep Lac Survey: Surveys on six of the eleven Lakshadweep islands found no lac insect populations.

On-farm trials on lac cultivation technologies

With support from the Kerala Forest Research Institute, several new farmers adopted lac cultivation. They include Pannerselvam (Pudukottai, Tamil Nadu), Sivanesan (Perambalur, Tamil Nadu), Soman (Thrissur, Kerala), and Francis Felix (Palakkad, Kerala).

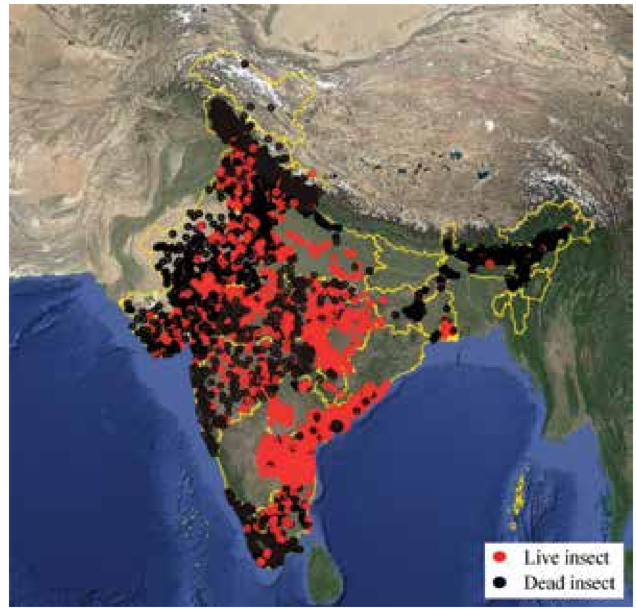
Host plant establishment

Flemingia semialata, an important host plant for lac insects, was successfully established in farmers' fields in Thrissur, Palakkad, and Pudukottai. This demonstrates its adaptability across diverse agro-climatic conditions.

Glimses of lac cultivation activities at different places of Kerala and Tamil Nadu

National mapping of lac resources:

A national mapping initiative on the distribution of the lac insect and its host plant resources has been launched. Mapping is now complete for most centres.



Lac insect and host plant distribution map in India

ICAR- KVK SIRSI, UTTARA KANNADA - UAS, DHARWAD (KARNATAKA)

Introduction of lac cultivation in Mysuru, Mandya, Davanagere, and Ballari districts of Karnataka on Flemingia, Ber Kusum and Ficus religiosa.

Commercial cultivation of Kusmi lac on Ber and *Flemingia* is ongoing in several Karnataka districts, including Mysuru, Mandya, Davanagere, and Ballari. Inoculation was conducted at six locations. Persistent rainfall during and after inoculation led to poor colonisation at four sites, while Daginakatte (Davanagere) saw moderate results, and Kurugodu (Ballari) achieved excellent colonisation. Notably, Shri Hanumanthappa of Daginakatte inoculated 5 kg of Kusmi broodlac on 500 *Flemingia*, 15 Ber, and 15 Ficus spp. plants, yielding 70 kg of lac. Shri Raju of Kurugodu inoculated 10 kg of broodlac on 100 Ber plants and harvested approximately 165 kg, most of which was distributed as broodlac to other farmers. In contrast, Shri Cheluvaraju of Bannikuppe, Mysuru, inoculated 2 kg on 7 Ber and 24 *Flemingia* plants, yielding 6 kg. Shri Nagendra of Panakanahalli, Mandya, and Vinayaka of Uruhundi, Mysuru, inoculated 5 kg and 2 kg, respectively, on *Flemingia* plants, but did not achieve any yield.

STATE FOREST RESEARCH INSTITUTE, JABALPUR (MADHYA PRADESH)

Collection and conservation of lac insect genetic resources

A survey of lac insects and their host plants was conducted across 18 blocks in four districts of Chhattisgarh: Bijapur, Sukma, Dantewada, and Jagdalpur. Lac insect presence was confirmed at 18 sites within seven blocks, primarily on Kusum and Ber host plants. For the first time, lac insect emergence was also observed on pipal (*Ficus religiosa*) in Khargone Block of Khargone District and in Ujjain District. The Regional Field Gene Bank currently maintains 650 plants representing 18 different host species, including *F. macrophylla, F. semialata*, *Calliandra sp.*, palas, gular, jangli jalebi, ber, pipal, sitaphal, shisam, bargad, kusum, rain tree, akashmoni, khair, safed siris, ghont, and kala siris.

Promotion of Kusmi lac cultivated on *F. semialata*

ngoing guidance was provided to Mr Mahendra Solanki in Indore District, resulting in a successful harvest of 80 kg of Kusmi broodlac from *F. semialata* plants. In addition, over 210 *Flemingia semialata* and Calliandra plants were established across four farmer fields in Mandla, Katni, Dindori, and Jabalpur for on-farm cultivation trials.

***F. semialata* plantation at farmers field for the promotion of Kusmi lac cultivation**

ICAR-RESEARCH COMPLEX FOR EASTERN REGION, PATNA (BIHAR)

Collection and conservation of lac insect genetic resources

Resource mapping of lac insects: Conducted a comprehensive survey in 16 districts of Eastern Uttar Pradesh. Documented natural lac insect populations in six districts and identified Ficus religiosa, *Ficus bengalensis*, and *Ficus rumphii* as the primary host plants.

Rangeeni lac cultivation with farmer participation: Introduced farmer-participatory lac cultivation in Hirmoti (Banka block) and Bengalgarh (Chandan block), Banka district. Harvested 370 kg of broodlac in July 2025 (Baisakhi crop) from 230 palas and 2 ber trees, demonstrating successful adoption of scientific cultivation methods.

Enhanced production through scientific inoculation: Supported inoculation of 290 kg broodlac on 340 palas trees in July 2025. This yielded 410 kg of broodlac in November 2025 (Katki crop), highlighting the potential of participatory lac cultivation to increase productivity and improve farmer livelihoods.

ACHARYA N. G. RANGA AGRICULTURAL UNIVERSITY (ANGRAU) GUNTUR (ANDHRA PRADESH)

Collection and conservation of lac insect genetic resources

A survey conducted across all 33 districts of Telangana State found lac insect encrustation in 19 districts. The species Kerria destructor was identified in both Andhra Pradesh and Telangana. The Zoological Survey of India (ZSI) confirmed

Kerria destructor on *Annona squamosa L.* and *Albizia saman* (Jacq.) Merr. in these states, and also reported its presence on *Ficus religiosa* in Kangal Mandal, Nalgonda district, Telangana.

Glimses of survey activities at different places of Andhra Pradesh and Telangana

SHER-E-KASHMIR UNIVERSITY OF AGRICULTURAL SCIENCES AND TECHNOLOGY, JAMMU (JAMMU & KASHMIR)

Conservation and brood multiplication of lac for sustainability

The Kusmi lac strain was introduced and established in the Jammu region for the first time, achieving significantly higher productivity (2.8–3.8 kg per 10 bushes) than the traditional Rangeeni strain (0.20–0.42 kg per 10 bushes). This represents a major step toward climate-resilient lac cultivation. *Flemingia semialata* was identified as the optimal host plant for Kusmi lac, with the highest crawler settlement rate (79.08%), maximum brood yield (82.81 g per stick), and a favourable female sex ratio (1:3.01 male: female), all of which are essential for sustainable broodlac production.

Climate resilience study

Total 13 lac strains collected, Gole Market (GM) and Cherni Pahari (CP) were identified as climate-resilient based on the Climate Resilience Index (CRI). Climate resilience modelling with Generalised Additive Model (GAM) using key temperature and humidity thresholds achieved high predictive accuracy (R^2 = 0.79–0.91). The analysis found crawler settlement collapses above 38 °C and resin production declines below 50% relative humidity. These findings indicate that GM and CP strains are likely to remain viable in the Jammu region by 2040, supporting climate-adaptive lac cultivation strategies.

Future climate projections

Future projections using the Climate Resilience Index and scenario SSP5–8.5 estimate strain viability through 2040. Only strains with CRI values above 0.85, such as Gole Market and Cherni Pahari, are expected to remain viable, informing future conservation and strain selection efforts.

Identification of Climate-Resilient Lac Strains based on the Climate Resilience Index (CRI)

Response Variable	Model Formula	R^2	Explained Deviance (%)	GCV Score	Estimated Degrees of Freedom (EDF)
Settlement Rate	s(MaxTemp) + s(Rainfall) + s(HeatwaveDays)	0.91	89.2	124.3	7.82
Resin Weight	s(MaxTemp) + s(Humidity) + s(Rainfall)	0.87	85.6	0.89	6.45
Fecundity	s(MaxTemp) + s(Rainfall) + s(Humidity)	0.84	82.3	312.7	5.93
Mean Brood Cells	s(MaxTemp) + s(Humidity) + s(HeatwaveDays)	0.79	77.8	45.2	4.76

ICAR- CENTRAL AGROFORESTRY RESEARCH INSTITUTE, JHANSI (UTTAR PRADESH)

Collection and conservation of lac insect genetic resources in the Bundelkhand region

A block-level field survey was conducted in Panna, Chhatarpur, and Tikamgarh districts of Madhya Pradesh to document lac insects and their host plants in the Bundelkhand region. The objectives were to identify natural lac habitats, collect genetic resources, and evaluate the potential for lac cultivation and conservation. The survey identified six primary host plants supporting natural lac insect populations in the region: *Ficus benghalensis* (Bargad), *Ficus religiosa* (Peepal), *Butea monosperma* (Palas), *Ziziphus xylopyrus* (Ghont/Kath Ber), *Ziziphus mauritiana* (Ber), and *Acacia nilotica* (Babul). Only the Rangeeni strain of the lac insect was observed. Natural lac infestation was recorded at five locations, with various developmental stages, including young crawlers and mature female cells. Infestation intensity varied across sites.

Ex-situ conservation

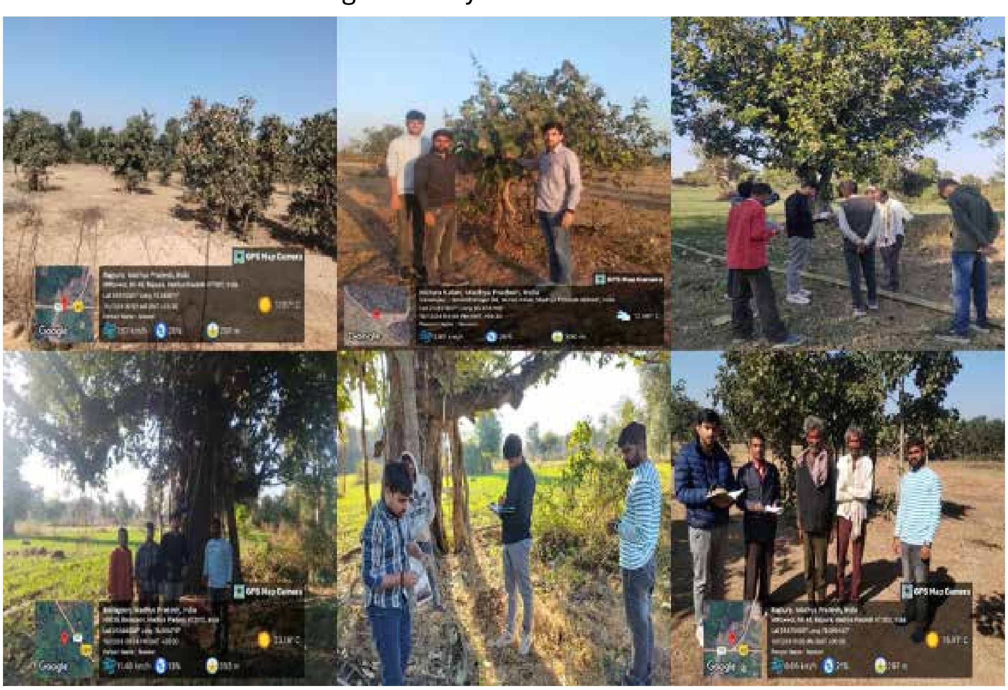
For ex-situ conservation, lac insect genetic resources were collected from the region and maintained at ICAR–Central Agroforestry Research Institute (CAFRI), Jhansi, Uttar Pradesh. Brood lac sticks with mature female insects were inoculated on selected host plants, including *Ficus benghalensis, Ficus racemosa, Butea monosperma,* and *Ziziphus mauritiana*. The inoculated plants were tagged for ongoing observation and research.

Field observations and socio-economic aspects

The survey found a rich diversity of lac host plants in the surveyed villages. In Tigoda village, Shahgarh Tehsil (Sagar district), natural lac infestation was observed on *Butea monosperma, Ficus religiosa, Ficus benghalensis, Ziziphus mauritiana,* and other nearby host plants. Tribal communities in this village actively collect and sell lac from natural forest areas.

Local traders purchase approximately 13–15 quintals of lac annually from nearby villages and supply it to traders and processing units in Chhatarpur, Lalitpur, Tikamgarh, and Sagar. In Bamhori Panji village, Tendukheda Tehsil (Damoh district), abundant natural lac infestation was also recorded on *Butea monosperma*.

The abundance of host plants and the presence of informal lac trade suggest significant potential to revive and expand lac cultivation in Bundelkhand through targeted scientific interventions.



Glimpses of training activities at different places of Bundelkhand Region

NETWORK PROJECT ON HARVESTING, PROCESSING AND VALUE ADDITION OF NATURAL RESINS AND GUMS

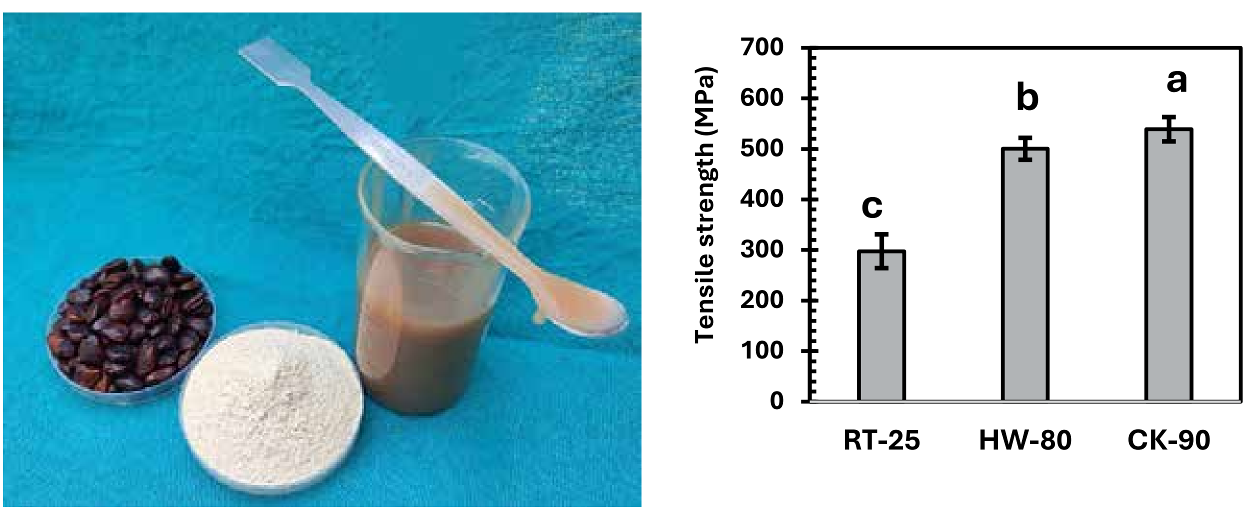
"Centre-wise Report"

LEAD CENTRE: ICAR-NATIONAL INSTITUTE OF SECONDARY AGRICULTURE, RANCHI (JHARKHAND)

Tamarind kernel powder (TKP) based paper adhesive

A protocol for tamarind gum (TG)-based aqueous paper adhesive was developed by optimising TG concentration, heating, pH modifiers, surfactants, and preservatives. Sodium carbonate was chosen as a non-hygroscopic alternative to NaOH. TKP solutions were prepared at room temperature (RT-25 °C), hot water (HW-80 °C), and cooked (CK-90 °C) to evaluate their effects on viscosity, gelation, and adhesive performance.

Pull-off strength testing (IS 2257:1989) on various paper substrates showed that HW-80 and CK-90 formulations provided superior adhesion, resulting in cohesive or substrate failure and indicating bond strength greater than the paper itself. RT-25 showed poor adhesion due to incomplete hydration. These results were consistent across all paper types, highlighting the importance of thermal treatment in gel development. Tensile strength analysis showed HW-80 and CK-90 reached peak forces of 200.1 N and 215.6 N, both significantly higher than RT-25 (~119 N). Tensile strength increased with temperature (RT-25: ~298 MPa; HW-80: ~500 MPa), with only a slight increase at CK-90 (~539 MPa), suggesting saturation in network formation. HW-80 provided the best balance between adhesive strength and processing feasibility. The TG-based adhesive shows strong potential as a sustainable alternative for paper and carton board applications.

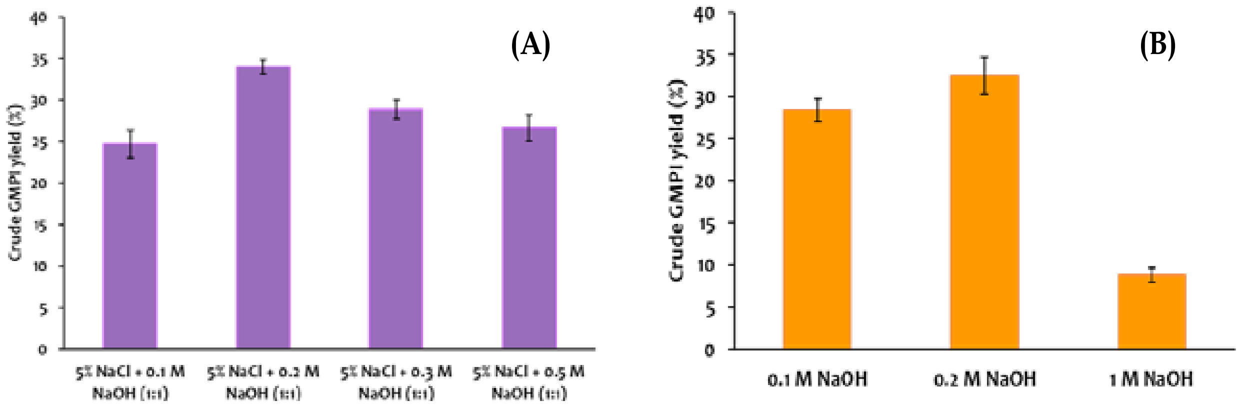


(a) *(b)*

Paper adhesive formulation: (a) Tamarind gum (TG) paper adhesive formulation; (b) tensile strength of the three formulations: RT-25, HW-80, and CK-90.

Extraction of guar meal protein isolate (GMPI)

Extraction of Guar Meal Protein Isolate (GMPI): The effects of solvent ratio, extraction duration, and NaOH concentration on GMPI yield were evaluated. Extending the extraction time to 120 minutes or reducing the solvent ratio did not significantly affect yield, which remained between 20% and 25%. Using a 1:40 solid-to-liquid ratio and 40 minutes of extraction, doubling the NaOH concentration increased the yield to 34%, but higher concentrations reduced it.

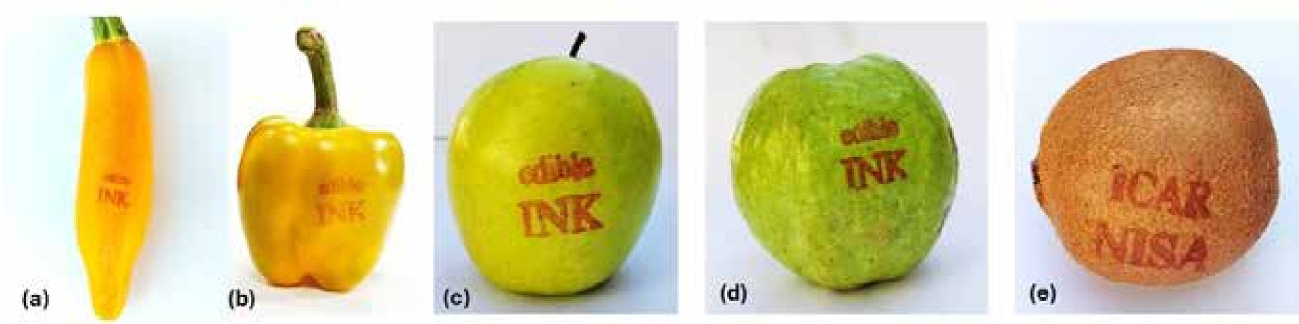


Effect of concentration of NaOH in GMPI extraction with (A) and without (B) NaCl

For ultrasound-assisted extraction, solvent ratio and stirring time had minimal impact, so a 1:20 solvent ratio and 30 minutes of stirring were used. Ultrasonication did not increase yield with the same solvent. Complete removal of NaCl improved yield. The highest protein isolate yield (38.8%) was achieved using 0.2 M NaOH, 30 minutes of stirring, and 15 minutes of ultrasonication. Roasting and longer extraction times did not significantly improve yield. However, reducing particle size to less than 0.15 mm substantially increased yield, with a twofold increase for 0.15–0.30 mm particles and a threefold increase for particles below 0.15 mm. Subsequent experiments used guar meal with particle size below 0.15 mm.

Natural gum based edible ink for food applications

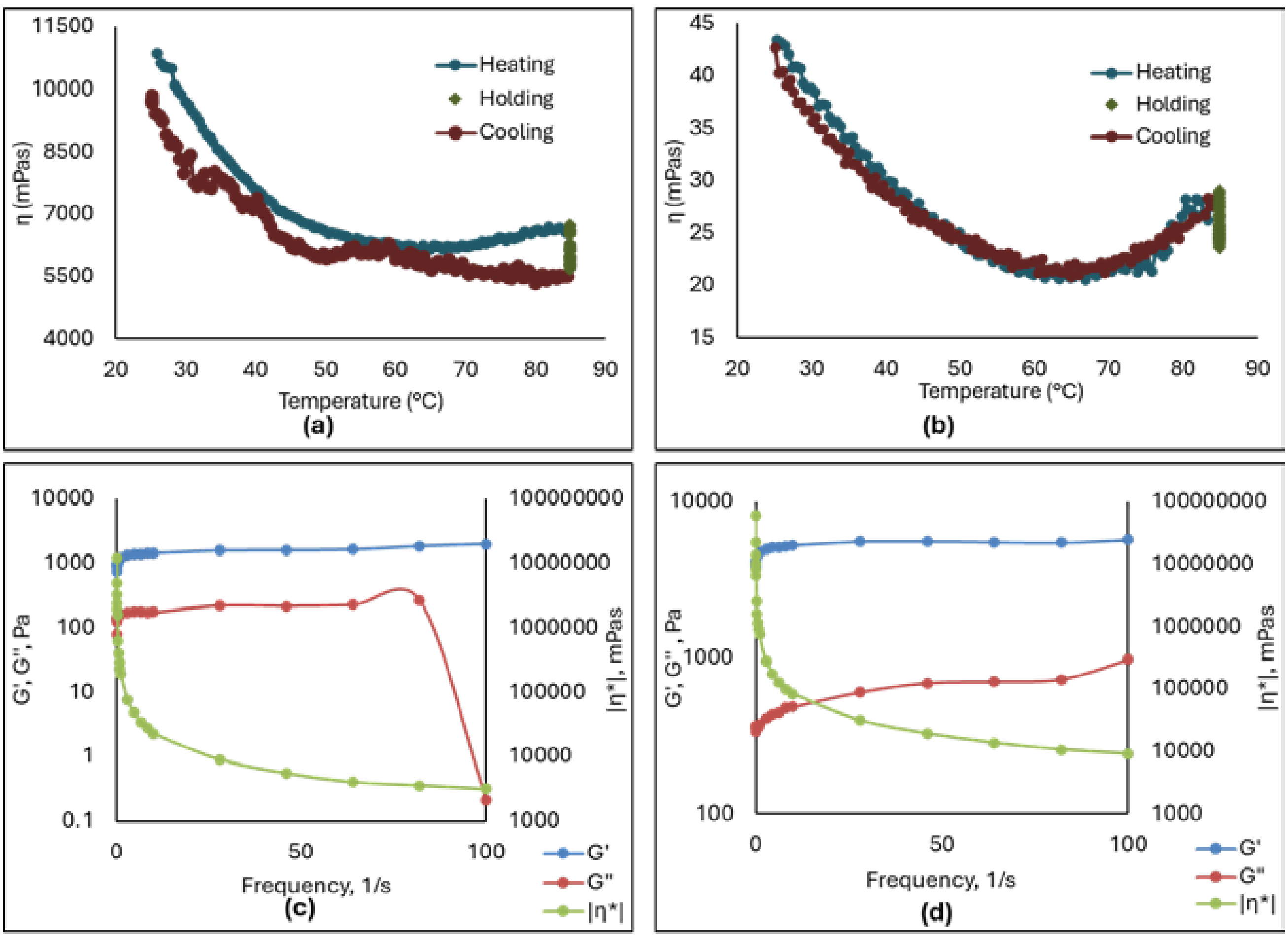
Edible ink formulations were developed as sustainable alternatives to conventional fruit and vegetable labelling stickers. Two systems were evaluated: aqueous-based and solvent-based. Aqueous inks (pigments: lac, litmus, curcumin; binders: gum arabic, gelatin; plasticizers: glycerol, Tween 80) had poor drying times (>5 min) and low font clarity (legibility 2.1 ± 0.3), making them unsuitable. Solvent-based inks (ethanol medium; pigments: lac dye, litmus, curcumin; binders: rosin, shellac, ethyl cellulose, dammar gum; plasticizers: Tween 80, glycerol, PEG; TiO_2 as opacifier) performed better, with drying times under 5 seconds. Rosin enabled rapid film formation, lac dye provided strong colour, and PEG improved flexibility. TiO_2 increased opacity but reduced rub and water resistance. Screening showed that rosin and lac dye concentrations significantly affected performance ($p<0.001$): rub resistance increased with higher rosin (5%: 12 cycles; 20%: 35 cycles), and lac dye improved readability (7% optimal; legibility 4.8 ± 0.2). The optimised ink formulation (15% rosin, 7% lac dye) demonstrated excellent printability on all tested fruit and vegetable surfaces. Rub resistance was strong (no font loss after 20 cycles), but water resistance was limited, with colour leaching under tap water abrasion, leaving a faint impression (residual legibility: 1.8 ± 0.4).



Stamping of optimised formulation on different fruits and vegetables (a) zucchini (b) yellow bell pepper (c) green apple (d) guava (e) kiwi

Comprehensive rheological characteristics of minor exudated gums

Minor exudated gums from Moringa (*Moringa oleifera*), Chironji (*Buchanania lanzan*), Palash (*Butea monosperma*), and Peach (*Prunus persica*) were systematically processed and evaluated. Physicochemical characterisation showed considerable variation in bulk density (652–750 kg/m^3), tapped density (750–857 kg/m^3), moisture content (8.2–17%), and flow indices (Carr index: ~10–16.6%; Hausner ratio: 1.11–1.20), indicating differences in particle packing, porosity, and hydration capacity, which affect rheological behaviour. Steady-shear rheological analysis showed all gum dispersions exhibited non-Newtonian, shear-thinning behaviour, described by the Power law model (R^2 > 0.98). The flow behaviour index (n) ranged from 0.20 to 0.65, confirming pseudoplasticity, while the consistency index (K) varied significantly among gums, reflecting differences in viscosity and thickening ability. Variations in apparent viscosity indicated differences in molecular weight distribution, chain entanglement, and hydration.



Temperature-dependent rotational rheology (a–b) and oscillatory viscoelastic behaviour (c–d) of gum dispersions: moringa gum (a, c) and peach gum (b, d)

Dynamic rheological measurements revealed the viscoelastic nature of the gums, as shown by the storage modulus (G') and loss modulus (G"). G' values exceeded G", suggesting weak gel-like behaviour. Temperature-dependent studies showed viscosity decreased with increasing temperature, following an Arrhenius-type relationship. The calculated activation energy (E_a) for flow ranged from 12 to 37 kJ/mol, depending on gum type and concentration, indicating moderate sensitivity of viscosity to temperature changes. Moringa and peach gums showed higher viscosity and similar activation energy, suggesting stronger intermolecular interactions compared to Chironji and Palas gums. These minor exudate gums possess desirable rheological properties, including shear-thinning flow, viscoelasticity, and structural stability, making them promising as natural thickeners, stabilisers, and functional ingredients. Overall, the findings establish a strong correlation between physicochemical properties, molecular structure, and rheological performance, supporting the use of underutilised gums for high-value applications in food and related industries.

ICAR-CENTRAL ARID ZONE RESEARCH INSTITUTE (CAZRI), JODHPUR (RAJASTHAN)

Physico chemical & morphological characterization of gum arabic grown across different agro-climatic zones

Acacia senegal (gum Arabic) gum samples were collected from twelve distinct regions, representing diverse agro-climatic conditions. The regions included eleven locations from Rajasthan, India (Ajmer, Kota, Barmer, Bhilwara, Bikaner, Chittorgarh, Jaisalmer, Jodhpur, Nagaur, Pali and Rajsamand), and one international location, Sudan.

The samples were analysed for moisture, bulk density, true density, tap density, porosity, colour parameters, pH, and ash content, viscosity, and metal content (copper, zinc, manganese and iron), and compared to the specification requirements of Bureau of Indian Standards (BIS Specification IS 6795:2007) and European Union (Regulation 231/2012).

Micromeritic properties of gum samples from different regions

Region	Bulk density	Tap density	True density	Hausner's ratio	Carp's index	Carr's compressibility index	Porosity	Bulkiness
Ajmer	0.62^{abc}	0.74^{a}	1.64^{bcd}	1.21^{a}	0.17^{a}	17.06^{a}	62.1^{bcd}	1.63^{cd}
Kota	0.60^{bcd}	0.68^{de}	1.38e	1.13^{bc}	0.12^{bc}	11.65^{bc}	56.7^{de}	1.69^{bc}
Barmer	0.63^{a}	0.72^{abc}	1.52^{de}	0.63^{e}	0.13^{b}	12.45^{b}	58.2^{cde}	1.62^{e}
Bhilwara	0.62^{abc}	0.72^{ab}	1.87^{b}	1.17^{b}	0.12^{b}	13.54^{b}	66.2^{ab}	1.62^{de}
Bikaner	0.61^{abcd}	0.71^{bcd}	1.72^{bcd}	1.16^{b}	0.13^{b}	13.05^{b}	61.1^{bcde}	1.64^{cde}
Chittorgarh	0.62^{ab}	0.72^{ab}	2.12^{a}	1.17^{ab}	0.14^{b}	13.73^{ab}	70.0^{a}	1.63^{de}
Jaisalmer	0.61^{abcd}	0.62^{de}	1.62^{cd}	1.05^{d}	0.13^{b}	13.00^{b}	61.6^{bcd}	1.74^{b}
Jodhpur	0.60^{cd}	0.70^{bdce}	1.52^{de}	1.04^{d}	0.14^{ab}	14.53^{ab}	60.6^{bcde}	1.68^{bcd}
Nagaur	0.62^{abcd}	0.68^{e}	1.69^{bcd}	1.09^{c}	0.09^{c}	8.58^{c}	63.3^{bc}	1.64^{cde}
Pali	0.62^{abcd}	0.70^{bcde}	1.37^{e}	1.13^{bc}	0.12^{bc}	11.47^{bc}	54.8^{e}	1.63^{cde}
Rajasamand	0.60^{abcd}	0.70^{bcde}	1.78^{bc}	1.16^{b}	0.33^{b}	13.09^{b}	65.9^{ab}	1.68^{cde}
Sudan	0.59^{d}	0.68^{cde}	1.38^{e}	1.16^{b}	0.14^{b}	13.35^{b}	57.2^{cde}	1.85^{a}
Size (S)								
S1 (5-9 mm)	0.65^{a}	0.69^{b}	1.55^{b}	1.05^{b}	0.06^{b}	6.07^{b}	57.01^{b}	1.55^{b}
S2 (0.35µm)	0.57^{b}	0.71^{a}	1.72^{a}	1.24^{a}	0.20^{a}	19.81^{a}	65.80^{a}	1.75^{a}
Significance								
District	***	***	***	***	***	***	***	***
Size	**	***	***	***	**	*	***	***
G×T	***	***	*	***	***	***	NS	***

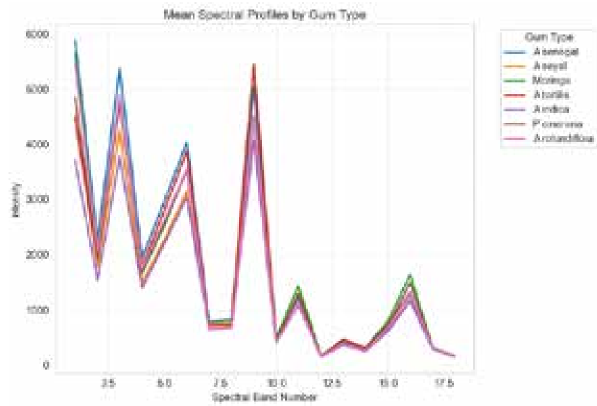
*Values with different letters (e.g., a, b, c) denote statistically distinct groups, meaning these treatments categories produce significantly different values.

Significant ($p < 0.001$) variation in colour parameters was observed among regions. Gum samples from Jaisalmer (39.75), Bikaner (32.89), Nagaur (33.02) and Jodhpur (34.96) recorded higher L* values, indicating comparatively lighter-coloured gums. In contrast, gums from Kota (16.73), Pali (16.33) and Sudan (18.04) showed significantly lower L* values, suggesting darker appearance. Viscosity varied across regions, with samples from Bikaner, Nagaur, and Barmer showing lower viscosity, while others exceeded 40 cP, indicating variability in functional performance related to thickening and stabilising behaviour. All analysed gum Arabic samples from Rajasthan, along with samples imported from Sudan, complied with the BIS and European Union Specifications with respect to moisture content, total ash, insoluble matter, solubility, tannin, and pH. All samples had ash content within 4%, moisture content less than 15%, insoluble matter less than 1%, no blackish colouration with ferric chloride solution and were acidic.

Authentication of gum arabic by hyperspectral imaging

A portable spectroscopic device based on the SparkFun AS7265x reflectance sensor was developed for rapid authentication of gum Arabic. Sixty-eight authenticated gum samples representing seven plant species were collected from twelve geographic locations. Spectral measurements were recorded at 18 wavelengths spanning 400–1000 nm. To reduce redundancy, highly correlated wavelengths ($r > 0.95$) were removed, leaving 9 independent variables for analysis.

A comprehensive statistical framework was employed using Python 3.9, including MANOVA to assess group-level differences, ANOVA for individual wavelengths, PCA for dimensionality reduction, and LDA for classification. PCA reduced the dataset to three principal components, which explained 92% of the total variance, indicating substantial redundancy in the spectral data. The results revealed a significant effect of geographic location, while species-level differences were not statistically significant. LDA achieved 75% accuracy in classifying samples by geographic origin, demonstrating the potential of spectral methods for provenance authentication. Although species classification achieved 100% accuracy, this result is unreliable due to severe sample imbalance, with the majority of samples belonging to *Acacia senegal*, which led to overfitting.



Mean spectral profiles based on gum type.

Wavelength-wise analysis identified only the 940 nm band as significantly influenced by location, while no individual wavelength showed significant species discrimination. Overall, the findings indicate hyperspectral analysis is effective for geographic authentication of gum Arabic but limited for species differentiation with the current dataset. The study highlights the importance of balanced sampling and robust statistical design for developing reliable classification models. With improved datasets, hyperspectral techniques have strong potential as rapid, non-destructive tools for quality assessment and authentication of natural gums.

Optimising tapping methods and inducer technology for enhancing gum production from lesser-known gum producing tree species

The gum induction experiment on the lesser-known gum-producing tree species *Prosopis cineraria* and *Moringa oleifera* was conducted for the second consecutive year, while *Azadirachta indica* was included for the first time in 2024–25.

In *Prosopis cineraria*, gum yield differed significantly across girth classes, inducer treatments, and their interaction ($p < 0.01$). Among girth classes, trees with G1 (>75 cm) recorded a higher gum yield (42.6 g/tree) than G2 (<75 cm) trees (19.2 g/tree). Similarly, inducer treatments showed marked differences: 25% concentration (T2) gave the highest yield (49.2 g/tree), followed by 50% (T1; 36.8 g/tree), while blaze-only (T3) produced the lowest (6.61 g/tree). A significant G × T interaction showed that the response to inducer concentration varied with tree girth, confirming that larger trees responded more positively than smaller ones.

Gum induction from P. cineraria after treatment

In *Moringa oleifera*, gum yield varied significantly across girth classes, inducer treatments, and their interaction. Among girth classes, trees with G3 (>61 cm) produced the highest yield (134 g/tree), significantly greater than G2 (45–60 cm; 90.1 g/tree) and G1 (<44 cm; 69.4 g/tree) ($p < 0.05$). Similarly, inducer treatments showed clear differences ($p < 0.01$), with the standard dose (T3) yielding the highest yield (152.6 g/tree), followed by 25% (T2; 79.2 g/tree) and 50% (T1; 61.8 g/tree), both of which were statistically lower.

Gum yield from *Azadirachta indica* was significantly influenced by inducer treatments ($p < 0.01$), while tree girth had no significant effect. The two girth classes, G1 (>75 cm) and G2 (<75 cm), produced similar yields of 8.48 g $tree^{-1}$ and 8.10 g/tree, respectively. In contrast, inducer treatments showed clear differences: 50% concentration (T1) gave the highest yield (15.1 g/tree), followed by 25% (T2; 7.24 g/tree), while the blaze-only control (T3) yielded the lowest (2.55 g/tree). A significant G × T interaction indicated that the response to inducer concentration varied across girth classes, despite the non-significant main effect of girth.

Effect of inducer application and cut position on oleo-gum resin yield in guggul (*Commiphora wightii*) under hyper-arid conditions of Western Rajasthan

A strong interaction between inducer application and cut position was observed, with chemical induction being the primary driver of gum yield enhancement and stem-based cutting strategies maximising its effectiveness. From a management perspective, inducer application combined with stem-only or stem-dominated cutting emerges as the most efficient and practical approach for oleo-gum resin harvesting in *C. wightii*. These results provide field-based evidence to support the refinement of sustainable tapping protocols for Guggul in arid and hyper-arid ecosystems, balancing productivity with plant health and long-term resource conservation.

Enhancing farmers' income through gum arabic production in arid districts of Rajasthan

During 2025-26, a total of 151 farmers from the arid districts of Rajasthan- Jodhpur, Balotra, Barmer, Jaisalmer, Phalodi, Nagaur, Bikaner, Rajsamand, and Pali participated in gum Arabic production initiatives. A total of 8,390 doses of CAZRI gum inducer were distributed, leading to the treatment of an equivalent number of Acacia senegal trees. This intervention resulted in approximately 4.12 tonnes of gum Arabic being produced. With an average market price of ₹1,000 per kg, farmers collectively generated an estimated revenue of ₹41.20 lakh. The activity demonstrates the significant potential of gum Arabic as a high-value non-timber forest product to enhance farmers' incomes and promote sustainable livelihoods in arid regions.

ICAR-CENTRAL AGRO-FORESTRY RESEARCH INSTITUTE (CAFRI), JHANSI (UTTAR PRADESH)

Documentation of ITKs on harvesting, processing and value addition natural gums and resins

During the reporting year, selected villages in six districts of Madhya Pradesh—Jabalpur, Mandla, Dindori, Panna, Chhatarpur, and Tikamgarh—were surveyed with Divisional Forest Officers to document Indigenous Technical Knowledge (ITKs) on natural gums, resins, and other non-timber forest products (NTFPs).

Major gum-yielding species identified included *Boswellia serrata* (salai gum), *Butea monosperma* (palas gum), *Anogeissus latifolia/pendula* (dhawra/dhau gum), *Acacia nilotica* (babul gum), and *Sterculia urens* (kullu gum). In addition, a variety of NTFPs, such as aonla *(Emblica* *officinalis),* satawar *(Asparagus racemosus),* bael *(Aegle marmelos),* safed musli *(Chlorophytum borivilianum),* kali musli *(Curculigo orchioides), Pueraria tuberosa (Vidarikand),* Anantmool *(Dudha veli),* mahua flowers, lac, and other medicinal plants were commonly collected by tribal communities.

Across all districts, tribal populations primarily relied on small and marginal farming, supplemented by NTFP collection and livestock rearing. Gum and resin extraction used traditional tapping methods with minimal post-harvest processing, mainly cleaning. Storage practices were mostly absent, and most collectors sold their produce immediately to local traders. Some collectors segregated gum tears by origin and quality to get better prices. However, pricing was mostly controlled by local traders, limiting collectors' bargaining power. Dependence on advance payments from traders often led to tied transactions, restricting market access and fair price realisation.

The study highlights the need for capacity building, improved processing and storage practices, and better market linkages to enhance income generation from gums, resins, and other NTFPs.

Tapping of salai gum with indigenous tool

Identification of promising gum yielding trees for economic viability in agroforestry

Various agroforestry models such as multi-component agri-horti-silviculture, rainfed agri-silviculture, bio-fence, silvi-herbal systems, and gum gardens were evaluated using gum-yielding species such as *Acacia senegal, A. nilotica, Aegle marmelos, Citrus limon,* and *Terminalia arjuna*.

In the multi-component agri-horti-silviculture model, maximum GBH, tree height, and canopy spread were observed in *A marmelos*, followed by *A senegal* and *C. limon*. Intercropping with barley reduced yields near tree bases, with the greatest decline under *C. limon*. The horticultural component produced 178 kg of lemon, 190 kg of karonda, and 1556 kg of bael fruits during the year.

In the rainfed agri-silviculture system, wider spacing (10 m × 10 m) resulted in higher GBH for *A. nilotica* (0.7 m) and *A. senegal* (0.5 m). However, intercrop yield (taramira, *Eruca sativa*) remained low and was negatively affected by tree association, with greater reductions at closer spacing (5 m× 5 m).

Eruca sativa intercrop in A. sengal and A. nilotica based rainfed agroforestry model

In the silvi-herbal model, *A. nilotica* recorded the highest growth (GBH: 0.703 and 1.05 m), along with superior tree height and canopy spread, followed by *A. senegal* (0.53 and 0.41 m). *T. arjuna* showed the least growth. Lemongrass performance varied with spacing. Maximum survival and plant height were observed at 1 m × 0.75 m spacing. Planting at 1 m × 1 m spacing resulted in the highest number of tillers per tussock (70.0) and the highest fresh biomass production per tussock (1.62 kg).

During summer, only one *A. senegal* tree in the multi-component model produced gum, yielding 14.2 g per tree. The mean gum yield of *A. senegal* was 19.0 g/tree in old gum gardens, 13.4 g/tree in new gum gardens, and 36.5 g/tree in the rainfed agri-silviculture model. For *A. nilotica*, mean gum yields were 38.2 g/tree in the silvi-herbal model and 7.3 g/tree in the rainfed system. The number of gum tears ranged from 1 to 27 per tree in the silvi-herbal system and from 1 to 7 per tree in the rainfed model.

VASANTRAO NAIK MARATHWADA KRISHI VIDYAPEETH (VNMKV), PARBHANI (MAHARASHTRA)

Process for bottled sugarcane juice blended with guar gum and aonla juice

The study focused on the standardisation and quality evaluation of sugarcane juice incorporated with guar gum and aonla (*Emblica officinalis*) juice for the development of a functional ready-to-serve beverage. Formulations of sugarcane juice were prepared using FSSAI-permissible preservatives and guar gum at varying concentrations (0.4–0.6%) to assess their effect on physicochemical and sensory properties. Sensory evaluation revealed that the formulation containing 0.5% guar gum achieved the highest overall acceptability, with improved mouthfeel, consistency, and stability compared to other treatments. The incorporation of guar gum contributed to enhanced viscosity and suspension stability, resulting in a more uniform and appealing beverage. The developed process for sugarcane juice with guar gum was found to be simple, effective, and suitable for scale-up, offering a fibre-enriched drink beneficial for consumers across all age groups.

Further optimisation was carried out by blending sugarcane juice with aonla juice to enhance nutritional and functional properties. Among the different formulations, the blend containing 92% sugarcane juice and 8% aonla juice exhibited superior sensory attributes, including improved colour, flavour, and overall acceptability. This formulation also demonstrated enhanced physicochemical stability and nutritional quality. The addition of aonla juice significantly improved the bioactive profile of the beverage, with increased total phenolic content, antioxidant activity, and vitamin C levels. Mineral content, particularly iron, potassium, and phosphorus, was also enhanced. The developed beverage maintained acceptable quality and microbial safety for up to 60 days under refrigerated storage conditions. Overall, the study resulted in the development of a nutritionally enriched, organoleptically acceptable, and shelf-stable sugarcane-based functional beverage, highlighting its potential as a value-added product for commercialization in the fruit juice sector.

Sugarcane juice incorporated with guar gum

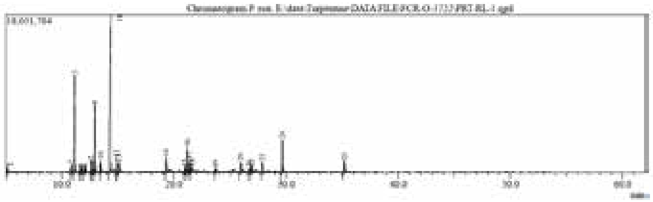
DR. YASHWANT SINGH PARMAR UNIVERSITY OF HORTICULTURE & FORESTRY (YSPUH&F), SOLAN (HIMACHAL PRADESH)

Physico chemical & morphological characterisation of oleoresin *Pinus Roxburghii* grown across different agro-climatic zones

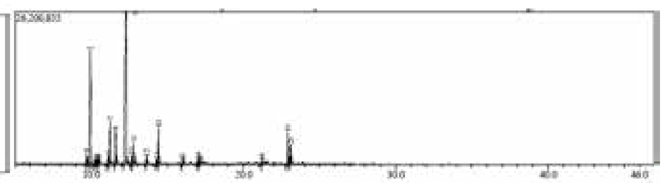
Volatile (turpentine) and non-volatile (rosin) fractions of pine oleoresin collected from 20 agro-climatic zones of Himachal Pradesh were analysed. Turpentine content ranged from 10.78% (Chowari) to 21.62% (Badsar), while rosin content ranged from 78.38% to 89.22%, with mean values of 14.85% and 85.15%, respectively, indicating significant regional variation in oleoresin composition. GC-MS analysis of the turpentine samples revealed a complex mixture of volatile organic compounds, predominantly composed of monoterpenes and their oxygenated derivatives. The major constituents identified were α-pinene, β-pinene, and Δ^3-carene, which together accounted for the dominant fraction in all the samples. Other notable compounds detected include limonene, camphene, myrcene, and terpinolene, along with minor amounts of oxygenated terpenes such as borneol and terpineol. Maximum α- pinene content (24.96 %) was recorded in the Jhunghi unit (1460 m) of Sundernagar Forest Division, whereas maximum β- pinene (21.63 %) was recorded in the Chowari unit (1037 m) of Chamba Forest Division.

Comparison of turpentine from rill and borehole method of resin tapping in chir pine

Turpentine obtained by the borehole method has higher amounts of α-pinene (22.69%), β-pinene (7.83%), longifolin (6.02%), and caryophyllene (3.40%) compared to the rill method, which showed 18.22% α-pinene, 5.45% β-pinene, 44.25% Δ^3-carene, 5.61% longifolin, and 1.59% caryophyllene.



Chromatogram of turpentine from Borehole method of resin tapping



Chromatogram of turpentine from Rill method of resin tapping

Physicochemical properties of rosin obtained through different tapping methods

Notable differences in colour and chemical indices were observed between rosin from the borehole and the rill method. Rosin from the borehole method was light yellow and had an acid number of 162.18 mg KOH/g and a saponification number of 172.19 mg KOH/g. In contrast, rosin from the rill method was yellow with a higher acid number (171.43 mg KOH/g) and saponification number (182.44 mg KOH/g).

INDIRA GANDHI KRISHI VISWA VIDYALAYA (IGKV), RAIPUR (CHHATTISGARH)

Characterisation of babool gum tapped by various methods, collected from different climatic zones

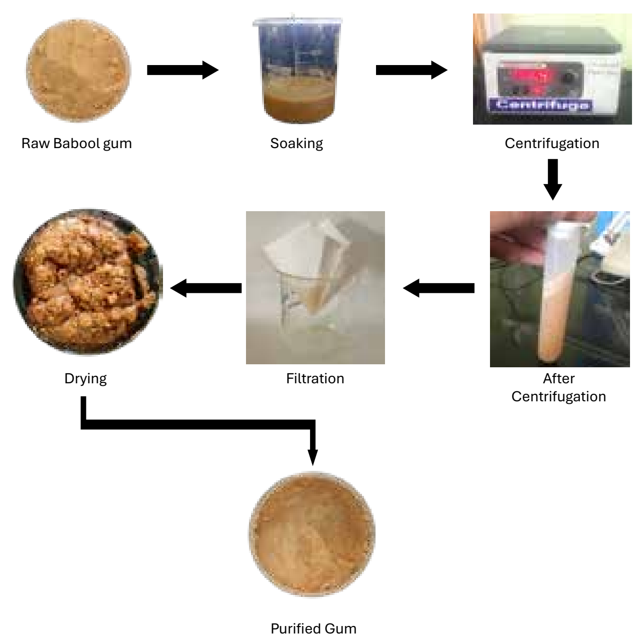
Physicochemical properties:

The pH of chemically and mechanically tapped babool gum was found to be 2.48 and 2.43, respectively. Solubility was higher in hot water (54-54.2%) and cold water (33.4-33.5%), whereas minimal solubility was observed in acetone (0.03-0.08%) across both seasons. The swelling index ranged from 31.82 to 33.12. Water holding capacity and oil holding capacity were recorded as 31.48 and 29.43, respectively. The angle of repose was lower in traditionally tapped gum (~35°), indicating better flowability, compared to higher values observed in summer (45.18°) and winter (45.33°) samples collected from the Mungeli region.

Bulk density varied slightly with season, being 0.725 g/cm^3 in summer and 0.735 g/cm^3 in winter samples. Elemental analysis revealed the presence of essential nutrients such as nitrogen (0.37%), phosphorus (35.5 ppm), and potassium (10.9 ppm) in samples from Raipur, along with trace elements including Co, Cu, Fe, Mn, Zn, Cr, Cd, and Pb. Comparative analysis of samples from Mungeli and Jhansi indicated the presence of Fe, Mn, Cu, Zn, Ni, Pb, and Cd in both locations, with variations in concentration across seasons.

Protein content was recorded as 2.48% and 2.41% in winter and summer samples, respectively. Ash content was slightly higher in mechanically tapped gum (6.5% in winter and 6.32% in summer), reflecting the presence of mineral constituents.

Mechanical purification was found to be more effective than chemical purification. Optimised conditions-dilution ratio of 1:0.5 and centrifugation at 5000 rpm for 5 minutes resulted in a purification yield of 83.97%, with improved colour (15.33), viscosity (51.75 cP), and pH (5.16).



Flow chart of mechanical purification method for babool gum

Thermal properties (DSC) and functional groups (FTIR) analysis:

Differential Scanning Calorimetry (DSC) analysis indicated typical thermal behaviour of plant gums, with distinct endothermic peaks corresponding to moisture loss and exothermic transitions associated with decomposition or glass transition. Traditionally tapped gum exhibited lower water loss enthalpy but higher normalised exothermic enthalpy, suggesting a more crystalline structure and greater stability under dry conditions. In contrast, gum obtained using ethephon (3.9%) treatment showed higher endothermic enthalpy, indicating greater moisture retention and stronger water–polymer interactions, along with slightly higher thermal resistance.

Fourier Transform Infrared (FTIR) analysis confirmed the presence of characteristic functional groups, including -OH, C-H, CH_2, N-H, and C=O, along with glycosidic linkages typical of polysaccharide structures. Minor variations were observed between control and enhancer-treated samples, reflecting subtle changes in molecular interactions across samples from New Raipur, Mungeli, and Jhansi.

Physico chemical properties and characterisation of jingan gum for various applications

Various physicochemical properties of Jingan gum viz. pH, solubility, fat, protein, nitrogen content, moisture content, swelling index, water holding capacity (WHC), oil holding capacity (OHC), and ash content, were evaluated for both summer and winter seasons. The application of gum enhancers showed a marginal influence on these properties, resulting in a slight decrease in moisture content and pH, while increasing fat, protein, and ash content. No significant changes were observed in bulk density and tapped density of the extracted biopolymers.

The solubility of gum exudates was higher in hot water (42.47-43.19%) compared to cold water (25.95-30.85%), while the gum was insoluble in acetone and ethanol. Physical properties indicated tap density values of 0.768-0.779 g/cm^3 and true density of 1.263-1.265 g/cm^3. Bulkiness ranged from 1.30 to 1.32, Hausner ratio from 1.07 to 1.072, and Carr's compressibility index from 6.72 to 6.93, indicating good flow properties. The coefficient of friction was recorded as 0.452-0.46 on mild steel and 0.387-0.399 on glass surfaces. The angle of repose was higher in enhancer-treated samples (~45°) compared to traditionally tapped gum (~35°), indicating differences in flow behavior.

FTIR analysis confirmed the polysaccharide nature of Jingan gum, showing characteristic peaks corresponding to -OH stretching (3289-3298 cm^{-1}), carbohydrate ion stretching (1594 cm^{-1}), CH_2 and C-OH vibrations (1369 cm^{-1}), and glycosidic linkages (1011-1016 cm^{-1}) in samples from Kanker and Mungeli.

Thermal analysis using DSC revealed typical plant gum behaviour, including initial moisture loss (50-160 °C), glass transition (250-265 °C), and thermal decomposition (~315 °C). Gum treated with ethephon (3.9%) exhibited higher enthalpic stability compared to traditionally tapped gum, indicating better suitability for applications involving thermal processing.

Elemental analysis (AAS) of samples from Kanker and Mungeli showed the presence of N (0.26%), P (1.25-1.75 ppm), and K (1.86-2.12 ppm), along with trace elements such as Fe, Mn, Cu, Zn, Ni, and Pb, while Cd was absent. Variations in elemental composition were observed between locations, reflecting environmental and seasonal influences.

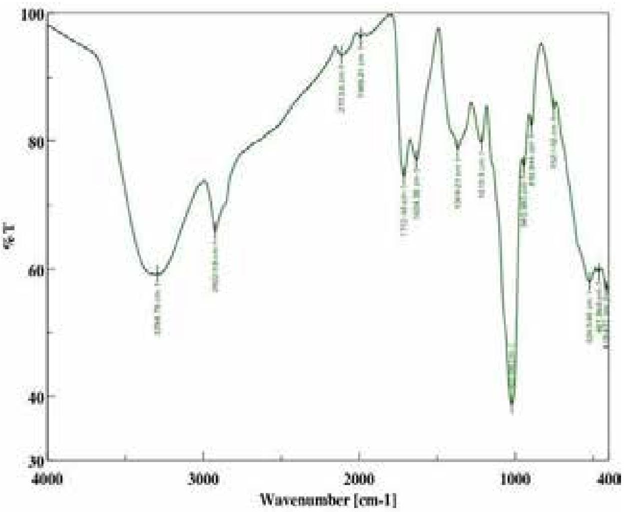
FCRI, TAMIL NADU AGRICULTURAL UNIVERSITY (TNAU), METTUPALAYAM (TAMILNADU)

Standardisation of tamarind gum extraction technique

The aqueous extraction of tamarind seed gum (TSG) was standardised using modified citric acid treatment and ethanol precipitation. From 50 g of tamarind kernel powder, an average gum yield of 5 g (10% recovery) was obtained. The extracted gum appeared as a fine, milky-white powder with a slightly translucent appearance, showing successful removal of most impurities. The yield percentage was within the reported range for laboratory-scale extraction of tamarind gum, though slightly lower than values from enzyme-assisted or microwave-assisted techniques. The moderate yield suggests citric acid treatment followed by ethanol precipitation is effective, but further optimisation may improve recovery.

Characterisation of TSG

The FTIR spectrum of TSG was recorded over 4000–400 cm^{-1}. The spectrum exhibits several characteristic absorption bands corresponding to hydroxyl groups, aliphatic C–H stretching, glycosidic linkages, and saccharide ring vibrations, confirming the polysaccharide nature of the sample.



FTIR Spectra of tamarind seed gum (TSG)

The FTIR spectral analysis clearly confirms that the extracted TSG is a polysaccharide-based biopolymer with characteristic hydroxyl groups, aliphatic C–H groups, and β-glycosidic linkages. The absence of unusual or extraneous peaks indicates the gum's good purity.

Viscosity of TSG was measured at 25 °C (unheated) and after heaViscosity of TSG was measured at 25 °C (unheated) and after heating at 75 °C. At both temperatures, viscosity increases with concentration, confirming the typical thickening behaviour of polysaccharide gums. At low concentrations (0.5–1.0%), viscosity remains low, indicating limited polymer chain overlap. Beyond about 1.5% concentration, viscosity rises sharply, especially for the heated sample, suggesting polymer chain entanglement and network formation. Heating to 75 °C results in a dramatic increase in viscosity compared to 25 °C.

Tamarind seed gum based value added tamarind products

Tamarind seed gum yoghurt: Yoghurt with tamarind seed gum showed enhanced functional and textural properties due to the hydrocolloid nature of tamarind seed polysaccharides, which act as natural stabilisers and texture modifiers. The gum improved viscosity, creaminess, and water-holding capacity while reducing syneresis, enhancing product stability and mouthfeel without synthetic additives. Functionally, tamarind seed gum is a soluble dietary fibre with prebiotic potential, supporting the growth of beneficial lactic acid bacteria and promoting gut health. Its antioxidant and mild anti-inflammatory properties also help reduce oxidative stress.

Tamarind seed gum soft drinks: Soft drinks made with polysaccharides from Tamarindus indica seeds offer significant functional and nutritional benefits. Tamarind seed gum acts as a natural hydrocolloid, enhancing viscosity, mouthfeel, and suspension stability. This prevents phase separation and sedimentation, ensuring a smooth, uniform texture. It also has excellent water-binding and emulsifying properties, enabling uniform dispersion of flavours, colours, and fruit solids, which improves shelf stability. Additionally, tamarind seed gum supports clean-label formulation by reducing the need for synthetic stabilisers. Nutritionally, it aids digestion, enhances satiety, and may improve glycemic response, making it a promising ingredient for functional soft beverages.

Tamarind seed gum soft drinks process flowchart

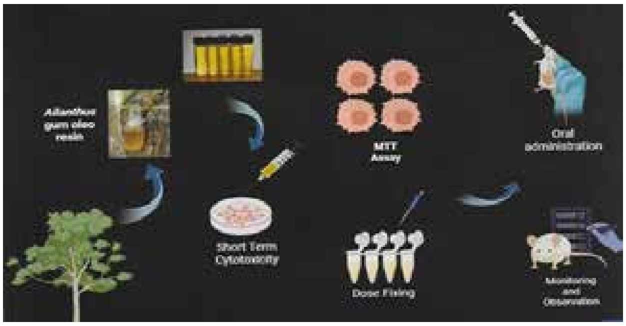
Gluten-free tamarind seed gum cake: Gluten-free cakes with tamarind seed gum show functional properties that compensate for the absence of gluten and improve product quality. Tamarind seed gum acts as a natural hydrocolloid and structure-forming agent, enhancing batter viscosity, gas retention, and crumb cohesiveness. This results in better volume, softness, and less crumbliness. Its high water-holding capacity delays moisture loss, improving freshness and extending shelf life. Functionally, tamarind seed gum provides soluble dietary fibre, supporting digestive health and potentially moderating post-prandial glycemic response. The gum also has antioxidant and mild anti-inflammatory activity from associated phenolic compounds, adding nutritional value.

KERALA AGRICULTURAL UNIVERSITY (KAU), THRISSUR (KERALA)

Preclinical evaluation of *Ailanthus* oleoresin for toxicity & anti-cancer activities

Approval from the Institutional Animal Ethics Committee was obtained prior to conducting preclinical studies on Ailanthus oleoresin using Wistar rat models. Acute toxicity, sub-acute toxicity, and anti-tumour studies were carried out to assess safety and therapeutic potential.

Acute-Toxicity study: The acute toxicity study evaluated the safety of the gum oleoresin by administering a single high oral dose (2000 mg/kg) and monitoring for toxic, neurological, behavioural, physiological, or lethal effects. This assessment established its safety for pharmacological and anticancer investigations. Administration of Ailanthus gum oleoresin (AGO) at doses up to 2000 mg/kg caused no observable toxicity or mortality in animals over 14 days. The median lethal dose (LD_{50}) is therefore ≥ 2000 mg/kg. The extract is safe and non-toxic at this dose, supporting further preclinical evaluation.



Exploring the anti-cancer potential of Ailanthus gum oleoresin

Sub-Acute Toxicity Study (OECD 407): A 28-day repeated-dose oral toxicity study was conducted in male and female Wistar rats to evaluate the cumulative and organ-specific toxicity of Ailanthus gum oleoresin extract. Post-treatment assessments included haematological, biochemical, and histopathological analyses to detect physiological or tissue-level changes. Lipid Profile-Cholesterol (CHO), TGL, HDL, LDL, VLDL: All showed no significant difference ($p>0.05$); the treatment is lipid-neutral and does not alter fat metabolism.

Kidney markers: Creatinine decreased significantly ($p=0.037$), suggesting improved renal filtration. Urea and uric acid remained unchanged, indicating no accumulation of toxic nitrogenous waste. Electrolytes: Potassium (K) showed a highly significant decrease ($p=0.001$), suggesting a diuretic-like or potassium-wasting effect. Sodium (Na), Chloride (Cl), and Bicarbonate (HCO3) remained stable ($p>0.05$), indicating fluid and electrolyte homeostasis is preserved. Liver Function Tests (LFT): Alkaline Phosphatase (ALP) showed a highly significant increase ($p=0.001$), indicating potential mild biliary irritation or enzyme induction. SGOT and SGPT showed no significant change, confirming hepatocellular integrity. Bilirubin (Total and Direct) remained unchanged, showing no impairment in liver excretory function. Total Protein, Albumin, Globulin, and A/G Ratio were not significantly different, indicating intact liver synthetic capacity.

Haematology: Platelets (PLT) showed a significant decrease ($p=0.001$), suggesting a mild antithrombotic effect. RBC, Hb, PCV, MCV, MCH, and MCHC showed no significant change, ruling out anaemia or haemolysis. WBC (TC) and Differential (P, L, E) remained stable, indicating no immune suppression. Overall, the extract was safe for major organs (liver, kidney, and heart) with no toxicity or damage. Its only significant effects were lowering potassium and platelet levels, suggesting mild diuretic and blood-thinning actions.

Anti-tumour studies: An in vivo anti-tumour study was conducted to evaluate the efficacy of Ailanthus gum oleoresin (AGO) extract in inhibiting solid tumour growth and to compare its performance with a standard chemotherapeutic agent.

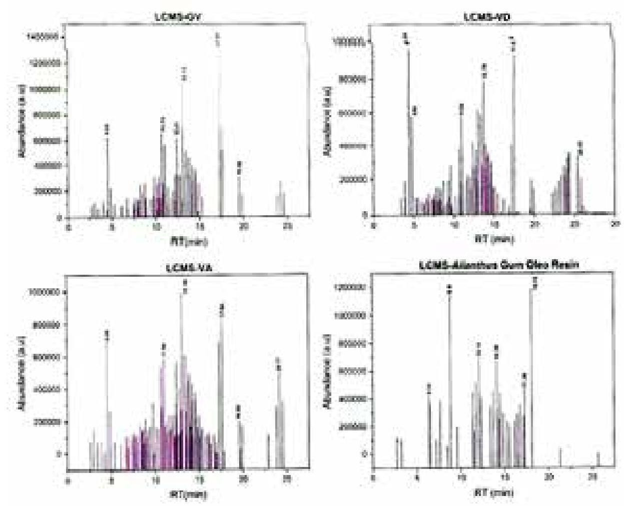
The findings demonstrated that AGO exhibits strong, dose-dependent anti-tumour activity. At higher doses, the extract achieved approximately 70% tumor inhibition, significantly suppressing tumour progression compared to the control group. Although slightly lower than the standard drug (92% inhibition), AGO showed substantial therapeutic potential.

Importantly, the treatment improved survival rates without inducing mortality or observable toxicity, indicating both efficacy and safety. These results suggest that AGO may be a promising natural therapeutic candidate for the management of solid tumours.

Physico chemical & morphological characterisation of black and white dammar resin grown across different agro-climatic zones

Black Dammar samples were collected from eight locations in Kerala: Wayanad (WY), Gavi (GV), Silent Valley (SV), Nelliampathy (N), Vazhachal (VA), Muthappanpuzha (MUH), Vilangad (VD), and Thamarassery. They were then subjected to Gas Chromatography-Mass Spectrometry (GC-MS) analysis to determine their chemical composition. Caryophyllene was detected in all samples, indicating it is a stable core compound of *Canarium strictum* resin and suggesting consistent baseline therapeutic properties, such as anti-inflammatory and analgesic effects. Major compounds such as Humulene and Germacrene D appeared regularly across locations, supporting the resin's antibacterial and insect-repellent potential. Some regions (Muthappanpuzha and Vilangad) showed higher levels of oxygenated compounds, hinting at stronger antifungal activity in resins from those areas. A few compounds occurred only in certain sites (Vazhachal or Gavi), indicating that different forests may have distinct chemical fingerprints, though larger datasets are needed to confirm unique markers. Because chemical profiles vary by location, some regions might produce resin more suitable for incense, while others may be better for medicinal applications, depending on the dominant compounds.

LC-MS analysis was carried out on Black Dammar samples from 3 locations: Gavi (GV), Vazhachal (VA), and Vilangad (VD). The resin contains major lanostane-type and dammarane-related triterpenoids such as 3β-Hydroxylanostane-7,11-dione acetate, 6-Deoxocathasterone (putative), and 22,23-Dihydroxycampesterol. These compounds confirm the authentic Canarium strictum chemistry responsible for anti-inflammatory and healing activity. High levels of γ-Tocopherol (Vitamin E) were consistently detected across all samples, indicating strong antioxidant capacity and supporting traditional uses in skin repair, wound management, and anti-ageing formulations.



The GV sample had the highest abundance of medicinal compounds, including γ-Tocopherol, Hydroxylated Stanol derivatives, and polyhydroxy sterols, making GV the chemically superior and most therapeutically valuable sample. The VD sample was uniquely rich in furanoid volatiles, especially Perilla ketone, and in defensive fatty acid derivatives, such as colonic acid (an oxylipin). These compounds indicate that VD resin originates from trees experiencing greater environmental or biological stress, resulting in a more pungent and active chemotype. The VA sample showed comparatively higher levels of fatty aldehydes such as (Z)-4-Dodecenal, giving it a softer, waxier physical character and placing its chemistry midway between GV and VD in terms of medicinal and aromatic properties. The clear variation in compounds-Hydroxylanostane triterpenoids (GV), fatty aldehydes (VA), and Perilla ketone + Colnelenic acid (VD)-demonstrates distinct geographical chemotypes, showing that location and environment strongly influence the resin's chemical quality and potential applications.

GENDER RESEARCH AND EXTENSION

STRAWBERRY BITES: GOODNESS OF STRAWBERRIES ALL YEAR ROUND

Strawberries are highly nutritious fruits valued for their attractive colour, pleasant flavour, and rich content of vitamins, antioxidants, and dietary fibre. However, their high moisture content and rapid respiration rate make them extremely perishable, leading to substantial post-harvest losses. During peak harvesting seasons, market glut often results in low prices and considerable wastage, adversely affecting farmers' income. Existing preservation techniques, such as freeze drying, produce high-quality products but require expensive equipment and high operating costs, limiting their adoption by small-scale processors and rural entrepreneurs.

To address these challenges, a simple convective drying technology with optimised pre-treatment was developed to produce high-quality dried strawberry bites. Drying parameters, including temperature and time, were standardized to retain the natural colour, texture, nutritional quality, and sensory attributes of the product. The resulting strawberry bites are 100% natural, sugar-free, nutritionally rich, shelf-stable for up to eight months, and suitable as a healthy snack or functional food ingredient. Physicochemical and storage studies confirmed good quality retention during storage.

The technology has been designed with a gender-responsive approach, recognizing the significant role of women in post-harvest handling and value addition. The processing operations including sorting, washing, slicing, pre-treatment, drying, packaging, and marketing are simple, require limited technical skills, and can be performed using low-cost equipment after short-term training. The technology is therefore well suited for adoption by women Self-Help Groups (SHGs), Farmer Producer Organisations (FPOs), and rural micro-enterprises, enabling decentralized processing, reducing post-harvest losses, creating local employment opportunities, and enhancing women's income and entrepreneurship in secondary agriculture.

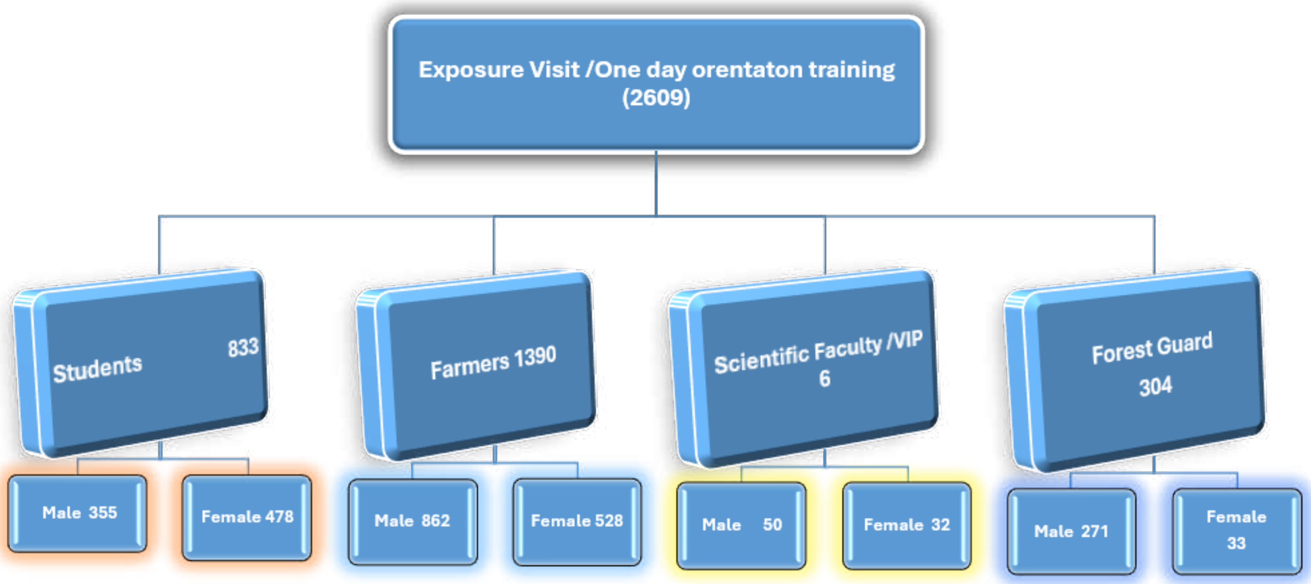
Strawberry bites

FARMERS TRAINING PROGRAMME ON "SCIENTIFIC METHOD OF LAC CULTIVATION, PRIMARY PROCESSING AND UTILIZATION"

Sl. No.	Sponsoring Organisation	Period of Training		Number of Participants	Male	Female
		From	To			
1	ICICI Foundation, Ranchi	03.02.25	07.02.25	50	32	18
2	ICICI Foundation, Ranchi	10.02.25	14.02.25	50	32	18
3	JASCOLAMPF, Ranchi	24.02.25	28.02.25	64	59	5

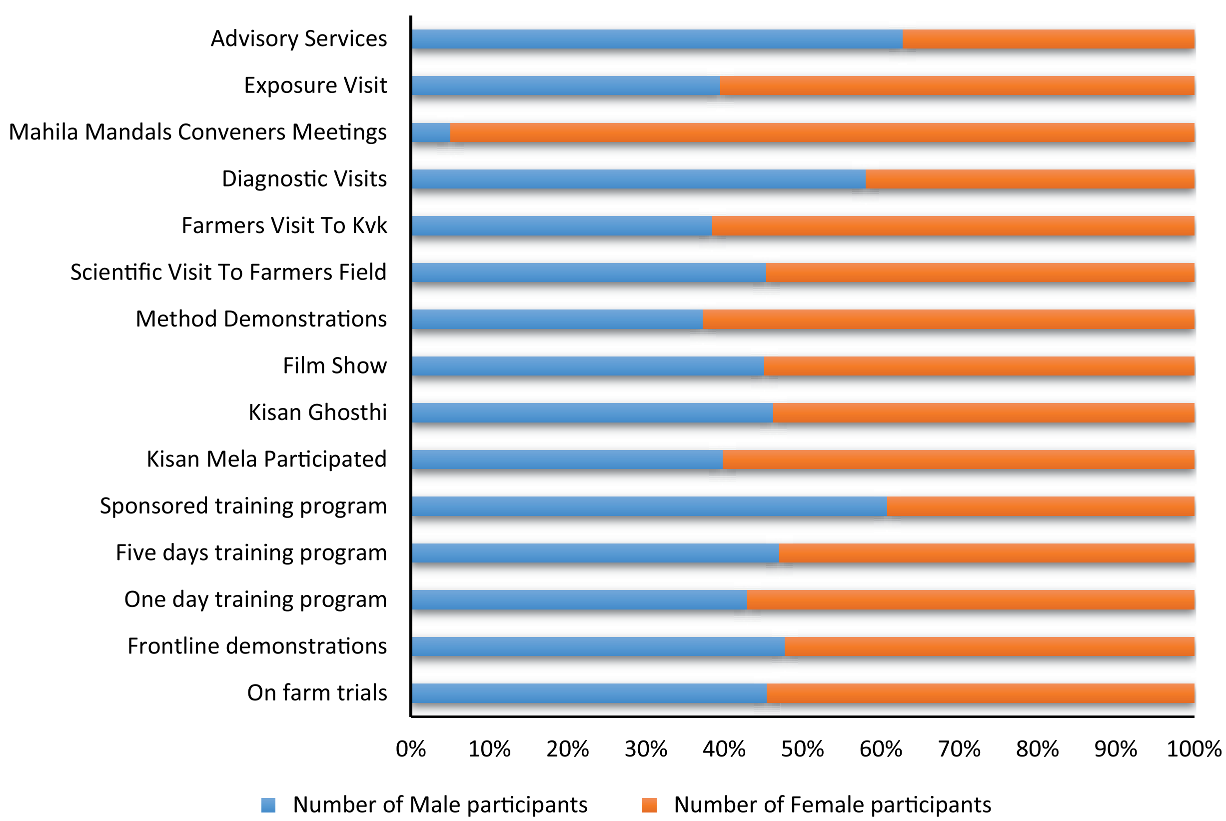
Sl. No.	Sponsoring Organisation	Period of Training		Number of Participants	Male	Female
		From	To			
4	JASCOLAMPF, Ranchi	03.03.25	07.03.25	61	29	32
5	JASCOLAMPF, Ranchi	17.03.25	21.03.25	53	49	04
6	JASCOLAMPF, Ranchi	24.03.25	28.03.25	46	38	08
7	JASCOLAMPF, Ranchi	21.04.25	25.04.25	64	33	31
8	Sarthak Halwai, Chhattisgarh	21.04.25	25.04.25	01	01	00
9	JASCOLAMPF, Ranchi	28.04.25	02.05.25	52	25	27
10	JASCOLAMPF, Ranchi	05.05.25	09.05.25	51	28	23
11	JASCOLAMPF, Ranchi	13.05.25	17.05.25	56	27	29
12	JASCOLAMPF, Ranchi	19.05.25	23.05.25	53	31	22
13	Ajeet kr Singh & Lal Narayan Singh, W.B.	19.05.25	23.05.25	02	02	00
14	JASCOLAMPF, Ranchi	25.08.25	29.08.25	44	44	00
15	JASCOLAMPF, Ranchi	08.09.25	12.09.25	55	35	20
16	JASCOLAMPF, Ranchi	22.09.25	26.09.25	59	33	26
17	JASCOLAMPF, Ranchi	13.10.25	17.10.25	25	15	10
			Total	**786**	**513**	**273**

ONE DAY ORIENTATION TRAINING/EXPOSURE VISITS ORGANISED FOR STAKEHOLDERS AT ICAR-NISA, RANCHI DURING 2025



GENDER RESEARCH AND EXTENSION ACTIVITIES OF KVK KHUNTI

Nature of Extension Activity	Number of activity	Number of participants		
		Male	Female	Total
On farm trials	6	10	12	22
Frontline demonstrations	9	83	91	174
One day training program	91	1211	1607	2818
Five days training program	5	71	80	151
Sponsored training program	3	62	40	102
Kisan mela participated	3	187	283	470
Kisan ghosthi	10	166	193	359
Film show	16	190	231	421
Method demonstrations	4	60	101	161
Scientific visit to farmers field	79	373	449	822
Farmers visit to KVK	40	443	709	1152
Diagnostic visits	21	288	208	496
Female SHG meetings	7	8	151	159
Exposure visit	7	79	121	200
Advisory services	104	41112	24396	65508



TECHNOLOGY DISSEMINATION

TRAININGS CONDUCTED

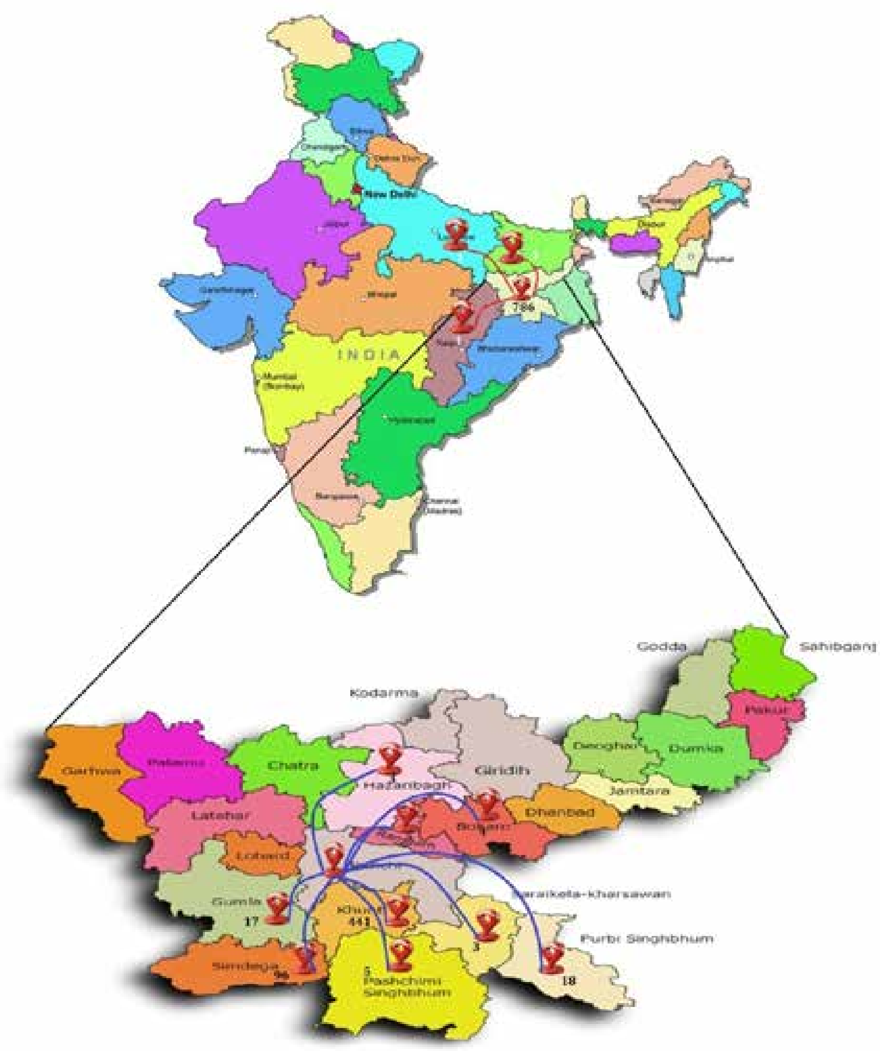
The Agri-Business Development Unit (ABD), ICAR–National Institute of Secondary Agriculture (ICAR–NISA), Ranchi, systematically conducts structured capacity-building and skill development programmes on scientific lac cultivation, processing, value addition, and utilization. These programmes are tailored to meet the diverse requirements of key stakeholders, including farmers, rural youth, aspiring entrepreneurs, students, and self-help groups (SHGs). In addition, specialized master trainer development programmes on scientific lac cultivation and beekeeping have been organised to create a cadre of trained resource persons for wider technology dissemination and scaling.

The institute adopts a comprehensive extension approach by integrating on-campus training with off-campus interventions, including off-farm training programmes, demonstrations, and need-based technical advisory services through regular field visits. Through these concerted efforts, a total of 6,619 stakeholders have been capacitated, enhancing their technical competencies and entrepreneurial capabilities. The initiatives are strategically designed to strengthen knowledge systems, improve adoption of scientific practices, and promote sustainable livelihood opportunities, thereby contributing to economic empowerment and resilience in the secondary agriculture sector.

Details of Capacity building and entrepreneurship development programmes

Capacity building programmes	No. of programme/ batches/ courses	No. of beneficiaries
Farmers training program on Scientific method of lac cultivation, primary processing and utilization	15	786
On campus one-day exposure visits/ orientation program on natural resins and gums	39	2609
Processes and products training to entrepreneurs	4	7
Kisan Mela cum Agricultural Exhibition 2025	1	3000
Participation in programme, mela, events, exhibition etc. from ICAR-NISA, Ranchi	11	-
Off Campus Training on Scientific methods of lac cultivation in different lac host plants	02	45
Students training on Scientific lac cultivation and beekeeping (5 days)	1	21
Master Trainers Training programme on Scientific methods of Lac cultivation, primary processing and utilization.	03	126
Master Trainers Training programme on Foundation Training for Beekeepers.	01	25
Total	**77**	**6619**

FARMER'S TRAINING AT ICAR-NISA, RANCHI FROM DIFFERENT STATES DURING 2025



TECHNOLOGY/KNOW-HOW TRANSFER ON PROCESSES AND PRODUCTS TO ENTREPRENEURS UNDER ENTREPRENEURS PROGRAMME

Sl. No.	Date	Technology Transfer	Trainees	Firm/Organisation
1	03.03.2025 to 07.03.2025	Aleuritic Acid	Mr. Saket Saraogi	Scube Tutorials, Kolkata
2	08.07.2025 to 17.07.2025	Lac Dye	Mrs. Gita Devi Mrs. Sarita Devi Mr. Vikas Bagti	Vedic Lah Foundation, Bundu , Ranchi, Jharkhand
3	04.08.2025 to 08.08.2025	Dewaxed Bleached lac	Mr. Shagun Saraogi Mr. Saket Saraogi	Parwati Lakh Udyog
4	11.08.2025 to 15.08.2025	Dewaxed Bleached lac	Mr. Pranay Agarbala	Raj Kumar Shellac, West Bengal

LIST OF MOU SIGNED BY ICAR-NISA, RANCHI

Sl. No.	Collaboration with Organisation/Firm/Enterprises	Objective/Aim/Vision	Signed on/Valid upto
1	Manab Kalyan Welfare Society, Laxmi Narayan Market, Nehru Road, Ramgarh Cantt., Jharkhand	Providing technical guidance and support on secondary agriculture, apiculture, lac culture, modern farming practices, agro-processing & product development to uplift underprivileged farming communities and promote rural industrialization in Jharkhand.	January 17, 2025
2	Live and Let Live (LALL), Nuagada, Jagatsinghpur, Odisha	Providing guidance and support regarding promoting lac based integrated cropping system, processing and value addition in lac and other agri-produce.	April 11, 2025
3	Netarhat Beverages Private Limited, Netarhat, Latehar, Jharkhand.	Up-scaling and commercialization of wine making process/products from Strawberry, Jamun & Mahuwa by Netarhat Beverages Private Limited, Netarhat, Latehar, Jharkhand.	June 30, 2025
4	Rangmunch Club, Anandpuri Chowk, Harmu, Argora, Ranchi.	Providing technical guidance, exposure, and knowledge-sharing support in secondary agriculture, modern farming practices, agri-processing, and product development.	September 03, 2025
MoU is remain in force until September 02, 2030.			
5	DSR Garuda Aerials Pvt. Ltd., Village Hutar, P.O. Fudi, Khunti	The establishment of a Remote Pilot Training Organisation (RPTO) in PPP mode for drone training at KVK, Khunti.	September 20, 2025
MoU is valid until September 19, 2028.			
6	Shubharambh, Ashok Nagar Society Marketing Complex, Ranchi.	The utilization of the honey processing facility, technical support for bee hive product development by ICAR–NISA, and commercial processing/product development by Shubharambh.	September 20, 2025
MoU is valid until September 19, 2028.			
7	Aryavrat Agrotech Private Limited, Baskupi, Sarath, Deoghar, Jharkhand	The utilization of the honey processing facility and technical support for bee hive product development by ICAR–NISA, and commercial processing/ product development by the company.	September 20, 2025

Sl. No.	Collaboration with Organisation/Firm/Enterprises	Objective/Aim/Vision	Signed on/Valid upto
8	Sidho-Kanho Agriculture and Forest Produce State Co-operative Federation Limited, Ranchi.	Providing technical guidance and support in natural resins, gums, and secondary agriculture.	November 17, 2025
9	Tamil Nadu Food Processing and Agri Export Promotion Corporation (Government of Tamil Nadu).	To promote sponsored research, product development, and innovation in the food processing sector.	December 07, 2025

DETAILS OF PARTICIPATION IN DIFFERENT MELAS/ EVENTS IN DIFFERENT DISTRICTS OF JHARKHAND

Sl. No.	Events	Period	Venue
1	Exhibition Stall on Secondary Agriculture was put up in the Block level Kisan Mela cum Exhibition and Workshop-2025.	18 January 2025	Sahid Veer Budhu Bhagat birth place, Sillagai, Chanho, Ranchi, Jharkhand.
2	Exhibition Stall on Secondary Agriculture was put up in the Annual Kisan Mela 2025.	30-31, January 2025	Getalsud R.K.Mission farm, Angara, Ranchi, Jharkhand.
3	Exhibition Stall on Secondary Agriculture was put up in the Agro-Tech. Annual Kisan Mela 2025.	8-10, February 2025	Kisan Mela Ground, BAU, Kanke,Ranchi, Jharkhand.
4	Exhibition Stall on Secondary Agriculture was put up in the Annual Kisan Mela 2025	20-21, February2025	Kisan Mela Ground, ICAR-NISA, Namkum, Ranchi, Jharkhand.
5	Exhibition Stall on Secondary Agriculture was put up in the Radiant Jharkhand Exhibition 2025	20-22, February 2025	Hotel Ramada by Wyndham, Jamshedpur, Jharkhand.
6	Exhibition Stall on Secondary Agriculture was put up in the Kisan Samridhi Mela 2025.	19 March 2025	ICAR-RCE-FRCHPR, Plandu, Ranchi.
7	Exhibition Stall on Secondary Agriculture was put up in the Tree Growers' Mela 2025.	19 March 2025	ICFRE-IFP, Lalgutua, Ranchi.
8	Exhibition Stall on Natural Resins and Gums on the occasion of celebration of 61th Foundation Day	19 Jun. 2025	CTRTI, Ranchi, Jharkhand
9	Exhibition stall on Natural Resins and Gums in Aakanksha Krishi Udyam Mela 2025	01-02, August 2025	Jawaharlal Nehru Stadium, Aakanksha, Haat, Chatra, Jharkhand.
10	Exhibition stall on Natural Resins and Gums at Swarnim Bharat Expo 2025	21-23, August 2025	Sarala Birla University, Birla Campus, Ranchi, Jharkhand.

TV TALKS

Following TV talks were delivered by ICAR-NISA during 2025.

Sl. No.	Name of Expert	Topic	Delivered on	Telecast on	Programme on Channel
2	Dr. M. F. Ansari, Principal Scientist	Importance of lac	November 26, 2025	December 3, 2025	Krishi Darshan on Doordarshan
1	Dr. N. Thombare, Senior Scientist	गोदं का उत्पादन एवं मूल्य संवर्धन'			

Following TV talks were delivered by KVK, Khunti during 2025.

Sl. No.	Name of Expert	Topic	Delivered on	Telecast on	Programme on Channel
1	Dr. Gavhane Kishor Pandurang	कृषि में सूक्ष्म एवं लघु सिंचाई का महत्व	February 28, 2025	March 7, 2025	Krishi Darshan on Doordarshan
2	Mr. Brijraj Sharma	किसान उत्पादक संगठन		March 7, 2025	
3	Dr. Deepak Rai	फलदार वृक्षों में किट प्रबंधन		March 21, 2025	
4	Dr. Nikhil Raj M.	कद्दू वर्गीय सब्जियों में कीट प्रबंधन		March 21, 2025	
5	Dr. Deepak Rai	आलू में कीट रोग प्रबंधन	October 6, 2025	October 31, 2025	
6	Mr. Om Prakash	रबी मौसम में सब्जी प्रबंधन		October 31, 2025	
8	Dr. Pardeep Kumar	तलहनी फसल की वैज्ञानिक खेती	October 28, 2025	November 14, 2025	
7	Dr. Gavhane Kishor Pandurang	रबी मौसम में भूमि एवं जल प्रबंधन		November 21, 2025	

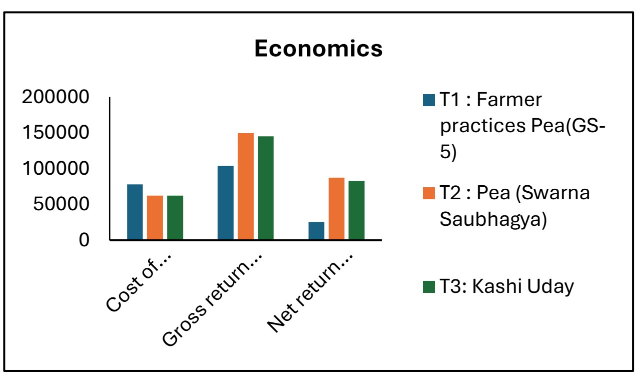
KRISHI VIGYAN KENDRA, KHUNTI

ON FARM TRIAL (OFT): Assessment of improved varieties of vegetable pea

Vegetable pea is a major vegetable crop in the Khunti district, occupying nearly 40% of the cultivated area during the Rabi season. However, most farmers continue to grow older varieties, such as the GS-5, resulting in comparatively low productivity. To address this issue, an on-farm trial was conducted to evaluate improved pea varieties and compare their performance with existing farmer's practices. The OFT was conducted in the villages of Kundla, Mundatoli, and Churgi in Khunti district. The results revealed that the improved variety Swarna Saubhagya performed significantly better than the farmers' variety. The pod yield of Swarna Saubhagya increased by 68% compared to the farmer practice (GS-5). In terms of economic returns, Swarna Saubhagya recorded the highest net return of ₹ 87,300 per hectare, whereas GS-5 provided a net return of only ₹ 25,750 per hectare.

OFT of improved variety of vegetable pea

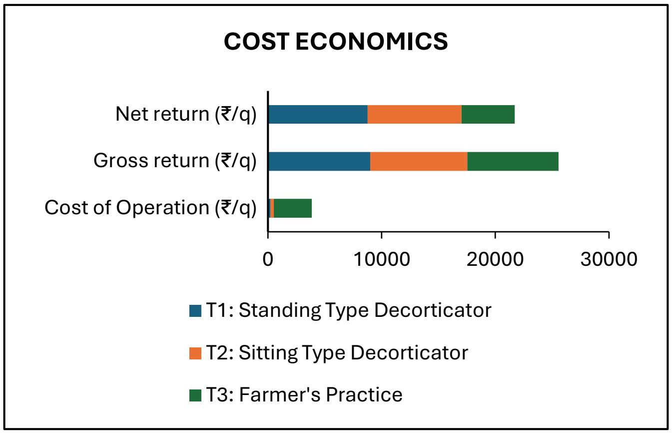
Technology option	No of trials	No. of Pod/ Plant	No. of Seeds/Pod	100 seed wt.(g)	Yield (q/ ha)	B:C
T_1 : Farmer practice Pea (GS-5)	3	8	5	16	29.7	1.3
T_2 : *Swarna Saubhagya*		15	9	25	49.8	2.4
T_3: *Kashi Uday*		10	8	23	48.3	2.3

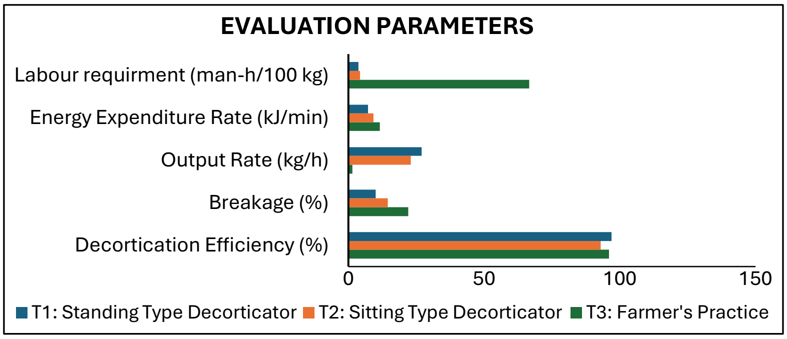


OFT on varietal evaluvation of vegetable pea

Assessment of efficiency and drudgery involved in groundnut decorticator

Groundnut is an important oilseed crop in Khunti district, grown in the Rabi season. However, post-harvest processing, particularly decortication, remains labour-intensive and is often carried out using traditional manual methods. These conventional practices are not only time-consuming but also impose severe physical strain. To address this, an OFT was conducted to assess the efficiency and drudgery of two types of groundnut decorticators: sitting and standing. This OFT was carried out in Chhatatoli, Gufu and Pandariya villages of Khunti district with three treatments, i.e., T1 - farmers' practice: groundnut shelling by hand, T2 - sitting-type groundnut decorticator, and T3 - standing-type groundnut decorticator. Results revealed that the standing type decorticator (T1) achieved the highest decortication efficiency (97%), output rate (27 kg/h) and the lowest breakage percentage (10%), followed by the seating type decorticator (T2) (93% efficiency, 23 kg/h, & 14.5% breakage). The farmers' practice (T3) recorded the lowest output rate (1.5 kg/h) and comparatively higher breakage percentage (20%). Labour requirement followed a similar pattern. In terms of drudgery, T1 resulted in the greatest reduction (38%), while T2 achieved 21%, confirming its ergonomic advantage over the traditional method.





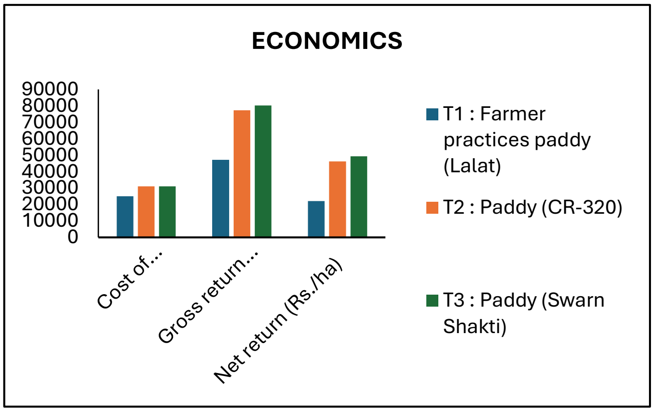
OFT on evaluvation of groundnut decorticator

Evaluation of improved varieties of paddy crop.

Paddy is the dominant cereal crop in Khunti district, occupying nearly 80% of the cultivated area during the Kharif season. Despite this large acreage, productivity remains low because farmers continue to use older rice varieties such as Lalat. Enhancing productivity requires introducing and evaluating improved varieties suited to the region. Conducting on-farm trials will allow a systematic comparison of promising rice varieties. The experiment was conducted in the Birhu, Gibilong, and Banganloya villages of Khunti district with three treatments: T1 - Rice (Variety - Lalat), T2 - Rice (Variety - CR-320), and T3 - Rice (Variety - Swarna Shakti). Integrated evaluation of yield performance and economics showed that the improved paddy varieties CR-320 (T2) and Swarna Shakti (T3) performed significantly better than the farmer's practice variety Lalat (T1). Although their cultivation cost was slightly higher, both improved varieties generated substantially greater returns. Swarna Shakti provided the highest net return (₹ 49,309 per hectare) and B:C ratio (2.6).

Performance of rice under assessment

Technology option	No of trials	No. of effective tillers/hill	No. of spikelet per panicle	1000 grain wt.(g)	Yield (Kg/ha)
T_1: Farmer practices paddy (*Lalat*)	3	9.5	139	23.7	1990
T_2: Paddy (CR-320)		13	161	25.5	3260
T_3: Paddy (*Swarn Shakti*)		14	167	26.9	3390



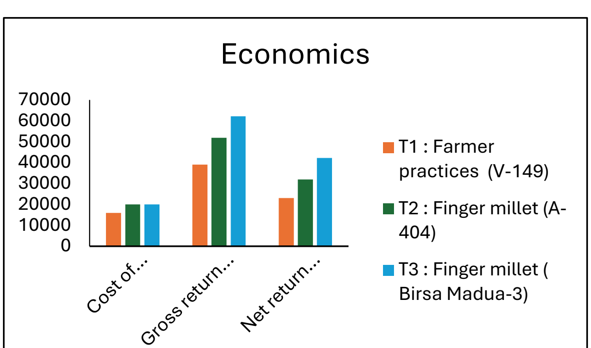
OFT on varietal evaluation of rice

Evaluation of improved varieties of finger-millet crop.

Finger millet is the second most important cereal crop in Khunti district after rice during the Kharif season. However, farmers continue to cultivate older, low-yielding local varieties, which limits productivity and reduces income. To overcome this constraint, an OFT was conducted in Diyankel, Mundatoli and Sarnatoli villages of Khunti district with three treatments, i.e. T1- Finger millet (Variety- VL-149), T2- Finger millet (Variety- A-404) and T3- Finger millet (Variety- Birsa Madua-3). On-farm evaluation in Khunti district showed that improved finger-millet varieties performed substantially better than the farmer's practice variety V-149 (T1). Economic analysis revealed that T1 generated a net return of ₹ 23,039 (B:C 2.4), while T2 improved profitability to ₹ 31,909 (B:C 2.6). Birsa Madua-3 again ranked highest, providing ₹ 42,205 net return and a B:C ratio of 3.1.

Performance of Finger millet under assessment

Technology option	No of trials	Yield component			Yield (Kg/ha)
		No. of effective tillers/hill	No. of spikelet per panicle	Test wt. (100 grain wt.)	
T_1 : Farmer practice (V-149)	3	5	4.6	2.9	910
T_2 : Finger millet (A-404)		6.5	6.1	3.4	1210
T_3 : Finger millet (Birsa Madua-3)		7.7	6.8	3.8	1450



OFT on varital evaluvation of finger millets

Assessment of IPM against yellow stem borer in rice

Rice is a major crop in Khunti district. However, this region is prone to stem borer, which causes significant yield loss in rice. Moreover, the majority of tribal farmers in the area are poor and practice low-input rainfed farming, which, when combined with stem borer attack, results in very low production.

OFT on IPM against yellow stem borer in rice

Therefore, an OFT was planned in which pheromone-trap (YSB lure)- based monitoring was conducted to determine the application time of a green-labelled insecticide (chlorantraniliprole) against stem borer and to compare it with calendar-based chemical insecticide treatment as well as with ongoing 'farmers' practice, i.e., no pesticide use. The OFT was carried out in the fields of 10 farmers from various villages, including Leteer, Saritkel, Jariya, Sonpurgarh, Gutuhatu, Panrriya, and Konhapa, in Khunti district. The result revealed that taking a decision based on pheromone trap catch reduced irrational use of chemical insecticides. A better management decision can be made this way. The reduction in cultivation cost is attributed to the decreased quantity of chlorantraniliprole required per hectare.

Effect of different treatments in rice

Treatments	Dead heart @ 35 day	Dead heart @ 55 day	White Earhead @ harvest	Yield (Kg/ha) Average
T_1 : Farmer practice	15	17.8	18.3	1830
T_2 : YSB lure @3/Acre + spray chlorantraniliprole 0.4% GR 4 kg/acre when 4-5 moths trapped	5	8	26.4	2640
T_3 : Broadcasting chlorantraniliprole 0.4% GR at rate 4 kg/acre mixing with sand in 1:1 ratio	4	7	26.8	2680

Deworming in cattle with a multi-purpose drug, effective against all endo & ecto-parasites along with ideal liver tonic

Deworming plays a vital role in maintaining livestock health, as internal and external parasites can severely affect an animal's well-being and productivity. These parasites can cause weight loss, reduced feed efficiency, liver damage, and overall poor health, which ultimately impacts milk and meat production. Keeping this in view, an OFT was conducted in the villages of Manhatu (Torpa block) and Japud (Rania block) to assess the effects of different deworming treatments on livestock health. The OFT was designed with three treatment groups: T1: Farmer's practice using local crude preparations; T2: Deworming with a drug effective against all endo- and ectoparasites; and T3: Deworming with a drug effective against all endo- and ectoparasites, plus an ideal liver tonic.

Effect of different treatments in cattle

Technology options with detailed treatments	Area (ha in crop & Fodder)/ Nos (in livestock)	Milk Yield (L/animal) milk for 90 days
T_1: Farmer's practice: Use of local crude preparations	10	90
T_2: Deworming with the drug which is effective against all endo and ectoparasites	10	220.5
T_3: Deworming with the drug which is effective against all endo and ectoparasites + ideal liver tonic.	10	283.5

OFT on deworming in cattle

Front Line Demonstrations (FLD)

In the year 2025, KVK, Khunti, organised 174 demonstrations in an 82.5 ha area of improved varieties of paddy, finger millets, mustard, marigold, lac cultivation practices, and mango fruit fly management to enhance agricultural productivity. It also includes promoting Hybrid Napier fodder grass, Sonali poultry, and a finger millet threshing machine to increase farmers' income and livelihood opportunities. Details are given below:

Performance of different crops & poultry under Front line demonstrations

Crop/ Enterprises	Technology Demonstration	Area (ha)	No. of Demo	% Increase in yield	B:C
Paddy	Swarna Shreya	10	25	55.6	2.2
Finger millet	A-404	10	26	67.1	2.8
Mustard	DRMR-150-35	20	50	-	-
Marigold	Cricket boll	0.5	5	37	2.2
Lac	Brood lac, insecticide & fungicide	30	10	83	7.9
Mango	Methyl Eugenol trap for mango fruit fly @ 5 traps/Acre	4	10	51	22.5
Finger millet	Vivek Madua Thresher & Pearler-1	6	10	55.6	11.7
Perennial Fodder Grass	Hybrid Napier	2	14	85.3	4.4
Poultry	Breed-Sonali	1000 Chicks	24	-	-

Field demonstration of finger millet

Field demonstration of paddy

Field demonstration of IPM in lac

Field demonstration of mustard

Field demonstration of marigold

Field demonstration of madua thresher

Field demonstration of hybrid napier

Field demonstration of fruit fly trap in mango

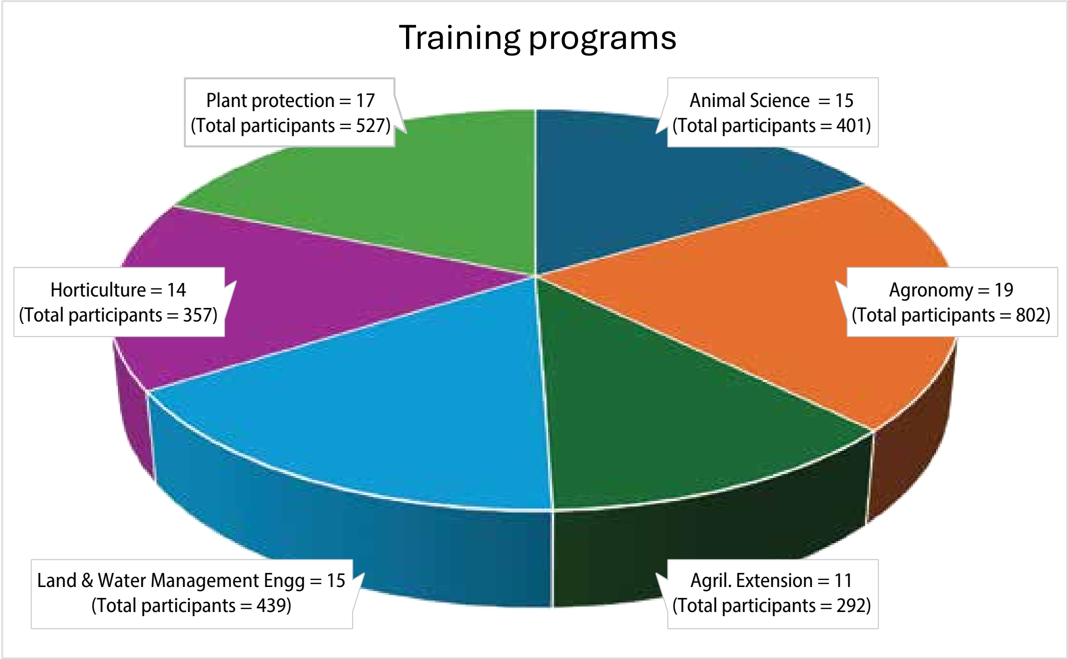
Field demonstration of backyard poultry

Training programs

Training programs are designed to enhance the knowledge, skills, and confidence of farmers, rural youth, and extension workers so that they can adopt improved agricultural technologies and practices. The primary objective of these training programs is to enhance farmer's knowledge and help them mitigate field-level problems in crop production, livestock management, natural resource management, and allied agricultural activities.

Farmers and farm women including the sponsored training programs

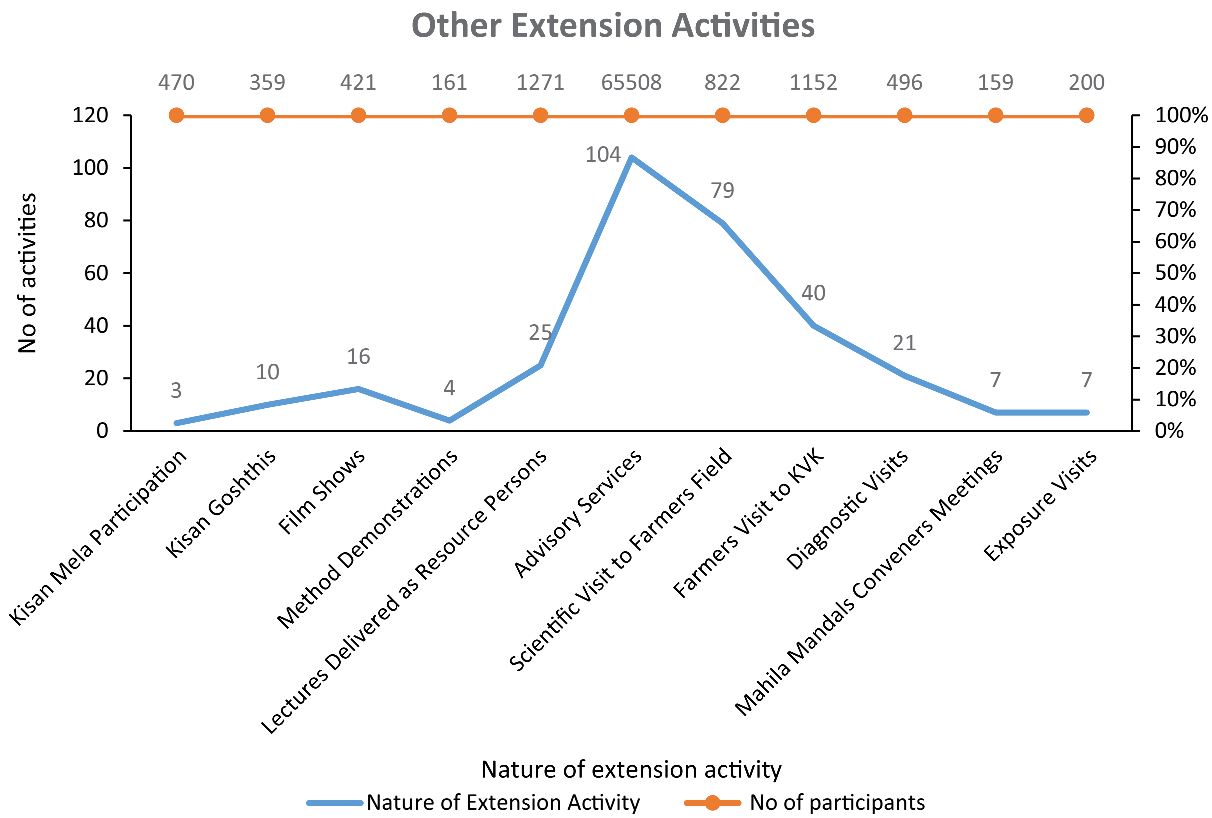
KVK, Khunti organised 91 training programs in the year 2025 where 2818 participants were participated for different field of agricultural activities, viz. plant protection, animal science, agronomy, agricultural extension, land and water management engineering, horticulture. The details of number of participants in each sector is in the pie chart on next page.



Details of different training programmes conducted

Other Extension Activities

For mass awareness, different types of extension activities have been conducted by KVK, Khunti, under which, 316 programs have been organised, where 71019 (M-36746 and F-34273) farmers and extension personnel were participated. Details are given below:



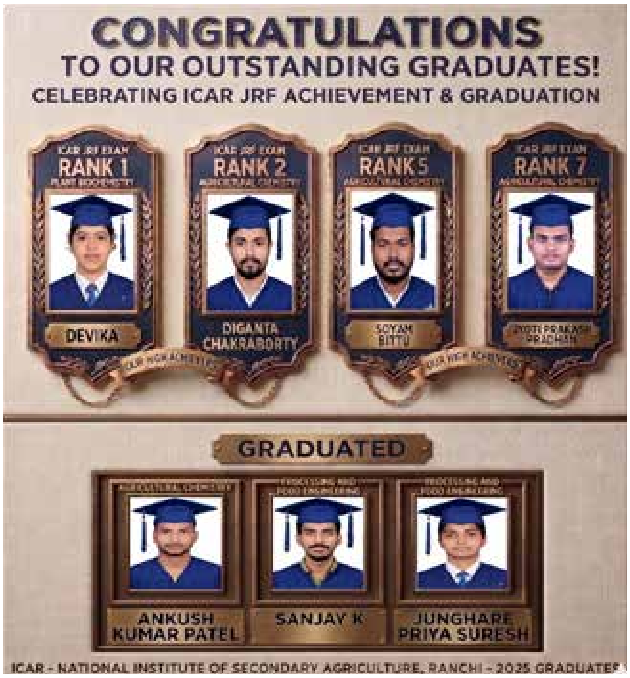
Details of different extension activities performed

HUMAN RESOURCE DEVELOPMENT

ACADEMIC CELL-ICAR-NISA

As IARI PG school has grown into IARI Mega University, with several hubs at different places in India, ICAR-NISA also joined in the IARI Ranchi hub as one of the participating institutes. Thus, apart from research activity, the faculty is engaged in teaching activities, making a holistic approach of amalgamating basic and applied research.

ICAR-NISA is offering post graduate courses in two disciplines, namely Process and Food Engineering (PFE) and Agricultural Chemicals (AC). The first batch of 6 Master's students joined the institute in November-December 2023 and successfully completed their Master's degree by September 2025.



ICAR-NISA welcomed 1st batch of 3 PhD students during January-May 2025.

Exposure visits

M. Tech (PFE) students visited the Food Corporation of India (FCI) godowns at Ranchi on January 15, 2025 along with Dr. D. Mohapatra, Pr. Scientist & Head and Dr. S. J. Kale, Sr. Scientist.

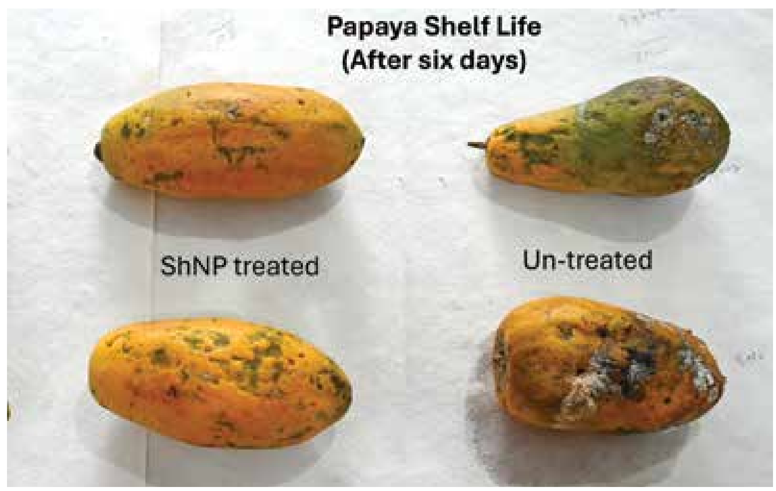
The visit provided the students with practical exposure to storage and handling operations in the grain supply chain, helping them connect theoretical knowledge with real-world practices.

The research outputs emanating from the student's work are as following.

Synthesis and characterisation of shellac nanoparticles for post-harvest disease management of fruits

M.Sc (Ag Chem) : Mr. Soyam Bittu
Supervisor : Dr. Nandkishore Thombare

The synthesis of shellac nanoparticles (ShNPs) was optimised by evaluating the effect of shellac concentration, temperature, solvent ratio, and stabilizer concentration, ultimately yielding stable nanoparticles of approximately 88 nm with a highly negative zeta potential, confirming colloidal stability. The use of guar gum as a stabilizer proved effective in preventing particle aggregation, thereby supporting long-term stability of the formulation. Particle size analysis confirmed their nanoscale dimensions and narrow size distribution. Results highlighted that nanosizing shellac not only reduced particle size but also altered structural and thermal properties in ways that enhance its suitability for protective applications. The biological evaluation of ShNPs revealed their strong potential as antimicrobial agents against important post-harvest pathogens of papaya, including Colletotrichum gloeosporioides, Rhizopus stolonifer, and Erwinia carotovora. In vitro assays established that the nanoparticles exhibited concentration-dependent and time-dependent inhibition of both fungal and bacterial pathogens, with maximum activity observed at higher concentrations. In vivo studies further validated their efficacy on papaya fruits, where ShNP coatings significantly delayed fungal colonization and bacterial infection, reduced lesion development, and suppressed pathogen proliferation over several days of storage. This highlights their advantage as a sustainable and safer alternative to synthetic fungicides and bactericides.



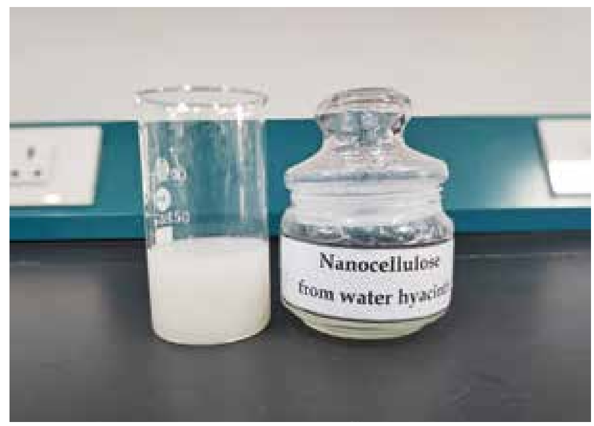
Shellac nano particle formulation & its post harvest disease management evaluation in papaya

The post-harvest quality parameters of papaya fruits treated with ShNPs were consistently superior to both untreated controls and fungicide-treated fruits. Treated fruits retained firmness for more extended periods, reflecting reduced tissue maceration and enzymatic degradation caused by pathogens. Weight loss during storage was minimized, suggesting that the nanoparticle coating acted as a barrier against transpiration and excessive respiration. In addition, treated fruits maintained higher levels of total soluble solids compared to controls, indicating that sugars were better preserved and that the fruits retained desirable sweetness and nutritional value. Visual observations confirmed that ripening was delayed in treated fruits, with slower color changes and reduced decay symptoms, leading to extended shelf life and improved marketability.

Deep eutectic solvent assisted extraction of nanocellulose from water hyacinth for development of sustained release delivery system of β-carotene

M.Sc (Ag Chem): Mr. Jyoti Prakash Pradhan
Supervisor: Dr. Arnab R. Chowdhury

Water hyacinth (Eichhornia crassipes), an invasive aquatic weed. This study explored the extraction of cellulose from water hyacinth (WH) biomass and its subsequent conversion into nanocellulose for stabilizing β-carotene emulsions. Nanocellulose was prepared from water hyacinth cellulose using Deep Eutectic Solvent (DES)-assisted pretreatment followed by ultrasonication, and the process was optimised through Response Surface Methodology (RSM). At the optimised condition (DES ratio 1:11.7, 58 min, 41% amplitude) nanocellulose yield with an average size of 93 nm, closely matching the predicted value (98.39 nm). Characterization of prepared WH nanocellulose confirmed structural integrity and enhanced crystallinity (65.26%). The extracted nanocellulose was further employed to stabilize β-carotene emulsions. WH nanocellulose significantly improved encapsulation efficiency (up to 98.7% at 0.5%), stability (lowest creaming index at 0.2%), and reduced droplet size (109.87 nm). Emulsions also exhibited higher viscosity and stronger electrostatic stabilization. Release studies demonstrated pH-responsive, sustained delivery of β-carotene. In vitro digestion study further demonstrated enhanced β-carotene bioaccessibility, with the highest release (86.5%) in intestinal phase condition observed in emulsion stabilized with 0.2% nanocellulose concentration. The findings revealed that water hyacinth-derived nanocellulose offers a sustainable, biocompatible stabiliser for nutraceutical emulsions, improving β-carotene stability, controlled release, and bioavailability.



Water hyacinth biomass & extracted nano cellulose from it

Biomacromolecule-based encapsulation of curcumin for enhancement of its stability and bioavailability

M.Sc (Ag Chem): Mr. Diganta Chakraborty
Supervisor: Dr. Anirban Dutta

Curcumin, the primary curcuminoid found in turmeric (*Curcuma longa*) rhizome, is regarded as one of the most potent natural compounds with high therapeutic potential. In the present study, curcuminoids were extracted from *Lakadong* turmeric using solvent extraction and purified through column chromatography, with a crude yield of 20.69 ± 1.92% and a purified yield of 12.15 ± 1.12% based on dry weight. The purified extract contained 16.78%, 6.75%, and 7.49% of curcumin, DMC, and BDMC, respectively. The curcuminoid extract was encapsulated with 1-3% shellac using a pH-induced simple coacervation technique, achieving encapsulation efficiencies of 86%, 76%, and 70% for curcumin, DMC, and BDMC, respectively. Additionally, a heat-induced gelation method was used to encapsulate the curcuminoids within three different gums (carrageenan, agar, and gellan), which possess thermoreversible gelation properties. The type and concentration of the gum significantly affected the curcuminoid loading and encapsulation. Encapsulated curcuminoids remained more stable within the gellan matrix. All biopolymers effectively protected against degradation of curcuminoids at lower (4±2 °C) and ambient temperature (25±2 °C). However, gellan provided the best protection under accelerated conditions (54±2 °C). The release of curcuminoids was greater from the shellac matrix at alkaline pH, whereas from the gum matrices, it was higher at neutral pH. The release was also influenced by biopolymer concentration, showing an inverse relationship. BDMC was released more from all formulations, followed by DMC and curcumin. Curcuminoids released from shellac at alkaline pH showed degradation over time, which affected their bioavailability. The least amount of curcuminoids was released under simulated gastric conditions. Approximately 40% of the curcuminoids were released at the oral phase from 1% agar and carrageenan-based formulations, while the highest intestinal release (~30%) was observed from a 2% carrageenan-based formulation.

(a) Carrageenan encapsulated curcumin

(b) Gellan encapsulated curcumin

(c) Shellac encapsulated curcumin

(d) Agar encapsulated curcumin

Biochar clock loaded rosemary essential oil

Development of biochar based slow-release formulation of rosemary essential oil and study of its fumigation toxicity against callosobruchus maculatus

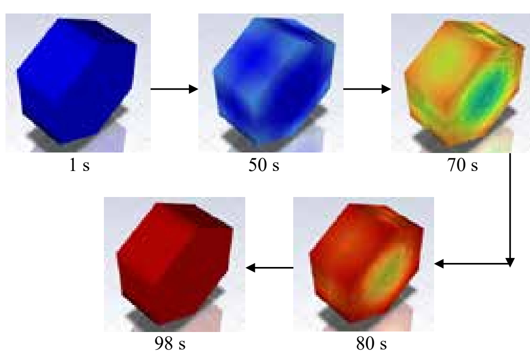
M.Sc (Ag Chem): Mr. Ankush Kumar Patel
Supervisor: Dr. Md. Ali

In the recent past, the rosemary essential oil has been explored as an alternative, safer botanical-based insecticide for storage pest management due to its strong fumigation, contact, oviposition, and repellent activity against numerous storage insect pests. However, due to its high volatility, poor solubility in water, susceptibility to oxidation in the presence of light and air, and negative impact on the organoleptic properties of the foods has limited the direct practical application of Rosemary essential oil for storage pest management. Therefore a slow-release formulation using biochar as a matrix was prepared. Further, the process was optimised for the preparation of solid slow formulation for binder percentage, Rosemary essential oil amount, and molding pressure by conducting full factorial experiments. The pellets containing 40% binder, 45% essential oil, and molded under 500 N showed the slowest release with 49.13% after 120 hr at 25 °C. Further, the release of the essential oils from the cylindrical pellets increases with the increase in initial concentration of the Rosemary essential oil and the environmental temperatures, following first-order release kinetics and quasi-Fickian diffusion mechanism. In addition, the study also found that besides the amount of binder, the nature of the binder, and the particle size of the biochar have also significantly affected the release of Rosemary essential oil from the pellets. The fumigation toxicity of the pure rosemary essential oil was conducted against adults *Callosobruchus maculatus* and found an LC50 of 3.68 μl/500 mL of air after an exposure of 8 hours at room temperature. Further the prolonged toxicity evaluation of the prepared formulation revealed that after exposure of the pellets containing 65% Rosemary essential oil prior exposed to open hair for 24 h before the fumigation toxicity evaluation, to adults *Callosobruchus maculatus* has induced 100% mortality after 7 h of exposure compared to its counter pure rosemary essential oil which cause only 37% mortality that is after 24 h of treatment.

Modelling the melting behaviour of seedlac and development of melt-filtration unit

M.Tech (PFE): Mr. Sanjay K.
Supervisor: Dr. Sakharam Kale

Lac growers harvest lac from host plants in the form of sticklac, which is further crushed and washed to obtain the semi-refined material known as seedlac. Seedlac is refined using the melt-filtration method. Melt-filtration is achieved using either a hand-made process or a machine-made process. However, both methods have some constraints, such as operator drudgery, environmental pollution, uneven product quality, and limitations of space and investment. Hence, a study was undertaken to develop an Infrared heating-based melt-filtration unit for the filtration of seedlac. In this study, the quality characteristics, namely physical (size, shape, bulk density, true density, porosity, and angle of repose), rheological, and thermal (specific heat, latent heat, initial and final melting points) properties of seedlac were determined. The viscosity of the seedlac was measured over a temperature range of 80 - 130 °C, where it decreased with an increase in the shear rate and temperature, irrespective of shear rate conditions. The initial and final melting points of seedlac were 58 °C and 77 °C, respectively. The specific and latent heats of seedlac were 3.351 kJ/kg·K and 17.07 kJ/kg, respectively. The melting behaviour of seedlac was determined under conduction and radiation-based heating. Seedlac's melting behaviour was affected by its geometry; however, the effects were negligible at higher temperatures, irrespective of heating method. Radiation-based modelling of melting bahaviour confirmed that a temperature range of 300 – 400 °C is required for the radiation heating source to achieve efficient filtration. Hence, mid-IR strip heaters (temperature nearly 400 °C) were preferred for heating seedlac. The rheological analysis and simulation modelling showed that the melting behaviour of seedlac was ideal at melt-filtration temperatures (MFT) ≥ 100 °C. Hence, a table-top size, compact melt-filtration unit was developed and its performance was evaluated at four MFTs: 100, 110, 120, and 130 °C. The performance efficiency of the developed machine varied from 82.29 – 87.25 % whereas its capacity varied from 0.86 – 1.25 kg/h 87.25 % over a MFT range of 100 – 130 °C.



Melting behavior of hexagonal shaped seedlac under radiation heating at 300 °C & melt filtration unit

Refractance window drying of custard apple (*Annona Squamosa L.*) pulp for its leather production

M.Sc (Ag Chem): Ms. Priya Junghare
Supervisor: Dr. Priyanka Sakare

The present study aimed to develop custard apple leather using two drying methods: refractance window (RW) drying and conventional hot air drying, while evaluating the effects of these techniques on drying behaviour, mass transfer characteristics, and product quality. Further, the process parameters of both drying methods have been optimised. Initially, to prevent enzymatic browning of the pulp, different preservatives, including potassium metabisulfite (KMS), citric acid, benzoic acid, and sodium benzoate, were tested, with KMS proving most effective. Drying kinetics were investigated at three temperatures (75, 85, and 92 °C for RW and 50, 60, and 70 °C for hot air) and three pulp thicknesses (2, 3.5, and 5 mm). The results showed that higher drying temperatures and reduced layer thickness significantly accelerated the drying rate and reduced the drying time. Six thin-layer drying models (Newton, Page, Modified Page, Henderson-Pabis, Logarithmic, and Wang & Singh) were evaluated, and the Page model best described the drying behaviour in both RW and hot air drying. Mass transfer parameters, including lag factor, drying coefficient, Biot number, effective moisture diffusivity (D_{eff}), and mass transfer coefficient (h_m), were estimated. Mass transfer parameters were found to be affected by temperature and pulp thickness.

Refractance window dried custard apple leather

Quality of the leather produced by both drying methods was assessed based on water activity, total color difference, sugar content, and total phenol content. Water activity levels in all dried leather remained below 0.6, confirming microbial shelf stability. RW drying produced leather with superior quality attributes, including lower color difference, higher retention of sugars and phenolics, shorter drying time and higher drying rates compared to hot air drying. Optimisation studies revealed that the optimal RW drying parameters were 92 °C water temperature and 2 mm pulp thickness, resulting in a drying time of 50 minutes, a drying rate of 0.032 g/g.min, a total sugar content of 54.42%, and a colour difference of 9.6. In contrast, optimised hot air drying at 50 °C and a thickness of 2 mm required 266.67 minutes, resulting in lower product quality. Overall, the study concludes that refractance window drying is a superior technique for producing custard apple leather, offering reduced drying times, higher drying rates, better preservation of quality attributes compared to hot air drying.

Suitability of natural gums and their partial hydrolysates as prebiotics

M.Sc (Ag Chem): Ms. Devika Ajith
Supervisor: Dr. Sandip Kumar

Gums are naturally occurring heteropolysaccharides with hydrocolloidal properties. They are generally regarded as safe for consumption and hence exploited for food applications along with other diverse industrial purposes. These are soluble dietary fibres due to the inherent structural complexity, which renders them undigested, making them a suitable candidate for prebiotic studies. The prebiotic potential of four natural gums such as Guar gum (galactomannan), Acacia gum (arabinogalactan), tamarind gum (glucan), and flaxseed gum (xylan) and their partial hydrolysates on the growth of six lactic acid bacterial strains, including four *Lactobacillus species* (*Lactobacillus plantarum, L. brevis, L. rhamnosus, L. bifermentans*) and two strains of Lactococcus lactis subsp. lactis. Partial depolymerisation of the complex native form has significantly boosted the growth of selected strains over the native form, suggesting that the complexity of the native form limits its utilisation. Highest growth was observed in *Lactobacillus plantarum* (1746)-partially hydrolysed acacia gum and *Lactococcus lactis* subsp. Lactis (3041)-partially hydrolysed tamarind gum combinations. In silico studies indicated that the species specificity in the production of particular glycosyl hydrolases contributes to substrate specificity and also showed the variations in the number of isozymes for specific glycosidases across different species. Quantitative real-time data could validate the overexpression of all isoforms of the targeted glycosidase in response to growth condition. In *Lactobacillus rhamnosus*, all the three isoforms of -galactosidase were overexpressed, with the highest fold change (18.43) in one of the isoforms in case of guar gum, whereas the cumulative expression of all the three contributed to higher growth in partially hydrolysed guar gum. Our findings highlight the biochemical and molecular basis for substrate preference and provide insights into potential combinations for developing synbiotic formulations.

Partially hydrolysed natural gums from various sources

CAPACITY BUILDING

Participation in Conferences / Seminars / Symposia by the Staff of ICAR-NISA:

Sl. No.	Name of Expert/ Designation	Topic/Subject matter/ Theme	Program/Event organised/Held & Date/Duration, Mode
1.	Dr. D. Mohapatra, Pr. Scientist & Head	Sensors, Artificial Intelligence & Machine Learning	Participated as a lead speaker in the International Conference held at DSLD College of Horticultural Engineering & Food Technology, Haveri, Karnataka. January 23, 2025 (online)
2.	Dr. Udaykumar, M. S., Scientist	Novel approaches in Agricultural Systems.	Participated in 30 days International Agriculture Winter School-cum-Training Program organised jointly by ICAR-ATARI (11 Zones) & all Krishi Vigyan Kendra; CAUAT, Kanpur; ISPB, New Delhi; SKRAU, Bikaner; DYP ATU, Talsande; ARWS, Agraon. March 01-30, 2025 in Hybrid mode
3.	Dr. D. Mohapatra, Pr. Scientist & Head	विकसित भारत-२०४७ का लक्ष्य प्राप्त करने हेतु खाद्य प्रसंस्करण उद्योग मैं आधुनिक तकनीकों का अनुप्रयोग	Participated and presented paper in राष्ट्रीय वैज्ञानिक हिन्दी संगोष्ठी on विकसित भारत - 2047 का लक्ष्य प्राप्त करने हेतु कृषि में यंत्रीकरण, कृत्रिम बुद्धिमत्ता, एवं रोबोटिक की भूमिका organised at ICAR-NINFET, Kolkata. September 25, 2025
4.	Dr. Nandkishore Thombare, Sr. Scientist	स्पेक्ट्रोस्कोपी आधारित गुणवत्ता नियंत्रण: खाद्य सुरक्षा की दिशा में नई प्रगति	
5.	Dr. Archana Mahapatra, Scientist	बागवानी अपशिष्ट से सेल्यूलोज़ निष्कर्षण: सतत संसाधन प्रबंधन की संभावनाएँ	
6.	Dr. Priyanka Sakare, Scientist	खाद्य अपशिष्टों से प्राकृतिक रंगों का निष्कर्षण	
7.	Dr. Udaykumar, M. S., Scientist	Exporting advantage: A decadal analysis of India's natural resins and gums in global markets	Participated and presented paper in Global Research Initiatives for Sustainable Agriculture and Allied Sciences in X International Conference on October 05-07, 2025 Hybrid Mode.
8.	Dr. Achintya Pramanik, Senior Scientist & In-charge, IBDC	Delivered a lead lecture on the theme "Zero-waste Bio economy through Commercial Insect Integration: The Future of Lac-centered Secondary Agriculture"	National Symposium on Technological Advancements: Emerging Trends in Entomology (ESI-ETE-2025), held during 8–9th October, 2025 at Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST-Kashmir).

Sl. No.	Name of Expert/ Designation	Topic/Subject matter/ Theme	Program/Event organised/Held & Date/Duration, Mode
9.	Dr. Archana Mahapatra, Scientist	Kinetic Modelling of Lemongrass Essential Oil Extraction by Deep Eutectic Solvents	Participated and presented a paper in 59th Annual Convention of Indian Society of Agricultural Engineers in 'Engineering Innovations for Agriculture 5.0' and International Symposium on 'Mechatronics and Robotics in Pre and Post Production Agriculture' organised at ICAR-CIAE, Bhopal. November 10-12, 2025
10.	Dr. Priyanka Sakare, Scientist	Bigel based 3D printed intelligent indicator for real-time freshness monitoring of fish	

Participation in Conferences / Seminars / Symposia by the Staff of KVK, Khunti:

Sl. No.	Name of Expert/ Designation	Topic/Subject matter/ Theme	Programme/Event organised/ Held & Date/Duration, Mode
1.	Dr. Deepak Rai, Senior Scientist cum Head	Annual action plan review workshop-2025	Attended the workshop held at Divyayan KVK, Ranchi from 5-6 May, 2025
2.	Dr. Deepak Rai, Senior Scientist cum Head	Social-ecological Resilience: Strengthening Biocultural Resources-based Livelihood in Face of Multiple Stressors	Participated in National Seminar organised at ICAR-NISA, Ranchi on 11th May, 2025
3.	Dr. Deepak Rai, Senior Scientist cum Head	Frontiers in Science & Technology for Agricultural Transformation	Participated in 2nd international conference organised by ICAR-NAARM, Hyderabad and Ag. Entrepreneur environment & technology development society, Lucknow from 25-26th Sept., 2025 Hybrid mode
4.	Mr. Om Prakash, SMS; Dr. Pardeep Kumar, SMS; Dr. Gavhane Kishor Pandurang, SMS	ICAR & Ministry of Agriculture Framework for Sustainable and Climate Resilient Agriculture Natural Farming and Allied Science	Participated in winter school (online) organised by ICAR-IIMR, Hyderabad; ICAR-IISS Mau; Gujrat Natural Farming Science University, Halol, Gujrat CIMMYT and ICARDA

Participation in Events / Trainings / Workshops / Meetings by the Staff of ICAR-NISA:

Sl. No.	Name & Designation of Staff	Programme or Event	Date/Venue
1.	Dr. Nandkishore Thombare, Sr. Scientist.	Completed 5 day 'Pedagogy Development Program' training	From January 28 to February 1, 2025 at NASC Complex, New Delhi.

Sl. No.	Name & Designation of Staff	Programme or Event	Date/Venue
2.	Dr. Sandeep Kumar, Scientist, and Shri Indrajeet Kumar, Technician	Participated in the online workshops on the "One Nation One Subscription" initiative and successfully registered the Institute on this national digital resource platform.	January-February, 2025.
3.	Ms. Sonika Meena, Assistant and Shri Vishwanath Anand, Assistant	Completed Module II of Orientation Training Program	From February 17-21, 2025 at ICAR-CIFRI, Barrackpore, Kolkata.
4.	Dr. Priyanka Sakare, Scientist	Attended ICAR-sponsored short course on 'Novel and Emerging Technologies in Food Processing to Achieve Food Sustainability and Nutritional Security'	From February 24 to March 5, 2025 organised by Tamil Nadu Agricultural University, Tamil Nadu.
5.	Shri Vishwanath Anand, Assistant	Attended four days workshop on 'e-procurement & GeM'	From April 06-09, 2025 at ISTM, Delhi.
6.	Dr. Nandkishore Thombare, Sr. Scientist, Dr. Sakharam Kale, Sr. Scientist, Dr. Archana Mahapatra, Scientist, Dr. Priyanka Sakare, Scientist	Attended two days hands-on training on Matlab programming software	From June 30 to July 01, 2025 at ICAR-NISA, Ranchi.
7.	Shri Hardik Ambadas Tamgadge, Administrative Officer	Attended Module-III of Foundation training for newly recruited AO's & FAO's	From June 09 to July 04, 2025 at ICAR Headquarter, New Delhi.
8.	Senior Scientists Dr. Arnab Roy Choudhary, Dr. Nandkishore Thombare, Dr. Anirban Dutta, Dr. Sakharam Kale and Scientists Dr. Archana Mahapatra, Dr. Priyanka Sakare, Dr. Mridusmita Debnath, Dr. Udaykumar, M. S." participated in 3-days Hands-on Workshop	Empowering Agricultural Innovation with MATLAB, Simulink, and Think Speak	ICAR-National Institute of Secondary Agriculture, Ranchi, in collaboration with Math Works Inc. at ICAR-NISA, Ranchi campus on August 05-07, 2025
9.	Dr. Debabandya Mohapatra, Pr. Scientist & Head	Participated in the ESTIC-2025 (Emerging Science, Technology, and Innovation Conclave)	Department of Science & Technology (DST), Government of India, in collaboration with ARCI, Hyderabad at the Bharat Mandapam, New Delhi. November 03-05, 2025.

Sl. No.	Name & Designation of Staff	Programme or Event	Date/Venue
10.	Senior scientists Dr Arnab Roy Chowdhury, Dr. Nandkishore Thombare, Dr. Anirban Dutta and scientists Dr. Archana Mahapatra and Dr. Priyanka Sakare,	Completed 2-day hands-on training on "Multivariate Analysis and Design of Experiments in Chemometrics & Spectroscopic Applications" using UnscramblerX	From December 18 and 19, 2025 at ICAR-NISA, Ranchi, in association with SCIENCE4U Analytics and Research Solutions Pvt. Ltd., Bangalore.

OTHER:

Sl. No.	Name & Designation of Staff	Programme or Event	Date/Venue
1.	Dr. Archana Mahapatra, Scientist	Delivered two lectures for one day Farmer's training on 'Conventional and Advanced Processing Technology for Jackfruits'	From February 6 and 7, 2025 at ICAR- RCER, Farming System Research Centre for Hill and Plateau Region, Ranchi.
2.	Dr. Debabandya Mohapatra, Pr. Scientist & Head	Delivered an invited lecture on 'Importance & Detection of VOC in Storage' in the winter school on Technological Advances in Packaging and Storage of Fresh and Processed Agricultural Commodities"	On 24th February 2025 (online) organised by ICAR-CIPHET, Ludhiana.
3.	Dr. Nawalesh Kumar Sinha, Principal Scientist	Attended the 9th meeting of the IMC of ATARI, Patna (Zone IV).	On August 18, 2025.
4.	Dr. Jyotirmoy Ghosh, Principal Scientist and Dr. Udaykumar, M. S., Scientist	Participated as Chief Guests in one day Entrepreneurship Awareness Program (EAP) for SC farmers organised by Br. MSME-DFO, Durgapur, Ministry of MSME, Govt. of India in Association with Sheva Ashram Biswa Shanti Dham Mission, Bankura	On September 09, 2025 at Jhalda Co-operative Hall, Jhalda, Purulia.
5.	Mrs. Anima Prabha (Senior Technical Officer) and Mr. Indrajeet Kumar (Technician)	Represented ICAR–NISA at the Biannual Meeting of the Nagar Rajbhasha Implementation Committee (NARAKAS), Ranchi	On September 12, 2025 at Ranchi.

Participation in Events / Trainings / Workshops / Meetings by the Staff of KVK-Khunti:

Sl. No.	Name & Designation of Staff	Programme or Event	Date/Venue
1.	Dr. Pardeep Kumar, SMS	Participated in National workshop on sustainable agriculture through natural farming	ICAR-CIARI, Andaman and Nicobar island on 13th May 2025, Online mode
2.	Dr. Pardeep Kumar and Mr. Om Prakash, SMS, participated in 3 days training program	Technology up scaling for sustainable agriculture development	BAU, Ranchi from 20-22nd November, 2025
3.	Dr. GavhaneKishorPandurang, SMS, participated in 5 days training propgram	Precision Agriculture using Drones and Remote sensing Data	ICAR-NAARM, Hyderabad from 15-19th December, 2025

Visit of Foreign Delegates

Two entrepreneurs Miss Ninon De Loisyi from France and Miss Ori Orisun Merhau from Belgium visited ICAR-NISA on August 25, 2025 and interacted with the Director and scientists. The delegates visited the institute's research farm and museum, and were apprised of ongoing R&D activities in lac cultivation, lac-based value-added products, and secondary agriculture technologies for sustainable rural livelihood enhancement.

Delegates visiting the institute museum

Awards & Recognition received by ICAR-NISA:

Awards				
Sl. No.	**Awarded to**	**Name of Award**	**Awarded for**	**Awarded by**
1.	Sr. Scientists Arnab Roy Choudhury, Sakharam Kale & Scientists Dr. Archana Mahapatra, Priyanka Sakare	Best article award for article published in Hindi magazine Lasksha-2024.	The article 'पॉलीसेकेराइड के स्रोत के रूप में उद्यानिकी अपशिष्ट का उपयोग: संसाधन प्रबंधन के लिए एक शाश्वत दृष्टिकोण'	ICAR-NISA, Ranchi
3.	Dr. Udaykumar M. S., Scientist	Best Oral Presentation Award in Technical Session III at the Xth International Conference on Global Research Initiatives for Sustainable Agriculture and Allied Sciences, held from 5th to 7th October 2025.	Presenting the research paper titled "Exporting Advantage: A Decadal Analysis of India's Natural Resins and Gums in Global Markets"	MPUAT, Udaipur, Rajasthan

Awards

Sl. No.	Awarded to	Name of Award	Awarded for	Awarded by
11.	Technicians Shri Shravan Kr. Mandal and Shri Dinkar Kumar	Secured 2nd in 400 m race and 3rd in 100 m race, respectively during ICAR Inter-Zonal Sports Meet 2024, held at ICAR–Indian Sugarcane Research Institute (ISRI), Lucknow from November 04-07, 2025.		

Recognition

Sl. No.	Name & Designation	Recognition received
7.	Dr. Nawalesh Kumar Sinha, Principal scientist	Served as an external examiner for the viva-voce of a M.Sc. student in the Department of Plant Physiology and Biochemistry, BAU Sabour on August 20, 2025.
8.	Dr. Saroj Kumar Giri, Principal scientist & Head	Nominated as a member of the Institute Management Committee (IMC) of ICAR–CIAE, Bhopal, and attended the 55th IMC Meeting on August 28, 2025
10.	Dr. Debabandya Mohapatra, Principal Scientist & Head	Attended as "technical expert" in the Initial Screening committee (ISC) meeting for the evaluation of projects received under INDIA-SPAIN JOINT CALL FOR R&D&I PROJECTS 2024, hosted by Technology Development Board, Department of Science & Technology. Govt. of India.

Award received by KVK, Khunti:

Awards

Sl. No.	Awarded to	Name of Award	Awarded for	Awarded by
1.	Dr. Deepak Rai, Sr. Scientist cum Head	Best oral presentation award in 2nd international conference on Frontiers in Science & Technology for agricultural transformation organised at ICAR-NAARM, Hyderabad from 25-26 September, 2025.	Online mode oral presentation of paper entitled "Assessment of management practice of Kusmi Lac in Khunti district of Jharkhand"	ICAR-NAARM, Hyderabad and Ag. Entrepreneur environment & technology development society, Lucknow

PUBLICATION

Research papers

- Arpitha SR, Sasi M, Kumar S, Yeasin M, Harun M, Sethi S, Kumari S, Lata DA, Sachdev A & Dahuja A (2025). Optimising single and co-culture soymilk fermentation using *Weissella* probiotics for improved nutritional and sensory quality. *Food Bioscience, 61*, 106791.
- Debnath M, & Sarma AK (2025). Assessment of climate change impact on irrigation water demand for food security in rice-fallow cropland areas using an integrated modeling technique: *Theoretical & Applied Climatology,* 156(2), 119.
- Garcia-Gutierrez E, Arbulu S, Oliver C, Kumar S, Dam SA, Jakobi B, Pennone V, Sarda FAH, Mukherjee A & Cotter PD (2025). Gut microbiot Aware: an international exploratory survey on awareness and understanding of the gut microbiota. *Frontiers in Microbiology*. 16,1643257.
- Ghoshal S, Dutta A, Mandal A & Saha S (2025). An optimised technique for ultrasound-assisted extraction of xanthophylls from *marigold (Tagetes erecta L.)* using saturated fatty acid-based hydrophobic deep eutectic solvent. *Journal of Molecular Liquids, 437*, 128398.
- John H, Giri SK, Sinha LK, Pandiselvam R, Sain M & Ray A (2025). Investigating flux decline and fouling mechanisms in ultrafiltration of soy protein using a 10 kDa hollow fiber membrane module. *Journal of Food Process Engineering, 48*(5), e70113.
- Karmakar S, Suman S, Uchoi J, Saha S, Dutta A, Das A & Kundu A (2025). Essential oils of *Alpinia officinarum* and *Alpinia zerumbet*: Potential fungistatic action and molecular dynamics perspectives. *Chemistry & Biodiversity*, e00221.
- Kumar R, Dutta TK, Mandal A, Saha S, Dutta A & Kundu A (2025). Nanoemulsions of essential oil of *Zanthoxylum alatum* for protection against *Meloidogyne incognita*. *Journal of Taibah University for Science*, *19*(1), 2464461.
- Kumari M, Tiwary A, Sheel R, Roy Chowdhury A, Sarkar B, Mukherjee K & Maity, D (2025). Evaluating the molecular basis of nanocalcium-induced health regulation in zebra fish (*Danio rerio*). *Bioengineering, 12*(10), 1016.
- Lohot VD, Thamilarasi K, Ghosh J, Mohanasundaram A & Thakur VV (2025). Assessment of changes in leaf biochemical constituents of Palas *(Butea monosperma)* during different stages of Lac insect *(Kerria lacca Kerr)* life cycle, *International Journal of Tropical Insect Science,* 45,1483–1488.
- Meghana D, Rachana KS, Pan RS, Kumar S, Bishi SK, Jawed D, Mahatma MK, Kumari M, Shinde R, Sharma BB, Talukdar A, Kumar P, Sinha AK, Nair RM, Dahuja A & Das A (2025). Nutritional analysis of vegetable soybean [Glycine max (L.) Merrill] accessions in Eastern India. *Frontiers in Nutrition,* 12, 1643470.
- Paramaguru PK, Ghosh J, Bakade R & Kumar N (2025). Empowering tribal women of Jharkhand: A replicable lac-based socio-economic model, *Journal of AgriSearch,* 12 (3), 180-184.
- Paul A, Dutta A, Kundu A, Banyal N, Chawla G, Dahuja A & Saha S (2025). Selective separation and characterization of acylated and non-acylated anthocyanins via resin adsorption–desorption method. *Microchemical Journal, 219*, 115976.
- Paul A, Dutta A, Kundu A, Ghosh A, Chawla G & Saha S (2025). Adsorption-guided purification of rose petal anthocyanins. *Biomass Conversion and Biorefinery, 15*(23), 30571–30586.
- Punia R, Anurag, Niwas R, Rajrana Y, Kumar P, Choudhary K & Kumar A (2025). Assessment of climate change impact on potential evapotranspiration trends in Sirsa and Hisar districts of Haryana, India. *Journal of Scientific Research & Reports,* 31(8), 78-92.

- Punia R, Anurag, Kumar P, Manjeet, Rajrana Y and Choudhary K (2025). Temporal Variability of potential evapotranspiration in response to climate change in Ambala district, Haryana, India. *Journal of Experimental Agriculture International,* 47(7), 642-651.
- Punia R, Anurag, Manjeet, Choudhary K & Kumar P (2025). Impact of climate change on potential evapotranspiration in Bawal and Karnal district of Haryana, India: A spatio-temporal analysis. *International Journal of Environment and Climate Change,* 15(8), 642-651.
- Puramshetti L, Giri SK, Mohapatra D, Tripathi MK, Kate A, Kumar M, Lalita & Mishra A (2025). Impact of ultrasonic-assisted extraction on the release of bioactive compounds from Carica papaya Linn. leaves using probe and bath sonication. *Biomass Conversion & Biorefinery*, 15, 30505–30517.
- Rao SK, Naresh T, Krishna VA, Dhurua S, Kar A, Lohot VD & Sharma KK (2025). Occurrence of lac insect and its host plants in Andhra Pradesh, India. *Plant Archives, 25* (Supplement 2), 453–460.
- Sasi M, Kumar S, Prakash O, Krishnan V, Vinayaka T, Tomar GS, Mishra JRAS Kaushik P, Rana VS & Dahuja A (2025). Evaluation of sensory properties and short-chain fatty acid production in fermented soymilk on addition of fructooligosaccharides and raffinose family of oligosaccharides. *Fermentation, 11*(4), 194.
- Selvan SS, Mohapatra D, Kate A, Tripathi MK & Kar A (2025). Fatty acid profiling for discriminating fermented and non-fermented pearl millet (*Pennisetum glaucum* L.) grains under different storage temperatures. *Scientific Reports, 15*(1), 34210.
- Selvan SS, Mohapatra D, Mahore A, Patel A, Kate A, Singh K, Ray H & Modhera B (2025). Evolution of a novel sensing system for monitoring the quality deterioration in pearl millet (*Pennisetum glaucum* L.) grains coupled with rancidity indicators and GC–MS analysis: A potential cardinal approach. *Journal of Stored Products Research, 112*, 102642.
- Shelake P, Mohapatra D & Sabat M (2025). Development of recurrent neural network (RNN)-based model for predicting the temporal decomposition kinetics of gaseous ozone in the presence of onion (*Allium cepa* L.) bulbs. *Food Analytical Methods, 18*(11), 2394–2401.
- Shelake P, Mohapatra D & Sabat M (2025). Impact of gaseous ozone treatment on storability and quality of onion (*Allium cepa* L.) during bulk storage. *Journal of Stored Products Research, 112*, 102656.
- Thombare N, Mohanasundaram A & Sharma KK (2025). Natural resin-derived adhesives for sticky insect traps: Development and field evaluation in mustard and okra. *International Journal of Adhesion & Adhesives, 146*, 104244.
- Udaykumar MS, Roy A, Pandey SK, Patil MK, Vaishnavi & Kar A (2025). Production and export dynamics of natural resins and gums in India. *Indian Journal of Economics & Development,* 21(1), 105-112.

Popular articles

- Ghosh J, Ghosal S, Lohot VD, Sinha NK & Vidyakar V (2025). From fruits to lac: How pruning transforms ber trees into profit powerhouses. *Agriculture & Food: e-Newsletter, 7*(8), 105–109.
- Kumar S, Ram MK and Sasi M (2025). Isoflavones: Usage and Commercial Extraction. *Agri Magazine* 02 (05), 254-257.
- Kumar S, Ram MK & Sasi M (2025). Aleuritic acid: A fascinating high-value constituent of lac resin and its uses. *Agri Magazine, 2*(6), 166–169.
- Lohot VD, Ghosh J, Sinha NK, Bakade R, Kindo A, Mishra R, Kumar S & Prasad N (2025). Kusum *(Schleichera oleosa)* Seed Oil: A potential biodiesel fuel. *Agriculture & Food: e-Newsletter.* 07 (12), 49-52.
- Ghosal S, Bakade RR, Sinha NK, Ghosh J (2025). Problems associated with lac cultivation in acid lateritic soil & its Solutions. *Agriculture & Food: e-Newsletter.* 07 (02), 414-418.

- Udaykumar MS, Pandey SK, Vaishnavi, Mahto AK & Kumar D (2025). Empowering farmers through ICT: Transforming agriculture for sustainable growth. *The Agriculture Magazine,* 04 (07), 490-496. (E-ISSN: 2583-1755)
- Udaykumar MS & Pandey SK (2025). Is urban farming and its strategies: A solution for climate change? *Krishi Science-e Magazine for Agricultural Sciences,* 6(4), 29–33.
- Udaykumar MS, Pandey SK, Pramanik A, Kar, A & Mahto AK (2025). From mud walls to millionaire: The lac legacy of Joydeb Mahato. *Agritech Today, 3*(4), 80–81.
- Udaykumar MS, Pandey SK, Mahto AK & Kumar D (2025). Success story of Amrit Lakra: from daily wage workers to successful lac farmers. *The Agriculture Magazine,* 04 (07), 395-397. (E-ISSN: 2583-1755)
- Udaykumar MS, Pandey SK, Kumar TJ & Suman L (2025). Exploring opportunities in fish processing and value addition in Karnataka. Krishi Science – *eMagazine for Agricultural Sciences,* 06 (01): 36-39.

Following popular articles were published in Laksha 2025, in-house magazine of ICAR-NISA:

- दीपक राय, पंकज नौटियाल, दुष्यंत कुमार राघव एवं राजन चौधरी: खरीफ फसलों में समेकित सूत्रकृमि प्रबंधन, 1-2
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Book

- Kotyal K, Chavhan VU, Udaykumar MS, Vashisath DS & Deepak IP (2025). Agricultural economics and agribusiness: Strategies for growth and innovation. *Stella International Publication,* Kurukshetra-136118 (Haryana). (ISBN: 978-93-48909-19-0) (DOI- https://doi.org/10.5281/zenodo.15122554).
- Nautiyal P, Rai D, Singh YP, Papnai G and Ragav, DK (2025). Smart agriculture: Next generation technologies for a sustainable future. *Integrated Publication,* New Delhi. pp. 1-382. (ISBN: 978-93-58-3407-16).
- Schulz H, Jayakumar VS & Prasad N (2025). Natural gums and resins: Botany and sustainable uses in medicine, nutrition, perfumery and cosmetics (p. 377). CABI (ISBN 978-1-80062-667-6).

Book Chapters

- Corrêa da Silva M, Rossi Borges JA, Wasonga OV, Forrer C, Kamau S, Karanja NN, Veith C, Sharif M, Umesh KB, & Uday Kumar MS (2025). Lessons learned from teaching an international virtual course on climate change. In Leal Filho W, De Andrade Guerra JBSO, M Sima, AL Salvia, F Frankenberger, & T Dibbern (Eds.), *The transformative power of higher education institutions in accelerating the implementation of the UN SDGs* (pp. 121–137). Springer Nature. ISBN 978-3-031-96250-9 (Print), ISBN 978-3-031-96251-6 (eBook).
- Rai D, Nautiyal P, Raghav DK, Chaudhary R, Gavhane KP, Rafiq MM, & Raj NM (2025). The role of AI in smart agriculture: Precision, efficiency and sustainability. In D. Rai, YP Singh, G Panpnai, & DK Raghav (Eds.), *Smart Agriculture: Next-Generation Technologies for a Sustainable Future* (pp. 101–110). *Integrated Publications*. ISBN: 978-93-58-3407-16.
- Gavhane KP, Kiran PR, Pradhan NC, Mandal S, Kumari K, & Parray RA (2026). Precision agriculture and unconventional food sources. In T Sarkar and S Smaoui (Eds.), *Health, Nutrition and Sustainability* (pp. 627-648). *Academic Press*. ISBN: 978-0-443-32920-3.
- Gavhane KP, Rai D, Chaudhary R, Rafiq MM, Hasan M, Singh AK, & Prakash O (2025). Smart farming in cities: AI and ML applications in vertical and urban agriculture. In D Rai, YP Singh, G Panpnai, & DK Raghav (Eds.), *Smart Agriculture: Next-Generation Technologies for a Sustainable Future* (pp. 341–354). *Integrated Publications*. ISBN: 978-93-58-3407-16.

- Kumar R, Manna M, Bhat AG, Satpute AN, Gavhane KP (2025). Intervention of hydroponics and aeroponics for climate-resilient cultivation. In R Rajan, F Ahmad, K Pandey (Eds.), *Innovations in Climate Resilient Agriculture. Springer, Cham.* ISBN: 978-3-031-84801-8.
- Lalita, Wahid A, Hamad R, Manik S, Mohapatra D (2025). Processing mediated changes in micro-and macronutrients of colored cereals, Chapter 8. *In* Colored Cereals: Properties, Processing, Health Benefits and Industrial Uses, edited by SS Purewal, RS Singh (Eds.), *CRC press,* eBook: ISBN9781003454922. published on 28th March, 2025.
- Lohot VD, Chowdhury AR, Thombare N, Pramanik A, Ansari MF, Kar A, Azmi SI, Makbul SAA, Ali MA & Akhtar MS (2025). Phytopharmacology and methods of production of lac (*Kerria lacca* Kerr.) used in the Unani system of medicine. S Aziz, A Makbul (Eds.) In *Crude drugs of Unani medicine* (Vol. 2: Phytochemistry and pharmacology aspects, pp. 357–378). Apple Academic Press. ISBN 9781998511983.
- Lyngdoh ME, Chettri J, Kharchandy VF, Sheel R, Choudhury AR, Sarkar B, Pattanayak A, Deori S, Abedin SN & Kadirvel G (2025). Synthesis of green zinc-oxide nanoparticles and its dose-dependent beneficial effect on spermatozoa during preservation: Sperm functional integrity, fertility and antimicrobial activity. In G Slaughter, A Marz, & M Bahoura (Eds.), *The road toward nanobased diagnostics for health and disease*. *Frontiers Media* SA. https://doi.org/10.3389/978-2-8325-7156-9.
- Rafiq MM, Rai D, Gavhane KP, Chaudhary R, & Kumar P (2025). Smart livestock management: A way forward for animal health. In D Rai, YP Singh, G Panpnai, & DK Raghav (Eds.), *Smart Agriculture: Next-Generation Technologies for a Sustainable Future* (pp. 357–366). *Integrated Publications*. ISBN: 978-93-58-3407-16.
- Mollazadeh A, Ghaffariannia H, Schulz H, Akaberi M, Giri SK & Emami SA (2025). Historical significance of gums and resins in cultural practices, cosmetics and nutrition in the Middle and Far East. In H Schulz, VS Jayakumar & N Prasad (Eds.), *Natural gums and resins: Botany and sustainable uses in medicine, nutrition, perfumery and cosmetics* (pp. 1–37). CABI.
- Pathare PB, Mohapatra D, Nikhil C, Pawar D & Mahanti NK (2025). Non-thermal techniques for fresh produce quality and safety. In PB Pathare (Ed.), *Postharvest handling and management* (pp. 21–48). CRC Press. ISBN 9781779641069.
- Pradhan NC, Gavhane KP, Bhalekar DG, & Kiran PR (2026). Sustainable agriculture fundamentals. In T Sarkar and S Smaoui (Eds.), Health, Nutrition and Sustainability (pp. 609-626). Academic Press. ISBN: 978-0-443-32920-3.
- Raghav DK, Vimal C, Nautiyal P & Rai D (2025). Role of IoT in rural and agricultural development. In D Rai, YP Singh, G Panpnai, & DK Raghav (Eds.), *Smart Agriculture: Next-Generation Technologies for a Sustainable Future* (pp. 185–204). *Integrated Publications.* ISBN: 978-93-58-3407-16.
- Chaudhary R, Rai D, Gavhane KP, Rafiq MM, & Sharma BR (2025). Innovative practices in climate smart farming for sustainable food systems. In D Rai, YP Singh, G Panpnai, & DK Raghav (Eds.), *Smart Agriculture: Next-Generation Technologies for a Sustainable Future* (pp. 173–183). *Integrated Publications.* ISBN: 978-93-58-3407-16.
- Prasad N, Sharma SC, Pandey SK & Kale SR (2025). *Postharvest and storage management.* In H Schulz, VS Jayakumar & N Prasad (Eds.), *Natural gums and resins: Botany and sustainable uses in medicine, nutrition, perfumery and cosmetics* (pp. 191–216). CABI.
- Prasad N, Pandey SK, Kale SR & Sharma SC (2025). *Processing of natural gums and resins.* In H Schulz, VS Jayakumar, & N Prasad (Eds.), *Natural gums and resins: Botany and sustainable uses in medicine, nutrition, perfumery and cosmetics* (pp. 217–264). CABI.

- Prasad N & Schulz H (2025). Valuable chemical constituents and properties. In H Schulz, VS Jayakumar & N Prasad (Eds.), *Natural gums and resins: Botany and sustainable uses in medicine, nutrition, perfumery and cosmetics* (pp. 107–140). CABI.
- Ramani R, Sharma KK, Prasad N & Thombare N (2025). Post Harvest Technology and Value Addition: Natural resins and gums. *In* Handbook of Agricultural Engineering, Revised Second Edition. DKMA, ICAR, New Delhi. pp. 926 – 954. ISBN: 978-81-7164-286-1.
- Ramani R, Sharma KK, Prasad N & Thombare N (2025). Post-harvest technology and value addition: Natural resins and gums. In *Handbook of agricultural engineering* (Rev. 2nd ed., pp. 926–954). DKMA, ICAR. (ISBN 978-81-7164-286-1)
- Jha SN, Narsaiah K, Kotwaliwale N, Vishwakarma RK, Giri SK, Dhingra D &. Thakur AK (2025). Circular Agricultural Economy. In H Pathak, PK Joshi, WS Lakra, AK Singh, VK Baranwal and RK Jain (Eds.), *Indian Agriculture by 2047: A roadmap for research, education and extension*. National academy of agricultural sciences, New Delhi, pp: 371. ISBN: 978-81-931524-8-5
- Schulz H, Jayakumar VS & Prasad N (2025). *Future global market for resins, gums and related products.* In H Schulz, VS Jayakumar & N Prasad (Eds.), *Natural gums and resins: Botany and sustainable uses in medicine, nutrition, perfumery and cosmetics* (pp. 345–366). CABI.
- Sharma SC & Prasad N (2025). Harvesting and trade with special focus on sustainability aspects. In H Schulz, VS Jayakumar & N Prasad (Eds.), *Natural gums and resins: Botany and sustainable uses in medicine, nutrition, perfumery and cosmetics* (pp. 141–190). CABI.
- Thombare N, Lohot VD, Kanani MR, Nadjafi F, Prasad N & Schulz H (2025). Taxonomy and distribution of botanical resources providing most important gums and resins. In H Schulz, VS Jayakumar & N Prasad (Eds.), *Natural gums and resins: Botany and sustainable uses in medicine, nutrition, perfumery and cosmetics* (pp. 38–106). CABI.

Technical Bulletin

- Pavithra KN, Nath V, Sinha PK, Kumar N, Pal S, Teli KG, Akash A, Prakash K, Udaykumar, MS & Rao CS (2025). *Agriculture in Jharkhand: Status and SWOT analysis* (Technical Bulletin No. IARI-J/TeB-003/2025, pp. 1–36). ICAR–Indian Agricultural Research Institute, Jharkhand, Hazaribagh.
- चौधरी राजन, राय दीपक, ओम प्रकाश और अनुरंजन (2025)। खूंटी जिले के लिए जलवायु आधारित सब्जियां तथा मोटे अनाजों की खेती.एटीएमए,खूंटी.1-47पृ.
- राय दीपक, एम. निखिल राज, चौधरी राजन, प्रमाणिक अचिंतय और कर अभिजीत (2025)। मधुमक्खी पालन: एक लाभकारी उद्यम.कृषि विज्ञान केन्द्र, खूंटी.1-40.

Folders

- Thombare N, Sharma D & Kar A (2025, September). *Lac dye–based natural alta: A liquid cosmetic for feet decoration* (pp. 1–4).
- Thombare N, Mohanasundaram A, Sharma KK & Kar A (2025, September). *Natural glue-based sticky insect trap: Lac resin modified as a non-drying adhesive* (pp. 1–4).
- Thombare N, Kumar S, Bhondekar AP, Sharma A, Kumar R, Bagchi S, Ansari MF & Kar A (2025). *Lac color index analyser: An electronic, handheld, low-cost, Make-in-India device for quality analysis of lac resin* (pp. 1–4).

Patent

- Tripathi MK, Giri SK & Shrivastava RM (2025). *Fermented tofu whey and ripe tomato based coagulant composition for tofu and method of producing tofu using the same* (Indian Patent Application No. 202521059282, filed June 20, 2025).
- Ansari MF, Thombare N, Roy Chowdhury A & Kar A (2025). *A natural resin-based, eco-friendly adhesive for multipurpose application and method of preparation thereof* (Indian Patent Provisional No. 202431043306, filed June 3, 2025).
- Roy Chowdhury A, Thombare N, Kale SJ, Gupta AK, Giri SK & Kar A (2025). *Natural gum-based gluten-free millet flour composition* (Indian Patent Application No. 202531089880, filed September 20, 2025).

LIBRARY AND DOCUMENTATION CENTER

The library of the Institute playing an important role in meeting the information needs of its user. Library of the Institute is a repository of scientific and Technical information on natural resins and gums. Besides catering to the needs of Institute scientists it also renders services to other researchers, academicians, technologists and students as well as lac/gums/resins industrialists from other part of the country.

The One Nation One Subscription (ONOS) is a national consortium initiative for e-journal subscriptions in India that provides institutional access to global research journals across various academic disciplines. Under this initiative, access to journals is centrally negotiated, funded, and made available to participating institutions. ONOS hosts more than 13,000 journals for over 6,300 government academic and R&D institutes, benefiting nearly 1.8 crore students, faculty members, and researchers across the country.

Following the shutdown of Consortium for e-Resources in Agriculture (CeRA), the institute was registered on the ONOS platform in January 2025 by Dr. Sandeep Kumar and Indrajeet Kumar.

All regular institute publications (Annual Reports/ Newsletters/Lac-Resins-Gums Statistics/ Laksha/Dorothy Norris Lecture Series etc,.) since beginning and Research Article/ Bulletins are available in PDF form for the internal users. Annual Reports/Newsletters/Lac-Resins-Gums Statistics, Laksha' Dorothy Norris Lecture Series are also uploaded on ICAR-Krishi Portal.

The library also continued to exchange of institute publications with the scientific institutions in and outside the country.

Services provided by the Library to its users:

- E-journals access through ONOS (One Nation One Subscription)
- Document Delivery Services.
- Reprographic Services.
- Bibliographic Services.
- Current Awareness Services.
- Sale and distribution of Institute publications.
- Institute news compilation and distribution.

Journals & periodical received:

Foreign Periodicals (Gratis/exchange)		01
Indian Periodicals (Gratis/exchange)		04
Library holdings (as on 31/12/2024)		
Documents	**Additions**	**Total**
Holdings	6	24767
Annual Report	1	3574
IS-Specification	-	184
Thesis	-	13

भाकृअनुप - राष्ट्रीय कृषि उच्चतर प्रसंस्करण संस्थान, राँची में दिनांक 1 जनवरी से 31 दिसंबर, 2025 के दौरान हिन्दी अनुभाग की गतिविधियों का विवरण

1. संस्थान राजभाषा कार्यान्वयन समिति की तिमाही बैठक: संस्थान में वर्ष 2025 में राजभाषा के प्रगामी प्रयोग की समीक्षा एवं संघ की राजभाषा नीतियों के प्रभावी कार्यान्वयन के लिए प्रत्येक तिमाही में राजभाषा कार्यान्वयन समिति द्वारा निदेशक महोदय की अध्यक्षता में दिनांक 24.03.2025, 22.07.2025, 26.09.2025 तथा 31.12.2025 को संस्थान राजभाषा कार्यान्वयन समिति की तिमाही बैठकों का आयोजन किया गया।

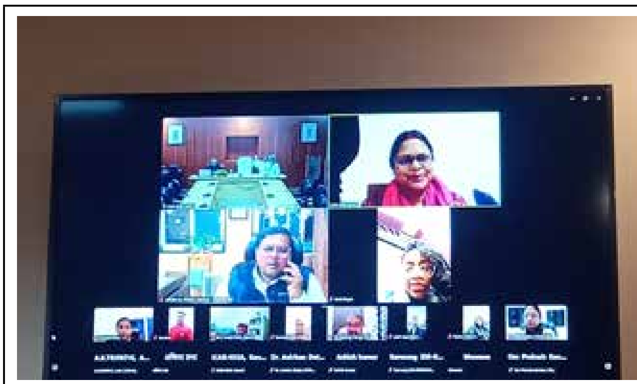
2. हिंदी पुस्तकों की खरीद: संस्थान में हिंदी साहित्य और प्रशासनिक लेखन को सुदृढ़ करने के उद्देश्य से विभिन्न विधाओं की हिन्दी भाषा की कुल 31 (इकतीस) पुस्तकों का क्रय कर पुस्तकालय में समाविष्ट किया गया।

3. हिन्दी कार्यशालाओं का आयोजन:

    - संस्थान के कार्मिकों को हिन्दी में काम करने में होनेवाली झिझक को दूर करने और उन्हें राजभाषा के नियम-अधिनियम की जानकारी प्रदान करने के उद्देश्य से दिनांक 27.03.2025 को संस्थान में "हिन्दी कार्यशाला-सह-व्याख्यान" का आयोजन किया गया जिसमें केन्द्रीय अप्रत्यक्ष कर एवं सीमा शुल्क बोर्ड, रांची के पूर्व उप निदेशक (राजभाषा) श्री शैलेन्द्र नाथ दुबे द्वारा "संघ की राजभाषा नीति के विभिन्न पहलू" विषय पर व्याख्यान प्रस्तुत किया गया। कार्यशाला में वैज्ञानिक तकनीकी एवं प्रशासनिक संवर्गों के अधिकारी एवं कर्मचारीगण ने सक्रिय रूप से प्रशिक्षण प्राप्त किया।


हिन्दी कार्यशाला-सह-व्याख्यान: संघ की राजभाषा नीति के विभिन्न पहलू

    - दिनांक 30.12.2025 को एक ऑनलाइन हिन्दी कार्यशाला का आयोजन किया गया जिसमें श्री पुष्पनायक, मुख्य प्रशासनिक अधिकारी, भारतीय कृषि अनुसंधान परिषद का पूर्वी अनुसंधान परिसर, पटना द्वारा "अद्यतित प्रशासनिक नियम तथा हिन्दी टिप्पण-प्रारूपण" पर विस्तृत ज्ञान एवं प्रशिक्षण प्रदान किया गया। कार्यशाला में वैज्ञानिक तकनीकी एवं प्रशासनिक संवर्गों के अधिकारी एवं कर्मचारीगण ने सक्रिय रूप से भाग लिया।




हिन्दी व्याख्यान-सह-प्रशिक्षण: अद्यतित प्रशासनिक नियम तथा हिन्दी टिप्पण-प्रारूपण

4. नराकास, राँची की छमाही बैठकों में संस्थान की सहभागिता: राँची नगर राजभाषा कार्यान्वयन समिति द्वारा आयोजित 28वीं एवं 29वीं छमाही बैठकों (क्रमशः दिनांक 18.02.2025 एवं 12.09.2025) में संस्थान के निदेशक एवं अधिकारीगण ने भाग लिया।

5. हिन्दी उल्लास पखवाड़ा का आयोजन: दिनांक 1 से 15 सितम्बर, 2025 के दौरान संस्थान में "हिन्दी उल्लास पखवाड़ा" का आयोजन किया गया। इसके अंतर्गत संस्थान के अधिकारियों एवं कर्मचारियों के लिए अनेक ज्ञानवर्द्धक एवं रोचक प्रतियोगिताओं एवं कार्यक्रमों का आयोजन किया गया। इस अवधि में हिन्दी एवं हिन्दीतर भाषी वर्गों के लिए निबंध लेखन प्रतियोगिता, हिन्दी व्याकरण, टिप्पण-प्रारूपण एवं कार्यालयी शब्दार्थ प्रतियोगिता, प्रश्नोत्तरी प्रतियोगिता, वाद-विवाद प्रतियोगिता, अंताक्षरी प्रतियोगिता, यूनिकोड टंकण प्रतियोगिता के आयोजन में संस्थान के वैज्ञानिक तकनीकी एवं प्रशासनिक वर्गों के अधिकारियों एवं कर्मचारियों ने अत्यंत उत्साहपूर्वक भाग लिया। इन प्रतियोगिताओं के विजेता कार्मिकों को संस्थान के 102वें स्थापना समारोह के अवसर पर दिनांक 20 सितंबर, 2025 को पुरस्कृत किया गया। इस अवसर पर संस्थान के निदेशक डॉ. अभिजीत कर द्वारा समस्त कार्मिकों से कार्यालयी कार्य में शत-प्रतिशत हिंदी के उपयोग का करने का आह्वान किया।


हिन्दी उल्लास पखवाड़ा 2025 के अन्तगर्त आयोजित विभिन्न प्रतियोगितायें

6. नकद पुरस्कार योजना का कार्यान्वयन: हिन्दी में कार्य करने के लिए विभागीय प्रोत्साहन योजना के अंतर्गत नकद पुरस्कार योजना के अंतर्गत संस्थान के 5 कार्मिकों को अपना अधिकतम कार्य हिन्दी में करने के लिए नकद पुरस्कार प्रदान किए गए।

7. हिन्दी प्रकाशन: वार्षिक राजभाषा गृह पत्रिका 'लाक्षा 2025' तथा हिंदी पुस्तक 'मधुमक्खी पालन: एक लाभकारी उद्यम' का प्रकाशन किया गया।

8. लाक्षा-2024 का सर्वश्रेष्ठ आलेख पुरस्कार: संस्थान द्वारा प्रकाशित वार्षिक हिन्दी गृह पत्रिका "लाक्षा-2024" के आलेख शीर्षक ''पॉलीसेकेराइड के स्रोत के रूप में उद्यानिकी अपशिष्ट का उपयोग: संसाधन प्रबंधन के लिए एक उपयुक्त दृष्टिकोण" (लेखकगण : डा. अर्चना महापात्र, डा. प्रियंका साकरे, डा. अर्णब राय चौधुरी एवं डा. सखाराम काले) को संस्थान के 102वें स्थापना समारोह के अवसर पर दिनांक 20 सितंबर, 2025 को सर्वश्रेष्ठ आलेख पुरस्कार प्रदान किया गया।

EVENTS ORGANISED BY THE INSTITUTE

Kisan Mela and Agricultural Exhibition 2025

The Kisan Mela-cum-Agricultural Exhibition 2025 was organised during February 20-21, 2025 at the ICAR-National Institute of Secondary Agriculture, Namkum, Ranchi. The event was graced and inaugurated by Smt. Shilpi Neha Tirkey, Hon'ble Minister for Agriculture, Animal Husbandry & Co-operatives, Government of Jharkhand. Distinguished guests included Mr. Abubakar Siddiqui, Principal Secretary, Department of Agriculture, Animal Husbandry & Co-operative, Government of Jharkhand; Mr. Rajesh Kachhap, Hon'ble MLA, Khijri Assembly Constituency; Dr. Abhijit Kar, Director, ICAR-NISA; and Dr. J. Ghosh, among others. The primary objective of the Kisan Mela was to empower and educate the farming community of Jharkhand with the latest agricultural technologies, sustainable practices, and innovations. It served as a dynamic platform for stakeholders such as farmers, researchers, policymakers, entrepreneurs, and extension agencies to engage in meaningful dialogue and collaboration aimed at transforming traditional agriculture into a modern and profitable enterprise. A special focus was placed on improving farmers' income and livelihood through grassroots-level technological interventions, aligning with the broader vision of sustainable agricultural development and rural prosperity. The event also played a pivotal role in spreading awareness about various Government schemes, innovations in agri-tech, and public-private partnership opportunities, particularly tailored to uplift tribal and marginal farmers. In her keynote address, Hon'ble Minister Smt. Shilpi Neha Tirkey emphasised the Government's commitment to make farmers self-reliant and economically secure, with a vision to double their income. She highlighted the crucial role of science and technology in enhancing productivity, promoting organic farming, improving nutrition, and advancing agro-processing initiatives. The mela hosted over 65 exhibition stalls representing ICAR institutes, Krishi Vigyan Kendras (KVKs), Farmer Producer Organisations (FPOs), Self Help Groups



Glimpses of Kisan Mela 2025

(SHGs), Non-Governmental Organisations (NGOs), and other government departments. Each stall showcased innovations and best practices across diverse agricultural domains. Kisan Gosthis were organised on a wide array of topics, including Scientific Lac Cultivation, Lac-Based Integrated Cropping Systems, Natural Farming, Cropping System Diversification, Farm Mechanization, Nutrient Management, Nutri-Gardens, Crop Production Techniques, Animal Husbandry & Poultry Science, Mushroom and Fishery Production, Minor Forest Produce Utilization and Tasar Sericulture. Overall, the Kisan Mela 2025 successfully facilitated knowledge exchange, encouraged innovation adoption, and fostered stronger connections among key players in the agricultural ecosystem, setting a promising direction for sustainable and inclusive agricultural growth in Jharkhand. Around 4000 farmers participated in mela and got benefitted through this programme.

International Women's Day

International Women's Day celebrated at ICAR-NISA

ICAR-NISA proudly celebrated International Women's Day, featuring the inspiring presence of Dr. S. N. Trivedi, Chairman, Jharkhand State Committee of the Sri Aurobindo Society. His thought-provoking lecture on "Spirituality to Accelerate Action for Gender Equality" captivated an audience of students, staff, and family members from the ICAR-NISA community. The celebration also included an engaging cooking competition centered around the theme "Meal on a Dish," which saw remarkable participation from the NISA family. Awards were presented to the deserving winners. Furthermore, cultural programs and quiz competitions were organised to empower women participants to shine and display their unique talents. The event was convened by Dr. Debabandya Mohapatra, Chairperson, Women's Cell making it a memorable and impactful occasion for all involved.

Hindi Workshop-cum-Lecture

A 'Hindi Workshop-cum-Lecture' was organised at ICAR-NISA on March 27, 2025, with the objective of encouraging personnel to work confidently in Hindi and enhancing their understanding of the rules and regulations governing the Official Language. On this occasion, Shri Shailendra Nath Dubey, former Deputy Director (Official Language), Central Board of Indirect Taxes and Customs, Ranchi, delivered a lecture on *'Various Aspects of the Official Language Policy of the Union'.* Officers and staff members from the scientific, technical, and administrative cadres actively participated in the training.

Hindi Karyashala at ICAR-NISA

4th Lac Insect Day celebration

The ICAR-National Institute for Secondary Agriculture (ICAR-NISA), in collaboration with its network cooperating centres, celebrated 4th Lac Insect Day on May 16, 2025, with a nation-wide awareness campaign highlighting the economic and ecological significance of lac insects, especially for rural and tribal communities in India. At ICAR-NISA lead centre, scientists engaged farmers and students in informative sessions, focusing on the promising host plant *Calliandra* for lac cultivation. They also shared insights into the insect's biology and the importance of adopting a scientifically supported package of practices to improve both the productivity and quality of lac yield. In addition to the central event, cooperating centers under the Network Project on Conservation of Lac Insect Genetic Resources

(NP-CLIGR) held parallel awareness programmes across the country. These included events at SKUAST (Jammu), PAU (Ludhiana), CAU (Imphal), AAU (Jorhat), MPUAT (Udaipur), KFRI (Thrissur), SFRI (Jabalpur), ANGRAU (Guntur), and ICAR-RCER (Patna), reaching out to farmers, students, and other stakeholders. The NP-CLIGR continues to play a vital role in empowering lac cultivators and supporting the socio-economic development of lac-producing regions through scientific interventions, capacity-building, and sustainable practices.

AAU, Jorhat PAU, Ludhiana

MPUAT, Udaipur ICAR-NISA, Ranchi

Lac insect day celebrated at different network centres including ICAR-NISA, Ranchi

Participation in Viksit Krishi Sankalp Abhiyan 2025

Scientists from ICAR–National Institute of Secondary Agriculture, Ranchi, in collaboration with Subject Matter Specialists from Krishi Vigyan Kendras (KVKs) of Latehar, Khunti, Lohardaga, and Ranchi, actively participated in the Viksit Krishi Sankalp Abhiyan 2025 launched by the Ministry of Agriculture and Farmers Welfare, Government of India during 27 May- 12 June, 2025. Under this campaign, the teams visited 450 villages covering different blocks and interacted with 47,332 farmers across Jharkhand. During the visits, the scientists shared knowledge on a wide range of topics including utilization of crop residues, crop diversification, lac-based cropping system models, entrepreneurship and skill development, agri-tourism, crop production and protection, farm mechanization, value addition, scientific lac cultivation and processing (with special emphasis), integrated farming systems, and organic farming. Farmers were also briefed about various government schemes and their benefits. The interactions provided a valuable platform to listen to farmers' concerns, provide practical solutions, and encourage them to adopt sustainable and modern agricultural practices. Through this extensive outreach, ICAR-NISA reaffirmed its commitment to strengthening secondary agriculture and enhancing farmers' income in Jharkhand.


Glimpses of different events organised during Viksit Krishi Sankalp Abhiyan 2025

11th International Yoga Day Celebration

On occasion of the 11th International Yoga Day, a one-day Yoga training & practice program was organised at ICAR-National Institute of Secondary Agriculture, Ranchi on June 21, 2025. During the programme, Mrs. Antara and Mr. Aman, yoga instructors from the Art of Living Foundation guided the staff and explained about different Asanas, Pranayamas, and Mudras, explaining their benefits for maintaining good health and happiness in daily life. A meditation session was also conducted, during which participants experienced relaxation and rejuvenation. Following the practice, an interactive session was held, where the instructors answered queries from participants. All staff members of ICAR-NISA, including scientific, technical, administrative, and contractual personnel, actively participated in the event. On the occasion, Dr. Dr. Abhijit Kar, Director highlighted the importance of yoga in daily life and its role in maintaining a healthy work-life balance. Dr. Nandkishore Thombare, Convener of the programme, emphasized the physical, mental, and emotional benefits of yoga. The yoga instructors were felicitated at the end of the programme.


11th International Yoga Day at ICAR- NISA, Ranchi

ICAR-NISA celebrated its 102nd Foundation Day

ICAR-NISA, Ranchi celebrated its 102nd Foundation Day on September 20, 2025 with great enthusiasm. Dr. Shyam Narayan Jha, DDG (Engineering), ICAR graced the occasion as Chief Guest. Dr. S. C. Dubey, Vice Chancellor, Birsa Agricultural University, Ranchi and Dr. Sujay Rakshit, Director, ICAR- Indian Institute of Agricultural Biotechnology, Ranchi were Guests of Honour. Dr. Abhijit Kar, Director, ICAR-NISA welcomed the dignitaries and outlined the institute's achievements and strategic roadmap. Dr. Jha appreciated the institute's R&D efforts, particularly the development of a gluten-free binder for millet roti. He emphasized its potential in promoting nutritious, millet-based products. The Guests of Honour lauded the institute's significant contributions to the lac sector and secondary agriculture. They also expressed satisfaction in collaborating under the unified framework of One ICAR. On the occasion of its Foundation Day, ICAR-NISA signed three MoUs with Aryavrat

Agrotech Pvt. Ltd. (Deoghar), DSR Garuda Aerials Pvt. Ltd. (Khunti), and Shubharambh (Ranchi) to strengthen collaborative initiatives in agriculture and allied sectors. The event also witnessed the release of few publications by the institute – the annual Hindi magazine *Laksha 2025,* booklet *Beekeeping: A Profitable Enterprise* and three leaflets on institute developed technologies. The programme was graced by former officials of the institute, officers from other ICAR institutes, progressive farmers and ICAR-NISA staff members. The progressive farmers expressed their gratitude towards the institute and shared their thoughts during the event. The event highlighted ICAR-NISA's continued commitment to agricultural innovation and rural development.

Glimpses of foundation day celebration at ICAR-NISA

14th Ms Dorothy Norris Memorial Lecture

The ICAR-National Institute of Secondary Agriculture, Ranchi organised the 14th Ms Dorothy Norris Memorial Lecture on the theme "Empowering Secondary Agricultural Processes to Build a Thriving Bio-based Economy: Strategies for Achieving a Developed and Self-Sufficient India" on September 24, 2025. Dr. Sanjay Kumar, Chairman, Agricultural Scientists Recruitment Board (ASRB), New Delhi delivered the memorial lecture as the Chief Guest. Dr. Abhijit Kar, Director, ICAR-NISA, welcomed the dignitaries and emphasized the enduring significance of Dr. Dorothy Norris's pioneering work as founding director of erstwhile Indian Lac Research Institute. Dr. Sujay Rakshit, Director, ICAR-IIAB, Ranchi also graced the event. In his lecture, Dr. Sanjay Kumar underlined the transformative potential of secondary agriculture in realizing the vision of Viksit Bharat and Atmanirbhar Bharat. He highlighted strategies such as residue valorization, post-harvest innovation, technology diffusion, and MSME empowerment as vital steps in strengthening India's bio-economy. Dr. Sanjay Kumar also called upon agri-tech institutions to prioritize mechanization, reduce imports, and lower production costs. He stressed the need to utilize indigenous resources to reduce dependency on high-value imports, such as asafetida, rose oil, tulips, and medicinal compounds. He urged greater collaboration among institutions, industries, and startups to bridge the lab-to-market gap and establish India as a global leader in sustainable bio-economy.

14th Ms Dorothy Norris Memorial lecture by Dr. Sanjay Kumar, ASRB

Celebration of Hindi Ullas Pakhwada- 2025

Guests presenting certificates to winners of Hindi Pakhwada 2025.

To promote and encourage the progressive use of Hindi in daily official work, the institute observed *Hindi Ullas Pakhwada* from September 1-15, 2025. A series of competitions including essay writing, Hindi grammar, noting and drafting, office terminology, quiz, debate, antakshari, unicode typing, and a Hindi workshop were organised during the fortnight. Officers and staff from scientific, technical, and administrative wings participated enthusiastically. The activities aimed to strengthen the emotional connect with Hindi, enhance work efficiency, and encourage its natural and spontaneous use as the Official Language.

On September 20, 2025, during the institute's 102nd Foundation Day, winners of the Hindi Pakhwada competitions were felicitated with prizes and certificates by distinguished guests. Authors of the best articles published in last year's house journal *Laksha 2024* were also honored. *Hindi Ullas Pakhwada- 2025* not only deepened the institute's affinity for Hindi but also marked an important step toward strengthening its use as an active and integral part of workplace culture.

Workshop on MATLAB tools for agricultural innovation organised at ICAR-NISA

ICAR-NISA, Ranchi organised a three-day national workshop and hands-on training on "Empowering Agricultural Innovation with MATLAB, Simulink & ThingSpeak" in collaboration with MathWorks Inc. The workshop was held from August 5 to 7, 2025, with 23 participants from ICAR-CIAE, Bhopal, ICAR-CIPHET, Ludhiana, ICAR-CIWA, Bhubaneswar, ICAR-IIAB, ICAR-RCER, and ICAR-NISA, Ranchi. The inaugural programme was attended by Dr. K. P. Singh (ADG, FE); Dr. Abhijit Kar, Director, NISA (online); Heads of Divisions; scientists; officials; and trainers from MathWorks- Mr. Ramana Anchuri, Dr. Nisha Chetana Sastry, Ms. Zahida Vaseem, Dr. Viju Ravichandran, Dr. Pranav, Mr. Janardan Mandal along with ELMAX officials. Dr. Abhijit Kar welcomed the participants and dignitaries and emphasized the importance of advanced analytical tools in agricultural research. Dr. Niranjan Prasad, Head, ABA Division, briefed the participants about the institute's background. In his address as Chief Guest, Dr. K. P. Singh encouraged active participation and highlighted the relevance of the MATLAB platform for modern data analysis in an era driven by machine learning, deep learning, artificial intelligence, IoT, and big-data analytics- key components of Industry 4.0. Ms. Zahida Vaseem from MathWorks introduced about various MATLAB applications, while Dr. Debabandya Mohapatra, Convenor of the workshop, proposed the vote of thanks and outlined MATLAB tools useful in agriculture. Over the three days, participants were trained in concepts of data analysis, statistical tools, optimisation, curve fitting, image processing, IoT applications, and machine learning and deep learning techniques, followed by extensive hands-on sessions.

Live streaming of PM Dhan Dhaanya Krishi yojana launch

Staff and farmers during live streaming of PM Dhan Dhaanya Krishi Yojana launch

ICAR- NISA organised a live streaming of the launch of PM Dhan Dhaanya Krishi Yojana on October 11, 2025. During the programme, several schemes and projects of various Ministries of the Government of India were inaugurated and foundation stones were laid.

Farmers from different parts of Jharkhand participated in the event. A Scientist–Farmer interaction was also conducted, focusing on natural farming practices, pulses, and oilseed cultivation. The interaction provided a platform for knowledge exchange and strengthened awareness about sustainable agricultural practices among the participating farmers.

Celebration of Vigilance Awareness Week at ICAR-NISA, Ranchi

In accordance with the guidelines of the Government of India, ICAR–National Institute of Secondary Agriculture, Ranchi, observed Vigilance Awareness Week from October 27 to November 02, 2025 as part of the Vigilance Awareness Campaign (August- November, 2025).

As part of the week-long activities, the Integrity Pledge was administered to all employees on October 27, 2025 by Dr. Abhijit Kar, Director, reaffirming the Institute's collective commitment to a corruption-free environment and ethical conduct in official duties. A capacity building programme was organised on October 28, 2025, wherein Shri Hardik A. Tamgage, Administrative Officer, delivered a presentation aimed at strengthening officials' understanding of vigilance-related aspects such as investigation procedures, procurement norms, ethics, and digital security, with the objective of preventing corruption and enhancing transparency. Further, a lecture titled "Vigilance: Our Shared Responsibility" was conducted on October 29, 2025 by Dr. Niranjan Prasad, Head, ABA Division & Vigilance Officer. The lecture highlighted the causes and consequences of corruption and emphasized the importance of collective responsibility in promoting integrity and supporting national development. The observance of Vigilance Awareness Week at ICAR–NISA reinforced the institute's commitment to ethical governance and its resolve to uphold the core values of integrity, transparency, and accountability.

Staff members taking integrity pledge at the institute

Celebration of Rashtriya Ekta Diwas at ICAR-NISA

ICAR–NISA, Ranchi, observed Rashtriya Ekta Diwas on October 31, 2025 to commemorate the 150th Birth Anniversary of Shri Sardar Vallabhbhai Patel, the Iron Man of India. The day was celebrated to promote the values of national unity, integrity, and collective responsibility.

On this occasion, a Unity Pledge was administered to all employees of the institute, reaffirming their commitment to the ideals of unity, integrity, and dedication to the nation. To highlight the life and contributions of Sardar Vallabhbhai Patel, a 30-minute short video showcasing his role in nation-building and integration of India was screened for the employees. In addition, a quiz contest was organised to spread awareness about vigilance and ethical practices. The programme witnessed active participation from staff members, and winners were suitably recognised.

Staff during video screening on Rashtriya Ekta Diwas

Valedictory ceremony of the Master Trainer's Training Programme

ICAR–NISA, organised the valedictory ceremony of the Master Trainer's Training Programme on "Scientific Methods of Lac Cultivation, Primary Processing and Utilization" on November 17, 2025. Welcoming the dignitaries and participants, Dr. Abhijit Kar, Director, ICAR–NISA, emphasized the importance of equipping master trainers with scientific knowledge to strengthen grassroots capabilities in lac cultivation and processing. He highlighted that such capacity-building initiatives play a vital role in improving productivity and enhancing rural livelihoods. Hon'ble Minister Smt. Shilpi Neha Tirkey graced the occasion as the Chief Guest and stressed the need to promote scientific awareness among farmers to improve the production of lac and other agro-forestry-based products. The programme, sponsored by SIDKOFED, witnessed the participation of 38 trainees from Chaibasa and Karsawa districts. Certificates were distributed to the participants by the Hon'ble Minister during the ceremony. Memorandum of Understanding (MoU) was also exchanged between ICAR–NISA, Ranchi and SIDKOFED, to strengthen collaborative efforts in the areas of natural resins, gums, and secondary agriculture.

Hon'ble Minister presenting certificate to a trainee

Trainees with officials of ICAR–NISA and SIDKOFED

Live streaming of the release of the 21st instalment of PM-KISAN

ICAR–NISA organised the live streaming of the release of the 21st instalment of PM-KISAN on November 19, 2025. Smt. Annapurna Devi, Hon'ble Union Cabinet Minister for Women & Child Development, Government of India, graced the occasion as the Chief Guest. Dr. Abhijit Kar, Director welcomed the dignitaries and highlighted the institute's improved technologies and innovative practices aimed at enhancing farmers' income and sustainability. In her address, the Hon'ble Minister emphasized key Central Government schemes including PM-KISAN, PM Fasal Bima Yojana, Kisan Credit Card (KCC), and Rashtriya Krishi Vikas Yojana (RKVY), underlining their role in ensuring farmers' financial security and access to institutional support. She also highlighted the growing contribution of agri-startups and innovations in improving productivity, value addition, and market linkages. Farmers from various districts of Jharkhand, along with ICAR–NISA staff, actively participated in the programme, making the event informative and impactful.

Director, ICAR–NISA presenting a memento to the Hon'ble Minister

Live streaming of PM-KISAN programme

Live streaming of the address by the Hon'ble Union Minister

Hands On Training Multivariate Analysis and Design of Experiments in Chemometrics and Spectroscopic Applications at ICAR-NISA, Ranchi

ICAR-NISA organised 2-days hands-on training on "Multivariate Analysis and Design of Experiments in Chemometrics and Spectroscopic Applications" using Unscrambler X, in association with SCIENCE4U Analytics and Research Solutions Pvt. Ltd., Bangalore, during December 18-19th 2025. A total of 15 participants including scientists and students of ICAR-NISA participated in this event. The training course leader Mr. Bhanu Prakash R helped the participants analyse chemometric and spectroscopic data and design of experiments through real problems and answered all the queries during the participatory session. Dr. Debabandya Mohapatra, convenor of the training program, briefed the participants about usage of the UnscramblerX software and hoped for wide usage of this software for data analysis and design of experiments.

Farmer's Day Celebration at ICAR-NISA, Ranchi

ICAR-NISA, Ranchi, organised Kisan Diwas (Farmers' Day) on December 23, 2025. Farmers and students from different parts of Jharkhand participated in the programme. A scientist-farmer interaction was held, focusing on the institute's improved technologies and innovative practices aimed at enhancing farm productivity and income. The interaction provided an effective platform for knowledge exchange and awareness on sustainable agricultural practices.

On the occasion, the Hon'ble Union Minister of Agriculture & Farmers Welfare addressed farmers across ICAR institutions through an online interaction, inspiring the farming community and reaffirming the Government's commitment towards farmers' welfare and sustainable agriculture.

PARTICIPATION IN MELA/ EVENTS

ICAR-NISA actively participated in 11 Kisan Melas and Agricultural Exhibitions organised by esteemed institutions, including the Ministry of Agriculture and Farmers Welfare, Indian Council of Agricultural Research (ICAR), State Forest Departments, Central Silk Board, State Agricultural Universities (SAUs), and Krishi Vigyan Kendras (KVKs). During these events, the institute showcased its innovative technologies and value-added products related to lac cultivation, lac-based processing, and secondary agriculture, with the objective of technology dissemination and enhancing farmer awareness.

A wide spectrum of farmers and agricultural stakeholders engaged with the exhibits, gaining insights into sustainable lac production practices, pest management, and post-harvest value addition. The demonstration of agro-technologies drew considerable attention, with thousands of farmers benefiting from interaction with experts and technical literatures. Shri Santosh Kumar Gangwar, Hon'ble Governor of Jharkhand, senior officials from central and state agencies, visited the ICAR–NISA stall and appreciated the institute's contributions toward lac-based livelihoods, efficient bio-resource utilization, and rural agro-entrepreneurship. The proactive outreach efforts of the ICAR-NISA team were widely appreciated for their role in knowledge transfer, capacity building, and strengthening the secondary agriculture sector.

Visitors at ICAR-NISA exhibits

Visitors at ICAR-NISA stall

Hon'ble Governor visiting ICAR-NISA stall

Products are exhibited in the stall

LIST OF RESEARCH PROJECTS FOR THE YEAR 2025-26

ICAR-National Institute of Secondary Agriculture, Ranchi

S. No.	Title of the Project	Name of Investigators
Program I : Conservation and Improvement of lac hosts and insects Leader : Dr. Jyotirmoy Ghosh		
1	Conservation, selection and management of lac host plants *Flemingia semialata* and *Ziziphus mauritiana*	**Dr. Jyotirmoy Ghosh** Dr. Vaibhav D. Lohot Dr. Nawalesh Kumar Sinha Dr. Soumen Ghosal
Program II : Development of sustainable lac based agri-production system Leader : Dr. Soumen Ghosal		
2	Development of package of practices for lac cultivation on ber and *semialata* along with compatible intercropping system	**Dr. Soumen Ghosal** Dr. Niranjan Prasad Dr. Rahul R. Bakade Dr. Achintya Pramanik
3	Effect of moisture stress in a drip irrigated field and optimisation of cropping pattern in lac-integrated cropping system	**Dr. Mridusmita Debnath** Dr. Udaykumar, M.S.
4	Development of cultivation technology for *Tremella fuciformis* (White jelly mushroom)	**Dr. Rahul R. Bakade** Dr. Sandeep Kumar
Program III : Development of suitable strategies for post-harvest management and valorization of agri-bio produces Leader : Dr. Saroj Kumar Giri		
5	Development of energy efficient and high recovery processes for extracting essential oils from aromatic plants	**Dr. Archana Mahapatra** Dr. Sandeep Kumar
6	Design and development of equipment and machinery for processing and product development from natural resins and gums	**Dr. Sakharam J. Kale** Dr. Debabandya Mohapatra Er. Sanjay Kumar Pandey Dr. Satish Chandra Sharma
7	Development of smart packaging systems for enhancing shelf-life of agro-produce	**Dr. Priyanka Sakare** Dr. Saroj Kumar Giri Dr. Arnab Roy Chowdhary Dr. Nandkishore Thombare
Program IV : Development of advanced processing, extraction, formulation, and delivery system from agri-bioproducts and co-products Leader : Dr. Md. Fahim Ansari		
8	Development of value-added products from natural resins, gums and their co-products	**Dr. Md. Fahim Ansari** Dr. Md. Ali Co-PI Dr. Santosh Kumar Singh Yadav
9	Development of a green process for extraction of nano-cellulose from agri bio-products	**Dr. Arnab Roy Chowdhary** Dr. Santosh Kumar Singh Yadav Dr. Archana Mahapatra Dr. Md. Ali

10	Development of suitable delivery systems for bioactive compounds for nutraceuticals and cosmeceuticals	**Dr. Anirban Dutta** Dr. Arnab Roy Chowdhary Dr. Sandeep Kumar
Program V : High throughput and low-cost system based on sensors and artificial intelligence for process, quality control and automation Leader : Dr. Debabandya Mohapatra		
11	Development of analytical techniques for identification and quality control of commercially important agri-bioproducts	**Dr. Nandkishore Thombare** Dr. Priyanka Sakare Dr. Anirban Dutta
12	Development of an automated ultrasound-assisted membrane filtration system for lac-dye recovery	**Dr. Debabandya Mohapatra** Er. Sanjay Kumar Pandey Dr. Sakharam J. Kale Dr. Sandeep Kumar
Program VI : Conducting translational research, transfer of technology and entrepreneurship development for the stakeholders Leader : Er. Sanjay K. Pandey		
13	Translational research to promote secondary agriculture	**Dr. Udaykumar, M.S.** Er. Sanjay Kumar Pandey
14	Training to stakeholders and business incubation for entrepreneurship development	**Dr. Udaykumar, M.S.** Er. Sanjay Kumar Pandey
ICAR-Network Projects		
15	Network project on conservation of lac insect genetic resources	**Dr. Niranjan Prasad PC** Dr. Vaibhav D. Lohot PI Dr. S Kumar Co-PI
16	Network project on harvesting, processing and value addition of natural resins and gums (ICAR)	**Dr. Saroj Kumar Giri, PC & PI** Dr. Arnab Roy Chowdhary Dr. Nandkishore Thombare Dr. Sakharam J. Kale Dr. Anirban Dutta Dr. Archana Mahapatra Dr. Priyanka Sakare
CRP on Secondary Agriculture		
17	Development of pilot scale technologies for high value derivatives from gaur gum and utilization of guar meal	**Dr. Saroj Kumar Giri, PC & PI** Dr. Arnab Roy Chowdhary Dr. Satish Chandra Sharma Dr. Sakharam J. Kale
18	Enhancing food, nutritional and livelihood security of marginal and small farmers in Jharkhand through need based agricultural technologies (ICAR-NISA, Ranchi & ICAR-RCER FSRCHPR, Plandu, Ranchi)	Dr. Nawalesh Kumar Sinha, Co-PI
Inter-Institutional Collaborative Projects		
19	Post-harvest management and by-product utilization of litchi fruit (ICAR-NISA, Ranchi and ICAR-NRC litchi, Muzaffarpur)	Dr. Santosh Kumar Singh Yadav, Co-CC-PI

Externally Funded Project		
20	Development of suitable equipment for uprooting cinchona trees in hilly terrains (DCOMP, WB; 30 lakhs)	**Dr. Satish Chandra Sharma** Er. Sanjay Kumar Pandey Dr. Niranjan Prasad
21	Evaluation of the synergistic potential of apiculture with lac cultivation for sustainable livelihood security (NBHM, National Bee Board; 169.65 lakhs)	**Dr. Achintya Pramanik** Dr. Nandkishore Thombare Dr. Sandeep Kumar
22	Intellectual property management, technology transfer/ commercialization and Agribusiness incubation (NAIF Scheme of ICAR; 10 lakhs/year)	**Er. Sanjay Kumar Pandey** Dr. Satish Chandra Sharma Dr. M.S. Udaykumar
23	Development of suitable equipment for debarking cinchona tree branches in hilly terrains (DCOMP, WB; 20 lakhs)	**Dr. Satish Chandra Sharma** Er. Sanjay Kumar Pandey Dr. Niranjan Prasad

Externally Funded Projects at KVK Khunti:

Sl. No.	Project name	Project cost (₹ In lakh)	Duration	Sponsoring agency	Involvement
1.	District agro-meteorology unit (DAMU)	Rs.46.93	From 2019 to till date	IMD, New Delhi	Dr. Deepak Rai, PI
2.	Training & Seminar, Development of quality nucleus stock, plantation of bee preferred host plants for availability of honey round the year	47.73	From 22.02.24 to till date	National Bee Board under Ministry of Agriculture & Farmers Welfare	Dr. Deepak Rai, PI
3.	Round the year vegetable production with precision cum resource conservation technology for doubling farmers income in Jharkhand.	196.07	From 2023 to till date	Rashtriy Krishi Vikas Yojana (RKVY) under Ministry of Agriculture & Farmers Welfare	Dr. Deepak Rai, Co-PI
4.	Production of quality planting materials and establishment of medicinal and aromatic plants nursery in Jharkhand for herbo-agro forestry system	417.0	From 2024 to till date	Rashtriy Krishi Vikas Yojana (RKVY) under Ministry of Agriculture & Farmers Welfare	Dr. Deepak Rai, Nodal Officer
5.	Strenthening of Krishi Vigyan Kendra for Improving socio-economic conditions of small and marginal farmers of Khunti	188.61	From 2025 to till date	Rashtriy Krishi Vikas Yojana(RKVY) under Ministry of Agriculture & Farmers Welfare	Dr. Deepak Rai, PI
6.	Establishment of high-density lac brood bank with advanced support systems at ICAR-NISA, KVK, Khunti	75	From 2026 to till date	SIDCOFED, Jharkhand	Dr. Deepak Rai, PI

IMPORTANT COMMITTEES

Research Advisory Committee (RAC)

Name of Expert	Designation	Role
Dr V Geethalakshmi	Ex- Vice Chancellor, TNAU	Chairperson
Dr Harminder Singh Sidhu	Principal Scientist, Department of Farm Machinery and Power Engineering, PAU Ludhiana	Member
Dr Kanchan Kumar Singh	Ex-ADG (Engg), ICAR	Member
Dr Ramabhau Tumadu Patil	Ex-Director, ICAR-CIPHET, Ludhiana	Member
Prof. Arun Kumar Padhi	Dean (Research & Development), Central University of Jharkhand, Ranchi	Member
Dr Bikash Das	Director, ICAR-National Research Center on Litchi, Muzaffarpur	Member
Dr Krishna Prasad Singh	ADG (FE), Agricultural Engineering Division, KAB-II, Pusa, New Delhi	Member
Shri Subhash Chandra Mahto	Two non-official persons representing agricultural/rural interest	Member
Shri Prashant Kumar Khakha		Member
Dr Abhijit Kar	Director, ICAR-NISA, Ranchi, Jharkhand	Member
Dr Saroj Kumar Giri	Head, AS&PE Division ICAR-NISA	Member Secretary

List of IMC Members as on 31.12.2025

Sl. No.	Name & Designation of the member	Nomination as	Rule & Sub-rule	Rule position	Validity period
1.	Director ICAR-NISA, Ranchi	Chairman	66(a) 1	Director of the Institute	Ex-officio
2.	Director, Agriculture, Govt. of Jharkhand, Ranchi	Member	66(a) 2	A representative of the State Govt. in which the Institute is located nominated by the President ICAR	Ex-officio
3.	Director, Agriculture, Govt. of Bihar, Patna	Member	66(a) 3	A representative of any other state Govt. concerned with the research in the Institute nominated by the President ICAR	Ex-officio
4	Vice Chancellor, Birsa Agricultural University, Kanke, Ranchi	Member	66(a) 4	A representative of the Agricultural University, having jurisdiction over the area, nominated by the President	Ex-officio
5.	Shri Subhash Chandra Mahto Madhupur, Pirtand, Giridih	Member	66(a) 5	Two non-official persons representing agricultural/ rural interest to be nominated by the President	07.03.2024 to 06.03.2027
6.	Shri Prashant Kumar Khakha AT-Kundo,PO-Jhiko Chatti, PS-Bhadra, Lohardaga				

BUDGET ALLOCATION AND UTILIZATION DURING FINANCIAL YEAR 2025-26

Budget Utilization Status as on 28.03.2026

Sl. No.	Heads	Allocation (2025 - 2026) ₹	Release (2025 - 2026) ₹	Expenditure incurred ₹	Balance Available ₹	% utilization
INSTITUTE						
1	GIA-CAPITAL	5,07,60,000	5,07,60,000	5,07,60,000	0	100
2	GIA-GENERAL	5,93,64,000	5,93,64,000	5,93,64,000	0	100
3	SCSP-CAPITAL	29,72,000	29,72,000	29,72,000	0	100
4	SCSP- GENERAL	72,37,000	72,37,000	72,37,000	0	100
HPVA						
5	GENERAL	73,58,000	73,58,000	73,58,000	0	100
CLIGR						
6	GENERAL	91,98,000	91,98,000	91,98,000	0	100
7	GENERAL (NEH)	36,94,000	36,94,000	36,94,000	0	100
	TOTAL	**14,05,83,000**	**14,05,83,000**	**14,05,83,000**	**0**	**100**
CORPUS FUND						
1	CAPITAL	58,11,294	58,11,294	58,11,294	0	100
2	GENERAL	19,37,098	19,37,098	19,37,098	0	100
	TOTAL	77,48,392	77,48,392	77,48,392	0	100
	GRAND TOTAL	**14,83,31,392**	**14,83,31,392**	**14,83,31,392**	**0**	**100**
CRP on SA						
1	CAPITAL	9,43,000	9,43,000	9,43,000	0	100
2	GENERAL	9,00,000	9,00,000	9,00,000	0	100
3	SCSP-GENERAL	1,62,848	1,62,848	1,62,848	0	100
	TOTAL	**20,05,848**	**20,05,848**	**20,05,848**	**0**	**100**
KVK, Khunti						
1	GIA-GENERAL	6,77,760	5,71,200	5,71,200	0	100
2	TSP-CAPITAL	23,50,427	23,50,427	23,50,427	0	100
3	TSP- GENERAL	13,56,000	13,56,000	13,56,000	0	100
4	SCSP- GENERAL	1,00,000	1,00,000	1,00,000	0	100
6	VKSA	1,10,000	1,10,000	1,10,000	0	100
7	Swachata Action Plan	1,00,000	1,00,000	1,00,000	0	100
8	CFLD on Oilseeds	59,250	59,250	59,250	0	100
9	PM-DDK	75,000	75,000	75,000	0	100
10	PM-KISAN	75,000	75,000	75,000	0	100
	TOTAL	**49,03,437**	**47,96,877**	**47,96,877**	**0**	**100**
	GRAND TOTAL	**15,52,40,677.00**	**15,51,34,117.00**	**15,51,34,117.00**	**0**	**100**

PERSONNEL

Strength of ICAR-NISA as on 31.12.2025

Sl. No.	Cadre	Sanctioned Strength	In Position	Vacant
1.	Scientific	42 + 1	27 + 1	15
2.	Technical (Cat. I)	41	28	13
	Technical (Cat.II)	20	12	08
3.	Administrative	28 + 1	13+ 1	15
4.	MTS	43	22	21
	TOTAL	**175 + 1**	**103 + 1**	**72**

KVK, Khunti

Sl. No.	Cadre	Sanctioned Strength	In Position	Vacant
1.	Scientific	01	01	-
2.	Technical (Cat. I)	02	-	02
	Technical (Cat.II /T-4)	03	-	03
	Technical (Cat.III)	06	06	-
3.	Assistant	01	-	01
4.	Stenographer	01	-	01
5.	MTS	02	-	02
	TOTAL	**16**	**07**	**09**

Details of employees as on 31.12.2025

Sl. No.	Name of the employee	Designation of employee	Email ID (ICAR)
Category: Scientific			
1.	Dr Abhijit Kar	Director	abhijit.kar@icar.org.in
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4.	Dr Saroj Kumar Giri	Principal Scientist & Head	saroj.giri@icar.org.in
5.	Dr Debabandya Mohapatra	Principal Scientist & Head	debabandya.mohapatra@icar.org.in
6.	Dr Soumen Ghosal	Principal Scientist	soumen.ghosal@icar.org.in
7.	Dr Nawalesh Kumar Sinha	Principal Scientist	nawalesh.sinha@icar.org.in
8.	Dr Jyotirmoy Ghosh	Principal Scientist	jyotirmay.ghosh@icar.org.in
9.	Dr Vaibhav D. Lohot	Principal Scientist	vaibhav.lohot@icar.org.in

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22.	Er Pradosh Kumar Paramaguru	Scientist	p.paramaguru@icar.org.in
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20.	Shri Dewbrat Hari	STA	dewbrat.hari@icar.org.in
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24.	Shri Jaleshwar Horo	Technician	jaleshwar.horo@icar.org.in
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26.	Shri Binay Kumar Singh	Technician	bnay.singh1@icar.org.in
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31.	Shri Bhupendra Sahu	Technician	bhpendra.sahu@icar.org.in
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34.	Shri Dinesh Kumar	Technician	dinesh.kumar018@icar.org.in
35.	Shri Prabhat Kumar Singh	Technician	prabhat.singh92@icar.org.in
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37.	Shri Ashwini Kumar	Technician	ashwini.kumar2@icar.org.in
38.	Shri Shravan Kumar Mandal	Technician	shravan.mandal@icar.org.in
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40.	Mrs Manju Devi	Technician	manju.devi@icar.org.in
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5.	Shri Kameshwar Oraon	AAO	kameshwar.oraon@icar.org.in
6.	Shri Arun Kumar Tripathi	AAO	arun.tripathi1@icar.org.in
7.	Shri Krishna Murari Kumar	AAO	krishna.kumar2@icar.org.in
8.	Shri Arjun Gope	Assistant	arjun.gope@icar.org.in
9.	Mrs Laxmi Kumari	Assistant	laxmi.jha@icar.org.in
10.	Shri Vishwanath Anand	Assistant	vishwanath.anand@icar.org.in
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6.	Dr Achintya Pramanik	Senior Scientist	achintya.pramanik@icar.org.in
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13.	Shri Anmol Dan Kindo	Senior Technician	anmol.kindo@icar.org.in
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8.	Dr Haraprasad Naiya	STA	haraprasad.naiya@icar.org.in
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11.	Shri Ashwini Kumar	Technician	ashwini.kumar2@icar.org.in
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10.	Shri Binod Kumar Nayak	MTS	b.kumarnayak@icar.org.in
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11.	Shri Balram Ram	MTS	balram.ram@icar.org.in
12.	Shri Chandan Kumar Nayak	MTS	chandan.kumar2235@icar.org.in
13.	Shri Yogendra Sharma	MTS	yogendra.sharma1@icar.org.in
14.	Shri Bhim Nayak	MTS	bhim.nayak@icar.org.in
15.	Shri Pramod Kumar Nayak	MTS	pramod.kumar96@icar.org.in
16.	Shri Sajeet Kachhap	MTS	sajeet.kachhap@icar.org.in
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4.	Shri Luis Ekka	MTS	luis.ekka@icar.org.in
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14.	Shri Ashish Kumar	Lower Division Clerk	ashish.kumar2@icar.org.in
15.	Shri Lodo Lakra	MTS	lodo.lakra@icar.org.in
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21	Shri Ajit Kumar	MTS	ajit.mahto1@icar.org.in
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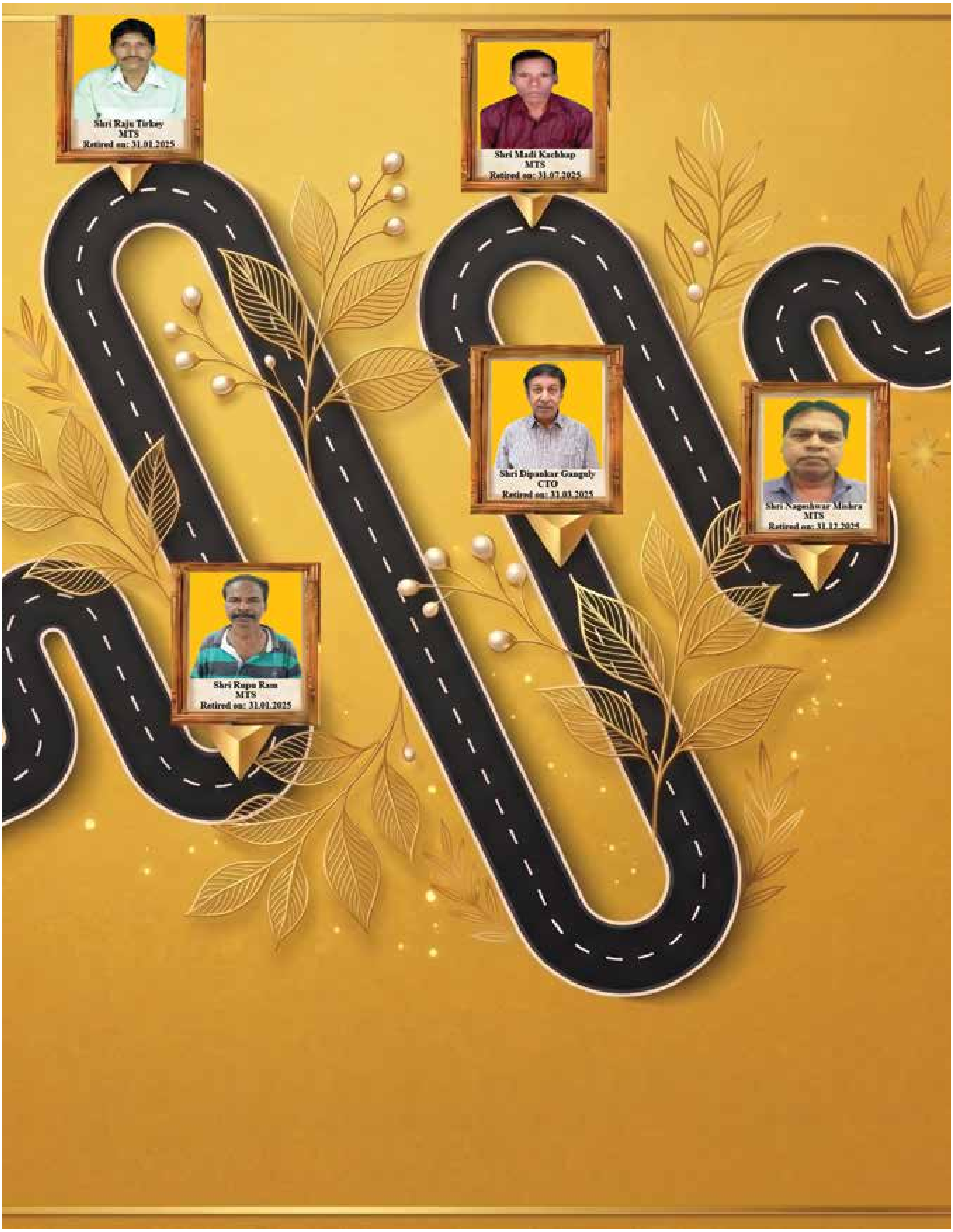
JOINING


NEW JOINEES
TO THE INSTITUTE
SCIENTIFIC CADRE
TECHNICAL CADRE
ADMINISTRATIVE CADRE
MTS CADRE

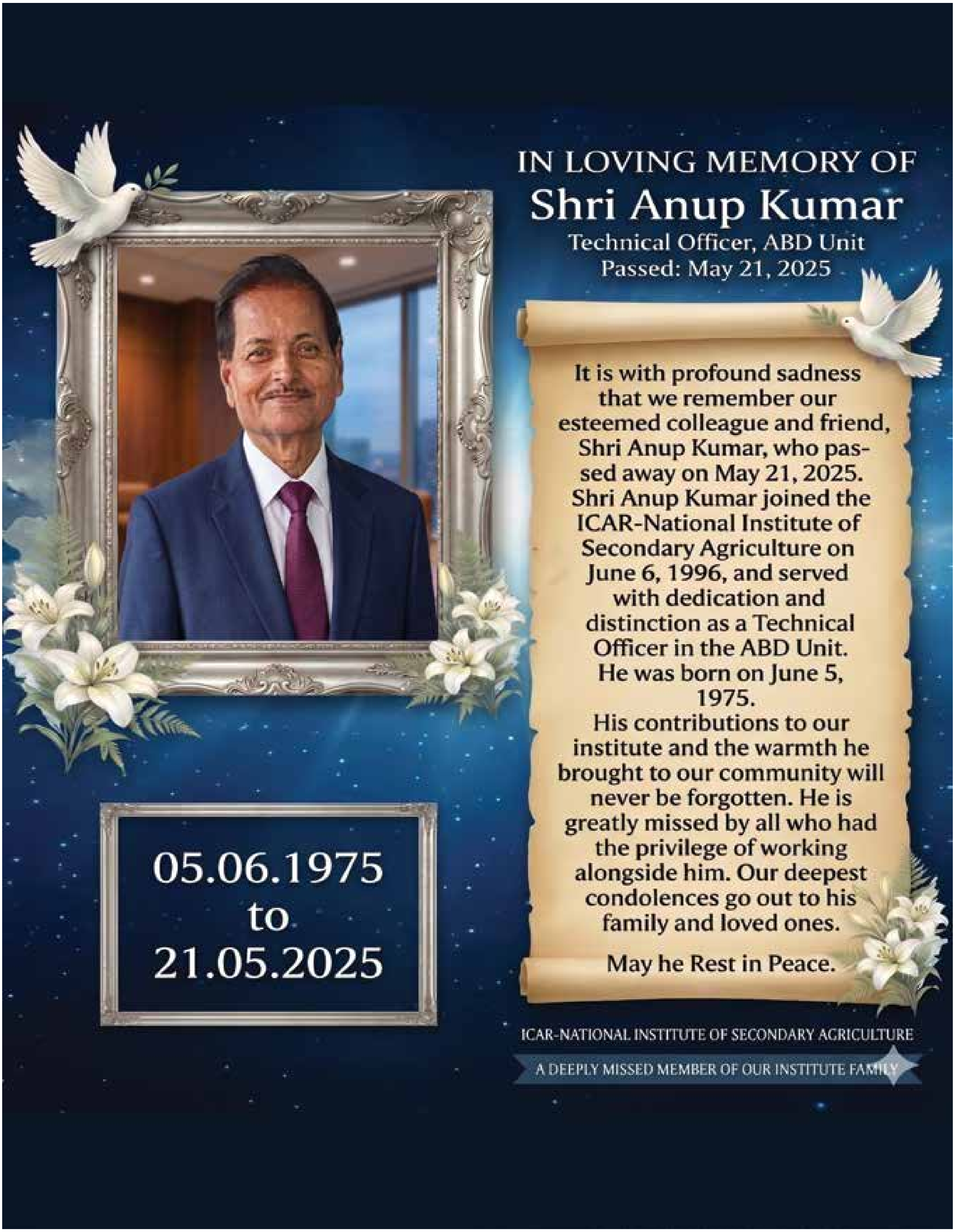
PROMOTION

TRANSFER

RETIREMENT


Shri Raju Tirkey
MTS
Retired on: 31.01.2025
Shri Madi Kachhap
MTS
Retired on: 31.07.2025
Shri Dipankar Ganguly
CTO
Retired on: 31.03.2025
Shri Nageshwar Mishra
MTS
Retired on: 31.12.2025
Shri Rupu Ram
MTS
Retired on: 31.01.2025

OBITUARY


IN LOVING MEMORY OF
Shri Anup Kumar
Technical Officer, ABD Unit
Passed: May 21, 2025
It is with profound sadness that we remember our esteemed colleague and friend, Shri Anup Kumar, who passed away on May 21, 2025. Shri Anup Kumar joined the ICAR-National Institute of Secondary Agriculture on June 6, 1996, and served with dedication and distinction as a Technical Officer in the ABD Unit. He was born on June 5, 1975.
His contributions to our institute and the warmth he brought to our community will never be forgotten. He is greatly missed by all who had the privilege of working alongside him. Our deepest condolences go out to his family and loved ones.
May he Rest in Peace.
05.06.1975
to
21.05.2025
ICAR-NATIONAL INSTITUTE OF SECONDARY AGRICULTURE
A DEEPLY MISSED MEMBER OF OUR INSTITUTE FAMILY

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