



1924-2024

Anniversary Celebration



Annual Report 2024

लाह उत्पादन के माध्यम से
खुशहाली एवं समृद्धि



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

Namkum, Ranchi - 834 010 (Jharkhand)

नामकुम, राँची - 834 010 (झारखण्ड)





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PREFACE



This issue of the annual report has a special significance as we celebrate a monumental milestone – the 100th anniversary of ICAR-NISA. This milestone not only marks our rich history but also serves as a catalyst for our future endeavors. ICAR-NISA, which began its journey as a research institute in the British era in 1924, has evolved into the National Institute of Secondary Agriculture. We were honored to have the President of India grace us with her presence during this landmark celebration, underscoring the importance of our work in advancing agriculture. On this momentous occasion, we also had the privilege of releasing several publications, including books, folders, and leaflets, furthering our commitment to disseminating knowledge and research.

Rooted in our history, we stand as global leaders in lac research, a testament to our unwavering expertise. We proudly maintain a lac host gene bank and continue to strive for improved rooting and yield of lac from the host plants through various agronomic and pest management practices. Our research initiatives continue to make remarkable progress, particularly in the development of smart packaging systems and the extraction of cellulose from alternative resources, such as banana pseudo-stem, water hyacinth, and *Lantana camara*. The development of gum-based binders for producing millet chapatis can lead to a paradigm shift in how we perceive millet-based products. Gum-based hydrogels have proven their merit in absorbing dyes from wastewater. This innovation has the potential to tackle environmental pollution. A lac-based formulation for enhancing the shelf life of fresh fruits, such as litchi, has seen success. Similarly, a natural dye-based indicator for intended use in smart packaging systems and 3D printing has been developed. We are not limited to technology and protocol development; the tools and equipment developed for the production and processing of lac and allied produce, like gum tapping tools, guar-gum processing machinery, button-lac production equipment, lac dye recovery system, and cinchona uprooting machines, need special mention as they are turning ideas into reality. Our foray into the non-destructive quality evaluation of traditional medicinal products using spectroscopy has taken shape, as we have gained some insight into this area, which will serve as the basis for developing handheld gadgets.

This year, we hosted a 3-day regional agriculture fair, a resounding success with overwhelming participation from over 1000 farmers each day. These events are the fruits of our collective effort and dedication to our profession, inspiring us for the future. Additionally, multiple MOUs were signed to strengthen collaborations and expand our impact across various sectors. One of the proudest achievements of this quarter was receiving ICAR certification for three of our technologies on ICAR Foundation Day, which highlights the cutting-edge work we are doing in the field of secondary agriculture.

Our scientists are continually striving for personal and professional growth, as evidenced by their published research papers, books, book chapters, popular articles, and the awards and accolades they received this year. They are actively participating in national and international conferences and workshops, sharing their ideas that can bring about positive change. Many of our scientists are also part of national-level committees, which showcases our commitment to our profession.

I extend my heartfelt congratulations to our dedicated staff for their tireless efforts. It is with great pride that I share this issue of the annual report with you, celebrating our collective achievements and the bright future ahead.

Dr. Abhijit Kar
Director



C O N T E N T S

EXECUTIVE SUMMARY	1
कार्यकारी सारांश	4
INTRODUCTION	7
General Information	7
Divisions/Unit and their Objectives	7
Meteorological Observations	8
Organogram	9
RESEARCH ACCOMPLISHMENTS	10
Agri-Bioresources Augmentation Division	10
Agricultural Structures & Process Engineering Division	16
Downstream Agro-Processing Division	19
Automation & Plant Engineering Division	24
Agri-Business Development Unit	26
SALIENT ACHIEVEMENTS UNDER NETWORK PROJECTS	28
Network Project on Conservation of Lac Insect Genetic Resources (CLIGR)	28
Network Project on Harvesting, Processing and Value Addition of Natural Resins and Gums (HPVA-NRG)	43
Consortium Research Project (CRP) on Secondary Agriculture	58
SUCCESS STORY	59
TECHNOLOGY DISSEMINATION	61
Training Conducted	61
List of MOU signed by ICAR-NISA, Ranchi	63
Agri Business Incubation (ABI)	64
Institute Technology Management Unit (ITMU)	64
Licensing & Certification	65
Radio/TV Talk	65
KRISHI VIGYAN KENDRA, KHUNTI	66
HUMAN RESOURCE DEVELOPMENT	80
Academic Cell (ICAR-NISA)	80
Training Programs Attended	81
Presentation in Conferences/Seminars/Symposia/Workshops	82
Events & Meeting Attended	83
Visit of Foreign Delegates to ICAR-NISA	84
AWARDS, HONOURS AND RECOGNITION	85
हिन्दी प्रकोष्ठ की गतिविधियां	86
PUBLICATIONS	88
EVENTS ORGANIZED BY INSTITUTE	94
IMPORTANT COMMITTEES	104
BUDGET	105
PERSONNEL	106
DETAILS OF JOINING, PROMOTION, SUPERANNUATION & TRANSFER	110

EXECUTIVE SUMMARY

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

- **Gene bank for lac insect lines and host plants:** In the conservation program of lac host plants, 1050 cultures representing 48 lac insect lines are being maintained on *Flemingia macrophylla* at the National Lac Insect Germplasm Centre (NATLIGEC). Additionally, 92 accessions from 65 host plant species are being conserved in the lac host field gene bank.
- **Mutagen treatment for bringing genetic variability in *F. semialata*:** Significant difference has been observed in M_2 generation of *F. semialata* with higher plant height in all the treated plants and the highest number of leaves in T_3 ($NaNO_3$ 0.75 mM + MNU 1.5 mM), while T_1 ($NaNO_3$ 2.0 mM + MNU 1.5 mM) had the maximum basal diameter of the plants.
- **Performance evaluation of selected *F. semialata* genotypes for winter kusmi lac production:** The 125 selected genotypes have shown significantly higher crawler density (65 crawlers/cm²), plant height, fresh biomass, broodlac yield (267 g/plant) and scrapped lac yield (72.3 g). Multi-location trials with 3,000 seedlings at five locations in Jharkhand, has shown satisfactory plant establishment and growth.
- **Revalidation of lac yield potential in *Ziziphus mauritiana*, varieties for winter kusmi lac:** Mehrawali has exhibited the highest broodlac output ratio (10.5), scrapped lac yield (85.4%) and maximum lac incrustation.
- **Process protocol for rooting enhancement in kusum:** In optimizing asexual propagation protocols for *Butea monosperma* and *Schleichera oleosa* using air layering, maximum rooting has been achieved with IBA 1500 ppm + NAA 750 ppm, yielding 80% success in *B. monosperma* and 90% in *S. oleosa*.
- **Growth of palas tree as affected by topography and soil fertility levels:** Considering the factors responsible for *palas* (*Butea monosperma*) growth in relation to lac yield, the dry matter content of shoots is 9.5% lower under lowland conditions, liming has reduced the dead branch incidence by 38% over the control and enhanced flower bunch production with the recommended NPK dose. Lac yield in the lowland plots has produced a yield ratio of 3.26, which is 34% lower than that observed for upland areas (yield ratio 5.01).
- **Eco-friendly approach for management of sooty mold:** The treatment having combination all three bio-agents (*T. viride*, *P. fluorescence* and *B. subtilis*) with alternate spray has shown the highest efficacy (52% infestation) than the single-agent treatments.
- **Evaluation of biopesticides for the management of spiralling whitefly:** Biopesticides demonstrated efficacy in managing *Aleurodicus dispersus* infestations on lac-inoculated *F. semialata*, while conserving natural enemies and ensuring minimal impact on lac insects. *Metarhizium anisopliae* at 2 g/L has been the most effective treatment, followed by *Beauveria bassiana* (2 g/L) and azadirachtin 1500 ppm (2.5 mL/L). Although imidacloprid (0.3 mL/L) has effectively controlled whiteflies, it is deemed to be unsuitable for its adverse effects on lac insects and associated beneficial fauna.
- **Assessment of the synergistic integration of apiculture with lac-based agroforestry by intercropping:** Intercropping of strawberry (c.v. Winter Down) with lac-inoculated *F. semialata* and introduction of *Apis cerana* colonies (@ 2 colonies/acre), has shown significantly enhanced bee pollination, increasing the strawberry yield by up to 70%. Furthermore, enhanced bee visit frequency on *F. semialata* based lac agro-ecosystem has resulted in reduced sooty mold incidence on lac, and increased seed set in *F. semialata*.

Development of Value-added products and process protocols

- **Cellulose extraction from banana pseudostem:** The cellulose was extracted from banana pseudostem (23.9%) and water hyacinth biomass (24.3%) using alkali hydrolysis. The deep eutectic solvent was employed to extract cellulose from water hyacinth biomass resulting higher cellulose yield (29.9%). The extracted cellulose was subjected to ultrasonication treatment for preparation of nanocellulose from lignocellulosic biomass as a green alternative method.
- **Extraction of cellulose from *Lantana camara* agri-biomass:** Cellulose extraction from the *Lantana camara* stem biomass has been carried out using alkaline hydrolysis followed by bleaching using hydrogen peroxide, with a cellulose yield of 23.4%.
- **Development of matrix independent NRG based gluten free binder for use with millets and pseudo cereals:** Guar and psyllium gum (individual: 1-2.5% & in-combinations: 1.25%) have been found to be the best gluten free binders to be mixed in *Bajra*, *Ragi* & *Jowar* for preparation of gluten free chapati.
- **Energy efficient and high recovery process for extracting essential oils from lemongrass:** Deep eutectic solvents extraction of essential oil from lemongrass has the same yield as that of hydro-distillation (≈ 1.1 mL/100 g) with 50% reduction in extraction time.
- **Remediation of dye using gum arabic hydrogel:** Brilliant green dye adsorption onto gum Arabic hydrogel has been found to be a multistage adsorption process, while the positive value of the Gibbs free energy (ΔG°) increases from 30.86 to 32.58 kJmol⁻¹ when temperature increases from 25 °C to 45 °C, suggesting favourable adsorption at higher temperature and its non-spontaneous nature.
- **Lac-based formulation for increasing shelf life of litchi:** A lac-based coating has shown positive effect on shelf life of litchi even after 5 days of storage. The treatment of litchi with two lac-based formulations, 70:30 dilutions with water and 50:50 dilution with water, has exhibited least color change, loss in weight, decay, discoloration %age and flavor.
- **Natural dye-based intelligent indicators:** Natural dye-based intelligent ink formulation has been developed with ethanol (95%) as base formulation, where Ethyl cellulose and titanium dioxide (TiO₂) have been found to be the most suitable binder, and optimal filler, respectively. The developed ink formulation has shown excellent printability and adhesion on paper, LDPE, HDPE, PP, and PVC flexible films
- **Evaluation of the rheological behavior of molten seedlac:** Rheological behavior of molten seedlac evaluated at 11 different temperatures ranging from 80 to 130 °C at constant shear rate (1/sec). It has exhibited viscous behavior at temperatures 80-95 °C as compared to higher temperatures indicating that seedlac may be heated at ≥ 100 °C for effectual melt-filtration.
- **UV-Vis-NIR and FTIR analysis of Triphala:** FTIR analysis of Harad and Dabur Triphala suggested broad peaks between 3700–2800 cm⁻¹ corresponding to –OH stretching, a peak at 2368 cm⁻¹ due to aliphatic –CH and –CH₂ stretching, and a peak at 1719 cm⁻¹ related to carboxylic acid groups and Ester groups at peaks around 1120 cm⁻¹ in all samples. Aonla has exhibited a unique UV-Vis-NIR spectral curve, with peaks between 800–1400 nm, while Harad and Bibhitaki displayed similar spectra.
- **Ultrasonication assisted lac dye recovery using membrane technology:** A feasibility study on ultrafiltration for lac dye recovery from the lac wash water has shown encouraging results.

Development of prototypes and machinery

- **Development of a prototype of lac filtration unit:** Research work is being carried out at ICAR-NISA to replace the bhatta method of button lac production with newer technology. In this regard, a prototype of lac-filtration unit (4 kW heat source, filtration unit length 38 cm) has been developed and evaluated.

- **Development for guar gum processing plant:** A pilot plant (capacity: 5 kg/batch) consisting of different units installed, has been improvized, and evaluated for carboxymethyl guar gum derivative preparation, and quality parameters were found closer to the acceptable value.
- **Development of a sustainable gum production hand tool:** A hand operated gum tapping tool has been developed to increase gum production with lesser time, reduced injury to trees, reduced man power requirement and minimal application of gum inducer.
- **Development of cinchona tree uprooting equipment:** Design of the cincona tree uprooting machine has been achieved.

Technology transfer, training and capacity building

The Agri-Business Development Unit, ICAR-NISA, Ranchi regularly organizes capacity-building programs on scientific lac cultivation, processing, and utilization, addressing the needs of various stakeholders, including farmers, aspiring entrepreneurs, students, and self-help groups. Beyond on-campus sessions, extensive field outreach activities such as off-farm training and technical guidance through field visits are also conducted. A total of 17,303 stakeholders have benefited from these skill development initiatives. These efforts are designed to equip individuals with essential knowledge and expertise, fostering proficiency in scientific lac cultivation while promoting economic advancement and agricultural sustainability in the region.

Krishi Vigyan Kendra, Khunti

In the year 2024, KVK Khunti organized six on farm trials (OFT) and 643 demonstrations in 210 ha and 89 training programs where 2730 participants were participated. For mass awareness 274 other extension activities have been organized, where 59289 (male: 30803 & female: 28486) farmers and extension personnel participated.

Publication

In the year 2024, 38 research papers, 6 books, 1 booklet, 10 book chapters, 9 extension folders, 23 popular articles and 8 patents were published.

Revenue Generation

Generated revenue of Total ₹ 52.24 lakh through training, exposure visit etc. (Farmers training & exposure visits etc.- ₹ 46.38 lakhs, Technology/Know-how transfer of NRG process & products etc.- ₹ 6.86 lakhs)

Sl. No.		Particulars	Revenue Generation (₹ In Lakh)
1	Institute	Farmers training & exposure visits	46.38
2		Technology/Know-how transfer of NRG process & products	6.86
		Total	52.24
3	KVK	KVK, produces	3.14
		Grand total	55.38

कार्यकारी सारांश

कृषि उत्पादों के स्रोतों का संग्रह, संरक्षण, सुधार और निर्माण

- **लाख कीट लाइनों और पोषक पौधों के लिए जीन बैंक:** लाख पोषक पौधों के संरक्षण कार्यक्रम में, 1050 कल्चर जो 48 लाख कीट लाइनों का प्रतिनिधित्व करते हैं, *फ्लेमिंगिया मैक्रोफिला* पर राष्ट्रीय लाख कीट जननद्रव्य केंद्र (एन ए टी एल आई जी ई सी) में बनाए रखा जा रहा है। इसके अतिरिक्त, 65 पोषक पौधों की प्रजातियों से 92 एक्सेसन लाख पोषक क्षेत्र जीन बैंक में संरक्षित हैं।
- **एफ. सेमीयालता में आनुवंशिक विविधता लाने के लिए म्यूटाजेन उपचार:** एफ. सेमीयालता की M_2 पीढ़ी में व्यापक अंतर देखा गया है, जिसमें सभी उपचारित पौधों में अधिक पौधों की ऊंचाई और T_3 ($NaNO_3$ 0.75 mM + MNU 1.5 mM) में सबसे अधिक पत्तियों की संख्या है, जबकि T_1 ($NaNO_3$ 2.0 mM + MNU 1.5 mM) में पौधों का अधिकतम सतह का व्यास है।
- **सर्दियों के कुसमी लाख उत्पादन के लिए चयनित फ्लेमिंगिया सेमीयालता जीनोटाइप का प्रदर्शन मूल्यांकन:** 125 चयनित जीनोटाइप ने काफी अधिक क्रॉलर घनत्व (65 क्रॉलर/सेमी²), पौधों की ऊंचाई, ताजा बायोमास, बीहन उपज (267 ग्राम/पौधा) और छिली लाख उपज (72.3 ग्राम) दिखाई है। झारखंड में पांच स्थानों पर 3,000 पौधों के साथ बहु-स्थान परीक्षण ने संतोषजनक पौधों के विकास और वृद्धि को दिखाया है।
- **सर्दियों के कुसमी लाख के लिए जीजीफस माउरीशियाना किस्मों में लाख उपज क्षमता का पुनर्मूल्यांकन:** मेहरावली ने उच्चतम बीहन उपज अनुपात (10.5), छिली लाख उपज (85.4%) और अधिकतम लाख इनक्रस्टेशन (परत निर्माण/लेपन) दिखाया है।
- **कुसुम में जड़ वृद्धि के लिए प्रक्रिया प्रोटोकॉल:** ब्यूटिया मोनोस्पर्म और स्लिचेरा ओलिएसा के लिए एयर लेयरिंग का उपयोग करके अक्रिय प्रजनन प्रोटोकॉल को अनुकूलित करने में, IBA 1500 ppm + NAA 750 ppm के साथ अधिकतम जड़ों का विकास रहा, जिससे ब्यूटिया मोनोस्पर्म में 80% और ब्यूटिया मोनोस्पर्म स्लिचेरा ओलिएसा में 90% सफलता प्राप्त हुई है।
- **पलास पेड़ की वृद्धि पर स्थलाकृति और मिट्टी की उर्वरता स्तर का प्रभाव:** पलास (ब्यूटिया मोनोस्पर्म) वृद्धि के लिए जिम्मेदार कारकों को ध्यान में रखते हुए, निम्नभूमि स्थितियों में टहनियों की शुष्क पदार्थ सामग्री 9.5% कम है, चुने हुए NPK मात्रा के साथ फूलों के गुच्छों के उत्पादन में वृद्धि हुई है और नियंत्रण की तुलना में मृत शाखा की संख्या में 38% की कमी आई है। निम्नभूमि प्लॉटों में लाख उपज अनुपात 3.26 है, जो ऊपरी क्षेत्रों (उपज अनुपात 5.01) में देखे गए अनुपात से 34% कम है।
- **सूटी मोल्ड प्रबंधन के लिए इको-फ्रेंडली दृष्टिकोण:** तीन बायो-एजेंट (टी. विरीडी, पी. एस फ्लोरेसेंस और बी. सबटिलिस) के संयोजन के साथ वैकल्पिक छिड़काव ने एकल एजेंट की तुलना में उच्चतम प्रभावकारिता (52% संक्रमण) दिखाई है।
- **स्पाइरलिंग व्हाइटफ्लाई प्रबंधन के लिए बायोपेस्टिसाइड मूल्यांकन:** बायोपेस्टिसाइड ने लाख-संचारित फ्लेमिंगिया सेमीयालता पर एल्यूरोडिकस डिस्पर्सस संक्रमणों के प्रबंधन में प्रभावकारिता प्रदर्शित की है, जबकि प्राकृतिक शत्रुओं का संरक्षण और लाख कीटों पर न्यूनतम प्रभाव सुनिश्चित किया है। 2 ग्राम/लीटर पर मेटाराइजियम एनिसोप्लिया सबसे प्रभावी उपचार पाया गया है, इसके बाद ब्यूवेरिया बेसियाना (2 ग्राम/लीटर) और अज़ाडिरैक्टिन 1500 पीपीएम (2.5 मिली/लीटर) हैं। हालांकि इमिडाक्लोप्रिड (0.3 मिली/लीटर) ने सफेद मक्खियों को प्रभावी ढंग से नियंत्रित किया है, लेकिन इसके लाख कीटों और संबंधित लाभकारी जीवों पर प्रतिकूल प्रभाव के कारण इसे अनुपयुक्त माना जाता है।
- **मधुमक्खी पालन के सहक्रियात्मक एकीकरण का मूल्यांकन लाख-आधारित कृषि वानिकी के साथ अंतरफसल द्वारा:** स्ट्रॉबेरी (विविधता विंटर डाउन) को लाख-संचारित फ्लेमिंगिया सेमीयालता के साथ अंतरफसल करना और एपिस सेराना कॉलोनियों (@ 2 कॉलोनियां/एकड़) का देने के कारण काफी अच्छे स्तर तक मधुमक्खी परागण को बढ़ाया है, जिससे स्ट्रॉबेरी की पैदावार में 70% तक की वृद्धि हुई है। इसके अतिरिक्त, फ्लेमिंगिया सेमीयालता आधारित लाख कृषि-परिस्थितिकी तंत्र पर मधुमक्खी भ्रमण आवृत्ति में वृद्धि के परिणामस्वरूप लाख पर सूटी मोल्ड की घटनाओं में कमी आई है और फ्लेमिंगिया सेमीयालता में बीज के जमने में वृद्धि हुई है।

मूल्य वर्धित उत्पादों और प्रक्रिया प्रोटोकॉल का विकास

- **केले के छद्म तने से सेल्युलोज निष्कर्षण:** केले के छद्म तने और जलकुंभी बायोमास से सेल्युलोज को क्षारीय हाइड्रोलिसिस का उपयोग करके निकाला गया था। जलकुंभी बायोमास से सेल्युलोज निकालने के लिए डीप यूटेक्टिक सॉल्वेंट का उपयोग किया गया था। निकाले गए सेल्युलोज को लिग्नोसेल्युलोजिक बायोमास से नैनोसेल्युलोज तैयार करने के लिए एक हरित वैकल्पिक विधि के रूप में अल्ट्रासोनिकेशन उपचार के अधीन किया गया था।
- **लैंटाना कैमेरा कृषि बायोमास से सेल्युलोज निष्कर्षण:** लैंटाना कैमेरा स्टेम बायोमास से सेल्युलोज निष्कर्षण क्षारीय हाइड्रोलिसिस और हाइड्रोजन पेरोक्साइड का उपयोग करके ब्लीचिंग के बाद किया गया, जिसमें 23.4% की सेल्युलोज उपज प्राप्त हुई है।
- **बाजरा, रागी और ज्वार के लिए मैट्रिक्स निराश्रित एन आर जी आधारित ग्लूटेन फ्री बाइंडर का विकास:** बाजरा, रागी और ज्वार में उपयोग के लिए मैट्रिक्स निराश्रित एनआरजी आधारित ग्लूटेन फ्री बाइंडर की मात्रा को अनुकूलित किया गया है। ग्वार और साइलियम गोंद [व्यक्तिगत (1-2.5%) और संयोजन (1.25%)] बाजरा, रागी और ज्वार में मिलाने के लिए सबसे अच्छा ग्लूटेन फ्री बाइंडर पाया गया है।
- **लेमनग्रास से तेल निकालने के लिए ऊर्जा संयत और उच्च मात्रा में प्राप्त करने की प्रक्रिया:** लेमनग्रास से तेल को डीप यूटेक्टिक सॉल्वेंट (DES) का उपयोग करके निकाला गया है और हाइड्रोडिस्टिलेशन विधि (HD) के साथ तुलना की गई है। DES निष्कर्षण में HD के समान उपज (~1.1 मिली/100 ग्राम) है, जिसमें निष्कर्षण समय में 50% की कमी है।
- **अरबी गोंद के हाइड्रोजेल का उपयोग करके डाई का उपचार:** ब्रिलियंट ग्रीन डाई का गम अरबी हाइड्रोजेल पर अधिशोषण एक बहुस्तरीय अधिशोषण प्रक्रिया पाई गई और जब तापमान 25°C से 45°C तक बढ़ जाता है तब गिब्स फ्री ऊर्जा (ΔG°) का सकारात्मक मान 30.86 से 32.58 kJmol⁻¹ तक बढ़ जाता है, जो उच्च तापमान पर अनुकूल अधिशोषण और इसके गैर-स्वतःस्फूर्त प्रकृति का सुझाव देता है। इसलिए, अधिशोषण प्रक्रिया डाई द्वारा ही नियंत्रित नहीं होती है, बल्कि अधिशोषक की प्रकृति पर निर्भर करती है।
- **लीची के शेल्फ लाइफ बढ़ाने के लिए लाख-आधारित फॉर्मूलेशन:** लाख-आधारित कोटिंग ने 5 दिनों के बाद भी लीची के शेल्फ लाइफ पर सकारात्मक प्रभाव दिखाया है। लीची के उपचार में दो लाख-आधारित फॉर्मूलेशन, 70:30 और 50:50 पानी के साथ मिलावट ने कम से कम रंग परिवर्तन, वजन घटाने, क्षय, रंगहीनता प्रतिशत और स्वाद दिखाया।
- **प्राकृतिक डाई-आधारित इन्टेलिजेन्ट संकेतक:** प्राकृतिक डाई-आधारित इन्टेलिजेन्ट इंक फॉर्मूलेशन विकसित किया गया है, जिसमें इथेनॉल (95%) आधार फॉर्मूलेशन के रूप में है, जहां एथिल सेल्युलोज और टाइटेनियम डाइऑक्साइड (TiO₂) क्रमशः सबसे उपयुक्त बाइंडर और इष्टतम फिलर के रूप में पाया गया। विकसित स्याही फॉर्मूलेशन ने कागज, LDPE, HDPE, PP और PVC लचीली फिल्मों पर उत्कृष्ट छपाई और आसंजन(चिपकने) की क्षमता दिखाई।
- **पिघले सीडलाख के रियोलॉजिकल व्यवहार का मूल्यांकन:** पिघले हुए सीडलाख के रियोलॉजिकल व्यवहार का मूल्यांकन 80 से 130°C के बीच 11 अलग-अलग तापमान पर स्थिर कतरनी दर (1/सेकंड) पर किया गया है। इसने 80-95°C के तापमान पर चिपचिपा व्यवहार प्रदर्शित किया है, जो दर्शाता है कि सीडलाख को प्रभावी पिघल-फिल्ट्रेशन के लिए $\geq 100^\circ\text{C}$ पर गरम किया जा सकता है।
- **त्रिफला का UV-Vis-NIR और FTIR विश्लेषण:** हरड़ और डाबर त्रिफला के FTIR विश्लेषण ने 3700-2800 से.मी.⁻¹ के बीच व्यापक अधिकतम मान दर्शाए, जो -OH स्ट्रेचिंग के अनुरूप हैं। 2368 से.मी.⁻¹ पर एक अधिकतम मान अलिप्टिक -CH और -CH₂ स्ट्रेचिंग के कारण है, और 1719 से.मी.⁻¹ पर एक अधिकतम मान कार्बोक्जिलिक एसिड समूहों और एस्टर समूहों से संबंधित है, जो लगभग 1120 से.मी.⁻¹ पर सभी नमूनों में देखा गया है। आंवला ने 800-1400 एनएम के बीच अधिकतम मान के साथ एक अद्वितीय UV-Vis-NIR स्पेक्ट्रल वक्र प्रदर्शित किया है, जबकि हरड़ और बिभीतकी ने समान स्पेक्ट्रा दिखाया है।
- **मेम्ब्रेन तकनीक के प्रयोग से पराध्वनिक सहायक लाख डाई रिकवरी:** लाख के धुले पानी से लाख डाई की रिकवरी पर अल्ट्राफिल्ट्रेशन के अध्ययन ने अत्यंत ही उत्साहजनक परिणाम दर्शाए।

प्रोटोटाइप और मशीनरी का विकास

- **लाख फिल्टरेशन यूनिट का प्रोटोटाइप विकास:** आईसीएआर-एनआईएसए में बटन लाख उत्पादन की भट्टा विधि को नई तकनीक से बदलने के लिए अनुसंधान कार्य किया जा रहा है। इस संबंध में, एक लाख-फिल्टरेशन यूनिट (4 किलोवाट ऊष्मा स्रोत, फिल्टरेशन यूनिट लंबाई 15 इंच) का प्रोटोटाइप विकसित और मूल्यांकन किया गया है।
- **ग्वार गोंद प्रसंस्करण संयंत्र का विकास:** पायलट संयंत्र (क्षमता: 5 किग्रा/बैच) जिसमें विभिन्न इकाइयाँ स्थापित की गई हैं उसे कार्बोक्सीमिथाइल ग्वार गोंद डेरिवेटिव निर्मित करने के लिए सुधारा और मूल्यांकन किया गया है, और गुणवत्ता मापदंड स्वीकार्य मानक के अनुरूप पाए गए हैं।
- **हस्त संचालित गोंद टैपिंग औजार का विकास:** एक हस्त संचालित गोंद टैपिंग औजार विकसित किया गया है जो कम समय में गोंद उत्पादन बढ़ाने, पेड़ों को कम से कम क्षति करने, श्रम की आवश्यकता को कम करने और गोंद इंड्यूस्टर के न्यूनतम अनुप्रयोग के साथ है।
- **सिंकोना पेड़ की छाल उखड़ने वाले उपकरण का विकास:** सिंकोना पेड़ की छाल उखड़ने वाली मशीन का डिजाइन हासिल किया गया है।

प्रौद्योगिकी हस्तांतरण, प्रशिक्षण और क्षमता निर्माण

- आईसीएआर-एनआईएसए, रांची की कृषि-व्यवसाय विकास ईकाई नियमित रूप से वैज्ञानिक विधि से लाख उत्पादन, प्रसंस्करण और उपयोग पर क्षमता-निर्माण कार्यक्रम आयोजित करती है, जिसमें किसानों, इच्छुक उद्यमियों, छात्रों और स्वयं सहायता समूहों सहित विभिन्न हितधारकों की जरूरतों को संबोधित किया जाता है। परिसर में सत्रों के अलावा, विस्तृत क्षेत्र आउटरीच(प्रत्येक ग्रामीणों तक पहुँचने का प्रयास) गतिविधियाँ जैसे कि फार्म से बाहर प्रशिक्षण और क्षेत्र भ्रमण के माध्यम से तकनीकी मार्गदर्शन भी आयोजित किया जाता है। कुल 17,303 हितधारकों ने इन कौशल विकास पहलों से लाभ उठाया है। ये प्रयास व्यक्तियों को आवश्यक ज्ञान और विशेषज्ञता से समृद्ध करने के लिए निर्मित किए गए हैं, जो वैज्ञानिक विधि से लाभ की खेती में प्रवीणता को बढ़ावा देते हैं जिससे कि क्षेत्र में आर्थिक प्रगति और कृषि स्थिरता को बढ़ावा मिलता है।

कृषि विज्ञान केन्द्र, खूंटी

- वर्ष 2024 में, कृषि विज्ञान केन्द्र, खूंटी ने 210 हेक्टेयर में छह ऑन-फार्म परीक्षण (OFT) और 643 प्रदर्शन आयोजित किए, साथ ही 89 प्रशिक्षण कार्यक्रम भी आयोजित किए जिनमें 2730 प्रतिभागियों ने भाग लिया। जन जागरूकता के लिए, 274 अन्य विस्तार गतिविधियों का आयोजन किया गया, जिसमें 59289 (पुरुष-30803 और महिला-28486) किसानों और विस्तार कर्मियों ने भाग लिया।

प्रकाशन

पिछले वर्ष 2024 में कुल 38 अनुसंधान पत्र, 6 पुस्तकें, 1 पत्रिका, 10 पुस्तक अध्याय, 9 प्रसार फोल्डर, 23 प्रचलित लेख एवं 8 पेटेंट प्रकाशित हुए।

राजस्व सृजन

प्रशिक्षण एवं अन्य गतिविधियों (किसान प्रशिक्षण, विभिन्न भ्रमण गतिविधि, प्रौद्योगिकी, एन.आर.जी. प्रक्रिया एवं उत्पाद का हस्तांतरण) के माध्यम से कुल रु. 50.24 लाख का रोजगार सृजित किया गया।

क्र. सं.		विषय/क्षेत्र	राजस्व सृजन (रु. लाख में)
1	संस्थान	किसान प्रशिक्षण एवं अवलोकन भ्रमण	46.38
2		प्रौद्योगिकी, एन.आर.जी. प्रक्रिया एवं उत्पाद का हस्तांतरण	6.86
		कुल	52.24
3	के.वी.के.	के.वी.के. के विभिन्न उत्पाद	3.14
		कुल योग	55.38

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 the month of 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 & DG-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/Unit 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.

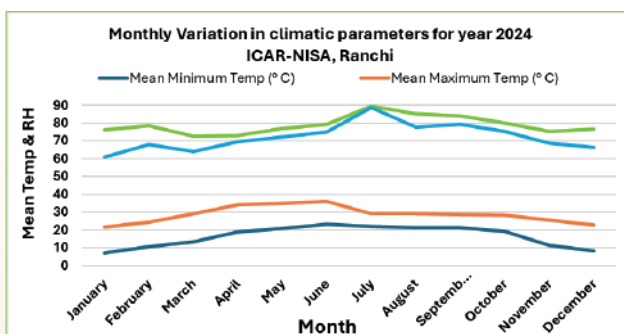
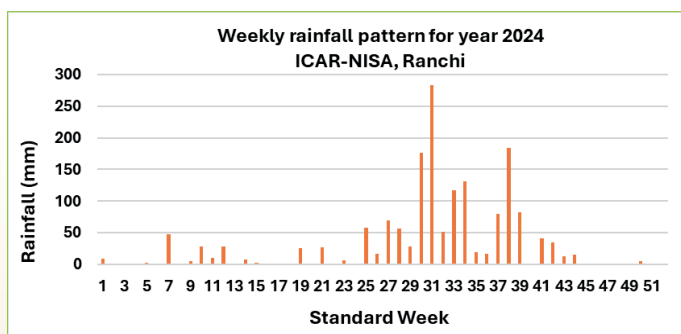
Over the years, the Institute has developed many successful technologies. Training and skill enrichment programs for different types of stake holders, viz., farmers, manufacturers, upcoming entrepreneurs, extension functionaries, teachers, students, etc., of either gender have been continuing for a long 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".

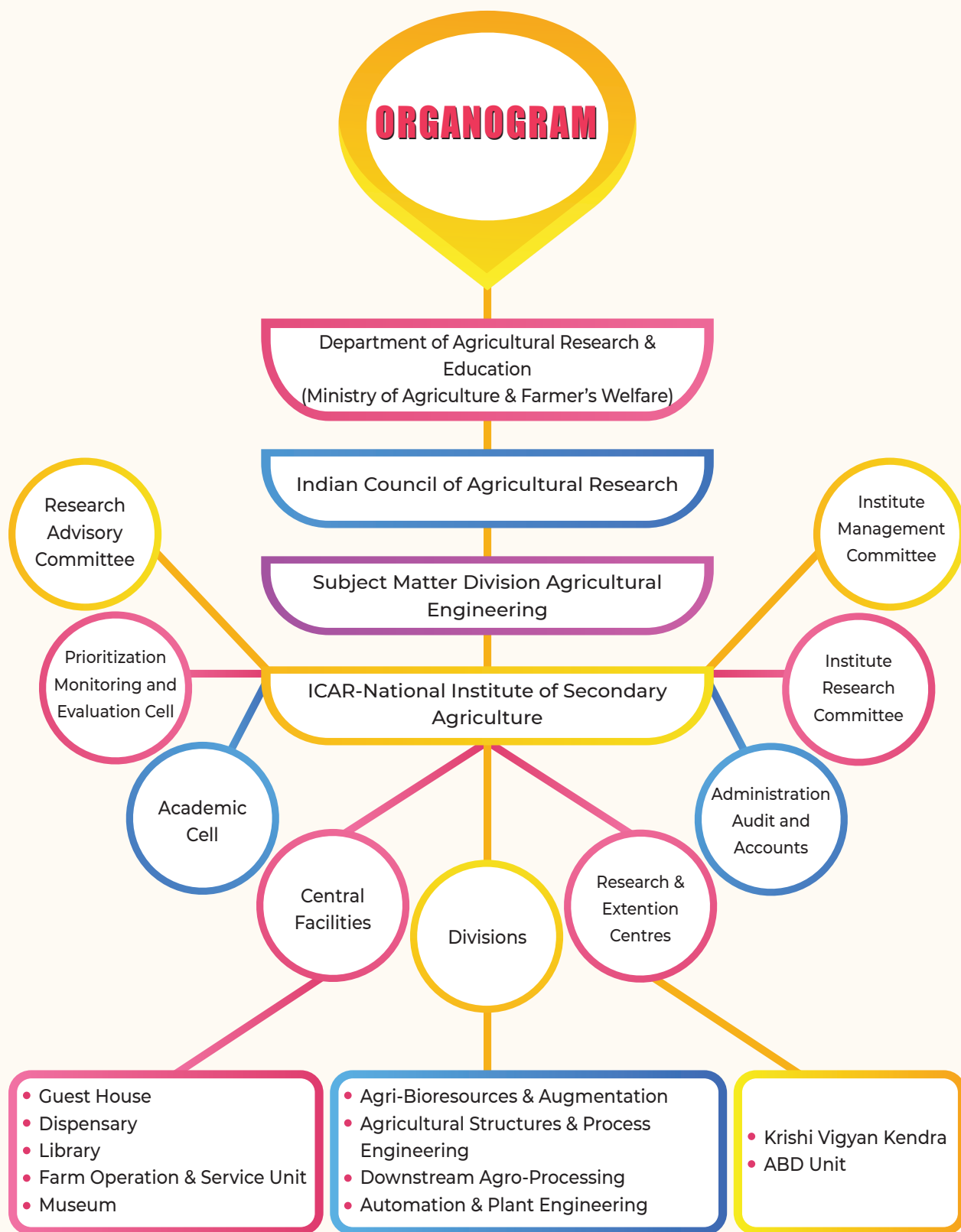
Meteorological Observations

Agro-meteorological observatory of the Institute is located at 23° 23' N latitude and 85° 23' E longitude, at an elevation of 650 m above mean sea level. Rainfall, minimum and maximum temperatures, minimum and maximum relative humidity (RH) have been recorded on a regular basis at the observatory. Salient meteorological observations for 2024 are:

Monsoon arrived on June 20, 2024, one week after its normal arrival course and withdrew on

October 31, 2024. The year's highest rainfall (150.8 mm) has been recorded on August 03, 2024. Annual rainfall of 1690.80 mm occurred on 119 rainy days during the year 2024. The maximum temperature of the year (41.5 °C) has been recorded on May 29, 2024, while the minimum temperature (2.4 °C) has been recorded on December 15, 2024. The monthly average Relative Humidity (RH) in the morning (7:30 am) varied from 72.7 to 89.4%, while in the afternoon (2:30 pm), it varied from 60.7 to 88.6%.





RESEARCH ACCOMPLISHMENTS

Agri-Bioresources Augmentation Division

Maintenance of lac insect gene bank, host plant gene bank and different host plots

Ninety-two collections of 65 species are being conserved in the lac host field gene bank; 1050 cultures of 48 lac insect lines are being conserved on *F. macrophylla* in the National Lac Insect Germplasm Centre (NATLIGEC). The Swadi palas plantations, consisting of 75 plants, are being conserved in a separate plot. *Calliandra calothyrsus* (95 plants with a spacing of 4 m × 8 m) and Rain tree (*Albizia saman*) (30 plants with a spacing of 8 m × 8 m) are being maintained in separate plots for evaluation.

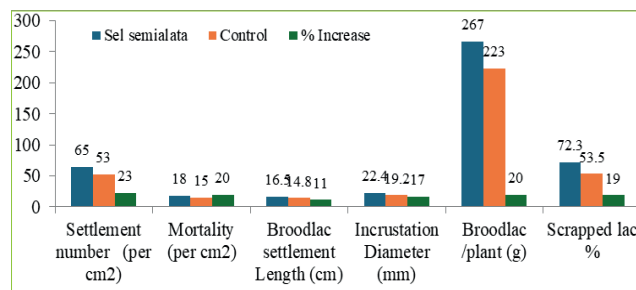
Variability study on M₂ generation plants of *Flemingia semialata*

Assessment of the genetic variability in only one available germplasm of *F. semialata* under a new plot of M₂ generation of the treated seeds with two mutagens combination viz., sodium azide (NaN₃) @2 mM and 1.5 mM and N-Nitroso-N-methyl urea (NMU) @ 0.75 mM and 0.5 mM with 223 seedlings along with selected and control semialata plants, during rainy season of 2024, has been carried out. A significant morphological variation has been observed in the vegetative phase of M₂ plants. The morphologically variant plants have been tagged for further evaluation. The maximum plant height in all treatments is higher than in the selected

and control. In general, the extreme range of the number of leaves is higher in the treated seedlings and maximum with T3 (NaN₃ 0.75 mM + MNU 1.5 mM) treatment, whereas the extreme range of basal diameter is highest in T1 (NaN₃ 2.0 mM + MNU 1.5 mM) treatment.

Performance evaluation of winter kusmi lac on selected *F. semialata* plants

The seedlings of selected plants and control have been transplanted in 2022. Fifty-gram good quality kusmi broodlac has been inoculated in 360 bushes while taking adequate lac cultivation measures for proper growth and development. Data recorded from 125 selected and 25 control plants of *F. semialata* reveals that the crawler settlement per square centimetre is 65 and 53 in the selected and control, respectively. The plant height, fresh biomass, and scrapped lac yield are higher in the selection than in the control, as depicted in the following graph.



Performance of winter kusmi lac on selected *F. semialata*

Morphological variations of mutated/ modified plants of *Flemingia semialata*

Treatments	Composition	n	Range		Plant height (cm)	Range		Leaf number	Range		Basal dia. (mm)
			Max	Min		Max	Min		Max	Min	
T1:	NaN ₃ 2.0 mM + MNU 1.5 mM	71	54	7	26.5	30.0	1.0	9.4	11.2	3.5	6.7
T2:	NaN ₃ 2.0 mM + MNU 0.5 mM	71	54	12	26.5	20.0	2.0	9.7	9.5	4.0	6.6
T3:	NaN ₃ 0.75 mM + MNU 1.5 mM	199	58	9	31.4	38.0	2.0	11.2	9.8	3.1	6.3
T4:	NaN ₃ 0.75 mM + MNU 0.5 mM	166	58	7	30.0	23.0	3.0	10.4	9.7	3.0	6.2
S:	Selected	52	48	12	32.6	21.0	3.0	9.4	8.3	3.3	6.0
C:	Control	40	46	10	28.1	17.0	2.0	10.0	10.4	3.2	6.2
	Total	599									

Multi-locational performance evaluation of selected *F. semialata* for stability

Multi-locational trials (MLT) on selected semialata have been planned to know the actual potential of this line for lac production. For establishing MLT, 3000 semialata seedlings have been transplanted at Krishi Pathsala, Patamda, East Singbhum; Krishi Vigyan Kendra, Kisko, Lohardaga; Krishi Vigyan Kendra, Bano, Saraikela; Krishi Vigyan Kendra Bishunpur, Gumla; and Krishi Vigyan Kendra, Torpa, Khunti. The growth has been found to be satisfactory.



Torpa, Khunti



Kisko, Lohardaga


Birra, Jharkhand, India
W9MX-WQF, Birra, Jharkhand 832105, India

Patamda, E. Singbhum

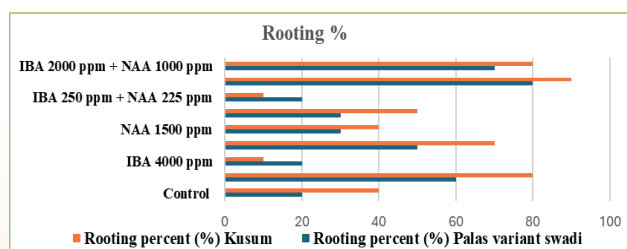
Multi-locational evaluation of selected *F. semialata* for stability of performance

Optimum rooting response of PGRs (plant growth regulators) on air layering propagated palas (*Butea monosperma*) and kusum (*Schleichera oleosa* Lour.)

A set of experiments has been initiated to standardize the protocol for mass propagation of palas (*B. monosperma*) and kusum (*S. oleosa* Lour.), the lac host tree species in India. The

effects of different treatments of plant growth regulators (PGRs) viz., IBA 3000 ppm, IBA 4000 ppm, NAA 250 ppm, NAA 1500 ppm, NAA 2000 ppm, IBA 250 ppm + NAA 225 ppm, IBA 1500 ppm + NAA 750 ppm, and IBA 2000 ppm + NAA 1000 ppm on the rooting ability have been investigated in fresh branch of palas variant swadi and kusum (*Schleichera oleosa* Lour) tree, selected from the phenotypically superior trees. The study reveals that the treatment IBA 3000 ppm, NAA 250 ppm, IBA 1500 ppm + NAA 750 ppm and IBA 2000 ppm + NAA 1000 ppm application significantly enhances the rooting percentage of the species of palas with a tune of 60, 50, 80 and 70%, respectively. In contrast, in kusum, the rooting percentages observed are 80, 70, 90 and 50%, respectively. The results indicate that the application IBA 1500 ppm + NAA 750 ppm has been the best for effective rooting in air layering, a suitable vegetative propagation technique for the palas (*Butea monosperma*) and kusum (*Schleichera oleosa* Lour) followed by IBA 2000 ppm + NAA 1000 ppm.


Air layering of Palas variant Swadi (*Butea monosperma*)

Air layering of Kusum (*Schleichera oleosa* Lour)


Optimum rooting response in air layering propagated palas variant swadi and kusum under different treatments of Plant Growth Regulators.

Performance of fruit ber variety as lac host plant for winter *kusmi* broodlac production

The lac yield production potential of fruit-bearing varieties has been revalidated as a lac host plant for winter *kusmi* lac. Mehrawali excelled in broodlac production with an output ratio of 10.5, followed by Illaichi (8.9), Seb (7.4), Seb × Tikadi

BC1 (7.3), Banarasi Pebandi (7.2), Kaithali (7.2). CAZRI Gola, used as a check, also performed well, with an output ratio of 5.3. Mehrawali has the highest scrapped lac yield (85.4%), followed by Kali, Banarasi Pebandi, and Kaithali. The highest brood lac settlement length has been recorded in Kaithali, whereas the highest lac incrustation is in Mehrawali, as depicted in the following table.

Winter *kusmi* lac production potential of fruit ber varieties

Patamda, E. Singbhum	Treatment Variety	Broodlac settlement length (cm)	Broodlac settlement diameter (mm)	Broodlac yield (g)		Broodlac output ratio		Scraped lac ratio	
		Mean	Mean	Mean	S.E.	Mean	S.E.	Mean	S.E.
1	Bagwadi	52.3	18.1	1,094.5	24.5	3.7	0.1	68.8	2.7
2	Illaichi	72.5	21.7	2,612.5	241.5	8.9	0.9	68.4	2.6
3	Meharwali	58.3	22.9	3,093.5	91.5	10.5	0.3	85.4	1.0
4	Kali	59.0	18.9	1,949.0	61.0	6.6	0.2	75.5	5.3
5	Cazri Gola	48.2	21.5	1,556.0	90.0	5.3	0.3	61.8	5.3
6	Reshmi	59.7	21.0	1,153.0	214.0	3.9	0.7	69.7	3.3
7	Katha	63.8	19.5	1,398.0	117.0	4.7	0.4	57.8	5.4
8	F1 Seb * Gola	59.5	22.4	1,756.5	482.5	6.0	1.7	71.5	4.8
9	BC1 Seb * Tikadi	46.2	19.4	2,134.5	67.5	7.3	0.3	62.2	6.2
10	Chhuhara	62.2	19.3	674.0	69.0	2.3	0.2	54.1	1.4
11	Umran	18.7	14.3	723.0	15.0	2.5	0.1	26.1	0.3
12	Jogia	66.2	20.6	1,957.5	165.5	6.7	0.6	68.2	5.1
13	Banarsi Karaka	50.7	19.3	2,125.5	166.5	7.2	0.6	63.0	0.8
14	ZG-3	45.3	18.0	1,209.0	185.0	4.1	0.6	59.4	1.2
15	Seb	28.2	20.7	2,162.0	38.0	7.4	0.2	34.9	0.3
16	Kaithali	75.8	21.0	2,123.5	122.5	7.2	0.4	69.2	1.7
17	Banarsi Pebandi	67.7	21.3	1,803.5	188.5	6.2	0.7	70.9	6.1
18	Mundia	33.8	24.3	1,763.5	6.5	6.0	0.0	60.0	1.2
SE (m)				175.0		0.6		3.8	
C.D.				526.4		1.8		11.4	
C.V.				14.2		14.3		8.6	

Impact of topography, soil fertility, and rest intervals on palas tree growth and lac yield.

Different growth parameters, e.g. number of dead branches, flower bunch and fruit bunch per 10 cm trunk diameter, has been recorded with respect to

different topography (upland and lowland), fertility levels (control, lime 2 kg/ tree, recommended dose (lime 2 kg + urea / DAP 300 g + 800 g MOP) and double the recommended dose) and rest period (7 months and 19 months). The number of dead branches per 10 cm trunk diameter are 76% higher

under lowland conditions compared to uplands. Flower and fruit production are significantly higher in upland conditions. The shoot dry matter content was 9.5% lower in the lowlands, and the difference was statistically significant. Among soil fertility treatments, liming notably reduced dead branch count by 38% compared to the control, while liming combined with recommended NPK dosage significantly enhanced flower bunch production. A rest period of 19 months markedly increased fruit bunches per 10 cm trunk diameter to 0.98 (in average), over a 7 month rest period having fruit bunches per 10 cm trunk diameter to 0.06 (in average), emphasizing the importance of adequate recovery time.

The lac yield ratio (YR) under upland conditions (5.01) was significantly higher by approximately 34% than in lowland conditions (3.26), potentially attributable to the lower male proportion (19%) observed in uplands compared to lowlands (25%). Among soil fertility-improving treatments, liming was most effective, yielding a maximum lac yield ratio of 5.49, in contrast to the control (3.17). At the same time, chemical fertilizers resulted in intermediate values ranging from 3.3 to 4.6. Rest period significantly influenced yield; a 19-month rest resulted in a higher lac yield ratio (4.8) than a 7-month rest (3.47). Correspondingly, the male population was slightly lower (20%) with longer rest compared to those with shorter rest (23%).

Among different agronomic factors, i.e., topography, fertility levels, and rest period, the first one proved to be the most effective on lac yield attributes. The encrustation thickness was 3.62 mm and 3.26 mm in upland and lowland conditions, respectively (i.e., 11% thicker than in the lowland). Sticklac and broodlac weight was 18% and 19% higher in uplands than in lowlands respectively. The highest rate of soil fertility (urea/DAP at 600 g each, MOP at 1600 g, and lime at 4 kg/tree) resulted in a maximum encrustation thickness of 3.87 mm, compared to 3.34 mm in the control. Different rest periods could not influence these attributes.

Growth of ber trees as affected by application of different levels of lime, phosphate solubilizing bacteria (PSB), Farm Yard Manure (FYM) and Jeevamrit

Variations in different growth attributes of ber trees, as affected by various factors, such as liming, PSB, FYM, and Jeevamrit at different levels, were analyzed for interpretation. Range for observation on number of shoots and cumulative shoot diameter per 10 mm branch diameter has been found between 1.22-1.31 number of shoots/10 mm branch diameter and 15.1 – 17.03 mm for lime application rates, i.e. 0-200 g/ m². Application @ 100 g/ m² assumed the highest value. However, liming at the highest rate resulted in maximum production of dry matter per 10 mm branch diameter. Phosphate-solubilizing bacteria showed a slight increase in the number of shoots, cumulative shoot diameter, and dry biomass per 10 mm branch diameter. The increase in these attributes was to the tune of 14.4%, 12.2%, and 32.4%. *Givamrit* application has shown a positive influence on dry biomass per 10 mm branch diameter. An increase of 8.3% was observed.

Growth and broodlac production in *semialata* plants as affected by application of different levels of lime, phosphate solubilizing bacteria (PSB), Farm Yard Manure (FYM) and Jeevamrit

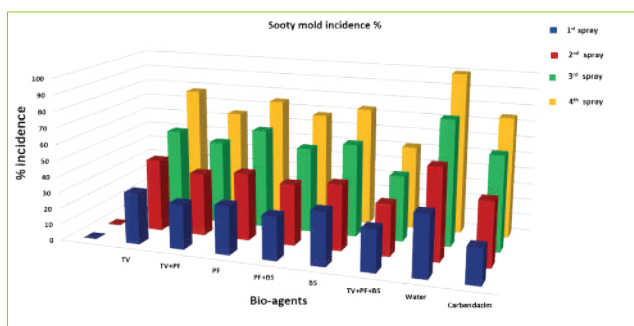
Growth parameters as affected by different levels of lime, PSB, FYM and *Jeevamrit* application showed varying levels of responses. The biomass weight of plants, both under inoculated and uninoculated conditions, and broodlac production per plant have recorded their best performance with the application of 100 g lime/ m². The brood lac weight produced in the best treatment was 143g, compared to 97 g in control. A 40% increase in plant biomass weight was observed. PSB application was found to reduce broodlac production to the tune of 34 % (134 g in control compared to 88 g in application). The FYM application could increase biomass by 25%, while broodlac production increased by 16%. The *Jeevamrit* application could increase biomass production by 2-18%, while broodlac production could be increased by 45% (131 g in treated plots compared to 91 g in control plots).

Liming at 100 g/m² showed a tendency for higher broodlac production per plant, i.e., 143 g against 96 g in the control. PSB application proved to show lower production, i.e. 88 g only under treated plot as compared to 133 g in control. FYM and *Jeevamrit* applications tended to produce higher brood lac per plant. FYM could produce 119 g against 102 g

in control and *Jeevamrit* produced 131 g against 90 g in control.

Eco-friendly management of sooty mold: Evaluation of bio-agents for sustainable control

Due to the significant environmental and ecological hazards associated with chemical insecticides and pesticides, bioagents were selected as an alternative for managing sooty mould and associated insect pests. The efficacy of three bio-agents, *Trichoderma viride*, *Pseudomonas fluorescens*, and *Bacillus subtilis*, in various combinations against the fungi responsible for sooty mold development, has been evaluated and compared with the local existing practices of spraying carbendazim at 0.1%. The experiment consisted of eight different treatment approaches for managing sooty mold. T1: four sprays of *Trichoderma viride* (TV). T2: an alternate spray pattern of *Trichoderma viride* and *Pseudomonas fluorescens* (PF), beginning with *Trichoderma viride*. T3: four sprays of *Pseudomonas fluorescens*. T4: alternating spray of *Pseudomonas fluorescens* and *Bacillus subtilis* (BS), starting with *Pseudomonas fluorescens*. T5: four sprays of *Bacillus subtilis*. T6: sequential application method, beginning with *Trichoderma viride*, followed by *Pseudomonas fluorescens*, then *Trichoderma viride* again, and concluding with *Bacillus subtilis*. T7: negative control, where no treatment was applied. T8: four sprays of the chemical fungicide carbendazim at 0.1% as a comparative standard.



The negative control (T7), treated with water, showed the highest incidence, reaching 100 % after the fourth spray, confirming the absence of control measures. The best-performing treatment (T6) resulted in the lowest infestation rate (52%) after the fourth spray. The carbendazim treatment

(T8) resulted in an infestation rate of 75%. Treatments involving only one bio-agent (TV, PF and BS) showed higher incidence compared to combination treatments, indicating that a single bio-agent may not be sufficient for effective control. Alternate bio-agent treatments (T2 and T4) performed moderately well, with infestation rates lower than those of single-agent treatments but not as effective as the sequential multi-agent application (T6). *Trichoderma viride* alone (T1) had an infection rate of 78%, suggesting it provided moderate control but was not highly effective when used alone. *Pseudomonas fluorescens* alone (T3) resulted in a 75% infection rate, indicating a mild effect. *Bacillus subtilis* alone (T5) had a 74% infestation rate, performing slightly better than *Trichoderma* and *Pseudomonas* alone. All these bioagents are comparable to carbendazim, a regular practice among local farmers.

Evaluation of biopesticides for the management of spiralling whitefly (*Aleurodicus dispersus*) on lac-inoculated *F. semialata*

The spiralling whitefly (*Aleurodicus dispersus*) is a major pest of lac-inoculated *F. semialata*, a host plant for the lac insect (*Kerria lacca*). Conventional systemic insecticides, such as imidacloprid, are ineffective due to their non-selectivity, which harms lac insects.



White fly infestation on untreated *F. semialata* leaf

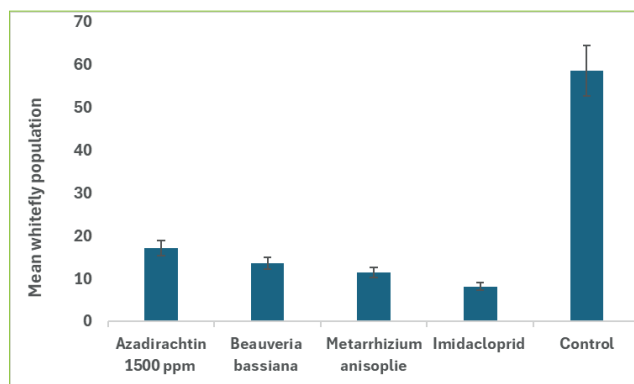
This study evaluated the efficacy of three biopesticides against spiralling whiteflies while assessing their impact on natural enemies and lac insects. Treatments included: T1: Azadirachtin 1500 ppm @ 2.5 mL/L; T2: Beauveria bassiana @ 2 g/L; T3: Metarrhizium anisoplie @ 2 g/L; T4 (Positive

Control): Imidacloprid @ 0.3 mL/L; Negative Control: No spray.



White fly population after 5 days of treatment with *Metarrhizium anisopliae* @ 2 g/L

Whitefly population: The average whitefly population per leaf varied significantly across treatments. The negative control (no spray) recorded the highest whitefly population at 58.7 ± 12.8 adults per leaf, indicating severe infestation.

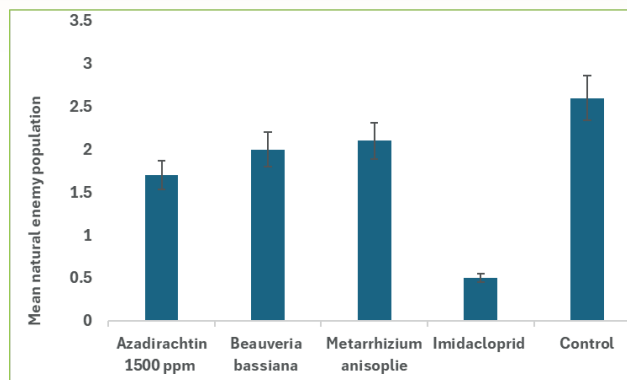


Effects of different treatments on whitefly population in *F. semialata*

Among the treatments, *M. anisopliae* (T3) was the most effective, reducing the whitefly population to 11.4 ± 6.2 adults per leaf. This was followed by *B. bassiana* (T2) with 13.7 ± 5.5 adults per leaf and azadirachtin (T1) with 17.2 ± 7.8 adults per leaf. Imidacloprid (T4), the positive control, also showed efficacy with 8.2 ± 1.9 adults per leaf, but its non-selectivity made it unsuitable for lac cultivation.

Natural enemy population: The populations of syrphid and coccinellid natural enemies were

significantly affected by the treatments. The negative control recorded the highest natural enemy population at 2.6 ± 0.14 individuals per leaf, reflecting minimal disturbance in the absence of chemical interventions.



Effects of different treatments on whitefly natural enemy population

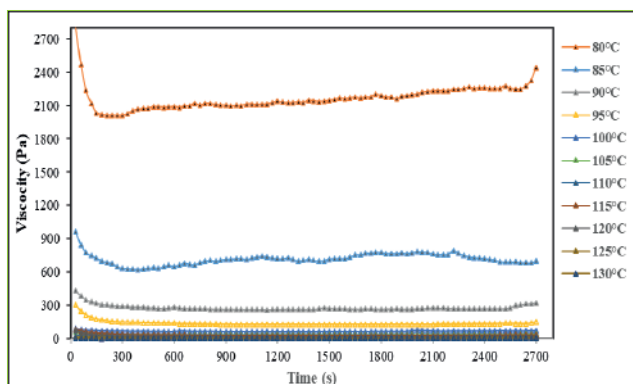
Among the biopesticides, *M. anisopliae* (T3) preserved natural enemies the best, with 2.1 ± 0.17 individuals per leaf, followed by *B. bassiana* (T2) with 2.0 ± 0.15 individuals per leaf and azadirachtin (T1) with 1.7 ± 0.2 individuals per leaf. In contrast, imidacloprid (T4) drastically reduced natural enemy populations to 0.5 ± 0.1 individuals per leaf, highlighting its detrimental impact on beneficial insects.

Lac insect mortality: The number of dead lac insect cells per cm^2 also showed significant variation among treatments. The negative control recorded the lowest lac insect mortality at 0.1 dead cells per cm^2 , indicating minimal natural mortality. Among the biopesticides, *M. anisopliae* (T3) caused the least lac insect mortality at 0.1 dead cells per cm^2 , followed by azadirachtin (T1) and *B. bassiana* (T2), both with 0.2 dead cells per cm^2 . Imidacloprid (T4) caused significant lac insect mortality, with 4 dead cells per cm^2 , underscoring its non-selectivity and unsuitability for lac cultivation. *M. anisopliae* emerged as the most effective and selective biopesticide, followed by *B. bassiana* and azadirachtin. Imidacloprid, while effective against whiteflies, was unsuitable due to its harmful effects on lac insects and natural enemies.

Agricultural Structures & Process Engineering Division

Evaluation of the rheological behavior of molten seedlac

During lac processing, seed lac (semi-refined lac) is filtered to obtain refined lac (button lac/shellac) through a process of simultaneous melting and filtration. This process is known as hot filtration or melt filtration. Seedlac melts at nearly 75 °C; however, its viscosity remains very high at this temperature, making filtration difficult. Hence, the viscosity of molten seedlac needs to be lowered considerably by heating it to temperatures higher than its melting point, allowing for efficient melt filtration. However, no detailed study is available on the temperature-dependent viscosity and rheological behavior of molten seedlac. Hence, a study has been conducted to evaluate the rheological behavior of molten seedlac at various temperatures, ranging from 80 °C to 130 °C at 5 °C intervals. The viscosity of seedlac decreased significantly ($p < 0.05$) with test temperature indicating that seedlac is more viscous in the temperatures range of 80-95 °C as compared to higher temperatures (100-130 °C), implying that at constant shearing, seedlac may be heated at ≥ 100 °C to achieve effectual melt-filtration.



Rheological behavior of molten seedlac at different temperatures

Development of a prototype of lac filtration unit

Seedlac is hot-filtered using a wood- and charcoal-fired furnace (*Bhatta*). However, these bhattas are disadvantageous in terms of environmental pollution, operator drudgery and un-even product quality. Hence, efforts are being made at ICAR-NISA, Ranchi, to develop a newer technology that

can overcome the drawbacks of the *Bhatta* method. In this regard, a prototype of the lac filtration unit has been developed. It features a large filtration area and provisions for continuous filter replacement. It is equipped with electricity-based radiation heaters of 4 kW as a heating source. It has been observed that the developed prototype could filter the seedlac as per the requirement, be operated by a single semi-skilled operator, and precise control could be established over the temperature and exposure time of the seedlac. Hence, further development work is being carried out.

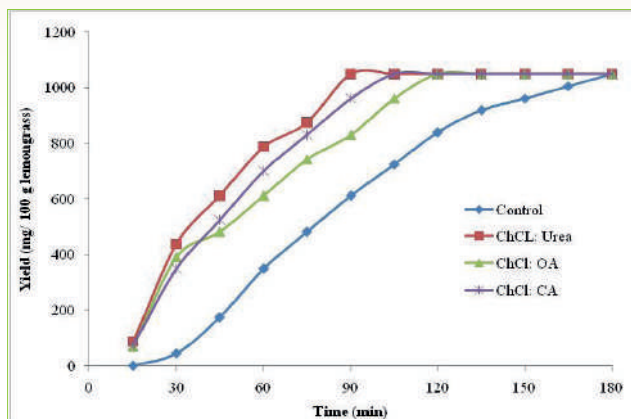


Prototype of a lac extruder

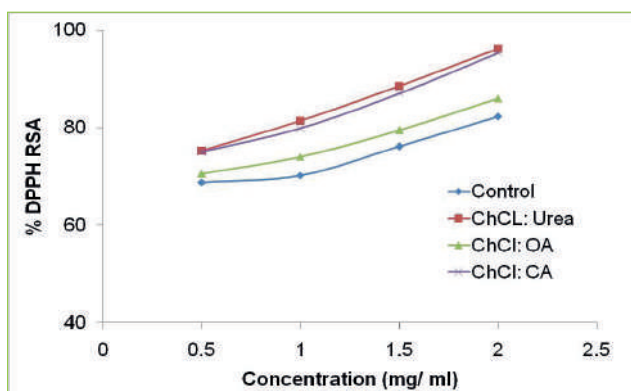
Development of energy efficient and high recovery process for extracting essential oils from aromatic plants

Essential oils (EO) are odorous, volatile, hydrophobic and highly concentrated complex mixtures of secondary metabolites comprised of low-boiling-point phenylpropanes and terpenes. The green extraction of essential oils (EOs) with Deep eutectic solvents (DESs) has been explored as a novel and efficient alternative to hydrodistillation. The EO from lemongrass has been extracted using different DES, composed of choline chloride and urea (DES 1), choline chloride and oxalic acid (DES 2), and choline chloride and citric acid (DES 3), in various molar ratios at a concentration of 10%. The yield of EO was found to be 1.2 mL/100 g of fresh lemongrass. The extraction time has been reduced by 50%, 33.3%, and 42.7%, respectively, when using urea, oxalic acid-, and citric acid-based deep eutectic solvents (DES) compared to hydrodistillation. The

antioxidant activity, measured in terms of DPPH radical scavenging activity, showed significantly higher activity in EO extracted with DES 1 and DES 3.



Extraction kinetic of lemongrass EO with different DES



Antioxidant activity of lemongrass EO

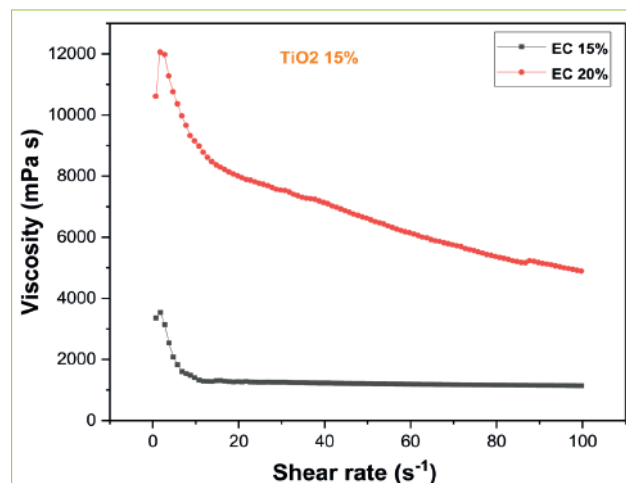


Lemongrass EO extracted by different methods :
(a) hydrodistillation, (b) ChCl: Urea,
(c) ChCl: oxalic acid, (d) ChCl: Citric acid

Natural dye-based intelligent indicators for real-time freshness monitoring of packaged perishable food products

Screen printing technology has been selected to produce intelligent indicators due to its cost-effectiveness, excellent operability, simple manufacturing process, and capability for large-scale production. A custom screen was designed for printing of different sizes and shapes of

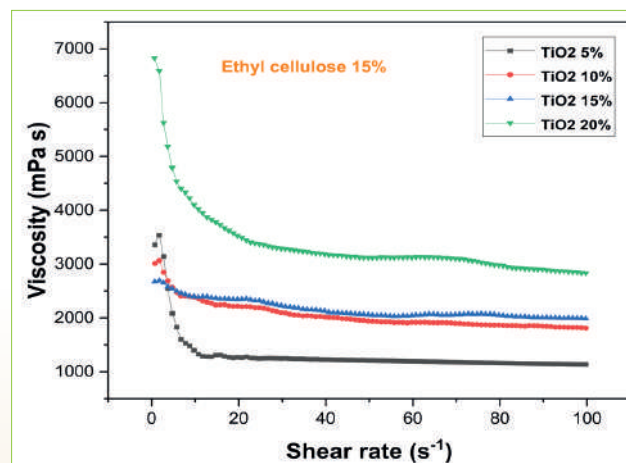
indicators. The screen-printing ink formulation typically consists of a binder, pigment, solvent, and fillers. To prepare the base formulation of ink (excluding dye), ethanol (95%) has been utilized as the solvent. Of the several binders including ethyl cellulose, shellac, rosin, and combinations of shellac and rosin tested, ethyl cellulose has been found to be the most suitable, as it provided the required viscosity for screen printing inks at lower concentrations.



Effect of different concentration of filler on rheological property of ink

Various fillers have also been evaluated, including starch, silica, calcium carbonate, microcrystalline cellulose, and titanium dioxide. Titanium dioxide (TiO_2) is identified as the optimal filler due to its superior dispersibility in the ethanolic solution of ethyl cellulose.

Further optimization of the base formulation has been carried out by evaluating the effect of varying concentrations of ethyl cellulose (10-20%) and TiO_2 (5-20%) on the rheological properties of the ink.



Effect of different concentration of binder on rheological property of ink

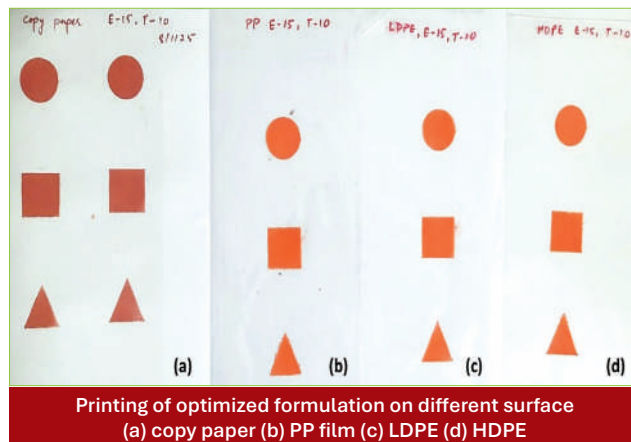
Rheological tests performed on the developed inks indicated non-Newtonian, shear-thinning behavior. The viscosity of the base formulations increased with an increase in concentrations of both TiO_2 and ethyl cellulose. Additionally, the printability of the base formulations has been assessed using a customized screen. Based on rheological performance and printability, the base formulation has been optimized.



Screen printing setup

Subsequently, various dyes, including lac, carmine, and alizarine, has been incorporated into the base formulation at different concentrations to develop an intelligent ink formulation.

The optimized formulation demonstrated excellent printability and adhesion on various flexible films, including paper, LDPE, HDPE and PP films.

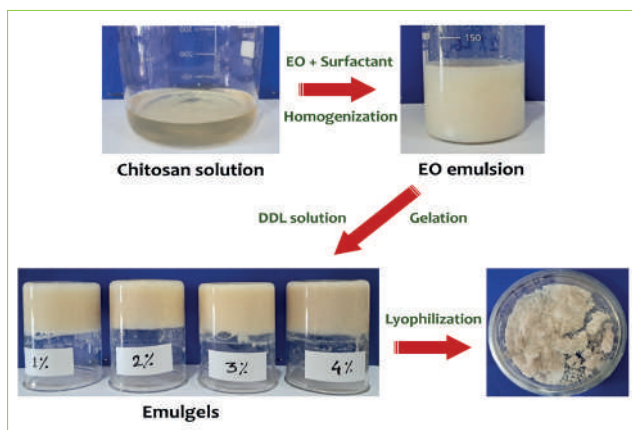


Printing of optimized formulation on different surface
(a) copy paper (b) PP film (c) LDPE (d) HDPE

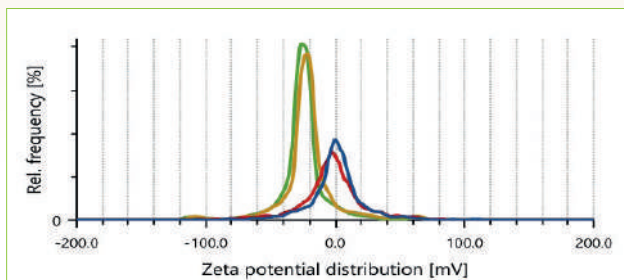
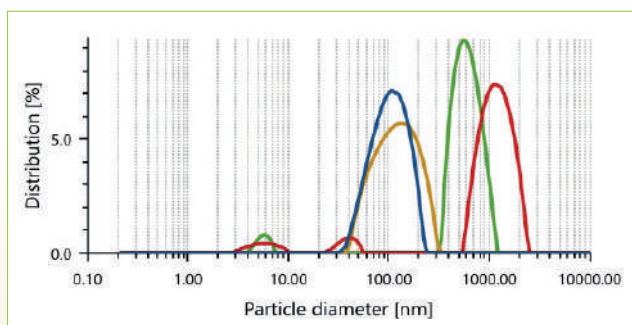
Downstream Agro-Processing Division

Preparation of lac resin encapsulated essential oil formulation

Essential oil from the fresh leaves of lemon grass (*Cymbopogon sp.*) has been extracted using the hydrodistillation technique. The crude yield of the essential oil from lemongrass is recorded at $0.6 \pm 0.05\%$ on a fresh weight basis. Lemon grass essential oil has been encapsulated within a biopolymeric matrix comprising lac resin (1% and 4%). The microemulsification process of the essential oil within an aqueous solution of chitosan (2%) has been standardized using a surfactant through a high-speed homogenization technique, followed by mixing with an aqueous seedlac solution and ageing to prepare an emulgel, which has been freeze-dried to obtain the essential oil-encapsulated solid powder. All the prepared emulgels showed syneresis. EG2 (2% lac resin) showed the highest viscosity among all the samples. The particle size of the microemulsion is as small as 113 nm, with a zeta potential of -24 mV, which ensures the stability of the microemulsion.



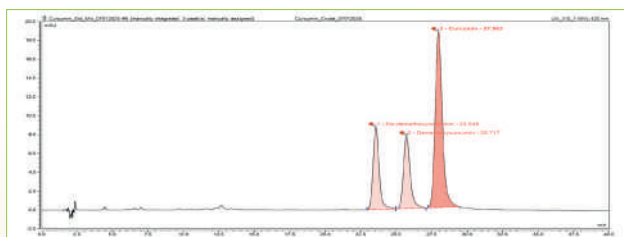
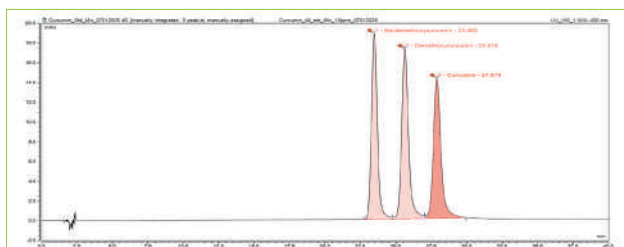
The process of formation of lac resin encapsulated essential oil formulation



Particle size distribution and zeta potential of the prepared microemulsion

Extraction, purification, and quantitative estimation of curcuminoid from Lakadong turmeric:

Authentic Lakadong turmeric powder has been collected from Meghalaya and extracted using the conventional solvent extraction technique for exhaustive extraction. The crude curcuminoids extract yield is around 21%. The extracted curcuminoids are further purified using column chromatography. Three compounds, namely, curcumin demethoxycurcumin, and bis-demethoxycurcumin, are identified in the sample and quantified using HPLC. HPLC analysis showed that the crude curcuminoid extract contains 12.32% curcumin, 4.77% demethoxycurcumin, and 5.12% bis-demethoxycurcumin. Purification of the crude extract using the column chromatography technique improved the purity of curcumin, demethoxy curcumin, and bis-demethoxycurcumin to 16.78%, 6.75%, and 7.49%, respectively.



HPLC chromatogram of curcuminoid standard mixture (1st chromatogram) and crude extract of Lakadong turmeric (2nd chromatogram)

Extraction of cellulose from *Lantana camara* agri-biomass

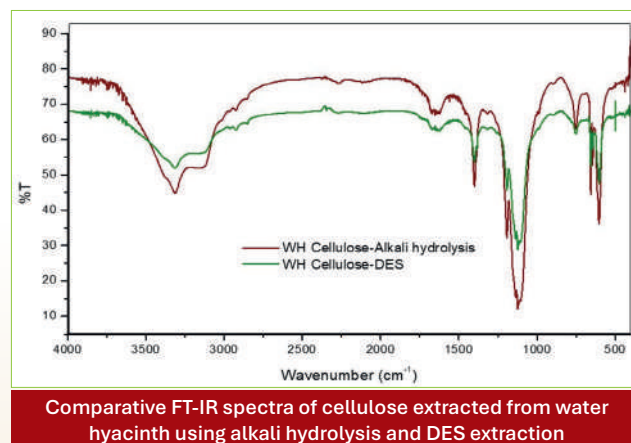
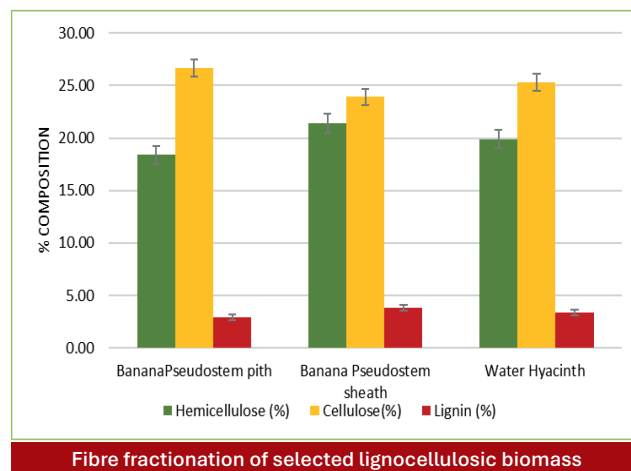
Increasing attention has been paid to the extraction of nanocellulose from different biomass sources for applications in a variety of fields. *Lantana camara* is one such invasive alien species and considered by International Union for Conservation of Nature (IUCN) as one of the world's 100 most invasive species, and among the world's 10 worst weeds. Therefore, *Lantana camara* stem biomass has been selected for the study for extraction of nanocellulose using green methodology. Proximate chemical analysis of *Lantana camara* stem biomass has been conducted. The chemical composition was found to be: Hemicellulose: 19.17(%), Lignin: 23.90(%), Cellulose: 37.00(%), moisture content: 62.55% and ash content: 1.68%. The yield of cellulose from the alkali hydrolysed and bleached *Lantana camara* agri-biomass was found to be 23.4%.

Development of green process of extraction of nanocellulose from agri-bioproducts

Cellulose is the primary component of lignocellulosic biomass, and its efficient extraction and conversion into nanocellulose may pave the way for a promising future in biomass waste utilization. The banana pseudostem and water hyacinth have been selected for extraction of nanocellulose using green methodology due to their high cellulose content, abundance, and biodegradable nature. The hemicellulose and cellulose content of the banana pseudostem (pith and sheath) ranges from 18.48-26.68% and 21.43-23.90%, respectively. The hemicellulose and cellulose contents of the water hyacinth biomass were 19.90% and 25.29%, respectively. The lignin content of the banana pseudostem sheath portion is higher (3.85%) than that of the pith portion (2.95%), and the lignin content in water hyacinth has been estimated to be 3.40%. Cellulose extraction from banana pseudostem and water hyacinth biomass has been carried out using alkaline hydrolysis, followed by bleaching with hydrogen peroxide. The cellulose yield after alkaline hydrolysis of banana pseudostem sheath and pith is 31.8% and 23.1%, respectively, whereas that of the water hyacinth is 27.75%.

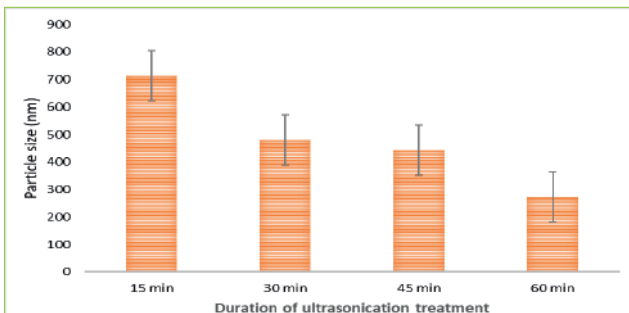
Oxalic acid (OA) and choline chloride (ChCl) (1:1) are used to prepare OA-ChCl DES for cellulose

extraction from water hyacinth biomass. The different ratios of water hyacinth biomass with DES (1:10, 1:8, 1:6 and 1:4) are utilized for cellulose extraction. The yield of cellulose extracted from water hyacinth using DES ranged from 29.47% to 29.93%. The 1:4 ratio of water hyacinth biomass to DES yielded the highest cellulose content. The FT-IR spectra of the cellulose from water hyacinth using alkali hydrolysis as well as DES extraction showed similar absorption peaks at 3410 cm^{-1} (OH stretching), 1640 cm^{-1} (H-OH bending), 1059 cm^{-1} (C-O stretching) and 897 cm^{-1} (β -glycosidic linkage of cellulose). The DES-extracted cellulose from water hyacinth biomass has been converted to nanocellulose by ultrasonication treatment in an aqueous medium. The particle size of the ultrasonically treated cellulose gradually decreased with the treatment duration; from 712.6 of 271.9 nm after 60 minutes of ultrasonication treatment. The study demonstrated that DES extraction, followed by ultrasonication treatment, can be utilized as a green methodology for extracting nanocellulose from lignocellulosic biomass.





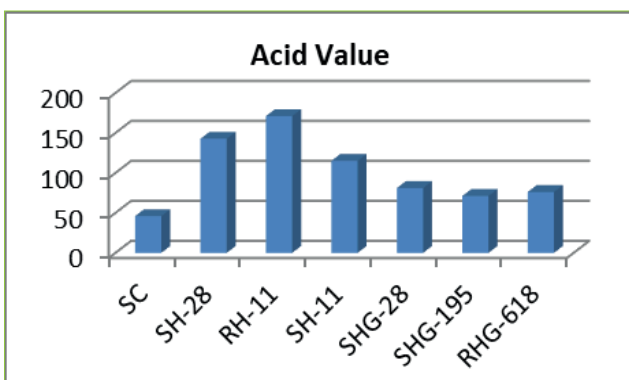
Cellulose extraction from water hyacinth using DES extraction



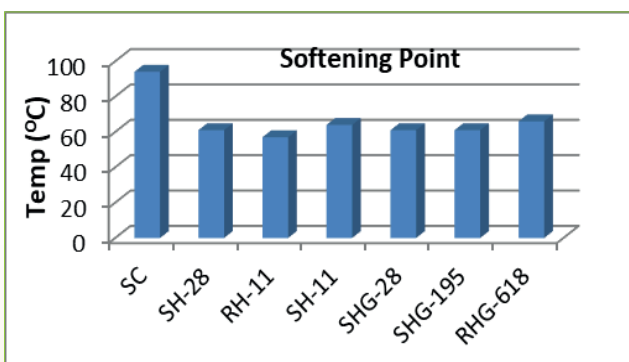
Effect of duration of ultrasonication treatment on particle size of WH cellulose

Development of pressure sensitive adhesive using natural resin based tackifiers

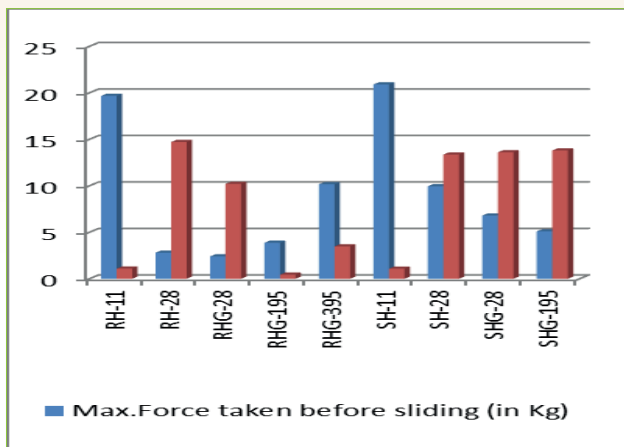
Natural resins have been reacted with different molecules and a number of derivatives were synthesized. Adhesive formulations have been prepared using the developed derivatives. Acid values of the adhesive formulations have been determined and found in the varying range (46-171).



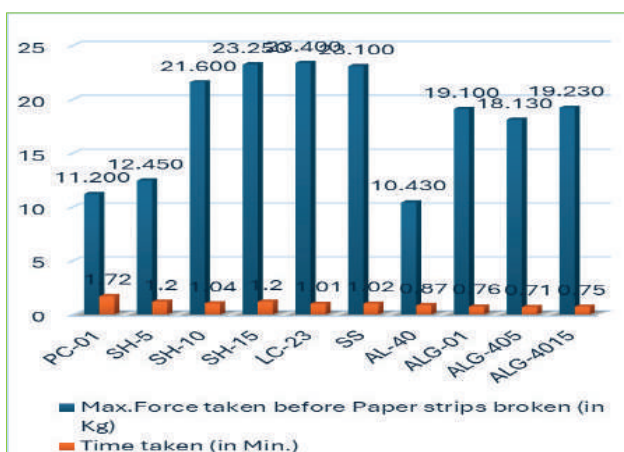
Acid values of Adhesive formulations



Softening point of the adhesive formulations



Adhesive strength of the adhesives

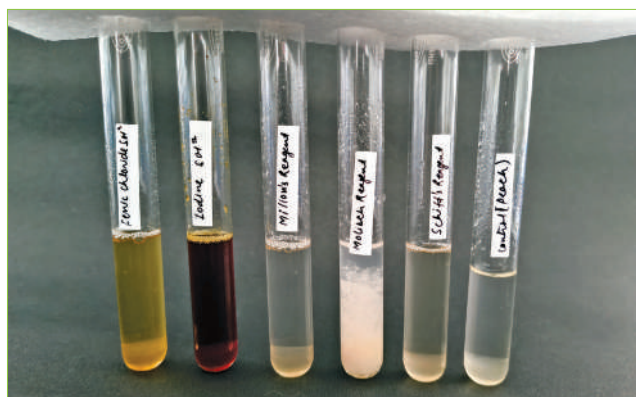


Adhesive strength of the adhesives

One set of formulations showed character of sticky nature while formulations having another set of ingredients showed drying character. Softening point of the formulation have been determined and found in the range of 57-94 °C. Adhesive strength of lac-based binder was studied by pasting of two sheets of paper with the help of lac binder. Adhesive strength (zero peel) of the adhered papers has been determined through Texture Analyzer. Force taken to slide the paper strips has been observed to be in the range of 20-206 N, and time taken for complete detachment of the paper strips has been recorded as 1-15 minutes. In another set of experiments, paper strips have been adhered by applying heat and pressure. While determining the adhesive strengths, it has been observed that paper strips were broken but the adhesives did not lose adhesion. Maximum force taken by the adhered paper strips was found in the range of 98-225 N but papers did not slide but broke within 0.7 – 1.7 minutes. The control paper strip was broken around 108 N force applied.

A study on various techniques for identification of commercially important natural gums

For the identification of unknown gum samples by wet-lab analysis, the response of various gums to different chemical reagents has been recorded by categorizing them into three groups: water-soluble, partially soluble, and insoluble. The gums included soluble gums (sodium alginate, gellan, carrageenan, xanthan, guar gum, palas gum, agar, cashew gum, gum arabic, babool, locust bean gum), partially soluble (tree bean gum, ghatti, psyllium husk, tamarind gum, saja-asana, piyar gum, bahera gum, moringa gum, salai gum) and insoluble gums (Karaya, tragacanth and peach gum). Dilute solutions (mostly 0.5% w/v) of these gums have been prepared and the effects of twelve different reagents, especially on color change or precipitation, have been observed.



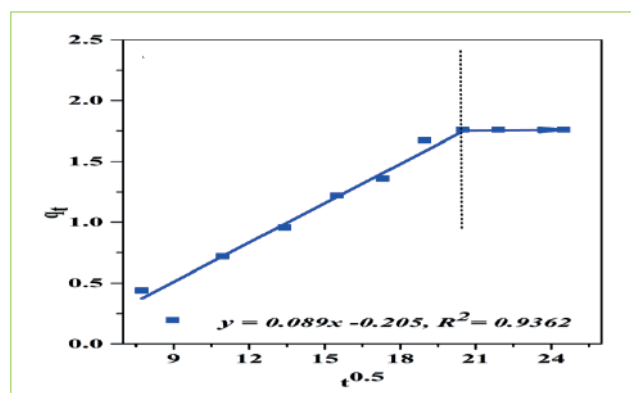
Response of Peach gum to various chemical reagents

These reagents include basic lead acetate, borax solution, boric acid solution, concentrated hydrochloric acid, sulfuric acid, ferric chloride solution, iodine solution, Molisch's reagent, neutral lead acetate, Schiff's reagent, sodium hydroxide solution, Stokes reagent and tannic acid solution. Based on the reaction of the gum against twelve different reagents, the distinct identification criteria for specific gums are identified. Gum Tragacanth formed a white precipitate with a neutral lead acetate solution, unlike other gums. A dark green precipitate was obtained when iodine solution was added to the tamarind gum solution. Psyllium husk gum solution produced a dark wine-red color with iodine solution. A green precipitate has been formed by moringa gum with a neutral ferric chloride solution. Palas gum formed a brown precipitate after the addition of the Millon's

Reagent. These unique responses are useful tests for identifying unknown gum samples and can serve as identification criteria for them.

Kinetic and thermodynamic behavior of brilliant green dye adsorption onto Arabic gum-based hydrogel

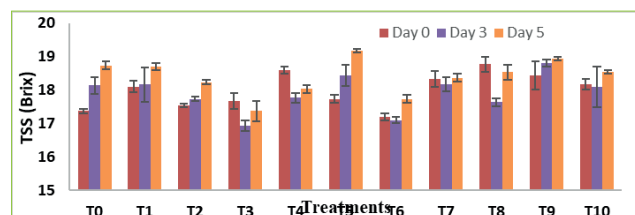
The kinetic behavior of the adsorption process of brilliant green dye onto hydrogel has been studied using Weber-Morris model (intra-particle diffusion). This intra-particle diffusion model revealed R^2 value (0.936) near to unity, yet it has not passed through the point of origin but appeared to display two stages. This suggested participation of multistage adsorption. Therefore, this model was not the only mechanism that controlled the adsorption process but involved other steps such as chemical reaction and pore diffusion.



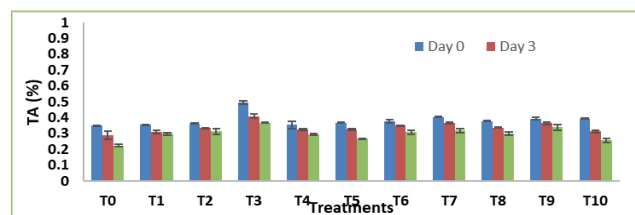
The Gibbs free energy (ΔG°), enthalpy (ΔH°), and entropy (ΔS°) are crucial thermodynamic parameters in the adsorption process to assess the viability and spontaneous nature of the reaction. The different thermodynamic parameters affecting adsorption of Brilliant Green dye has been studied. The enthalpy value has been found to be 6.68 kJmol⁻¹. The positive value of ΔH° suggested that adsorption process was endothermic. The negative value (-0.0811 kJmol⁻¹) of entropy suggested that there was decrease in randomness at solid-liquid interface. The positive value of Gibbs free energy which increased from 30.86 to 32.58 kJmol⁻¹ when temperature was increased from 25 °C to 45 °C, suggested favourable adsorption at higher temperature and non-spontaneous nature. Therefore, it can be concluded that adsorption process was not governed by dye itself but depends on the nature of adsorbent.

Effect of lac-based formulation on the shelf life of litchi

Lac-based formulations developed by ICAR-National Institute of Secondary Agriculture (ICAR-NISA) have been tested on litchi fruits. Freshly harvested litchi fruits were kept in air-conditioned room for 2 h for precooling. The precooled litchi was dipped in 5% sodium hypochlorite solution for 1 min. after surface drying in open air; the samples have been dipped in different formulations (1.0 L of solution for 4.0 kg of litchi).

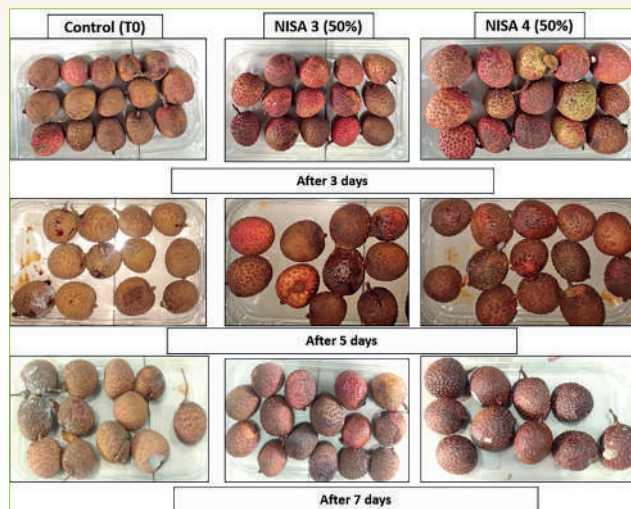


Variation in total soluble solid of the sample with treatments and duration of storage



Variation in titratable acidity of the sample with treatments and duration of storage

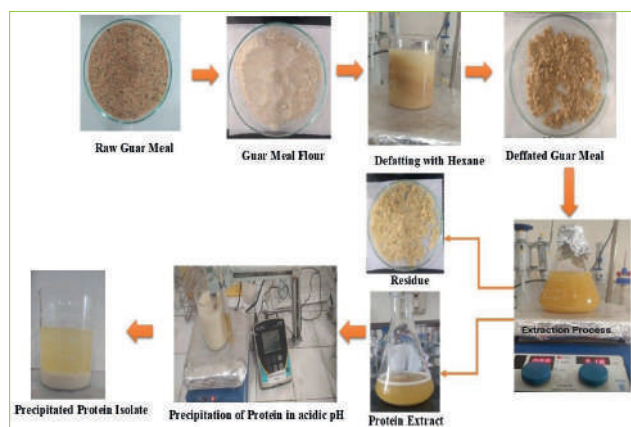
The coated samples after treatments have been dried in open air for 2 h till surface becomes dry. The dried samples were kept in PET punnet boxes and analyzed for different storage parameters. Treatment 7 [NISA 03 (70:30 dilution with water)] and T9 [NISA 04 (50:50 dilution with water)] treatments showed least color change and loss in weight. The decay and discoloration percentage have also been found to be the least in these samples. There has been degradation of litchi flavor in treatments without dilution. In the case of NISA 7, the flavor has not been degraded even after 5 days. The lac-based coating showed positive effect on shelf life of litchi even after 5 days.



Variation in Lac based formulation treated samples with storage

Preparation of working document for BIS standard on fruit coating formulation

Working document of lac-based fruit coating formulations has been prepared, revised and resubmitted to BIS for consideration of its adoption as BIS standard for lac-based fruit coating formulation. The coating formulations were freshly prepared and tested for properties such as drying time, finish, color scratch hardness, flexibility and adhesion, volatile matter content, ash content, acid value, keeping properties, pH, density, viscosity, etc.



Protein extraction Process from Guar Meal

Automation & Plant Engineering Division

Development of pilot plant of guar gum derivative for training and demonstration

A pilot plant of capacity 5 kg per batch consisting of four different units, viz. mixing-cum-reaction unit, filtration unit, drying-cum-agitator unit, and distillation unit has been fabricated in collaborative mode at ICAR-Central Institute of Agricultural Engineering, Bhopal to mechanize the process of carboxymethyl guar gum derivative preparation from guar gum powder with reagents. The pilot plant

has been preliminarily evaluated for carboxymethyl guar gum derivative preparation, and minor improvements and adjustments in the mixing-cum-reaction unit and drying-cum-agitator unit have been carried out as per requirement, to improve the mixing-cum-reaction and drying process. The carboxymethyl guar gum derivative has the viscosity ranging between 525-2050 cP, pH 7.2-8.5, and degree of substitution 0.13-0.18 with mean yield 83.22% and efficiency 77.33-87.73%.



Guar gum derivative pilot plant

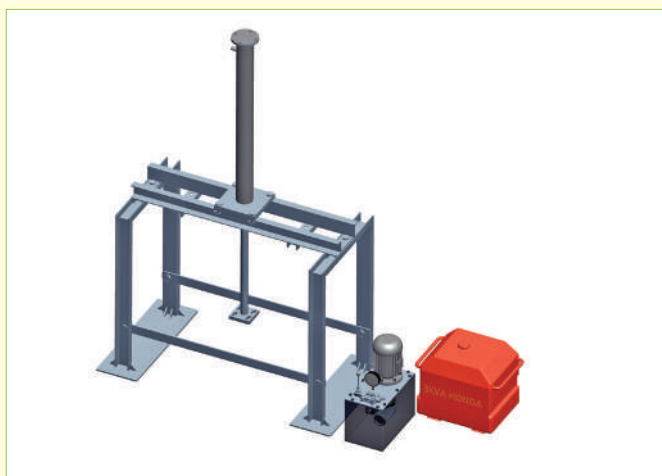


Prepared guar gum derivative

Development of a suitable equipment for uprooting cinchona trees in hilly terrains

To mechanize the cinchona tree uprooting process, a conceptual diagram along with the mechanism, size, and type of different components for two models has been prepared. A detailed

manufacturing design drawing of both models has been developed at ICAR-Central Institute of Agricultural Engineering, Bhopal. Fabrication of the cinchona tree uprooting equipment (vertical and horizontal) as per the detailed manufacturing design drawing is in progress.

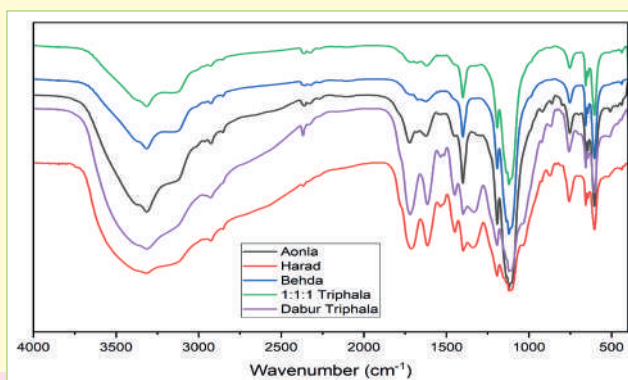


Development of analytical techniques for identification and quality control of commercially important agri-bioproducts

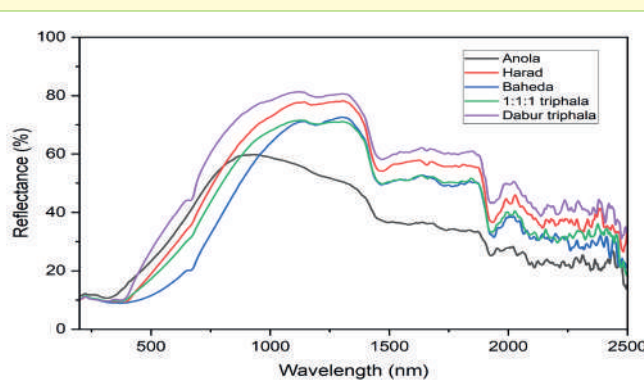
The research focused on the spectroscopic characterization of individual Triphala components, such as Aonla (*Phyllanthus emblica*), Haritaki (*Terminalia chebula*), and Bibhitaki (*Terminalia bellerica*), as well as their standard 1:1:1 mixture and a commercially available Triphala powder (Dabur). Samples were sun-dried, powdered, and analyzed using UV-Vis-NIR and FTIR spectroscopy. FTIR analysis revealed characteristic broad peaks between 3700–2800 cm^{-1} corresponding to $-\text{OH}$ stretching, a peak at 2368 cm^{-1} due to aliphatic $-\text{CH}$ and $-\text{CH}_2$ stretching,

and a peak at 1719 cm^{-1} related to carboxylic acid groups, especially in Harad and Dabur Triphala. Ester groups were identified by peaks around 1120 cm^{-1} in all samples. UV-Vis-NIR spectra showed distinct patterns across the components.

Aonla had a unique spectral curve, particularly with lower intensity peaks between 800–1400 nm, while Harad and Bibhitaki displayed similar spectra. Variations in spectral features were attributed to differences in texture and moisture content. The study offers insights into the spectral profiles of Triphala components, which can aid in quality control and standardization of this widely used agri-bioproduct.



FTIR spectra of the different components of triphala and its formulations



UV-Vis-NIR spectra of the different components of triphala and its formulations

Membrane filtration for lac-dye recovery from scrapped lac wash water

Lac wash water disposal causes environmental problem as it has high biological oxygen demand (BOD) and it contains the body parts of lac insects, waxy substances and lac dye, a red pigment, which has applications in pharmaceutical, textile and cosmetic industry. Traditionally, lac dye is recovered using acid and alkali treatments of lac resin wash water. A feasibility study on membrane filtration system for lac-dye recovery has been conducted using ultrafiltration unit developed at Central Tasar Research and Training Institute, Ranchi. Five-liter lac wash water of pH 7.5, total dissolved solids 217 and turbidity above 800

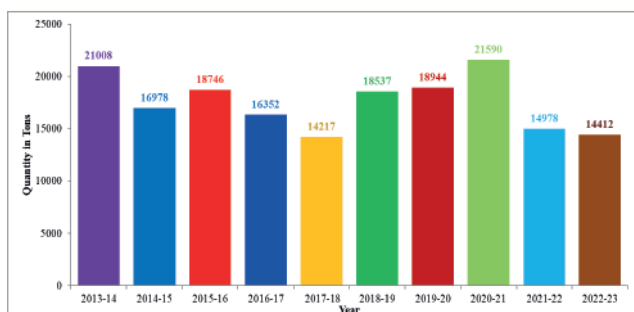
NTU, has been filtered using sand filter followed by an Ultrafiltration membrane. The permeate has been treated with acid for coagulation of waxy substances and lac dye has been recovered. The amount of crude lac-dye extracted from 5 liters of wash water is nearly 5 g (i.e., 1000 ppm).



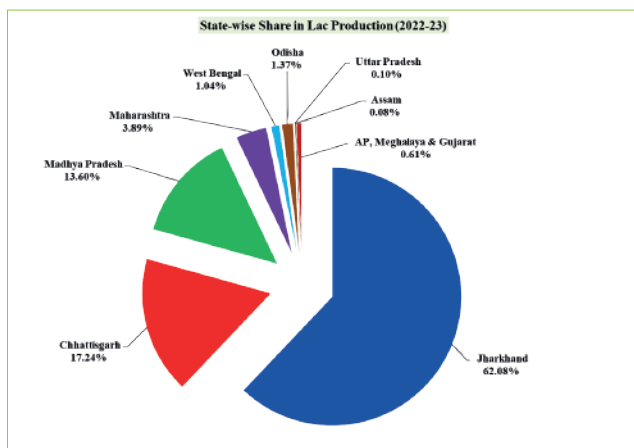
Agri-Business Development Unit

Trend analysis and export performance of natural resins and gums from 2013-14 to 2022-23

A survey was conducted to estimate the growth trend and estimates of instability in natural resins and gums production in India from 2013-14 to 2022-23. The survey indicated that nearly all types of resins and gums experienced negative growth over the years, with the exception of the “other resins and gums” category. The decrease in production of all resins and gums, except for lac, is statistically significant at 1% significance level. Among the various types of resins and gums, dhawda gum production has decreased the most, with a compound annual growth rate (CAGR) of -0.2536, while lac production has decreased the least, with a CAGR of -0.0172.



Lac Production Scenario in India Over 10 Years (2013-14 to 2022-23)

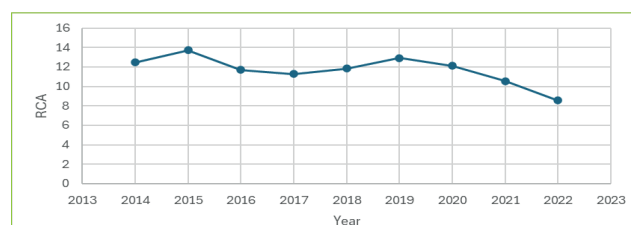


State-wise Share of Lac Production During the Year 2022-23

The estimated national production of sticklac during 2022-23 was approximately 14,412 tons. The lac production trends in India from 2013-14 to 2022-23, highlighting variations over the years. The production levels exhibit fluctuations, influenced by factors such as climatic conditions, market

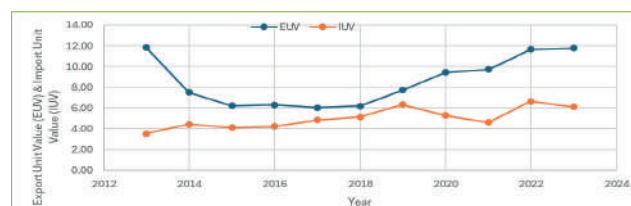
demand, and policy interventions. Jharkhand state ranks 1st in production during 2022-23 followed by Chhattisgarh and Madhya Pradesh. These three states contribute more than 93% to the lac production in India. This dominance is due to favourable agro-climatic conditions and better adoption of scientific lac cultivation techniques. The disparity in production across states highlights the need for targeted interventions to promote lac cultivation in underperforming regions.

India's Revealed Comparative Advantage (RCA) in Natural Resins and Gums (NRGs) exports has declined from 14.58 in 2014 to 8.56 in 2023, signalling a weakening global competitiveness.



Comparative Advantage of Indian Natural Resins and Gums export (2014 to 2023)

RCA remained stable between 2015 and 2021 (11.71 to 12.93), but the sharp drop in 2022 (10.55) and 2023 (8.56) suggests rising competition, trade barriers, or supply chain challenges. Despite the decline, RCA values above 1 indicate India still holds a comparative advantage.



Trend in Unit values of exports and imports from 2014 to 2023

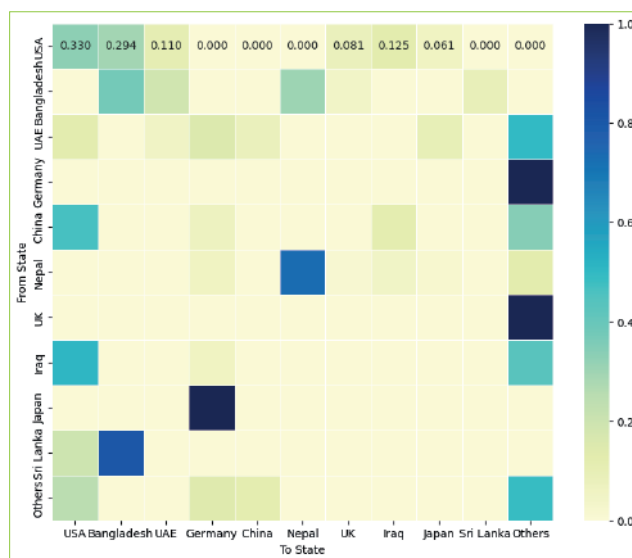
Export Unit Value (EUV) and Import Unit Value (IUV) trends from 2013 to 2023 are given in above fig. Over this period, the EUV had shown a consistent upward trend, starting from around 7 in 2013 and reaching approximately 12 by 2023, indicating a significant increase in the value per unit of exports. In contrast, the IUV has remained relatively stable with minor fluctuations, starting near 4 in 2013 and slightly rising to about 6 by 2023. The widening gap between EUV and IUV suggests an improving export value advantage for the NRGs category over

the time. This was an expected result as the export quantity of NGRs products had recorded higher growth rates during the period of 2014 to 2023, whereas export unit value touched double digit growth rates during terminal period. The changes in the covariance between mean export unit value and mean export quantity accounted for increase in the values of EUV and IUUV. The changes in the covariance could arise through the changes in the variance of export and import unit value

Transitional probability matrix of Indian Natural Resins and Gums (NRGs) export (2014 to 2023)

The transition probability matrix illustrates the export dynamics of Indian Natural Resins and Gums across key international markets. The United States (0.33), China (0.46) and Iraq (0.51) emerge as major importers, with high probabilities of retaining imports. Germany, the UK, and Japan exhibit complete persistence (1.0), indicating stable, non-diverting trade relationships. In contrast, Nepal and Bangladesh display strong interlinkages with probabilities of 0.73 and 0.37

respectively, highlighting their role as consistent markets. Notably, a significant portion of UAE's exports (49.7%) transitions to other destinations, suggesting weaker retention. The presence of high transition probabilities to 'Others' (e.g., 0.491 for other countries) underscores diversification in export destinations.



Markov Chain Transition Probability Heatmap

Growth and instability analysis in production of natural resins and gums in India during 2013-14 to 2022-23

Particulars	CAGR	Mean	SD	CV	Adj R ²	CDVI
Guar gum	-0.112 **	640995.30	275591.10	42.99	0.84	17.19
Lac	-0.0172 ^{NS}	17576.20	2623.69	14.93	0.01	14.83
Pine resin	-0.0669**	5146.00	1126.90	21.90	0.93	5.76
Gum karaya	-0.218**	50.80	40.56	79.84	0.89	26.52
Dhawda gum	-0.2536**	145.80	138.10	94.72	0.93	24.42
Other gums	-0.2515**	195.90	184.50	94.18	0.84	37.7
Other resins & gums	0.0088 ^{NS}	1198.50	203.50	16.98	-0.10	17.78
Grand total	-0.1094**	665066.80	278089.11	41.81	0.84	16.72

Note: ** indicates significance at 1 % level of significance and NS indicates non-significant

SALIENT ACHIEVEMENTS UNDER NETWORK PROJECTS

Network Project on Conservation of Lac Insect Genetic Resources (CLIGR)

Survey Conducted in 2024

Out of total 227 assigned districts to various NP on CLIGR centers, 156 districts were surveyed during 2024. Out of 156 districts surveyed, natural occurrence of lac insects were found in 79 districts as follows:

Survey conducted under NP on CLIGR in 2024

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 found during survey in the Regional Gene Banks at the centers. The number of local lac-insects/ races and host plants found during survey

and conserved during 2014-24 at the Regional Gene Banks at the Centers is presented herewith.

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

In lac production system it is important to conserve the broodlac, which is live lac insect on suitable host tree. As lac cultivation is mostly carried out by resource constrained farmer for whom purchasing broodlac is difficult being a costly item. Thus, it becomes essential to recommend them suitable lac host tree on which broodlac may be produced throughout the year farmer need not to purchase it for subsequent crop season. Considering this important aspect network project centre has recommended suitable lac-insect-host plant combination based on the availability of the host plant in the respective reasons.

Center	No. of districts assigned for survey	No. of districts surveyed	No. districts remaining for survey	No. of districts where lac insect found	No. of districts where no lac insect found
AAU, Jorhat	19	19	0	03	16
PAU, Ludhiana	33	33	0	15	18
CAU, Imphal	23	02	21	01	01
SKUAST, Jammu	0	0	0	0	0
ANGARU, Guntur	50	24	26	15	09
MPUAT, Udaipur	21	11	10	07	04
SFRI, Jabalpur	35	29	6	26	03
KFRI, Thrissur	02	0	02	0	0
KVK, Sirsi	0	0	0	0	0
ICAR-RCER, Patna	14	08	06	04	04
ICAR-NISA, Ranchi	30	30	0	08	22
Total	227	156	71	79	77

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

S. No.	Center Name	Host Plant	Lac Insect species
1	ICAR-NISA, Ranchi	92 collections of 65 species	1290 cultures of 56 lac insect lines
2	KFRI, Thrissur	470 collections of 05 species	-
3	SFRI, Jabalpur	160 collections of 16 species	-
4	AAU, Jorhat	504 collections of 15 species	02 collections each of <i>Kerria chinensis</i> and <i>Kerria lacca</i>
5	PAU, Ludhiana	528 collections of 13 species	-
6	MPUAT, Udaipur	809 collections of 12 species	-
7	CAU Imphal	276 collections of 16 species	
8	SKAUST, Jammu	152 collections of 11 species	13 collections

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 (<i>Ficus religiosa</i>), Ber (<i>Zizuphus marutuiana</i>), <i>Leea</i> sp., <i>Flemingia semialata</i> , Arhar (<i>Cajanus cajan</i>), <i>Flemingia strobilifera</i> , <i>Calliandra haematocephala</i>
2	CAU, Imphal	Humid Eastern Himalayan Region and Bay Islands	<i>Malvaviscus penduliflorus</i> , <i>Litchi chinensis</i> , <i>Malvaviscus penduliflorus</i> , <i>Hibiscus</i> sp., <i>Ficus religiosa</i> and <i>Ficus glomerata</i>
3	KFRI, Thrissur	Humid to Semi-arid Western Ghats and Karnataka Plateau	Ber (<i>Z. mauritiana</i>), Rain Tree (<i>Albizia saman</i>) and <i>F. Semialata</i>
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 (<i>Ziziphus mauritiana</i>) and Pipal (<i>Ficus religiosa</i>)
7	ICAR RCER, Patna		<i>Ficus religiosa</i> (Peepal), <i>Ficus rumphii</i> (Pakur)
8	ANGRAU, Guntur	Sub-humid to Humid Eastern and South- eastern Uplands	<i>Albizia saman</i> , <i>Ficus religiosa</i> and <i>Ficus benghalensis</i> , <i>Ficus amplissima</i> , <i>Conocarpus lancifolius</i> ., Ber (<i>Ziziphus mauritiana</i>) and Palas (<i>Butea monosperma</i>)
9	SKUAST, Jammu	Humid Western Himalayan Region	<i>A. nilotica</i> and <i>Z. mauritiana</i> , <i>A. lebbeck</i> (summer broodlac)
10	SFRI, Jabalpur	Semi-arid Lava Plateau and Central Highlands	Palas, Ber, Kusum, <i>F. semialata</i> , Ghont, Gular, Pipal, Sitaphal

Capacity building in lac cultivation through training of resource persons and farmers of Network Centers

Extension of scientific method of lac cultivation to resource persons and farmers in the potential regions falling under the Network Centre is one of

the important objectives on the project. The details of the training imparted to resource persons and farmers by Network Centres are presented during 2024. Network centres conducted 37 training programmes on improved method of lac cultivation in which 1456 trainees were benefited, the details are provided hereunder.

Details of the training imparted to resource persons and farmers by Network Centres during 2024

Sl. No.	Centre	Number of trainings conducted in 2024	Number of beneficiaries
1	AAU, Jorhat	05	150
2	CAU, Imphal	08	295
3	KFRI, Thrissur	01	15
4	ICAR- KVK Sirsi	02	94
5	MPUAT, Udaipur	09	361
6	PAU, Ludhiana	04	252

Sl. No.	Centre	Number of trainings conducted in 2024	Number of beneficiaries
7	ICAR RCER, Patna	03	101
8	ANGRAU, Guntur	0	0
9	SKUAST, Jammu	02	106
10	SFRI, Jabalpur	02	82
11	ICAR- CAFRI, Jhansi	0	0
	Total	37	1456

Achievement of the Network Project Centers

LEAD CENTRE: ICAR-National Institute of Secondary Agriculture, Ranchi

Isolation and identification of endosymbionts from lac insects

Endosymbiotic bacteria were isolated from *kusmi* and *rangeeni* lac insects grown on ber, *Flemingia*

macrophylla, and palas by following culturing method. Based on the genomic DNA sequences, bacterial species (endosymbionts) identified for *kusmi* strain of lac insect were *Bacillus* sp. strain, *Microbacterium* sp. strain SR256, *Moraxella* sp. strain and *Microvirga* sp. For *rangeeni* strain of lac insect the bacterial species (endosymbionts) identified are *Enterobacter* sp. strain AM264, *Microbacterium zeae* strain and *Bacillus cereus*.

Details of endosymbionts obtained from lac insects

Sample code	Description	16S rDNA length in bp	Matched with	Accession no.	E value	Identity %
<i>Kusmi</i> endosymbionts						
KBYS	From Ber, Yellow smooth colony	1365	<i>Bacillus</i> sp. strain	NR_118439.1	0	99.92
KBWR	From Ber, White Rough colony	1361	<i>Microbacterium</i> sp. strain SR256	MZ026412.1	0	99.93
KBWS	From Ber, White smooth colony	1365	<i>Moraxella</i> sp. strain	MZ067754.1	0	99.93
MKL8	From <i>Macrophylla</i> , Yellow small colony	1197	<i>Microvirga</i> sp.	OR578339.1	0	98.58
<i>Rangeeni</i> endosymbionts						
RPYR2	From Palas, Yellow rough colony	1332	<i>Enterobacter</i> sp. strain AM264	MZ768658.1	0	99.85
RPOS	From Palas, Orange smooth colony	1283	<i>Microbacterium zeae</i> strain	OR122058.1	0	99.22
MRH2	From <i>Macrophylla</i>	1229	<i>Bacillus cereus</i>	MW889122.1	0	99.27
White round colony						

Updated list of host plants of lac insect (*Kerria species*)

Many of the previously recognized names, families, and genera of host plants for Indian lac insects (Homoptera: *Tachardiidae*) have undergone taxonomic revisions, resulting in changes to the accepted names of these plants. An updated list of host plants for lac insects (*Kerria species*) has been compiled, revealing that these plants belong to 61 families, 208 genera, and 354 species is presented.

Updated list (Family, Genera & Species wise) of host plants for lac insects (<i>Kerria species</i>)							
Sl. No.	Taxa	Total		Sl. No.	Taxa	Total	
	Family	Genus	Species		Family	Genus	Species
1	<i>Acanthaceae</i> Juss.	1	1	31	<i>Hypericaceae</i> Juss.	1	2
2	<i>Altingiaceae</i> Horan.	1	1	32	<i>Juglandaceae</i> DC.	4	6
3	<i>Amaranthaceae</i> Juss.	1	1	33	<i>Lauraceae</i> Juss.	1	1
4	<i>Anacardiaceae</i> R.Br.	4	5	34	<i>Lecythidaceae</i> A. Rich.	1	1
5	<i>Annonaceae</i> Juss.	3	7	35	<i>Lythraceae</i> J. St.-Hil.	3	3
6	<i>Apocynaceae</i> Juss.	6	6	36	<i>Magnoliaceae</i> Juss.	1	1
7	<i>Araliaceae</i> Juss.	3	3	37	<i>Malvaceae</i> Juss.	20	31
8	<i>Asteraceae</i> Giseke	2	2	38	<i>Meliaceae</i> Juss.	2	2
9	<i>Betulaceae</i> Gray	1	1	39	<i>Moraceae</i> Gaudich.	4	38
10	<i>Bignoniaceae</i> Juss.	3	4	40	<i>Myricaceae</i> Rich. ex Kunth	1	1
11	<i>Boraginaceae</i> Juss.	1	1	41	<i>Myrtaceae</i> Juss.	4	6
12	<i>Burseraceae</i> Kunth	4	4	42	<i>Oleaceae</i> Hoffmanns & Link	1	1
13	<i>Calophyllaceae</i> J. Agardh	1	1	43	<i>Oxalidaceae</i> R.Br.	1	1
14	<i>Cannabaceae</i> Martinov	2	2	44	<i>Phyllanthaceae</i> Martinov	4	4
15	<i>Casuarinaceae</i> R.Br.	1	1	45	<i>Platanaceae</i> T. Lestib.	1	1
16	<i>Celastraceae</i> R.Br.	1	1	46	<i>Proteaceae</i> Juss.	1	1
17	<i>Combretaceae</i> R.Br.	3	8	47	<i>Putranjivaceae</i> Endl.	2	2
18	<i>Connaraceae</i> R.Br.	1	1	48	<i>Rhamnaceae</i> Juss.	4	13
19	<i>Cornaceae</i> Bercht.	1	1	49	<i>Rosaceae</i> Juss.	2	2
20	<i>Cucurbitaceae</i> Juss.	1	1	50	<i>Rubiaceae</i> Juss.	4	4
21	<i>Cupressaceae</i> Gray	2	2	51	<i>Rutaceae</i> Juss.	4	4
22	<i>Cycadaceae</i> Pers.	1	1	52	<i>Salicaceae</i> Mirb.	2	2
23	<i>Dilleniaceae</i> Salisb.	1	1	53	<i>Santalaceae</i> R.Br.	2	2
24	<i>Dipterocarpaceae</i> Blume	4	6	54	<i>Sapindaceae</i> Juss.	6	7
25	<i>Ebenaceae</i> Gurke	1	3	55	<i>Sapotaceae</i> Juss.	2	2
26	<i>Elaeocarpaceae</i> Juss.	1	1	56	<i>Simaroubaceae</i> DC.	1	1
27	<i>Euphorbiaceae</i> Juss.	10	17	57	<i>Tamaricaceae</i> Link	1	1
28	<i>Fabaceae</i> Juss.	56	119	58	<i>Theaceae</i> Mirb.	3	3
29	<i>Castanopsis</i> (D. Don)	1	1	59	<i>Zygophyllaceae</i> R.Br.	1	2
30	<i>Quercus</i> L. sp.	1	1	60	<i>Hypericaceae</i> Juss.	1	2

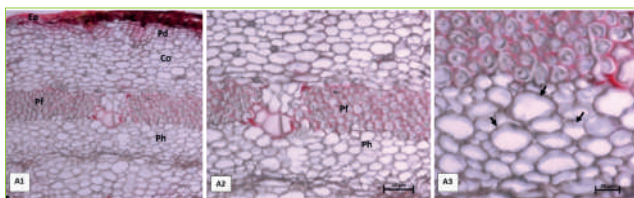
Analysis of phloem sap from different lac host plants

The components of phloem sap of *Flemingia semialata* were estimated using UHPCL. The preliminary UHPLC results shows the presence of fructose sugar, glucose sugar and sucrose.

Analysis of phloem sap <i>Flemingia semialata</i> using UHPCL				
Sl. No.	Standards	Retention Time (min.)	Peak Area	Concentration (ppm/mL)
1.	Fructose	6.79	29.4554	10000
2.	Glucose	7.65	30.6634	10000
3.	Sucrose	10.30	28.5166	10000
Sample (<i>F. Semialata</i>)				
1.	Fructose	6.78	7.9215	2,689.32
2.	Glucose	7.77	1.8030	587.99
3.	Sucrose	10.33	25.6516	8,995.32

Bark anatomy of *Flemingia semialata* to study the phloem cell location and arrangement

The Longitudinal section (LS) of *F. semialata* bark illustrates various tissue types such as the epidermis, cortex, phloem fiber and phloem. Starting from outermost layer, the tissues observed is: epidermis, followed by cortex, then phloem fiber and phloem on the innermost side. The total thickness of the bark tissue is 480.15 μm , combined thickness of the epidermis and cortex was approx. 203.11 μm . Phloem fiber is about 51.05 μm , while the phloem around 120.54 μm in thickness. The phloem was situated 254.16 μm from the outermost layer of the bark. A single phloem element had a length & width 89.92 μm 14.95 μm respectively. Although the size of phloem tissues shows variation.



A1, A2 and A3: Transverse sections of *Flemingia semialata* bark. Scale bars: (A1) = 100 μm , (A2) = 50 μm , (A3) = 20 μm , Ep= Epidermis; Pd= Phelloderm; Co= Cortex; Pf= Phloem Fibre; Ph= Phloem

Assam Agricultural University, Jorhat (Assam)

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

In Assam, 16 districts (Majuli, Dhemaji, North Lakhimpur, Dibrugarh, Kamrup rural, Kamrup

Metro, Golaghat, Nalbari, Sonitpur, Darrang, Jorhat, West Karbi Anglong, Nagaon, Dima Hasao, Biswanath and Hojai) consisting 64 blocks and 3 districts (Coochbehar, Alipurduar and Purulia) of West Bengal consisting of 32 blocks were surveyed in the year 2024. Naturally occurring lac was observed in Chinthong block of west Karbi Anglong and Sanbar block of Dimahasao of Assam. In west Bengal, lac was observed in Purulia, Jhaldha, Arsha, Para, Kashipur, Bagmundi, Raghunathpur and Joypur blocks of Purulia. Total of 504 host plants under 15 species are being maintained at the field gene at the Centre. Two strains of *Kerria chinensis* (Doloi: AAUK-20, Langardang: AAUK-06) and 2 strains of *Kerria lacca* (Purulia: AAUK-03, Howrah: AAUK-17) of lac insect (total 4 strains) are being maintained in Regional Field Gene Bank, Jorhat, Assam.



Photographs of survey work carried out in different districts of Assam.

Evaluation of collected *Kerria lacca* strain in Assam

Kerria lacca (Howrah strain: AAUK-17) which usually is bivoltine in the *in-situ* condition has exhibited trivoltinism in Assam climatic condition. The Howrah collection has completed its three life cycles (generations) in 373 days of duration during 2023-24. The three voltine (periods) are summer (101 days), monsoon (164 days) and winter (108 days). This strain has completed four (4) generations from 2018 onwards.

Evaluation of various insecticides/ biopesticides against predator, *Eublemma amabilis* and their safety to lac insect

Eight insecticides namely Emamectin benzoate 5 SG, Chlorantraniliprole 18.5 SC, Flubendiamide 480 SC, Bacillus thuringiensis var. kustaki (Delfin WG and Dipel

8L), Indoxacarb 14.5 SC, Neemcare (azadirachtin 0.15%) and Chlorpyrifos 20 EC were evaluated during the study. The evaluation study indicated that

the Bt based biopesticides and Neemcare 0.15% were comparatively safer to lac insects while chlorpyrifos was found to be most toxic.

Detail of life cycle evaluation of collected *Kerria lacca* strain in Assam

Strain	Voltinism	Summer (days)	Monsoon (days)	Winter (days)	Total (days)
<i>Kerria lacca</i> (normal)	Bivoltine	148	-	162	310
<i>Kerria lacca</i>	Trivoltine	101	164	108	373
<i>Kerria chinensis</i>	Bivoltine	148	-	192	340

Bio-efficacy of plant powders against *Callosobruchus chinensis*: A storage grain pest of *F. semialata*

To control the *Callosobruchus chinensis*, 05 number of plant powders viz., black pepper (pepper corns), neem leaf (*A. indica*), bael leaf (*Aegle marmelos*), *Leucas aspera* leaf and *Vitex negunda* leaf were tested at four different concentrations i.e., 0.5%, 1%, 3% and 5% and compared with control (without any treatment). Out of these, black pepper @3% has shown promising results (100% mortality) in controlling the *Callosobruchus chinensis* followed by neem. Probit analysis has depicted that the lethal time of mortality (LT50) is minimum (0.617 days) in black pepper.

Central Agriculture University, Imphal (Manipur)

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

Two districts of Tripura state (Unakoti and Dhalai) and Manipur were surveyed in 2024 and recorded *Litchi cinensis*, *Bombex ceiba*, Cassod tree, *Malvaviscus penduliflorus*, Hibiscus sp., *Ficus glomerata*, and *Ficus religiosa* lac host plants. Live lac insect, has been recorded on *Ficus glomerata* in Kamjong district of Manipur.



Photographs of survey work carried out in different districts of Tripura.

Evaluation of different eco-friendly insecticides against the Egyptian Fluted scale, *Icerya aegyptiaca*

The ecofriendly insecticides viz., uroinsecticides, pestoguard, green mealikil and neemazal were tested against *F. semialata* pest *Icerya aegyptiaca*. Maximum nymphal mortality of 81.67% and 78.34% was observed at 0.2% Pestoguard and Neemazal after 12 days of treatment which is statistically at par with each other. The 51.67% mortality was achieved after 12 days of treatment at 1% Uro-insecticide and Green mealikil, which is a microbial pesticide is also effective against Egyptian fluted scale, *Icerya aegyptiaca*. The mortality percentage was low after 1, 3 days and 7 days but it gradually increases after 12 days of treatment obtaining 48.34% mortality, which is statistically at par with Uro-insecticide. All the eco-friendly insecticides used in the present experiment (Uroinsecticides, Pestoguard, green mealikil and neemazal) are effective in controlling the population of *Icerya aegyptiaca*. Unlike Malathion and Imidacloprid, who don't have quick knockdown effect; however, the mortality due to exposure significantly increases as there is increase in days or duration of application and they are safe to the lac insect.

Management of pulse beetle, *Callosobruchus chinensis* (Linnaeus) (Bruchidae: Coleoptera) under Stored *Flemingia semialata* Roxb. seeds using plant powders

An experiment was conducted for management of pulse beetle (*Callosobruchus chinensis* L.) through the use of indigenous plant powders on seeds of *Flemingia semialata* under stored conditions. black pepper (*Piper nigrum*) treated seeds have high mortality (88.89%) of pulse beetle followed by

and chinaberry tree/pride of India, *Melia azedarach* (82.78%). Minimum adult emergence of pulse beetle (23.50%) was noticed in black pepper treatment. Treatment of these powders didn't affect the seed germination of *Flemingia semialata*. Therefore, the

use of admixture of powders of *P. nigrum*, *A. calamus* and *M. azedarach* plants may be recommended as protectants of *F. semialata* seeds against the pulse beetle, *C. chinensis* at household level in villages and urban locality.

Establishment of Sub-Lac cultivation centres in adopted farmer's fields in Manipur

Sl. No	Farmer's Name	Address/Location	Host plants grown
1.	Emoinu Self-Help group	Sambei Makha Leikai, Khundrakpam, Imphal East district.	<i>Malvaviscus penduliflorus</i> , <i>Flemmingia semialata</i>
2.	Kahu Farmer's Group	Shingkap village, Kamjong district.	<i>Malvaviscus penduliflorus</i> , <i>Flemingia semialata</i>
3.	Sachungam Kamei	Sorbung village, Phungyar, Kamjong district.	<i>Malvaviscus penduliflorus</i> , <i>Flemingia semialata</i>
4.	Longjang (Thangal) Farmers' Group	Longjang (Thangal), Noney District.	<i>Malvaviscus penduliflorus</i> , <i>Flemingia semialata</i>
5.	Noney Farmers' Group	Noney.	Litchi, <i>Malvaviscus penduliflorus</i>

Punjab Agricultural University, Ludhiana (Punjab)

Collection and conservation of lac insect genetic resources

Survey was completed in 20 districts of Punjab (Sri Muktsar Sahib, Mansa, Bathinda, Amritsar, SBS Nagar, Hoshiarpur, Barnala, Sangrur, Ludhiana, Malerkotla, Rupnagar, Fatehgarh Sahib, Kapurthala, Patiala, SAS Nagar, Jalandhar, Moga, Ferozepur, Faridkot and Fazilka), 6 districts of Delhi (North Delhi, North West Delhi, North East Delhi, West Delhi, Central Delhi and South West Delhi) and 7 districts of Uttar Pradesh (Bagpat, Meerut, Hapur, Amroha, Sambhal, Bulandshahar and Ghaziabad). Two lac insect samples were collected from host plant, *Ziziphus mauritiana* in Punjab. Only dead lac insects were recorded in Delhi region. Eight lac insect samples were collected from Murlipur (Meerut), Lohia Nagar (Meerut), Gangaghat (Hapur), Nandgram (Ghaziabad) and Industrial area (Ghaziabad-Meerut Road, Ghaziabad) of Uttar Pradesh.

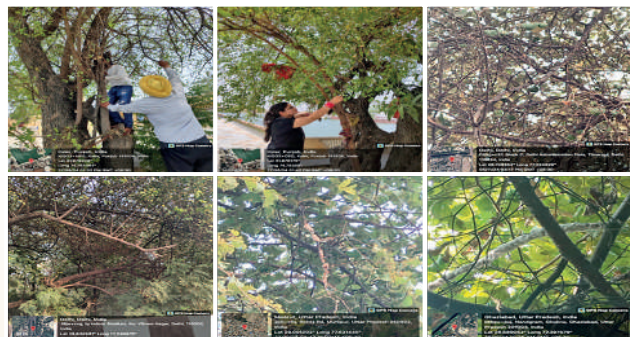


Fig. 3 Surveys conducted in Punjab, Delhi and Uttar Pradesh

Biological and productivity linked parameters of lac insects on *Butea monosperma*

The life cycle and productivity-linked parameters of lac insects (*rangeeni* strain; *baisakhi* crop) was studied on *Butea monosperma* under Punjab condition. The study shows that the life cycle of *rangeeni* strain of lac insects (*baisakhi* crop) ranged from 215-244 days (reported 250 days) under Punjab conditions.

The life cycle and productivity-linked parameters of lac insects (*rangeeni* strain; *baisakhi* crop)

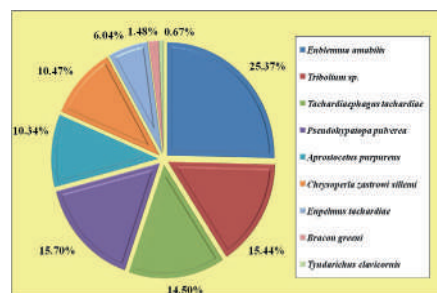
Parameters	Mean $\pm$ SE
Initial density of settlement (no./cm ²)	84.66 $\pm$ 0.39
% Mortality	5.82 $\pm$ 0.48
Sex ratio (% male insects)	12.63 $\pm$ 0.30
Survival at maturity (no./cm ²)	4.86 $\pm$ 0.17
Duration of pre-sexual stages (days)	113.67 $\pm$ 0.76
Initiation of male emergence (days)	156.67 $\pm$ 3.07
Longevity of female cell (days)	231.0 $\pm$ 6.93
Female cell weight (mg)	8.43 $\pm$ 0.26
Resin output (mg)	5.51 $\pm$ 0.25
Fecundity/female (no.)	139.87 $\pm$ 3.96
Broodlac output ratio	6.14 $\pm$ 0.71

Diversity of natural enemies associated with lac insects under Punjab conditions

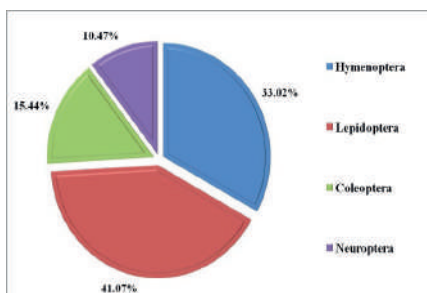
Five natural enemies including four predators, *Eublemma amabilis* Moore (Noctuidae: Lepidoptera), *Pseudohypatopa pulverea* (Blastopidae: Lepidoptera), *Chrysoperla zastrowi sillemi* (Esben-Peterson), *Tribolium* sp. (Tenebrionidae: Coleoptera) and two parasitoids, *Aprostocetus purpureus* (Cameron) (Eulophidae: Hymenoptera) and *Tachardiaephagus tachardiae* (Howard) (Encyrtidae: Hymenoptera) were found to be associated with lac insect. Among these, *E. amabilis* was the predominant species with overall abundance of 31.22%.

Diversity of natural enemies (predators and parasitoids) associated with lac insect under Punjab conditions (2024)

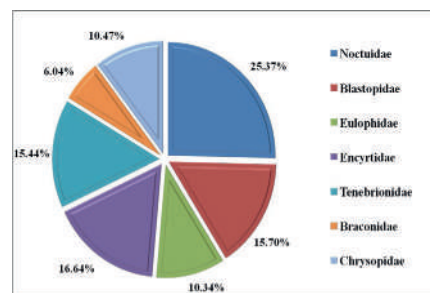
Predators	Parasitoids
<i>Eublemma amabilis</i> (Noctuidae: Lepidoptera)	<i>Aprostocetus purpureus</i> (Eulophidae: Hymenoptera)
<i>Pseudohypatopa pulverea</i> (Blastopidae: Lepidoptera)	<i>Tachardiaephagus tachardiae</i> (Encyrtidae: Hymenoptera)
<i>Chrysoperla zastrowi sillemi</i>	
<i>Tribolium</i> sp. (Tenebrionidae: Coleoptera)	



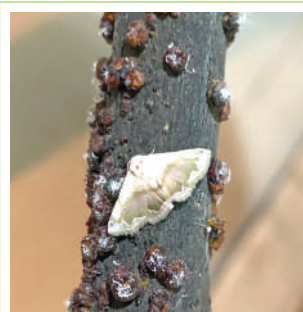
Percent distribution of natural enemies (species wise) associated with lac insects under Punjab conditions



Percent distribution of natural enemies (Genera wise) associated with lac insects under Punjab conditions



Percent distribution of natural enemies (family wise) associated with lac insects under Punjab conditions



Eublemma amabilis



Pseudohypatopa pulverea



Tachardiaephagus tachardiae



Aprostocetus purpureus



Chrysoperla zastrowi sillemi



Tribolium sp.



Eupelmus tachardiae



Bracon greeni

Photographs of different natural enemies associated with lac insect

Evaluation of various insecticides/ biopesticides against predator, *Eublemma amabilis* and their safety to lac insect

Eight insecticides namely emamectin benzoate 5 SG, chlorantraniliprole 18.5 SC, flubendiamide 480 SC, *Bacillus thuringiensis* var. *kurstaki* (Delfin WG and Dipel 8L), indoxacarb 14.5 SC, Neemcare (azadirachtin 0.15%) and chlorpyrifos 20 EC were evaluated for safety to lac insects. *Bt* based biopesticides and Neemcare 0.15 % were comparatively safer to lac insects while chlorpyrifos was found to be most toxic at all the tested concentrations.

Evaluation of various insecticides/biopesticides against predator, *Eublemma amabilis* and their safety to lac insect

Treatments	Concentration (% a.i.)	Survival of lac insects (%)
Emamectin benzoate 5 SG	0.00025	84.00±1.68 ^{abc}
	0.0005	80.18±1.03 ^{bcd}
	0.0010	78.75±1.32 ^{cde}
	0.0015	75.25±1.93 ^e
Chlorantraniliprole 18.5 SC	0.0010	86.10±2.56 ^a
	0.0019	85.75±2.84 ^a
	0.0037	84.80±2.00 ^{ab}
	0.0056	83.08±1.72 ^{abcd}
Flubendiamide 480 SC	0.0018	85.50±2.06 ^a
	0.0039	84.63±1.89 ^{ab}
	0.0079	83.75±1.97 ^{abc}
	0.0118	83.00±1.73 ^{abcd}
Indoxacarb 14.5 SC	0.0072	82.00±2.16 ^{abcd}
	0.0145	78.75±2.29 ^{cde}
	0.029	77.50±1.50 ^{de}
	0.044	75.75±1.93 ^e
<i>Bacillus thuringiensis</i> <i>kurstaki</i>	0.082	86.25±1.93 ^a
	0.17	85.75±2.72 ^a
	0.34	85.30±1.84 ^{ab}
	0.51	84.00±1.08 ^{abc}
Chlorpyrifos 20 EC	0.010	57.75±1.31 ^f
	0.020	54.25±1.65 ^f
	0.040	46.50±2.50 ^g
	0.060	45.25±1.25 ^g
Untreated control	-	86.75±1.49 ^a

Maharana Pratap University of Agriculture & Technology, Udaipur (Rajasthan)

Collection and conservation of lac insect genetic resources

Surveys was completed in 58 blocks of 07 districts of Rajasthan and 26 blocks of 04 districts of Gujarat. During survey prevalence of lac insect was noticed at different locations of which a total of 08 host were identified as natural host for natural prevalence of the lac insect in the region. It was noticed that at majority of locations lac insect was recorded on Peepal, Ber, Babool, Bargad, Custard apple, Palas, Sheesam, Siras and Keekar out of 226 locations covered with 15 live and 37 dead samples. The different activities for the conservation of the lac insect under *in-situ* conditions were under taken during the year 2024 and for the conservation of lac insect biodiversity, total 45.48 kg brood lac was collected from natural hosts in the region and was inoculated at farmer's field of the region.

Lac associated insect fauna from the arid western region (Rajasthan and Gujarat)

The findings indicated that the lac-associated insect fauna comprised species from four different orders: Lepidoptera, Hymenoptera, Coleoptera, and Psocoptera. Among the predators, two species, *Eublema amabilis* and *Pseudohytopa pulvereae* belong to the Lepidopteran order and the families Noctuidae and Blastobasidae, respectively. The primary parasitoids, belonging to the families Encyrtidae and Eulophidae, along with hyperparasitoids from the family Braconidae, are part of the Hymenoptera order.

Large population of storage pests was identified and belong to the families Curculionidae and Liposelidae of the Coleoptera and Psocoptera orders, respectively.





Surveys conducted in Rajasthan and Gujarat

The diversity and species richness of natural enemies of lac insect

The results of the investigation carried out to study the diversity and species richness of natural enemies of lac insect demonstrated that the relative density of the natural enemies emerged from the collected lac samples was

maximum with 46.31% in Rajasthan followed by 34.73% in Haryana and 18.94% in Gujarat. The observations also revealed that among the three states the relative density of primary parasitoids was maximum in Gujarat with 61.10% followed by 59.08 & 52.05% in Rajasthan & Haryana, whereas, the relative density of predators was highest in Haryana with 43.92 percent followed by 36.35 & 33.33% in Rajasthan & Gujarat, respectively.

Studies on the productivity linked parameters of major lac hosts for the lac insect in Southern Rajasthan

The different productivity linked parameters of *rangeeni* strain of lac insect were studied during *baisakhi* season. The observations recorded on mean duration of pre-sexual stages, duration to male emergence, density of mature female cells, life period of female, mean weight of female cell, mean fecundity/female cell and yield of brood lac is given on lower, middle and upper portion of the host branch. It was concluded that Ber is the most preferred host for the lac cultivation in the region followed by Peepal, Acacia sp., Palas, Flemingia, Pigeon pea, Custard apple and Kikar in Southern Rajasthan of arid western plains.

Lac associated insect fauna from the arid western region

	Predators		Parasitoids	Hyper-parasitoid		Storage Pests	
Order	Lepidoptera		Hymenoptera			Coleoptera	Psocoptera
Family	Noctuidae	Blastobisidae	Encyrtidae	Eulophidae	Braconidae	Curculionidae	Liposelidae
Species	Eublema ammabilis	Pseudohytopa pulverea	-	-	-	-	-

Productivity linked parameters of Lac insect (*Rangeeni* strain) on different lac host during *Baisakhi* season

Lac host	Mean duration of pre-sexual stages (Days)			Mean duration to male emergence (Days)			Mean density of mature female cells (per sq. cm)			Mean life period of female cells (Days)		
	Lower	Middle	Upper	Lower	Middle	Upper	Lower	Middle	Upper	Lower	Middle	Upper
Ber	6.99 (48.33)	6.92 (47.33)	7.04 (49.00)	9.91 (97.67)	9.99 (99.33)	10.22 (104.00)	2.55 (6.00)	2.48 (5.67)	2.27 (4.67)	14.22 (201.67)	14.37 (206.00)	14.77 (217.67)
Palas	7.52 (56.00)	7.65 (58.00)	7.52 (56.00)	10.45 (108.67)	10.51 (110.00)	10.61 (112.00)	2.27 (4.67)	2.12 (4.00)	2.04 (3.67)	14.71 (216.00)	14.85 (220.00)	15.06 (226.33)
Flemingia	7.71 (59.00)	7.74 (59.33)	7.76 (59.67)	10.68 (113.67)	10.84 (117.00)	10.90 (118.33)	2.20 (4.33)	1.96 (3.33)	1.78 (2.67)	14.83 (219.33)	15.01 (224.67)	15.02 (225.00)

Lac host	Mean duration of pre-sexual stages (Days)			Mean duration to male emergence (Days)			Mean density of mature female cells (per sq. cm)			Mean life period of female cells (Days)		
	Lower	Middle	Upper	Lower	Middle	Upper	Lower	Middle	Upper	Lower	Middle	Upper
Pigeon pea	7.88 (61.67)	7.78 (60.00)	7.74 (59.33)	10.73 (114.67)	10.78 (115.67)	11.01 (120.67)	2.12 (4.00)	1.87 (3.00)	1.68 (2.33)	14.95 (223.00)	15.13 (228.33)	15.15 (229.00)
Kikar	8.55 (72.67)	8.57 (73.00)	8.48 (71.33)	10.96 (119.67)	11.07 (122.00)	11.25 (126.00)	2.04 (3.67)	1.68 (2.33)	1.58 (2.00)	15.15 (229.00)	15.39 (236.33)	15.35 (235.00)
Custard apple	8.34 (69.00)	8.26 (67.67)	8.36 (69.33)	10.82 (116.67)	10.99 (120.33)	11.07 (122.00)	2.04 (3.67)	1.78 (2.67)	1.58 (2.00)	15.09 (227.33)	15.32 (234.33)	15.38 (236.00)
<i>Acacia sp.</i>	7.49 (55.67)	7.45 (55.00)	7.43 (54.67)	10.12 (102.00)	10.19 (103.33)	10.30 (105.67)	2.35 (5.00)	2.04 (3.67)	1.87 (3.00)	14.55 (211.33)	14.71 (216.00)	15.18 (230.00)
<i>Ficus religiosa</i>	7.04 (49.00)	7.11 (50.00)	7.06 (49.33)	9.92 (98.00)	10.06 (100.67)	10.24 (104.33)	2.48 (5.67)	2.35 (5.00)	2.27 (4.67)	14.29 (203.67)	14.45 (208.33)	14.66 (214.33)
SEm±	1.00	1.13	1.09	0.93	1.27	1.00	0.54	0.37	0.29	0.49	1.21	1.36
CD at 5 %	3.04	3.46	3.32	2.85	3.89	3.04	1.65	1.13	0.89	1.50	3.70	4.15

Mean weight of female cell and mean fecundity of *Rangeeni* strain lac insect on different Lac hosts during *Baisakhi* season

Lac host	Mean weight of female cell (mg)			Mean fecundity/female cell		
	Lower	Middle	Upper	Lower	Middle	Upper
Ber	4.00 (15.53)	3.99 (15.43)	3.98 (15.36)	20.40 (415.67)	20.33 (412.67)	20.27 (410.33)
Palas	3.91 (14.76)	3.89 (14.63)	3.89 (14.59)	19.86 (394.00)	19.85 (393.67)	19.84 (393.00)
<i>Flemingia</i>	3.69 (13.13)	3.70 (13.16)	3.67 (12.99)	19.62 (384.33)	19.51 (380.33)	19.54 (381.33)
Pigeon pea	3.50 (11.76)	3.48 (11.63)	3.48 (11.63)	19.33 (373.33)	19.24 (369.67)	19.21 (368.67)
Kikar	3.59 (12.39)	3.55 (12.09)	3.56 (12.19)	19.46 (378.33)	19.50 (379.67)	19.46 (378.00)
Custard apple	3.82 (14.13)	3.77 (13.70)	3.81 (13.99)	19.69 (387.33)	19.69 (387.00)	19.72 (388.33)
<i>Acacia sp.</i>	3.96 (15.16)	3.93 (14.93)	3.93 (14.96)	19.87 (394.33)	19.89 (395.00)	19.82 (392.33)
<i>Ficus religiosa</i>	3.97 (15.26)	3.96 (15.19)	3.94 (15.06)	20.35 (413.67)	20.27 (410.33)	20.27 (410.33)
SEm±	0.23	0.28	0.21	1.95	1.16	1.31
CD at 5 %	0.68	0.84	0.65	5.95	3.50	3.97

Productivity parameters of lac on different host plant at Udaipur Region

Lac host	Lac Stick per plant (g)	Scrapped lac / plant (g)	Lac host	Lac Stick per plant (g)	Scrapped lac / plant (g)
Ber	5019.35	642.92	Custard apple	698.37	177.43
Palas	3872.53	393.12	<i>Acacia sp.</i>	4508.4	585.94
<i>Flemingia</i>	376.3	197.9	<i>Ficus religiosa</i>	4628.94	598.51
Pigeon pea	286.01	183.34	SEm±	0.42	2.17
Kikar	898	178.3	CD at 5 %	1.028	5.39

Morpho-taxonomic studies of major predators of the rangeeni strain of lac insect

The observations for various morphological parameters viz., body length, wingspan, length of

right and left antennae, length and breadth of both forewings & hindwings of both male and female of major predators viz., *Eublemma amabilis* & *Pseudohypatopa pulverea* shows that females is larger in size than males for both the predators.

Body dimensions of *Eublemma amabilis*

Sl. No.	Parameters (mm)		Eublemma amabilis				Pseudohypatopa pulverea			
			MALE		FEMALE		MALE		FEMALE	
			Range	Mean	Range	Mean	Range	Mean	Range	Mean
1	Body length		1.00-1.95	1.08	1.00-1.24	1.11	0.62-0.69	0.66	0.73-0.75	0.74
2	Total Wingspan		2.32-3.09	2.60	2.32-2.85	2.60	1.50-1.80	1.50	1.70-1.90	1.70
3	Antennae	R	0.25-0.58	0.39	0.33-0.48	0.39	0.46-0.49	0.47	0.46-0.48	0.47
		L	0.24-0.58	0.39	0.32-0.49	0.40	0.46-0.49	0.47	0.46-0.48	0.47
4	Forewing (Length)	R	0.86-1.32	1.15	0.97-1.24	1.03	0.67-0.71	0.68	0.74-0.78	0.76
		L	0.81-1.38	1.13	1.00-1.23	1.05	0.66-0.69	0.68	0.76-0.78	0.77
5	Forewing (Breadth)	R	0.41-0.59	0.50	0.44-0.59	0.57	0.17-0.19	0.18	0.19-0.22	0.20
		L	0.40-0.58	0.49	0.44-0.64	0.58	0.17-0.19	0.18	0.19-0.21	0.20
6	Hindwing (length)	R	0.68-1.07	0.86	0.77-0.97	0.78	0.62-0.65	0.63	0.60-0.65	0.61
		L	0.65-1.02	0.85	0.73-0.92	0.77	0.61-0.66	0.63	0.61-0.64	0.61
7	Hindwing (Breadth)	R	0.31-0.64	0.47	0.34-0.54	0.49	0.22-0.26	0.25	0.30-0.35	0.32
		L	0.30-0.68	0.47	0.34-0.60	0.49	0.23-0.26	0.25	0.31-0.35	0.32

Body dimensions of *Eublemma amabilis*

			
Body length of female <i>E. amabilis</i>	Forewing breadth of male <i>E. amabilis</i>	Left wing length of female <i>P. pulverea</i>	Total wingspan of <i>P. pulverea</i>
Morpho-taxonomic measures of the major predators of Lac insect			

Kerala Forest Research Institute, Thrissur (Kerala)

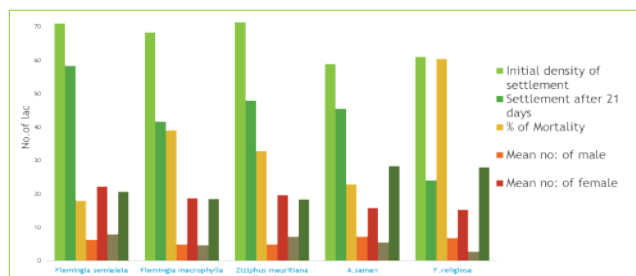
Field surveys have been completed except Lakshadweep, two districts of Tamil Nadu (Nagapattinam Tiruvarur) one district (Idukki) in Kerala. Mr. Manjula Parthiban in Kolapalur village of Erode district is continuing lac cultivation on *F. semialata*.



Lac cultivation in Tamil Nadu

Performance of Lac insect *Kerria madurensis* on different host plants

The performance of *K. madurensis* on different host plants such as *F. semialata*, *F. macrophylla*, *Z. marutiana*, *A. saman* and *F. religiosa* showed significant difference among the group. Initial settlement, final settlement and percentage of female lac cell were high on the host plant *F. semialata* inoculated with *Kerria madurensis*. Based on the results *F. semialata* is a potential host plant for the cultivation of *Kerria madurensis* in Kerala.



Performance of lac insect *K. madurensis* on different host plants

ICAR- KVK Sirsi, Uttara Kannada - UAS, Dharwad (Karnataka)

All the 31 districts of Karnataka were surveyed. Lac encrustation (live and dead) was noticed in 31 blocks of Karnataka.



Fig. 12. Surveys conducted in Vijayapur district of Karnataka

Lac cultivation in Karnataka

In 2024, *kusmi* lac cultivation was carried out by farmers in Bannikuppe village, Mysuru, on *Ber* and *Flemingia semialata* plants, resulting in the harvest of 70 kg of *kusmi* broodlac. Of this, 50 kg was sold at ₹700 per kg, while the remaining was used to inoculate different host plants for continued lac cultivation.



kusmi lac cultivation at farmers field in Bannikuppe village, Mysuru on *Flemingia semialata* and *Ber*

State Forest Research Institute, Jabalpur (Madhya Pradesh)

Collection and conservation of Lac Insect Genetic Resources

The survey was conducted in 126 blocks of 29 districts (Kawardha, Bilaspur, Mungeli, Raigarh, Janjgeer-Champa, Gariaband, Bilaigarh-Sarangarh, Korba, Mahasamund, Dhamtari, Balodabazar, Sakti, Raipur, Rajnandgaon, Balod, Manpur-Mohla, Korea, Surajpur, Surguja, Jashpur, Balrampur, Manendragarh-Chirmiri-Bharatpur, Kanker, Kondagaon, Kondagaon, Narayanpur, Durg, Khairagarh-Chikhadan, Bemetara) and lac occurrence was recorded in 168 sites of 64 blocks of 26 districts in Chhattisgarh on palas (*Butea monosperma*), kusum (*Schleichera oleosa*), ber (*Ziziphus mauritiana*), pipal (*Ficus religiosa*), rain tree (*Samanea saman*) Galwang, safedsiris (*Albizia procera*), semialata, akashmoni (*Acacia auriculiformis*).



Kusmi lac cultivation in Bichhiya Village of Umaria district of Madhya Pradesh



Surveys conducted in Chhattisgarh



Kusmi lac cultivation at farmers field

In a joint venture of SFRI, Jabalpur and Umaria Territorial Forest Division 40 Village Forest Committee (VFC) members were trained for Kusmi lac cultivation. 80 kg of kusmi broodlac was inoculated on selected Kusum trees (1 kg/tree) in February 2024 (Jethwi crop). Samiti harvested 180 kg broodlac from 50 Kusum trees in July 2024.

Socio-economic status of lac collecting farmers of Kanker district of Chhattisgarh

Survey on socio-economic status of 22 lac farmers of Kodaikundel, Pandaripani, Sonekahal, Moharband, Behradih, Khairwah, Lilejhar, Mayana, Chapeli, Botha, Markatola, Hafra, Katagaon, Makdi, Kalagaon, Gudphel, Peswani of Kanker, Charama, Durgkondal and Bhanupratappur block of Kanker district of Chhattisgarh was carried out in 2024. All the farmers of Kanker district cultivated kusmi lac on kusum, ber, *Flemingia semialata* and Galwang lac host plants in their farm field. Amongst the different sources of income, income from lac cultivation contributed 29.27% of their total annual income.

ICAR-Research Complex for Eastern Region, Patna (Bihar)

Collection and conservation of lac insect genetic resources

In Bihar's Nalanda district, six new blocks (Hilsa, Biharsharif, Asthwan, Islampur, Rahui, and Harnaut) were surveyed and lac insects were exclusively observed in the Hilsa block on *Ficus religiosa* (Peepal). In Eastern Uttar Pradesh, 55 blocks across seven districts viz., Deoria, Kushinagar, Maharajganj, Ballia, Ghazipur, Gorakhpur and Basti were surveyed. Lac insects were observed in five blocks within three districts: Deoria Sadar block (Deoria district) on *Ficus rumphii* (Pakur), Pharenda block (Maharajganj district) on *Ficus religiosa* (Peepal) and Basti, Gaur

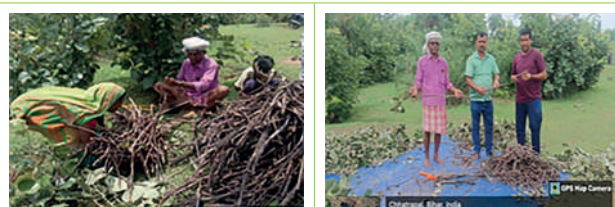
and Bahadurpur block (Basti district) on *Ficus religiosa*.



Surveys conducted in Bihar and Eastern Uttar Pradesh

Scientific lac cultivation in selected villages of Banka district

Rangeeni lac cultivation, involving farmer participation was carried out in Hirmoti village, Banka district. In July 2024, about 150 kg of broodlac was harvested from 38 Palas trees and 5 Ber trees during the *baisakhi* crop. This 150 kg of broodlac was then inoculated on 200 Palas trees across Hirmoti (Banka block), Samukhia (Banka block), Bengalgah (Chandan block), and Salayia (Katoriya block), resulting in the harvest of around 340 kg of broodlac. This entire 340 kg was subsequently inoculated on 230 Palas trees and 2 Ber trees at all four sites to cultivate the Baisakhi 2024-25 crop, which is currently in progress.



Scientific lac cultivation in Banka district of Bihar

Sher-E-Kashmir University of Agricultural Sciences and Technology, Jammu (Jammu and Kashmir)

Multiplication of the location specific local collection of the lac insect

All the collections (13 Nos.) were maintained *in-situ* and in the gene bank at SKUAST, Jammu. About 42 kg of brood of two collections (2 best strains) was produced.

In-situ and *ex-situ* conservation of lac insect

Ex-situ conservation: Nearly 1593 plants were inoculated for conservation and about 200 people were involved in the campaign. About 1157 Kgs of brood was produced for multiplication and small-scale demonstrations.

In-situ conservation: All the collections (13 No.) are being maintained *in-situ* and at the gene bank in SKUAST, Jammu. About 40 kg of brood of five collections (5 strains) was produced and re-inoculated in the collected regions.

During the survey, it was ascertained that the lac insect is highly prone to summer mortality in Jammu region. However, *Albizia lebbeck* and *Calliandra sp.* were found the most suitable for summer broodlac conservation while *Acacia nilotica* and *Zizyphus mauritiana* were recorded as the best host plants for lac cultivation.

Broodlac multiplication for exploring cultivation

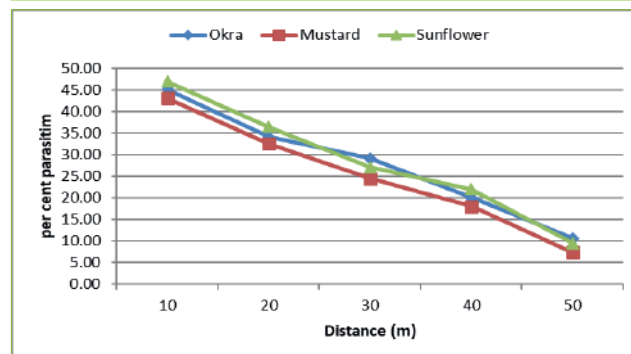
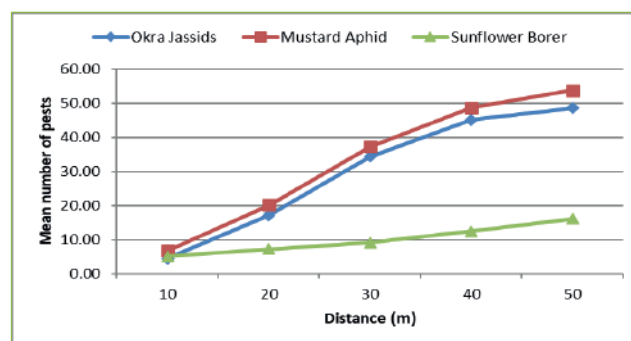
The lac insect samples collected from the different lac hosts from different localities were inoculated on 11 lac host plants at SKUAST, Jammu during the month of June and October 2024. After inoculation the emergence and settlement data were recorded for each sample of lac insect on host plants. Total 453 kg of brood was multiplied and inoculated on 125 plants across 5 villages on *Zizyphus mauritiana*, *Albizia lebbeck* & *Acacia nilotica*.



Broodlac multiplication at farmers field

Lac cultivation can enhance biological control

Lac cultivation decreased the incidence of many sucking pests in the neighbouring agriculture field. As the distance of other neighbouring agriculture field decreases from the lac cultivation plots, there was less incidence of Okra Jassids, Mustard Aphid and Sunflower borer and more incidence of natural enemies.



Incidence of sucking pests in the neighbouring agriculture field upon lac cultivation

Climate smart initiative lac cultivation

Small experiment was conducted on *Katki* lac crop to study the effect of protected condition on lac production. In the experiment 10 *Flemingia semialata* bushes under protected house conditions were compared with similar set in open conditions. It was found that in protected conditions, the productivity was higher with early maturity by 16 days & significantly greater number of brood cells. The higher best deposition in protected conditions suggested the protection from natural enemies.

Among all the strains, the Gole Market strain was found to be the most promising in terms of higher settlement rate (198.80 crawlers/cm²), lower mortality (30%), lowest parasitism, greater fecundity (220 larvae per cell) and dense female cells (13.30/cm²), differences being significant.

Network Project on Harvesting, Processing and Value Addition of Natural Resins and Gums (HPVA-NRG)

Lead Centre: ICAR-NISA, Ranchi

Extraction of guar meal protein isolates (GMPI)

The method described by Khalil et al. (2001) is commonly adopted for extracting GMPI from guar meal flour. The method was reported to yield > 80% of crude GMPI. However, repeating the same method yielded only 19% of GMPI. Therefore, some modifications were made in the method, and corresponding GMPI yields were determined.

Modification of Khalil's method for extraction of GMPI

The effect of the extraction solvent ratio, extraction time, and concentration of NaOH in the extraction solvent was observed on the crude yield of GMPI. The results suggested that increasing extraction time up to 120 min or reducing the ratio of extraction solution to half did not significantly change the extraction yield, and the yield varied between 20-25%. A two-fold increase in the yield to 34% has been observed by keeping the solid solvent ratio and extraction time constant at 1:40 and 40 minutes respectively. However, a three-fold or five-fold increase in NaOH concentration impacted the yield negatively. Surprisingly, the complete elimination of NaCl from the extractant and only using 0.2 M NaOH yielded 32.5% GMPI.

Ultrasound (US)-assisted extraction of GMPI

US extraction was carried out using different concentrations of NaOH only. The highest protein isolate (yield 38.8%) has been obtained with the treatment extracted with 0.2 M NaOH solution with 30 min stirring with 15 min ultra-sonication time.

Standardization of the process of separation of proteins from tamarind seed gum

A protocol to prepare tamarind gum (TG) based aqueous paper glue formulation has been developed. Different parameters like concentration of TG, heating conditions, pH-controlling compounds, surfactants, and preservatives were optimized through a series of experiments.

Different concentrations of TG Solutions ranging from 1 to 3.5% were prepared and checked for their viscosity, ease of application, spreadability, etc. Based on the practicability of pasting papers, 3% TG solution was found to be better with a viscosity of 860 cP. Sodium carbonate (Na_2CO_3) was used as an alternative to NaOH. The pH of gum solution could be raised to 11 with the addition of 3% Na_2CO_3 , which is sufficient for desirable consistency.

To address the shelf-life issue of glue formulations, several preservatives (Sodium benzoate, Methyl paraben-Na salt, acetic acid, phenol, and sodium nitrite) were tried, and phenol was found to be best preservative for TG glue. Further, an open beaker experiment was conducted to test phenol's preservation effect at various concentrations and, it was observed that phenol with 0.3 (% wt of TG) concentration could preserve the glue up to the 28th day.



Tamarind gum (TG) glue formulations

Development of matrix independent NRG based gluten free binder for use with millets and pseudo cereals

Preparation of chapatti from the millet flour added with natural resins and gums (NRG) based gluten free binder. Millet flour was added with a known amount of NRG based gluten free binder. Single NRG at different doses & combined NRGs in different doses were mixed in millet flour as gluten

free binder for preparation of chapatti. The dough was prepared manually by mixing millet flour, NRG based gluten free binder & hot water (50-60 °C), and the dough was rested for 30 min for hydration of NRG based binder. Chapatti were prepared from dough, and texture & sensory analysis of chapatti were carried out.

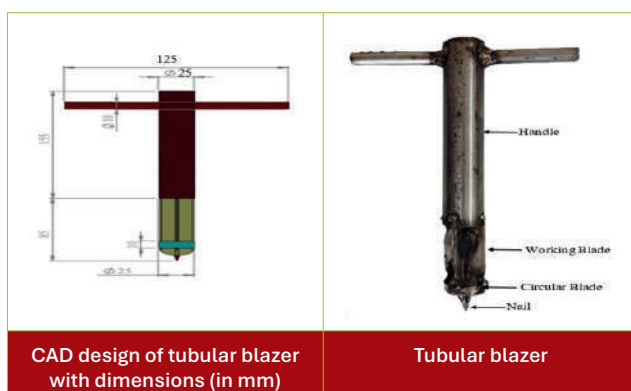
The addition of guar & psyllium gum (individual & combinations) in millet flours showed better performance as a gluten free binder. NRG doses which gave the best quality chapatti are summarized in the following table.

Millet flour	NRG dose	
	Added Individually	Added in Combination
Bajra	Guar gum: 2.5% Psyllium gum: 1%	Guar and psyllium gums: 1.25%
Ragi	-	Guar and psyllium gums: 1.25%
Jowar	Psyllium gum: 2.5%	-

On-going other activities at the Lead Centre:

Design and development of a sustainable gum production hand tool

Conceptual/line diagram of the gum tapping hand tool developed considering IINRG-Gum tapping blaze-75 of moringa gum tapping developed by ICAR-NISA, so that the shape and size of blaze/incision made on the tree trunk for gum tapping may be uniform for each blaze/incision per tree.



To increase gum production with less time, reduce man power requirement and minimal application of gum inducer, which can be used to reduce the injury to selected gum producing tree species with

minimum injury. The developed tubular blazer has been tested for tapping Baheda, Chironji, Karaya, Palas and Moringa gum from *Terminalia bellirica*, *Buchanania lanzan*, *Streulia Uren*, *Butea Monosperma* and *Moringa oleifera* trees.

Experimentation on *chironji* gum tapping from *Buchanania lanzan* trees

A gum tapping experiment from *B. lanzan* trees has been initiated with the sub project 'Effect of Tapping Techniques on Gum Yield from *Buchanania lanzan* Trees' in the first week of January, 2022 at Kowali village forest (23°19' N and 85°25' E) of Namkum block, Ranchi district of Jharkhand. Twenty-four trees of *B. lanzan* (10-15 years old) were selected & numbered for natural gum collection. The diameter at breast height (DBH) of selected trees was measured. The trees were classified into three diameter classes viz 15-20 cm and 21-25 cm and 26-30 cm. Eight tapping techniques (Battery operated drilling-12.5 mm), Hand operated drilling (12.5 mm), Hand operated drilling (25 mm) and tubular blazer with and without inducer) have been evaluated with three replicates.

During the trial of the developed hand tool for gum tapping from *Buchanania lanzan* as well as different gum producing trees, it was observed that blaze/incisions developed easily with the sharp edges on the tree trunk utilizing developed Tubular blazer. The detailed specifications of the tubular blazer are mentioned below.

Specification of Tubular Blazer	
Overall dimension, (length, width and Thickness), mm	235 x 130 x 25
Weight, kg.	0.77
Price, ₹	900
Requirement of man power, man per day	01
Time requirement for making blaze, Second	1520-
Blaze making capacity, Blaze/day	*1400-1500
Increase in gum productivity	2 - 20 times

*Requirement of 2 man per day for making blaze 1400-1500

Comparison of gum yield through different tapping techniques

The comparative result of the study showed that, the developed tool was simple and safe for making blaze for gum production. The tubular blazer for making blaze in both treatments with or without application of gum inducer was found better for chironji gum tapping producing about 661.4 g and 249.4 g of the gum, respectively. Use of developed tubular blazer saves time and reduces cost for blaze making. Further the developed tool was found to be less injurious to the trees in terms of volume of bark removal in making blaze for gum production.

Network Cooperating Centers

ICAR-Central Arid Zone Research Institute (CAZRI), Jodhpur (Rajasthan)

Study on gum production from known and lesser-known gum producing tree species of arid zone of Rajasthan

Optimizing tapping methods and inducer technology for enhancing gum production

Experiments were carried out for gum induction from lesser-known gum producing tree species like *Prosopis cineraria*, *Moringa oleifera*, *Azadirachta indica*, *Anogeissus latifolia*, *Cordia rohtii* and *Boswellia serrata*, and the effects of tree girth and treatment type (level of gum inducer) on gum yield have been evaluated to determine optimal strategies for maximizing production. The results showed that statistically significant differences were observed in the yield of gum among different treatments that is among the different girth and different dose of CAZRI gum inducer treatment.

Gum yield from <i>P. cineraria</i> and <i>M. Olifera</i> in different girth classes and CAZRI gum inducer treatments		
Treatments	Gum yield from <i>P. cineraria</i> (g tree ⁻¹)	Gum yield from <i>M. olifera</i> (g tree ⁻¹)
Girth (G)		
G1 (>75 cm)	5.10 ^a	78.0 ^a
G2 (<75 cm)	2.32 ^b	65.9 ^b

Treatment (T)		
T1 (50%)	2.96 ^b	19.3 ^c
T2 (25%)	6.58 ^a	47.0 ^b
T3 (Only blaze)	1.60 ^c	149.6 ^a
Significance		
Girth	**	**
Treatment	**	**
G×T	**	*

Enhancing Farmers' Income through Gum Arabic Production in Arid Districts of Rajasthan

About 7030 number of *A. Senegal* trees were treated with CAZRI gum inducer by the CAZRI, Jodhpur registered gum pickers during the period (January - December, 2024). The production of gum Arabic as well as economic earned by 31 target villages of Barmer, Jodhpur and Nagaur district of arid western Rajasthan is depicted below.

Gum arabic production and economic earned by CAZRI inducer method	
Particulars	2024-25
Number of <i>A. senegal</i> trees treated (in thousands)	7030
Production of gum Arabic by farmers (t)	3.51
Total income earned by farmers (₹ Lakhs)	35.15
Revenue generated by CAZRI (₹ Lakhs)	1,40,600/-

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

The gum samples of *Acacia senegal* (gum Arabic) were collected from different agro-ecological zones of Rajasthan (from 10 different districts).

Physical characterization of gum samples from different agro-ecological zones of Rajasthan

Physical and physico-chemical characteristics (true density, bulk density, tapped density, bulkiness, porosity, Hausner's Ratio, Carr's Compressibility Index, color parameters,

Moisture, pH, viscosity, Ash, Protein content, minerals Copper, Zinc, Manganese and Iron) of gum samples collected from different agro-ecological zones of Rajasthan (from 10 different districts) and different physical and physico-chemical characteristics properties of gum Arabic

as determined in the current study have been compared to the specification requirements of Bureau of Indian Standards (BIS Specification IS 6795:2007) and European Union (Regulation 231/2012) as presented in the following Table:

Physical properties of gum samples from different districts of Rajasthan

District	Bulk density (g/cc)	Tap density (g/cc)	True density (g/cc)	Bulkiness (g/mL)	Hausner's ratio	Carr's compressibility index	Porosity (%)
Jodhpur	0.64 ^b	0.71	1.40	1.653	1.11	11.78	53.40
Jaisalmer	0.66 ^a	0.70	1.40	1.651	1.08	11.65	53.40
Barmer	0.63 ^b	0.71	1.40	1.654	1.12	11.65	53.40
Size (S)							
S1 (5-9mm)	0.63 ^c	0.68 ^{bc}	1.41	1.63 ^b	1.09	8.27 ^b	55.43 ^{ab}
S2 (1-4mm)	0.68 ^b	0.75 ^{ab}	1.37	1.48 ^b	1.09	8.44 ^b	49.15 ^c
S3 (31-300µm)	0.70 ^a	0.76 ^a	1.43	1.46 ^b	1.10	10.36 ^b	50.82 ^{bc}
S4 (0.35µm)	0.57 ^d	0.63 ^d	1.39	2.05 ^a	1.11	19.72 ^a	58.21 ^a
Significance							
District	***	NS	NS	NS	NS	NS	NS
Size	***	***	NS	***	NS	***	**
G×T	***	NS	NS	NS	NS	NS	NS

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

Chemical characterization (% dry basis) of gum samples from different districts of Rajasthan

Properties	Jodhpur	Jaisalmer	Barmer
Moisture	10.08±0.005	9.30±0.153	10.23±0.007
pH	5.18±0.003	5.20±0.004	5.19±0.002
Ash	0.03±0.00	0.03±0.00017	0.02±0.00035
Viscosity (cP)	23.7±3.57	27±2.54	28.04±3.25
Protein (%)	1.75±0.05	2.53±0.09	2.18±0.24
Copper (ppm)	12.95±1.15	10.3±0.75	9.52±0.58
Zinc (ppm)	2.7±0.04	4.28±0.07	3.57±0.49
Manganese (ppm)	1.84±0.49	0.73±0.04	0.48±0.03
Iron (ppm)	55.6±5.35	42.55±1.90	32.45±2.94

Comparison of specification of Gum Arabic as per Indian and European standards with those determined in the current study

S. No.	Physico-chemical property	BIS Specification IS 6795:2007	European Union regulation 231/2012	Determined in current study		
				Jodhpur	Jaisalmer	Barmer
1	Moisture content	15% Max	17% Max	9.9 to 10.25%	1.95 to 9.65%	9.6 to 11.8%
2	Total Ash	4% Max	4% Max	2 to 3.5 %	2 to 3.1%	0.2 to 3.7 %
3	Insoluble matter	1% Max	1% Max	<1%	<1%	<1%
4	Solubility	Soluble in cold water in soluble in ethanol	Soluble in cold water in soluble in ethanol	Soluble in cold water in soluble in ethanol	Soluble in cold water in soluble in ethanol	Soluble in cold water in soluble in ethanol
5	Tannin	No blackish coloration or blackish precipitate with Ferric chloride	No blackish coloration or blackish precipitate with Ferric chloride	No blackish color	No blackish color	No blackish color
6	pH	acid to litmus	acid to litmus	Acidic	Acidic	Acidic
7	Optical rotation	Levorotatory for <i>A. senegal</i> and Dextrorotatory for <i>A. seyal</i> samples	-	nd	nd	nd
8	<i>Salmonella</i> sp.	Negative	Negative	nd	nd	nd
9	<i>E. coli</i>	Negative	Negative	nd	nd	nd
10	Hydrolysis products	-	Mannose, xylose and galacturonic acid are absent	nd	nd	nd

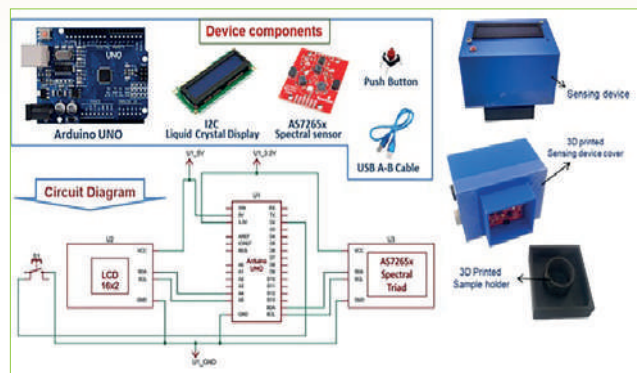
Nd – not determined

Detection of gum adulteration using spectral sensing and chemometric analysis

The detection of adulteration in natural gums is critical to ensure their quality and preserving their functional properties in various applications. The study focused on analyzing gum samples from different species, including *Acacia senegal*, *Acacia tortilis*, *Acacia rotundifolia*, *Moringa*, and *Prosopis juliflora*. The adulteration process involved

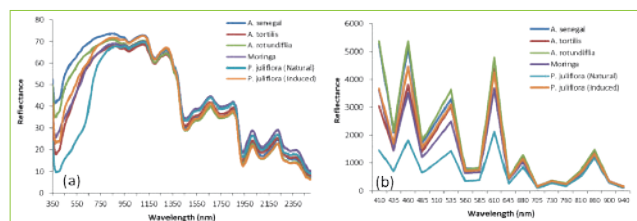
blending *A. senegal* with *A. tortilis* at varying levels (5%, 10%, 20%, 30%, and 40%), along with control samples of 0% adulteration (*A. senegal*) and 100% adulteration (*A. tortilis*). A portable spectroscopic device has been developed using Sparkfun AS7265x reflectance spectroscopy sensor by connecting it with Arduino Uno and a protocol was developed for detection of gum adulteration using spectral sensing and chemometric analysis. The study utilized both a laboratory-grade

spectroradiometer and the handheld 18-channel spectral sensing device to acquire spectral data from the gum samples, providing a comprehensive comparison of their performance.



Hand held 18 channel spectral sensing device (410-940 nm)

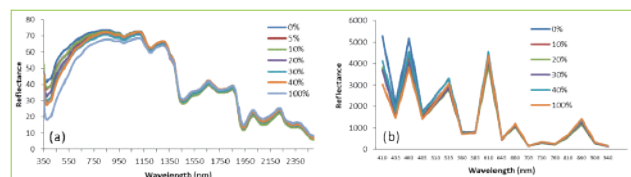
Spectral data were collected from six samples per group using a spectroradiometer covering a wide spectral range of 350–2500 nm. Additionally, 12 samples per group were analysed with the handheld device, which operates in the narrower spectral range of 410–940 nm. This dual approach enabled the study to assess the capabilities of the handheld device against the benchmark spectroradiometer. Distinct differences in the reflectance spectra of the gum samples were observed between pure and adulterated gum arabic. In the visible spectrum, *A. senegal* exhibited the highest reflectance intensity, whereas *P. juliflora* had the lowest. The classification accuracy of the handheld device was 72%, closely matching the 75% accuracy achieved with the spectroradiometer. It was noted that the highest classification error occurred with *A. rotundifolia*, which was frequently misclassified as *A. Senegal*.



Average reflectance spectra of different gum samples using (a) Spectroradiometer (b) Hand-held sensing device

Adulteration caused a noticeable decrease in reflectance intensity, especially in the visible region, making it a useful indicator of adulteration levels. Quantification of adulteration using PLSR models revealed an R^2 value of 0.714 for the handheld device, compared to 0.992 for the

spectroradiometer. Similarly, the Root Mean Square Error (RMSE) was 17.345 for the handheld device and 2.975 for the spectroradiometer. These findings demonstrate the handheld device's capability to approximate the performance of the spectroradiometer, though with room for improvement in accuracy and precision.



Average reflectance spectra of adulterated gum samples using (a) Spectroradiometer (b) Hand-held sensing device

ICAR-Central Agro-Forestry Research Institute (CAFRI), Jhansi

Documentation of indigenous technical knowledge (ITKs) on harvesting, processing and value addition natural gums and resins

Survey of tribal area for ITK

Surveyed Newari district of M.P. and collected information on ITK of gum tapping techniques, processing and uses. Based on ITK of gum collection techniques, a tool namely 'CAFRI-Thorny Tree Gum Amasser' was developed for collecting natural gum-exudes from thorny trees and tested on *A. nilotica* trees.

Design and development of gum collection tool

Based on ITK, a gum tapping tool- CAFRI-Thorny Tree Gum Amasser has been developed to collect exudate gum from thorny trees like *Acacia nilotica*, *Acacia senegal*, *Acacia catechu* etc. The CAD design has been developed with the help of ICAR-CIAE Bhopal, and two prototypes have been fabricated locally with bamboo sticks as handle. During summer season, the tool has been used for collecting gum tears from the trees of *Acacia nilotica*. It has been easy to use and a labourer collected 15 gum tears (65.0 g) in 10 min. Total gum collection depends on presence of exuded gum tears on the tree. Further, it has also reduced drudgery of labourer and risk of being pierced with thorn. The concept and design of CAFRI-Thorny Tree Gum Amasser has been registered in ITMU of ICAR-CAFRI, Jhansi.



Feasibility for inclusion of NRG plants in agroforestry

Acacia senegal based multi-component agri-hort-silviculture model

In *A. senegal* based multi-component agri-hort-silviculture model, maximum GBH and canopy spread has been observed in *A. marmelos* followed by *A. senegal* and *C. limon* while the minimum (collar dia) in *C. carandas*. Maximum tree height was recorded in *A. senegal*. During summer season, the field was green manured with dhaincha (*Sesbania aculeata*) by which green biomass of 3.8 t ha⁻¹ was added. During winter season, barley was grown as intercrop and data were recorded for different parameters for assessing tree-crop interaction. Presence of trees as well as distance from tree trunk has shown variable effects on growth and yield characters of barley grown as intercrop. The grain yield was significantly higher in association of *Acacia senegal* than the other two woody fruit plants. Further, 180 kg lemon, 156 kg karonda 1550 kg of bael fruits were produced from the fruit yielding components.

A. Nilotica and *A. Senegal* based rainfed agri-silviculture model

In rainfed agri-silviculture model, both these tree species attained more GBH at 10x10 m spacing than the plantation at 10x5 and 5x5 m. During summer season of 2024, green manuring was practiced with dhaincha crop and biomass of 1.99, 2.89 and

4.41 ton/ha was added in soil in 5x5, 10x5 and 10x10 m spacing, respectively. The results of study revealed that the tree species did not influence crop parameters while the tree spacing significantly affected the plant population, pods/plant and grain yield. Maximum grain yield was recorded in 10x10 m spacing followed by 10x5 m and 5x5 m. In comparison to control, maximum reduction in grain yield was noticed at 5x5 m followed by at 10x5 m. There was no reduction in grain at 10x10 m spacing. In silvi-herbal Model-I and II *A. nilotica* attained more GBH, height and canopy spread than *A. senegal* and *T. arjuna*. Maximum survival, growth and biomass yield of lemon grass were recorded in tussocks planted at 1x1 m spacing.

Evaluation of IINRG- gum tapping Blazer- 75 and Blazer-150

To assess feasibility of using IINRG-gum tapping Blazer-75 and Blazer- 150 in agroforestry trees. Trials have been conducted on existing trees at research farm of the institute for tapping gum-butea (*B. monosperma*), gum-dhwarra (*A. latifolia*), gum-gatti (*A. pendula*), gum babul (*A. nilotica*) and gum Arabic (*A. senegal*). Single cut was made on a tree with blazer-75 and blazer-150 by hammering with hammer. Three replications were used for each tree species. Observation on gum exudation was recorded and exuded gum collected. The findings revealed that use of Blazer-75 yielded negligible gum only in *B. monosperma* (2.0 g/cut) and *A. latifolia* (1.0 g/ cut) and in other species such as *A. pendula*, *A. nilotica* and *A. Senegal*. No gummosis was observed when gum was tapped using Blazer-75. The Blazer-150 was tested on *A. latifolia* (Gum-dhawara) and the cut made with Blazer-150 did not yield gum.



Assessment of months-wise and seasonal variability in exudation of Palas gum

The trial for assessing month-wise and seasonal variability in gum exudation in Palas (*Butea monosperma*) has been concluded. The findings of the trial revealed that months of December and January of winter season are the best time to tap butea trees for maximum gum yield.

Demonstration and development of gum yielding tree-based agroforestry models on farmers' fields

During the year, visits have been conducted to villages Garhkundar, Binwara, Ambabai and Kochhabhawar to see agroforestry models developed on farmers' fields and growth of trees was monitored. The farmers have been motivated to adopt more agroforestry on their farm. About

500 seedlings of *A. senegal* raised in nursery have been supplied to farmers. Besides, the agroforestry models including bio-fence models developed at the research farm of the institute has been demonstrated to visiting farmers. Data on tree growth on farmer's field reveals that the GBH of *A. senegal* on farmer's field ranged from 22.4 cm in village ambabai to 41.9 cm in garhkundar.



Boundary planting of *A. senegal* on farmers' field as bio-fence

Vasantrao Naik Marathwada Krishi Vidyapeeth (VNMKV), Parbhani (Maharashtra)

Studies on characterization of guar gum genotypes of different locations

Seed samples of guar genotypes of 12 varieties (viz. HG-2-20, RGC-1066, RGC-1033, CAZG-17-4-1, RGR-20-15, X-30, GD-570, HG-2-20, RGR-20-15, HG-19-4, GG-1806, GG-1909, GD-567, X-25)

have been obtained from All India Coordinated Research Project on Arid Legumes, College of Food Technology, VNMKV, Parbhani, which have been collected from different centers viz; Kanpur, Jodhpur, Gwalior and Parbhani for the quality analysis. These samples have been evaluated for different physico-chemical parameters, proximate composition, gum content and viscosity profile.

Physical quality characteristics of different varieties of guar seed

Region	Sample	Thousand seed weight (g)	Bulk density (g/cm ³)	True density (g/cm ³)	Angle of repose (°)
Parbhani Centre	GG-1806	30.10	1.23	1.85	27.50
	GG-1909	29.80	1.22	1.73	28.20
	GD-567	29.60	1.24	1.78	29.20
	X-25	31.70	1.22	1.77	29.50
Kanpur Centre	RGC-1066	32.59	1.21	1.83	26.82
	RGC-1033	32.30	1.20	1.81	26.84
Jodhpur Centre	CAZG-17-4-1	32.40	1.22	1.84	26.81
	X-30	32.20	1.25	1.80	26.80
	GD-570	30.80	1.26	2.11	30.35
Gwalior Centre	HG-2-20	30.20	1.18	1.92	28.70
	RGR-20-15	30.25	1.16	1.86	28.60
	HG-19-4	30.15	1.15	1.88	28.50

*Each value is average of three determinations

*Bold letters represent highest values

Average proximate composition of guar seed genotypes (%)

Region	Sample	Moisture	Fat	Protein	Carbohydrate	Fiber	Ash
Parbhani	GG-1806	8.95	2.63	30.85	47.5	5.20	4.40
	GG-1909	8.90	2.65	29.53	48.96	5.16	4.80
	GD-567	8.70	2.70	29.47	48.98	5.83	4.32
	X-25	8.85	2.60	29.30	49.83	5.29	4.10
Kanpur	RGC-1066	9.20	3.10	32.40	45.03	5.89	4.38
	RGC-1033	9.10	3.05	32.17	45.09	5.67	4.92
Jodhpur	CAZG-17-4-1	9.70	3.45	30.71	45.28	5.83	5.03
	X-30	9.75	3.28	30.54	45.40	6.38	4.87
	GD-570	9.78	3.20	31.06	45.65	5.69	4.80
Gwalior	HG-2-20	10.15	2.29	30.80	46.54	5.49	4.73
	RGR-20-15	10.10	2.40	30.38	46.20	5.94	4.98
	HG-19-4	9.90	2.35	31.82	45.01	5.80	5.12

*Bold letters represent highest values

Standardization and quality evaluation of sugarcane juice incorporated with guar gum

The process of sugarcane juice incorporated with guar gum was standardized by varying the levels of sugarcane juice and guar gum. The process involves cleaning of sugarcanes to remove the impurities and treating with 0.2% KMS. Juice is extracted from treated sugarcanes, filtered and homogenized. During homogenization, 0.4 to 0.6% guar is added to the juice followed by filling the juice in glass bottles, pasteurization (90 °C for 3 min), cooling, labelling and storage at room temperature. The formulation was standardized for sugarcane juice incorporated with FSSAI permissible preservatives and guar gum at different concentration (0.4 to 0.6%) to assess its effect on quality of prepared sugarcane juice. On the basis of organoleptic evaluation, the sample with 0.5% guar gum was selected. Incorporation of gaur gum found to be acceptable with respect to appearance, color, flavor, texture and overall acceptability. Utilization of guar gum achieved the required nutritional importance with maintaining the nutritional quality specially fiber content and product stability during storage. Therefore, development of sugarcane juice added

with guar gum will provide a new opportunity for the entrepreneurs and millet cultivators to strengthen their economy and growth of food processing sector.



Sugarcane juice incorporated with guar gum

Mineral composition of location wise guar seed genotypes

Mineral content of guar seed is essential in justifying its food value. Calcium, iron, manganese, phosphorus, and zinc are the minerals of interest in current study. Minerals play a key role in various physiological functions of the body especially in the building and regulation processes. The data pertaining to mineral content is presented in the next table.

Mineral composition of guar seed (mg/100 g)

Region	Sample	Calcium	Magnesium	Phosphorus	Iron	Zinc
Parbhani	GG-1806	109.66	400.15	1106.33	10.36	5.19
	GG-1909	112.32	389.22	1083.10	10.62	5.68
	GD-567	111.86	395.10	1085.19	10.56	5.34
	X-25	112.65	394.30	1090.83	10.50	5.40
Kanpur	RGC-1066	110.53	390.63	1080.34	10.51	5.70
	RGC-1033	112.60	386.40	1085.65	10.32	5.78
Jodhpur	CAZG-17-4-1	115.63	394.23	1090.30	10.46	5.32
	X-30	112.93	382.89	1070.38	9.96	5.93
	GD-570	109.80	390.88	1095.10	10.96	5.80
Gwalior	HG-2-20	113.16	394.11	1070.84	10.10	5.23
	RGR-20-15	114.09	393.19	1110.30	9.85	5.06
	HG-19-4	109.86	385.30	1108.83	9.89	5.38

*Bold letters represent highest values

Dr. Yashwant Singh Parmar University of Horticulture & Forestry (YSPUH&F), Solan

Standardization of multiple boreholes and comparison of oleoresin yield with traditional rill method of resin tapping in *Pinus roxburghii*

The trees of different diameter class were marked at Masariya- Majhgaon area of UHF Nauni, Solan. The trees i.e. 30-40 cm, 40-50 cm and 50-60 cm diameter class were selected for tapping. The loose and rough bark was shaved with the help of a bark shaver. In each tree, 1 inch (2.54 cm) diameter with 4 inches (10 cm) deep borehole was drilled with the help of Hand Drill (Girmits), and holes were cleaned with the help of wooden stick. The holes were drilled with a slight slope towards the opening, so as to facilitate the flow of oleoresin. The chemical stimulants were sprayed after holes were cleaned with the help of spray bottle. The spouts were tightly fitted in the respective holes. The plastic bags made of high-density polyethylene (HDPE) attached to the spout with the help of tie for collection of oleoresin and polybags. The summary of results obtained under standardization of multiple boreholes and comparison of oleoresin yield with traditional Rill method of resin tapping in *Pinus roxburghii* Sargent at Nauni (Main Campus) are presented as follows:

Among different diameter class, the maximum

oleoresin yield recorded (981.53 g/tree) in 50-60 cm diameter class (D_3). In case of borehole number, oleoresin yield increased with increase in number of borehole and highest yield (1455.83 g/tree) was observed in trees drilled with 8 boreholes (B_4).

In borehole drilling interval, the maximum oleoresin yield (317.00 g/hole) recorded in the borehole drilled in the month of June. Among different borehole number based on duration (month), the highest oleoresin yield (509.00 g/hole) recorded in B_1 i.e. during April-November period.

Oleoresin yield increased with increase in borehole height (150 cm) and highest yield (489.69 g/hole/tree) was observed in borehole drilled at 150 cm of tree height.

Among the different chemical stimulants used for oleoresin tapping, treatment T_7 (20 % H_2SO_4 + 20 % HNO_3) showed the best results for oleoresin yield in both methods i.e. Borehole and Rill method.

In borehole freshening interval, the maximum oleoresin yield recorded in the first borehole freshening interval (I_1 -7 days) and minimum in third borehole freshening interval (I_3 -30 days).

The highest healing %age was shown by Treatment T_6 (NAA) in the case of one-time application of

chemical stimulants, in the Borehole method (M_1). Similarly, the highest healing %age was shown by Treatment T_6 (NAA) in Rill method (M_2).

The highest number of resin ducts/mm² and diameter of resin ducts was found in the Rill method (M_2) and treatment T_3 (five-year tapped wood) and T_2 (one-year tapped wood) respectively in the case of untapped and tapped Chir Pine wood.

To improve oleoresin yield and wound healing, different chemical stimulants can be tailored and modified such as CEPA can be replaced with NAA, which can be used in combination with sulphuric acid which helps in prolonged resin flow.

Indira Gandhi Krishi ViswaVidyalaya (IGKV), Raipur

Physico-chemical characterization of babool (*Acacia nilotica* L.) gum grown across different agro-climatic zones and its valorization

Physicochemical properties: Physico-chemical properties (pH, protein content, ash content, hot water solubility, cold water solubility, water holding capacity) and physical properties (bulk density, true density, color) of chemically (gum inducer) and mechanically tapped babool gum were determined. The solubility was higher in hot water (50.13%, 49.55%) and cold water (20.17%, 39.62%), but least solubility shows in acetone in both the season winter and summer (3.42%, 0.47%). The pH was determined in chemically and mechanically tapped gum in winter and summer season is 5.46 and 5.40. The water holding capacity and oil holding capacity of tapped gum exudates was recorded in winter and summer is 33.29 and 30.73, respectively. Protein content was 2.63% and 2.73% in tapped gum in winter and summer season.

Thermal properties (DSC) and Functional Groups (FTIR) analysis: The DSC of babul gum sample analysis indicated the endothermic peak at 107.86 °C in control and 104.43 °C in tapped by use of gum enhancer. While the exothermic peaks were observed at 310.04 °C in control and 316.78 °C in tapped by gum enhancer. Use of gum enhancer enhanced the both endothermic and exothermic peak in gum sample. FTIR analysis indicated that the slight change in control and gum tapped via use of gum enhancer. It indicated -OH stretching at 3259.98 cm⁻¹, -CH and -CH₂ streaching at 1597.71 cm⁻¹ and glycosidic

linkage vibration at 1010.92 cm⁻¹ in control. In the gum obtained via use of gum enhancer, it was -OH stretching at 3250.41 cm⁻¹, -CH and -CH₂ stretching at 1598.11 cm⁻¹ and glycosidic linkage vibration 1011.88 cm⁻¹. The significant difference was in control 1413.12 cm⁻¹ peak was observed while in gum enhancer treated gum there was no peak in this region.

A process was developed for purification of crude babool gum for food applications. It involved drying of crude gum (100 g) at 50 °C, grinding to make the gum powder followed by soaking in 200 mL distilled water. Soaking is followed by filtration using muslin cloth and precipitation using 350 mL ethanol. Subsequently the sample is washed twice using diethyl ether (100 mL) and subsequently dried at 40 °C. the dried sample is ground to obtain purified gum.



Flow chart of purification and value addition of babool gum

Study of exudation behavior of jhingan indian ash tree (*Lannea coromandelica* houtt.) for potential production of gum

Jhingun Indian ash (*Lannea coromandelica*) tree is available on almost all the forest area of Chhattisgarh mainly Baloda bazar (Deopur), Bhoramdeo wild life sanctuary, Kabirdham district, Bilaspur, Mungeli, Lormi Block, Dhamtari, Kanker Charama, District Gariyaband, Rajnandgoan area. Jingam trees produced more biopolymer in the winter and summer with gum enhancer treatment, such as ethophon, acetic acid and H_2SO_4 at different concentration and Gum exudation peaked in the summer (May–June) in year 2024. The physicochemical properties of the gum exudate obtained mechanically and using gum enhancers were analysed. Bulk density, true density and tapped density values of the gum were reported to be 0.823, 6.625 and 0.793 g/cm³, respectively. The application of gum enhancers had a minor impact on the physicochemical characteristics. The solubility of gum exudates of winter and summer was determined in acetone (2.310%, 2.011%), cold water (25.952%, 30.847%) and hot water (42.471%, 43.192%). pH (5.71, 5.69), protein (1.23%, 1.17%), fat (0.08, 0.21) and ash content (2.36%, 3.64%).



Gum exudation in Jhingun tree by Drill method using gum enhancers and single cut

DSC thermos analytical analysis of Jhingun Indian ash tree (*Lannea coromandelica*) indicated the endothermic peak and exothermic peak at 111.19 °C and 313.16 °C, respectively. FTIR analysis revealed *Lannea coromandelica* exudates indicates -OH, -CH, CH bonding and glycosidic linkage vibration at different peaks.

FCRI, Tamil Nadu Agricultural University (TNAU), Mettupalayam

Physico-chemical characterization of tamarind seed gum and moringa gum grown across different agro-climatic zones and its valorization.

Separation of protein from tamarind kernel powder (TKP) by adopting iso-electric point to get high purity tamarind gum

Enhancing the purity of gum is crucial to improve the applications of tamarind seed gum. The study progressed by adapting concentration of 1% TKP is standardized and the series of technique adapted for effective removal of protein from TKP. The protein separation process involved heating the 1% TKP solution at 70-90°C for 5 h, followed by centrifugation at 5500 rpm for 15 min. The supernatant is collected and lactic acid (0.5%) is added in it to adjust pH to 3.5 and kept at room temperature for 4 h. The solution is further centrifuged at 9000 rpm for 15 min and supernatant-1 is collected. It is again centrifuged at 5500 rpm for 15 min to obtain supernatant -2. supernatant -2 is added with 2% activated carbon and centrifuged at 5500 rpm for 15 min to get supernatant -3. supernatant -3 is further subjected to dialysis at 12-14 kDa for 6 h followed by drying at 80°C in oven. Results of proximate analysis of sample mentioned in table below.

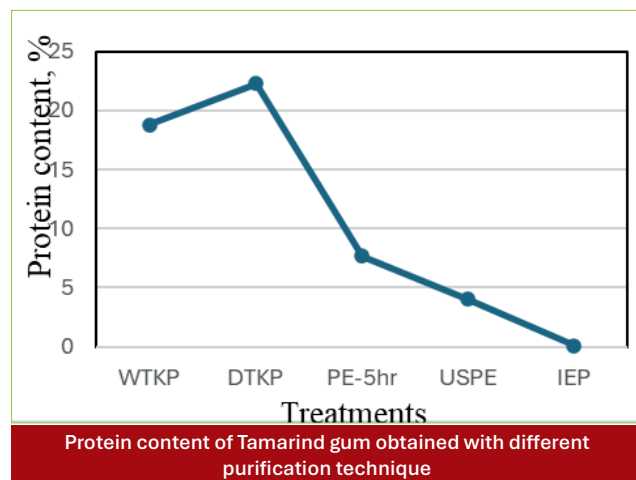
Proximate analysis of sample (dry basis)

Proximate analysis of sample		
Parameters	Test Method	Result
Carbohydrate, %	SSFTL/CH/SOP/017	<1.0
Protein, %	SSFTL/CH/SOP/015	<0.1
Fat, %	Inhouse method	<0.1
Energy, Kcal/100g	CAC/GL-2 : 1985	<10.0

Effectiveness of treatments on removing protein from tamarind seed gum

Separation of protein was done by different removal techniques viz. degermination of the seed, enzymatic technique (utilizing protease enzyme 0.80 µL for 5 hours), combination of ultra-sonication with protease enzyme, and isoelectric point separation with dialysis. The techniques

adapted have shown effective results on removing the protein. The protein content in TSP was found as 22.30% in degermination method, 7.69% in enzymatic technique, 4.01% in combination of ultra-sonication with protease enzyme, and 0.1 % by adapting isoelectric point separation with dialysis.



(WTKP- Whole Tamarind Kernal Powder; DTKP- Degerminated Tamarind Kernal Powder; PE-5 h- Protease Enzyme of 0.80 μ L for 5 hours treatment; USPE- Combination of protease enzyme with Protease enzyme; IEP- Isoelectric point extraction with dialysis)

Influence of tamarind seed gum coating on guava: Edible Fruit coating

Tamarind seed gum-based fruit coating solutions at two different concentrations of TSP (5% and 3%) have been developed, and the effects of coating on various parameters, that determine the freshness and quality of the fruits like moisture loss, pH, titratable acidity and TSS during storage under ambient condition, have been studied.

Physicochemical properties of guava after 7 days of storage

Treatment	PLW (%)	TSS ($^{\circ}$ Bx)	Titrateable acidity (%)	pH
Fresh fruits	-	8.7	0.47	3.7
Control	21.8	3.1	0.24	2.42
5% TSP	14.5	5.3	0.30	1.98
3% TSP	19.8	6.1	0.28	2.1

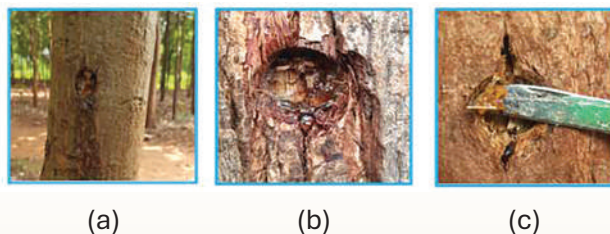


Control coated guava fruits after 7 days storage period

The results of the study revealed that TSP extends its potential as an edible fruit coater like other commercially available gums. Increase in concentration of TSP directly reduces the moisture loss and also have an influence over other properties where the quality and shelf life of a fruit also increased.

Preliminary studies on assessing gum production in few tree species of regional importance

To identify the most efficient and sustainable tapping practices for maximizing gum production, also know the effect of gum tapping in different species of regional importance with or without ethephon, the experimental study has been conducted at the gum garden of the Forest College and Research Institute, Mettupalayam, Tamil Nadu, focusing on three tree species: *Lannea coromandelica*, *Azadirachta indica*, and *Terminalia bellirica*. The experiment included eight treatments, combining four trunk diameter classes (40–50 cm, 50–60 cm, 60–70 cm, and 70–80 cm) with and without the application of ethephon. Each treatment was replicated three times. Circular incisions, 3 cm in diameter and 2 cm in depth, were made on the trunks of selected trees using the BIRSA gum blazer (Tubular blazer), a tool designed & developed by ICAR-NISA, Ranchi (Jharkhand) for precision and uniformity in tapping. Ten % ethephon was applied at a dosage of 4 mL per tree at a concentration of approximately 100 mg/mL. The tapping and gum collection was conducted during the monsoon season (July to October, 2024).



Gum exudation in a) *Lannea coromandelica*, b) *Azadirachta indica*, and c) *Terminalia bellirica*

The results of the study revealed that the gum yield from different tree species (*Lannea coromandelica*, *Azadirachta indica*, and *Terminalia bellirica*) was significantly influenced by the diameter classes and the application of ethephon. The highest gum yield (31.07 g) was observed in treatment T4 (70–80 cm + 10 % Ethephon), followed by treatment T3 (60–70 cm + 10% Ethephon) with 29.03 g. Treatments without ethephon also showed an increasing trend with diameter, with the highest yield (26.73 g) recorded in treatment T8 (70–80 cm + No Ethephon). The application of ethephon led to an average increase of 49.63% to 70.43% in gum yield compared to untreated trees across all diameter classes, emphasizing its potential in enhancing resin flow.

Kerala Agricultural University (KAU), Thrissur (Kerala)

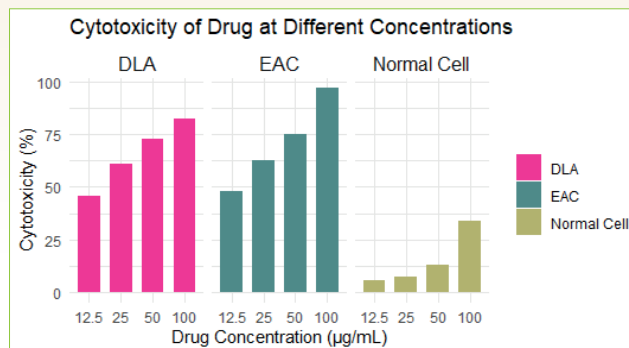
Extraction of ailanthus oleo-resin and its characterization

Short-term cytotoxicity was conducted using Ailanthus oleoresin in different solvents such as DMSO, Ethanol and Hexane. Promising results were found in ethanol extract of Ailanthus.

Short-term cytotoxicity study in DLA, EAC and normal spleen cell using *Ailanthus* gum oleo resin

Drug concentration (µg/mL)	cytotoxicity in Ethyl alcohol extract (%)		
	DLA	EAC	Normal cell
12.5	45.7 ± 2	47.7 ± 2.2	5.88 ± 0
25	60.8 ± 1.9	62.4 ± 1.9	7.33 ± 0.6
50	72.6 ± 3.3	74.8 ± 1.2	12.9 ± 2.2
100	82.3 ± 2.3	96.7 ± 2.2	±2.9

Further tests were conducted using ethanol extract of Ailanthus on different cell lines like MCF7 (Human breast cancer cell line), HCT15 (Human colon cancer cell line), 3T3L1 (Mouse fibroblast cell line), HepG2 (Human liver cancer cell line), A375 (Human melanoma cell line) and promising results were found in HCT15, i.e. human colon cancer cell line with IC₅₀ of 4.49



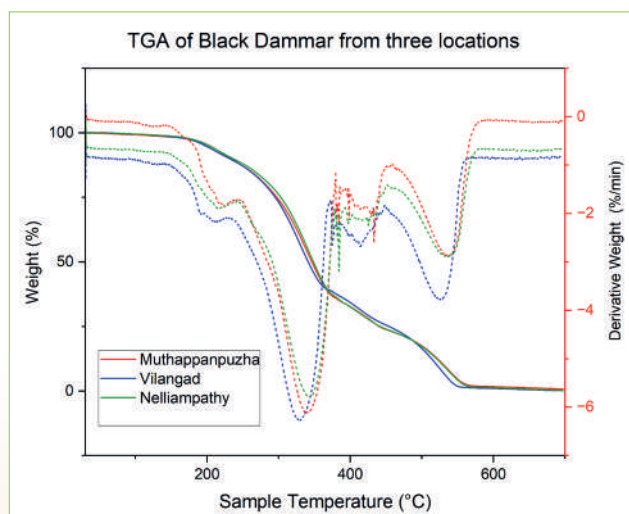
Cytotoxicity of *Ailanthus* in short-term cytotoxicity studies

A collaborative project has been signed by Kerala Agricultural University and Amala Cancer Research Centre, Thrissur, Kerala for further research on the anti-cancerous properties of *Ailanthus* gum-oleo resin.

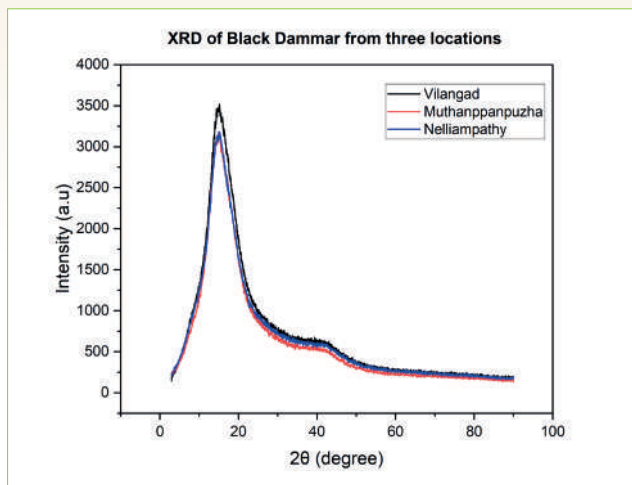
Physico-chemical characterization of black and white dammar resin grown across different agro-climatic zones and its valorization

Samples of dammar resin were collected from Wayanad, Gavi, Silent Valley forest areas of Kerala and collected samples were analyzed using various analytical techniques such as FTIR, TGA, XRD, GCMS, DSC, SEM, TGA analysis of black dammar from different locations showed not much difference in the temperature vs weight loss (%) graph. This suggests that the samples have similar thermal stability and composition.

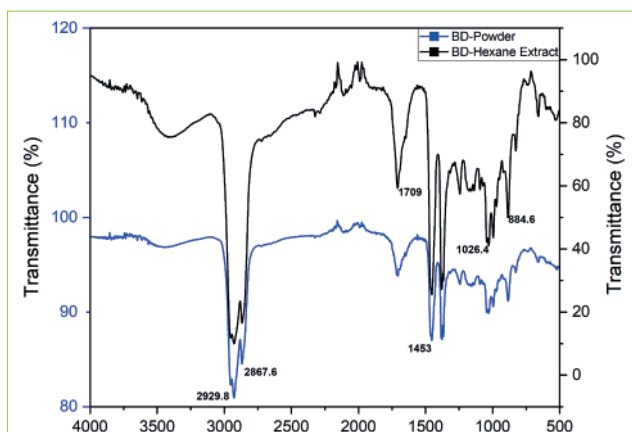
From XRD analysis of Black Dammar, the Crystallinity index was found to be 45.88%, suggesting that the Black Dammar sample has a moderate degree of crystallinity. It is neither completely crystalline nor completely amorphous.



TGA



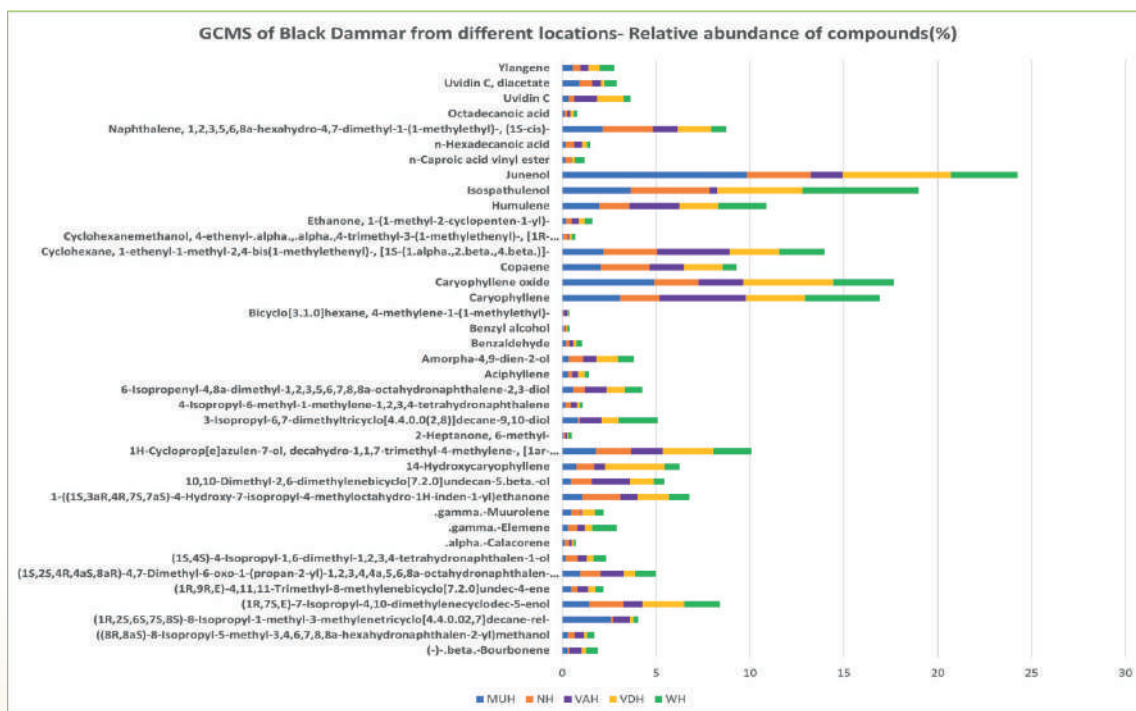
XRD



The presence of both crystalline and amorphous phases can influence the material's properties, such as its mechanical strength, thermal stability, and chemical reactivity.

FT-IR analysis of Black dammar powder and Hexane extract of the same was conducted. From the FTIR analysis, the presence of hydroxyl and carbonyl groups indicates that the Black dammar powder contains a variety of oxygenated compounds, including terpenes and other polyphenolic compounds. In the Hexane extract of Black dammar, weaker oxygenated peaks suggest that it is enriched in aliphatic compounds, such as hydrocarbons and terpenes, which are more soluble in hexane.

SEM-EDAX of Black dammar was conducted to study its morphological properties and to study the elemental analysis. The oxygen content indicates the presence of oxygenated functional groups, which contribute to the material's chemical properties such as adhesion, solubility, and reactivity. The oxygen-to-carbon ratio (O/C ratio) is approximately 0.11 (Atomic %), suggesting a low degree of oxidation. This is characteristic of hydrocarbons with some polar functional groups, likely responsible for its resinous and adhesive properties.

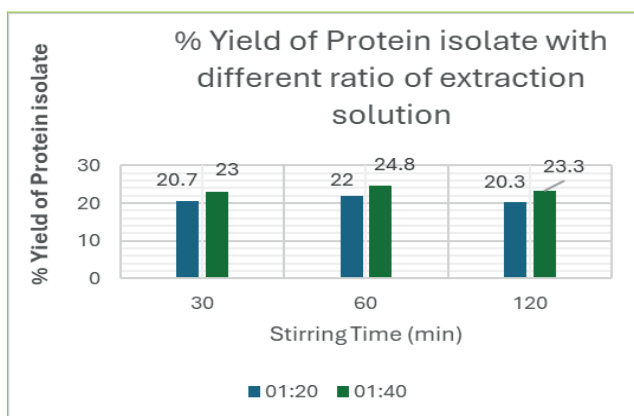


Consortium Research Project (CRP) on Secondary Agriculture

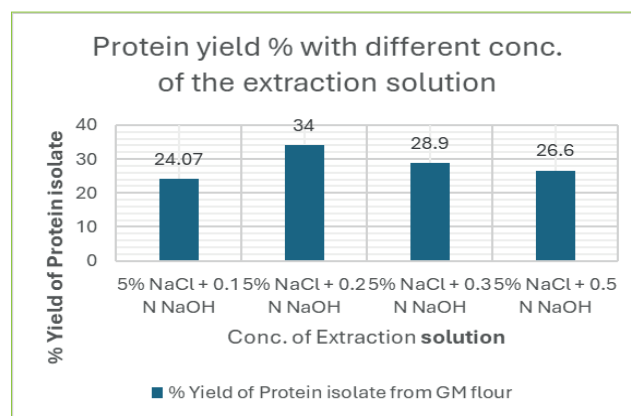
Development of process and pilot plant for protein isolate production from guar meal

Extraction of Guar gum from endosperm produce high protein rich byproducts i.e. Guar Meal (GM), which contain high protein about 32-52%. Therefore, extracting protein from guar meal can mitigate high demand of plant-based protein products. Guar meal was obtained from a supplier from Rajasthan and characterized for different parameters viz. moisture, protein and fat content. The moisture content was determined as $6.7 \pm 0.4\%$ (w.b.), while the protein and fat content of the guar meal was found to be $33.36 \pm 3.02\%$ and $5.70 \pm 0.07\%$, respectively. Experiments were carried out for preparation of protein isolates from guar meal flour by using salt alkali solution. The salt alkali (NaCl + NaOH) solution was used for extraction of protein from guar meal flour (GMF) with varying concentration of NaOH,

(0.1, 0.2, 0.3 and 0.5 N), solid: solvent ratio (1:20 & 1:40), and mixing/stirring time (30, 60 & 120 minutes) at 500 rpm. The extracted guar meal sample was filtered through muslin cloth to separate the residue and filtrate was used for protein separation. The filtrate was then acidified with 1 N HCl and pH was adjusted to 4.5 (Iso-electric point of protein) to precipitate the protein isolate. The protein isolate was then obtained by filtration through filter paper followed by freeze-drying to obtain dried protein isolate sample. The protein isolate yield was slightly higher when 1:40 ratio was taken, whereas stirring time did not affect the protein isolate yield. When the concentration of the NaOH increases from 0.1 N to 0.2 N, the protein isolate yield increased from 24% to 34%, whereas further increase of the NaOH concentration up to 0.5 N, the yield was observed to decrease.



Effect of solid: solvent ratio on yield of protein isolate from guar meal flour



Effect of NaOH concentration on yield of protein isolate from guar meal flour

SUCCESS STORY

SUCCESS STORY OF AMRIT LAKRA: From Daily Wage Worker to Successful Lac Farmer

Amrit Lakra, a resident of Jerki Toli in Rajaulatu Panchayat, Namkum block, Jharkhand, transformed his life from a daily wager to a successful Lac farmer. His journey, driven by determination and training, reflects how perseverance and learning can lead to a thriving Lac farming business, significantly improving his income and securing his family's future. Amrit Lakra owned 10 acres of land, where he practiced seasonal farming of vegetables and paddy, but struggled financially, earning around ₹ 10,000 per month as a daily wager. Traditional farming wasn't enough to sustain his family. In 2022, inspired by a YouTube video by renowned Lac farmer Shakti Dhar Koiri, Amrit explored Lac farming. He began with two Kusum and 35 Ber trees, inoculating them with 15 kg of brood Lac bought at ₹ 400/kg. While continuing his labour work, he managed both the tasks. After six months, he harvested 30 kg of Lac, earning ₹ 15,000, which made him realize the potential of Lac farming's as a profitable livelihood. Inspired by his initial success, Amrit expanded his Lac farming in 2023 by leasing 20 Kusum trees and planting 100 more, along with 6,000 *Flemengia Semialata* seedlings, investing ₹ 40,000. He inoculated one quintal of brood Lac on the leased trees and, after six months, harvested 2.5 quintals, although the expected yield was around 5 quintals, which was attributed to a forest fire in the area damaging some of the trees. Still, he earned ₹ 75,000 from scrapped Lac. Realizing the need for technical knowledge, Amrit joined a one-week training program in December 2023, organized by Jharkhand State Co-operative Lac Marketing & Procurement Federation Ltd., in collaboration with ICAR-National Institute of Secondary Agriculture, Ranchi (ICAR-NISA). The training equipped him with scientific Lac farming techniques covering host plant selection, pruning, inoculation, pest management, harvesting, and marketing, boosting his confidence and preparing him to improve future yields. With his training, Amrit made strong progress in 2024 by scientifically inoculating 1 quintal of brood Lac on 2,000 *Semialata* plants and 2 quintals on his Ber trees. Applying improved methods like pruning and pest control, he harvested 2.5 quintals of Ari Lac in 2025, earning ₹ 2,12,500 at ₹ 850/kg. He also collected 2.5 quintals of brood Lac, using it to inoculate 30 Kusum trees, and applied a total of 4 quintals across

all Kusum trees. By January–February 2025, Amrit earned around Three lakh from Ari and scrapped Lac. Selling directly to local vendors at Rampur Bazar, Namkum, helped him avoid middlemen and maximize profits, proving the success of his scientific and market-driven approach.



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

Impact

Before training, Amrit lacked knowledge of advanced farming, pest control, and marketing, and was unaware of Lac's true market value. After completing training at ICAR-NISA, he learned efficient farm management, reducing losses and boosting income. His annual earnings rose from ₹ 1,20,000 to ₹ 1,35,000 in 2022 (12.5% growth), and by 48 % in 2023. The most significant jump came in 2025, with a 250 % increase over 2022, following his scientific training. Ongoing support from ICAR-NISA, including practical guidance and telephonic help, played a key role in his success.

SUCCESS STORY OF NELSON EKKA: Reviving a Traditional Practice with Modern Learning

Nelson Ekka, a farmer from Fathetoli, Banpur, cultivates urad, paddy, ragi, and tomato on his 7 acres of land, earning ₹ 70,000 – ₹ 80,000 annually. His real breakthrough came with the revival of lac cultivation, a traditional practice once followed by his grandfather. Though he began lac farming in 2015, he had to stop between 2018 and 2020 due to lack of knowledge, brood lac, funds, and poor spraying practices. During this period, another farmer used his trees for lac production. In 2021, realizing that other crops were less profitable, Nelson resumed lac farming using 10 Ber, 1 Kusum, and 30 Palas trees (later discontinuing Palas). Initially, poor techniques led to losses, including brood lac damage. However, he managed to earn ₹ 1 lakh from lac in 2020, which enabled him to purchase a motorbike marking a turning point in his journey. In 2022, Nelson Ekka pursued skill training in Odisha

through the STEP Foundation but he was unsuccessful and returned in 2023 to prepare for government jobs, which also didn't materialize. Determined to revive his lac farming, he underwent training at ICAR-NISA in 2024, learning essential techniques like brood lac inoculation, proper pruning, and spraying—correcting past mistakes like over-inoculation that damaged trees.



Currently, Nelson cultivates lac on one 40-year-old Kusum tree, 45 large and 10-15 small Ber trees, along with 10 rented Ber trees on a one-third yield-sharing basis. He also recently planted seven Kusum saplings in his field. In 2023, he planted 1,200 Semialata plants 900 from ICICI Foundation and 300 on his own. By January–February 2025, he earned ₹ 1.5–2 lakh annually from lac, selling it at ₹ 900–950/kg in Rampur Bazaar. After taking training and practicing scientific lac cultivation his income has doubled. Nelson's journey reflects resilience and growth, blending traditional knowledge with scientific training. With continued support and improved infrastructure, he is set for even greater success.

SUCCESS STORY OF TURLAN DHAN: A Journey from Daily Wages to Prosperity through Lac Cultivation

Turlan Dhan, a determined and enterprising woman farmer from Ruitola village, Murhu block of Khunti District, Jharkhand, has transformed her family's livelihood through a remarkable journey of hard work and innovation. Owning 1.5 acres of land and cultivating an additional 0.7 acres on rent, she initially depended solely on traditional agriculture, growing crops like tomato, potato, brinjal, paddy, and various other vegetables. Her family income was a modest ₹10,000–₹15,000 annually, mostly from agriculture and occasional daily wage labor. In 2013, a turning point came when she was introduced to Lac cultivation through a one-day training session conducted by the PRADAN organization in her village. Inspired and eager to learn, she began her Lac

cultivation journey with 3–4 Ber host plants. Over the years, with persistent effort and further training from PRADAN in 2016–17 and later from the ICICI Foundation in 2021–22, she expanded her knowledge and operations. However, between 2017 and 2020, due to a lack of proper technique, she faced setbacks, where brood lac production failed, causing temporary discontinuation.



Despite these challenges, she made a strong comeback. By 2024–25, she had successfully inoculated 30 kg of brood lac on 5 Kusum trees and 20 kg of rangeeni brood lac on 24 Palas trees and 7 Ber trees during the Oct–Nov 2024 season. Her brood lac yield reached 50 kg, selling at ₹ 800–900/kg locally and earned nearly ₹ 40,000–45,000 and 60 kg of scrapped lac sold in Ranchi and Orissa fetched her ₹ 57,000–60,000. She also retained 30–40 kg brood lac for her own future cultivation. Apart from lac, her vegetable farming has flourished. In the last two years, she earned around ₹ 80,000 from 0.4 acres of tomatoes and ₹ 5,000–6,000 from chillies sold at ₹ 40–50/kg. Her active involvement in the SHG “Upbalba Mahila Mandal” has added more value, where she leads initiatives like grafting tomato, stacking bitter gourd, planting marigold, and managing a mother unit of duck and poultry. Turlan also engages in allied activities such as goatry and piggery, further diversifying her income sources.

Today, Turlan Dhan earns approximately ₹ 50,000 annually from vegetable cultivation and ₹ 1–1.5 lakh from lac production. Despite challenges like water scarcity due to a shallow well and dependence on diesel irrigation, she continues to persevere. As a leader of her women's group and a role model in her community, Turlan's journey from marginal farmer to a successful agro-entrepreneur is an inspiring example of resilience, self-belief, and sustainable rural livelihood transformation.

TECHNOLOGY DISSEMINATION

Training Conducted

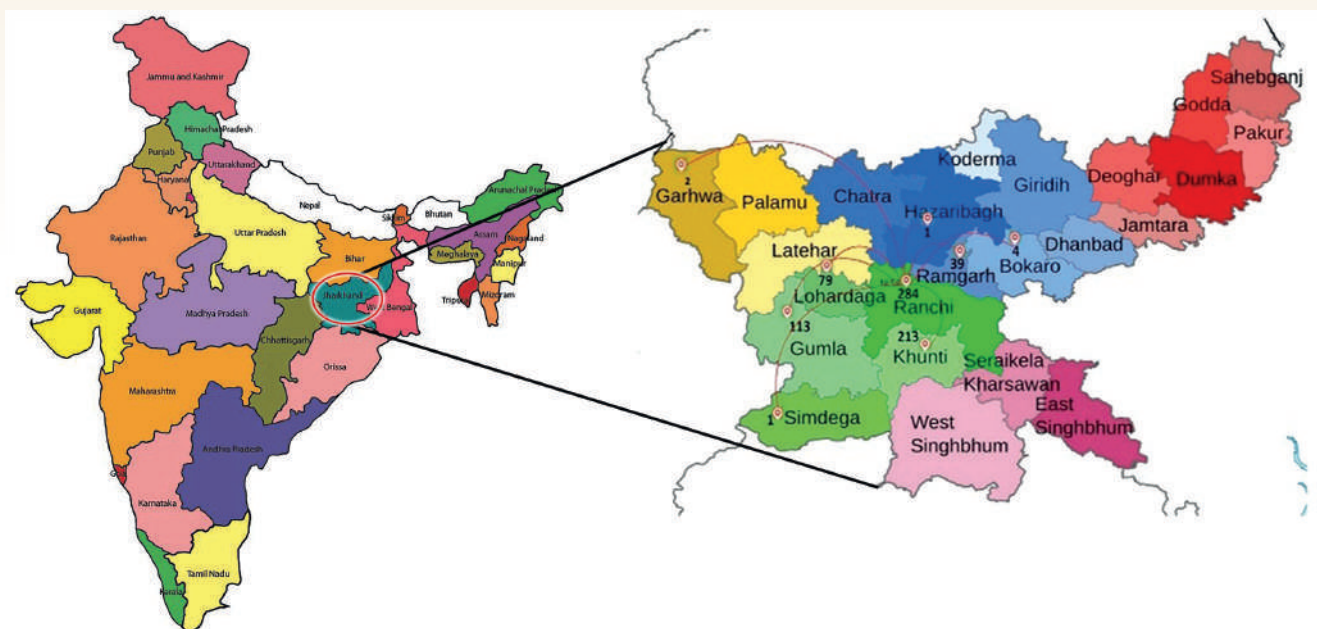
The Agri-Business Development Unit, ICAR-NISA, Ranchi regularly organizes capacity-building programs on scientific lac cultivation, processing, and utilization, addressing the needs of various stakeholders, including farmers, aspiring entrepreneurs, students, and self-help groups. Beyond on-campus sessions, extensive field outreach activities such as off-farm training and technical guidance through field visits are also conducted. A total of 17,303 stakeholders have benefited from these skill development initiatives. These efforts are designed to equip individuals with essential knowledge and expertise, fostering proficiency in scientific lac cultivation while promoting economic advancement and agricultural sustainability in the region. The ABD Unit organized 18 Farmers' Training Programs on 'Scientific lac cultivation, processing and utilization' were organized for 796 farmers from three States viz., Jharkhand, West Bengal, and Chhattisgarh and 26 On Campus one-day Exposure Visits/ Orientation Program on Natural Resins and Gums and Secondary Agriculture for 1299 Farmers/Students/ Faculty/other stakeholders.

Details of Capacity building and entrepreneurship development programs

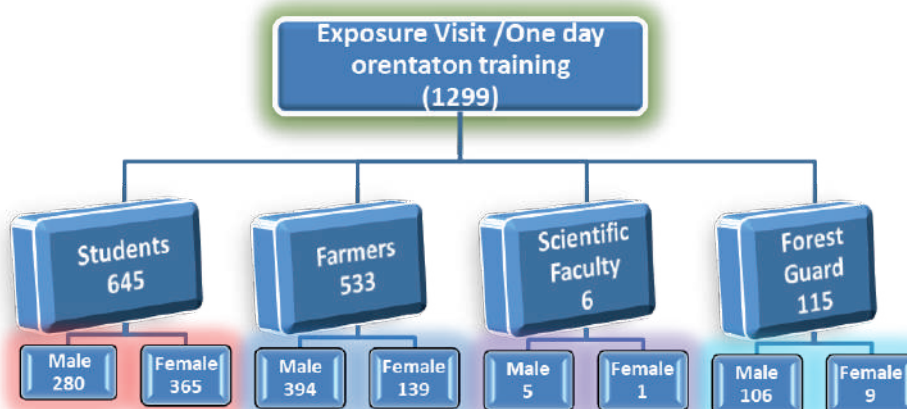
Capacity building programs	No. of program/batches/courses	No. of beneficiaries
Farmers training program on "Scientific method of lac cultivation, primary processing and utilization"	18	796
On campus one-day exposure visits/ orientation program on natural resins and gums	26	1299
Processes and products training to entrepreneurs	05	08
Participation in program, mela, events, exhibition etc. from ICAR-NISA, Ranchi	10	-
Regional agriculture fair for eastern region 2024	01	10000
Awareness program on honey and bamboo production	01	1200
Centenary celebration/ Foundation Day cum awareness program	01	4000
Total		17303



Farmer's Training at ICAR-NISA, Ranchi from different States during 2024



One day orientation training/exposure visits organized for stakeholders at ICAR-NISA, Ranchi during 2024



Farmers training program on “Scientific method of lac cultivation, primary processing and utilization”

Sl. No.	Sponsoring Organization	Period of Training		Number of Participants	Male/ Female	
		From	To			
1	JASCOLAMPF, Ranchi	08.01.24	12.01.24	69	28	41
2	Director cum District Agriculture Officer, Lohardaga, Jharkhand	15.01.24	17.01.24	20	15	05
3	KVK, Banka, Bihar	05.02.24	09.02.24	15	15	00
4	DAO, Khunti, Jharkhand	12.02.24	14.02.24	14	12	02
5	JASCOLAMPF, Ranchi and ICAR-NISA (DAP SC)	19.02.24	23.02.24	51	21	31
6	JASCOLAMPF, Ranchi and ICAR-NISA (DAP SC)	26.02.24	01.03.24	55	19	36
7	JASCOLAMPF, Ranchi	18.03.24	22.03.24	42	25	17
8	DAP-SC, ICAR-NISA, Namkum, Ranchi, Jharkhand	26.03.24	30.03.24	42	35	07



Sl. No.	Sponsoring Organization	Period of Training		Number of Participants	Male/ Female	
		From	To			
9	PRADAN-NGO, Khunti, Jharkhand	01.04.24	03.04.24	51	26	24
10	PRADAN-NGO, Khunti, Jharkhand	08.04.24	10.04.24	37	33	04
11	PRADAN-NGO, Khunti, Jharkhand	22.04.24	24.04.24	26	15	11
12	JANMITRAM-NGO, Raigarh, Chhattisgarh	13.05.24	15.05.24	20	20	00
13	DAP SC JASCOL AMPF, Ranchi	10.06.24	14.06.24	53	16	37
14	JASCOLAMPF, Ranchi	14.07.24	19.07.24	50	02	48
15	JASCOLAMPF, Ranchi	30.09.24	04.10.24	62	41	21
16	JASCOLAMPF, Ranchi	21.10.24	25.10.24	63	53	10
17	JASCOLAMPF, Ranchi	25.11.24	29.11.24	62	17	45
18	JASCOLAMPF, Ranchi	02.12.24	06.12.24	64	26	38
Total				796	419	377

List of MOU signed by ICAR-NISA, Ranchi

Sl. No.	Title/Purpose	MoU signed	Date of signing MoU/Valid up to
1	Developing potential relationship for working towards mass adoption of innovation in serviceable secondary agro-industry	ICAR-NISA, Ranchi and Guru Gobind Singh Educational Society, Technical Campus, Chas Bokaro Jharkhand	08.04.2024 07.04.2027
2	Commercial production of lac color index analyzer	ICAR-NISA, Ranchi and Mansa Enterprises, Chandigarh	10.06.2024 09.06.2029
3	Lac based natural adhesive for leaf dining utensils	ICAR-NISA, Ranchi and M/s Nature's Solutions, Noida, Gautam Buddha Nagar, U.P	20.09.2024 19.09.2027
4	Technical guidance, exposure, knowledge sharing, research studies and support to the livelihood program of The Hans Foundation in Jharkhand	ICAR-NISA, Ranchi and The Hans Foundation, Ranchi, Jharkhand	20.09.2024 19.09.2027
5	Technical collaboration for providing guidance of advisory nature regarding lac cultivation and processing of lac products	ICAR-NISA, Ranchi and Vedic lac foundation, Ranchi, Jharkhand	20.09.2024 19.09.2027
6	Facilitation of technological backstopping for production and processing system of DCOMP products including cinchona	ICAR-NISA, Ranchi and Directorate of Cinchona and Other Medicinal Plants (DCOMP), West Bengal	30.10.2024 29.10.2029
7	Fabrication of <i>Cinchona</i> tree uprooting equipments	ICAR-NISA, Ranchi and <u>Dass Group Mechanical Engineering Consultant</u> , Ranchi, Jharkhand	13.11.2024 -
8	Technical guidance & support regarding agri and horticulture-based farming system, processing, value addition & product utilization	ICAR-NISA, Ranchi and Life Line Mission Trust (LLMT), H.Office: Patna B.Office: Netarhat, Jharkhand	13.12.2024 12.12.2027

Agri Bussiness Incubation (ABI)

Date of start & Duration (Yrs)	Name of incubatee	Technologies for incubation
07.08.2024 (01 Year)	Mr. Prasun Agarwal, OM Shellac Udyog and Agarwal Shellac, Purulia, W.B	Agri-business incubation on aleuritic acid, bleached lac, shellac gasket compound & gummy mass utilization

Institute Technology Management Unit (ITMU)

Kisan Mela/Exhibitions:

Participation in the one-day Krsihi Unnati Mela held at Kharsawan Jharkhand on 01st January 2024 was made by Dr. Udaykumar, M. S., Scientist (Agricultural Economics), ABD Unit and exhibited the institute technologies, products for the benefit of farmers. Honorable Agriculture Minister Sri. Arjun Munda Ji and His Excellency Governor Sri. C. P. Radhakrishna Ji graced the occasion as chief guests in the mela.

Participated in National Dairy Mela and Agricultural Exhibition organized by NDRI, Karnal was made by Dr. Udaykumar, M. S., Scientist (Agricultural Economics), ABD Unit from 9th to 11th March, 2024 at Adivasi Khuntkatti Maidan, Chaibasa, West Singhbhum, Jharkhand. Honorable Agriculture Minister Sri. Arjun Munda Ji visited the institute stall exhibited during the mela.



Details of participation in different melas/ events in different district of Jharkhand

Sl. No.	Events	Venue/Period
1	Krishi Unnati Mela	Kharsowan/01, January 2024
2	Regional Agriculture Fair (RAF) Eastern Zone-2024	Krishi Vigyan Kendra, Khunti/03-05 February, 2024
3	Annual Kisan Mela 2024	R.K. Mission, Ranchi/08-09 February, 2024
4	Annual Kisan Mela-2024	IARI, Hazaribag/01 March, 2024
5	Agrotech Kisan Mela-2024	Birsa Agriculture University, Ranchi/02 - 04 March, 2024
6	National Dairy Mela-2024	Chaibasa, West Singhbhum/09-11 March, 2024
7	Pusa, Krishi Vigyan Mela 2024	Simdega/10-12 March, 2024
8	Honey Bee Mela 2024	ICAR-NISA, Ranchi/14 March, 2024
9	Celebration of 60 th Annual Foundation Day	Central Tasar Research & Training Institute, Ranchi/19 June, 2024
10	Celebration of National Space Day	Sarla Birla University, Ranchi/23 August, 2024

Licensing & Certification

Technology/Know-how transfer through Licensing

 Lac color index analyzer - Licensed to: Mansa Enterprises - Address: Plot No. 915-A, Cabin No. 1, 1st Floor, Industrial Area, Phase-2, Chadigarh - 160002 - E-mail : mansaengineers.chd@gmail.com - Licensing agreement of 05 years signed on 10.06.2024	 Lac based natural adhesive for leaf dining utensils - Licensed to: M/s. Nature's Solutions - Address: Gautam Buddha Nagar (Noida) Uttar Pradesh - E-mail : sanjay@naturessolutions.in - Licensing agreement of 03 years signed on 20.09.2024
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Technology/Know-how transfer on Processes and Products to entrepreneurs under entrepreneurship program

Sl. No.	Date	Technology Transfer	Trainees	Firm/Organization
1	22.07.2024 to 26.07.2024	Dewaxed decolorised lac (DDL)	Mr. Ashutosh Kumar Agrawal	Triloki Lakh Udyog, Kathgora, Korba (C.G.)
2	22.07.2024 to 02.08.2024	Testing and Analysis of lac	Mr. Prasun Agarwal	OM Shellac Udyog and Agarwal Shellac, Purulia, W.B
3	23.09.2024 to 27.09.2024	Aleuritic Acid	Miss Seema Kumari, Smt. Shushma Kumari, Miss Sudipta Das and Sri M. K. Goyal	Vedic lac foundation, Bundu and Shree Balaji Trader, Upper Bazar, Ranchi
4	23.09.2024 to 07.10.2024	Isoambrettolide	Mr. Mahesh Sharma and Mr. Sanjay Kumar	Vedic lac foundation, Bundu, Ranchi

ISO Certification obtained for the Institute

- Institute received ISO 9001-2015 certificate on 06/11/2024, from Correct Certification, Varanasi, issued by Saara Management System Private Limited, New Delhi.

Radio/TV Talk

Scientist & designation	Topic	Media	Date of Broadcast
Dr. Debabandya Mohapatra, Principal Scientist	हमारी वनौषधि हमारे खेत	DD Kishan Chanel, Delhi	11-02-2024
Dr. Soumen Ghosal, Principal Scientist	लाह उत्पादन में पोशक वृक्ष के पोशक तत्व का महत्व	Kisan vani program of DD Ranchi	28.11.2024
Dr. Nandkishore Thombare, Senior Scientist	Livelihood possibilities through Lac processing and value addition	Doordarshan Ranchi	17.12.2024.
Dr. Achintya Pramanik, Scientist	कुसमी अगहनी लाख फसल में बिहन परिपक्वता का आकलन	DD Kisan, Ranchi	30.12. 2024

KRISHI VIGYAN KENDRA, KHUNTI

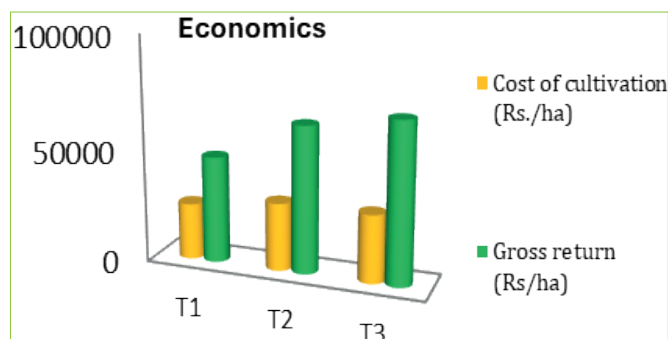
On Farm Trial (OFT):

This is an approach of adoptive research conducted on farmer's field within their farming system perspective in their active participation and management under supervision of KVK scientists. The objective is to evaluate production practices under realistic growing conditions.

Evaluation of improved varieties of rice crop.

Rice is a major cereal crop in Khunti district, covering around 80% of the area during the Kharif season. However, farmers predominantly use

older paddy varieties, like Lalat, which results in low productivity. To address this issue, on-farm trials with different rice varieties, which can help to evaluate and compare their performance in terms of yield attributes, grain yield, economics and adaptability to local conditions, have been conducted in village Keyodatoli (Torpa), Nishitpur (Torpa) and Selda (Murhu) of Khunti district with three treatments and three trials. The yield of Swarn Shakti has demonstrated 50% higher yield than that of Lalat. Maximum net return has been found in the swarn shakti, i.e. ₹ 40840/ha followed by CR-320 (₹ 34860/ ha)



OFT on varital evaluation of rice crop

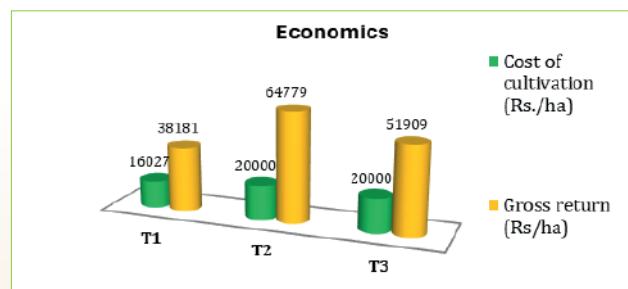
Parameters for evaluation of different rice varieties.

Technology option	No of trials	No. of effective tillers/hill	No. of spikelet per panicle	1000 grain wt.(g)	Yield (q/ha)	B:C
T ₁ : Farmer practices rice (Lalat)	3	9	135	23.5	20.5	1.9
T ₂ : Rice (CR-320)		12	152	25.6	28.2	2.2
T ₃ : Rice (Swarn Shakti)		13.5	157	27.8	30.8	2.4

Evaluation of improved variety of finger millet crop:

Finger millet is 2nd important cereal crop in Khunti district after the rice in the Kharif season. However, farmers predominantly use older finger millet varieties, which result in low productivity. To address this issue, on-farm trials with different finger millet varieties, which can help to evaluate and compare their performance in terms of yield attributes, grain yield, economics and adaptability to local conditions. This OFT has been conducted in village Keyodatoli (Torpa) and Kotenger (Raniya) of Khunti

district. The yield of birsa Madua-3 has been 70% over the conventional farmer practices. Maximum net return was found in birsa Madua-3, i.e., ₹ 44779/ ha followed by GPU-28 (₹ 31909/ha).





OFT on varital evaluvation of finger millets

Parameters for evaluation of different finger millets varieties.

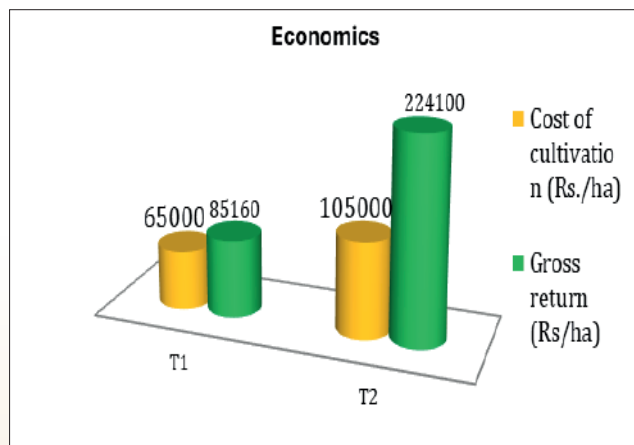
Technology option	No. of trials	Growth Parameters			Yield, q/ ha	B:C
		No. of effective tillers/hill	No. of spikelet per panicle	Test wt, g		
T ₁ : Farmer practices Finger millet	6	4.2	4.2	2.4	8.9	2.4
T ₂ : Finger millet (Birsa Madua-3)		6.4	6	3.2	15.1	3.2
T ₃ : Finger millet (GPU-28)		5.4	5.1	2.6	12.2	2.6

Assessment of improved variety of vegetable pea.

Vegetable pea is a major vegetable crop in Khunti district, covering around 40% of the area during the Rabi season. However, farmers predominantly use older varieties, like Gs-5, which results in low productivity. To address this issue, on-farm trials with adoptive pea variety was conducted in villages Birhu, Ghufu and Banganloya of Khunti district. The yield of Swarna Saubhagya 68% higher than that of farmer practices (GS-5). Maximum net return was found in Swarna Saubhagya i.e., ₹ 119100/ha followed by GS-5 (₹ 20160/ha)

Parameters for evaluation of different varieties 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 practices Pea (GS-5)	3	8	5	16	29.7	1.3
T ₂ : Pea (Swarna Saubhagya)		15	9	25	49.8	2.1

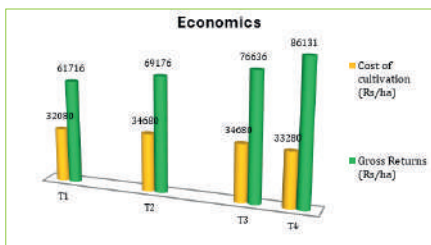


OFT on varital evaluvation of vegetable pea

Assessment of bio-pesticides for termite management in groundnut.

Groundnut is a major oilseed crop in Khunti district. However, this region is prone to termites and they cause significant yield loss in groundnut. Moreover, majority of the farmers in this area are poor and practice low input rain-fed farming, which when combined with termite attack results in a very low production and productivity. Therefore, KVK chose to evaluate bio-pesticides against termites in groundnut and compare it to a prevalent chemical insecticide treatment as well as against

ongoing farmers practice, i.e. no pesticide use. Bio-pesticides were chosen for management as they can become an integral part in sustainable agriculture and are ecologically sound. The OFT was carried out in the village Churgi block-Torpa on the farmers variety PG-37A. The result revealed that use of chemical insecticides was found more effective in comparison of the bio-pesticides i.e. *Beauveria bassiana* and *Metarhizium anisopliae* due to which yield was 12.7 q/ha followed by *Metarhizium anisopliae* (11.3q/ha), *Beauveria bassiana* (10.2 q/ha) and farmers practice (9.1q/ha).



OFT on assessment of bio-pesticides for termite management in groundnut

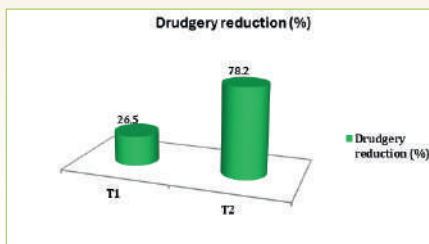
Parameters for assessment of termite management in groundnut.

Treatments	No. of trials	Yield q/ha	% yield increase	% Pest reduction	Cost of cultivation, ₹/ha	Gross Returns, ₹/ha	Net Returns, ₹/ha	B:C Ratio
T1: Farmers practice (no pesticide use)	3	9.1		0	32080	61716	29636	1.9:1
T2: Use of bio-pesticide <i>Beauveria bassiana</i> (2 L/500 L)		10.2	12	15	34680	69176	34496	2.0:1
T3: Use of bio-pesticide <i>Metarhizium anisopliae</i> (2 L/500 L)		11.3	24	17	34680	76636	41956	2.2:1
T4: Use of chemical insecticide: Imidacloprid 17.8% SL (125 mL/500 L)		12.7	39	36	33280	86131	52851	2.6:1

Performance evaluation of millets thresher.

Finger millet is the second largest cereal crop grown in Khunti district after paddy. Traditional threshing methods, such as manual beating and animal-driven threshing, are still widely practiced. These methods are labor-intensive, time-consuming,

and result in significant grain losses and lower threshing efficiency. Additionally, the manual process causes physical strain, especially for women who predominantly handle post-harvest activities. Keeping this in mind, KVK Khunti initiated this OFT to address the post-harvest challenges faced by millet growers.



OFT on performance evaluation of millets thresher

Parameters for performance evaluation of millets thresher.

Technology option	No of trials	Reduction in Post harvest losses, %	Threshing efficiency %	Man days/ Labor cost, ₹/q	Cost of Threshing, ₹ /q	Gross return, ₹/q	B:C
T ₁ : - Farmers Practice -Manual threshing	5	15-20	84	4 days/ ₹1200	1200	3432	2.86
T ₂ : Vivek Madua Thresher & Pearler-1		5-6	97	1 day/ ₹300	450	3976	8.86

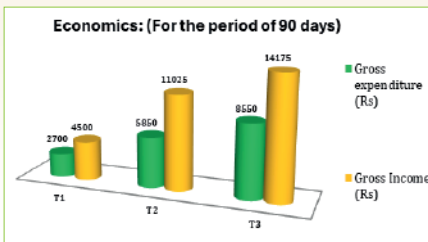
Assessment of effect of deworming and liver tonic on health and milk production of milch animal.

Deworming is a crucial part of livestock health management, as internal and external parasites can significantly impact an animal's well-being and productivity. The deworming treatment with a drug effective against all endo-parasites and ecto-parasites. These parasites can lead to weight loss, reduced feed efficiency, and in general poor health, liver damage which ultimately affects the animal's growth and milk or meat production. By targeting all endo-parasites and ecto-parasites this deworming injection (like Ivermectin) not only

ensures a cleaner, healthier digestive system, enhancing the overall vitality of the livestock but also removes ecto-parasites. So, an OFT was designed with three treatment groups. In addition to deworming, the inclusion of an ideal liver tonic in the treatment plan provides crucial support to the animal's liver function. This holistic approach strengthens the animal's immune system, improves nutrient absorption, and supports better overall health. As a result, livestock treated with this combination of deworming and liver tonic experience enhanced energy levels, improved productivity, and a stronger resistance to diseases, leading to better long-term health outcomes.

Parameters for effect of deworming and liver tonic on health of milch animal.

Technological option	No. of Trial	Total parasitic load (%)	Mortality rate (%)	Avg. weight (kg)	Conception rate (%)	Milk Yield (Kg/day)	B:C Ratio
T1: Farmer's practice: Use of local crude preparations	10 (30 animals)	21	10	180.1	20	1.00	1.66
T2: Deworming with the drug which is effective against all endo and ecto-parasites		11	0	180.1	20	2.45	1.84
T3: Deworming with the drug which is effective against all endo and ecto-parasites + ideal liver tonic.		9	0	191.0	20	3.15	1.73



OFT on effect of deworming and liver tonic on health of milch animal at village Manhatu

Front Line Demonstrations (FLD): In the year 2024, KVK, Khunti organized 643 demonstrations in 210 ha area of improved varieties of paddy, finger millets, marigold, perennial fodder grass, poultry and deworming and cluster front line

demonstration (CFLD) of oil seed crops, i.e. ground nut, niger, mustard, linseed, of oil seed crops under NFSM to improve the production and productivity of farmers as well as district. Details are given below.

S.N.	Crop/ Enterprises	Technology Demonstration	Area (ha.)	No. of Demo	% Increase in yield	B:C
1.	Groundnut	K-1812, GJG-32	45	120	59.1	3.05
2.	Niger	JNS-29	50	125	65.5	3.20
3.	Paddy	Swarn Sareya	24	125	36.6	2.10
4.	Finger millet	A-404	20	60	56.2	3.00
5.	Mustard	DRMR-150-35, RCHB-101	50	125	24.6	2.28
6.	Linseed	Divya	20	28	21.7	2.09
7.	Marigold	Cricket boll	0.5	5	37.0	2.20
8.	Perennial Fodder Grass	Hybrid Napier	0.5	14	-	-
9.	Poultry (Chicks)	Breed-Sonali	400	32	-	-
10.	Deworming of goat	Ivermectin	35 Goats	9	-	-



Groundnut seed distribution under CFLD



Method Demonstrations of Rice Nursery



Field Demonstrations of Groundnut



Field Demonstrations of Finger Millet



Field Demonstrations of Marigold



Field Demonstrations of Niger



Field Demonstrations of Rice



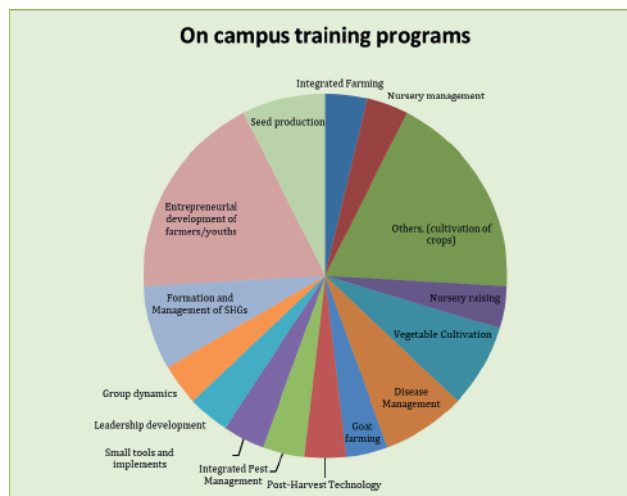
Field Demonstrations of Mustard



Training Programs: This activity was organized to upgrade the knowledge and mitigate the field problems of farmers. KVK, Khunti organized 89 training programs in the year 2024 where 2730 participants were participated. Details are given below.

One day training Programs for Farm Practicing farmers and Extension personnel

Farmers and farm women including the sponsored training program (on campus): KVK, Khunti has been organized 27 training programs at KVK, where 925 farmers (299 male & 666 females) were participated.



Rural youth including the sponsored training programs (on campus)

Thematic Area	No. of Courses	No. of Participants									Grand Total		
		Other			SC			ST					
		M	F	T	M	F	T	M	F	T	M	F	T
Production of organic inputs	1	0	0	0	0	0	0	18	17	35	18	17	35
Integrated pest management	1	0	0	0	0	0	0	18	17	35	18	17	35
Nursery management of horticulture crops	1	0	0	0	0	0	0	23	12	35	23	12	35
Value addition	1	0	0	0	0	0	0	17	18	35	17	18	35
Poultry production	1	0	0	0	0	0	0	9	26	35	9	26	35
Enterprise development	1	3	2	5	0	0	0	7	23	30	10	25	35
Small scale processing	1	0	0	0	0	0	0	0	35	35	0	35	35
Post-harvest technology	1	0	0	0	0	0	0	16	19	35	16	19	35
Tailoring and stitching	1	0	0	0	0	0	0	0	35	35	0	35	35
TOTAL	9	3	2	5	0	0	0	108	202	310	108	202	310

Extension Personnel including the sponsored training programs (on campus)

Thematic Area	No. of Courses	No. of Participants									Grand Total		
		Other			SC			ST					
		M	F	T	M	F	T	M	F	T	M	F	T
Productivity enhancement in field crops	1	0	0	0	0	0	0	19	16	35	19	16	35
Integrated Pest Management	1	0	0	0	0	0	0	26	9	35	26	9	35
TOTAL	2	0	0	0	0	0	0	45	25	70	45	25	70

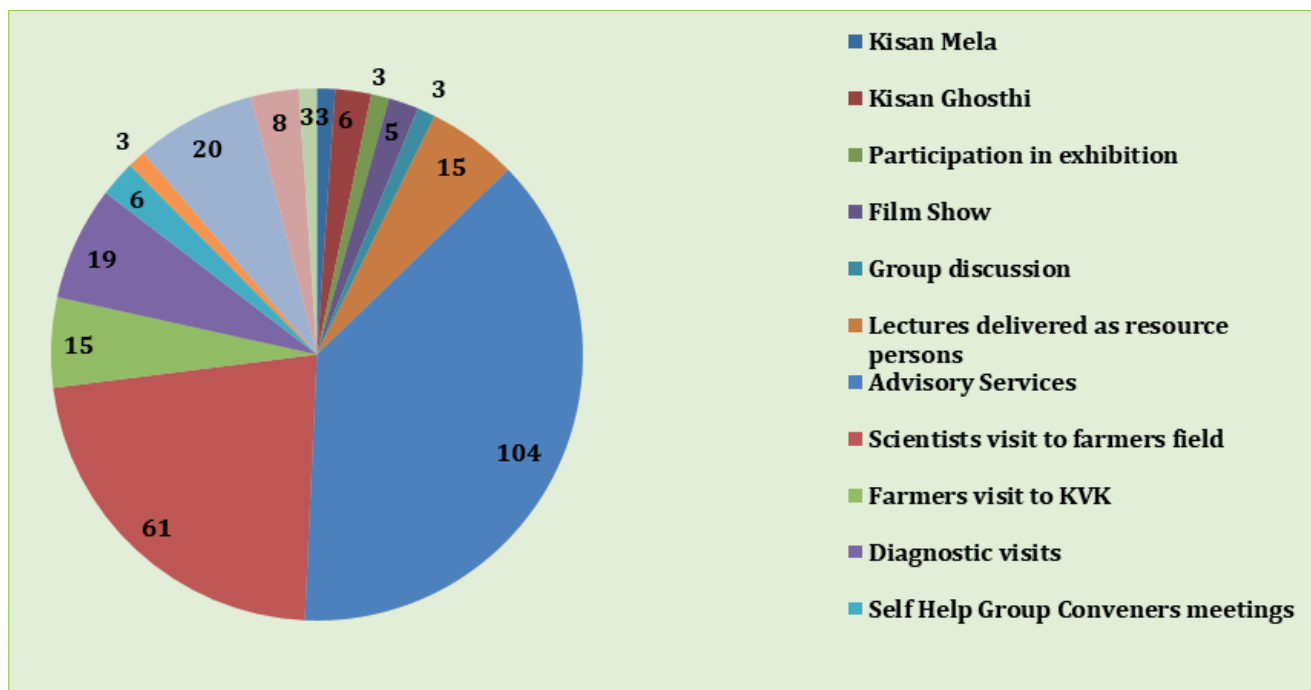
Farmers and farm women including the sponsored training programs (off campus)

Thematic Area	No. of Courses	No. of Participants									Grand Total		
		Other			SC			ST					
		M	F	T	M	F	T	M	F	T	M	F	T
Weed management	2	1	28	29	0	0	0	23	6	29	24	34	58
Resource conservation technologies	1	5	21	26	0	0	0	1	1	2	6	22	28
Crop diversification	1	0	2	2	0	0	0	9	16	25	9	18	27
Water management	2	0	0	0	0	0	0	16	37	53	16	37	53
Integrated crop management	1	0	0	0	0	0	0	8	21	29	8	21	29
Production of organic inputs	4	1	1	0	14	17	31	36	47	83	51	65	116
vegetable cultivation	4	0	31	35	2	6	8	16	75	91	16	114	130
Floriculture	1	0	0	0	0	0	0	16	9	25	16	9	25
Production and management technology	1	3	1	4	0	0	0	19	4	23	22	5	27
Soil and water conservation	7	2	1	3	1	3	4	71	96	167	74	100	174
Dairy management	2	2	1	3	0	0	0	18	30	48	20	31	51
Poultry management	2	4	3	7	0	0	0	9	37	46	13	40	53
Disease management	2	0	0	0	0	0	0	41	15	56	41	15	56
Feed management	1	0	0	0	0	0	0	7	18	25	7	18	25
Goat farming	2	0	0	0	0	0	0	17	41	58	17	41	58
Installation and maintenance of micro irrigation systems	1	4	1	5	0	0	0	19	6	25	23	7	30
Use of plastics in farming practices	2	12	3	15	0	0	0	24	19	43	36	22	58
Integrated pest management	7	10	7	17	8	5	13	50	105	155	68	117	185
Integrated disease management	2	0	0	0	0	0	0	10	42	52	10	42	52
Bio-control of pests & diseases	2	0	0	0	0	0	0	0	76	76	0	76	76
Production of bio control agents & bio pesticides	2	1	6	7	0	0	0	13	37	50	14	43	57
Seed Production	2	0	0	0	1	0	1	19	32	51	20	32	52
TOTAL	51	45	106	153	26	31	57	442	770	1212	511	909	1420



Organized On & Off campus training program

Other extension activities: For mass awareness different types of extension activities have been conducted by KVK, Khunti, under which, 274 programs have been organized, where 59289 (male: 30803 & female: 28486) farmers and extension personnel participated. Details are as follows:





Goshthi on organic farming



Sapling Distribution under Plantation drive



KVK Exhibition stall



Farmers scientist intraction



District level Rabi Workshop at Khunti



Block level Rabi Workshop at Karra



Welcome of DDG, ICAR, Ag.Engg. Dr S.N. Jha and Director ICAR-NISA, Dr Abhijit Kar & Farm equipment distributed by Sri Kali Charan Munda (M.P., Khunti) in Farmers Scientist intraction meeting



Group discussion with farmers at KVK,Khunti



Inauguration of Administrative building of KVK, Khunti by Sri Arjun Munda (Hon'ble Ag. Minister)

Farmers awareness program (FAP) under DAMU, GKMS: Awareness programs have been organized in various panchayat of Karra block selected under the Aspirational Block Program by NITI Aayog, Government of India. Under this program, farmer awareness programs were organized by the District Agro-met Unit KVK Khunti. In this program, information has been given on weather-based farming, impact of climate change on crops and measures to prevent them, benefits of using weather advisory, benefits of using Meghdoot and Damini mobile apps and other scientific methods of farming, while also providing information on identification of improved seeds, methods of planting them, maintenance, storage after harvesting and sale. Necessary information was given about the benefits of vaccinating livestock on time and using more green fodder. In collaboration with Krishi Vigyan Kendra, farmers were made aware at the village level to increase the %age of

soil testing of their fields so that farmers prosperity increases.



FAP in different villages of Karra block of Khunti district

In the field of education, information about basic facilities in schools and the importance of Anganwadi were emphasized. People were made aware of the basic facilities of every village. 528 farmers from various villages of Karra block along with block level public representatives, officers and workers participated in this program.

Tribal sub plan (TSP) Scheme: The main objective of “Tribal Sub Plan” scheme is focused on the empowerment of tribal farmers through training, demonstrations and provided the mentioned resources. In the year 2024 65 training programs and 560 demonstrations have been organized. Other than this knapsack sprayer (60), vermibed (60), lopper (100), skater (100), Sewing machine (20), cono-weeder (100), spade (200), rocking sprayer (20) animal health kit (200) have also been distributed free of cost to ST farmers to improved livelihood.



Distribution of sprayers and vermi bed under TSP

Women empowerments: Khunti district tribal women play important role in agriculture, with aim of mobilizing women farmers to form self-help groups (SHGs) through awareness programs, providing them technical assistance through capacity building, FLDs, OFTs other extension activities and farm equipment/ implements available to them motivate them so as to generate income round the year. In the year 2024, approx. 30800 farm women have participated in KVK activities.



Women empowerment through equipment and implement distribution

Schedule caste Sub Plan (SCSP) Scheme: An umbrella strategy is to ensure flow of targeted financial and physical benefits from all the general sectors of development for the benefit of

Scheduled Castes. To improve the livelihood of the Scheduled Caste population in Khunti district, Jharkhand, conducted exposure visits (200 farmers) and distributed fishing net (150), manual

seed planter (1) and Vivek Madua Thresher & Pearler-1 (1), oyster mushroom growing units (27) were distributed in year 2024.



Installation of mushroom units at Farmers field



Distribution of manual seed planter to SHG members

Other activities of KVK, Khunti:

Workshop on energy conservation and water conservation in agriculture sector

KVK, Khunti and Jharkhand Renewable Energy Development Agency (JREDA) jointly organized a workshop on “Energy conservation and water conservation in agriculture sector” on 12 June, 2024 at KVK, Khunti. In this program 53 farmers and other stake holders have participated. Workshop has inaugurated by chief guest, Shri Rohit Surin, block Pramukh, Torpa. Experts and KVK personals shared their views on natural resource conservation. Stake holders were made aware about the increasing challenges facing by them agriculture industry like water scarcity and high energy costs. So, that the use of sources of renewable energy may contribute to environmental sustainability, reducing the carbon footprint and

ensuring that natural resources are preserved for future generations.



Workshop on energy conservation and water conservation in agriculture sector organized at KVK

Live telecast program on “Transfer of 17th installment of PM Kisan Samman Nidhi

KVK organized Live telecast program on “Transfer of 17th installment of PM Kisan Samman Nidhi” on June 18th, 2024 at KVK Khunti. In this program, 103 farmers and farm women participated. Which was inaugurated by Honorable Prime Minister Shri Narendra Modi from Varansi.



Live telecast program on “Transfer of PM Kisan Samman Nidhi at KVK

Tree Plantation awareness campaigns under “Ek Ped Maa Ke Nam”: KVK, Khunti organized this awareness campaigns from June 5th to August 30, 2024 at different villages of Khunti district. Where, the participants were educated on the need of more

trees for betterment of environment. Multiple tree seedlings were distributed and many were planted by the KVK personnels. Just as a mother, cares for, and gives life, a tree grows, provides shelter, and sustains life through oxygen, fruits, and shade.



Plantation and their awareness program organized at different places



Animal Health cum Vaccination Camp: KVK, Khunti organized an animal health cum vaccination camp at KVK on September 9, 2024. 200 animals (60 cattle and 140 goats) were examined and treated free of cost. The event was a significant step towards strengthening the community's agricultural and livestock health. In addition, the Kissan Gosthi brought together farmers and experts, fostering an interactive discussion on best practices for animal husbandry, crop management, and overall farm productivity.



Animal Health cum Vaccination Camp organized at KVK

Swachhata Abhiyan Program: KVK, Khunti organized "Swachhata Abhiyan" program during the period of September 17th to December 1st, 2024. This was part of national program slogan "Swabhav Swacchhta Sanskar Swacchhata". The program included multiple on-campus and off-campus awareness campaigns. Its primary objective is to

make India cleaner, healthier, and more sustainable by focusing on sanitation, waste management, and hygiene. The initiative promotes waste segregation, reduction of single-use plastic, and proper disposal. This helps protect the environment, reduces pollution, and encourages sustainable living practices.



Swachhata Pledge at Torpa School



Swachhata Abhiyan Program at Church

Rashtriya Poshan Maah: KVK, Khunti organized this program from 1 September to 30 September, 2024 in different villages of Khunti district. Awareness programs on importance of their nutrition and how its positively correlated to the well being of family and the society itself were carried out for the farm women.



Organized awareness programs under Rashtriya Poshan Maah

World Soil Day: KVK, Khunti celebrated this program on December 5th, 2024 at KVK. On this occasion a goshthi was organized where 55 farmers participated. In this program KVK scientist made aware to the farming community about soil degradation, soil conservation how healthy soils store carbon, and act as carbon sinks, etc. The day is also an opportunity to advocate for policies that promote sustainable soil management at national and global levels.



Organized a goshthi under world soil day at KVK

Live telecast of release of 109 climate resilient and bio-fortified varieties of horticulture and field crops: KVK organized krishi chaupal on the occasion of live telecast of release of 109 climate resilient and bio-fortified varieties of horticulture and field crops of ICAR on 07 December 2024 with a group of farmers. The farmers were made aware about the ongoing discussion between eminent scientists and farmers on various topics such as newly released crop varieties, their benefits, agronomic practices and their scientific management.



Organized Krishi Chaupal Live telecast of release of 109 climate resilient and bio-fortified varieties of horticulture and field crops

National Farmer's Day: KVK, Khunti celebrated national farmer's day on the occasion of birth day of Honorable Ex-Prime Minister, Govt. of India, Chauhary Charan Singh on December 23th, 2024 at KVK. A goshthi was organized to make the farmers aware about their hard work, dedication, and sacrifices that the farmers make to ensure the country's food security.



Organized program on the occasion of National Farmers Day at Krishi Vigyan Kendra, Khunti

Awareness program on sanitary and Phytosanitary (SPS), good agricultural practices and food safety: KVK, Khunti and NIPHM, Hyderabad jointly organized an awareness program on 09 August 2024 at KVK premises. In this program, farmers were made aware about good agricultural practices, sanitary and phytosanitary measures for export-oriented farming and food safety. The regional head APEDA (Kolkata); scientific officer and assistant scientific officer of NIPHM, Hyderabad; assistant director, CIPMC; head KVK; other SMS of KVK and selected farmers participated in this program.



Organized awareness program on SPS, good agricultural practices and food safety at KVK

Parthenium Awareness Week Program: KVK organized such program at different villages of Khunti district from 16-22 August, 2024. Under this program farmers were made aware of the harmful effects of this noxious weed. Then all participants and organizers altogether removed this weed from a heavily affected area.



Parthenium Awareness Week Program at farmers field

Externally Funded Projects:

S.N.	Project name	Project cost (₹ in lakh)/ Duration	Sponsoring agency & Scientist involved
1.	District agro-meteorology unit (DAMU)	₹ 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.	Bamboo Development Initiative through KVK for Empowerment and Sustainable Livelihood in Khunti District.	₹ 34.88 From 2024 to till date	National Bamboo Mission under Ministry of Agriculture & Farmers Welfare Dr. Deepak Rai, PI
4.	Round The Year Vegetable Production with Precision cum Resource Conservation Technology for Doubling Farmers Income in Jharkhand.	₹ 196.07 From 2023 to till date	Rashtriya Krishi Vikas Yojana (RKVY) under Ministry of Agriculture & Farmers welfare Dr. Deepak Rai, Co-PI
5.	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	Rashtriya Krishi Vikas Yojana (RKVY) Under Ministry of Agriculture & Farmers Welfare Dr. Deepak Rai, Nodal Officer

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, whereas second batch joined the institute in October-December 2024.

PG cell encourages the young minds to improve their vision, understanding of the subject, and quality of research through practical learning, which was accomplished through industrial visits and sending the students on specialized training for better learning exposure.

SECOND YEAR STUDENTS					
M.Tech. in Processing & Food Engineering		M.Sc. in Agricultural Chemicals			
					
Sanjay K	Junghare Priya Suresh	Jyoti Prakash Pradhan	Ankush Kumar Patel	Diganta Chakraborty	Soyam Bittu
FIRST YEAR STUDENTS					
M.Tech. in Processing & Food Engineering		M.Sc. in Agricultural Chemicals			
					
Satish K Gaharwariya	Fahmidha	Debagha Dey	Aishik Sadhukhan	B Naresh	Nirmal U Ajgekar

Training programs and Industrial Visits attended by PG students

Trainings/ Industrial visits	Duration/Date	Students participated
Training on GC-MS/MS for quantification of pesticides and metabolite profiling	22/07/2024 to 31/07/2024	Soyam Bittu Diganta Chakraborty
Industrial visit to Jharkhand State Cooperative Milk Producers' Federation Ltd (Medha Dairy plant), Hotwar, Ranchi	15/03/2024	Junghare Priya Suresh Sanjay K
Industrial visit to SMV Agro Products Pvt. Ltd. (Rice Processing plant), Ara Gate, Namkum, Ranchi	27/11/2024	Fahmidha Satish K Gaharwariya

Training Programs Attended

Name of Scientist(s) and TOs	Name of Course/ Training	Organization and Venue	Period
Dr. S Kumar	Decoding Genomics & Proteomics Data using Machine Learning Approach	IASRI Online	Feb 21-27, 2024
Dr Md Ali Dr. S Kumar	Pedagogy Development Program on “Enhancing Pedagogical Competencies for Agricultural Education” Program	National Academy of Agricultural Sciences, New Delhi	Mar 03-08, 2024
Dr SKS Yadav			Apr 01-05, 2024
Dr Md. Ali	Training on Laboratory Quality Management System and Internal Audit as per IS/ISO/IEC 17025:2017	NITS, Noida	Jun 04-07, 2024
Er. SK Pandey	Building successful Incubation Ecosystem	ICAR-NAARM, Hyderabad	Jul 03-05, 2024
Dr AR Chowdhury	NABL Assessors’ training Course based on ISO/IEC 17025:2017	New Delhi	Aug 05-09, 2024
Dr. N Thombare	Training & demonstration on ‘Operating UV-Vis-NIR Spectrophotometer’ from the JASCO Pvt. Ltd.	Innovation Laboratory, ICAR-NISA, Ranchi	Aug 23-24, 2024
Dr. N Thombare	Training and demonstration on ‘Operating HPLC’ from the Thermo Scientific Pvt. Ltd.	Innovation Laboratory, ICAR-NISA, Ranchi	Sep 04-05, 2024
Dr. M S Udaykumar	Innovations in Digital Extension	MANAGE & ICAR-IVRI	Sep 23-27, 2024.
Dr. N Prasad	Training on Vigilance Perspectives for ICAR Officers	ICAR-NAARM, Hyderabad	Nov 06-08, 2024
Dr. D Rai	10th MDP training program for newly recruited senior scientist and heads of KVKs	ICAR-NAARM, Hyderabad RVSKVV-KVK, Ujjain ICAR-ATARI, Patna	Nov 27 to Dec 11, 2024 Dec 14-23, 2024 Dec 27-31, 2024
Er. Sonu Kumar Er. Bhupendra Sahu	Industrial Automation & Robotics	Skill Development Institute, Bhubaneswar	Nov 20 to Dec 19, 2024

Presentation in Conferences/Seminars/Symposia/Workshops

Scientist	Topic of presentation	Event	Organizer	Date & Venue
Debabandya Mohapatra, Principal Scientist	Food processing opportunity for women entrepreneurs in Odisha	Krusha Odisha 2024	APICOL, Govt. of Odisha	Jan 12-14, 2024, Bhubaneswar
Debabandya Mohapatra, Principal scientist	Recent trends and opportunities for automation and robotics in food processing	Automation and robotics in food processing: The way forward (virtually)	DSLDCHEFT	May 15 2024, Baglakot, Karnataka
Nandkishore Thombare, Senior Scientist	Development of an electronic device for color analysis of lac: Quality assurance for sustainable farming and trade	VIIIth International Conference on "Global approaches in agricultural, biological, environment and life sciences for sustainable future	ATDS, UP, India	Jun 8-10 2024, Kathmandu, Nepal
Archana Mahapatra, Scientist	Isolation and Characterization of Cellulose from Pea Pods: Towards Sustainable Biomaterials			
Priyanka Sakare, Scientist	Lac dye based intelligent colorimetric indicators for real-time freshness monitoring of packaged perishable food products			
Deepak Rai, Senior scientist & Head, KVK	Impact analysis of sustainable management practices of mango leaf webber (<i>Orthaga euadrasalis</i> , Walker) in central plain of Uttar Pradesh	International conference on "Ecological Impact on Agriculture, Business and Technology	SAUATS, Prayagraj, RS Krishi Shodh Sansthan, Prayagraj	Jun 18-19, 2024, Agriculture and Forestry University, Chitwan, Nepal
Priyanka Sakare, Scientist	प्राकृतिक रंग आधारित खाद्य ताजगी संकेतक: खाद्य सुरक्षा बढ़ाने की दिशा में एक कदम	राष्ट्रीय वैज्ञानिक हिन्दी संगोष्ठी on औद्योगिकीकरण- 4.0 के युग में प्राकृतिक संसाधनों का भारतीय अर्थव्यवस्था में योगदान: चक्रीय अर्थव्यवस्था एवं चिरस्थायी पर्यावरण का एकीकरण (virtually)	ICAR-NINFET, Kolkata (virtually)	Sep 26, 2024, ICAR-NINFET, Kolkata, online mode
Debabandya Mohapatra, Principal scientist	औद्योगिकीकरण-4.0 के युग में प्राकृतिक संसाधनों का भारतीय अर्थव्यवस्था में योगदान			
Satish Chandra Sharma, senior scientist	Effect of Tapping Techniques on Gum Yield from <i>Buchanania lanzan</i> Trees. Paper presented in	3rd International Conference on Climate-Smart Nutri-Sensitive Integrated Farming System for Gender-equitable Sustainable Agriculture: Prospects and Challenges	ICAR- CIWA, Bhubaneswar,	Nov 06-08, 2024, ICAR- CIWA, Bhubaneswar Odisha



Scientist	Topic of presentation	Event	Organizer	Date & Venue
Archana Mahapatra, Scientist	Green Recovery of Lemongrass Essential Oil with Hydrogen-Bonded Supramolecular Eutectic Solvents	58th Annual Convention of Indian Society of Agricultural Engineers (ISAE)	ISAE	Nov 12- 14, 2024 at VNMKV, Parbhani
Deepak Rai, Senior scientist & Head, KVK	Evaluation of Sustainable Management Practices of Thrips (Scirtothrips spp.) in Mango Orchard of Lucknow District	1st International conference on Innovations to achieve Climate Resilient Smart Agriculture for Ensuring Global Food & Nutritional Security (IACRSAEGNS-2024)	ICAR-IISR, Lucknow, A. EE&TDS, Lucknow and CAR, UP	Nov 18-19, 2024 held at ICAR-IISR, Lucknow
Nandkishore Thombare, Senior Scientist	A simple, convenient, and statistically optimized method to determine the solubility of polysaccharide gums: Guar gum and beyond	International Conference on Advances in Materials and Chemical Sciences	BIT, Mesra	Dec 18-20, 2024 at BIT, Mesra, Ranchi
Priyanka Sakare, Scientist	Impact of Immobilization Matrix on the Sensing Performance of Freshness Indicators: A Comparative Analysis'			

Events & Meeting Attended

Scientist	Role and Event	Date of event	Organizer & venue
Dr. AR Chowdhury Dr. MF Ansari	Member, 27th BIS CHD-23	Mar 21, & Sep 27, 2024	BIS
Dr. D Rai	Participant, International conference on "Recent Advances in Agriculture for Atmnirbhar Bharat"	Apr 19-21, 2024	AMF UP & CCSHAU, Hisar
Dr. J Ghosh	Research Advisory Committee, member of Indian Council of Forest Research Institute (ICFRE), Dehradun	May 22 & 24, 2024 & Nov 5 2024	ICFRE (Online)
Dr. MF Ansari Dr. MS Udaykumar Er. SK Pandey	Participant, Consultative Learning Workshop on 'Unleashing the potential of lac in addressing rural livelihood: Status, Constraints and Strategies'	Jun 18-19, 2024	ICAR-NISA & PRADAN and partner CSOs
Dr. A Pramaik Dr. D Mohapatra	member, Indian Grain Storage Working Group meeting	Aug 21, 2024	ICAR (Engineering SMD), New Delhi
Dr. D Rai	Member, Annual zonal review workshop of Bihar and Jharkhand KVKs	Aug 29 & 31, 2024	BAU, Sabour, Bihar
Dr. J Ghosh	CSB-Central Tasar research and Training Institute (CSB-CTR&TI) and attended 54th and 55th Research Advisory Group meeting on	Aug 31, 2024	CSB-CTR&TI, Ranchi

Scientist	Role and Event	Date of event	Organizer & venue
Dr. J Ghosh	ICFRE-Institute of Forest Productivity (IFP) and attended XXV Research Advisory Group meeting	Sep 22 2024	IFP, Ranchi
Dr. A Kar Dr. D Mohapatra	expert member in the Initial Screening Committee (ISC) for the India-Israel Industrial R&D and Technological Innovation Fund (I4F), 2024	Oct 03, 2024.	DST (online)
Dr. AR Chowdhury Dr. A Dutta	Annual workshop of CRP on Secondary Agriculture on	Oct 18, 2024	NRC Makhana, Darbhanga, Bihar
Dr. S Kumar	Participant, 5th International Electronic Conference on Foods (virtually)	Oct 28-30, 2024	MDPI and Foods
Dr. SC Sharma	Co-chair, 3rd International Conference on Climate-Smart Nutri-Sensitive Integrated Farming System for Gender-equitable Sustainable Agriculture: Prospects and Challenges,	Nov 06-08, 2024	ICAR- CIWA, & Pragati Int. Scientific Research Foundation, Bhubaneswar
Dr. S Ghosal	Member, IMC Meeting of ICAR-IIAB, Garhkhatanga	Nov 14, 2024.	IIAB, Ranchi
Dr. NK Sinha	Member, 8th Institute Management Committee Meeting of ATARI, Patna (Zone IV)	Nov 26, 2024	ATARI, Patna (Zone IV)

Visit of Foreign Delegates to ICAR-NISA

Strengthening Global Collaborations in Secondary Agriculture

Dr. Udaykumar, M. S., Scientist and Mr. P. Patmajhi briefed regarding the cultivation of lac, processing and value addition aspects and its industrial applications to three Japanese delegates such as Mr. Hitoshi Mizutani, Ms. Yoko and Mr. Daisuk from Higashiuzura, Gifu, Japan who visited to ICAR-NISA, Namkum, Ranchi, Jharkhand on 15.03.2024. They also visited Insect gene bank, institute farm and the museum.



Dr. Robin Gogoi, Professor & Principal Scientist (Plant Pathology), ICAR- IARI, New Delhi and OSD, ICAR- IARI, Guwahati, Assam visited ICAR -NISA, Namkum, Ranchi, Jharkhand on 19.03.2024. He also visited the museum, institute farm and the insect gene bank.

AWARDS, HONOURS AND RECOGNITION

Awardee's name and designation	Award	Organization/ society	Event and Date
Deepak Rai, Senior Scientist & Head, KVK	Distinguished Scientist Award	Agri Meet Foundation U.P.&CCSHAU, Hisar, Haryana	International conference on Recent Advances in Agriculture for Atmnirbhar Bharat during Apr 19-21, 2024
Priyanka Sakare, Scientist,	Young Women Scientist Award-2024	Agricultural Technology Development Society (ATDS), UP, India	7th International Conference on Global Approaches in agricultural, biological, environment and Life Sciences for sustainable future held on Jun 8-10, 2024 at D.A.V. College, Kathmandu, Nepal
Deepak Rai, Senior Scientist & Head, KVK	Best Senior Scientist Award	Sam Higgin bottom Uni. of Agri. Tech. and Science, Prayagraj, R.S. Krishi Sodh Sansthan, Prayagraj, Agriculture and Forestry University, Chitwan, Nepal	International conference on "Ecological Impact on Agriculture, Business and Technology held during Jun 18-19, 2024
Sakharam Kale, Scientist	Special Recognition Certificate' for distinguished services in Academic Activities	ICAR-IARI Mega University Ranchi Hub	13th Foundation Day of ICAR-IIAB on Oct 09, 2024
Priyanka Sakare, Scientist	Gold medal in Table Tennis event	ICAR	ICAR- Inter-Zonal Sports Tournament-2023 held at ICAR-CAZRI, Jodhpur during Oct 14-17, 2024
Deepak Rai, Senior Scientist & Head, KVK	Best Oral Presentation	ICAR-IISR, Lucknow, Agricultural Entrepreneur Environment & Technology Development Society, Lucknow and Council of Agricultural Research, UP.	Ist International conference on "Innovations to achieve Climate Resilient Smart Agriculture for Ensuring Global Food & Nutritional Security" during Nov 18-19, 2024 at ICAR-IISR, Lucknow
Nandkishore Thombare, Senior Scientist	Best Oral Presentation Award	BIT, Mesra, Ranchi	International Conference on Advances in Materials and Chemical Sciences held on Dec 18-20, 2024 at BIT, Mesra, Ranchi.

हिन्दी प्रकोष्ठ की गतिविधियां

वार्षिक प्रतिवेदन 2024

भारत सरकार के राजभाषा विभाग (गृह मंत्रालय) द्वारा किये गए वार्षिक कार्यक्रम एवं राजभाषा अधिनियम व नियम के समबन्ध में भारतीय कृषि अनुसंधान परिषद्, नयी दिल्ली से समय-समय पर प्राप्त निर्देशों पर अनुवर्ती कार्यवाई तथा सरकारी कार्यों में हिंदी के प्रयोग को और गति प्रदान करने के लिए संस्थान में राजभाषा इकाई की स्थापना की गयी है। संस्थान 'क' क्षेत्र में है, इसे राजभाषा अधिनियम की धारा 4(10) के अंतर्गत केन्द्रीय बजट में अधिसूचित किया जा चुका है। संस्थान के सात अनुभागों को शत प्रतिशत कार्य हिंदी में करने हेतु विनिर्दिष्ट की गया एवं प्रवीणता प्राप्त सभी अधिकारियों/ कर्मचारियों को अपना-अपना कार्य हिंदी में करने हेतु व्यक्तिशः आदेश दिए गए हैं।

संस्थान के दैनिक कार्य में हिंदी के प्रयोग में प्रगति एवं सरल बनाने के लिए राजभाषा इकाई द्वारा निम्नलिखित कार्य सम्पादित किये गए हैं :

संस्थान की वार्षिक राजभाषा पत्रिका लाक्षा के 16वें संस्करण लाक्षा-2024 के प्रकाशन के लिए विभिन्न रोचक एवं ज्ञानवर्धक विषयों पर लिखे गए लगभग 27 लेखों का संकलन कर प्रकाशित कर दिया गया है।

लाक्षा-2024 में प्रकाशित सर्वश्रेष्ठ आलेख के चयन हेतु कमिटी का गठन किया गया तथा कमिटी द्वारा सुझाए गए आलेख के लेखकों को पुरस्कार प्रदान किया गया है।

अधिकारियों और कर्मचारियों को नगर राजभाषा कार्यान्वयन समिति के सदस्य कार्यालयों द्वारा आयोजित विभिन्न हिन्दी प्रतियोगिताओं एवं कार्यशालाओं में सहभागिता हेतु प्रेरित करने का कार्य किया गया।

हिन्दी दिवस, हिन्दी चेतना मास एवं योजनानुसार नगर स्तरीय राजभाषा संबंधी, संगोष्ठी एवं कार्यशाला का आयोजन किया गया।

द्विभाषी नामपट्ट एवं बैनरों के निर्माण में सक्रिय सहयोग किया गया।

प्रचार सामग्रियों को तैयार कर 16 समारोहों के मीडिया प्रबंधन का कार्य किया गया एवं समाचार संकलन का कार्य किया गया।

परिषद् मुख्यालय के अधिकारियों द्वारा 15-17 मई 2024 में हिंदी में कार्य की निरीक्षण किया गया।

संसदीय राजभाषा समिति की दूसरी उप-समिति के द्वारा दिनांक 21.10.2024 को तैयार प्रश्नावली पर हिंदी में कार्य की निरीक्षण की गई।

निदेशक महोदय की अध्यक्षता में संस्थान राजभाषा कार्यान्वयन समिति की चार तिमाही बैठकों का आयोजन निम्नलिखित तिथियों को किया गया तथा प्रगति की समीक्षा की गई। तिमाही रिपोर्ट एवं कार्यवृत्त परिषद् सहित अन्य संबंधित कार्यालयों में प्रेषित की गई। (क) दिनांक 14.02.2024, (ख) दिनांक 20.05. 2024, (ग) दिनांक 09.07. 2024, (घ) दिनांक 22.10. 2024

पुरस्कार / सम्मान

नगर राजभाषा कार्यान्वयन समिति (नाराकास) रांची द्वारा दिनांक 06.03.2024 को आयोजित बैठक में संस्थान की राजभाषा पत्रिका लाक्षा-2022 को द्वितीय पुरस्कार से सम्मानित किया गया।



संसदीय राजभाषा समिति की उप-समिति द्वारा संस्थान का निरीक्षण

दिनांक 21 अक्टूबर 2024 को अपराह्न 12:30 बजे, संसदीय राजभाषा समिति की दूसरी उप-समिति द्वारा भाकृअनुप-राष्ट्रीय कृषि उच्चतर प्रसंस्करण संस्थान, रांची का राजभाषा कार्यान्वयन से संबंधित निरीक्षण किया गया। यह बैठक होटल बीएनआर चाणक्य, रांची में आयोजित की गई। इस अवसर पर उप-समिति के अध्यक्ष माननीय सांसद श्री उदय प्रताप सिंह सहित समिति सचिवालय के अधिकारीगण तथा अन्य माननीय सांसदगण उपस्थित थे। संस्थान की ओर से निदेशक डॉ. अभिजीत कर सहित अन्य अधिकारियों ने प्रतिनिधित्व किया। निरीक्षण बैठक में संस्थान द्वारा पूर्व में प्रेषित प्रश्नावली प्रपत्र के आधार पर प्रस्तुत रिपोर्ट की समीक्षा की गई।

समिति के माननीय सदस्यों एवं अधिकारियों द्वारा प्रश्रवली में भरी गई जानकारी के विभिन्न पहलुओं पर चर्चा की गई तथा स्पष्टीकरण मांगे गए। इस अवसर पर समिति द्वारा राजभाषा हिंदी के प्रयोग, प्रगति एवं कार्यान्वयन से संबंधित दस्तावेजों, पंजियों एवं प्रक्रिया का अवलोकन किया गया। बैठक के अंत में समिति ने आवश्यक सुझाव भी प्रदान किए।



हिन्दी दिवस समारोह-2024

भाकृअनुप-राष्ट्रीय कृषि उच्चतर प्रसंस्करण संस्थान में आयोजित हिंदी उत्सव समारोह न केवल भाषा का सम्मान था, बल्कि एक प्रेरणादायक और गहन विचारशील आयोजन के रूप में उभरा। इस अवसर पर मुख्य अतिथि के रूप में डॉ. पंकज मित्र, कार्यक्रम अधिशासी, आकाशवाणी, रांची, ने अपनी गरिमामयी उपस्थिति से समारोह की शोभा बढ़ाई।

डॉ. मित्र ने “विश्व भाषा की ओर अग्रसर होती हिंदी” विषय पर अपने सारगर्भित व्याख्यान की शुरुआत करते हुए हिंदी के उद्गम, विकास और उसके वैश्विक महत्व को बड़े ही प्रभावी ढंग से प्रस्तुत किया। उन्होंने हिंदी के संस्कृत से खड़ी बोली तक के उत्कर्ष की यात्रा का

विस्तार से वर्णन किया, जहाँ महाभारत काल से लेकर आधुनिक युग तक हिंदी ने अपनी समृद्ध और विविधतापूर्ण पहचान को संजोए रखा है। उन्होंने मानव इतिहास की तीन महत्वपूर्ण खोजों—आग, पहिया और भाषा—में भाषा की विशेष भूमिका को रेखांकित किया और इसे मानव सभ्यता को नए आयाम देने वाला माध्यम बताया।

समारोह के दौरान संस्थान के निदेशक महोदय ने सं बताया कि संस्थान किस प्रकार हिंदी भाषा को वैज्ञानिक और तकनीकी क्षेत्रों में आगे बढ़ाने के लिए प्रतिबद्ध है। समारोह में कुल आठ श्रेणियों में आयोजित प्रतियोगिताओं के विजयी प्रतिभागियों को पुरस्कार और प्रमाण-पत्र से सम्मानित किया गया। साथ ही, लाक्षा 2023 के सर्वश्रेष्ठ आलेख लेखकों को भी विशेष सम्मान प्रदान किया गया। श्री बिनोद कुमार, संस्थान के प्रभारी हिंदी अधिकारी, ने वर्ष 24-2023 का हिंदी समीक्षा प्रतिवेदन प्रस्तुत किया। कार्यक्रम को सफलतापूर्वक संपन्न कराने में श्री इंद्रजीत कुमार ने हर संभव सहायता प्रदान की। अंत में, हिंदी आयोजन समिति के अध्यक्ष डॉ. सरोज कुमार गिरी ने मुख्य अतिथि को धन्यवाद ज्ञापित किया और कार्यक्रम का संचालन मोहम्मद तारिक जमान ने कुशलता से किया।



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संस्थान की वार्षिक हिन्दी पत्रिका "लाक्षा-2024" में प्रकाशित लेख

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PATENTS FILED/GRANTED

Patent filing by the institute during 2024

Sl. No.	Title (Application No.)	Activity/progress, date	Inventors
1	A natural resin-based eco-friendly adhesive for application in disposable dining utensils and method of preparation thereof (202431043306)	Filing on 04.06.2024	Ansari MF, Thombare N, Roy Chowdhury A & Kar A
2	A natural resin-based scavenging system for reduction of caffeine and bitterness from beverages (202431061991)	Filed on 14.08.2024	Thombare N, Kumar S, Sakare P, Bhondekar AP, Das S, Cherwoo L, Sharma A, Kumar R, Gaur V, Sudeendra UR, Gupta V, Ansari MF & Kar A
3	A rapid process for the preparation of multipurpose conducting ink using natural rosin as a conductivity enhancer (202331016762)	Filing complete specification & examination filing on 13.03.2024 & 10.08.2024	Thombare N, Sharma KK, Kar A, Kumar S, Bhondekar AP Purushottam, Sharma A, Cherwoo L & Das S
4	A system for estimation of Color Index of shellac and a process thereof (202331062688)	Filing request for examination on 10.08.2024	Thombare N, Kumar S, Bhondekar AP, Upadhyay A, herwoo L, Sharma A, Mahto A, Kumar R, Bagchi S, Ansari MF & Kar A
5	Natural carrier-based anthocyanin formulation for targeted release in GIT and process thereof (510789)	Patent granted on 14.02.2024	Saha S, Dutta A, Chatterjee NS & Tejpal CS
6	Natural Gum Based Nanocomposite Hydrogel Having Antibacterial and Wound Healing Effects and A Method of Preparation Thereof (497567)	Granted on 11.01.2024	Srivastava S, Roy Chowdhury AR, Sarkar B, Bhattacharjee S and Sharma KK
7	Natural resin based novel nondrying adhesive: Preparation and application in insect trap (202031019392/ 497208)	Patent granted on 10.01.2024	Thombare N, Srivastava S, Mohanasundaram A, & Sharma KK
8	Water soluble powder formulation of xanthophylls and process thereof (202411053291)	Patent filed on 12.07.2024	Dutta A, Ghoshal S, Saha S, Kundu A, Singh A & Shetty S

EVENTS ORGANIZED BY INSTITUTE

Brain storming session on ‘Secondary Agriculture for Lac and Tasar production systems’

A brain storming session on Secondary Agriculture for Lac and Tasar production systems has been jointly organized by National Institute of Secondary, Namkum, Ranchi, and the Central Tasar Training and Research Institute, Piska Nagri, Ranchi during 21-22 January, 2024 at ICAR-NISA, Ranchi, which was inaugurated by Shri Arjun Munda, Hon’ble Minister of Agriculture and Farmers’ Welfare and Minister of Tribal Affairs, Government of India. While delivering his anagural speech via online, Shri Munda emphasized on the need to prioritize research and innovation in the lac and tasar industries. The session discussed ways to empower artisans and farmers involved in lac and

tasar production. Strategies were discussed to improve production systems, increase farmers’ income and to make lac and tasar products competitive in the global market. Wecome address was given by Dr. Abhijit kar, director NISA, and the initial comments were given by co-chair Dr. N. B. Chowdary. Dr. A Bandyapadhyay, special invitee emphasized on suggested for collaborative work between NISA and CTRTI. The session has seen an impressive footfall of personel belonging to the farming community, industries, FPOs, apart from the heads of the division and scientists from ICAR-NISA and Indian Tasar Research and Training Institute (ITRTI), Ranchi. Drs. N Prasad, MF Ansari, D Mohapatra, S Ghosal, SC Sharma, N Thombare, S Kale, A Pramanik, P Sakare, S Kumar & Er. SK Pandey, from ICAR-NISA participated in this event.



Regional Agriculture Fair (Eastern Region), 2024

The Regional Agriculture Fair (Eastern Region), 2024 was organized by the Ministry of Agriculture and Farmers Welfare, Govt. of India and convened by the ICAR-National Institute of Secondary Agriculture, Namkum, Ranchi at the Krishi Vigyan Kendra, Diyankel, Torpa, Khunti, Jharkhand during 03-05 February, 2024. The theme of the fair was “Sustainable & Circular Bioeconomy – A Catalyst for Atmanirbhar evam Viksit Bharat”. The fair was inaugurated by the chief guest Hon’ble Union Minister of Agriculture and Farmers Welfare & Minister of Tribal Affairs, Shri Arjun Munda on

3rd February, 2024. Padma Bhushan Shri Kariya Munda, former Deputy Speaker of Lok Sabha was the guest of honor on the occasion. Dr. Himanshu Pathak, Secretary, DARE and Director General, ICAR, Shri Koche Munda, Hon’ble MLA, Torpa, Shri Ravindra Rai, former MP, Koderma also graced the occasion. Public representatives and officials of central and state government, ICAR dignitaries were also present during the inaugural session. The minister also inaugurated the newly established Administrative Building of the KVK.

The Regional Agriculture Fair aimed to sensitize the farming community in the eastern region of India to the latest agri-technologies and farming

practices. The fair provided an exclusive platform for agricultural transformation to different stakeholders, especially the farmers regarding the modernization of traditional practices. This fair also focused on enhancing farmers' income and profit through technological interventions from the grassroots level. The prime goal of the fair was to generate awareness about Govt. policies, disseminate information about the latest technologies, and create meaningful linkages between the farming community, and public or private sectors to uplift the living status of tribal farmers in particular and other farmers in general.

During his speech, the honorable minister highlighted the importance of the fair and central government's effort to make the farmers self-sufficient by doubling their income. He also emphasized that integrating science and technology into traditional farming can make farmers self-reliant which will positively impact the country's economy. He expressed his concern about India's growing population, climate change, and environmental pollution. The minister said that science and technology should be focused on increasing productivity, organic farming, nutrition, and agro-processing.

The fair featured 139 stalls by ICAR institutes (28), KVKs (25), FPOs (5), other government organizations (21), SHGs (11), and NGOs (41) each offering insights into various farming aspects. A total of 13 Kishan Gosthis were organized on various topics like natural farming, cropping systems, farm mechanization, nutrient management, Nutrigarden, crop production, animal husbandry, poultry science, minor forest produce, mushroom production, fishery, tasar and lac production, etc.

More than 600 farmers were distributed various inputs like agricultural tools, machinery, animal feed, mineral mixture, fishing net, etc. worth more than ₹ 40 Lakhs (Rupees Forty Lakhs Only) by various ICAR Institutes as well as central and state government agencies.

Around 10000 farmers from various parts of Jharkhand, Bihar, Odisha, and West Bengal attended and participated in the fair. Majority of the farmers belonged to tribal communities. Farm equipment, seed bins, animal feeds, fish nets, cattle feed and medicine kits, etc. were distributed among many farmers by the honorable minister during the inauguration session of the fair. The farmers interacted with the scientists, entrepreneurs, company representatives, NGOs, FPOs and gained knowledge about the latest agricultural technologies related to seeds, varieties, production processes, farm machinery, fertilizers, crop and soil management, use of drones in agriculture, etc. His Excellency, the Governor of Jharkhand, Shri C. P. Radhakrishnan was the chief guest of the closing ceremony of the fair on 5th February, 2024. The Vice-Chancellor of Birsa Agricultural University, Dr. S. C. Dubey also graced the occasion. During his speech, the Governor said that organizing a grand fair of this capacity on the soil of Bhagwan Birsa Munda is appreciable. He highlighted that along with crop farming farmers should adopt alternate income sources like animal husbandry, poultry farming, horticulture etc. to improve their income. He also said that central schemes like PM Kisan Samman Nidhi and PM Fasal Bima Yojna helped the farmers immensely. He hailed the annadata kisan for their role in improving the country's economy. Many progressive farmers, stalls were awarded by him during the program.



Celebration of International Women's Day

ICAR-NISA marked International Women's Day 2024 with an enriching celebration on 7th March 2024, that highlighted the theme "Invest in Women: Accelerate Progress." The event aimed to honor women's contributions to society and raise awareness about pressing health issues. The occasion was graced by Dr. Rajanigandha Tudu, Medical Oncologist, Ranchi Cancer Hospital and Research Center, Ranchi as chief guest and Dr. Sujay Rakshit, Director, ICAR- Indian Institute of Agricultural Biotechnology, Garkhatanga as guest of honour. The event started with a warm welcome address by Dr. Abhijit Kar, Director, ICAR-NISA, who extended heartfelt greetings to all attendees and expressed gratitude to Dr. Tudu for her time and expertise. He also acknowledged the tremendous contributions of women in various fields and emphasized the institute's commitment to promoting women's health and empowerment.



Dr. Rakshit highlighted about the importance of empowering women through education, health, and equal opportunities to drive progress in society. Dr. Tudu, chief guest delivered an insightful guest lecture on "Cancer Awareness", highlighting the importance of early detection and preventive measures in combating cancer. She emphasized the need for regular health check-ups and shared valuable insights on how lifestyle choices impact cancer risks, stressing the significance of investing in women's health for societal progress. The event concluded with a vote of thanks delivered by Dr. Debabandya Mohapatra, Head, APE Division and Convener of the program expressing gratitude to all those who participated and contributed to making the event a success. Further, a health check-up camp was set up for the employees of

the institute and their family by RCHRC, Ranchi. Cultural program was organized for the female staff members and the female family members of ICAR- NISA staff.

Awareness program about honey and bamboo production for the farmers of Jharkhand

ICAR – National Institute of Secondary Agriculture (ICAR-NISA) organized awareness program on honey and bamboo production for the farmers of Jharkhand on 14th March, 2024. Hon'ble Union Minister of Agriculture and Farmers Welfare & Minister of Tribal Affairs, Shri Arjun Munda was the chief guest of the program. Padmashree Shri Ashok Bhagat Secretary Vikash Bharti, Shri Snajay Seth, Member of Parliament Ranchi, Dr. SC Dubey, Vice Chancellor Birsa Agricultural University, Ranchi Dr. Sujay Rakshit, Director Indian Institute of Agricultural Biotechnology, Ranchi Dr. Abhijit Kar, Director National Institute of Secondary Agriculture, Ranchi and other dignitaries graced the occasion. A total of about 1200 farmers from Khunti, Ranchi, Gumla, Simdega, Seraikela and West Singhbhum districts attended the program. Hon'ble Union Minister of Agriculture and Farmers Welfare & Minister of Tribal Affairs, Shri Arjun Munda laid the foundation stone of the newly approved Regional Honey Testing Laboratory (RHTL) and Integrated Bee Development Centre (IBDC) at ICAR-NISA. Bamboo Development in Jharkhand and National Bee Keeping & Honey Mission projects were launched on the same day by Hon'ble minister. During his speech, the honorable minister highlighted the importance of beekeeping and bamboo production. He said that this area will develop as a honey hub in the coming days and it is a first step towards bringing sweet revolution to the eastern region.



Through this project, the unique honey varieties of Jharkhand, Bihar, Chhattisgarh, West Bengal and Orissa get an international recognition. Shri Sanjay Seth, said that beekeeping can prove to be a good option of additional income for farmers for which the region of Jharkhand is a highly suitable place. We must focus on increasing our sources of income by using such environmental resources. The scientists from different ICAR institutes of Jharkhand attended the program and also institutes displayed their institute technologies in the site through exhibition stalls for the benefit of the farmers.



As a part of Awareness program about honey and bamboo production organized by ICAR-NISA on 14th March, 2024, Kisan Gosti on lac cultivation and processing was organized for the farmers of Jharkhand. A total of about 1200 farmers from Khunti, Ranchi, Gumla, Simdega, Seraikela and West Singhbhum districts attended the program. Dr. Udaykumar, M. S. Scientist and Mr. P. Patmaji, ACTO was involved in the Kisan Gosthi program

Research Advisory Committee (RAC) Meeting

The XXXI meeting of the Research Advisory Committee (RAC) of the Institute (Third meeting of the current RAC constituted vide the council letter no. A. Engg.4/11/2021-IA-II (AE) e-file no.171040 dated December 27, 2021) was held on March 18-19, 2024 by ICAR-NISA, Ranchi. The meeting was presided over by the Chairman, RAC Dr. K. Alagusundaram, former DDG (Engg.), ICAR, New Delhi. The members present in the meeting are Dr. KP Singh, ADG (FE), ICAR, New Delhi, Dr. HN Mishra, Professor (Food Technology), IIT, Kharagpur, Dr. Dandamudi Usharani, Principal Scientist, CSIR-

CFTRI, Mysuru, Dr. Debaraj Behera, Professor & Head, OUAT, Bhubaneshwar, Dr. Nachiket Kotwaliwale, Director, ICAR-CIPHET, Ludhiana, Dr. Abhijit Kar, Director, ICAR-NISA, Ranchi, Dr. NK Sinha, Principal Scientist and Member Secretary RAC, ICAR-NISA, Ranchi.



Hon'ble Chairman and Members, RAC

Institute Research Council (IRC) Meeting

Institute Research Council (IRC) meeting was held on 24th and 25th April, 2024 in the Institute. The meeting was presided over by the Dr. Abhijit Kar, Director, ICAR – NISA & Chairman of the IRC. Progress of the work conducted under various approved research and extension programmes during the last financial year 2023 – 2024 (April, 2023 to March, 2024) was presented by the programme leaders and reviewed. All the Heads of the Divisions/Units (HoD's/HoU) also presented new programmes and projects aligning with the revised mandates, aspirations and priorities of the Institute. During the meetings, the research progress of on-going projects (18), and new project proposals (12), under six core programmes and externally funded projects (06) were discussed thoroughly and approved/adopted by the House.



World IP Day 2024 organized by Institute Technology Management Unit (ITMU)

On the occasion of World IP Day 2024 celebration, the ITMU, ICAR-NISA, Ranchi organized a guest lecture on the topic “Copyright protection in Digital Era: Issues and Challenges” on 29th April, 2024. The lecture was delivered by Dr. M.R. Srineevasa Murthy, DPIIT-Chair Professor IPR, National University of Study and Research in law, Kanke. More than 50 Scientists, Students and staff benefited from the program, gaining valuable insights into intellectual property rights in the digital age.



Lac Insect Day Celebration (May 16, 2024)

ICAR-National Institute of Secondary Agriculture, Ranchi celebrated National Lac-insect Day on 16th May, 2024 to create the desired impact on promotion and improvement of the lac sector. In his welcome address Dr. Niranjana Prasad, Head ABA division & PC, NPCILGR highlighted the importance of lac for sustainable livelihood of tribal farmers of Jharkhand. The program was followed by three expert lectures on “Lac cultivation” by Dr. Soumen Ghosal, “Lac Processing and different lac products” by Er. SK Pandey and “Value addition and application of Lac” by Dr. Fahim Ansari. In his address Dr. Abhijit Kar, Director, ICAR-NISA, emphasized that ICAR- National Institute of Secondary Agriculture, Ranchi (Formerly Indian Institute of Natural Resins and Gums & Indian Lac Research Institute) has played a pioneering role in maintaining the leadership position of India in lac sector through research and innovation in all aspect of lac cultivation, processing and application. The institute has played a key role in providing minimum support price for lac and declaring it as an agricultural commodity. However, strengthening of entire lac value chain through policy interventions like MSP and farmer-industry

linkages through village level organizations, formation of FPOs, increased R&D support will be helpful to harness the full potential of available resources.



Further, awareness campaign, field day for students and expert lectures on lac cultivation, lac-based value-added products and lac processing machinery were organized in different states of India at Centres of Network Project on Conservation of Lac Insect Genetic Resources. The program was graced by Dr. Abhijit Kar, Director ICAR-NISA, Dr. Niranjana Prasad, Head ABA Division, other heads of the divisions, Scientists, students and other institute officials. The program was also attended by 20 Progressive lac farmers from different districts of Jharkhand.

10th International Yoga Day Celebration at ICAR- NISA, Ranchi

A one-day Yoga training & practice program was organized on at ICAR-National institute of secondary agriculture, Namkum, Ranchi on 10th International Yoga Day on 21 June 2024. During the program Er Ujjwal Bhashkar, Yoga instructor, Art of Living Foundation, along with his team guided the staff and explained about different Asana, Pranayama and Mudras, and their benefit to maintain prosperous health and happiness in our daily life.



A session on meditation was also conducted. After practicing the yoga, an interaction session was also held where Yoga instructor answered various queries asked by the participants. All staff of ICAR-NISA including scientists, technical, administrative and contractual actively participated in the event. During the program Dr. Abhijit Kar, Director, ICAR-NISA highlighted the importance of the yoga in our life. Dr. Nandkishore Thombare, Convener of the program, drew attention towards benefits of yoga for both mental and physical health and presented the vote of thanks. The yoga guru Er Ujjwal Bhashkar and his team was felicitated during the program.

Events organized to mark centenary celebration

The institute, which was established on September 20, 1924, has undergone a major metamorphosis from being a Lac research institute to a Lac and natural gums and resin research institute and is now the present National Institute of Secondary Agriculture. To honour its 100-year glorious past, the institute has undertaken several activities to mark this Centenary Celebration. A series of lectures have been organized as part of the centenary celebration, featuring a diverse range of topics and speakers from different spheres of society.



The first talk in this series was delivered by Mr Premchand Jiwal on “Work and life balance” on 26th July 2024. More than 100 participants, including Scientists, students and staff from ICAR-NISA, ICAR-IIAB, and ICAR-PLANDU, attended and interacted with the guests. Dr Subrat Kar, professor IIT Delhi, delivered a talk on “Sensors in Agriculture” on via online mode on 5th August 2024. Dr RK Pal, former Director, ICAR- NRC on Pomegranate” delivered a talk on “Entrepreneurship opportunities in Secondary Agriculture” on 12th August 2024 and interacted with the staff and students of

ICAR-NISA. Dr Anish, Scientist at Indian Institute of Spice Research, delivered a talk on “Secondary agriculture prospects of spice processing” on 19th August 2024. Dr SL Mehta, former DDG education, ICAR, delivered a talk on “New Education policy and its impact on Agriculture’ addressing the scientists and students of NISA and IIAB on 24th August 2024.



An alumni meet was organized on 20th September 2024, which witnessed the enthusiastic participation of NISA alumni and their family members from India and abroad. The event was a heartwarming reunion, with alumni reminiscing about the golden days spent on the NISA campus and sharing their experiences. On this occasion, a book on “**Koer Bagaan**” has been unveiled, further strengthening the bond between the institute and its alumni.

Centenary Celebration of ICAR-NISA

The centenary celebration of the Indian Council of Agricultural Research-National Institute of Secondary Agriculture (ICAR-NISA) was held on September 20, 2024, in Ranchi, marking 100 years of its establishment. The event was graced by Her Excellency Smt. Droupadi Murmu, President of India, as the chief guest, alongside His Excellency Shri Santosh Kumar Gangwar, Hon’ble Governor of Jharkhand; Shri Shivraj Singh Chouhan, Hon’ble Union Minister of Agriculture & Farmers Welfare and Rural Development; Shri Hemant Soren, Hon’ble Chief Minister of Jharkhand; Shri Bhagirath Choudhary, Hon’ble Union Minister of State for Agriculture & Farmers Welfare; Shri Sanjay Seth, Hon’ble Union Minister of State for Defence; Shri Rajesh Kachhap, Hon’ble Member of Legislative Assembly, Khijri, Jharkhand; Dr. Himanshu Pathak, Secretary (DARE) & Director General (ICAR), Government of India; Dr. Shyam Narayan Jha, Deputy Director General (Engineering), ICAR; and Dr. Abhijit Kar, Director, ICAR – National Institute of Secondary Agriculture, Ranchi. The President, in her address, praised the institute for its century-long journey, emphasizing the institution’s ability to

maintain its identity and commitment to agricultural development. She underscored the importance of developing technologies that extend the shelf life of agricultural products like fruits and vegetables while being environmentally sustainable and economically viable. The President also highlighted the need for India to focus on high-value agricultural products to ensure fair prices for farmers and boost domestic and international demand. Governor Shri Santosh Kumar Gangwar and Chief Minister Shri Hemant Soren both stressed the importance of this institute for farmers and comprehensive support for improving their economic conditions. During the event, several key announcements were made by the Central Agriculture Minister. These included the establishment of cluster-based lac processing units, the recognition of lac as

an agricultural product, the launch of the Lakhpati Didi and Bhaiya Scheme to involve women and youth in lac production, and a plan to increase training for lac production from 1,500 to 5,000 farmers annually. During this event the institute technologies were exhibited for the benefit of farmers. The ceremony also witnessed the launch of “My Stamp”, “Laksha 2024”, “Vision 2047” and “100 Years of Excellence” symbolizing the institute’s continued progress. Over the past century, ICAR-NISA has played a vital role in lac production, benefiting over 1 million agricultural families and contributing to rural skill development and industrialization. Looking forward, the institute aims to expand its impact, continuing to foster innovation and sustainability in agriculture.



Sensitization workshop on POSH at workplace

As per the Council's guidelines, a sensitization workshop on POSH at workplace was organized on Dec 13, 2024 in online mode by the women's cell. Dr. Nita khandekar, principal Scientist, ICAR-CIAE delivered a talk in online mode and sensitized the gathering about the POSH act through various examples. All the staff and students of ICAR-NISA participated in this program.

Sensitization workshop on Matlab

A sensitization workshop on Matlab, Mathworks Ltd. was organized for the student and staff of ICAR-NISA on 9th August 2024 in online mode. Representatives from Mathworks Mr. Janardan mandal and Dr. Monalisha Pal briefed about the matlab functions and interacted with the scientists and responded to their queries.

Observation of Vigilance Awareness Week

As per the Council's /Gol guidelines, Vigilance Awareness Week was observed during 28.10.2024 to 03.11.2024. During the period, Integrity pledge was taken by the staff of NISA on 28.10.2024. A guest lecture was delivered by Shri B.B. Pradhan (IPS), former DGP on a topic "Culture of Integrity for Nation's Prosperity" on 29.10.2024. A quiz competition was held for the staff of NISA on 30th october 2024.

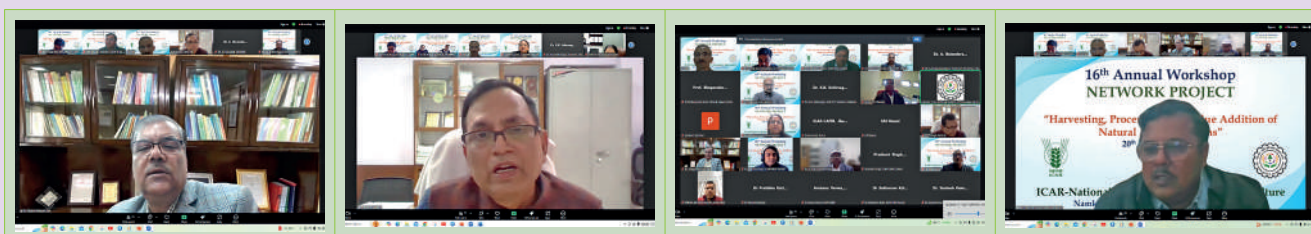
Observation of Communal harmony week

As per the Council's /Gol guidelines, Communal harmony week was observed during 19.11.2024 to 25.11.2024. During the period, Lectures by the employees of the Institute was held on 19.11.2024 and flag day was observed on 25.11.2024.

Sixteenth Annual Review Workshop of the Network Project on HPVA of NRG

The sixteenth Annual Review Workshop of "Network Project on Harvesting, Processing and Value Addition of Natural Resins and Gums" (NP-HPVA of NRG) was held on 20th December 2024 through online video conference mode to review the annual progress of the on-going projects at different centers, and to discuss the future research programmes for the year 2025-26. The inaugural session of the Workshop was chaired by Dr. S. N. Jha, DDG (Engineering), ICAR, New Delhi. Dr. K. P. Singh, ADG (Farm Engineering), Dr. K. Narsaiah, ADG (Process Engineering), and Dr Panna Lal Singh, Pr. Scientist attended the same from the ICAR headquarter. Dr. Abhijit Kar, Director ICAR-NISA, Dr. S. K. Giri, PC, NP- HPVA

on NRG, and all the PI's, Co-PI's and other staff of the lead and co-operating centers attended the review workshop. Dr. S. K. Giri presented the theme of the workshop and salient progress and achievements made by different centers of the Network project during the period from January to December, 2024. He also presented the ATR on the recommendations of the 15th Annual Workshop of the Network project held on 19th December 2023. The inaugural session was followed by technical session in which the PIs of the Network Cooperating centers presented the progress made during Jan.-Dec., 2024. Dr. K. P. Singh, ADG (Farm Engineering) chaired the technical session. Scientists from ICAR-NISA, Drs. A. Dutta, A. Mahapatra, A. R. Chowdhury, D. Mohapatra, P. Sakare, S. Kale, and S. C. Sharma participated in the program.



LIST OF ONGOING RESEARCH PROJECTS

S. N.	Institute projects	PIs & Co-PIs
1	Conservation, selection and management of lac host plants <i>Flemingia semialata</i> and <i>Ziziphus mauritiana</i>	Dr. Jyotirmoy Ghosh PI, Dr. Vaibhav D. Lohot Co-PI, Dr. Nawalesh K. Sinha Co-PI, Dr. Soumen Ghosal Co-PI
2	Development of package of practices for lac cultivation on ber and semialata along with compatible intercropping system	Dr. Soumen Ghosal PI, Dr. Niranjana Prasad Co-PI, Dr. Rahul R. Bakade Co-PI, Dr. Achintya Pramanik Co-PI
3	Development of energy efficient and high recovery processes for extracting essential oils from aromatic plants	Dr. Archana Mahapatra, PI, Dr. Sandeep Kumar, Co-PI
4	Design and development of equipment and machinery for processing of natural resins & gums	Dr. Sakham J. Kale, PI, Dr. Debadandya Mohapatra, Co-PI, Er. Sanjay Kumar Pandey, Co-PI, Dr. Satish Chandra Sharma, Co-PI
5	Development of smart packaging systems for enhancing shelf life of agro-produce	Dr. Priyanka Sakare, PI, Dr. Arnab Roy Chowdhury, Co-PI, Dr. Saroj Kumar Giri, Co-PI
6	Development of value-added products from natural resins, gums and their co-products	Dr. Md. Fahim Ansari, PI, Dr. Md. Ali, Co-PI, Dr. Santosh K.S. Yadav, Co-PI
7	Development of a green process for extraction of nano-cellulose from agri bio-products	Dr. Arnab Roy Chowdhury, PI, Dr. Santosh K.S. Yadav, Co-PI, Dr. Archana Mahapatra, Co-PI, Dr. Md. Ali, Co-PI
8	Development of suitable delivery systems for bioactive compounds for nutraceuticals and cosmeceuticals	Dr. Anirban Dutta, PI, Dr. Arnab Roy Chowdhury, Co-PI, Dr. Sandeep Kumar, Co-PI
9	Development of analytical techniques for identification and quality control of commercially important agri-bioproducts	Dr. Nandkishore Thombare, PI, Dr. Priyanka Sakare, Co-PI
10	Development of Membrane Filtration System for Lac-dye Recovery (Exploratory work)	Dr. Debadandya Mohapatra, PI, Dr. Sakham J. Kale, Co-PI, Er. Sanjay Kumar Pandey, Co-PI, Dr. Karmveer Jena, CTRTI, Co-PI
11	Translational research to promote secondary agriculture	Dr. M.S. Udaykumar, PI, Er. Sanjay Kumar Pandey, Co-PI
12	Training to stakeholders and business incubation for entrepreneurship development	Er. Sanjay Kumar Pandey, PI, Dr. M.S. Udaykumar, Co-PI
CRP, Network project and ICAR NAIF schemes and ICAR-partnering institutes		
13	CRP project on Secondary Agriculture	Dr. Saroj Kumar Giri, PC & PI
14	Network project on Harvesting, Processing and Value Addition of Natural Resins and Gums (ICAR)	Dr. Saroj Kumar Giri, PC & PI, Arnab Roy Chowdhury, Co-PI, Dr. Satish Chandra Sharma, Co-PI, Er. Sanjay Kumar Pandey, Co-PI
15	Network project on Conservation of Lac Insect Genetic Resources (ICAR)	Dr. Niranjana Prasad, PC & PI, Dr. Vaibhav D. Lohot, Co-PI, Dr. Thamilarasi K, Co-PI
16	Agri-Business Incubation under Component-II of NAIF Scheme of ICAR	Er. Sanjay Kumar Pandey, PI, Dr. Satish Chandra Sharma, Co-PI
17	Intellectual property management, technology transfer/ commercialization and Agribusiness incubation NAIF Scheme of ICAR	Er. Sanjay Kumar Pandey, PI, Dr. Satish Chandra Sharma, Co-PI, Dr. M.S. Udaykumar, Co-PI

S. N.	Institute projects	PIs & Co-PIs
18	Development of technology for post harvest management for value addition of Jackfruit in Eastern region	Dr. Sakharam Kale Co-PI, Prerana Nath, PI (ICAR-FSRCH&PR), Dr. Mahesh Kumar Dhakad, Co-PI (ICAR-FSRCH&PR), Dr. A. K. Jha, Co-PI (ICAR-FSRCH&PR)
19	Enhancing food, nutritional and livelihood security of marginal and small farmers in Jharkhand through need based agricultural technologies	Dr. Dr. Nawalesh Kumar Sinha, Co-PI, Dr. Vinay Kumar Yadav, PI (ICAR-FSRCH&PR)

Externally funded projects

Externally funded projects

Sl. No.	Project title	PI	Funding agency & budget for NISA, ₹ in Lakhs
20	Estimation of chemical quality parameter of cinchona, jute and allied fiber and lac by florescent and NIR sensor and development of portable sensor instruments with thrust on fluorometry	Dr. A. R. Chowdhary, CCPI	National Agricultural Science Fund Budget: ₹ 39.61 lakhs
21	Development of suitable equipment for uprooting cinchona trees in hilly terrains	Dr. S. C. Sharma, PI Er. S. K. Pandey Dr. N. Prasad	DCOMP, Govt. of West Bengal Budget: ₹ 30 lakhs
22	Evaluation of the synergistic potential of apiculture with lac cultivation for sustainable livelihood security	Dr. A. Pramanik, PI Dr. N. Thombare Dr. S. Kumar	National Bee Board, NBHM, Ministry of Agriculture and Farmers Welfare, Gol Budget: ₹ 169.65 lakhs
23	Setting up of regional honey testing laboratory at ICAR-National Institute of Secondary Agriculture, Ranchi, Jharkhand	Dr. A. Dutta, PI Dr. A. R. Chowdhury Dr. P. Sakare Dr. A. Pramanik	National Bee Board, NBHM, Ministry of Agriculture and Farmers Welfare, Gol Budget: ₹ 716.00 lakhs
24	Setting up of Integrated Beekeeping Development Centre (IBDC) at ICAR-National Institute of Secondary Agriculture, Ranchi, Jharkhand	Dr. A. Pramanik, PI Dr. S. C. Sharma Dr. R. Bakade	National Bee Board, NBHM, Ministry of Agriculture and Farmers Welfare, Gol Budget: ₹ 257.24 lakhs
25	Estimation of chemical quality parameter of cinchona, jute and allied fiber and lac by florescent and NIR sensor and development of portable sensor instruments with thrust on fluorometry	Dr. A. R. Chowdhary, CCPI	National Agricultural Science Fund Budget: ₹ 39.61 lakhs

IMPORTANT COMMITTEES

Research Advisory Committee (RAC)

Name of Expert	Designation	Role
Dr. K. Alagusundaram	Former DDG (Engg.), ICAR, New Delhi	Chairman
Dr. H.N. Mishra	Professor (Food Technology), IIT, Kharagpur	Member
Dr. D. Usharani	Principal Scientist, CSIR-CFTRI, Mysuru	Member
Dr. S.K. Dhyani	Former Director, ICAR- CAFRI, Jhansi	Member
Dr. D. Behera	Professor & Head, OUAT, Bhubaneswar	Member
Dr. A. Kar	Director, ICAR-NISA, Ranchi	Member
Dr. N.K. Sinha	PS & I/C Head, ABA Div., ICAR-NISA, Ranchi	Member Secretary

LIST OF IMC MEMBERS AS ON 31.12.2024

Sl. No.	Name & Designation of the member/ Nomination as	Rule position/Rule & Sub-rule	Validity period
1.	Director ICAR-NISA, Ranchi/Chairman	Director of the Institute/[66(a) 1]	Ex-officio
2.	Director, Agriculture, Govt. of Jharkhand, Ranchi/Member	A representative of the State Govt. in which the Institute is located nominated by the President ICAR/[66(a) 2]	Ex-Officio
3.	Director, Agriculture, Govt. of Bihar, Patna/Member	A representative of any other state Govt. concerned with the research in the Institute nominated by the President ICAR/[66(a) 3]	Ex-Officio
4	Vice Chancellor, Birsa Agricultural University, Kanke, Ranchi/Member	A representative of the Agricultural University, having jurisdiction over the area, nominated by the President/[66(a) 4]	Ex-Officio
5.	Sri Subhash Chandra Mahto Madhupur, Pirtand, Giridih/Member	Two non-official persons representing agricultural/ rural interest to be nominated by the President/[66(a) 5]	07.03.2024 to 06.03.2027
6.	Sri Prashant Kumar Khakha Lohardaga/Member		
7.	Dr. S.N. Sushil Director, ICAR-IIHR, Bengaluru/Member	Four Scientists of Council's Institute to be nominated by the Director-General/[66(a) 6]	31.07.2025
8.	Dr. Bikash Das, Director ICAR-NRC on Litchi, Muzaffarpur/Member		
9.	Dr. S.K. Giri, Head, ASPE, ICAR-NISA, Ranchi/Member		
10.	Dr. Pannalal Singh, P.S. Engg. Division, ICAR Hqr, Pusa, New Delhi/Member		
11.	Dr. K. P. Singh ADG (FE), Engg. Division, ICAR, New Delhi/ Member	A representative from the Council, nominated by the Director-General/[66(a) 7]	31.07.2025
12	F & AO, ICAR-CIFRI, Barrackpore/Member	FA at Council/DARE level or Accounts Officer of the same or any other Institute nominated by the Institute/[66(a) 8]	27.12.2025
13.	Administrative Officer ICAR-NISA, Ranchi/Member Secretary	Head of Office of the concerned Institute/[66(a) 9]	Ex-officio



BUDGET

TABLE-I		25.03.2025					₹ in Lakhs	
Head of Expenditure	Other than NEH & TSP			NEH/SCSP			Total	
	Approved allocation as per BE 2024-25	Fund Released 2024-25	Expenditure upto 25.03.2025	Approved allocation as per BE 2024-25	Fund Released 2024-25	Expenditure upto 25.03.2025	Approved allocation as per BE 2024-25	Expenditure upto 25.03.2025
NISA				SCSP		SCSP	Total	
Grant-in-aid Capital	416.50	416.50	416.50	74.00	74.00	74.00	490.50	490.50
Grant-in-aid General	640.00	640.00	640.00	64.00	64.00	64.00	704.00	704.00
Sub Total	1056.00	1056.00	1056.00	138.00	138.00	138.00	1194.50	1194.50
Grant-in-aid Salaries	1402.95	1388.04	1388.04	0.00	0.00	0.00	1402.95	1388.04
Pension	417.09	226.51	226.13	0.00	0.00	0.00	417.09	226.13
Sub Total	1820.04	1614.55	1614.17	0.00	0.00	0.00	1820.04	1614.17
Grand Total	2876.54	2671.05	2670.67	138.00	138.00	138.00	3014.54	2808.67
NWP ON HPVA ON NRG				NEH				
Grant-in-aid Capital	82.00	82.00	82.00	0.00	0.00	0.00	82.00	82.00
Grant-in-aid Salaries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grant-in-aid General	110.00	110.00	110.00	0.00	0.00	0.00	110.00	110.00
Total	192.00	192.00	192.00	0.00	0.00	0.00	192.00	192.00
NWP ON CLIGR				NEH				
Grant-in-aid Capital	25.50	25.50	25.50	0.00	0.00	0.00	25.50	25.50
Grant-in-aid Salaries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grant-in-aid General	100.00	100.00	100.00	60.00	60.00	60.00	160.00	160.00
Total	125.50	125.50	125.50	60.00	60.00	60.00	185.50	185.50

Table-II					
Approved allocation as per BE 2024-25	Total remittance under 2024-25 upto 25.03.2025	Total expenditure under 2024-25 upto 25.03.2025	Percentage utilization under BE 2024-25	Percentage utilization with respect to remitt.	
NISA					
Research		1194.50	1194.50	100.00	100.00
Establishment		1614.55	1614.17	88.69	99.98
Total		2809.05	2808.67	93.17	99.99
NWP ON H&PHP & VANR&G					
	192.00	192.00	192.00	100.00	100.00
NWP ON CLIGR					
	185.50	185.50	185.50	100.00	100.00

Table-III(REVENUE GENERATION TARGETS & ACHIEVEMENT)		
Financial Year	Target for the financial year	Revenue Generated
2024-25	70	120.84

PERSONNEL

Details of scientific, technical, administrative and supporting staff of ICAR-NISA & KVK-Khunti

	ICAR-NISA			KVK, Khunti		
	Sanctioned strength	In position	Vacant	Sanctioned strength	In position	Vacant
RMP	1	1	0	-	-	-
Scientific	42	25	17	1	1	0
Technical	61			11	6	5
Administrative	29			-	-	-
Skilled supporting	43	12		-	-	-

Details of Personnel as Per Different Divisions and Section

DIRECTOR'S CELL		
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Shri Shatrughan Kumar Yadav	Private Secretary to Director	shatrughan.yadav@icar.org.in
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Shri Arun Kumar Tripathi	Assistant Administrative Officer	arun.tripathi1@icar.org.in
Shri Krishna Murari Kumar	Assistant Administrative Officer	krishna.kumar2@icar.org.in
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DETAILS OF JOINING, PROMOTION, SUPERANNUATION & TRANSFER

JOINING IN 2024

ADMINISTRATIVE CADRE



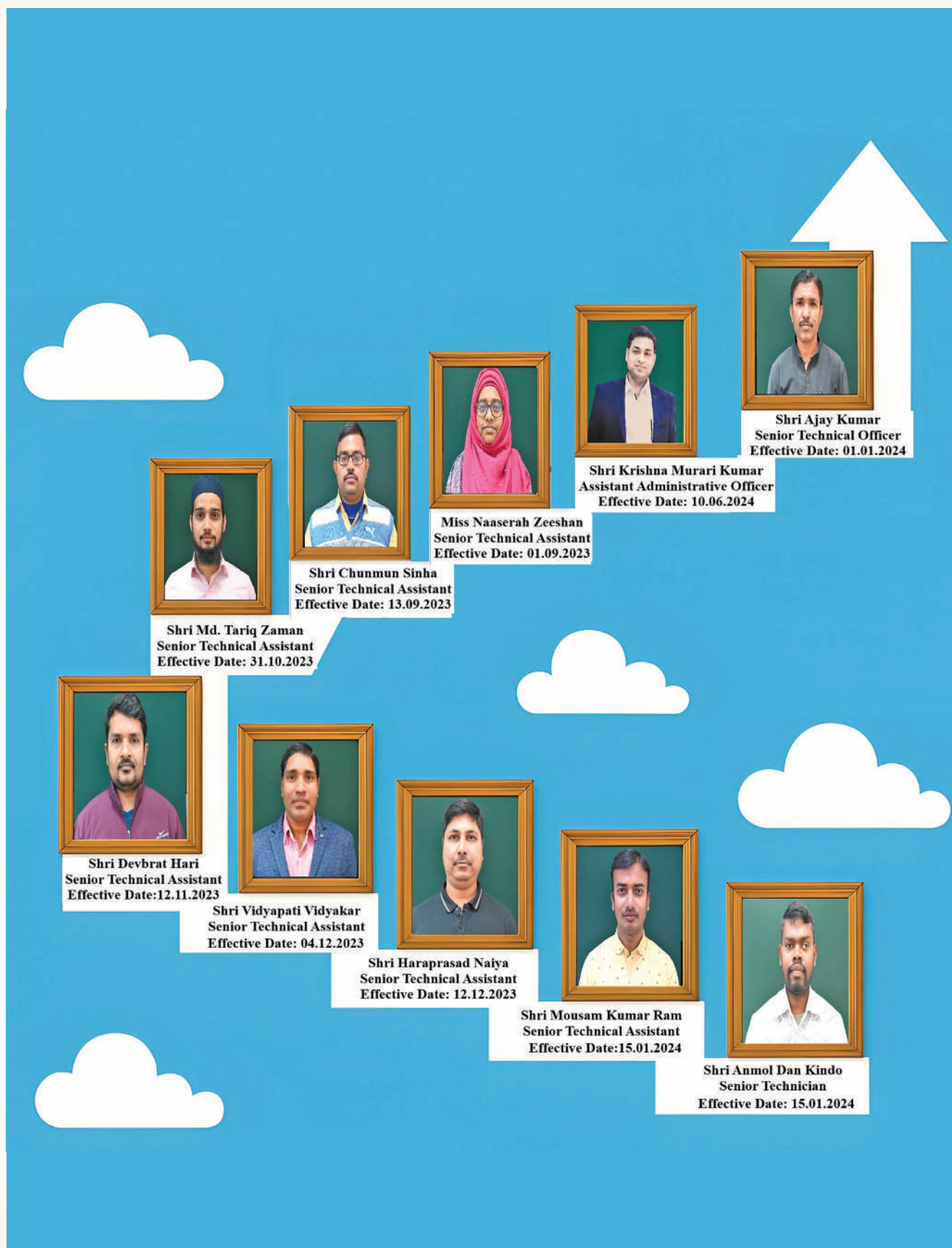
TECHNICAL CADRE



KVK KHUNTI



Promotions in 2024



Superannuation in 2024



Transfer in 2024



Dr K Thamilarasi

Transferred to ICAR-Sugarcane Breeding Institute, Coimbatore, Tamil Nadu on 14.07.2024



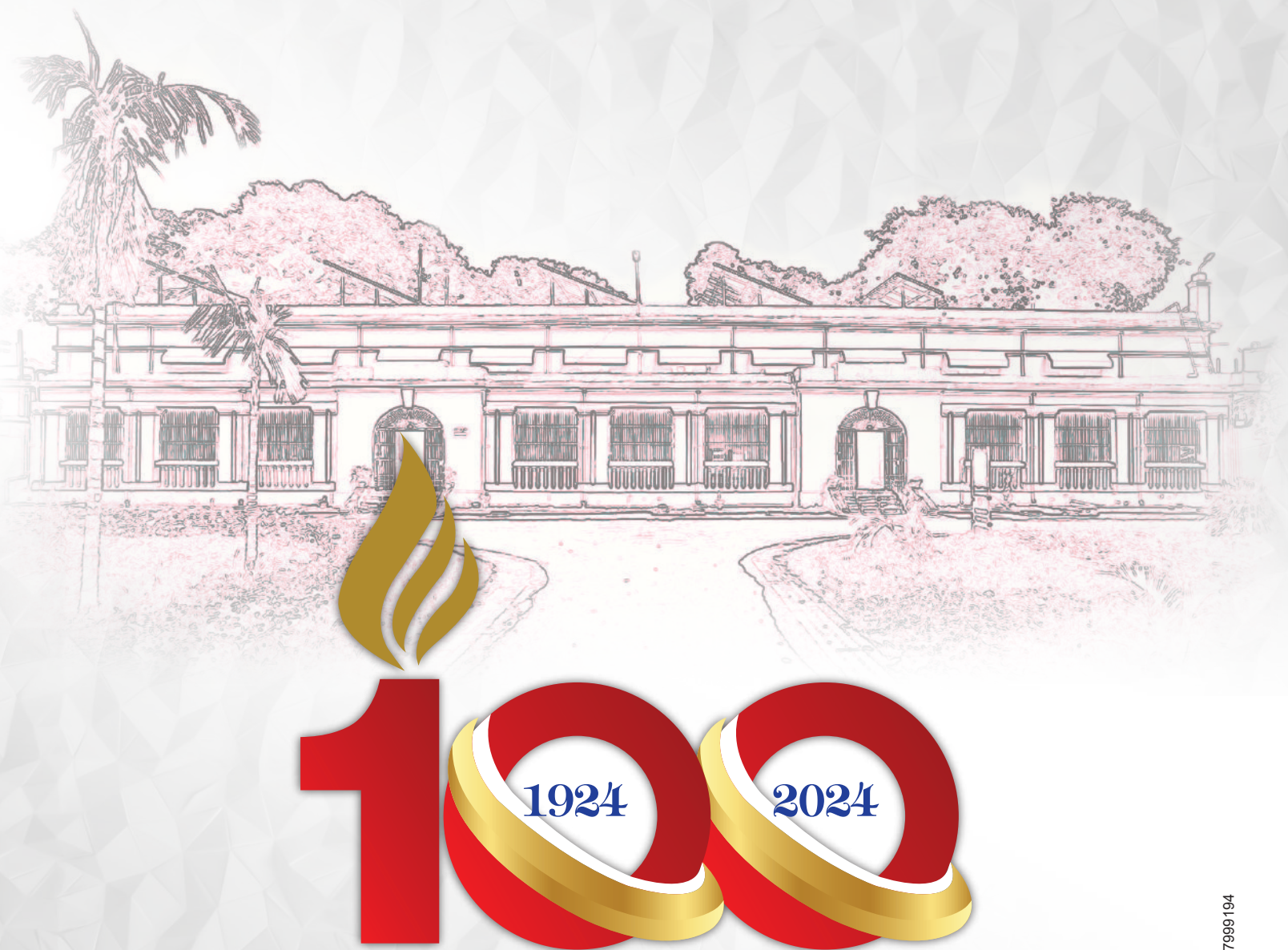
हर कदम, हर डगर

किसानों का हमसफर

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