



ICAR- National Institute of Secondary Agriculture E-NEWSLETTER



Director's Desk

It is heartening to witness our Institute's research momentum growing steadily since the realignment of our mandate towards *Secondary Agriculture*. The dedication and collaborative spirit of our scientific team are now translating into tangible outcomes. Notable among these are development of nanocellulose from water hyacinth and extraction of curcuminoids from Lakadong turmeric, both contributing to sustainable bio-resource utilization. Research on enhancing the post-harvest storability of strawberries through coating techniques addresses the challenge of high perishability induces loss, marking a significant step forward in sustainable post-harvest technology development.

In the lac and natural resin & gum sectors, remarkable progress has been achieved through shellac nanoparticle synthesis, establishment of a pilot plant for guar gum derivatives, genome sequencing of the lac insect, and analysis of scrapped lac for novel applications, collectively catering to industrial and scientific needs. Beyond research, the Institute remains deeply committed to capacity building and stakeholder engagement, encompassing farmers, industries, students, and government agencies. The Institute's active participation in the Viksit Krishi Sankalp Abhiyan, a flagship initiative of the Government of India, reflects our alignment with national priorities. Multiple MoUs, patents, research publications, and collaborative initiatives further underscore our scientific dedication and growing visibility.

With great pleasure, I present this issue of our quarterly newsletter, highlighting our collective achievements and reaffirming our resolve to advance innovation, sustainability and impactful research in the agri-based sector.



(Abhijit Kar)

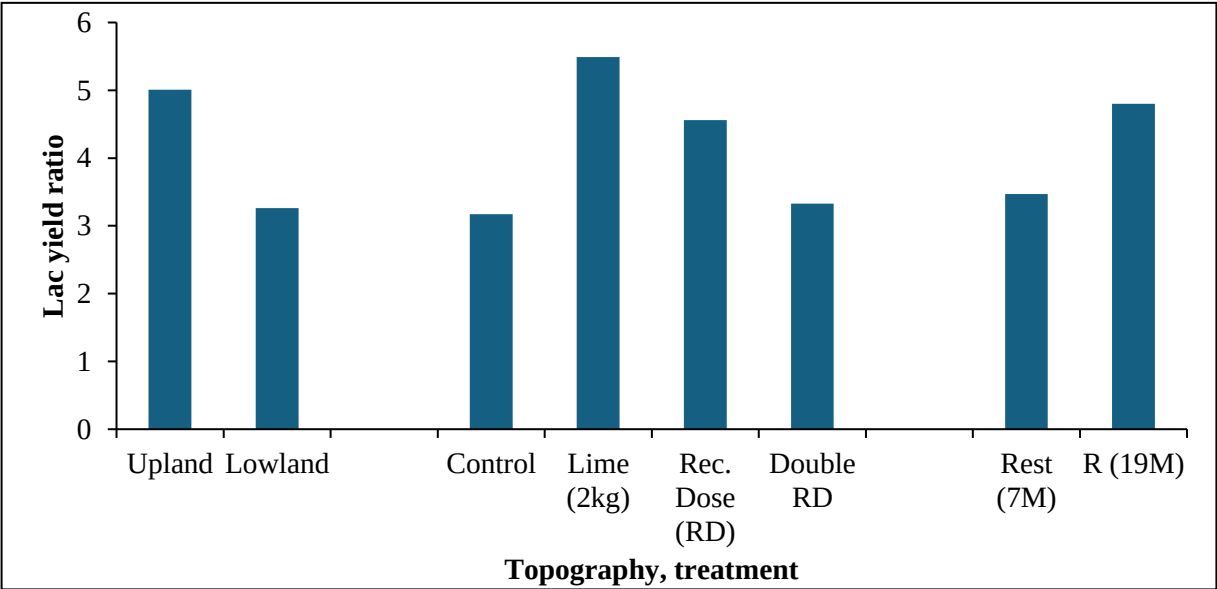
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RESEARCH HIGHLIGHTS

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

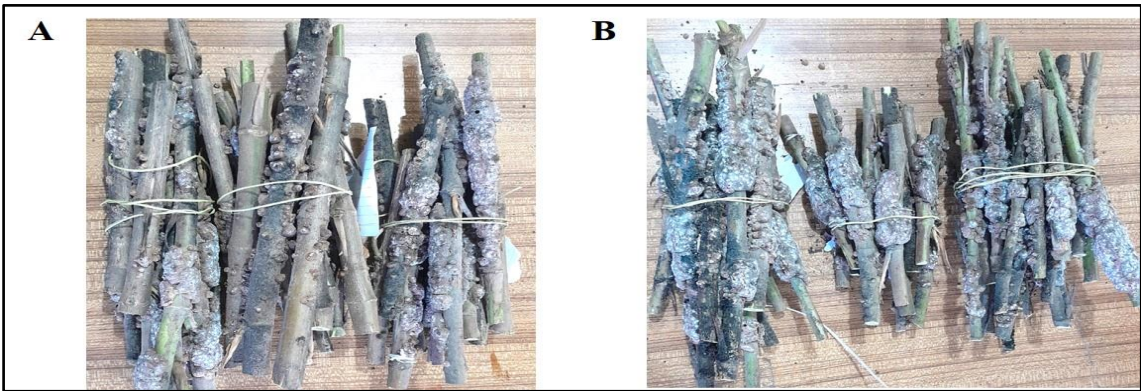
Lac yield ratio in lowland conditions was 3.26, compared to 5.01 in upland areas- about 34% lower than in upland. The male proportion in the lac population was 25% in lowland and 19% in upland, which may explain the higher yield observed under upland conditions. Among the soil fertility treatments, liming resulted in the highest lac yield ratio (5.49) compared to the control (3.17). Treatments with chemical fertilizers recorded yield ratios ranging between 3.3 and 4.6. However, variations in male percentage and density of settlement were not statistically significant. Lac yield ratio also varied significantly with the rest period. A longer rest period (19 months) produced a higher yield ratio (4.8) than a shorter rest period (7 months), which yielded 3.47. Correspondingly, the male proportion was 20% in the longer rest period and 23% in the shorter one.



Lac yield ratio as affected by various factors

Efficacy of entomopathogenic bioagents and Indoxacarb on brood lac yield in Flemingia semialata

A field experiment was conducted to evaluate the efficacy of entomopathogenic fungi- *Beauveria bassiana* and *Metarhizium anisopliae* against the synthetic insecticide Indoxacarb (commercially used as Isacarb) in enhancing brood lac production in *Flemingia semialata*. The study included three treatments (Isacarb, *Beauveria*, and *Metarhizium*) and an untreated control, with 10 plants per treatment.

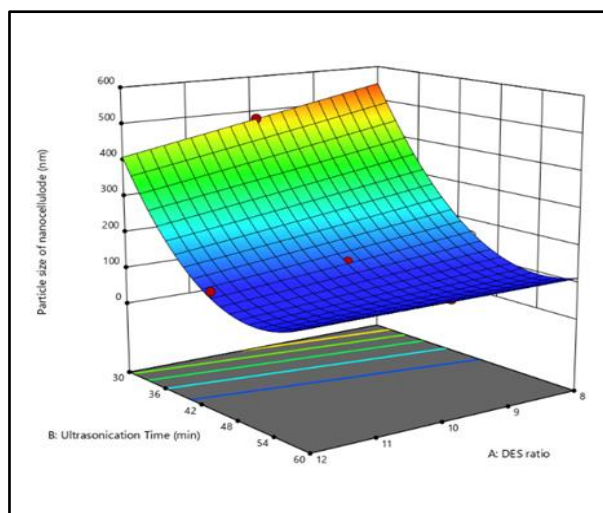


Broodlac from untreated control (A) and Broodlac from *Metarhizium anisopliae* treatment (B)

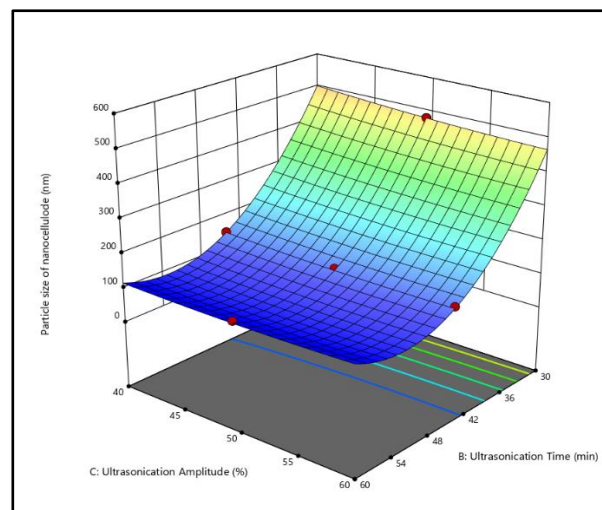
Fresh brood lac yield per plant was: Isacarb- 55.00 ± 4.68 g, *Metarhizium*- 44.61 ± 4.44 g, *Beauveria*- 33.20 ± 3.61 g, and Control- 28.40 ± 2.88 g. All treatments outperformed the control, with Isacarb showing the highest yield. Statistical analysis using one-way ANOVA revealed a significant difference among the four treatments ($F = 5.53$; $df = 3,36$; $P = 0.0032$). Notably, while Indoxacarb led to the highest brood lac yield, *Metarhizium anisopliae* significantly outperformed the control and showed yields statistically close to Isacarb, indicating its potential as a sustainable and environmentally safer alternative. In contrast, *Beauveria bassiana* also improved yields compared to control but to a lesser extent. These findings underscore the promise of using bioagents, particularly *Metarhizium*, as effective biocontrol alternatives to synthetic insecticides in lac cultivation.

Optimization of ultrasonication assisted nanocellulose extraction using DES from water hyacinth

Nanocellulose was extracted from water hyacinth biomass using deep eutectic solvent (Choline chloride and oxalic acid) pretreatment combined with ultrasonication. A central composite design (CCD) under response surface methodology (RSM) was employed to optimize the effects of DES ratio (1:8–1:12), ultrasonication time (30–60 min), and amplitude (40–60%) on nanocellulose particle size. The optimized conditions for nanocellulose extraction were- DES ratio 1:11.73, ultrasonication time 58 min, and amplitude 41.33%, which produced nanocellulose of uniform particle size (~ 93 nm) and excellent colloidal stability (zeta potential -29.4 mV). This study highlights a sustainable and efficient approach for nanocellulose production from water hyacinth biomass.



(a)



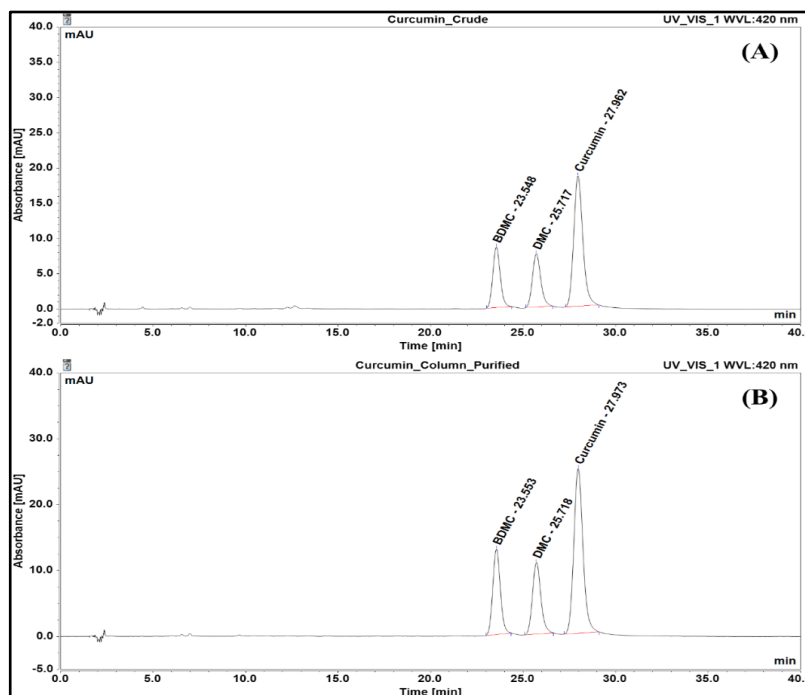
(b)

(a) Surface plot for interaction effect between DES ratio and ultrasonication time, with a fixed ultrasonication amplitude of 50%, (b) Surface plot for interaction effect between ultrasonication time (B) with ultrasonication amplitude with a fixed DES ratio of 1:10

Extraction of curcuminoids from *Lakadong* turmeric

Curcuminoids were extracted from *Lakadong* turmeric using solvent extraction and purified through column chromatography. Exhaustive solvent extraction of *Lakadong* turmeric powder yielded $20.69 \pm 1.92\%$ of crude curcuminoids. HPLC analysis revealed that the crude extract contained 12.32% curcumin, 4.77% demethoxycurcumin (DMC), and 5.12% bisdemethoxycurcumin (BDMC) with a relative ratio of 1:0.39:0.42.

Purification of the crude extract through column chromatography resulted in a physical yield of 12.15 ± 1.12% of purified curcuminoids from the turmeric powder. The purified extract contained 16.78%, 6.75%, and 7.49% of curcumin, DMC and BDMC, respectively, as estimated by HPLC (recovery of 58.72% of curcuminoids in purified form).



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

Synthesis of shellac nanoparticles (ShNPs)

To optimize the synthesis of shellac nanoparticles (ShNPs) from raw shellac, key parameters, including shellac concentration, temperature, solvent ratio, and guar gum concentration were systematically evaluated. ShNPs were synthesized using the anti-solvent precipitation method, wherein a dilute aqueous guar gum solution was added to the ethanolic solution of dewaxed shellac. Based on extensive experimentation, the optimized conditions were established as 0.25% shellac concentration, 25 °C temperature, 1:30 ethanol-to-water ratio and 0.025% guar gum concentration. The optimized formulation produced stable nanoparticles with a mean particle diameter of approximately 88 nm and zeta potential of -46.8 mV, confirming their nanoscale dimensions and colloidal stability.

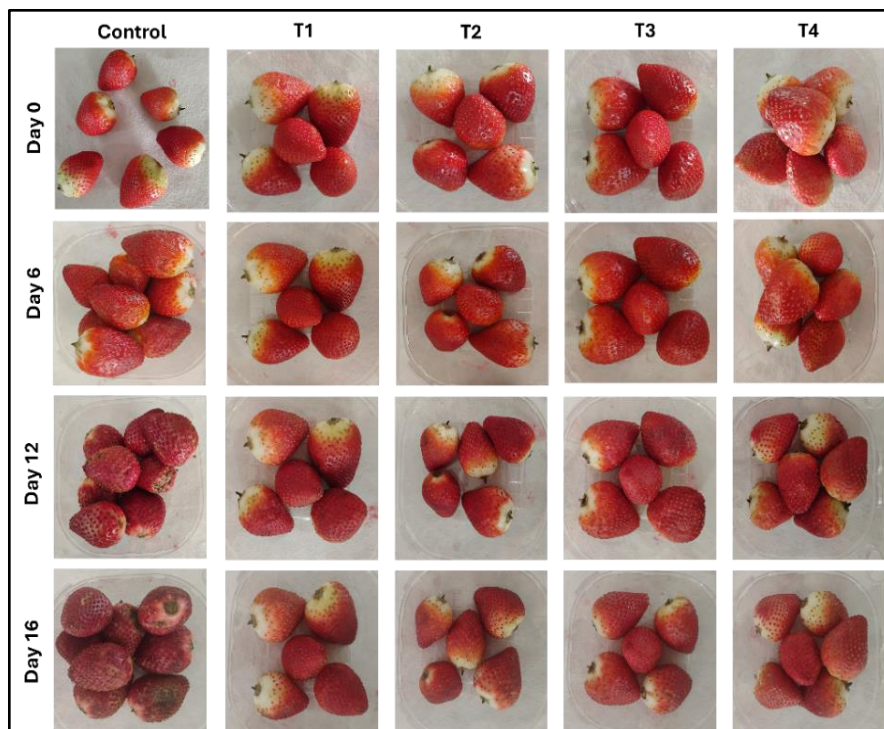
Enhancement of post-harvest storability of strawberry through coating technique

The effect of biopolymer-based coating formulation on post-harvest shelf life of strawberry was evaluated. Coating formulations based on sodium alginate and calcium chloride were prepared and lemongrass essential oil was incorporated as active agent. Matured, fresh strawberries of uniform size collected from Institute Research Farm were washed and disinfected with sodium hypochlorite,



Shellac nanoparticles (Colloidal suspension and the dried powder)

followed by dipping in prepared formulation and ambient air drying. The coated strawberries were stored under refrigeration at 8 °C and quality was evaluated at every 4 days interval, upto 16 days. The coated fruits showed lower weight loss, and maintained the anthocyanin content and firmness as compared to the uncoated fruits. The firmness reduced by 69.4% in uncoated strawberries as compared to only 5.8% in strawberries coated with 2% sodium alginate and 0.1% lemongrass essential oil during 16 days storage.



Uncoated and coated strawberries during refrigerated storage

Refinement of pilot plant for production of guar gum derivative

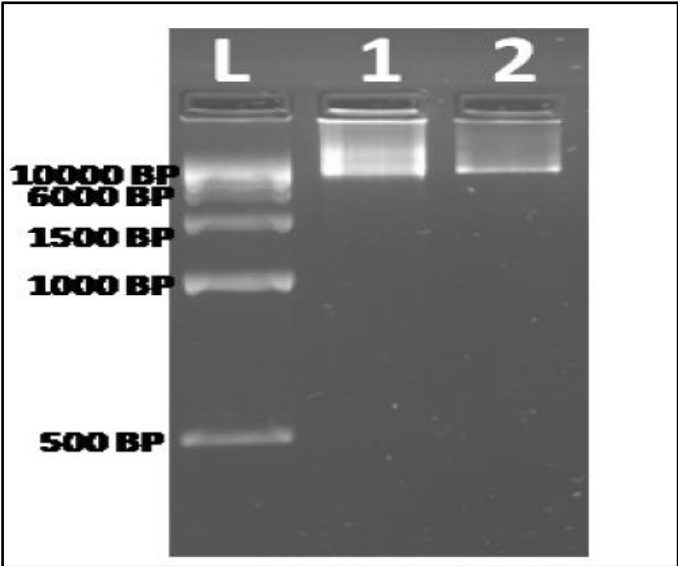
To improve the water heating for reaction purpose, the existing system of two 1500 wattage immersion rod type water heating elements was replaced with one 4000 Watt heater in the jacketed chamber of mixing-cum- reaction unit. A stainless steel water tank of 200 L capacity was fabricated and a temperature control mechanism including display unit, relay and thermocouple was installed in the fabricated water tank to maintain the desired water temperature. Experimentation on guar gum derivative manufacturing from guar gum powder along with reagents using the developed gum derivative pilot plant yielded 1526.2 kg guar gum derivative having 76.31% efficiency at 7.29 pH, 0.1728 degree of substitution and 700 cP viscosity.

Proximate analysis of scrapped lac

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

Whole Genome Sequencing of Lac Insect (*Kerria lacca* & *Kerria chinensis*)

Whole genome sequencing of two lac insect samples, *Kerria lacca* and *Kerria chinensis* were carried out at Neuberg diagnostic, Gujarat. DNA extraction was carried out by the Phenol: Chloroform method. The quantity of sample DNA was measured using a Nanodrop 1000 spectrophotometer. The sample was quantified using Qubit 4.0 fluorometer using DNA HS assay kit. DNA size was measured by using genomic DNA screen tape. The *K. lacca* genome size was determined using the chicken embryo nucleus as a standard. This flow cytometry study of the lac insect revealed a genome size of approximately 376.5 Mbp for the single chromosomal copy.



Genomic DNA Quality Assessment: Lane L- Molecular marker, Lane 1- Genomic DNA (*K. lacca*), Lane 2- Genomic DNA (*K. chinensis*)

Moisture stress determination in drip irrigated field for *F. semialata*

As the moisture content tubes were installed in 3 points in a drip irrigated field, the trends were different for each site, both spatially and vertically, even though they were inserted in and around 3 m of spacing. For site 1, the moisture reached its peak value at a depth of 30 cm and then decreased for 40 cm further slight increased at 60 cm depth. The change ratios were 0.46, 0.25, 0.10 and 0.32 at 20 cm, 30 cm, 40 cm and 60 cm, respectively. For site 2, the moisture reached its peak value at a depth of 40 cm and then decreased for 60 cm. The change ratios were 0.45, 0.43, 0.10 and 0.16 at 20 cm, 30 cm, 40 cm and 60 cm, respectively. For site 3, the moisture reached its peak value at a depth of 30 cm and then decreases for 40 and 60 cm. The change ratios were 2.49, 0.09, 0.22 and 0.27 at 20 cm, 30 cm, 40 cm and 60 cm, respectively.

EDUCATIONAL AND CAPACITY BUILDING PROGRAMMES

Sl. No.	Name of programme	No. of programme/ batch	No. of beneficiaries
1	Farmers’ training programme on “Scientific methods of lac cultivation, primary processing and utilization”	5	279
2	One day training cum exposure visit programme	10	680
Total		15	959

05 IAS Officers and Faculty of Sri Krishna Institute of Public Administration, Ranchi visited ICAR-NISA on May 27, 2025 and interacted with the Director and scientists of the institute. They also visited the museum and institute research farm and were briefed regarding the scientific lac cultivation, its uses, lac based integrated cropping system, etc.



Officials gaining insight to scientific lac cultivation

EVENTS

Network Project on Conservation of Lac Insect Genetic Resources Celebrates 4th Lac Insect Day

The ICAR-National Institute for Secondary Agriculture (ICAR-NISA), in collaboration with its network cooperating centres, celebrated 4th Lac Insect Day on May 16, 2025, with a nation-wide awareness campaign highlighting the economic and ecological significance of lac insects, especially for rural and tribal communities in India. At ICAR-NISA lead centre, scientists engaged farmers and students in informative sessions, focusing on the promising host plant *Calliandra* for lac cultivation. They also shared insights into the insect's biology and the importance of adopting a scientifically supported package of practices to improve both the productivity and quality of lac yield. In addition to the central event, cooperating centers under the Network Project on Conservation of Lac Insect Genetic Resources (NP-CLIGR) held parallel awareness programmes across the country. These included events at SKUAST (Jammu), PAU (Ludhiana), CAU (Imphal), AAU (Jorhat), MPUAT (Udaipur), KFRI (Thrissur), SFRI (Jabalpur), ANGRAU (Guntur), and ICAR-RCER (Patna), reaching out to farmers, students, and other stakeholders. The NP-CLIGR continues to play a vital role in empowering lac cultivators and supporting the socio-economic development of lac-producing regions through scientific interventions, capacity-building, and sustainable practices.



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

11th International Yoga Day Celebration at ICAR- NISA, Ranchi

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



11th International Yoga Day at ICAR- NISA, Ranchi

Hands on training program on Matlab

A two-days hands-on training on Matlab was organized by ICAR-NISA on June 30 and July 1, 2025. The training was supported by Mr. Subhrajeet Mandal from Elmax solutions, Kolkata. The training was attended by scientists, technical officers, Masters' and PhD students of the institute and subject matter specialist from KVK Khunti, making a total of 19 participants. The inaugural session of the training program was graced by heads of the Divisions and Incharge, ABD unit. In 3 sessions, basics of MATLAB, IoT applications using MATLAB, optimization and curve fitting were covered. The instructor answered the queries raised by the participants. The convener of the program Dr. Debandya Mohapatra briefed the participants and guests about the features and applications of MATLAB and thanked the instructor from Elmax solutions.

PARTICIPATION IN EVENTS

ICAR-NISA participated in 61st Foundation Day of CSB-CTRTRI, Ranchi

ICAR-NISA participated in the 61st Foundation Day of CSB-Central Tasar Research and Training Institute, Central Silk Board, Ranchi. Union Minister of Textiles Shri Giriraj Singh graced the occasion as the Chief Guest and launched the “Mera Resham Mera Abhiman” campaign on June 19, 2025. During this event, the institute showcased its innovative technologies and value-added products related to lac cultivation, lac-based processing, and secondary agriculture, with the objective of technology dissemination and enhancing farmer awareness.



Visitors at ICAR-NISA stall

PUBLICATION AND PUBLICITY

Research papers

Arpitha, S. R., Sasi, M., Kumar, S., Yeasin, M., Harun, M., Sethi, S., Kumari, S., Lata, D. A., Sachdev, A., & Dahuja, A. (2025). Optimising single and co-culture soymilk fermentation using *Weissella* probiotics for improved nutritional and sensory quality. *Food Bioscience*, 61, 106791.

John, H., Giri, S. K., Sinha, L. K., Pandiselvam, R., Sain, M., & Ray, A. (2025). Investigating flux decline and fouling mechanisms in ultrafiltration of soy protein using a 10 kDa hollow fiber membrane module. *Journal of Food Process Engineering*, 48(5), e70113.

Karmakar, S., Suman, S., Uchoi, J., Saha, S., Dutta, A., Das, A., & Kundu, A. (2025). Essential oils of *Alpinia officinarum* and *Alpinia zerumbet*: Potential fungistatic action and molecular dynamics perspectives. *Chemistry & Biodiversity*, e00221.

Sasi, M., Kumar, S., Prakash, O., Krishnan, V., Vinayaka, T., Tomar, G. S., Mishra, J., R. A. S., Kaushik, P., Rana, V. S., & Dahuja, A. (2025). Evaluation of sensory properties and short-chain fatty acid production in fermented soymilk on addition of fructooligosaccharides and raffinose family of oligosaccharides. *Fermentation*, 11(4), 194.

Selvan, S. S., Mohapatra, D., Mahore, A., Patel, A., Kate, A., Singh, K., Ray, H., & Modhera, B. (2025). Evolution of a novel sensing system for monitoring the quality deterioration in pearl millet (*Pennisetum glaucum* L.) grains coupled with rancidity indicators and GC–MS analysis: A potential cardinal approach. *Journal of Stored Products Research*, 112, 102642.

Shelake, P., Mohapatra, D., & Sabat, M. (2025). Impact of gaseous ozone treatment on storability and quality of onion (*Allium cepa* L.) during bulk storage. *Journal of Stored Products Research*, 112, 102656.

Thombare, N., Lohot, V. D., Kumari, U., & Prasad, N. (2024). *Sal (Shorea robusta) forests of India: Importance, threats, and future potential. Journal of Non-Timber Forest Products, 31(4), 269–279.*

Popular articles

Kumar, S., Ram, M. K., & Sasi, M. (2025). Aleuritic acid: A fascinating high-value constituent of lac resin and its uses. *Agri Magazine, 2(6), 166–169.*

Udaykumar, M. S., & Pandey, S. K. (2025). Is urban farming and its strategies: A solution for climate change? *Krishi Science-e Magazine for Agricultural Sciences, 6(4), 29–33.*

Book Chapters

N. Jha, K. Narsaiah, N. Kotwaliwale, R.K. Vishwakarma, S.K. Giri, D. Dhingra and A.K. Thakur (2025). Circular Agricultural Economy. In Pathak, H., Joshi, P.K., Lakra, W.S., Singh, A.K., Baranwal, V.K. and Jain, R.K. (Eds). *Indian Agriculture by 2047: A Roadmap for Research, Education and Extension*. National Academy of Agricultural Sciences, New Delhi, pp: 371. ISBN: 978-81-931524-8-5

Prasad, N., Sharma, S. C., Pandey, S. K., & Kale, S. R. (2025). *Postharvest and storage management*. In H. Schulz, V. S. Jayakumar, & N. Prasad (Eds.), *Natural gums and resins: Botany and sustainable uses in medicine, nutrition, perfumery and cosmetics* (pp. 191–216). CABI.

Prasad, N., Pandey, S. K., Kale, S. R., & Sharma, S. C. (2025). *Processing of natural gums and resins*. In H. Schulz, V. S. Jayakumar, & N. Prasad (Eds.), *Natural gums and resins: Botany and sustainable uses in medicine, nutrition, perfumery and cosmetics* (pp. 217–264). CABI.

Schulz, H., Jayakumar, V. S., & Prasad, N. (2025). *Future global market for resins, gums and related products*. In H. Schulz, V. S. Jayakumar, & N. Prasad (Eds.), *Natural gums and resins: Botany and sustainable uses in medicine, nutrition, perfumery and cosmetics* (pp. 345–366). CABI.

Patent

Tripathi, M. K., Giri, S. K., & Shrivastava, R. M. (2025). *Fermented tofu whey and ripe tomato based coagulant composition for tofu and method of producing tofu using the same* (Indian Patent Application No. 202521059282, filed June 20, 2025).

Ansari, M. F., Thombare, N., Chowdhury, A. R., & Kar, A. (2025). *A natural resin-based, eco-friendly adhesive for multipurpose application and method of preparation thereof* (Indian Patent Provisional No. 202431043306, filed June 3, 2025).

MISCELLANEOUS

Participation in Viksit Krishi Sankalp Abhiyan- 2025

Scientists from ICAR–National Institute of Secondary Agriculture, Ranchi, in collaboration with Subject Matter Specialists from Krishi Vigyan Kendras (KVKs) of Latehar, Khunti, Lohardaga, and Ranchi, actively participated in the Viksit Krishi Sankalp Abhiyan 2025 launched by the Ministry of Agriculture and Farmers Welfare, Government of India, during 27 May- 12 June, 2025. Under this campaign, the teams visited 450 villages covering different blocks and interacted with 47,332 farmers across Jharkhand. During the visits, the scientists shared knowledge on a wide range of topics including utilization of crop residues, crop diversification, lac-based cropping system models,

entrepreneurship and skill development, agri-tourism, crop production and protection, farm mechanization, value addition, scientific lac cultivation and processing (with special emphasis), integrated farming systems, and organic farming. Farmers were also briefed about various Government schemes and their benefits. The interactions provided a valuable platform to listen to farmers' concerns, provide practical solutions, and encourage them to adopt sustainable and modern agricultural practices. Through this extensive outreach, ICAR-NISA reaffirmed its commitment to strengthening secondary agriculture and enhancing farmers' income in Jharkhand.



Glimpses of VKSA- 2025

MOU signed by ICAR-NISA, Ranchi

- MoU has been signed between ICAR-NISA and Live and Let Live (LALL), Nuagada, Jagatsinghpur, Odisha on April 11, 2025 for providing guidance and support regarding promoting lac based integrated cropping system, processing and value addition in lac and other agri-produce.
- MoU has been signed between ICAR-NISA and Netarhat Beverages Private Limited, Netarhat, Latehar, Jharkhand on June 30, 2025 for up-scaling and commercialization of wine making process/products from Strawberry, Jamun & Mahua by Netarhat Beverages Private Limited, Netarhat, Latehar, Jharkhand.

HRD

Dr. Anirban Dutta, Dr. Mridusmita Debnath, Dr MS Udaykumar, Dr Nandkishore Thombare, Dr Sakharam Kale, Dr Mir Muneb, Mr. Amarjeet Bharti, Mr Pravat Kumar Singh, Mr Anmol Kumar Mishra, Mr. Sonu Kumar, Mr Raviprasad, Mr. Jhalaknath Sharma, Mr Brendon Lachwaria, Ms Priya Junghare, Ms Fahmidha, Mr Satish Kumar Gharwaria, Mr Aishik Sadhukahan, Mr Nirmal Ajegkar, and Mr. B Naresh, attended two-days workshop and hands-on training on Matlab programming software from June 30 to July 01, 2025 at ICAR-NISA, Ranchi.

Shri Vishwanath Anand, Assistant attended four-days workshop on 'e-procurement & GeM' at ISTM, Delhi from April 06- 09, 2025

Shri Hardik Ambadas Tamgadge, Administrative Officer attended Module-III of Foundation training for newly recruited AO's & FAO's at ICAR Headquarter, New Delhi from June 09 to July 04, 2025

Other

Shri Rajesh Ranjan, Assistant (ICAR-IIAB, Garhkhatanga, Ranchi) attended Phase II of Module I Orientation Training program at ICAR-NISA, Ranchi between June 23-27, 2025.

Joining

Shri Hardik A. Tamgadge, Administrative Officer joined on April 21, 2025

Transfer basis

1. Md. Shadab Akhtar, Sr. Technician joined on April 28, 2025
2. Shri Santosh Kumar Nayak, MTS joined on June 05, 2025
3. Shri Chandan Kumar Nayak, MTS joined on June 05, 2025
4. Shri Rameshwar Mahato, MTS joined on June 09, 2025
5. Shri Ritam Nayak, MTS joined on June 19, 2025

Obituary



Shri Anup Kumar, Technical Officer
05.06.1975- 21.05.2025

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