



2025

वार्षिक प्रतिवेदन ANNUAL REPORT

भाकृअनुप-केन्द्रीय कंद फसल अनुसंधान संस्थान
(भारतीय कृषि अनुसंधान परिषद)

श्रीकार्यम, तिरुवनंतपुरम 695 017, केरल, भारत

ICAR-CENTRAL TUBER CROPS RESEARCH INSTITUTE

(Indian Council of Agricultural Research)

Sreekariyam, Thiruvananthapuram 695 017, Kerala, India



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ICAR-CTCRI

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From the Director



Dr. G. Byju

The ICAR-Central Tuber Crops Research Institute (CTCRI), in its 62nd year of service, is spearheading its journey for farmer's welfare with 79 improved varieties, besides farmer-friendly production, protection and value addition technologies in tropical tuber crops, a group of climate-ready crops that can sustain food, nutritional, health and livelihood security. Roots and tubers are nutraceutical-rich health foods rich in dietary fibres, minerals, vitamins and anti-oxidants. In this background, I take pride in presenting the research accomplishments, technological advancements and development activities for the year 2025 documented in the form of 'Annual Report of ICAR-CTCRI'.

The field gene bank constituting 5234 accessions, continued to be enriched and conserved with valued traits. Geotagged location maps were prepared for the major tuber crops like cassava, sweet potato and greater yam. During the period, two varieties viz., Sree Arunima, a biofortified purple hybrid in sweet potato and Bhu Shakarkanda-1, the first variety from CTCRI in yam bean were released for cultivation in the state of Odisha. The Institute also facilitated the registration of a farmer-developed cassava variety, 'Manna', under the Protection of Plant Varieties and Farmers' Rights Authority (PPV & FRA), New Delhi. With a focus on improving crops genetically through gene editing, a gene editing lab was inaugurated with full fledged facility, incorporating gene gun, advanced stereo microscope, inoculation and culture storage facilities.

Twelve value added food product technologies have been commercialized to Kudumbasree State Mission,

Government of Kerala. Two post harvest machineries were licensed to M/S., Cliff Innovations, No. 62 C1 & C2, Siruvani Main Road, Vadavalli, Coimbatore-641 041, Tamil Nadu, India. The Institute further strengthened its entrepreneurship friendly infrastructure development by commissioning a vacuum-frying chips processing unit under the ABI. Apart from this, an open root scape cum photo point, and an SBI ATM outlet were also installed.

For strengthening the R&D activities of the institute, RAC and IMC meetings were also convened. In tune with Governmental programmes, VKSA programme, MGMG programme, and Swachh Bharat Programmes are conducted regularly. The Institute also observed World Environment Day, International Yoga Day, World Soil Day, Kisan Diwas, National Science Day and Tuber Crops Day. Both, on-campus and off-campus training programmes, exhibitions, and farm advisory visits to major tuber crops growing states were organized to empower farmers and other stakeholders. Major events such as Tuber Crops Day,

A major milestone in the history of ICAR-CTCRI was the successful hosting of the 20th International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES) from 17-21 November 2025 at Thiruvananthapuram. The symposium brought together over 90 international delegates from 25 countries across six continents, along with 200 Indian delegates, representing scientists, policymakers, industry experts, entrepreneurs, students, and other stakeholders.

As part of the Government of India's capacity-building initiative, all staff members completed online courses through the iGOT Karmayogi platform. Six new research projects with a total funding of approximately ₹3.09 crores were sanctioned, thus strengthening the Institute's R&D programmes. The staff of ICAR-CTCRI received several prestigious awards for their meritorious contributions to tuber crops research, including the Lifetime Achievement Award of the International Society for Tropical Root Crops, Fellow of the Indian Society for Root Crops, and Young Scientist Awards, among others. With sustained innovations in research and development of tropical tuber crops, ICAR-CTCRI continues to march forward in alignment with the vision of Viksit Bharat.



I express my deep sense of gratitude to Dr. Himanshu Pathak, Hon'ble Former Director General, ICAR and Dr. M.L. Jat, present Secretary, DARE and Director General, ICAR for their invaluable guidance and support. I sincerely acknowledge the timely guidance and support provided by the most respected Dr. Sanjay Kumar Singh, DDG (Horticulture Science) and Dr. Sudhakar Pandey, ADG (FVS&MP), ICAR, New Delhi.

31 December 2025

The support extended by PPV&FRA, RKVY-Govt. of Odisha, Kerala State Biodiversity Board, Coconut Development Board and other R&D Institutes and consortia research platforms of ICAR are duly acknowledged. The unstinted support from ICAR and the concerted efforts and hard work of the entire ICAR-CTCRI family enabled the Institute to make this year highly commendable. I take this opportunity in conveying my sincere thanks to all our staff.

G. Byju
Director

कार्यकारि सारांश

आठ संस्थान परियोजनाओं, दो प्रमुख परियोजनाओं के साथ-साथ 22 बाहरी वित्त पोषित परियोजनाओं के तहत विकसित नए संग्रहों, जारी की गई किस्मों, प्रक्रियाओं, प्रोटोकॉल, प्रौद्योगिकियों, विधियों, उच्च मूल्य वाले यौगिकों और कटाई के बाद की मशीनरी के साथ संरक्षित आनुवंशिक संपदा नीचे दी गई है:

फसल सुधार

1. कुल जर्मप्लाज्म रिपॉजिटरी में 5244 परिग्रहण शामिल हैं, जिनमें 1216 कसावा, 905 शकरकंद, 801 रतालू, 655 खाद्य एरोइड्स, मुख्यालय से 387 छोटी कंद फसलें और क्षेत्रीय स्टेशन से 1280 परिग्रहण शामिल हैं, जिनमें 113 कसावा, 380 शकरकंद, 51 रतालू, 564 खाद्य एरोइड और 172 छोटी कंद फसलें शामिल हैं। आईवीएजी के तहत, मुख्यालय में कुल 153 परिग्रहण (71 कसावा, 31 शकरकंद, 33 रतालू, 7 तारो, 2 अरारोट, 8 करकुमा एंगुस्टिफोलिया और 1 चीनी आलू) बनाए रखे जाते हैं। क्षेत्रीय स्टेशन पर, जारी किस्मों में 10 कसावा, 11 शकरकंद, 5 तारो, 4 रतालू, 2 जिमीकंद और 1 चीनी आलू शामिल हैं।
2. कसावा आनुवंशिक संसाधनों (भाग -2) की एक सूची जिसमें 51 लक्षणों के लिए 100 परिग्रहण के रूपात्मक डेटा शामिल थे, प्रकाशित किया गया था। कई आशाजनक जीनोटाइप की पहचान छोटे कंद (13), फसल सूचकांक >0.75 (CE-40A, CE-18A, CE-38A और CE-16A) के साथ की गई थी; मीठा स्वाद और उच्च कंद उपज >5 किलो प्रति पौधे (CE-16A, CE-40A और CE-239) और CMDप्रतिरोधी (25)। कसावा की एक नई और उम्मीद जगाने वाली किस्म, SH1 की पहचान की गई, जो चिप्स बनाने के लिए उपयुक्त है।
3. शकरकंद की बैंगनी गूदे वाली एक किस्म - 'भू अरुणिमा' - ओडिशा राज्य के लिए जारी की गई थी। कई महत्वपूर्ण गुणों वाले अच्छे जीनोटाइप, जैसे ज़्यादा पैदावार (11), घुन-रोधी (16); फ्राइड चिप्स के लिए उपयुक्त (16); जल्दी पकने वाली और पोषण से भरपूर किस्मों (SP19, SP5, SP18, SP27 और SP1); मिनरल से भरपूर किस्मों (SP9 (K, Fe, Mn से भरपूर), SP20 (Zn से भरपूर) और SP1/SP11 (P से भरपूर), ज़्यादा स्टार्च (17.52% - SPH-23-120), ज़्यादा शुगर (3.48% - SPH-23-113), सबसे ज़्यादा नाइट्रोजन (2.28% - SPH-23-42); सबसे ज़्यादा फॉस्फोरस (0.98% - SPH-23-33 और SPH-23-54); सबसे ज़्यादा पोटैशियम (2.09% - SPH-23-25) आदि की पहचान की गई। एंथोसायनिन और β -कैरोटीन दोनों के साथ शकरकंद संकरों में से, 110/28 सबसे अच्छा प्रदर्शन करने वाला था, जिसकी पैदावार 750-1.15 किलोग्राम प्रति पौधा थी। शकरकंद में पराग प्रजनन अध्ययन से पता चला कि सुबह 6-11 बजे के बीच उच्च पराग प्रजनन क्षमता (80-94%) थी और सुबह 6-8 बजे के बीच उच्च कलंक ग्रहणशीलता (receptivity) दिखाई (79-93%) थी।
4. सफेद रतालू के तहत, श्री द्रोण किस्म (कॉम्पैक्ट कंद आकार और गैर अनुगामी स्थिति के तहत भी उच्च कंद उपज के साथ) को केरल राज्य के लिए भारत के राजपत्र में अधिसूचित किया गया था। कई आशाजनक लाइनों की पहचान की गई, जैसे, छह अत्यधिक प्रतिरोधी रतालू परिग्रहण (DA 5, DA 388, DA 17, DA 191, DA 59, और DA 502 - 2023-2026 के लिए लगातार); दो सीजन के लिए अत्यधिक प्रतिरोधी (18 - 2023-26 के लिए); एक सीजन के लिए एन्थ्रेक्मोज के लिए उच्च प्रतिरोध (TCR 12, DAH 10-3-28, DAS 19 और DAH 9-35-16); नर फूल रेखाएं (20) और मादा फूल रेखाएं (6) अधिक रतालू फूलों की रेखाओं में।
5. खाने योग्य एरोइड्स की श्रेणी में, 2024 में जारी अरबी की दो किस्मों - 'श्री टीलिया' और 'श्री हीरा' - को ओडिशा राज्य के लिए भारत के राजपत्र (राजट) में अधिसूचित किया गया। जिमीकंद में कई आशाजनक लाइनों की पहचान की गई थी (उच्च उपज >30 टन प्रति हेक्टेयर - टीवाई22-5; उच्च शुष्क पदार्थ >30% - 12); अरबी (उच्च शुष्क पदार्थ >25% - 3; उच्च कुल उपज >15 टन प्रति हेक्टेयर - 6) और टैमिया (उच्च कुल उपज >15 टन प्रति

- हेक्टेयर - 3)। जिमीकंद में BBCH पैमाने का पहली बार वर्णन किया गया था।
6. छोटी कंद वाली फसलों के अंतर्गत, ओडिशा राज्य के लिए CTCRI की ओर से RS से याम बीन (yam bean) की पहली किस्म - 'भू शकरकंद-1' - जारी की गई। ईस्ट इंडियन ऐरोरूट (*Curcuma angustifolia* Roxb.) के IC641835 परिग्रहण को पहली बार ICAR-NBPGR के तहत रजिस्टर किया गया। इसकी खासियतें हैं - लंबा प्राइमरी राइज़ोम (21 cm), ज़्यादा स्टार्च कंटेंट (16.8%) और कम समय में तैयार होने वाली फसल। इस फसल में सीड राइज़ोम और सीडलिंग की मजबूती के गुणों के लिए ब्रीडर सीड की गुणवत्ता के मानक तय किए गए थे। अच्छे बीज की गुणवत्ता के संकेतकों के तौर पर अंकुरण की उच्च दर, सही नमी (65-80%) और अंकुर की मजबूती के गुण (शूट की लंबाई 20-30 cm, जड़ की लंबाई 11-17 cm, सूखा वजन ≥ 0.20 g, SVI >3000) की पुष्टि की गई। चीनी आलू पर किए गए म्यूटेशन अध्ययनों से पता चला कि 55 Gy की मात्रा ने वांछित बदलाव उत्पन्न किए जैसे कुल कंद उपज और एक कंद का वजन।
7. स्टार्च संशोधनों के लिए कसावा में जीनोम संपादन के तहत, दो कसावा लाइनों (H226 और 9S127) को जीन गन बमबारी और एप्रोबैक्टोरियम-मध्यस्थता दृष्टिकोण दोनों का उपयोग करके सफलतापूर्वक रूपांतरित किया गया था। परिणामस्वरूप रूपांतरित ऊतकों को वर्तमान में चयन मीडिया के तहत बनाए रखा जा रहा है। 3 महीने के भीतर 92% की पुनर्जनन दक्षता के साथ कसावा 9S127 के पुनर्जनन के लिए एक सफल प्रोटोकॉल स्थापित किया गया है।
8. कसावा में पोषक तत्व होमियोस्टेसिस अध्ययन में, परिणामों से पता चला कि कंदों की तुलना में ऊपरी हिस्सों में प्रोटीन की मात्रा अधिक थी और पौधे की उम्र के साथ गिरावट आई थी। बायोफोर्टिफिकेशन अध्ययनों के तहत, जड़ों, कंदों और निचले तने में एक छोटे प्रोटीन की अंतर प्रोटीन अभिव्यक्ति थी, लेकिन पौधे के ऊपरी हिस्सों में ऐसा नहीं था।
9. PPD तनाव के तहत सहिष्णु और संवेदनशील कसावा जीनोटाइप के ट्रांसक्रिप्टोम अध्ययनों से 261-1187 भिन्न रूप से व्यक्त जीन का पता चला, जिसमें सहिष्णु बनाम संवेदनशील उपचारों में DEG की संख्या अधिक थी और तनाव प्रतिक्रिया, विकास और चयापचय जैसे प्रतिरोध तंत्र से जुड़े 143 बीपी, 26 एमएफ और 62 सीसी जीन ओन्टोलॉजी शब्दों की पहचान की गई। कसावा की जल्दी बढ़ने वाली किस्मों के ट्रांसक्रिप्टोम एनालिसिस से पता चला कि ढेर से बढ़ने वाली किस्म 'श्री पवित्रा' की तुलना में, जल्दी बढ़ने वाली किस्म 'वेल्लायानी हस्वा' में 1,028 जीन अप-रेगुलेटेड और 564 जीन डाउन-रेगुलेटेड थे। कसावा और शकरकंद में RT-PCR और ट्रांसक्रिप्टोम अध्ययनों से जीन अभिव्यक्ति के विशिष्ट जीनोटाइप पैटर्न का पता चला जो वृद्धि, सूखा और गर्मी के तनाव से जुड़े थे, हजारों जीनोम-व्यापी माइक्रोसेलेलाइट मार्करों की पहचान की गई और पॉलीमॉर्फिक SSR मार्करों को उजागर किया गया जो मैपिंग और मार्कर-सहायता प्राप्त प्रजनन के लिए उपयोगी हैं।
10. matK, KimmatK और ITS मार्कर्स का इस्तेमाल करके शकरकंद, आरोइड्स (aroids और रतालू की DNA बारकोडिंग से पता चला कि एम्प्लीफिकेशन और सीक्वेंसिंग के लिए matK सबसे असरदार (95-100%) था, जबकि ITS2 RNA स्ट्रक्चर से महत्वपूर्ण जेनेटिक अंतर का पता चला, जो किस्मों में फ्रक करने के लिए उपयोगी है।

फसल उत्पादन

11. सब्जियों से जुड़ी तीन प्रणालियों में से, चावल-कम अवधि का कसावा (किस्म. श्री विजया या वेल्लायानी हस्वा)-खीरा (किस्म. KAU विशाल) उच्च कंद समकक्ष उपज के साथ सबसे अधिक उत्पादक था (98.15 t ha⁻¹), उत्पादन क्षमता (272.63 kg ha⁻¹ day⁻¹) और ऊर्जा समतुल्य (323.63 x 103 MJ ha⁻¹) थी, जबकि प्रजनन स्तर लेवल कम था (आधा FYM और N, कसावा के लिए ज़ीरो P; आधा FYM, N और P खीरे के लिए)।
12. कसावा के साथ ग्वार/टमाटर/मिर्च जैसी सब्जियों की मिश्रित खेती के लिए

- जैविक तौर-तरीके विकसित किए गए, जिनमें FYM, पोल्ट्री खाद, वर्मी कम्पोस्ट, नीम की खली, मूंगफली की खली और PGPR शामिल हैं।
13. जिमीकंद में प्रजनन अध्ययन से पता चला कि सबसे अच्छा शेड्यूल 75-50-100 kg N, P₂O₅ और K₂O प्रति हेक्टेयर था, जिसे इस तरह दिया गया: 120 DAP से पहले 50%, 120-150 DAP के दौरान 25% और 150-180 DAP के दौरान 25% (47.8 टन प्रति हेक्टेयर)।
 14. बड़े रतालू में प्रजनन अध्ययन में, 60 विभाजनों के साथ 3 दिनों के अंतराल से उच्चतम कंद उपज (42.7 टन हेक्टेयर-1), निवल प्रतिफल (429800 हेक्टेयर-1 रुपये) और बी:सी अनुपात (3.03) प्राप्त हुआ।
 15. कसावा की फसल में, N:P:K को 100:50:100 kg/ha की दर से देने और साथ ही विकास के बीच के समय (120-150 दिन) में 1% KNO₃ का चार बार पत्तियों पर छिड़काव करने से सूखे का सामना करने की क्षमता बढ़ती है, कंद की गुणवत्ता बनी रहती है, पैदावार में सुधार होता है और सूखे के असर को कम करने में मदद मिलती है।
 16. शकरकंद की किस्मों में कंद निर्माण, आकारिक-शारीरिक वृद्धि, वर्णक संश्लेषण और प्रकाश संश्लेषक प्रदर्शन पर प्रकाश अवधि और पादप वृद्धि नियामकों के बीच परस्पर क्रिया के प्रभाव पर किए गए अध्ययनों से पता चला है कि लघु-दिशा प्रकाश अवधि, PGR के प्रभाव से नियंत्रित होकर, प्रकाश-अवशोषित विभाजन को भंडारण-जड़ विकास की ओर प्रभावी ढंग से पुनर्निर्देशित कर सकती है।
 17. कसावा पर लंबे समय तक चले पोषक तत्व प्रबंधन अध्ययनों से पता चला है कि अनुकूलित उर्वरक, कम इनपुट वाली प्रबंधन तकनीक (पोषक तत्व प्रबंधन प्रथाएं), FYM, लोबिया (जैविक खाद स्रोत) के साथ इन-सीटू हरी खाद और 'श्री पवित्रा', 'श्री मन्ना' व 'श्री अन्नम' (NUE जीनोटाइप) INM रणनीतियों के सबसे अच्छे टिकाऊ घटक हैं।
 18. शकरकंद में, पहले पेंडिमेथालिन (1 DAP) और उसके बाद पोस्ट-इमर्जेंस हर्बिसाइड क्लोडिनोफॉप-प्रोपार्गिल (35 DAP) का इस्तेमाल करने से खरपतवारों की संख्या और उनके सूखे वजन में प्रभावी रूप से कमी आई। इसके परिणामस्वरूप खरपतवार सूचकांक कम (-2.78) रहा, खरपतवार नियंत्रण की क्षमता बेहतर हुई और बाजार में बिकने लायक कंद की पैदावार 15.44 टन प्रति हेक्टेयर रही।
 19. पोटेसियम के इस्तेमाल की क्षमता के आधार पर शकरकंद की किस्मों की जांच से पता चला कि 'श्री भद्रा' सबसे अच्छी किस्म है, और उसके बाद 'कांजगढ़' और 'किशन' का स्थान है।
 20. बड़े रतालू में, 'श्री निधि' किस्म की बेल की कटिंग में जड़ें निकलने की प्रक्रिया पर बेल इकट्ठा करने के समय का काफी असर पड़ा और 135 DAP पर सबसे ज्यादा प्रतिशत में जड़ें निकलीं।
 21. संरक्षित खेती के लिए उपयुक्तता के लिए जांच की गई 20 किस्मों में से, SP 95/4, गौरी और भू झा ने अपनी सबसे कम फैलने वाली प्रकृति के कारण आशाजनक होने का खुलासा किया।

फसल सुरक्षा

22. SLCMV और SPLCV को लक्षित करने वाले कई gRNA को व्यक्त करते हुए निकोटियाना बेंथमियाना को CMD और शकरकंद पत्ती कर्ल रोग के खिलाफ CRISPR/Cas9 मध्यस्थता प्रतिरोध पर अध्ययन के एक भाग के रूप में विकसित या स्थापित किया गया था।
23. बड़े रतालू के एन्थ्रेक्नोज रोग के एकीकृत प्रबंधन पर किए गए एक क्षेत्र प्रयोग (2025-2026) में, जिसमें 12 तरह के उपचार (कवकनाशी, बायोएजेंट और एकीकृत संयोजन) शामिल थे, नियंत्रण की तुलना में रोग की गंभीरता में महत्वपूर्ण कमी का प्रदर्शन किया। कार्बेन्डाजिम (65% कमी) और एजोक्सीस्टोबिन + डिफेनोकोनाजोल (57% कमी) के सात स्प्रे में उच्चतम प्रभावकारिता दर्ज की गई।
24. इमिडाक्लोप्रिड 17.8 एसएल (0.05%) या श्रेया (1%) के बाद नन्मा (1%) और मैकोजेब 63% + कार्बेन्डाजिम 12% (0.2%) या ट्राइकोडर्मा-समृद्ध गाय के गोबर के घोल के साथ कॉर्म का इलाज करने से जिमीकंद में कटाई के बाद की बीमारियों और कीटों को काफी हद तक कम किया जा सकता है।
25. एंडोफाइटिक बायोएजेंट ट्राइकोडर्मा एस्पेरिलम के GC-MS विश्लेषण ने

1.0% NaCl तनाव के तहत शकरकंद का इलाज किया, जिससे बायोएक्टिव मेटाबोलाइट्स के बढ़े हुए संचय का पता चला, जिसमें हेप्टाकोसैनोइक एसिड, 25-मिथाइल-, मिथाइल एस्टर एक प्रमुख यौगिक के रूप में था, जो लवणता तनाव सहिष्णुता में भूमिका का संकेत देता है।

26. शकरकंद धुन प्रबंधन के लिए एक संशोधित फेरोमोन ट्रैप 10⁶ cfu/ml से अधिक सांद्रता में एंटोमोपैथोजेनिक कवक के विभिन्न उपभेदों के संयोजन में लालच (Z)-3-डोडेसेन-1-ol (E)-2-ब्यूटानोएट का उपयोग करके विकसित किया गया था। नर धुन को आकर्षित किया गया और सतह पर कवक वृद्धि के साथ ममीकृत कीड़ों वाले फेरोमोन जाल में एकत्र किया गया। ये संक्रमित नर बाद में संभोग के दौरान मादा धुन आबादी के बीच फैल गए, जिससे कवक के प्रसार में सुविधा हुई। यह तरीका वीविल (धुन) के नियंत्रण के लिए एक असरदार रणनीति साबित हुआ। हर दो हफ्ते में की गई निगरानी से पता चला कि उपचार के बाद कीड़ों के दोबारा आने में कमी आई।
27. केरल के कायमकुलम में जिमीकंद और तमिलनाडु के कडायम में चीनी आलू के क्षेत्र के मूल्यांकन से पता चला है कि फ्लुओपायरम (T1) मेलोइडोगाइन इनकॉमिटा गैलिंग को कम करने में सबसे प्रभावी था, जिसमें क्रमशः 4.7±0.72 और 11±0.61 की सबसे कम गाल संख्या दर्ज की गई। EPN आइसोलेट्स CTCRIH2 और CTCRIH3 को रूपात्मक और आणविक मार्करों का उपयोग करके हेटेरोहेब्रिडीटी इंडिका के रूप में पहचाना गया था और उनके अनुक्रमों को जेनबैंक में क्रमशः PX658224 और PX529684 के रूप में जमा किया गया था।
28. मॉरिशियाना के ट्रांसक्रिप्टोम अनुक्रमों को पहली बार शकरकंद धुन के खिलाफ मेजबान पौधे प्रतिरोध स्रोत की पहचान के लिए बायोप्रोजेक्ट आईडी - PRJNA1228266 के साथ प्रस्तुत किया गया था। ट्रांसक्रिप्शन फैक्टर जीन (WRKY) और किनेज (RLK) जैसे निष्क्रिय रिसेप्टर से संबंधित जीन की पहचान शकरकंद ट्रांसक्रिप्टोम अनुक्रम डेटा से की गई थी।

फसल उपयोग

29. दवा से भरे म्यूकोएडहेसिव ओरल पैच देशी के साथ-साथ संशोधित कसावा स्टार्च से विकसित किए गए थे और दवा सामग्री की एकरूपता, सतह पीएच, जलयोजन, मैट्रिक्स क्षरण और नकली लार में इन विट्रो ड्रग रिलीज के लिए मूल्यांकन किया गया था। फिल्म संरचना और सुखाने की स्थिति को लचीली फिल्मों का उत्पादन करने के लिए मानकीकृत किया गया था जो बुकल फिल्मों के रूप में उपयोग करने के लिए उपयुक्त थे और फिल्मों का उपयोग करके मौखिक पैच का निर्माण किया गया था।
30. कसावा स्टार्च मोनोफॉस्फेट और कसावा डिस्टार्च फॉस्फेट को बनाया गया, उनकी विशेषताओं की पहचान की गई और खाने-पीने और अन्य चीजों में उनके काम करने के तरीके का मूल्यांकन किया गया। सोखने की प्रक्रिया ने स्यूडो-सेकंड-ऑर्डर काइनेटिक्स और लैंगमुअर आइसोथर्म मॉडल का पालन किया, जिसमें संतुलन सोखने की क्षमता 228 mg g⁻¹ तक थी और अधिकतम मोनोलेयर क्षमता 515 से 850 mg g⁻¹ के बीच थी।
31. शकरकंद की कुल्फी, एक अभिनव कार्यात्मक जमे हुए मिठाई को एंथोसायनिन- और बीटा कैरोटीन युक्त शकरकंद प्यूरी का उपयोग करके विकसित किया गया था, ताकि इसकी पोषण की गुणवत्ता और प्राकृतिक रंग-रूप, दोनों को बेहतर बनाया जा सके। इन कुल्फियों में एंथोसायनिन की मात्रा 12.45 mg 100 g⁻¹ और बीटा-कैरोटीन की मात्रा 5.85 mg 100 g⁻¹ पाई गई। शिशुओं के लिए, दूध छुड़ाने के दौरान के बदलाव वाले समय में संतुलित पूरक आहार उपलब्ध कराने के मकसद से, पोषक तत्वों से भरपूर शकरकंद-आधारित तुरंत इस्तेमाल के लिए तैयार भोजन विकसित किया गया। शकरकंद के आटे के प्रभाव का अध्ययन रेडी-टू-यूज वीनिंग खाद्य पदार्थों की पोषण संबंधी विशेषताओं पर किया गया था जिसमें प्रोटीन, फाइबर, स्टार्च, खनिज, वसा और चीनी सामग्री शामिल होते हैं।
32. संतरे के रंग के गूदे वाली शकरकंद (किस्म: भू सोना) से एयर-फ्राइड चिप्स तैयार किए गए। इसके लिए हवा का तापमान 160 से 180°C और तलने का समय 9 से 11 मिनट के बीच रखा गया। अलग-अलग नमूनों में से, 170°C पर 10 मिनट तक एयर-फ्राई किए गए नमूनों को सबसे ज्यादा पसंद किया गया।

33. पशु आहार फॉर्मूलेशन के लिए, 15 कसावा किस्मों के छिलके और पत्तियों के भौतिक-रासायनिक विश्लेषण का परीक्षण किया गया, जिसमें विभिन्न कसावा किस्मों के बीच नमी की मात्रा, स्टार्च, चीनी, वसा, प्रोटीन और फाइबर सामग्री में महत्वपूर्ण अंतर दिखाया गया।
 34. अरबी और चाइनीज आलू जैसी नरम छिलके वाली कंद वाली फसलों से छिलका कुशलतापूर्वक और एकसमान रूप से हटाने के लिए नायलॉन ब्रश वाले रूट क्रॉप पीलर को डिजाइन और तैयार किया गया था। छीलने की प्रक्रिया एक नियंत्रित घर्षण-आधारित ब्रशिंग सिद्धांत पर काम करती है, जो बाहरी छिलके की परत को प्रभावी ढंग से अलग करते हुए गूदे के अनावश्यक नुकसान को कम करती है। इलेक्ट्रॉनिक स्टार्च इंडेक्टर का एक प्रोटोटाइप 10kg लोड सेल का इस्तेमाल करके बनाया गया था, जिसे आर्डूइनो माइक्रोकंट्रोलर के साथ इंटरफेस किया गया था, और आर्डूइनो एवातावरण में प्रोग्राम किया गया था। प्रारंभिक परीक्षणों से पता चला है कि यांत्रिक बिंदु पैमाने की तुलना में स्टार्च के आकलन में दोहराव की क्षमता अच्छी है, और विभिन्न कसावा किस्मों में इलेक्ट्रॉनिक स्टार्च संकेतक का क्षेत्र स्तर पर सत्यापन वर्तमान में चल रहा है।
- विस्तार और सामाजिक विज्ञान**
35. 746 वैश्विक कृषि शोध पत्रों (2000-2025) की समीक्षा की गई, जिसमें बहु-मानदंड स्कोरिंग (35%) को सबसे व्यापक रूप से उपयोग की जाने वाली अनुसंधान प्राथमिकता पद्धति के रूप में पहचाना गया, इसके बाद आर्थिक अधिशेष मॉडल (22%) और डेल्टा दृष्टिकोण (18%) का स्थान रहा। आईसीएआर-सीटीसीआरआई परियोजनाओं (2010-2025) के नेटवर्क विश्लेषण से फसल सुधार, उत्पादन प्रणाली, मूल्यवर्धन और किसान आजीविका के बीच मजबूत संबंध का पता चला।
 36. केरल में 180 कसावा किसानों के बीच जलवायु परिवर्तन के प्रति संवेदनशीलता का आकलन 'क्लाइमेट वल्लेरेबिलिटी इंडेक्स' (CVI) का इस्तेमाल करके किया गया, जिससे कम संवेदनशीलता (CVI = 0.360) का पता चला। चीनी आलू (Chinese potato) की मूल्य श्रृंखला के विश्लेषण में 100 हितधारकों को शामिल किया गया और किसानों, एग्रीगेटर्स, कमीशन एजेंटों, थोक विक्रेताओं और खुदरा विक्रेताओं को मुख्य भूमिका निभाने वाले के तौर पर पहचाना गया। मूल्य श्रृंखला में शामिल लोगों के अलग-अलग स्तरों पर कीमत के पैटर्न, बाजार चैनलों और मार्जिन का विश्लेषण किया गया।
 37. 120 महिला प्रतिभागियों पर मूल्य संवर्धन प्रशिक्षण के असर का अध्ययन करने पर पता चला कि प्रशिक्षण के बाद औसत ज्ञान स्कोर 2.26 से बढ़कर 7.98 हो गया, जबकि 73.42% महिलाओं ने बताया कि उनमें उद्यमी आत्मविश्वास बढ़ा है। हालांकि, पूंजी की कमी (35.50%) और बुनियादी ढांचे (25.50%) जैसी बाधाओं के कारण सिर्फ 36.77% ने ही उद्यम शुरू किए।
 38. ई-फसल आधारित स्मार्ट फर्टिगेशन सिस्टम (eCBSFS) का कसावा में तीन उपचारों के तहत तीन प्रतिकृतियों के साथ क्षेत्र परीक्षण किया गया, जबकि एक गैर-आक्रामक आईआर-आधारित मिट्टी नमी सेंसर ने मिट्टी की नमी का अनुमान लगाने में 84% सटीकता हासिल की। कटाई के बाद होने वाले शारीरिक खराब होने (PPD) का स्वचालित तरीके से पता लगाने के लिए, लगभग 1,500 कसावा की जड़ों की तस्वीरों का इस्तेमाल करके एक डीप लर्निंग ढांचा विकसित किया गया।
 39. आठ ट्रेडमार्क दायर किए, 16 प्रौद्योगिकियों का व्यवसायीकरण किया, जिससे राजस्व में ₹18.88 लाख से अधिक उत्पन्न हुए, और आईओटी-आधारित मिट्टी की नमी मापने वाले उपकरण (डिजाइन संख्या 477412-001) के लिए एक डिजाइन पेटेंट प्राप्त किया।
 40. आईसीएआर-सीटीसीआरआई, तिरुवनंतपुरम में 'कंद फसलों की उन्नत प्रौद्योगिकियों' पर एक दिवसीय एक्सपोजर विजिट-सह-प्रशिक्षण आयोजित किए गए, जिससे 805 किसानों, 2,125 छात्रों और 237 अधिकारियों को लाभ हुआ और राजस्व में 5,13,763 रुपये का सृजन हुआ। इसके अतिरिक्त, 11 प्रदर्शनियों का भी आयोजन किया गया।

Executive Summary

The genetic wealth conserved with newer collections, varieties released, processes, protocols, technologies, methods, high value compounds and post-harvest machineries developed under eight Institute projects, two flagship projects as well as 22 external funded projects are given below:

Crop Improvement

1. The total germplasm repository includes 5244 accessions, comprising 1216 cassava, 905 sweet potato, 801 yams, 655 edible aroids, 387 minor tuber crops from HQ and 1280 accessions from Regional Station comprising 113 cassava, 380 sweet potato, 51 yams, 564 edible aroids and 172 minor tuber crops. Under IVAG, a total of 153 accessions (71 cassava, 31 sweet potato, 33 yams, 7 taro, 2 arrowroot, 8 *Curcuma angustifolia* and 1 Chinese potato) are maintained at the HQ. At the Regional Station, released varieties comprising 10 cassava, 11 sweet potato, 5 taro, 4 yams, 2 elephant foot yam and 1 Chinese potato are maintained *in vitro*.
2. A catalogue of cassava genetic resources (Part-2) consisting of morphological data of 100 accessions for 51 traits was published. Many promising genotypes were identified with short stature (13), harvest index >0.75 (CE-40A, CE-18A, CE-38A and CE-16A); sweet taste and high tuber yield >5 kg plant⁻¹ (CE-16A, CE-40A and CE-239) and CMD resistant (25). A new promising line of cassava, SH1, suitable for chip making was identified.
3. In sweet potato, one purple fleshed variety – Bhu Arunima was released for the state of Odisha. Many promising genotypes for important traits viz., high-yield (11), weevil resistant (16); suitable for fried chips (16); early-maturity and nutritionally rich lines (SP19, SP5, SP18, SP27 and SP1); mineral rich accessions (SP9 (rich in K, Fe, Mn), SP20 (rich in Zn) and SP1/SP11 (rich in P), high starch (17.52% - SPH-23-120), high sugar (3.48% - SPH-23-113), highest Nitrogen content (2.28% - SPH-23-42); highest phosphorous content (0.98% - SPH-23-33 and SPH-23-54); highest potassium (2.09% - SPH-23-25), etc were identified. From the sweet potato hybrids with both anthocyanin and β -carotene, 110/28 was the best performer with 750-1.15 kg plant⁻¹. Pollen fertility studies in sweet potato showed high pollen fertility (80-94%) between 6-11 AM and high stigma receptivity (79-93%) from 6-8 AM.
4. Under white yam, the variety Sree Dhrona (with compact tuber shape and high tuber yield even under non trailing condition) was notified in The Gazette of India for the state of Kerala. Many promising lines were identified viz., six highly resistant yam accessions (DA 5, DA 388, DA 17, DA 191, DA 59, and DA 502 - consistently for 2023–2026); highly resistant for two seasons (18 - for 2023-26); high resistance to anthracnose for one season (TCR 12, DAH 10-3-28, DAS 19 and DAH 9-35-16); male flowering lines (20) and female flowering lines (6) in greater yam flowering lines.
5. Under edible aroids, two taro varieties released in 2024, Sree Telia and Sree Hira were notified in The Gazette of India for the state of Odisha. Many promising lines were identified in elephant foot yam (high yield >30 t ha⁻¹ - TEy22-5; high dry matter >30% - 12); taro (high dry matter >25% - 3; high total yield >15 t ha⁻¹ - 6) and tannia (high total yield >15 t ha⁻¹ - 3). BBCH scale in elephant foot yam was described for the first time.
6. Under minor tuber crops, the first yam bean variety - Bhu Shakarkanda - 1, from CTCRI was released from the RS for the state of Odisha. The East Indian arrowroot (*Curcuma angustifolia* Roxb.) accession, IC641835 was registered for the first time under ICAR-NBPGR characterized by long primary rhizome (21 cm) and high starch content (16.8%) and short crop duration. Breeder seed quality standards were established for seed rhizome and seedling vigour traits in this crop. High germination rates, ideal moisture (65–80%) and strong seedling vigour traits (shoot length 20–30 cm, root length 11–17 cm, dry matter $\geq$ 0.20 g, SVI >3000) were confirmed as indicators of good seed quality. Mutation studies in Chinese potato showed that 55 Gy induced desirable variations viz., total tuber yield and single tuber weight.
7. Under genome editing in cassava for starch modifications, two cassava lines (H226 and 9S127) were successfully transformed using both gene gun bombardment and *Agrobacterium*-mediated approaches. The resulting transformed tissues are currently being maintained under selection media. A successful protocol for regeneration of

cassava 9S127 with a regeneration efficiency of 92% within 3 months has been established.

8. In the nutrient homeostasis study in cassava, results revealed that protein content was higher in aerial parts than tubers and declined with plant age. Under biofortification studies, differential protein expression of a small protein in roots, tubers and lower stem was there, but not in the aerial plant part.
9. Transcriptome studies of tolerant and susceptible cassava genotypes under PPD stress revealed 261–1187 differentially expressed genes, with higher DEG counts in tolerant vs. susceptible treatments and identified 143 BP, 26 MF and 62 CC Gene Ontology terms linked to resistance mechanisms such as stress response, development and metabolism. Transcriptome analysis of early bulking accessions of cassava revealed that 1,028 genes were upregulated and 564 genes were downregulated in the early-bulking variety Vellayani Hraswa compared to the late-bulking variety Sree Pavithra. RT-PCR and transcriptome studies in cassava and sweet potato revealed genotype-specific gene expression patterns linked to bulking, drought and heat stress, identified thousands of genome-wide microsatellite markers and highlighted polymorphic SSR markers useful for mapping and marker-assisted breeding.
10. DNA barcoding of sweet potato, aroids and yams using matK, KimmatK and ITS markers showed that matK was the most efficient (95–100%) for amplification and sequencing, while ITS2 RNA structures revealed significant genetic divergence useful for varietal discrimination.

Crop Production

11. Of the three systems involving vegetables, rice-short-duration cassava (var. Sree Vijaya or Vellayani Hraswa)-cucumber (var. KAU Vishal) was the most productive with higher tuber equivalent yield (98.15 t ha⁻¹), production efficiency (272.63 kg ha⁻¹ day⁻¹) and energy equivalent (323.63 x 10³ MJ ha⁻¹) at reduced fertility levels (half FYM & N, zero P to cassava; half FYM, N & P to cucumber).
12. Organic package of practices for intercropping cassava with vegetables such as cluster bean/tomato/chilli, including FYM, poultry manure, vermi compost, neem cake, ground nut cake and GPGR were developed.
13. Fertigation studies in elephant foot yam indicated that the optimal schedule was 75-50-100 kg N, P₂O₅ and K₂O ha⁻¹ applied @ 50% before 120 DAP, 25% during 120-150 DAP and 25% during 150-180 DAP (47.8 t ha⁻¹).
14. In the fertigation studies in greater yam, the interval of 3 days with 60 splits produced highest tuber yield (42.7 t ha⁻¹), net returns (Rs 429800 ha⁻¹) and B:C ratio (3.03).
15. In cassava, N:P:K @ 100:50:100 kg ha⁻¹ along with four foliar sprays of 1% KNO₃ during mid-growth (120–150 days) can enhance drought resilience, maintain tuber quality and improve yield in cassava and help to mitigate drought in cassava.
16. Studies on the effect of interaction between photo-period and plant growth regulators on tuberization, morpho-physiological growth, pigment synthesis and photosynthetic performance of sweet potato varieties indicated that short-day photoperiods can effectively redirect photo-assimilate partitioning toward storage-root development as modulated by the effect of PGRs.
17. Long term nutrient management studies in cassava indicated that customized fertilizers and low input management technology (nutrient management practices), FYM and green manuring *in situ* with cowpea (organic manure source) and Sree Pavithra, Sree Manna and Sree Annam (NUE genotypes) are the best sustainable components of INM strategies.
18. In sweet potato, application of pendimethalin (1 DAP) followed by post emergence herbicide clodinafopropargyl (35 DAP) effectively reduced the weed population and weed dry weight, which resulted in a lower weed index (-2.78) and higher weed control efficiency and marketable tuber yield of 15.44 t ha⁻¹.
19. Screening of sweet potato genotypes for potassium use efficiency indicated Sree Bhadra as the superior variety, followed by Kanjanghad and Kishan.
20. In greater yam, rooting behaviour of vine cuttings of the variety Sree Nidhi was significantly influenced by time of vine collection and showed maximum per cent rooting at 135 DAP.
21. Among the 20 varieties screened for suitability to protected cultivation, SP 95/4, Gowri and Bhu Jha revealed to be promising due to their least spreading nature.

Crop Protection

22. *Nicotiana benthamiana* expressing multiple gRNAs targeting SLCMV and SPLCV was developed / established as a part of study on CRISPR/ Cas9 mediated resistance against CMD and sweet potato leaf curl disease.
23. A field experiment on integrated management of greater yam anthracnose (2025–2026) comprising 12 treatments (fungicides, bioagents and integrated combinations) demonstrated significant reduction in disease severity as compared to control. Seven sprays of Carbendazim (65% reduction) and Azoxystrobin + Difenconazole (57% reduction) recorded the highest efficacy.
24. Treating corms with Imidacloprid 17.8 SL (0.05%) or Shreya (1%) followed by Nanma (1%) and Mancozeb 63% + Carbendazim 12% (0.2%) or Trichoderma-enriched cow dung slurry could significantly reduce postharvest diseases and pests in elephant foot yam.
25. GC-MS analysis of endophytic bioagent *Trichoderma asperellum* treated sweet potato under 1.0% NaCl stress revealed enhanced accumulation of bioactive metabolites, with Heptacosanoic acid, 25-methyl-, methyl ester as a dominant compound, indicating a role in salinity stress tolerance.
26. A modified pheromone trap for sweet potato weevil management was developed using the lure ((Z)-3-dodecen-1-ol (E)-2-butanoate) in combination with different strains of entomopathogenic fungi at concentrations greater than 10^8 cfu/ml. Male weevils were attracted and collected in the pheromone traps containing mummified insects with fungal growth on the surface. These infected males subsequently dispersed among female weevil populations during mating, facilitating the spread of the fungi. This approach was found to be an effective strategy for weevil management. Fortnightly observations showed a reduction in insect revisitation following treatment.
27. Field evaluations in elephant foot yam at Kayamkulam, Kerala and Chinese potato at Kadayam, Tamil Nadu showed that Fluopyram (T1) was most effective in reducing *Meloidogyne incognita* galling, recording the lowest gall numbers of 4.7 ± 0.72 and 11 ± 0.61 , respectively. EPN isolates CTCRIH2 and CTCRIH3 were identified as *Heterorhabditis indica* using morphological and molecular markers and

their sequences were deposited in GenBank as PX658224 and PX529684, respectively.

28. Transcriptome sequences of *I. mauritiana* was submitted with bioProject ID - PRJNA1228266 for the identification of host plant resistance source against sweet potato weevil for the first time. Genes related to transcription factor gene (WRKY) and inactive receptor like kinase (RLK) were identified from sweet potato transcriptome sequence data.

Crop Utilization

29. Drug-loaded mucoadhesive oral patches were developed from native as well as modified cassava starches and evaluated for drug content uniformity, surface pH, hydration, matrix erosion and *in vitro* drug release in simulated saliva. The film composition and drying condition were standardized to produce flexible films suitable to be used as buccal films and oral patch was fabricated using the films.
30. Cassava starch monophosphate and cassava distarch phosphate were synthesized, characterized and evaluated for their functional performance in food and non-food applications. The adsorption process followed pseudo-second-order kinetics and the Langmuir isotherm model, with equilibrium adsorption capacities upto 228 mg g^{-1} and maximum monolayer capacities ranging from 515 to 850 mg g^{-1} .
31. Sweet potato kulf, an innovative functional frozen dessert was developed using anthocyanin- and beta carotene-rich sweet potato puree to enhance both nutritional quality and natural colour appeal. These kulfis exhibited an anthocyanin content of $12.45 \text{ mg } 100 \text{ g}^{-1}$ and beta carotene content of $5.85 \text{ mg } 100 \text{ g}^{-1}$. A nutrient-dense sweet potato-based ready-to-use weaning food was developed to provide a balanced complementary diet for infants during the transitional feeding period. The effect of sweet potato flour was studied on the nutritional characteristics of ready-to-use weaning foods which include protein, fiber, starch, minerals, fat and sugar contents.
32. Air fried chips were prepared from the orange fleshed sweet potato (Variety: Bhu Sona) by varying the air temperature from 160 to 180°C and frying time 9 to 11 min. Among the various samples, the maximum preference was for the samples air fried at 170°C for 10 minutes.
33. For animal feed formulations, physico-chemical

analysis of the peel and leaves of 15 cassava varieties were tested which showed significant difference in moisture content, starch, sugar, fat, protein and fibre content among the different cassava varieties.

34. A nylon brush based type root crop peeler was designed and fabricated to enable efficient and uniform removal of peel from soft skinned tuber crops, such as taro and Chinese potato. The peeling mechanism operates on a controlled abrasive brushing principle, which minimizes excessive flesh removal while ensuring effective detachment of the outer peel layer. A prototype of the electronic starch indicator was developed using a 10 kg load cell interfaced with an Arduino microcontroller, programmed in the Arduino environment. Preliminary trials demonstrated good repeatability of starch estimation compared to the mechanical point scale, and field level validation of the electronic starch indicator in different cassava varieties are currently in progress.

Extension & Social Sciences

35. Reviewed 746 global agricultural research papers (2000–2025), identifying multi-criteria scoring (35%) as the most widely used research prioritization method, followed by economic surplus models (22%) and Delphi approaches (18%). Network analysis of ICAR-CTCRI projects (2010–2025) revealed strong linkages among crop improvement, production systems, value addition and farmer livelihoods.
36. Assessed climate change vulnerability among 180 cassava farmers in Kerala using the Climate Vulnerability Index (CVI), which indicated low vulnerability (CVI = 0.360). Value chain analysis of Chinese potato covering 100 stakeholders identified farmers, aggregators, commission agents, wholesalers and retailers as key actors. Analyzed pricing patterns, market channels and margins at different levels of the value chain actors.
37. Studied the impact of value addition training among 120 women respondents showed that the mean knowledge score increased from 2.26 to 7.98 after training, while 73.42% reported improved entrepreneurial confidence. However, only 36.77% started enterprises due to constraints such as lack of capital (35.50%) and infrastructure (25.50%).
38. The e-Crop Based Smart Fertigation System (eCBSFS) was field-tested in cassava under three treatments with three replications, while a non-invasive IR-based soil moisture sensor achieved 84% accuracy in estimating soil moisture. A deep learning framework using approximately 1,500 cassava root images was developed for automated assessment of post-harvest physiological deterioration (PPD).
39. Filed eight trademarks, commercialized 16 technologies generating over ₹18.88 lakh in revenue, and obtained one design patent for an IoT-based soil moisture measurement device (Design No. 477412-001).
40. One-day exposure visit-cum-trainings on 'Improved technologies of tuber crops' were organized at ICAR-CTCRI, Thiruvananthapuram, benefiting 805 farmers, 2,125 students, and 237 officials and generating ₹5,13,763 in revenue. Additionally 11 exhibitions were also organized.

Introduction



ICAR-CTCRI, Headquarters, Thiruvananthapuram (48.19 ha)



ICAR-CTCRI, Regional Centre, Bhubaneswar (20 ha)

ICAR-CTCRI (1963-2025)

ICAR-Central Tuber Crops Research Institute (ICAR-CTCRI) was established on 1 July 1963 during the Third Five Year Plan to intensify research on tropical tuber crops other than potato. The institute is headquartered at Sreekariyam, Thiruvananthapuram, Kerala and has a Regional Station at Bhubaneswar, Odisha, established in 1976. In 1968, the All India Coordinated Research Project on Tuber Crops (AICRP-TC) was initiated at the institute to test and popularize location-specific tuber crop technologies across India. Over the past 61 years, ICAR-CTCRI has emerged as a leading global research organization exclusively dedicated to tropical tuber crops such as cassava, sweet potato, yams, taro, elephant foot yam, and arrowroot. The institute functions with the vision of ensuring better health, wealth generation, and inclusive growth through root and tuber crops, while its mission is to integrate these crops into sustainable farming systems for enhancing food and nutritional security and improving rural livelihoods.

Vision

Root and tubers for ensuring better health, wealth generation and inclusive growth

Mission

To integrate root and tuber crops as sustainable farming system components to ensure food and nutritional security of the nation and livelihood improvement of rural population

Mandate

The Institute has a broad mandate of generating information on research of tropical tuber crops that will help to enhance productivity and improve the utilization potential.

- Basic, strategic and applied research on genetic resource management, crop improvement, sustainable production and utilization of tropical tuber crops
- Co-ordinate research and validation of technologies through AICRP on Tuber Crops

General Achievements

ICAR-Central Tuber Crops Research Institute (CTCRI) is a globally recognized research institution exclusively dedicated to tropical tuber crops. Over more than six decades of research excellence, the Institute has released many improved crop varieties and developed numerous sustainable technologies for the production, protection and processing of tuber crops. With a strong commitment to marginal and resource-poor farmers, ICAR-CTCRI focuses on enhancing livelihoods while ensuring food and nutritional security through innovative and farmer-centric technologies. In recent years, the Institute has further expanded its impact by introducing technologies and services that facilitate resource generation through consultancy services, contract research and technology commercialization.

ICAR-Central Tuber Crops Research Institute (CTCRI) maintains a rich germplasm repository

comprising 5234 accessions of tropical tuber crops. Its pioneering contributions to tuber crop breeding have fostered several international collaborations aimed at genetic enhancement and crop improvement. The Institute continues to undertake advanced research in molecular breeding and genomics-based crop improvement. Till date, ICAR-CTCRI has released 79 improved varieties possessing diverse quality attributes and farmer-preferred traits. In 2025, a purple fleshed sweet potato, Bhu Arunima and yam bean variety Bhu Shakarakanda-1 were released. ICAR-CTCRI has also made significant contributions to arrowroot improvement by releasing three varieties for the first time in the country viz., Sree Nakshatra, Sree Karti, and Sree Aadya. A unique germplasm of East Indian arrowroot (IC641835) having the longest primary fingers and high starch content in the rhizomes was registered (INGR25038) with ICAR-NBPGR. The Institute facilitated the registration of a farmer-developed cassava variety, 'Manna', under the Protection of Plant Varieties and Farmers' Rights Authority (PPV & FRA). In addition, the Institute conducts robust biotechnology research programmes aimed at enhancing the productivity, quality and resilience of tropical tuber crops. A flagship genome-editing programme was also initiated to develop waxy cassava varieties tailored for food and industrial applications.

ICAR-CTCRI has developed eco-region-specific agronomic technologies for the cultivation of tuber crops under diverse production systems across the country. Significant achievements include the development of technologies for the production of high-quality planting materials, sustainable nutrient management through Integrated Nutrient Management (INM), Site-Specific Nutrient Management (SSNM) and organic farming approaches. Innovative water management strategies, including micro-irrigation and drip fertigation systems, as well as effective weed management practices, have also been standardized and promoted. These technological interventions have contributed substantially to enhancing crop productivity, improving soil health and fertility, optimizing resource-use efficiency and increasing farm profitability, thereby supporting the sustainable cultivation of tropical tuber crops and improving the livelihoods of farming communities.

The Institute also focuses on the development of advanced diagnostic tools for the rapid detection of

viral and fungal diseases, as well as the generation of transgenic cassava lines with resistance to cassava mosaic disease, enhanced starch content and resistance to sweet potato weevil. It has developed a range of integrated crop protection technologies to manage major diseases and pests affecting tropical tuber crops. These include effective management strategies for cassava mosaic disease, tuber rot, stem and root rot in cassava; taro leaf blight; collar rot and post-harvest rot in elephant foot yam; anthracnose in greater yam and sweet potato weevil infestations. These technologies provide sustainable and practical solutions for mitigating crop health challenges and reducing yield losses. The Institute has successfully demonstrated the management of banana pseudostem weevil in farmers' fields using cassava-based bioformulations, Nanma and Menma, highlighting the potential of eco-friendly pest management approaches. Two liquid bioformulations - Sree Syama, based on *Trichoderma asperellum*, and Sree Jala, based on an endophytic *Bacillus subtilis* strain - have been released with high colony-forming unit (CFU) counts. These microbial formulations enhance plant growth, improve crop health and suppress diseases in tuber crops and vegetables. The Institute has also isolated and characterized novel entomopathogenic nematode strains, which are being utilized as biological control agents against major insect pests of tuber crops and several other economically important crops. Collectively, these innovations strengthen sustainable pest and disease management strategies while reducing dependence on chemical pesticides and promoting environmentally friendly agriculture.

The Institute has made significant contributions to crop utilization through the development of value-added products and diversified technologies that enhance the economic potential of tropical tuber crops. The Institute has developed a wide range of technologies for industrial applications, including modified starches, superabsorbent polymers, adhesives, thermoplastic starch, particle boards, and various pre- and post-harvest machinery. Among its recent innovations is a novel food spoilage detection system based on pH-sensitive cassava starch films infused with natural dyes such as anthocyanin and curcumin, offering a sustainable approach to smart food packaging. Twelve value added food product technologies have been commercialized to Kudumbasree State Mission, Govt. of Kerala. Two post harvest machineries were licensed to

M/S., Cliff Innovations, No. 62 C1 & C2, Siruvani Main Road, Vadavalli, Coimbatore-641 041, Tamil Nadu, India. These technologies have been commercialized to improve operational efficiency, reduce labour requirements and enhance farmers' income. In the area of food processing and value addition, the Institute has developed a variety of products such as pasta, noodles, fried snack foods and several functional foods derived from cassava, sweet potato, yams and elephant foot yam. Notably, sweet potato vacuum-fried chips and sweet potato nutri-bar were selected for branding support by the Kerala Startup Mission, recognizing their commercial potential and nutritional value. The Institute has also pioneered the development of innovative extension programmes and dissemination methodologies aimed at accelerating technology adoption among farmers and other stakeholders, thereby contributing to improved livelihoods and rural entrepreneurship. Further strengthening its portfolio of health-oriented products, ICAR-CTCRI has developed probiotic-rich frozen desserts and gummy confections from purple- and orange-fleshed sweet potatoes, which are naturally rich in anthocyanins and β -carotene. These products exemplify the Institute's commitment to promoting nutrition, value addition and sustainable agri-food innovations based on tropical tuber crops.

The Institute has made significant advancements in digital agriculture and bioinformatics by developing a range of information technology tools for smart farming applications. These include e-Crop, a smart fertigation system, the Tuber Crops Online Marketing System (TOMS) and crop growth simulation and self-learning growth models for various tuber crops. These tools have been developed and validated to support precision agriculture, resource-use efficiency and informed decision-making in farming systems. In the field of computational biology, the Institute has developed intelligent bioinformatics tools for predicting plant-pathogen interactions, constructing biological networks and integrating and visualizing omics datasets. Extensive research has led to the identification of molecular markers, microRNAs (miRNAs), long non-coding RNAs (lncRNAs) and differentially expressed genes associated with important biotic and abiotic stress responses, as well as quality traits in tropical tuber crops. The Institute has successfully implemented several developmental programmes, including

the North Eastern Hill (NEH) Programme, Tribal Sub-Plan (TSP) and Scheduled Caste Sub-Plan (SCSP). Through farmer trainings, demonstrations and technology dissemination activities, these programmes have significantly enhanced livelihood security among farmers and other stakeholders across the country. The Techno Incubation Centre of the Institute has further contributed to entrepreneurship development by providing specialized training in the production and commercialization of value-added tuber crop products.

The Institute has received numerous national and international recognitions for its outstanding contributions to tropical tuber crop research and development. A landmark achievement was the conferment of the ICAR Sardar Patel Outstanding Institution Award (2005) in recognition of its exceptional contributions to tropical tuber crop improvement and the development of low-cost production technologies. The Institute has also received several prestigious awards, including the J. Chinoy Gold Medal, ICAR Team Research Awards, D.L. Plucknett Award for Tropical Root Crops, Hari Om Ashram Trust Award, Jawaharlal Nehru Awards, NRDC Cash Reward for Biodegradable Plastics, Pat Coursey Awards, Vasantharao Naik Memorial Gold Medal, Chaudhary Devi Lal Outstanding AICRP Award, Samantha Chandrasekhar Award, IPI-FAI Award, Shri L.C. Sikka Endowment Award, IZA-FAI Award and the Panjabrao Deshmukh Woman Scientist Award. In recognition of its global impact on cassava research and development, the Institute was honoured during the First International Meeting on Cassava Plant Breeding, Biotechnology and Ecology held in Brasília, Brazil, in November 2006. The Institute has also won several awards and recognitions at national and international agricultural exhibitions. Its excellence in scientific reporting was acknowledged through the Best Annual Report Awards (1997-98 and 2017-18) among small ICAR institutes. Reflecting its strong performance in research, extension and technology development, the Institute secured the 14th rank among all ICAR institutes in the Ranking of Institutes of the Indian Council of Agricultural Research for the years 2019-20 and 2020-21. Research activities at the Institute are further strengthened through substantial extramural funding from leading international organizations such as the International Center for Tropical Agriculture

(CIAT), International Potato Center (CIP), French Agricultural Research Centre for International Development (CIRAD), European Union (EU), International Fund for Agricultural Development (IFAD) and Indo-Swiss collaborative programmes. National support has been received from agencies including the Department of Biotechnology (DBT), Department of Science and Technology (DST), Defence Research and Development Organisation (DRDO), Department of Scientific and Industrial Research (DSIR), Indian Council of Agricultural Research (ICAR), Kerala State Council for Science, Technology and Environment (KSCSTE), National Bank for Agriculture and Rural Development (NABARD), Rashtriya Krishi Vikas Yojana (RKVY), Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA), State Horticulture Mission (SHM), Coconut Development Board (CDB), University Grants Commission (UGC) and several ICAR network and consortium projects. These collaborations have substantially enriched the Institute's research, innovation, and technology development.

The Institute Technology Management Unit (ITMU) plays a pivotal role in managing intellectual property (IP) activities and facilitating the commercialization of technologies developed by the Institute. A wide range of technologies related to agricultural machinery, value-added products and crop processing have been successfully transferred to stakeholders through technology licensing, consultancy services, contract research and technology transfer mechanisms. To strengthen research, education and technology dissemination in tropical tuber crops, the Institute has established collaborative partnerships through Memoranda of Understanding (MoUs) with various ICAR institutes, Universities, State Government Departments and Private-sector Organizations. Recent MoUs have focused on the commercialization of innovative technologies such as the Electronic Crop IoT Device for smart farming, elephant foot yam flakes and cassava-based protein-enriched noodles, thereby promoting agribusiness development and rural entrepreneurship. The Institute has also made notable contributions to agricultural informatics and crop modelling. Three crop growth simulation models - SIMCAS for cassava and MADHURAM and SPOTCOMS for sweet potato - have been developed and filed for copyright protection. These models support crop growth prediction, decision-

making and precision management under diverse production environments. The Bioinformatics and Statistics Laboratory is equipped with advanced computational infrastructure, including Linux and Windows workstations, six standalone terminals and an 8 TB network-attached storage system to support high-performance computing and data-intensive research. The laboratory houses commercial software packages such as SAS, DNASTAR and BioBam (Blast2GO), in addition to a wide range of open-source statistical and bioinformatics tools for genomics, transcriptomics and computational biology applications. To facilitate efficient communication and data management, the Institute has established a comprehensive Local Area Network (LAN) that interconnects all research divisions, administrative sections, accounts offices and farm units through a robust fibre-optic backbone infrastructure. The Institute's Agri-Business Incubation (ABI) Centre continues to foster entrepreneurship and innovation in the agricultural sector. Further expanding its incubation ecosystem, the Institute established three new Satellite Incubation Centres in collaboration with academic institutions across the country. These include: Kerala Agricultural University (KAU), Regional Agricultural Research Station, Pattambi, Kerala, focusing on Tribal Entrepreneurship; the College of Horticulture and Forestry, Central Agricultural University, Arunachal Pradesh, dedicated to the Protection and Commercialization of Traditional Knowledge and Farmer Innovations; and Assam University, Silchar, Assam, focusing on Indigenous and Local Community Entrepreneurship. These initiatives aim to promote innovation-driven enterprise development, strengthen regional value chains and enhance livelihood opportunities for farming and tribal communities.

The Institute has continuously strengthened its physical and digital infrastructure to support advanced research, knowledge dissemination and efficient administration. The main administrative building is equipped with a comprehensive Closed-Circuit Television (CCTV) surveillance system to enhance campus security. The entire campus has been enabled with secure Wi-Fi connectivity through access-controlled wireless devices and centralized controllers, ensuring seamless internet access for research, academic and administrative activities. In addition, Virtual Private Network (VPN) connectivity has been established to facilitate secure global access to institutional servers and



digital resources. The Institute's official website, portal offers several online services, including access to the sales counter, discussion forums, academic and human resource development (HRD) programmes and other stakeholder-oriented facilities. The Institute library serves as a vital knowledge resource centre, providing mobile access to electronic resources, secure e-journal access through static IP authentication and a wide range of scientific books, journals, circulation services and reference support for researchers, students and staff. Significant infrastructural developments were undertaken under the Genome Editing Project, including the establishment of new research facilities and procurement of advanced scientific equipment.

Major events such as Tuber Crops Day, World Soil Day and Kisan Diwas were also celebrated.

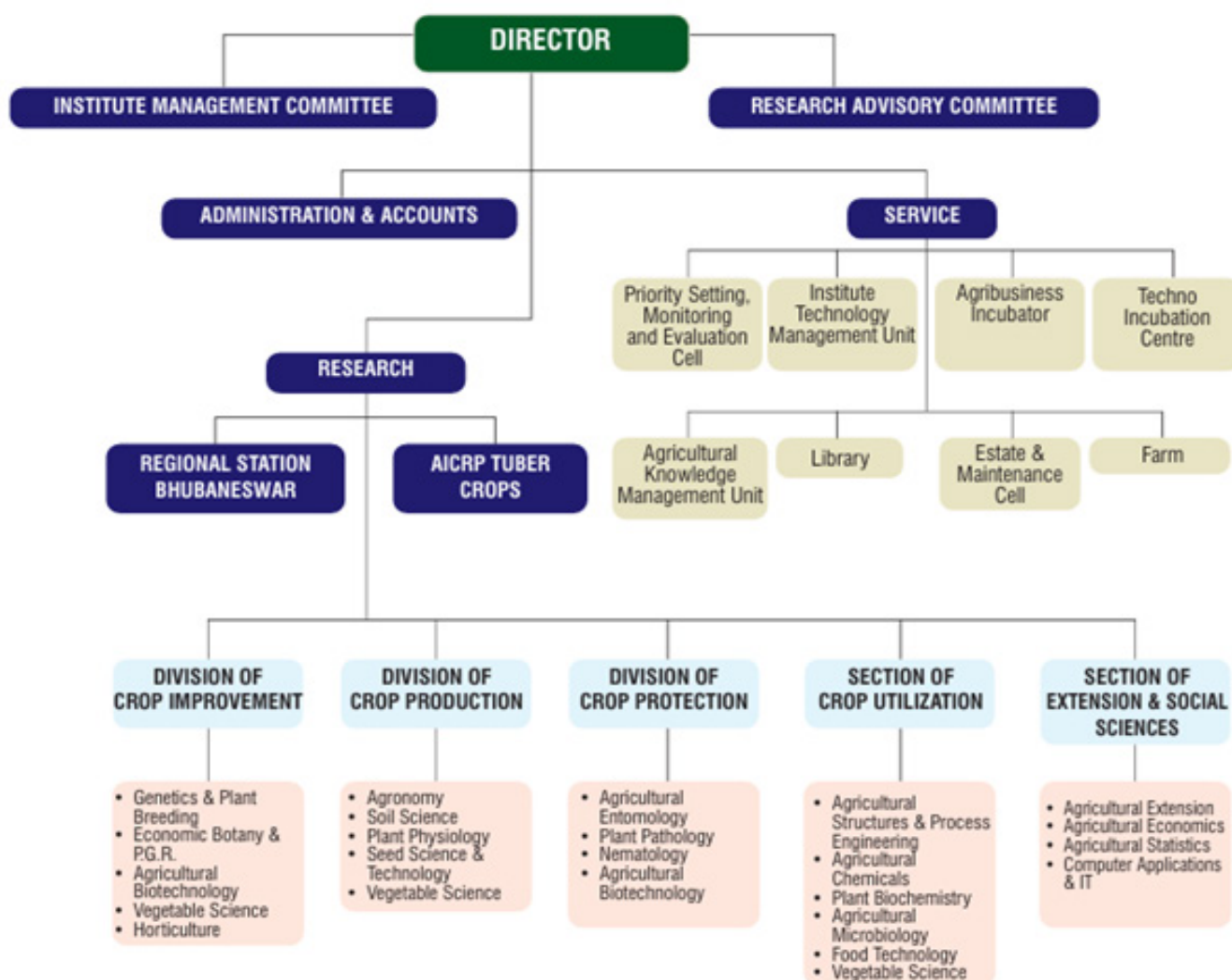
A major milestone in the history of ICAR-CTCRI was the successful hosting of the 20th International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES) during 17-21 November 2025 at Thiruvananthapuram. A brainstorming session was also organized on on tuber crops mechanization to promote mechanization in agriculture. As part of the Government of India's capacity-building initiative, all staff members completed online courses through the iGOT Karmayogi platform. The Institute further strengthened its infrastructure with the establishment of a Genome editing laboratory, vacuum-frying chips processing unit, an open root scape cum photo point and an SBI ATM outlet. Six new research projects with a total funding of approximately ₹3.09 crores were sanctioned, further strengthening the Institute's R&D programmes.

Mandate Crops



1. Cassava: *Manihot esculenta* Crantz, Euphorbiaceae
2. Sweet potato: *Ipomoea batatas* (L.) Lam., Convolvulaceae
3. Greater yam: *Dioscorea alata* L., Dioscoreaceae
4. White yam: *Dioscorea rotundata* Poir., Dioscoreaceae
5. Lesser yam: *Dioscorea esculenta* (Lour.) Burk., Dioscoreaceae
6. Taro: *Colocasia esculenta* (L.) Schott., Araceae
7. Tannia: *Xanthosoma sagittifolium* (L.) Schott., Araceae
8. Elephant foot yam: *Amorphophallus paeoniifolius* (Dennst.) Nicolson, Araceae
9. Giant taro: *Alocasia macrorrhiza* (L.) Schott., Araceae
10. Swamp taro: *Cyrtosperma chamissonis* (Schott.) Merr., Araceae
11. Chinese potato: *Plectranthus rotundifolius* (Poir.) J.K. Morton, Lamiaceae
12. Yam bean: *Pachyrhizus erosus* (L.) Urban, Fabaceae
13. Arrowroot: *Maranta arundinacea* L., Marantaceae
14. Queensland arrowroot: *Canna edulis* (Ker-Gawler), Cannaceae
15. East Indian Arrowroot: *Curcuma angustifolia* Roxb., Zingiberaceae

Organisational Set Up



Staff Position (2025)

Category	Sanctioned	Filled	Vacant
RMP	1	1	0
Scientists	44	42	2
Technical	47	32	15
Administration	30	22*	08
Multi tasking staff (MTS)	38	14	24
Total	160	111	49

*05 staffs are under deputation

Progressive Expenditure 2024-25

Head of Account		RE 2024-25 (Scheme) (In Lakhs)	RE 2024-25 (Non-Scheme) (In Lakhs)	Progressive Expenditure (Scheme+Non-scheme) (In Lakhs)	
Sl. No.	Name				
	CAPITAL				
1	Works				
	A. Land				
	B. Building				
	i. Office building	21.21	0.00	21.21	
	ii. Minor Works		0.00		
2	Equipments - Institute	85.85	0.00	85.85	
	- SCSP	1.50	0.00	1.50	
	- TSP	0.00	0.00	0.00	
3	Information Technology	11.81	0.00	11.81	
4	Library Books and Journals	1.28	0.00	1.28	
5	Vehicles & Vessels	0.00	0.00	0.00	
6	Furniture & Fixtures	4.85	0.00	4.85	
	Total – Capital	126.50	0.00	126.50	
	REVENUE EXPENDITURE				
1	A. Establishment Charges	0.00	2349.66	2349.66	
	B. Pension & Other Retirement Benefits	0.00	182.95	182.95	
2	Travelling Allowances	520.62	0.00	55.23	520.62
3	Research & Operational Expenses			191.15	
4	Administrative Expenses			263.62	
5	Miscellaneous			10.62	
	NEH	10.00	0.00	10.00	
	TSP	61.00	0.00	61.00	
	SCSP	45.00	0.00	45.00	
	Total – Revenue Expenditure	636.62	2532.61	3169.23	
	GRAND TOTAL (Capital + Revenue)	763.12	2532.61	3295.73	

Research Projects

List of Concluded Institute Projects

Date of start: 01 April 2020

Date of completion: 31 March 2025

Sl. No.	Project Title	PI	Co-PIs/ Project Associates
I	HORTCTCRISIL 202000901465 Mega project 1: Conservation and utilization of germplasm of tuber crops for sustaining production.	K. I. Asha	C. Visalakshi Chandra S.N. Rahana A. Asha Devi P. Murugesan Kalidas Pati N. Krishna Radhika L.K. Bharathi K.M. Senthilkumar V.B.S. Chauhan T.P. Sujatha K. Hanume Gowda M. Nedunchezhiyan T. Makeshkumar M.L. Jeeva S.S. Veena E.R. Harish H. Kesava Kumar A.N. Jyothi J. Sreekumar T. Krishnakumar R. Arutselvan Saravanan Raju P.S. Sivakumar C. Pradeepika
II	HORTCTCRISIL 202001001466 Mega Project 2: Genetic Improvement of tuber crops through conventional breeding and molecular approaches.	C. Mohan	
1	Project 1: Breeding to evolve trait-specific varieties in cassava, yams and arrowroot for productivity, earliness, quality and resistance to biotic stresses.	S. N. Rahana	C. Mohan K.I. Asha A. Asha Devi N. Krishna Radhika K.M. Senthilkumar C. Visalakshi Chandra T.P. Sujatha T. Makeshkumar A.N. Jyothi J. Sreekumar T. Krishnakumar S. Sunitha P. Prakash K. Susan John D. Jaganathan G. Suja

2	Project 2: Map based cloning of CMD resistant gene(s) & identification of markers associated with drought tolerance and high starch content in cassava.	C. Mohan	K.M. Senthilkumar T. Makeshkumar A.N. Jyothi J. Sreekumar Saravanan Raju
3	Project 3: Genetic analysis and QTL mapping for determining genetic basis of PPD tolerance and enhanced shelf life in cassava.	C.Visalakshi Chandra	K.I. Asha S.N. Rahana A.N. Jyothi J. Sreekumar Saravanan Raju C. Pradeepika
4	Project: 4 Genome analysis, identification and functional characterization of early bulking genes in cassava, abiotic stress and tuberization responsive genes in sweet potato.	K.M. Senthilkumar	C. Mohan N. Krishna Radhika J. Sreekumar Saravanan Raju
5	Project 5: Molecular characterization of nutrient homeostasis in tubers for biofortification of cassava.	T.P. Sujatha	A.N. Jyothi J. Sreekumar
6	Project 6: Phenomics approaches for physiological trait-based breeding for drought and PPD tolerance in cassava.	C. Mohan	N. Krishna Radhika K.M. Senthilkumar C. Visalakshi Chandra J. Sreekumar Saravanan Raju V.S. Santosh Mithra
7	Project 7: Breeding and evaluation for development of high yielding nutritionally enriched, photo insensitive, processable and multipurpose sweet potato varieties.	Shirly Raichal Anil	C. Visalakshi Chandra E.R. Harish A.N. Jyothi J. Sreekumar Saravanan Raju
8	Project 8: Harnessing the genetic potential of wild <i>Ipomoea</i> spp. through wide hybridization for improvement of sweet potato.	L.K. Bharathi	Kalidas Pati C. Visalakshi Chandra T. Makeshkumar E.R. Harish S. Sunitha
9	Project 9: Breeding for development of high starch, anthocyanin and beta carotene rich varieties in sweet potato and high yielding nutritional rich varieties in yam bean.	Kalidas Pati	V.B.S. Chauhan K. Hanume Gowda M. Nedunchezhiyan K. Lakshminarayana R. Arutselvan
10	Project 10: Genetic improvement for drought tolerance in sweet potato and high yielding, disease tolerant nutritionally rich lines in taro.	V.B.S. Chauhan	Manas Ranjan Sahoo Kalidas Pati K. Hanume Gowda M. Nedunchezhiyan K. Lakshminarayana R. Arutselvan
11	Project 11: Genetic improvement of sweet potato for drought and salinity stress tolerance.	K. Hanume Gowda	Manas Ranjan Sahoo Kalidas Pati V.B.S. Chauhan K.M. Senthilkumar K. Lakshminarayana Saravanan Raju

12	Project 12: Genetic improvement of edible aroids for resistance to biotic stress and quality parameters.	A. Asha Devi	Shirly Raichal Anil Manas Ranjan Sahoo N. Krishna Radhika K.M. Senthilkumar S.S. Veena S. Sunitha
13	Project 13: Developing breeder seed standards and precocity of genetic vigour for tropical tuber crops.	P. Murugesan	Shirly Raichal Anil Kalidas Pati R. Arutselvan
14	Project 14: Inducing genetic variability, characterization, grouping and developing breeding lines with large tuber size and short duration in Chinese potato.	P. Murugesan	L.K. Bharathi C. Visalakshi Chandra T.P. Sujatha P.S. Sivakumar H. Kesavakumar R. Muthuraj
15	Project 15: Development of DNA barcode standards and RNA secondary structure predictions in sweet potato.	Manas Ranjan Sahoo	Kalidas Pati C. Visalakshi Chandra K. Hanume Gowda
III	HORTCTCRISIL 202001101465 Mega Project 3: Resource management and climate smart agriculture for sustainable production of tropical tuber crops	G. Suja	
1.	Project 1: Crop diversification involving tropical tuber crops	G. Suja	G. Byju S. Sunitha J. Suresh Kumar D. Jaganathan E.R. Harish S.S. Veena A.N. Jyothi K. Sunilkumar
2.	Project 2: Weed management in tropical tuber crops	J. Suresh Kumar	S. Sunitha P. Prakash S.S. Veena
3.	Project 3: Precision management of water and nutrients in tropical tuber crops	S. Sunitha	G. Suja V. Ramesh J. Suresh Kumar
4.	Project 4: Drip irrigation and fertigation management in greater yam	M. Nedunchezhiyan	Kalidas Pati
5.	Project 5: Sustainable nutrient management in tropical tuber crops	K. Laxminarayana	M. Nedunchezhiyan K. Susan John J. Suresh Kumar Kalidas Pati J. Sreekumar A.N. Jyothi
6.	Project 6: Long term integrated nutrient management in tropical tuber crops	K. Susan John	S. Sunitha R. Muthuraj V. Ramesh J. Suresh Kumar S.S. Veena T. Makeshkumar
7.	Project 7: Soil carbon quality and conservation studies in tropical tuber crops	V. Ramesh	S. Sunitha H. Kesava Kumar

8.	Project 8: Climate change adaptation and mitigation in tropical tuber crops	V. Ramesh	K. Susan John Saravanan Raju J. Suresh Kumar P. Prakash
9.	Project 9: Physiological studies related to climate change in tropical tuber crops	Saravanan Raju	J. Sreekumar K.M. Senthilkumar
IV	HORTCTCRISIL202001201468 Mega Project 4: Quality planting material production of tropical tuber crops	R. Muthuraj	
	Project 1: Developing innovative techniques for seed production in tropical tuber crops and quality planting material production in cassava, sweet potato and Chinese potato.	R. Muthuraj	K. Sunil kumar G. Suja K. Susan John M. Nedunchezhiyan K. Laxminarayana P. Sethuraman Sivakumar D. Jaganathan T. Makeshkumar Saravanan Raju T. Krishnakumar J. Suresh Kumar V.B.S. Chauhan
	Project 2: Investigations on rapid multiplication of yams and aroids.	K. Sunilkumar	R. Muthuraj G. Suja M. Nedunchezhiyan K. Laxminarayana J. Suresh Kumar V.B.S. Chauhan
V	HORTCTCRISIL202001301469 Mega Project 5: Development of innovative technologies for the intensification of pest management in tuber crops through biorational approach	E.R. Harish	
1	Project 1: Management of important pests and documentation of emerging pests in tuber Crops.	E.R. Harish	B.G. Sangeetha H. Kesava Kumar R. Arutselvan V.S. Santhosh Mithra K. Susan John CC-PI Berin Pathrose, KAU
2	Project 2: Characterization of sweet potato weevil (<i>Cylas formicarius</i> (Fabricius)) resistance genes in sweet potato and related <i>Ipomoea</i> spp.	B.G. Sangeetha	E.R. Harish Shirly Raichal Anil J. Sreekumar CC-PI T. Santhoshkumar, KAU. P.S. Benher Lal, GKVK, UAS. N. Nagesh, GKVK, UAS.
3	Project 3: Screening of newer molecules and biocontrol agents for the management of nematodes in tuber crops.	H. Kesava Kumar	E.R. Harish B.G. Sangeetha M. L. Jeeva CC-PI: K. M. Anes, ICAR-CPCRI

VI	HORTCTCRISIL202001401470 Mega Project 6: Development and refinement of integrated disease management and forecasting system for improved tuber crop production	M.L. Jeeva	
1	Project 1: Emerging fungal diseases and management strategies for major diseases of aroids.	S.S. Veena	M. L. Jeeva R. Arutselvan G. Suja V.S. Santhosh Mithra J. Sreekumar CC-PI K.N. Anith, KAU
2	Project 2: Fungal pathogens and disease management in cassava and yams.	M.L. Jeeva	S.S. Veena T. Makeshkumar R. Arutselvan H. Kesava Kumar K. Susan John Saravanan Raju V.S. Santhosh Mithra C. Visalakshi Chandra
3	Project 3: Virus and phytoplasma diseases of tropical tuber crops and their management.	T. Makeshkumar	M. L. Jeeva S.S. Veena R. Arutselvan M.N. Sheela Shirly Raichel Anil A. Asha Devi J. Sreekumar V.S. Santhosh Mithra
4	Project 4: Mass production and effective utilization of bioagents to manage fungal diseases of tuber crops.	R. Arutselvan	M. L. Jeeva S.S. Veena T. Makeshkumar H. Kesava Kumar E.R. Harish M. Nedunchezhiyan K. Laxminarayana Kalidas Pati
VII	HORTCTCRISIL202001501471 Mega Project 7: Development and refinement of post-harvest handling, storage and processing techniques for minimization of losses in tropical tuber crops and production of value added products	M.S. Sajeev	
1	Project 1: Non-conventional applications of cassava starch in construction and building materials.	M.S. Sajeev	A.N. Jyothi T. Krishnakumar C. Pradeepika E.R. Harish
2	Project 2: Development of cassava and sweet potato based animal feed.	M.S. Sajeev	A.N. Jyothi T. Krishnakumar CC-PI E. Sanal, ICAR-CMFRI, Kochi. S. Chandrasekar, ICAR-CMFRI, Kochi. Pratap Chandra Das, ICAR-CIFA, Bhubaneswar. K. Ambasankar, ICAR-CIBA, Chennai. Sarjan Rao, Andhra Pradesh Veterinary University, Tirupathi.

3	Project 3: Development of modified starches of cassava and functional characterization of lesser known tropical tuber starches.	A.N. Jyothi	M.S. Sajeev P. Prakash
4	Project 4: Design and development of pre and post-harvest machineries/storage systems in tuber crops.	T. Krishnakumar	M.S. Sajeev A.N. Jyothi C. Pradeepika
5	Project 5: Quality changes associated with post-harvest storage/processing and development of value added functional foods from cassava and sweet potato.	C. Pradeepika	M.S. Sajeev A.N. Jyothi T. Krishnakumar M. Nedunchezhiyan Kalidas Pati C. Visalakshi Chandra CC-PI P. Nisha, CSIR-NIIST, TVPM
VIII	HORTCTCRISIL202001601472 Mega Project 8: Developing methodologies and tools for assessment and transfer of tuber crops technologies.	Sheela Immanuel	
1	Project 1: Technological interventions and documentation of farmer's innovations including ITKs in tropical tuber crops.	D. Jaganathan	P. Sethuraman Sivakumar Sheela Immanuel P. Prakash V.S. Santhosh Mithra G. Suja R. Muthuraj P. Murugesan H. Kesava Kumar T. Krishnakumar M. Nedunchezhiyan CC-PI Mahesh Tengli, Assistant Professor, CPGAS, CAU, Umiam
2	Project 2: Upscaling tuber crops technologies for promoting food and nutritional security.	P. Sethuraman Sivakumar	Sheela Immanuel P. Prakash J. Sreekumar T. Krishnakumar M. Nedunchezhiyan K. Laxminarayana CC-PI Sandeep K Panda, Kalinga Institute of Industrial Technology, Odisha. Ipsa Mohapatra, Kalinga Institute of Medical Sciences, Odisha. M. Elavarasan, SMS (Hort.), KVK, Tenkasi, Tamil Nadu. B. Shanmugasundaram, Professor, RARS Pattambi, Kerala. Mahesh Tengli, Assistant Professor, CPGAS, CAU, Umiam. P. Mooventhan, Senior Scientist, ICAR-NIBSM, Raipur, Chhattisgarh. Bineeta Satpathy, Associate Professor, RPCAU, Pusa, Samastipur, Bihar. R. Sasikumar, NEHU, Tura, Meghalaya.

Research Projects

3	Project 3: Mapping of women's empowerment in tuber crops cultivation for engendering research and development.	Sheela Immanuel	D. Jaganathan P. Sethuraman Sivakumar P. Prakash
4	Project 4: Impact assessment of technologies of tropical tuber crops.	P. Prakash	D. Jaganathan Sheela Immanuel J. Sreekumar CC-PI Prabhat Kishore, Scientist, ICAR-NIAP, New Delhi.
5	Project 5: Development of intelligent smart technologies for tuber crops.	V.S. Santhosh Mithra	D. Jaganathan S. Sunitha
6	Project 6: Generation and application of statistical and bioinformatics tools for tuber crops research and development.	J. Sreekumar	K.M. Senthilkumar C. Visalakshi Chandra T.P. Sujatha A.N. Jyothi

List of (New) Ongoing Projects

Date of start: 01 April 2025

Date of completion: 31 March 2030

Sl. No.	Project Title	Mega project leader/ Project leaders/ Principal investigators	Project associates/ Co-principal investigators
1	HORTCTCRISIL202501601473 Mega Project 1: Genetic resources management and sustainable improvement of tropical tuber crops.	Manas Ranjan Sahoo	
1	Project 1: Collection, characterization, conservation, documentation and utilization of genetic resources of tropical tuber crops.	K.I. Asha	Manas Ranjan Sahoo P. Murugesan C. Mohan A. Asha Devi N. Krishna Radhika Kalidas Pati C. Visalakshi Chandra K.M. Senthilkumar K. Hanume Gowda S.N. Rahana T. Makesh Kumar M.L. Jeeva S.S. Veena E.R. Harish H. Kesava Kumar R. Arutselvan A.N. Jyothi C. Pradeepika J. Sreekumar
2	Project 2: Genetic improvement of cassava through gene editing for modified starch. (Flagship project)	N. Krishna Radhika	K.M. Senthilkumar T.P. Sujatha T. Makesh Kumar A.N. Jyothi

3	Project 3: Breeding cassava for CMD resistance and drought tolerance using genomic and phenomic approaches.	C. Mohan	K.I. Asha N. Krishna Radhika K.M. Senthilkumar T. Makeshkumar J. Sreekumar Saravanan Raju V.S. Santhosh Mithra
4	Project 4: Breeding for development of short duration and postharvest physiological deterioration (PPD) tolerant varieties in cassava.	C. Visalakshi Chandra	P. Murugesan K.I. Asha K.M. Senthilkumar T. Makeshkumar J. Sreekumar J. Suresh Kumar D. Jaganathan R. Muthuraj
5	Project 5: Functional characterization of early bulking and drought responsive genes in cassava.	K.M. Senthilkumar	K.I. Asha C. Mohan N. Krishna Radhika C. Visalakshi Chandra J. Sreekumar Saravanan Raju
6	Project 6: Understanding the molecular mechanism of nutrient metabolism in cassava for biofortification.	T.P. Sujatha	N. Krishna Radhika A.N. Jyothi J. Sreekumar Jeena Mathew CC-PI R. Beena, KAU, Vellayani
7	Project 7: Genetic improvement of sweet potato for short duration, photo/thermo-insensitivity and processability.	Shirly Raichal Anil	C. Visalakshi Chandra A.N. Jyothi C. Pradeepika S. Sunitha Saravanan Raju P.S. Sivakumar
8	Project 8: Genetic improvement of sweet potato for biofortification and nutritional quality.	Kalidas Pati	Shirly Raichal Anil K. Hanume Gowda R. Arutselvan K. Laxminarayana CC-PI Awadhesh Kumar, ICAR-CRRI, Cuttack, Odisha
9	Project 9: Genetic improvement of sweet potato for drought and salinity stress tolerance.	K. Hanume Gowda	Kalidas Pati C. Visalakshi Chandra R. Arutselvan C. Pradeepika Saravanan Raju K. Laxminarayana M. Nedunchezhiyan
10	Project 10: Ploidy manipulation and Wide hybridization in sweet potato and its wild relatives to combat biotic and abiotic stress.	L.K. Bharathi	P. Murugesan E.R. Harish V. Ramesh

Research Projects

11	Project 11: Genetic improvement of yam for yield, earliness, anthracnose resistance and tuber quality.	S.N. Rahana	C. Mohan Kalidas Pati K.M. Senthilkumar M.L. Jeeva A.N. Jyothi J. Sreekumar K. Sunilkumar
12	Project 12: Genetic improvement in elephant foot yam for yield, earliness, quality and biotic stress.	A. Asha Devi	Shirly Raichal Anil K.M. Senthilkumar S.S. Veena H. Kesava Kumar A.N. Jyothi S. Sunitha K. Sunilkumar
13	Project 13: Genetic improvement of taro for leaf blight resistance and nutritional quality.	Manas Ranjan Sahoo	A. Asha Devi L.K. Bharathi S.S. Veena K. Hanume Gowda J. Sreekumar J. Suresh Kumar
14	Project 14: Genetic variability studies in Chinese potato, arrowroot and yam bean for economic traits through mutation and conventional breeding.	P. Murugesan	L.K. Bharathi Kalidas Pati T.P. Sujatha K. Hanume Gowda H. Kesava Kumar C. Pradeepika CC-PI V. Arunachalam, JNTBGRI, Palode. Awadhesh Kumar, ICAR-CRRI, Cuttack, Odisha.
II	HORTCTCRISIL202501601474 Mega Project 2: Sustainable and climate smart production of tropical tuber crops.	S. Sunitha	
1	Project 1: Resilient cropping systems and urban farming involving tropical tuber crops.	S. Sunitha	G. Suja J. Suresh Kumar S.S. Veena M. Nedunchezhiyan V. Ramesh C. Pradeepika K. Laxminarayana K. Sunilkumar Jeena Mathew
2	Project 2: Integrated weed management in tropical tuber crops.	J. Suresh Kumar	S. Sunitha S.S. Veena
3	Project 3: Precision farming in tropical tuber crops.	K. Sunilkumar	G. Suja J. Suresh Kumar S. Sunitha V. Ramesh Jeena Mathew A.N. Jyothi V.S. Santhosh Mithra

Research Projects



4	Project 4: Responsible plant nutrition in tropical tuber crops.	Jeena Mathew	J. Suresh Kumar S. Sunitha V. Ramesh K. Susan John Saravanan Raju T. Makeshkumar E.R. Harish V.S. Santhosh Mithra J. Sreekumar
5	Project 5: Sustainable soil fertility management for tropical tuber crops in Eastern India.	K. Laxminarayana	V. Ramesh K. Susan John R. Arutselvan Kalidas Pati
6	Project 6: Regenerative farming in tropical tuber crops.	V. Ramesh	G. Suja J. Suresh Kumar S. Sunitha Jeena Mathew A.N. Jyothi K. Susan John Saravanan Raju T. Krishnakumar B.G. Sangeetha
7	Project 7: Physiological approaches for abiotic stress resilience in tropical tuber crops.	Saravanan Raju	J. Suresh Kumar V. Ramesh K.M. Senthilkumar
8	Project 8: Sustainable seed systems with rapid techniques for quality planting material production of tropical tuber crops.	R. Muthuraj	J. Suresh Kumar S. Sunitha V. Ramesh K. Sunilkumar G. Suja Saravanan Raju T. Makeshkumar
III	HORTCTCRISIL202501601475 Mega Project 3: Biotic stress management in tropical tuber crops.	T. Makeshkumar	
1	Project 1: Ecofriendly management of important and emerging pests of tropical tuber crops.	E.R. Harish	T. Makeshkumar S. S. Veena H. Kesava Kumar B.G. Sangeetha K. Susan John V.S. Santhosh Mithra CC-PIs Berin Pathrose, KAU.
2	Project 2: Plant parasitic nematode management and utilization of entomopathogenic nematodes for pest management in tuber crops.	H. Kesava Kumar	S. S. Veena E.R. Harish B.G. Sangeetha P. Murugesan CC-PIs M. Elavarasan, RVS KVK- Tenkasi. K. M. Anes, ICAR-CPCRI.

3	Project 3: Management of viruses under changing climate in tropical tuber crops.	T. Makeshkumar	M.L. Jeeva S.S. Veena B.G. Sangeetha R. Arutselvan P. Murugesan C Visalakshi Chandra A. Asha Devi V.S. Santhosh Mithra
4	Project 4: Integrated management of cassava stem and root rot (CSRR).	M.L. JeevaW	T. Makeshkumar S.S. Veena R. Arutselvan Jeena Mathew K.I. Asha
5	Project 5: Molecular insights for developing resistance mechanisms in <i>Ipomoea batatas</i> from wild <i>Ipomoea</i> spp. against sweet potato weevil.	B.G. Sangeetha	T. Makeshkumar E.R. Harish Shirly Raichal Anil J. Sreekumar CC-PIs T. Santhoshkumar, KAU. B. Singaravelu, ICAR-SBI.
6	Project 6: Pathogen characterization and integrated disease management in taro and yams.	R. Arutselvan	T. Makeshkumar M.L. Jeeva S.S. Veena Kalidas Pati K. Hanume Gowda V.S. Santhosh Mithra
7	Project 7: Advancing the management of fungal diseases in elephant foot yam and minor tuber crops.	S.S. Veena	T. Makeshkumar M.L. Jeeva E.R. Harish H. Kesava Kumar B.G. Sangeetha R. Arutselvan Jeena Mathew A. Asha Devi J. Sreekumar V.S. Santhosh Mithra CC-PIs A. Kumar, ICAR- IARI.
IV	HORTCTCRISIL202501601476 Mega Project 4: Innovative industry friendly value added products and post-harvest technologies of tropical tuber crops.	M.S. Sajeev	
1	Project 1: Development and promotion of tuber crops-based innovative value-added food products.	C. Pradeepika	M.S. Sajeev A. N. Jyothi T. Krishnakumar CC-PIs P. Nisha, CSIR, NIIST.

2	Project 2: Development, refinement and upscaling of cassava starch based industrial products.	A.N. Jyothi	M.S. Sajeev J. Sreekumar P. Prakash CC-PIs Rajeev K. Sukumaran, CSIR-NIIST. Manoj Komath, SCTIMST, Thiruvananthapuram. K.P. Sudheer, KAU, Thrissur.
3	Project 3: Development of animal feed formulations from tuber crops.	M.S. Sajeev	A.N. Jyothi T. Krishnakumar S.S. Veena M. Nedunchezhiyan CC-PIs Rajeev K. Sukumaran, CSIR-NIIST. E. Sanal, ICAR-CMFRI, Kochi. S. Chandrasekhar, ICAR-CMFRI, Kochi. K. Ambasankar, ICAR-CIBA, Chennai. ICAR-NRC Pig, Guwahati. ICAR-CIRG, Makhdoom. ICAR-NIANP, Bangalore.
4	Project 4: Development of machinery and Post-harvest storage techniques for tuber crops.	T. Krishnakumar	M.S. Sajeev C. Mohan C. Pradeepika J. Suresh Kumar CC-PIs K.P. Sudheer, KAU, Thrissur. T. Senthil Kumar, ICAR-CIAE, Coimbatore. S. Anandakumar, NIFTEM-T. S. Parveen, TNAU, Coimbatore.
V	HORTCTCRISIL202501601477 Mega Project 5: Research-Extension framework for strengthening tuber crops through climate adaptations, digital solutions and livelihood empowerment.	V.S. Santhosh Mithra	
1	Project 1: Developing a stakeholder driven approach for prioritizing tuber crop research and extension.	P. Sethuraman Sivakumar	P. Prakash V.S. Santhosh Mithra C. Visalakshi Chandra J. Suresh Kumar E.R. Harish C. Pradeepika CC-PIs Dr. Bineeta Satpathy, Associate Professor, RPCAU, Samastipur, Bihar. Dr. B. Shanmugasundaram, Professor, RARS, KAU, Pattambi.

2	Project 2: Assessment of climate change vulnerability and adaptation in tropical tuber crops farming.	D. Jaganathan	Sheela Immanuel P. Prakash V.S. Santhosh Mithra J. Sreekumar V. Ramesh Saravanan Raju
3	Project 3: Empirical assessment of tuber crops value addition technologies on the livelihood of women and youth.	Sheela Immanuel	D. Jaganathan P. Prakash M.S. Sajeev
4	Project 4: Impact assessment and value chain analysis of tropical tuber crops.	P. Prakash	P. Sethuraman Sivakumar D. Jaganathan Sheela Immanuel J. Sreekumar J. Suresh Kumar V. Ramesh K. Sunilkumar
5	Project 5: Smart and AI solutions for strengthening tuber crops value chain.	V.S. Santhosh Mithra	S. Sunitha
6	Project 6: Integration of multi-omics GIS and AI for advanced data analytics in tropical tuber crops.	J. Sreekumar	C. Visalakshi Chandra J. Suresh Kumar K.M. Senthilkumar C. Mohan Jeena Mathew B.G. Sangeetha T.P. Sujatha

External Funded Projects

Sl. No.	Project Title	Funding agency	Principal investigators	Co- principal investigators	Total Budget (in lakhs)	Budget 2025-26 (in lakhs)
1	Establishment of varietal gene bank and development of standards of DUS testing for varietal gene bank in sweet potato and cassava	PPV & FRA, New Delhi.	C. Visalakshi Chandra	K.I. Asha A. Asha Devi Shirly Raichal Anil N. Krishna Radhika	99.03	7.79
2	Establishment of varietal gene bank and development of standards of DUS testing for varietal gene bank in yam bean and greater yam	PPV & FRA, New Delhi.	S.N. Rahana	J. Sreekumar P. Murugesan	33.84	9.40
3	Establishment of varietal gene bank and development of standards of DUS testing for varietal gene bank in taro and elephant foot yam	PPV & FRA, New Delhi.	Kalidas Pati	-	32.19	6.99
4	Establishment of varietal gene bank and development of standards of DUS testing for varietal gene bank in greater yam and yam bean	PPV & FRA, New Delhi.	Kalidas Pati	R. Arutselvan	27.77	7.24

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5	Establishment of varietal gene bank and development of standards of DUS testing for varietal gene bank in sweet potato and cassava	PPV & FRA, New Delhi.	Kalidas Pati	Hanume Gowda	32.24	6.99
6	ICAR-CIP collaborative work plan activity on crop improvement and varietal selection of sweet potato	International Potato Centre (CIP), New Delhi.	Shirly Raichal Anil	C. Visalakshi Chandra Associates: A.N. Jyothi, Saravanan Raju, V.S. Santhosh Mithra, P. Sethuraman Sivakumar	67.76	12.00
7	Microtuber production and gene prospecting for hotoresponsive tuberization in <i>Ipomoea batatas</i> (L.) Lam.	DST -SERB project (CRG/2021/001077)	Shirly Raichal Anil	N. Krishna Radhika K.M. Senthil Kumar	49.86	1.50
8	Collection and database creation of important named landraces of tuber crops from southern districts of Kerala	Kerala State Biodiversity Board (KSBB), Govt. of Kerala.	K.I. Asha	A. Asha Devi Shirly Rachal Anil N. Krishna Radhika	8.0	Nil
9	Establishment of aeroponics system for production of minitubers in sweet potato and greater yam to fulfill the quality planting material requirement of Odisha	RKVY, Odisha.	K. Hanume Gowda	M. Nedunchezhiyan R. Arutselvan Kalidas Pati	140.23	45.00
10	All-India Network Programme on Organic Farming (AINP-OF)	ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut, Uttar Pradesh.	G. Suja	G. Byju S. Sunitha S.S. Veena A.N. Jyothi D. Jaganathan	165.55	20.13
11	Adoption of bio-fortified varieties of tuber crops and promoting entrepreneurship development for livelihood and nutritional security of tribal farmers	Directorate of Horticulture, Govt. of Odisha.	K. Laxminarayana	M. Nedunchezhiyan R. Arutselvan M.S. Sajeev B.B. Das	138.00	52.00
12	AICRP on Tuber Crops, ICAR-CTCRI, TVPM Centre	AICRP on Tuber Crops, ICAR-CTCRI.	K. Susan John	A. Asha Devi Shirly Raichal Anil C. Visalakshi Chandra S.N. Rehana S.S. Veena	108.70	12.50
13	AICRP on Tuber Crops, Regional Station, ICAR-CTCRI, Bhubaneswar Centre	AICRP on Tuber Crops, ICAR-CTCRI.	M. Nedunchezhiyan	Kalidas Pati	56.01	8.00
14	ICAR-CRP on Vaccines & diagnostics: Development and application of diagnostics to viruses infecting tuber crops (cassava, elephant foot yam, sweet potato and yams)	ICAR-CRP on vaccines and diagnostics, New Delhi.	T. Makeshkumar	M.L. Jeeva R. Arutselvan R. Muthuraj	62.45	21.60

15	Establishment of mass production unit of bio-agents for ecofriendly disease management in vegetable crops of Odisha	RKVY, Odisha.	R. Arutselvan	Kalidas Pati K. Hanume Gowda M. Nedunchezhiyan K. Laxminarayana	320.91	104.80
16	Bioersity International & CIAT Alliance Collaborative Project No 5.1: Germplasm exchange, improvement and testing advanced clean seed technology in Cassava (<i>Manihot esculenta</i> Crantz)	ICAR-Bioersity International & CIAT Alliance.	T. Makeshkumar	G. Byju K.I. Asha S. Sunitha C. Visalakshi Chandra K.M. Senthilkumar P. Murugesan R. Muthuraj	53.89	18.90
17	Development of smart foods, bio-composites, green packaging and bio-energy from agroresidues	NASF, ICAR, New Delhi.	M.S. Sajeev	T. Krishnakumar A.N. Jyothi S.S. Veena	87.85	9.80
18	AICRP on Post-harvest Engineering & Technology	ICAR, New Delhi.	M.S. Sajeev	T. Krishnakumar	55.95	10.00
19	IP & TM Scheme 'National Agricultural Innovation Fund (NAIF)' Component I : Innovation fund	ICAR, New Delhi.	P. Sethuraman Sivakumar	T. Krishnakumar P. Prakash	86.44	30.44
20	IP & TM Scheme: National Agricultural Innovation Fund (NAIF)' Component II : Incubation fund	ICAR, New Delhi.	P. Sethuraman Sivakumar	M. Nedunchezhiyan T. Krishnakumar Satellite Incubation Centre Team: C. Sharmila Bharathi, Head KVK, Kallakurichi; Ashok Chhetri, Assistant Professor, MTTC & VTC, College of Fisheries, Lembucherra, Tripura; B. Shanmugasundaram, Professor, RARS, KAU, Pattambi; Mahesh B. Tengli, Assistant Professor, CPGSAS, CAU, Umiam, Meghalaya.	134.50	81.50
21	Soil health management in coconut based cropping system involving tuber crops for enhanced yield and income	Coconut Development Board, Kochi, Ministry of Agriculture and Farmers' Welfare, Government of India.	D. Jaganathan	G. Byju G. Suja	33.00	12.00
22	Smart cassava farms: Validation and upscaling of AI & an IoT device	Kerala State Planning Board.	V.S. Santhosh Mithra	G. Byju J. Sreekumar D. Jaganathan	34.76	8.15256

23	Rainbow diet campaign for Odisha development and scaling up customized rainbow diet food matrices for combating malnutrition among children in Keonjhar District, Odisha.	Government of Odisha.	Project team leader: G. Byju Principal investigators: P. Sethuraman Sivakumar M.Nedunchezhiyan	T. Krishnakumar Hanume Gowda S.K. Jata	682.00	209.92
24	Development of biofortified sweet potato value chain for industrial production in Telangana, Karnataka and Odisha	Xobu Foods and Beverages Private Limited, Hyderabad.	M.Nedunchezhiyan	G. Byju P. Sethuraman Sivakumar V. Ramesh	6.8272	6.8272
25	Development of value-added products from <i>Mudali</i> (<i>Colocasia esculenta</i>) and <i>Kone</i> (<i>Dioscorea</i>)	Spudnik Farms, Bengaluru.	M.S. Sajeev	T. Krishnakumar C. Pradeepika	6.48	Nil
26	Use of red mud for soil amelioration and development of red mud area for cultivation at Vedanta Limited, Lanjigarh, Odisha	Vedanta Limited, Lanjigarh, Odisha	V. Ramesh	M. Nedunchezhiyan, G. Byju P. Sethuraman Sivakumar	30.29	15.14

Special Category Projects

Sl. No	Title	PI	Co-PIs	Funding agency	Total Budget up to March 2025 (in lakhs)	Budget 2025-26 (in lakhs)
1.	Empowering scheduled caste tuber crop farmers through sustainable use of resources and technologies	K. Sunilkumar	G. Byju M.S. Sajeev V. Ramesh C. Mohan, E.R. Harish P. Prakash Jeena Mathew S.N. Rahana	ICAR - CTCRI - SCSP	239.70	70.00
2.	Livelihood improvement of tribal farmers through tuber crops technologies	M.Nedunchezhiyan	G. Byju R. Muthuraj V.S. Santhosh Mithra Kalidas Pati K. Hanume Gowda J. Suresh Kumar C. Pradeepika B.G. Sangeetha	ICAR - CTCRI - TSP	125.00	100.00
3.	Livelihood improvement of north - eastern hill (NEH) region farmers through tuber crops technologies	R. Muthuraj	G. Byju M.S. Sajeev V.S. Santhosh Mithra T. Krishnakumar P. Prakash R. Arutselvan	ICAR - CTCRI - NEH	106.93	10.00

RESEARCH ACHIEVEMENTS

INSTITUTE PROJECTS

CROP IMPROVEMENT

Conservation and utilization of germplasm of tuber crops for sustaining production

Germplasm conservation and evaluation at Head quarters

Germplasm status

A total of 5234 accessions comprising cassava (1329), sweet potato (1285), yams (852), aroids (1209) and minor tuber crops (559) were conserved in the field genebank of ICAR-CTCRI. Four hundred and thirty-five accessions of various tuber crops were collected from Gujarat, West Bengal, Chhattisgarh, Assam, Tripura, Manipur, Mizoram, Tamil Nadu and Andamans. A further set of 296 landraces of cassava, sweet potato, yams, aroids and minor tuber crops were collected from Kerala. Geotagged location maps were prepared for cassava, sweet potato and greater yam. IC number was assigned for 606 accessions (327 cassava accessions; 224 landraces comprising cassava (146), sweet potato (6), yams (18), aroids (52) and arrowroot (2); 35 arrowroot accessions; 10 each of Queensland arrowroot and Chinese potato) by NBPGR, New Delhi.

Cassava

A total of 1216 accessions were maintained in the field genebank of ICAR-CTCRI HQ for conservation and evaluation. A revised catalogue of cassava for 375 accessions for 51 traits was published and 25 core groups were identified. In cassava, promising lines with CMD resistance (25), high yield (20), high starch (12), carotene rich (IC652660, IC652744, IC652791) and erect plant type (15), high harvest index and resistance to CMD (IC652577, IC652592, IC652595, IC652608, IC652636); multi-traits with high harvest index, high yield and resistance to CMD (IC652570, IC652572, IC652592, IC652595, IC652604, IC652608, IC652612, IC652636) were identified.

Sweet potato germplasm

A total of 905 accessions of sweet potato are being

maintained in the field gene bank for conservation and characterization. Hundred and five accessions were characterized for 30 morphological traits (17 above ground traits, 2 petiole traits, 8 leaf traits and 13 tuber traits) as per IPGRI descriptor. Molecular characterization of 105 sweet potato accessions was done with 6 SSR markers. The 105 accessions grouped into 3 major clusters and 5 sub clusters. The percentage polymorphism observed was 83.3%.

In sweet potato, bench conservation was done for 230 accessions. Elite lines were identified in sweet potato for fried chips (S27); drought tolerance (SB21/57, 84x1 and Dhenkanal Local-2); salinity tolerant (SP12, SP13, SP23, SP27, SP33, SP42, SP44, SP45); early maturity (SP95/4, SP19, SP27, SP29); high yield (SP19, SP5, SP18, SP27, SP1); biofortified (minerals, vitamin C, protein, and antioxidant activity - CO3-50-33, S-19, KS-2, KS-12); moderate weevil resistance (S-1248, S-27, S-1470, S-1456) as well as multi trait fried chip lines having dry matter content (>20%), uniform tuber shape and size, flesh colour (cream), tuber weight (<250g) and absence of surface defects (S-27, S-1470, S-1653, S-1403, S-1401, S-1456, S-1668, S-1712). Four accessions have been submitted for registration under unique germplasm with NBPGR (S27-suitability for fried chips, SB21/57, 84x1 and Dhenkanal Local-2-drought tolerance).

Yams

A total of 801 yams accessions comprising greater yam (450), white yam (98), lesser yam (185), potato yam (3) and wild yam (65) were maintained in the field gene bank. In greater yam, promising lines were identified for high yield and resistance to anthracnose (60) and anthracnose resistance (51 - 28 resistant and 23 moderately resistant). Biofortified (anthocyanin rich) lines - Da 340 and Sree Neelima, were dedicated to the Nation by the Hon'ble PM in 2020 (among 17 biofortified varieties in 8 crops). In white yam, promising lines were identified for high yield (2) and profuse flowering (10). In lesser yam, high yielders (3) and *Yam Mild Mosaic Virus* negative clones (using DAC-ELISA) (De-24, De-28, De-34, De-42, De-58)

were identified. A genomic DNA isolation method without liquid nitrogen was developed for white yam and lesser yam using tuber samples.

Aroids

Under edible aroids, a total of 655 accessions comprising 409 taro, 200 elephant foot yam, 42 tannia and 4 *Alocasia* were maintained in the field genebank at ICAR-CTCRI, HQ. In taro, the promising lines identified include taro leaf blight resistant lines (16); high yielders (C-110 and C-553); accessions with less calcium oxalate content $<0.5\%$ (ADG/2022-1, TTr22-6, TTr22-5) and good shelf-life (upto 40 days) (IC204205). In elephant foot yam, the elite lines included root knot nematode resistant (TEy22-1 and TEy22-6) and high yielding lines (BCA-4, NDA-5, AD/R/2016-1, AC-67 and JAS-6). In tannia, two high yielding accessions with cormel yield $>10 \text{ t ha}^{-1}$ and total yield $>14 \text{ t ha}^{-1}$ (Xa-63 and Xa-AD/2014-18) were identified.

Minor tuber crops

A total of 387 minor tuber crops accessions comprising Chinese potato (150), yam bean (154), West Indian arrowroot (12), Queensland arrowroot (20), East Indian arrowroot (50) and *Curcuma zedoaria* (1) are maintained in the FGB. In East Indian arrowroot, one unique germplasm (IC641835) was registered with ICAR-NBPGR (INGR 25038) (Fig. 1). This was characterized by long primary rhizome (21 cm), highest recorded starch content (16.8%), and short crop duration. Elite germplasm identified included one accession each of Chinese potato (IC641830), yam bean (IC635945) and Queensland arrowroot (IC647797), developed with distinct qualitative traits. Chinese potato and yam bean accessions had high yield along with high starch content in tubers, while the Queensland arrowroot accession recorded high rhizome productivity with high starch content. In arrowroot, promising high yielders with high starch were identified (IC650786, IC650789, IC650785).



Fig. 1. Tubers of the unique germplasm (IC641835) of East Indian arrowroot and registration certificate (INGR 25038) received from ICAR-NBPGR

Germplasm conservation and evaluation at Regional Station

At the Regional Station (RS), a total of 1270 germplasm accessions were maintained in the field genebank comprising taro (510), sweet potato (380), cassava (113), yams (51), elephant foot yam (40), yam bean (165), Chinese potato (5), arrowroot (2), tannia (1) and *Alocasia* (3). Ten taro accessions were collected from Telangana (2), Karnataka (4), Bihar (2) and West Bengal (2).

Many elite lines biofortified accessions were identified in sweet potato viz., CO3-50-33 (highest P - 0.628% and Fe - 221.8 ppm content), S-19 (highest K - 1.21%), KS-2 (highest Mn - 284.1 ppm and protein content - 2.74 g 100g⁻¹), KS-12 (highest vitamin C - 29.94 mg 100g⁻¹ and the lowest IC50 value - 14.14 µg ml⁻¹, indicating the highest antioxidant activity).

In taro, biofortified genotypes were identified - CL-56 (highest phosphorus - 350.85 mg 100g⁻¹), and NEH-44 (highest potassium - 1027.20 mg 100g⁻¹), NEH-14 (highest iron - 10.91 mg 100g⁻¹), Megh-19 (highest manganese - 5.14 mg 100g⁻¹), Ciruli local (highest copper - 0.74 mg 100g⁻¹ and phenolic content - 4.57 mg gallic acid g⁻¹), Pipply (highest zinc - 5.63 mg 100g⁻¹), CL-56 (highest protein - 11.27 g 100g⁻¹), CE-12 (highest antioxidant activity - 15.93 µmol trolox g⁻¹) and Megh-18 (highest DPPH activity - 35.89%). Taro varieties Sree Hira and Sree Telia were notified in the Gazette of India

In yam bean also, biofortified genotypes were identified - RM1 (highest P - 0.292%), DPH6 (highest K - 0.357%), L.No.3 (highest vitamin C - 23.71 mg 100g⁻¹, highest Fe - 280.55 ppm and exhibited highest antioxidant activity with the lowest IC50 value of 462.47 µg ml⁻¹, L.No.19 (highest Mn - 86.59 ppm) and DPH10 (highest protein - 2.72 g 100g⁻¹).

Genetic variability of 30 sweet potato cultivars using 10 SSR markers showed average PIC value was 0.584

and the mean major allele frequency was 0.48. The observed heterozygosity (0.89) was higher than the expected heterozygosity (0.57). Jaccard's similarity coefficient ranged from 0.16 to 0.85, with an average of 0.64. A dendrogram grouped the cultivars into two main clusters. Genetic variability of 25 yam bean lines using 30 SSR markers revealed an average PIC value of 0.464. The mean major allele frequency was found to be 0.52, and the observed heterozygosity had a mean value of 0.76, which was higher than the expected heterozygosity value of 0.51. The dendrogram grouped the 25 yam bean lines into two main clusters.

***In vitro* gene bank at HQ**

At the HQ, *in vitro* germplasm was augmented with cassava (47), sweet potato (13), yams (31), taro (7) curcuma (9) and arrowroot (2). A total of 109 accessions are being maintained *in vitro*. Cryopreservation studies of yams pollen showed viability after 63 days of storage.

***In vitro* gene bank at Regional Station**

At the Regional Station, released varieties are maintained *in vitro*. These cultures include released varieties of cassava (10), sweet potato (11), varieties, taro (5) yam (4) and elephant foot yam (2). Four Chinese potato accessions are also maintained *in vitro*.

Bioprospecting of tuber crops

Toxicity studies in taro and *Xanthosoma violaceum* showed that, of the three doses (30, 60, and 120 $\mu\text{g ml}^{-1}$) of purple taro leaf extract tested, no toxicity was observed even at a dosage of 120 $\mu\text{g ml}^{-1}$ using tail regeneration study in Zebrafish larvae, 72 hours post-fertilization.

Anti angiogenic studies using ethanol extract prepared from purple coloured taro leaf ADSR (IC652061) and *Xanthosoma violaceum* - Xa-AAV/2022-11(VIOL) showed wound healing effect in both the extract. The IC50 value of ADSR (IC652061) was in the range 40-50 $\mu\text{g ml}^{-1}$.

Genetic improvement of tuber crops through conventional breeding and molecular approaches

Breeding to evolve trait specific varieties in cassava, yams and arrowroot for productivity, earliness, quality and resistance to biotic stresses

Six varieties were released, of which 3 were Central releases (Sree Kaveri, Sree Nakshathra and Sree

Karti) and the rest three were State releases. The crops include cassava-1 (Sree Kaveri); greater yam-1 (Sree Hima); white yam-1 (Sree Dhrona) and arrowroot-3 (Sree Nakshathra, Sree Karti, Sree Aadya). A total of 20 entries of these crops viz., cassava, yams, and arrowroot were tested under AICRP trials. Sree Dhrona, a white yam variety with compact tuber shape and high tuber yield even under non trailing condition got notified in The Gazette of India.

Under greater yam evaluation trials, the tuber yield of breeding lines of *D. alata* ranged from 1.91 to 28.39 t ha⁻¹. DAH 56 recorded the highest yield 28.89 t ha⁻¹, followed by DAH 403 (24.01 t ha⁻¹), DAH 10-12 (23.39 t ha⁻¹) and DAH 8-25 DUS (23.39 t ha⁻¹). DAH 56 also recorded the highest number of tubers per plant.

In white yam yield evaluation trials, the yield per plant ranged from 0.12 – 3.99 kg plant⁻¹. Dr 73 recorded the highest yield per plant. Among the semi dwarf breeding lines of white yam SD15 recorded the highest yield of 29.16 t ha⁻¹ followed by SD10 (28.64 t ha⁻¹) and SD23 (24.57 t ha⁻¹). Among the dwarf breeding lines of white yam, DRD 1160 recorded the highest yield (24.44 t ha⁻¹) followed by DRD 993 (21.42 t ha⁻¹) and DRD 1060 (21.00 t ha⁻¹).

Map based cloning of CMD resistant gene(s) and identification of markers associated with drought tolerance and high starch content in cassava

In cassava, phenotypic screening and biometric observation for 170 - CMD resistant and 100 - drought tolerant clones were completed. CMD resistant clones recorded 4-5 kg plant⁻¹ and drought resistant clones recorded 1.5-3 kg plant⁻¹. Thirty-five CMD resistant C₂ clones were subjected to biometric observation including CMD resistance. Yield per plant recorded was 4.5 – 6.0 kg plant⁻¹. Progenies were screened with CMD associated SSR markers and SSR28 and NS158 markers were found to be co-segregating with CMD. From drought specific transcriptome sequences, 175 SSR markers were identified. From this set, 10 SSR markers were validated in the drought mapping population (H-97 x 9S127). Phenotypic screening for CMD resistance was done and it was observed that disease segregated in the 3:1 ratio in 85 self-pollinated 9S127 C₁S₁ clones, thus confirming that the gene is in the monogenic condition.

Genetic analysis and QTL mapping for determining genetic basis of post-harvest physiological deterioration tolerance and enhanced shelf life in cassava

Evaluation of mapping population segregating for PPD tolerance/assessment of variability for PPD tolerance, yield and CMD resistance

The mapping population (300) segregating for PPD tolerance was phenotyped for PPD tolerance using visual assessment after harvesting, CMD resistance and yield. The analysis of variance for PPD response and other traits indicated significant differences for genotypes indicating the existence of significant variability among the progenies for all the traits studied and some progenies performed better than others. The tuber yield and CMD were highly skewed, while PPD was moderately skewed, explaining the genetic diversity among the F_1 progenies (Fig. 2). The average yield, CMD resistance and PPD observed were 39.56 t ha⁻¹, 2.05 and 2.19, respectively. Positive heterosis was recorded for tuber yield per plant indicating that the progenies outperformed the parents and

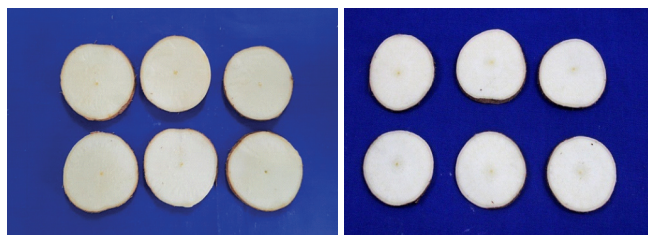


Fig. 2. PPD tolerance shown by cassava progenies

27.59% improvement over the mid-parent for tuber yield. Negative heterosis was observed for CMD and PPD and therefore, hybrid is more resistant/tolerant for CMD and PPD, respectively than the average of the parents.

Yield trials

Selected progenies (35) from mapping population were evaluated for traits such as root yield, total number of roots, number of marketable roots under on-station yield trials (PYT and AYT) during 2020-24. Five cassava progenies namely, 9SC-I-19, 9SC-I-13, 9SC-I-20, 9SC-I-23 and 9SC-I-26 were selected as best performers for on-farm trials and AICRP trials during 2024-25. The on-farm trial of the selected progenies was conducted in 3 different agroecological units (AEUs) of Kerala namely, AEU-10, AEU-9 and AEU-3 during 2024-25. The average yield recorded was 42.09 t ha⁻¹. The yield

of all the 5 breeding lines was higher than the check varieties across all AEUs. The average CMD and PPD score was 1 and 1.14 respectively. The average DMC recorded was 34.25%.

Molecular work

Parental Polymorphism and progeny screening:

The parental polymorphism survey of parents contrasting for PPD tolerance was done with 72 SSR markers. The genes coding for Amino cyclopropane 1 carboxylate, Phenyl alanine ammonia lyase, Catalase, Hydroxyproline rich glycoproteins, Linamarase were screened among the parents contrasting for PPD tolerance. Based on parental polymorphism studies, 24 markers were found to be polymorphic between the parents and were selected for progeny screening. The mapping population was screened with 15 markers so far. In addition, 140 SSR markers were designed based on transcriptome data analysis and 28 markers were validated.

Transcriptome analysis

The RNA-seq analysis of four transcriptome samples including tolerant control (T_0), tolerant treatment (T_7), susceptible control (S_0) and susceptible treatment (S_7) was done. Approximately, 23.43 million clean reads (94.77%) were uniquely mapped while only 1.70% was located in several positions. The total number of differentially expressed genes (DEGs) ranged from 261 to 1187. The number of DEGs in the T_7 S_7 comparison was higher than that of T_0 S_0 indicating effect of PPD on gene expression. 143 Gene Ontology terms related to biological process (BP), 26 related to molecular function (MF) category and 62 related to cellular component (CC) were identified in the T_7 T_0 comparison that outlined the resistance mechanism of Kalpaka, the PPD tolerant cassava genotype. Response to stimulus-abiotic, radiation, light, environment, stress and temperature, anatomical and reproductive structure development and metabolic process were the major gene functions related to PPD.

Genome analysis, identification and functional characterization of early bulking genes in cassava, abiotic stress and tuberization responsive genes in sweet potato

RT-PCR expression studies showed that three genes viz., *MeBRX*, *MeBRX2* and *MeBRX4* displayed enhanced expression in the early bulking genotype Vellayani Hraswa in comparison with the late bulking

genotype Sree Pavithra. Transcriptome analysis revealed that out of 35 genes studied in eleven cassava tissues, viz., OES, FEC, RAM, SAM, leaf, midvein, petiole, stem, lateral bud, fibrous root and storage root, ten genes viz., *MeRCBS2*, *MeOSAI*, *MeTGA4*, *MeATG8b*, *MeNPF5*, *MeTFII*, *MeKAT2*, *MeKUP3*, *MeKUP7* and *MeSBM1* displayed expression only in the storage root tissues of cassava. Genome-wide mining for microsatellite repeats resulted in identification of 17,671 genic (gene-based) markers and 28,231 non-genic (markers other than genic region) in cassava. Both genic and non-genic markers were found spanning in all the 18 chromosomes of cassava. These genome-wide markers will be used for mapping of genes and marker assisted breeding in cassava. Out of 26 SSR markers studied, four SSR markers viz., MeESSR34, MeESSR39, SSRY28 and SSRY45 displayed polymorphism among 32 cassava genotypes.

In sweet potato, out of ten genes studied, three genes *Pyrroline-5-carboxylate reductase (IbP5CR)*, *DREB transcription factor (IbCBF3)* and *ARF transcription factor (IbARF5)* displayed 2.7, 2.3 and 1.7 fold enhanced expression, respectively in the leaf tissues of the drought-tolerant variety Sree Kanaka in comparison with the drought sensitive variety Kanhangad local under drought stress conditions. Analysis of transcriptome datasets of sweet potato variety Sree Kanaka revealed that 967, 1461 and 109 genes were upregulated in the leaf, fibrous root and tuberous root tissues, respectively whereas, 904, 1264 and 2701 genes were down regulated in the leaf, fibrous root and tuberous root tissues, respectively during high temperature stress. Sixty genes were differentially regulated in the leaf, fibrous root and tuberous root tissues. Out of these, six genes viz., *DnaJ-domain, amino acid transporter 1 (AAT1)*, *Nuclear transport factor 2 (NTF2)*, *heat shock protein 90.1 (Hsp90.1)*, *Major facilitator superfamily protein, ABC transporter* and *hydrolase* were upregulated whereas, 26 genes were downregulated in the leaf, fibrous root and tuberous root tissues, respectively during high temperature stress. Genome-wide mining resulted in identification of 738 drought responsive candidate gene-based microsatellite markers and 126 tuberization gene responsive microsatellite markers in sweet potato. Out of 18 SSR markers studied, five SSR markers viz., Ib182, Ib2082, Ib244, Ib1845 and Ib346 displayed high polymorphism among 20 sweet potato genotypes.

Molecular characterisation of nutrient homeostasis in tubers for biofortification of cassava

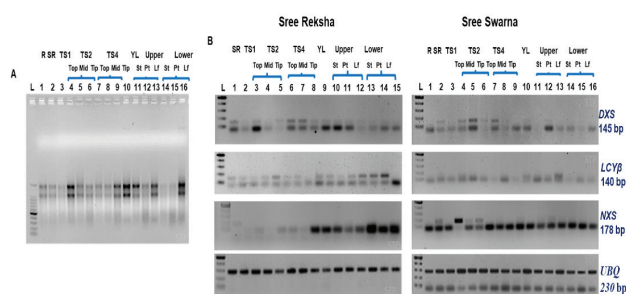
Total soluble protein content in the roots and tubers at different growth stages, stems and leaves from upper and lower regions, of seven cassava genotypes, at 6 and 8 months after planting (MAP) showed that aerial plant parts (stem and leaves) had higher protein content than lower region (roots and tubers). At 8 MAP, protein content declined in all plant parts when compared to 6 MAP, but there was no significant difference between 6 and 8 MAP. Sree Reksha and Sree Suvarna had higher protein content in tubers, but protein content in tuber stage 2 and 4 (TS2 and TS4) were not significantly different. Sree Swarna had higher protein content in leaves which was significantly higher when compared to other varieties. Thus, protein content declined with growth of tubers and plant growth stage.

Differential protein expression in Sree Vijaya and Sree Suvarna revealed differential expression of a small heat shock protein (sHSP) in roots, tubers and lower stem, but was absent from aerial plant parts. *In silico* analysis revealed the presence of 37 sHSPs in cassava genome in 18 chromosomes except chromosomes 3, 5 and 17. The 252 bp promoter region of sHSP with maximum hits in the promoter had several root-specific motifs.

Total carotenoid content was estimated at 5 MAP in white tuber (Vellayani Hraswa, NV23-1 and Sree Reksha) and yellow tuber varieties (Sree Swarna, NV-23-3 and Sree Prabha). The yellow colour of tubers correlated with carotenoid content and yellow colour intensified in cooked tubers. A breeding line NV23-3 had higher carotenoid content in tubers (485 IU) comparable to Sree Swarna (582 IU) and Sree Prabha (585 IU). At 11 MAP, the total carotenoid content of tubers declined.

Primers were designed for nine candidate genes involved in beta-carotenoid metabolism [*DXS* (1-deoxy-D-xylulose-5-phosphate synthase), *PSY* (phytoene synthase), *PDS* (phytoene desaturase), *CRISO* (carotenoid isomerase), *LCY β* (lycopene β -cyclase), *LCYE* (lycopene- ϵ -cyclase), *BCH* (β -carotenoid hydroxylases), *NCED* (9-cis epoxy carotenoid dioxygenase) and *NXS* (neoxanthin synthase) as well as two paralogues of *Orange* gene (*ORX1* and *ORX2*)] and PCR conditions were standardised using gradient PCR. Genomic DNA PCR

was carried out with 12 different cassava varieties, to verify mutations in primer-binding regions. A modified CTAB method with RNA precipitation using lithium chloride (LiCl_2), yielded RNA of good quality devoid of genomic DNA contamination in Sree Reksha and Sree Swarna. Differential gene expression analysis for eleven genes was carried out by semiquantitative RT-PCR using RNA isolated from various tissues of Sree Reksha (white tuber) and Sree Swarna (yellow tuber) varieties with the *ubiquitin* (*UBQ*) gene as control (Fig. 3).



(A) DNA-free total RNA isolated from all tissues of Sree Swarna using modified CTAB method with lithium chloride precipitation of RNA (B) Gene expression analysis semi-quantitative RT-PCR using candidate genes in various tissues of Sree Reksha and Sree Swarna. L - 100 bp DNA ladder. cDNA from roots (R), storage roots (SR), tuber stage 1 (TS1), tuber stage 2 (TS2), tuber stage 4 (TS4), top, middle (mid) and tip regions of tubers at TS2 and TS4, young leaves (YL), stem (St), petiole (Pt), leaf (Lf) from upper and lower regions of the plant. cDNA amplification of candidate genes *DXS*, *LCYβ*, and *NXS*, with amplification product size in bp. *UBQ* is the control gene *ubiquitin*

Fig. 3. Differential gene expression analysis of beta-carotenoid metabolism genes in cassava

Molecular mechanism of beta-carotenoid metabolism in Sree Reksha (white tuber) and Sree Swarna (yellow tuber) was identified. β -carotene was synthesized in Sree Reksha is due to higher expression of *PSY2* and *LCYβ* but was converted or hydrolysed into other compounds due to higher activity of *BCH* and *NCED*. In Sree Swarna, the yellow colour of tubers was probably due to higher expression of *CRISO*, *LCYε* and *NXS* resulting in all-trans-lycopene, α -carotene and neoxanthin, respectively and traces of β -carotene, due to *LCYβ* expression, which was retained due to down-regulation of *BCH* and *NCED*.

Single nucleotide polymorphism analysis in *PSY2* revealed G and A deletions in the 1287th and 1301st position in the exonic region in Sree Reksha, while G nucleotide insertion was observed between 1284th and 1285th position in Sree Swarna.

In silico analysis revealed sequence conservation and clustering of functionally related genes of betacarotenoid metabolism pathway (CBD genes). Genes *LCYε* and *NXS* were 93.3% and 66.5% similar, respectively to *LCYβ* indicating common evolutionary origin of these genes. Gene neighbourhood analysis of 16 CBD genes revealed that specific set of genes were associated and found in the vicinity of CBD genes (structural association), indicating functional correlation, similar to genes in an operon. Small nucleolar RNA was associated with *PSY2*, *PDS*, *CRTISO* etc. and gibberellin-2- β -dioxygenase was associated with *NCED*.

Phenomics approaches for physiological trait-based breeding for drought and PPD tolerance in cassava

For drought tolerance study, 15 C_3 - clones from the cross between H-97 x 9S-127 were planted in control and drought conditions. From this, 15 C_2 clones and parents were used for recording physiological characters *viz.*, plant height, leaf retention, leaf area index (LAI), canopy temperature at 15 days interval from November 2024 along with drone image using RGB camera. The chlorophyll content, carotene content, osmolytes content, photosynthesis rate and chlorophyll florescence were recorded at 60 days interval.

The physiological characters were recorded at twelve intervals with drone imaging. Similarly, photosynthesis and respiration rate were recorded along with biochemical parameters. Observations on plant height, leaf retention and Leaf Area Index (LAI) was recorded every 15 days on 30 cassava genotypes including 2 parents and 28 clonal progenies along with drone imaging using RGB camera. The correlation of physiological parameters with PPD was analyzed and no significant correlation was observed. Computational and machine learning model for HTP - both drought and PPD are in progress.

Breeding and evaluation for development of high yielding nutritionally enriched, photo insensitive, processable and multipurpose sweet potato varieties

Under this project preliminary and advanced yield trials of selected hybrid clones obtained by evaluation of hybrids from CIP obtained through ICAR-NBPGR during 2018 were done. Three advanced orange-flesh clones H-43/83 (52.9 t ha⁻¹, starch 22.9%, carotenoids 2.2 mg 100g⁻¹ FW), H-562/32 (27.86 t ha⁻¹, starch 20.3%, carotenoid 8.08 mg 100g⁻¹ FW) and H-473/8

(29.64 t ha⁻¹, starch 13.66%, carotenoids 7 mg 100g⁻¹ FW) was submitted to AICRP-TC for evaluation trials during 2022. Eight purple-fleshed biofortified lines (38/15, 38/46, 110/14, 110/28, 586/10, 586/7, 575/10, 598/2) containing both β -carotene and anthocyanin in different quantities were submitted for AICRP-TC trials during 2023. On farm trials on biofortified sweet potato are being conducted in seven locations in Kerala showed four hybrids as promising 38/15, 38/46, 110/28 and 43/83. Four orange-fleshed lines were submitted to AICRP trials during 2025-26 (38/15, 580/108, 598/2 and 582/18). Three white-fleshed hybrid clones were submitted to AICRP trials during 2025-26. Three orange fleshed low starch hybrids (447/1, 50/14 and 50/26) were recommended for OFT for salad purpose in the Institute Staff Research Council. The total carotenoid content in the selected biofortified hybrids ranged from 0.45 to 14.5 mg 100g⁻¹ FW, anthocyanin content varied between 8 mg- 97 mg 100g⁻¹ FW. The dry matter content ranged between 25.31 to 35.6%. The starch content ranged from 12.95 to 20.845 g 100g⁻¹ FW. Iron content ranged from 0.75 to 1.06 mg 100g⁻¹ FW and zinc content ranged from 56.53 to 85.09 μ g 100g⁻¹ FW. The carotenoid content of hybrid H-38/15 was 14.5 mg 100g⁻¹ equivalent to that of carrot and 110/28 showed both carotenoid content of 9 mg 100g⁻¹ and anthocyanin content of 60 mg 100g⁻¹.

Harnessing the genetic potential of wild *Ipomoea* spp. through wide hybridization for improvement of sweet potato

Exploration missions were conducted and eight wild species of *Ipomoea* were collected viz. *I. trifida*, *I. mauritiana*, *I. triloba*, *I. nil*, *I. indica*, *I. palmata*, and *Ipomoea* spp (Fig. 4). A total of 300 pollinations were made between the cultivated (*I. batatas*) and wild species (*I. mauritiana* and *I. trifida*) both at the



Fig. 4. Wild species of sweet potato (*Ipomoea* spp.)

main station and regional station. Only one seed was obtained in the cross between *I. batatas* and *I. trifida*, but this did not germinate. One hundred and fifty seeds of *I. trifida* were treated with 0.1, 0.2, 0.3% colchicine and 100 seedlings of *I. mauritiana* were treated with 0.5% colchicine through cotton plug method. The germination percentage (90%) and survival rate was highest in 0.1 % colchicine. But all the treated plants resembled the diploid (control) sample.

Breeding for development of high starch, anthocyanin and β carotene rich varieties in sweet potato and high yielding nutritionally rich varieties in yam bean

Sweet potato

Purple fleshed sweet potato hybrid, Bhu Arunima was released as variety in Odisha (Fig 5A). Two hundred and four progenies of 48 newly developed sweet potato hybrids and 36 newly developed hybrids in yam bean were maintained.

Out of 204 sweet potato progenies, 63 were purple fleshed, 36 orange fleshed and 34 white fleshed. The rest of the progenies did not produce tubers. Amongst the purple fleshed hybrids, highest yield was recorded in SPH-23-130 (27.32 t ha⁻¹), followed by SPH-23-29 (26.62 t ha⁻¹) and SPH-23-131 (25.64 t ha⁻¹). In orange fleshed hybrids, highest yield was recorded in SPH-23-82 (27.45 t ha⁻¹) followed by SPH-23-61 (26.75 t ha⁻¹) and SPH-23-83 (24.77 t ha⁻¹). In white fleshed hybrids, highest yield was recorded in SPH-23-107 (30.65 t ha⁻¹) followed by SPH-23-121 (29.62 t ha⁻¹) and SPH-23-104 (28.15 t ha⁻¹).

The highest anthocyanin content was recorded in SPH-23-29 (136.49 mg 100g⁻¹) followed by SPH-23-131 (116.86 mg 100g⁻¹), SPH-23-33 (115.34 mg 100g⁻¹) SPH-23-41 (108.16 mg 100g⁻¹) and SPH-23-134 (105.87 mg 100g⁻¹). Highest carotene content was recorded in SPH-23-64 (19.59 mg 100g⁻¹) followed by SPH-23-83 (13.12 mg 100g⁻¹), SPH-23-63 (12.49 mg 100g⁻¹), SPH-23-128 (10.68 mg 100g⁻¹) and SPH-23-61 (10.46 mg 100g⁻¹). Highest starch content was recorded in SPH-23-105 (16.61%) followed by SPH-23-120 (15.32%), SPH-23-61 (14.44%) and SPH-23-29 (14.12%). Highest sugar content was recorded in SPH-23-113 (3.37%) followed by SPH-23-64 (3.68%), SPH-23-113 (3.37%) and SPH-23-134 (3.51%).

Yam bean

The first yam bean variety from CTCRI (Bhu Shakarkanda-1) was released for the state of Odisha



Fig. 5. (A) Purple fleshed sweet potato hybrid, Bhu Arunima (B) Yam bean variety (Bhu Shakarkanda-1)

(Fig. 5B). In yam bean, a total of 36 F_1 hybrids were evaluated for yield and other nutritional traits. An additional batch of 36 F_1 seeds was raised to produce the F_2 generation for the assessment of subsequent generation for evaluation. Germination rates were recorded as 50% at 10 days after sowing (DAS) and greater than 95% at 20 DAS.

Among the F_1 hybrids, five superior hybrids were identified viz., YB-23-9 (38.33 t ha⁻¹), YB-23-12 (36.54 t ha⁻¹), YB-23-28 (34.44 t ha⁻¹), YB-23-18 (32.12 t ha⁻¹) and YB-23-3 (30.72 t ha⁻¹). The F_2 generation seeds were harvested and stored for subsequent evaluation. The starch content of the hybrids ranged from 12.32 to 16.53%, while the sugar content varied between 5.42% and 7.96%. Highest iron content was recorded YB-23-9 (280.35 ppm) followed by YB-23 -3 (264.18 ppm), YB-23 -18 (248.56 ppm) and YB-23 -12 (222.82 ppm). Highest zinc content was recorded in YB-23-12 (12.09 ppm) followed by YB-23-28 (10.52 ppm), YB-23 -3 (10.34 ppm) and YB-23 -9 (10.22 ppm).

Breeding for earliness, quality traits and salinity tolerance in sweet potato

Field evaluation of 48 sweet potato genotypes identified high-yielding genotypes viz., SP19 (18.33 t ha⁻¹), SP5 (20.10 t ha⁻¹), SP18 (17.40 t ha⁻¹), SP27 (20.60 t ha⁻¹) and SP1 (15.95 t ha⁻¹). Early tuber maturity (90–100 days) was recorded in genotypes SP95/4, SP19, SP27 and SP29.

SP9 recorded the highest levels of potassium (1.61%), iron (720.85 ppm) and manganese (59.8 ppm), while SP20 had the highest zinc content (28.24 ppm). SP1 and SP11 exhibited high phosphorus content (0.17%). High-yielding, early-maturing and nutritionally rich genotypes were identified.

Forty eight sweet potato genotypes were screened under NaCl mediated salinity stress conditions *in vitro*. Eight genotypes (SP12, SP13, SP23, SP27, SP33, SP42, SP44 and SP45) were found to exhibit tolerance at 0.5% NaCl.

DNA barcoding and RNA secondary structure predictions in tuber crop varieties

DNA barcoding of sweet potato (22), aroids (13) and yams (18) using *matK*, *KimmatK* and *ITS* barcode genes was performed. The efficacy of barcode candidate markers in discriminating the tuber crop varieties has been standardized. *MatK* (95–100%) among the chloroplast-plastid barcode primers was more efficient in amplification and sequencing than *KimmatK* (90%) and *ITS* (90–95%). The RNA secondary structures derived using the ribosomal nuclear *ITS2* region based on the minimum free energy exhibited significant inter- and intra-specific divergence among the samples. The DNA barcoding and RNA secondary structure predictions of all 79 released varieties will be completed and submitted to NCBI.

Genetic improvement of edible aroids for resistance to biotic stress and quality parameters

Under the improvement program for edible aroids, taro and elephant foot yam were screened for taro leaf blight, collar rot and for root knot nematode. Few TLB resistant/field tolerant lines were identified viz., E-10, TCR-961, Ce 286, UL-89 and Ce 532. Two lines were identified as nematode resistant in elephant foot yam viz., TEy22-1 and TEy22-6. Ce 553 was identified as moderately resistant to TLB and had high yield. Two tannia entries namely, Xa MTS Local (TTn14-5) and IGSGTN-1 (TTn14-1) were recommended for state release in Kerala and central release (Chhattisgarh, Manipur and Kerala), respectively, by the AICRP on Tuber Crops. Six entries of edible aroids - two tannia (Xa-MTS local and Xa-MNS/14-1), two elephant foot yam (Peerumade local and Am-141) and two taro (Ce-553 and Ce-167) are at various stages of testing under AICRP-TC. Five high yielding (17.82–40.05 t ha⁻¹), non-acrid elephant foot yam hybrids (H-6-7-2017, H-6-34-2017, H-102-2015, H-107-2015 and H-843/2-2017) and an early maturing hybrid (5 months) - AmH22-99 were identified.

Developing breeder seed standards and precocity of genetic vigour for tropical tuber crops

The study on East Indian arrowroot (*Curcuma angustifolia* Roxb.) established breeder seed quality standards for seed rhizome and seedling vigour traits. Standard mother rhizome weight ranged from 37–67 g, while primary finger weight varied between 26–50

g, indicating acceptable seed rhizome size for planting. Among the evaluated genotypes, CTCRI-CA PM-1 and the variety Chhattisgarh Tikhur-1 were identified as superior for rhizome yield and seed quality traits. Maximum germination of mother rhizomes (100%) and high germination of primary fingers ($\geq 90\%$) were recorded. Good seed quality was associated with rhizome moisture content of 65–80%, shoot length of 20–30 cm, root length of 11–17 cm, seedling dry matter production of ≥ 0.20 g, and a Seedling Vigour Index more than 3000.

Inducing genetic variability, characterization, grouping and developing breeding lines with large tuber size and short duration in Chinese potato

A study was undertaken to standardize gamma irradiation doses and assess their effects on germination, survival, yield components, reproductive traits and nutritional quality in Chinese potato (*Plectranthus rotundifolius*) cv. Sree Dhara for mutation breeding. Seed tubers were exposed to graded gamma doses (0–100 Gy), and responses were evaluated under laboratory and field conditions. Gamma irradiation hastened tuber germination and seedling survival, with low doses (≤ 20 Gy), maintaining high viability ($> 80\%$) and 5 Gy showed maximum germination and survival (90%). The decline was observed beyond 30 Gy and the LD_{50} for both traits was estimated at 48.54 Gy. Field evaluation showed that moderate doses, such as 55 Gy, induced desirable variability, recording the highest total tuber yield (546.6 g) and maximum single tuber weight (28.6 g). Proximate analysis of harvested tubers from different gamma irradiated progenies showed significant changes in starch, sugar, fibre and ash content. Higher doses (75–100 Gy) induced severe growth inhibition. It is concluded that LD_{50} doses of 45–55 Gy are optimal for generating useful genetic variability.

Sprouts from gamma-irradiated tubers of 15 treatments (5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70 and 75 Gy) and untreated control were sub-cultured into shoot multiplication medium (MS + 1 mg l^{-1} BAP). However, growth and multiplication were achieved in only control, while browning was noticed in other treatments (Fig. 6A). Callus induced in Rajakumari with red variegated leaf at 15 and 20 Gy did not grow further and started browning in subsequent subcultures at 3 weeks intervals. Also, from another set of gamma irradiated plants, 6 biological replications from each of 18 treatments (5, 10, 15, 20, 25, 30, 35, 40, 45,

50, 55, 60, 65, 70, 75, 80, 85 and 100 Gy) and control were inoculated into shoot induction medium (MS + 1 mg l^{-1} BAP) after sterilisation. Regeneration of tissues was observed in control and 60 Gy treatment (Fig. 6B).

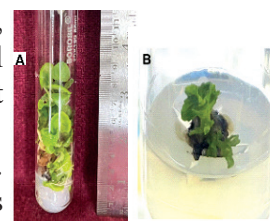


Fig. 6. Shoot multiplication in Chinese potato (A) Untreated plants (B). Gamma-irradiated (60 Gy) plants.

Gene editing in cassava for starch modifications

Two gene editing constructs for starch modifications in cassava - *gbss* gene editing construct targeting waxy cassava and *SBEI* and *IIB* gene editing constructs targeting high amylose cassava, respectively were prepared and confirmed through sequencing. Both constructs were transformed to FEC of cassava H226 using gene gun method and *via. Agrobacterium* mediated transformation. The transformed FECs are maintained under selection.

Genetic resources management and sustainable improvement of tropical tuber crops

Collection, characterization, conservation, documentation and utilization of genetic resources of tuber crops

Germplasm collection

A total of 275 new collections were made from Nagaland (43), Meghalaya (26), Assam (16), Arunachal Pradesh (12), Odisha (3), Karnataka (10) and Kerala (165) comprising cassava (41), sweet potato (27), yams (95), aroids (90) and minor tuber crops (22). These includes 165 accessions in 114 landraces comprising cassava (39), sweet potato (5), greater yam (86) and aroids (35) collected from southern districts of Kerala and conserved in the FGB. IC numbers were assigned for 222 newly collected accessions of landraces (cassava, sweet potato, yams and aroids), one each in taro and tannia and 35 arrowroot accessions by ICAR-NBPGR, New Delhi.

The total germplasm repository includes 5244 accessions, comprising 1216 cassava, 905 sweet potato, 801 yams, 655 edible aroids, 387 minor tuber crops from HQ and 1280 accessions from Regional Station comprising 113 cassava, 380 sweet potato, 51 yams, 564 edible aroids, 172 minor tuber crops. A total of 153 accessions comprising of 71 cassava accessions 31 sweet potato, 33 yams, 7 taro, 2 arrowroot, 8 *Curcuma angustifolia* and 1 Chinese potato accessions are maintained at HQ and at

RS, released varieties comprising 10 cassava, 11 sweet potato, 5 taro, 4 yams, 2 elephant foot yam and 1 Chinese potato are maintained *in vitro*.

Cassava germplasm

In cassava, a total of 1216 accessions comprising indigenous (545), exotic (315), landraces (115) and breeding lines (241) were replanted in the field for maintenance, characterization and preliminary

evaluation. Hundred accessions of cassava were subjected to morphological characterization using 51 traits (33 above ground plant + 18 tuber and yield) including screening for CMD, based on standard descriptors. Among the 100 accessions characterized, variation was noticed in plant height, shape, branching pattern, colour of stem cortex, stem epidermis, colour and pubescence of apical leaves, petiole colour, number of leaf lobes and height of first branching (Fig. 7).

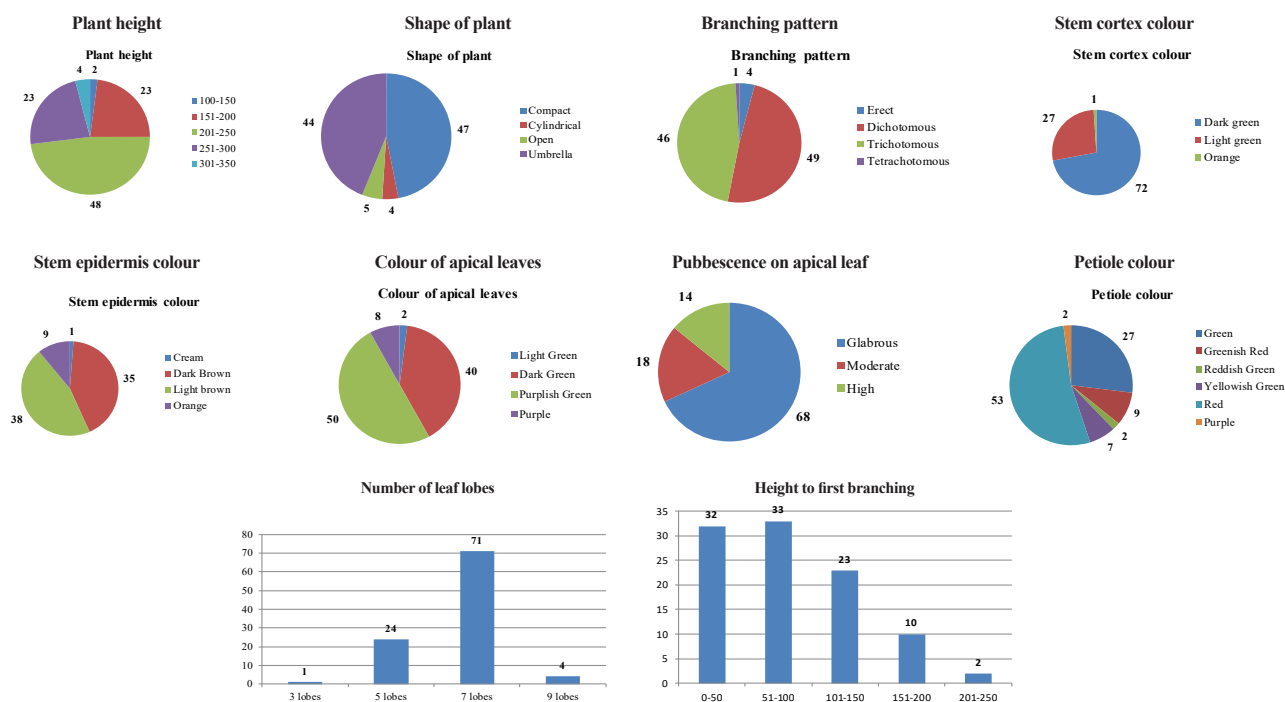


Fig. 7. Variability in aboveground plant traits

Among the tuber traits, variation was noticed in most of the traits (Fig. 8). Tuber growth direction varied from horizontal in 57 to vertical in 23 and irregular in 20 accessions. The tuber flesh colour varied from cream in 97 to white in 3 accessions. The shape of tubers varied from conical (40), conical-cylindrical (39) to cylindrical (21). CE-16A (16.34 kg) recorded the highest mean

tuber weight followed by CE-239 (11.75 kg), CE-40A (11.19 kg), CE-38A (9.91 kg), CE-272 (9.70 kg) and CE-303 (9.46 kg). The accession CE-172A recorded the highest number of storage roots (17). CE-242 had the highest single tuber weight (2.74 kg) followed by CE-303 (2.65 kg), CE-364 (2.40 kg) and CE-243 (2.26 kg).

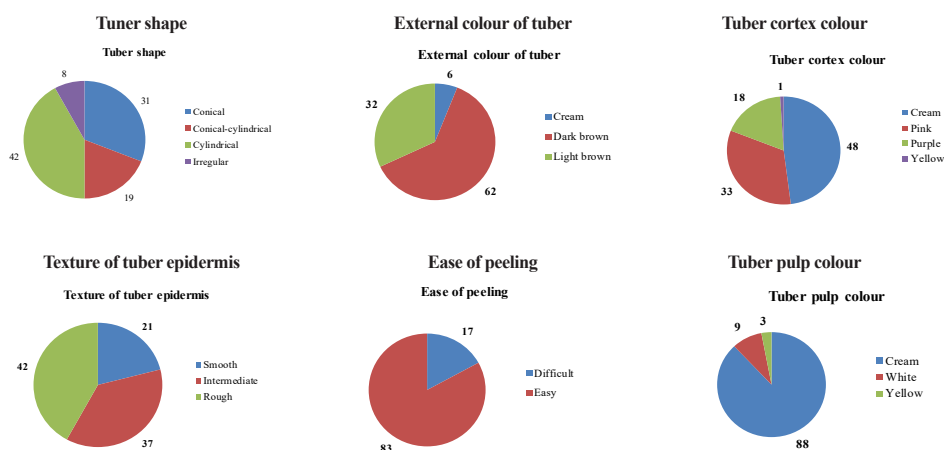


Fig. 8. Variability in tuber traits

The elite accessions identified were, four with high harvest index (>0.75) and three with sweet taste and high tuber weight (Table 1). Core grouping based on 50 morphological traits of 100 accessions of cassava grouped the accessions into 4 main groups with 24, 18, 49 and 9 accessions and no duplicates could be identified. The 25 CMD resistant accessions selected by field screening last year (Table 1) were checked using Virus-Specific Coat Protein Primer and absence of the virus was confirmed in these accessions.

Molecular characterization of these 25 CMD resistant accessions of cassava was done using 5 ISSR primers. The hierarchical cluster analysis grouped these 25 accessions into two main clusters at a similarity coefficient of approximately 0.92. Cluster 1 comprised 16 accessions in 6 sub-clusters while Cluster 2 had 9 accessions in 4 subclusters. CE-403 was identified as the divergent line.

For identification of true to type cassava landrace, Noorumuttan, the seven accessions of Noorumuttan collected from different locations in Kerala were

subjected to diversity analysis using five SSR markers. Results identified four accessions out of the seven as true to type. Dendrogram grouped these 7 genotypes into 2 principal clusters at 0.46 similarity coefficient and the accession IC651579 was found as an outlier. From the results it is inferred that the accessions IC651537, IC651580, IC651581 and IC651584 were the landrace 'Noorumuttan', while IC651575, IC651573 and IC651579 were mix ups.

Biochemical characterization of 45 accessions of cassava was done. Four promising accessions having starch content above 75% were CE-23 (78.4%), CE-31 (79.01%), CE-18 (81.25%) and CE-16A (81.65%). Sugar content ranged from 0.8 (CE-172A) to 2.5% (CE-430A). Crude fibre ranged from 0.2 (CE-166) to 1.7% (CE-131). Crude fat ranged from 0.18 (CE-114) to 1.15% (CE-430A). Total ash ranged from 0.895 (CE-127) to 1.91% (CE-146).

Catalogue of cassava genetic resources (Part-2) consisting of morphological data of 100 accessions of cassava for 51 traits was published in July 2025.

Table 1. Promising accessions identified in cassava

Character	Number of accessions evaluated	Number of promising accessions	Promising accessions
Short statured lines (<180 cm)	100	13	CE-93A, CE-170B, CE-174A, CE-231A, CE-297, CE-301, CE-302, CE-303, CE-308, CE-313, CE-333, CE-347, CE-396
Harvest index above 0.75	100	4	CE-40A, CE-18A, CE-38A and CE-16A
Sweet taste and high tuber weight (>5 kg plant ⁻¹)	100	3	CE-16A, CE-40A, CE-239
CMD resistant accessions	100	25	CE-28A, CE-38, CE-48, CE-50, CE-89, CE-90, CE-97, CE-99, CE-108, CE-114, CE-127, CE-142, CE-144, CE-152, CE-166, CE-272, CE-273, CE-279, CE-326, CE-331, CE-338, CE-394A, CE-403, CE-428, CE-456

Sweet potato germplasm

Thirteen new accessions of sweet potato collected from Kerala (8) and Meghalaya (5) were added to the field gene bank. A total of 905 accessions of sweet potato are being maintained in the field gene bank for conservation and characterization. Fifty accessions were characterized for 30 morphological traits including 17 above ground and 13 tuber traits as per IPGRI descriptor. Molecular characterization was carried out for the 50 accessions using 10 SSR markers

(DMS 1, SPGS 2, 3, 4, 6, SPES 2, 4, GDAAS0911, GDAAS0922 and GDAAS0819) and the 50 accessions grouped into 2 major clusters and 6 sub clusters. Accessions S1401, S1977, S1500, S1607, S1503 and S1575 were found to be divergent and 28 accessions had similarity coefficient (0.98) indicating the similarity/closeness. Based on clustering, duplicates were identified from morphological and molecular characterization. The average polymorphism shown was 81.13%. Nine accessions (S1508, S1522, S1300,

Table 2. Promising accessions identified in sweet potato

Character	Number of accessions evaluated	Number of promising accessions	Promising accessions
Weevil resistance (Moderately resistant)	105	16	S1248, S27, S1470, S1456, S1524, S1525, S1563, S1568, S1569, S1961, S1963, S1964, S1965, S1975, S1978, S2070
Suitable for fried chips with dry matter content (>20%)	105	16	S27, S1470, S1653, S1403, S1401, S1456, S1668, S1712, S1467, S1470, S1653, S1403, S1401, S1456, S1668, S1712
High yield	50	11	S1500, S1401, S1508, S1522, S1563, S1568, S1574, S1300, S1965, S1968, S1991

S1965, S1968, S1987, S1992 and S1994) were found to be high yielding. Weevil screening of 50 accessions harvested from both HQ and RS was completed and five accessions were found to be tolerant to weevil (Table 2). Out of the 50 accessions screened against root knot nematode, *Meloidogyne incognita* only one accession, S1500 showed nematode galls and was found moderately susceptible as it was rated a gall index of 3 (11-30 galls/plant) on a 0-5 scale rating. Revised and updated catalogue of 482 accessions (Vol-1) was prepared and submitted.

Yams germplasm

Seven hundred and sixty six accessions of yams comprising greater yam (410), lesser yam (186), white yam (105) and wild yam (65) were replanted and maintained in the field gene bank at ICAR-

CTCRI, Thiruvananthapuram. Two new accessions comprising one *Dioscorea alata* and one *D. bulbifera* from Umiam, Meghalaya were added to the collection. The accessions were planted in the field for characterisation.

Flowering behaviour in *D. alata* was recorded during the period. Flowering commenced in the second week of September and continued until the second week of November. Male flowers were observed in 24 accessions (Da 21, Da 29, Da 32, Da 43, Da 50, Da 51, Da 56, Da 58, Da 63, Da 70, Da 72, Da 79, Da 84, Da 93, Da 99, Da 121, Da 159, Da 168, Da 227, Da 287, Da 367, Da 496, Da 523 and Da 820) while female flowers were recorded in 9 accessions (Da 24, Da 22, Da 110, Da 114, Da 210, Da 222, Da 258, Da 295 and Da 386). Male flowering was recorded in Sree Swathy and Sree Hima during the

Table 3. Promising accessions identified for anthracnose resistance under natural infection in yams

Character	Number of promising accessions	Promising accessions
Highly Resistant (Three seasons: 2023-2026)	6	DA 5, DA 388, DA 17, DA 191, DA 59, DA 502
Highly Resistant (Two seasons: 2024-26)	18	DA 27, TCR 66, DA 367, DA 11, DA 14, DA 512, DA 12A, DA 63, DAH 10-3-28, DA 621, GY 58, DAS 19, GY 24, DA 523, DA 72, TCR 281, DA 14, DAH 9-35-16
Moderately resistant (Three seasons: 2023-26)	3	DA 601, DA 46, DA 209
Moderately resistant (Two seasons: 2024-26)	14	DA 73, DA 496, DA 1004, DA 58, DA 31, DA 604, CI 4, DA 94, DA 524, DA 2, DA 110, DA 493, TCR 20, DA 287 B
Highly Resistant (One season: 2025-2026)	1	TCR 12
Moderately resistant (One season: 2025-2026)	1	DaH 166

period. Among the male accessions, Da 21 and Da 820 exhibited profuse flowering. Similarly, Da 386, Da 114 and Da 258 were identified as prolific female flower bearers. The observed variation in sex expression and flowering intensity indicates the potential suitability of these accessions for use in hybridization programmes. Pollen samples from ten accessions of *D. alata* (Da 43, Da 21, Da 29, Da 32, Da 93, Da 51, Da 56, Da 58, Da 70 and Da 79) were used for cryopreservation.

In *D. rotundata*, flowering was predominantly male among the evaluated accessions. Five lines (Dr 19, Dr 24, Dr 26, Dr 59 and Dr 93) produced only male inflorescences, whereas female flowering was recorded solely in accession SD 15. The marked predominance of male flowering and the restricted occurrence of female flower expression indicate a skewed sex distribution within the studied material, which may influence parental selection in breeding programmes. No flowering was recorded in any of the evaluated *D. esculenta* accessions.

Greater yam lines were screened for anthracnose resistance over three seasons 2023-2024, 2024-2025 and 2025-2026, with 50, 108 and 147 lines, respectively. Across all three seasons, six lines consistently expressed high resistance (HR), while 18 additional lines exhibited HR in two seasons. With respect to moderate resistance (MR), three lines maintained stable reactions over all three seasons and fourteen lines in two seasons. In the

third season among the 39, one highly resistant and one moderately resistant line were identified (Table 3).

Edible aroids germplasm

The field genebank was augmented with 39 edible aroid collections comprising, elephant foot yam (7), from Kerala - 3, ICAR Research Complex for Eastern Regions - 1 and Tamil Nadu - 3; taro (26), from Tamil Nadu - 1, ICAR Research Complex for Eastern Regions - 1, AICRP Centres - 4, Kerala - 1 and Manipur - 19; swamp taro (3) from Assam; tannia (1) from ICAR Research Complex for Eastern Regions and giant taro (2) from ICAR Research Complex for Eastern Regions - 1 and AICRP Centres - 1.

Morphological characterization (NBPGR minimal descriptor) was done in 28 elephant foot yam accessions for 17 tuber traits. PCA showed that traits like fresh weight, diameter, length and thickness of corm were involved in maximum diversity. Accessions AD/R/2016-1, Peerumade local, AmH-dwarf, Am-39, Am-127, and H-64 were found to be the most diverse based on tuber traits. Correlation studies showed that traits like corm diameter and height as well as cormel thickness were significantly correlated with corm yield. Based on corm weight, three high yielding accessions ($>20 \text{ t ha}^{-1}$) were identified (Table 4).

Another set of 36 elephant foot yam accessions were morphologically characterized for 20 above-ground

Table 4. Promising accessions identified in edible aroids

Character	Crop	Number of accessions evaluated	Number of promising accessions	Promising accessions
Corm yield $> 20 \text{ t ha}^{-1}$	Elephant foot yam	28	3	AmH-dwarf, AD/R/2016-1 and Am-36
High dry matter ($>30\%$)	Elephant foot yam	22	12	AC-78, Sree Padma, H-61, NDA-5, AD/R/2016-1, Am-141, Peerumade local, AP-03, AD/R/2019-2, ADSK/2021-1, AD/2022-1 and H-64
High corm yield $>30 \text{ t ha}^{-1}$	Elephant foot yam	33	1	TEy22-5
High dry matter ($>25\%$)	Taro	6	3	Ce 286, Ce 110 and TTr22-1
High total yield $> 15 \text{ t ha}^{-1}$	Taro	36	6	Ce-681; Ce-553; U-89; E-10; C-286 and Shrew kwai
Total yield of $> 15.00 \text{ t ha}^{-1}$	Tannia	16	3	Xa-AKI/2015-9, Sreekariyam local and Xa-AD/2014-18

traits (NBPGR minimal descriptors). Of these, six traits showed no variation viz., number of primary/secondary partition - 3 each and 2 each, respectively; leaflet nature – entire; absence of leaf spot, leaf stalk and presence of winged rachis. Correlation studies showed that maximum correlation (0.804***) was obtained between pseudostem basal thickness and canopy spread with length of primary partition.

Molecular characterization of 25 elephant foot yam was done using five ISSR markers. One ISSR primer (UBC 825) showed that Am-178 was found to be different from the rest. Screening was completed for 11 ISSR markers and all were found to be polymorphic. In tannia, two morphotypes – those having green petiole (*Xanthosoma sagittifolium* - 5 acc.s) and those having purple petiole (*X. violaceum* - 7 acc.s) were tested using eight ISSR and eight SSR markers. Both ISSR and SSR markers could differentiate clearly between these two closely related *Xanthosoma* species viz. *Xanthosoma sagittifolium* and *X. violaceum*. The results showed that the two species are genetically distinct and not synonyms as suggested by some authors.

Biochemical characterization (dry matter) was done for 25 elephant foot yam, six karunaikizhangu and six taro accessions. Dry matter (DM) ranged from 23.5% (Am-48) to 38.0% (SP x Gajendra) in elephant foot yam; 16.5% (ASMV/2024-4) to 20.5% (ASMV/2024-5) in karunaikizhangu and 23.0% (Ce-553) to 30.5% (Ce-110) in taro. Promising lines with high dry matter is given in table 4.

In elephant foot yam, new diseases were observed this year viz., leaf blight and phytoplasma.

Preliminary yield trials were done with 36 taro, 33 elephant foot yam and 16 tannia accessions. In taro, six accessions gave total yield > 15 t ha⁻¹ (Table 4). In elephant foot yam TEy22-5 (37.86 t ha⁻¹) was found to be the best yielder, superior to check Sree Padma (17.94 t ha⁻¹). Six accessions yielded at par with Sree Padma viz., TEy22-4, TEy22-11, AC-78, TEy22-12, TEy22-7 and AD/2022-1. Amongst the tannia accessions, Xa-MTS local was the highest yielder with a total yield of 23.82 t ha⁻¹ and cormel yield of 15.88 t ha⁻¹. Three other accessions yielded total yield of > 15.00 t ha⁻¹ and cormel yield of 11.00 t ha⁻¹ (Table 4).

For standardization of *in vitro* protocol in edible aroids, two tannia accessions were subjected to shoot

multiplication in MS media fortified with BA (1-2 mg l⁻¹). It was observed that BA 1 mg l⁻¹ produced 2-3 shoots in both accessions.

IVAG

In vitro culture maintenance: A total of 153 accessions comprising of 71 cassava accessions 31 sweet potato, 33 yams, 7 taro, 2 arrowroot, 8 *Curcuma angustifolia* and 1 Chinese potato accessions are maintained. A protocol has been optimized for establishing *in vitro* cultures of *C. angustifolia*. MS media supplemented with 0.5 µg ml⁻¹ BAP showed maximum rooting and shooting.

Germplasm at Regional Station

Maintenance of tuber crops germplasm at RS: A total of 1280 germplasm accessions were maintained in the field genebank at the Regional Station comprising taro (520), sweet potato (380), cassava (113), yams (51), elephant foot yam (40), yam bean (165), Chinese potato (5), arrowroot (2), tannia (1) and *Alocasia* (3).

Characterization of germplasm at RS: Phenological growth stages of elephant foot yam (EFY) using the Biologische Bundesantalt, Bundessortenamt and Chemische Industrie (BBCH) scale have been described for the first time. Eight primary growth stages such as germination (stage 0), leaf/pseudo stem development (stage 1), tuber development (stage 4), inflorescence emergence (stage 5), flowering (stage 6), fruit growth (stage 7), fruit maturity (stage 8), and senescence (stage 9) have been specifically identified (Fig. 9). The BBCH scale has many applications in EFY cultivation since it encompasses all phenophases associated with the vegetative and reproductive stages. Due to the relative significance of phenophases in crop improvement and management, the BBCH scale

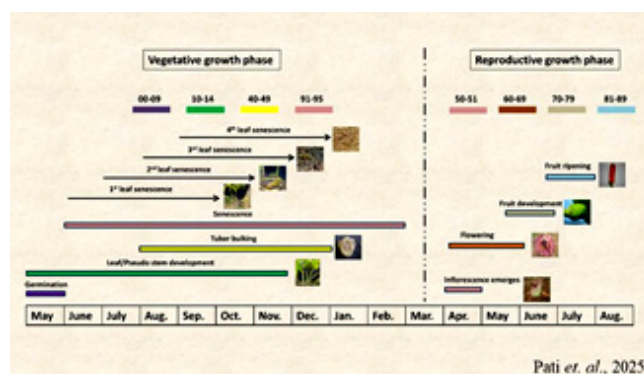


Fig. 9. Progression of the developmental phases in elephant foot yam (vegetative and reproductive growth)

will help to provide a standardized method to assist agronomists, breeders, germplasm curators, and researchers in effectively managing, developing, and conserving the genetic resources of this new crop.

Genetic diversity was assessed in 30 taro accessions using 15 SSR markers. The mean Polymorphic Information Content (PIC) value was 0.634, and the mean major allele frequency was 0.530. The observed heterozygosity had a mean value, 0.669 was higher than the mean expected heterozygosity of 0.640. Jaccard's similarity coefficient revealed a highest similarity of 0.686 and a lowest similarity of 0.267, with an average similarity of 0.467. The dendrogram analysis grouped the 30 taro cultivars into two main clusters. Furthermore, when analyzing the Cophenetic similarity coefficient matrix, the highest similarity percentage was 0.829, while the lowest was 0.397, with an average similarity of 0.600, which was higher than the mean value derived from Jaccard's similarity coefficient.

Screening for disease/ pest resistance of germplasm at RS: Evaluation of 50 sweet potato germplasm accessions for leaf curl disease during the *kharij* 2025 demonstrated distinct resistance patterns at 60 and 90 DAP. At 60 DAP, resistant genotypes showed low disease incidence (5-9%) with minimal symptom development, whereas susceptible accessions recorded 65-82% incidence. Symptoms in susceptible germplasm included pronounced leaf curling, chlorosis and moderate stunting, while resistant lines largely retained normal leaf architecture. At 90 DAP, susceptible genotypes exhibited further disease intensification, with incidence levels rising to 72-88% and symptoms progressing to severe leaf curling, reduced internode length and marked plant stunting. In contrast, resistant germplasm such as Tirupati, Sree Bhadra, Kishan and Samrat continued to express durable resistance, with only minor symptom amplification and no visible yield-limiting effects. Genotypes Indira Nandini and BPLR consistently showed high susceptibility, characterized by severe symptom expression and sustained disease pressure throughout the crop growth period

In vitro maintainence of released varieties of tuber crops at RS: Released varieties comprising 10 varieties in cassava, 11 varieties in sweet potato, 5 varieties in taro, 4 varieties in yam, 2 varieties in elephant foot yam and 1 variety in Chinese potato are maintained in *in vitro*.

Flagship project: Gene editing in cassava for starch modifications

In this project, under the first objective of *in planta* development of waxy starch through gene editing, the *gbss* gene editing construct was prepared and confirmed through sequencing and was subjected to transformation. Both gene gun mediated approach and *Agrobacterium* mediated approach were used for transformation. In both methods of transformation, friable embryogenic callus (FEC) developed from cassava variety H226 and an elite line, 9S127 were used for transformation. The green cotyledonary appearance of transformed H226 appeared after 50 days of bombarding (450 & 650 psi) in MSN + H15 media. The emerged shoot is maintained in elongation media. Two batches of transformants (80 events) of *gbss* gene editing construct with bombardment at 1100psi are maintained in regeneration with selection media. *Agrobacterium* mediated transformation of *gbss* gene editing construct has resulted in green cotyledonary emergence after 85 days under selection.

Under the second objective to develop high amylose cassava by editing *SBEI* and *Iib* genes together, the gene editing construct was developed and confirmed through sequencing. The construct was transformed to *Agrobacterium* and the *Agrobacterium* gene editing construct was co-cultivated with FEC of H226 and 9S127. The calli after transformation is maintained under selection. With gene gun approach, FEC of H226 and 9S127 was transformed and bombardment was done at 1100 psi on 50 H226 callus clumps and 10 9S127 callus clumps, which are being maintained in selection, and on cotyledonary emergence transferred to regeneration media.

A third gene editing construct targeting *SBE Iib* gene is being prepared. Two guide RNAs were each redesigned in exon 1 and exon 3 of *SBE Iib* and cloned into pHSE401 and transformed into *E. coli DH5a*.

A regeneration protocol was optimized in 9S127 and 92% regeneration efficiency was attained.

Protoplast regeneration from cassava: Protoplasts were isolated from *in vitro*-raised leaves of H226 after treatment with cellulase, pectinase and pectolyase enzymes. The viability of isolated protoplasts was verified using 1% Evan's blue staining (Fig. 10A). The protoplasts were subcultured in protoplast suspension medium every 3 weeks. However, the

viability of protoplasts was very less (10.3-22.5%) after 2 weeks. Protoplast suspension cultures after 3 weeks were inoculated into the callus induction medium. However, no response was obtained. For protoplast isolation from leaves to raise leaf explants, shoots of 6 varieties (H226, Sree Kaveri, Sree Reksha, Sree Vijaya, Sree Suvarna and Sree Prabha) were inoculated into MS media. For isolation of callus, leaf explants were placed in MS media with 4 combinations of NAA and BAP (0.1 mg l⁻¹ NAA + 1 mg l⁻¹ BAP, 0.1 mg l⁻¹ NAA + 2 mg l⁻¹ BAP, 0.5 mg l⁻¹ NAA + 1 mg l⁻¹ BAP and 0.5 mg l⁻¹ NAA + 2 mg l⁻¹ BAP). Callusing was good in 0.5 mg l⁻¹ NAA and 2 mg l⁻¹ BAP. However, the callus was hard. Friable callus was obtained in Gresshoff and Doys medium (GDP) with 12 mg l⁻¹ pichloram, which was subcultured into shoot induction medium (MS + BAP). However, there was no regeneration even after 3 months (Figs 10B&C).

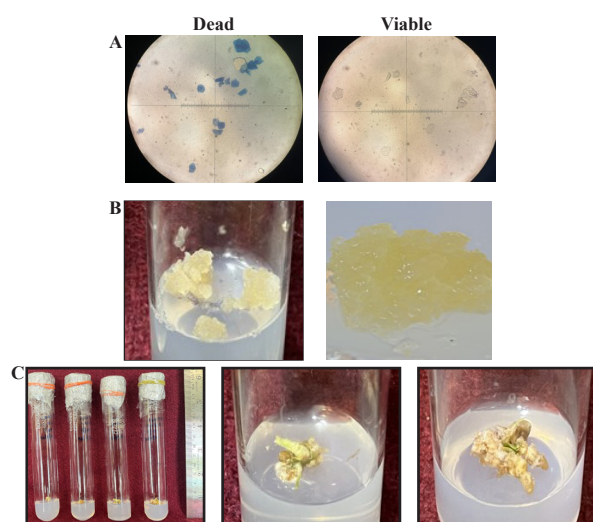


Fig. 10. Protoplast culture (A) Protoplasts isolated from leaves of H226 stained with 1% Evan's blue showing dead (blue color) and viable (colourless) protoplasts. (B) Friable callus in GDP medium (C) Callus initiation from leaves in MS medium with 0.5 mg/L NAA and 2 mg/L BAP.

Breeding cassava for CMD resistance and drought tolerance using genomic and phenomic approaches

For studying CMD resistance, self-pollination was done in 9S127 (CMD resistant, heterozygous parent). These self-pollinated seeds were sown in the nursery for seedling germination and a total of 90 seedlings were transplanted to the field and seedling characters were recorded. In a Preliminary Yield Trial (PYT) trial, 15 CMD resistant clones from the cross between Sree Jaya x 9S127 are planted for agronomic evaluation. A new promising clone (SH-1) suitable for

chip making and good cooking quality was identified (Fig. 11). It has desirable characteristics such as a conical tuber shape, non-bitter taste and high dry matter content (42%). This clone is free from cassava mosaic disease (CMD) and erect, non-branching and grows more than three meters. Peeling of the tubers is easy, the raw tubers have a good taste and exhibit very good cooking quality. The chips made from this line were very crispy with good taste.



Fig. 11. The promising cassava clone SH-1 - plant, tuber and fried chips

Based on the existing transcriptome sequence data analysis, the up- and down regulated genes responsible for CMD resistance was identified. The data analysis revealed that 233 genes were up-regulated and 52 genes were down-regulated in the Sree Jaya, whereas 159 genes were up-regulated and 426 genes were down-regulated in 9S127 under CMV infection. Among the DEGs, *Long Chain Acyl-CoA Synthetase1*, *WNK11*, *PERK1*, *Gibberellin 2-β-Dioxygenase-1* genes were down-regulated in susceptible cultivar. New SSR (motifs TC, AG, CT and GA were the most common types) and SNP markers (12,685, 7,147 SNPs were present in exonic regions in 9S-127, Sree Jaya cultivars) were identified from this transcriptome sequences. Twelve functional markers linked to key genes correlated with the response to CMV infection and regulation of defense pathway was identified.

For drought tolerance, 25 C₃ - clones from the cross between H-97 x 9S-127 were planted (August 2025) in control and drought conditions. From this, 15 C₂ clones and parents are used for recording physiological characters viz., plant height, leaf retention, leaf area index (LAI), canopy temperature at 15 days interval

from December 2025 along with drone image using RGB camera. The chlorophyll content, carotene content, osmolytes content, photosynthesis rate and chlorophyll fluorescence were recorded at 60 days interval. So far, eight rounds of observation were completed both in field and using drone imaging.

Breeding for development of short duration and postharvest physiological deterioration (PPD) tolerant varieties in cassava

Field experiment to screen for short duration cassava and identification of short duration parents for hybridization: Fifteen cassava genotypes were evaluated along with 3 checks (Sree Jaya, Sree Vijaya and Vellayani Hraswa) for short duration. Observations on CMD resistance was recorded at 3 and 6 MAP and the average CMD score recorded was 2.33. Observations on days to 50% flowering and CMD resistance showed that 40% of the studied genotypes were of flowering type whereas, the others were of non-flowering type.

Evaluation of mapping populations for CMD resistance, yield and PPD tolerance: The mapping populations (1 and 2) were screened for CMD resistance using 1 to 5 scale (Hahn *et al.*, 1980) at 3 and 6 MAP and results showed that the average CMD score recorded for both the mapping populations was 2.67 and 3.14, respectively. The genotypes under advanced yield trial (AYT-2) were evaluated for CMD resistance at 3 and 6 MAP and results showed that all the 10 genotypes were resistant to CMD except 2 genotypes (CII-3 and CII-5) which recorded average CMD score of 1.67. On-farm trials (OFT) of five cassava breeding lines (9SC-I-19, 9SC-I-13, 9SC-I-20, 9SC-I-23 and 9SC-I-26) are in progress at five different locations in Kerala (Kadinamkulam, Kazhakkootam, Thiruvananthapuram; Punnanoodu, Onatukara, Alapuzha; Thazhakeode, Thiruvambadi, Kozhikode; Chingavanam, Kottayam and Alakuzhi, Kottarakara, Kollam).

Functional characterization of early bulking and drought responsive genes in cassava

Transcriptome analysis of early bulking accessions revealed that 1,028 genes were upregulated and 564 genes were downregulated in the early-bulking variety Vellayani Hraswa compared to the late-bulking variety Sree Pavithra. The upregulated genes were involved in various functions, including starch and sucrose metabolism; transporters (nutrients, proteins, etc.); hormones (auxin,

gibberellins, brassinosteroids); chaperones; and kinases. In contrast, genes associated with DNA/RNA binding and kinases were downregulated in Vellayani Hraswa. Organized embryogenic structures (OES) and friable embryogenic calli (FECs) were developed and maintained from the cassava cultivars viz., H-226 and 9S-127 for the functional validation of selected early-bulking and drought-responsive genes in cassava.

Understanding the molecular mechanisms of nutrient metabolism in cassava for biofortification

Eighteen cassava varieties or genotypes were planted in field for analysis of nutrient metabolism. Soil nutrient analysis was carried out and soils were found to be poor in N, P and K. The cassava varieties showing highest and lowest content of Fe and Zn in tubers were chosen for the soil nutrient response studies based on analysis of previous experimental data. Zinc (Zn) and iron (Fe) content before and after acid wash was analysed for the sand to be used for soil-nutrient response studies. After acid wash with 0.001N HCl diluted using tap water, Zn and Fe content were found to increase, with Zn content increasing from 0.17 to 0.35 ppm after acid wash. Hence, Zn and Fe content were estimated in I and II lot sand (after making quadrants). Zn and Fe content were 0.406 ppm and 4.5 ppm in I lot acid-washed sand and 0.653 ppm and 9.34 ppm, respectively in II lot fresh sand. Zn content was negligible in 0.1N, 0.01 N and 0.001 N HCl while Fe content was 0.415 ppm in 0.1 N HCl.

Nine more genes in the beta-carotenoid metabolism pathway were selected and gene-specific primers were manually designed for six genes for gene expression analysis and PCR conditions were standardised using gradient PCR. Before gene expression analysis, genomic DNA PCR was carried out using the 6 gene-specific primer sets, in 12 cassava varieties or genotypes, to verify for any mutations in the cassava genome at the primer-binding regions. Samples from 4 cassava varieties (2 white and 2 yellow tuber varieties) were ground for RNA isolation and RNA was isolated from 2 cassava varieties. Protein was isolated from 18 tissues including roots, tubers at different developmental stages and stem, petiole and leaves from upper and lower regions of plant, buds and seeds of cassava variety, Sree Prabha, at 8 MAP.

Genetic improvement of sweet potato for short duration, photo/thermo-insensitivity and processability

Biofortified hybrids for stable photo insensitive genotypes

The best performers identified during the summer season (2025) at 120 days were 43/83, 110/14, 598/2, 670/69, 580/108, 447/1, 562/32, 678/36, 110/54, 125/20 and 526/7 with a yield range between 250 g - 667 g plant⁻¹. Of these, 526/7 is white fleshed and 110/14, 110/54 and 125/20 contained both carotene and anthocyanin and the rest were orange-fleshed. The trial was laid out with 40 best yielding biofortified and white fleshed genotypes. The best performers during the *kharif* season (2025) at 120 days were 43/83 (1000 g plant⁻¹), 595/41 (900 g plant⁻¹), 526/7 (700 g plant⁻¹) and 582/23, 536/6, 37/40, 473/8, 582/29 and 586/10 (500 g plant⁻¹). Among the white/cream-fleshed ones, 526/7, 577/25, 37/40 and 582/4 were the best performers.

Sweet potato hybrids for use as leafy vegetable

The Fe content in the leaves of 11 selected hybrids with Kanjangad as the control ranged between 0.38-1.29 mg 100g⁻¹ FW, Zn 0.042-0.08 mg 100g⁻¹ FW, Cu 0.039-0.085 mg 100g⁻¹ FW and Mg 2.22-3.95 mg 100g⁻¹ FW. The iron content in tubers of promising hybrids ranged between 0.78-1.06 mg 100g⁻¹ FW and Zn ranged between 0.058 to 0.079 mg 100g⁻¹ FW. H-110/28 had an iron content of 0.78 mg 100g⁻¹ FW and Zn content of 0.058 mg 100g⁻¹ FW. H-38/15 had iron content of 1.01 mg 100g⁻¹ FW and H-43/83 had iron content of 0.96 mg 100g⁻¹ FW.

A new spontaneous mutant, a sectorial chimera was obtained in clonal progeny of H-686/10 which can be used as ornamental line. This was found stable through three clonal generations.

On-farm trial on biofortified and high starch hybrids

Four on-farm trials (OFTs) each for white fleshed, orange-fleshed, high starch and biofortified with anthocyanin and carotene were laid out in seven locations Kasaragod, Kuttoor, Parassala, Mavilakkadavu, Vlathankara, Bharathanoor and Kollam. In the OFT on white-fleshed sweet potato, H-38/46 performed best in terms of yield across the four location with a mean yield of 33.48 t ha⁻¹ followed by H-105/6. Both were pink skinned with cream to white fleshed. In the OFT on high starch sweet potato across four locations, the highest yielder was H-43/83 with a mean yield of 32.9 t ha⁻¹ followed by H-536/6.

Both had starch content of 22 and 19% and carotene content of 2.2 and 4.8 mg 100g⁻¹ FW, respectively. In the OFT on sweet potato biofortified with both carotenoids and anthocyanin across four locations, H-110/28 was the best performer in terms of yield with 25.3 t ha⁻¹ containing a total carotenoid content of 9.45 mg and anthocyanin content of 60 mg 100g⁻¹ FW. In the trial on orange fleshed sweet potato across five locations, H-38/15 was the high yielder with a mean tuber yield of 33.17 t ha⁻¹ with a total carotenoid content of 14.5 mg 100g⁻¹ FW. In OFT on high starch sweet potato at Kollengode, Palakkad and Kannur (Pinarayi) also H-43/83 was the best performer among the high starch line with an average yield of 1-1.2 kg plant⁻¹. Among the hybrids with both anthocyanin and β -carotene, 110/28 was the best performer with 750-1.15 kg plant⁻¹ in Kollengode. In Kannur (Pinarayi) in the OFT on orange fleshed sweet potato, H-38/15 was the best performer with 0.500-1 kg plant⁻¹. The tuber of H-43/83 was processed to β -carotene enriched rava for 'kesari' preparation and H-110/28 was processed into biofortified vacuum fried chips.

Genetic improvement of sweet potato for bio fortification and nutritional quality

Evaluation of sweet potato hybrids

A total of 133 promising sweet potato progenies producing purple-fleshed (63), orange-fleshed (36) and white-fleshed (34) tubers were evaluated for pre-harvest traits, namely plant growth habit, vine pigmentation, vine tip pubescence, mature leaf shape, abaxial leaf vein pigmentation and immature and mature leaf colour, in accordance with DUS guidelines and results are shown in fig. 12.

Biochemical evaluation revealed considerable variation in starch and sugar content. The highest starch content was recorded in SPH-23-120 (17.52%), while the lowest was observed in SPH-23-10 (1.95%). Sugar content was highest in SPH-23-113 (3.48%) and lowest in SPH-23-19 (1.58%). Mineral analysis showed that nitrogen content ranged from 1.09 to 2.28%, with the highest value in SPH-23-42 (2.28%) and the lowest in SPH-23-21 (1.09%). Phosphorus content varied from 0.101 to 0.98%, with the highest levels recorded in SPH-23-33 and SPH-23-54, and the lowest in SPH-23-47 and SPH-23-67. Potassium content ranged from 0.63 to 2.09%, with SPH-23-25 exhibiting the highest concentration and SPH-23-134 the lowest. A total of 40 sweet potato genotypes, comprising 35 test genotypes and 5 released varieties, were planted in the field during September 2025 for evaluation of their mineral nutritional quality.

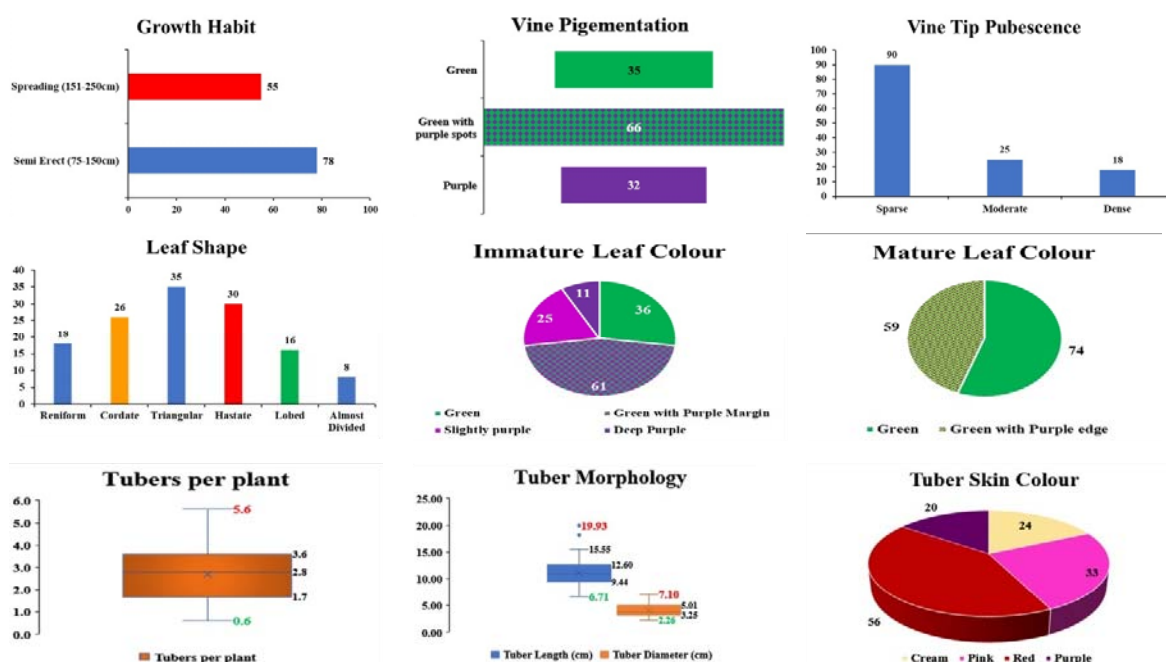


Fig. 12. Morphological characterization of sweet potato hybrids

Genetic improvement of sweet potato for drought and salinity stress tolerance

For identification of drought tolerant lines, a set of 42 sweet potato genotypes consisting of genotypes selected from earlier evaluations along with germplasm lines, were planted in October 2025 to assess their performance under drought stress and irrigated conditions. Drought stress was imposed on the stress treatment plots, while the non-stressed genotypes were provided with irrigations at frequent intervals to ensure optimum soil moisture, enabling a clear comparison of genotype performance under water-deficit and well-irrigated conditions. The trial is underway.

Ploidy manipulation and wide hybridization in sweet potato and its wild relatives to combat biotic and abiotic stress

Five accessions of sweet potato, tolerant to drought were collected from the Regional Station, Bhubaneswar. Seeds of *I. mauritiana* and *I. trifida* were multiplied for further evaluation. Moisture stress conditions in general, caused a reduction in growth parameters, including vine length, vine girth, number of branches, petiole length, number of leaves, leaf length and leaf width. The genotypes (Acc. No. 1, 2, 16, 24, 26) consistently showed high vegetative growth under stress, lower reduction compared to others and better overall stability. None of the accession was free from sweet potato weevil and none of the accession showed virus symptom

on leaves. Fifty seeds each of wild species, *I. trifida* and *I. mauritiana* were treated with 0.5 and 1% colchicine for 12 h. The seed germination was high in 0.5% colchicine (40%) compared to 1% colchicine (28%) and control (24%). However, 100 % mortality was observed in the colchicine treated seedlings. A crossing block consists of Sree Bhadra, Sree Rethna, Gouri, Bhu Sona, Bhu Krishna and two wild species (*I. mauritiana* and *I. batatas*) was established. A total of 402 artificial pollinations were made as follows. Sree Rethna x *I. trifida* (8); Sree Rethna x *I. mauritiana* (8); Sree Bhadra x *I. trifida* (60); Sree Bhadra x *I. mauritiana* (42); Gouri x *I. trifida* (100); Gouri x *I. mauritiana* (84); Bhu Krishna x *I. trifida* (4); Bhu Krishna x *I. mauritiana* (4); *I. mauritiana* x Gouri (82) and *I. trifida* x Gouri (10). Pollen fertility of sweet potato ranged from 80 to 94% during 6 to 11 AM. The stigma receptivity was high (79 to 93%) during the early hours (6-8AM). Preliminary studies on tuber sprouting and germination were initiated on five local varieties of market collected storage roots, to assess sprouting behavior and physiological traits and the experiment is currently in progress.

Genetic improvement of yams for yield, earliness, anthracnose resistance and tuber quality

In yams, the breeding lines, promising lines, released varieties and selected germplasm lines were planted for evaluation of desirable traits during the period. Morphological characterization was carried out in

the breeding line of *Dioscorea alata* and *Dioscorea rotundata* wherein 45 vegetative traits were recorded, comprising 15 stem traits and 30 leaf traits. The breeding lines exhibited considerable variation in quantitative traits, such as number of stems per plant, number of internodes up to the first branch, stem diameter, leaf tip length and petiole length. Among the qualitative traits, substantial variability was observed in leaf shape, petiole colour, emerging vine colour, stem cross-section and aerial tuber characters. Male and female flowers were observed in *D. alata* (Table 5). Overall, the breeding line DaH 9/196 and among the selected lines 'Assam Violet B' were found to have unique distinguishable morphological traits.

Among the greater yam breeding lines evaluated, DAH 10-3-28, DAS 19 and DAH 9-35-16 exhibited high resistance to anthracnose, whereas DAH 166 was classified as moderately resistant based on field level screening under natural infection.

Tuber dormancy was studied in 25 greater yam lines. Majority of the accessions (11) showed a dormancy period of 2 months (short), while 6 accessions showed dormancy of 3-5 months (medium), 6 accessions showed more than 5 months (long) of dormancy. Tubers having long dormancy were Da 11, Da 23, Da 68, Da 214, Da 817 and Da 243.

Table 5. List of flowering lines in *D. alata*

Male lines	DaH 10-404, DaH 10-43, DaH 10-24, DaH 9/196, DaH 10-277, DaH 660, DaH 166, Das 19, Das 7, DaH 10-3-28, DaS 10-425, DaS 76, DaS 99, Da 10-425, DaH 19-13, DaH 10-130, DaH 10-132, DaH 10-106, DaH 10-403
Female lines	DaH 10-12, DaH 9-2-19, DaH 10-41, DaH 8-25, DaS 48, DaH 9-22

Genetic improvement in elephant foot yam for high yield, earliness, quality and biotic stress tolerance

Under the elephant foot yam improvement programme, to overcome the main breeding barrier of non-synchronization of flowering, an experiment was taken up to standardize flowering using chemical means. Corms/cormels of Sree Padma and Gajendra were treated with four concentrations of GA₃ (100, 150, 200 and 300 ppm). Flowering was observed in Gajendra treated with GA₃ @ 150 ppm and Sree Padma treated with 100, 150 and 200 ppm GA₃. However, abnormality was noticed in the female flowers and lack of anther

dehiscence was also observed (Fig. 13A). GA₃ (100-150 ppm) was able to induce flowering in the non-flowering cv. Karunakizhangu for the first time.



Fig. 13. A. Abnormal flowers observed in elephant foot yam



B. Normal flower with spathe and without spathe

For identification of elite lines with traits of interest, screening was done in 22 accessions for acidity by analyzing the calcium oxalate content. Dry matter was also recorded. The dry matter content ranged from 23.5% (Am-48) to 37.5% (NDA-5 and Am-141). The calcium oxalate content ranged from 0.172 (Am-194) to 0.460 (Am-139) on dry wt. basis. Lines with calcium oxalate content <35 mg 100g⁻¹ FW were considered as non-acrid and will be used for further breeding programmes. For resistance studies, 23 accessions were monitored for their reaction to collar rot, leaf and pseudostem rot and Phytoplasma infection. However, none were found tolerant/ resistant. Field screening of elephant foot yam accessions for their reaction to foliar diseases showed that, TEy22-10, H-61, Am-162, AC-50 and Am 141 were less susceptible to leaf and pseudostem rot. Under natural field conditions, 27 elephant foot yam accessions were evaluated for nematode resistance. Accession Am-195 showed mild lesion severity with a score of 2 and was classified as moderately resistant. Accessions Am-36 and Am-21 recorded a score of 3 and were grouped as moderately susceptible, whereas TEy22-5 and Am-146 scored 4 and were classified as susceptible. The remaining 22 accessions were without any visible lesion symptoms

and were assigned score 0; however, they may be described as asymptomatic or apparently resistant under the prevailing natural field conditions.

Hybridization was attempted in elephant foot yam during May 2025 both at the Institute and the farmer's field. Of these, one cross – a sib mating of AD/2025-2 (a genotype with good culinary quality) was successful and produced fruits and seeds. One hundred and seventy seeds were collected and planted in portrays for germination. The previously derived hybrid AmH-99 was found to be early maturing (6M).

Four elite elephant foot yam accessions identified from the previous trials (Am-39, Am-141, AmH-dwarf and Am-162) were multiplied. From previous crosses few high yielding hybrids were identified - H-7-22/2-2017 (2.5 kg/plant, globose corm with 4 cormels), H-8-3-2019 (1.9 kg plant⁻¹-round depressed corm with no cormel) and H-8-15-2019 (2.5 kg plant⁻¹, round depressed corm with very few small cormels).

Evaluation trials (PYT-1 and 2) were conducted with five promising hybrids (H-6-7-2017, H-6-34-2017, H-102-2015, H-107-2015 and H-843/2-2017). In PYT-2 corm yield ranged between 30.35 t ha⁻¹ (H-6-34-2017) to 55.28 t ha⁻¹ (H-6-7-2017). Mean corm yield across the two years ranged between 17.82 (H-107-2015) to 40.05 t ha⁻¹ (H-6-7-2017). Cormel number per plant ranged between 1.89 (H-6-34-2017) to 13.74 (H-843/2-2017).

For molecular marker studies, 11 ISSR markers were screened and all were found polymorphic. Of these, eight ISSR markers were used to differentiate between two morphotypes of elephant foot yam based on cormels. The common elephant foot yam is characterized by a big corm and many insignificant cormels. On the other hand, cv. Karunakizhangu is characterized by a small corm and many prominent large cormels. ISSR marker studies showed clear differentiation in the banding pattern of these two morphotypes suggesting a different genetic make-up for these two. EST sequences of *Amorphophallus paeoniifolius* was analysed from the

NCBI database and 10 EST-SSR markers were designed for genetic diversity analysis.

Genetic improvement of taro for taro leaf blight resistance and nutritional quality

In vitro screening of taro germplasms for TLB resistance using artificial spore inoculation (15200 spores ml⁻¹) in the leaf disc method was performed. *Phytophthora* spore suspensions (10 µl) were inoculated on the dorsal leaf disc (8 cm) surface and incubated in a moist petri dish for 96 h. The time taken for infection, spot diameter and number of sporangia were observed at 96 h of inoculation. The time taken for infection varied from 24-48 hours, the spot diameters observed ranged from 2 to >4 cm, and the number of sporangia observed from <2 to >25 per microscopic field. Promising taro genotypes with TLB resistance and high nutrition quality will be evaluated under epiphytotic conditions in the ensuing season.

Genetic variability studies in Chinese potato, arrowroot and yam bean for economic traits through mutation and conventional breeding

Laboratory and field studies on Chinese potato and arrowroot were conducted to assess the effects of gamma irradiation treatments. In Chinese potato, laboratory experiments were carried out using gamma irradiation at 0 (control), 10, 20, 30, 40 and 50 Gy, sodium azide at 0.1, 0.2 and 0.3 per cent along with control, and mutagen-treated explants under *in vitro* conditions, following a Completely Randomized Design (CRD) with three replications. Observations were recorded on days to sprouting, sprouting percentage and survival rate. Mutagen-treated tubers/vines were subsequently established in the field in a Randomized Block Design (RBD) with three replications and observations were recorded on morphological traits as per ICAR-NBPGR descriptors and nutrient profiling of tubers and leaves was done. Flowering plants were identified and recorded on both individual plant and treatment-wise progeny bases for further observation.

CROP PRODUCTION

Resource management and climate smart agriculture for sustainable production of tropical tuber crops

Crop diversification involving tropical tuber crops

A. Cropping systems involving tropical tuber crops

Intercropping system involving short-duration cassava and legumes in rice-based system

Under intercropping studies averaging two years, of the three systems involving legumes, rice-short duration cassava (var. Vellayani Hraswa) + cluster bean (var. Gloria) was the most productive (tuber equivalent yield 34.28 t ha^{-1} , production efficiency $95.21 \text{ kg ha}^{-1} \text{ day}^{-1}$), profitable (Net return of ₹ $268,832 \text{ ha}^{-1}$, added profit of ₹ $130,311 \text{ ha}^{-1}$) and energy efficient ($277.10 \times 10^3 \text{ MJ ha}^{-1}$), besides saving half FYM and N and all P to cassava.

Sequential cropping system involving short-duration cassava and vegetables in rice-based system

Of the three systems involving vegetables, rice-short-duration cassava (var. Sree Vijaya or Vellayani Hraswa)-cucumber (var. KAU Vishal) was the most productive with higher tuber equivalent yield (98.15 t ha^{-1}), production efficiency ($272.63 \text{ kg ha}^{-1} \text{ day}^{-1}$) and energy equivalent ($323.63 \times 10^3 \text{ MJ ha}^{-1}$) at reduced fertility levels (half FYM and N, zero P to cassava; half FYM, N and P to cucumber).

B. Organic farming of tuber crops-based systems

Organic farming of elephant foot yam-based cropping systems

Combined analysis over two years indicated that the vegetable yield, tuber yield and tuber equivalent yield were not significantly affected by the interaction effect of vegetable x management options. But yield of cucumber was highest under 75% organic + 25% inorganic (16.93 t ha^{-1}), closely followed by 75% organic + innovative practices (15.98 t ha^{-1}). Corm yield of elephant foot yam was highest when intercropped with cucumber under 75% organic + 25% inorganic (23.79 t ha^{-1}) followed by, when intercropped with amaranthus under 100% organic (23.67 t ha^{-1}). The corm equivalent yield was highest with amaranthus as intercrop in 100% organic (32.28

t ha^{-1}). The soil chemical properties, pH, organic C, CEC, available N, P, K, Ca, Mg, Mn, Zn and Cu status were enhanced significantly in organic plots. The soil microbes, especially the count of bacteria and fungi were also favoured in these plots. Organic package of practices for intercropping elephant foot yam with vegetables such as cucumber and amaranthus, including FYM, poultry manure, vermi compost, neem cake, ground nut cake and PGPR were developed.

Organic farming of cassava-based cropping systems

Under organic farming trials, in the second season, cassava yield (36.17 t ha^{-1}) was significantly highest with cluster bean as intercrop. Tuber yield of cassava was unaffected by management options, with 75% organic + 25% inorganic producing highest yield (33.25 t ha^{-1}). The highest yield (2.03 t ha^{-1}) for vegetables as intercrops was under the treatment with 75% organic and 25% inorganic and was at par with the treatment 75% organic + innovative practices (2.02 t ha^{-1}). The interaction effect of inter crop and management was not significant for the yields of vegetables, cassava or tuber equivalent yield. The highest tuber yield for cassava (44.18 t ha^{-1}) and tuber equivalent yield of cluster bean (51.02 t ha^{-1}) was obtained with cluster bean as intercrop under 100% organic and under 75% organic + 25% inorganic, respectively.

Combined analysis indicated that the vegetable yield, tuber yield and tuber equivalent yield were not significantly affected by the interaction effect of vegetable x management options. However, the highest tuber yield of cassava (48.57 t ha^{-1}) and tuber equivalent yield (54.66 t ha^{-1}) were obtained with cluster bean as intercrop under organic treatment, 75% organic + 25% inorganic, followed by 100% organic treatment. Intercropping cassava with cluster bean under 100% organic was profitable with higher net income (₹ $10,36,856 \text{ ha}^{-1}$) and B:C ratio (3.30).

At the end of two years, pH was significantly higher in 100% organic plots. Though organic C was not significantly affected, it was highest and enhanced over the initial status in 75% organic + liquid organic manure plots, in both years. Available N was also significantly higher in 100% organic and 75% organic plots in the first year, and remained unaffected by treatments in the second year. Available P status was significantly higher in state PoP and 100% organic plots by the end of two

years. Available K content was highest in state PoP followed by organic/towards organic plots.

Organic package of practices for intercropping cassava with vegetables such as cluster bean/tomato/chilli, including FYM, poultry manure, vermi compost, neem cake, ground nut cake and PGPR were developed.

Weed management in tropical tuber crops

Integrated weed management in sweet potato

Second season experiment was conducted for weed management in sweet potato during 2024-25 with eight treatments including two controls (unweeded and weeded), replicated thrice to assess the crop growth, tuber yield and economics (Fig. 14). Application of pendimethalin (1 DAP) followed by post emergence herbicide clodinafopropargyl (35 DAP) effectively reduced the weed population (16.08 nos, 12.54 nos per square meter at 45, 90 DAP, respectively) and weed dry weight (12.54 g, 10.54 g per square meter at 45, 90 DAP, respectively). This treatment also resulted in a lower weed index (-2.78) and higher weed control efficiency (87.92%, 93.84% at 45, 90 DAP) and marketable tuber yield (15.44 t ha⁻¹). This was statistically at par with application of metolachlor (1 DAP) followed by application of clodinafopropargyl (35 DAP).

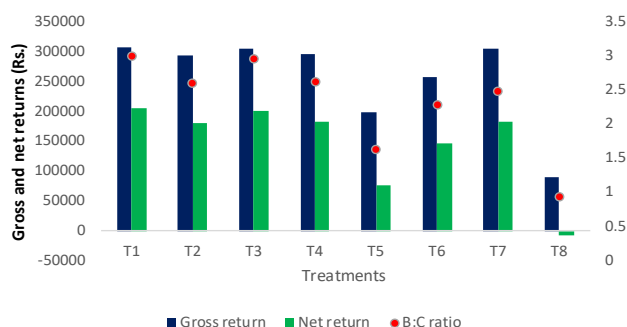


Fig. 14. Effect of different weed management methods on economics of sweet potato

Precision management of water and nutrients in tropical tuber crops

Fertigation studies in elephant foot yam

The experiment was laid out in split plot design with four levels of nutrients in main plots (M₁:75-50-100; M₂:100-50-100; M₃:100-50-125; M₄:100-50-150 kg N, P₂O₅ and K₂O ha⁻¹) and three schedules of fertilizer application in sub plots (S₁: 50% N and K < 90 days after planting (DAP), 25% 90-120 DAP, 25% 120-180

DAP; S₂: 50 % N and K <120 DAP, 25% 120-150 DAP, 25% 150-180 DAP and S₃: 25% N and K <90 DAP, 50% 90-150 DAP, 25% 150-180 DAP). The corm yield at harvest indicated no significant difference among the fertilizer doses and schedules of application. Corm yield varied from 38.0 (M₁) to 40.8 t ha⁻¹ (M₄) between main plot treatments and 37.5 (S₃) to 40.7 t ha⁻¹ (S₁) between sub plot treatments. The interaction effects were significant and based on the interaction effects, the lowest dose, 75-50-100 kg N, P₂O₅ and K₂O ha⁻¹ applied @ 50% before 120 DAP, 25% during 120-150 DAP and the rest 25% during 150-180 DAP, recorded the optimum yield (47.7 t ha⁻¹).

The study was completed and based on pooled data analysis of three seasons, the lowest dose, 75-50-100 kg N, P₂O₅ and K₂O ha⁻¹ applied @ 50% before 120 DAP, 25%,120-150 DAP and 25%,150-180 DAP, was found optimum for elephant foot yam under drip fertigation (47.8 t ha⁻¹). There was 25% saving in N and 33% saving in K nutrients, and also 53.2% increase in corm yield under drip fertigation over soil application of fertilizers. Agronomic efficiency for nitrogen and potassium was almost 2 and 2.3 times more compared to soil application of nutrients (Fig. 15).

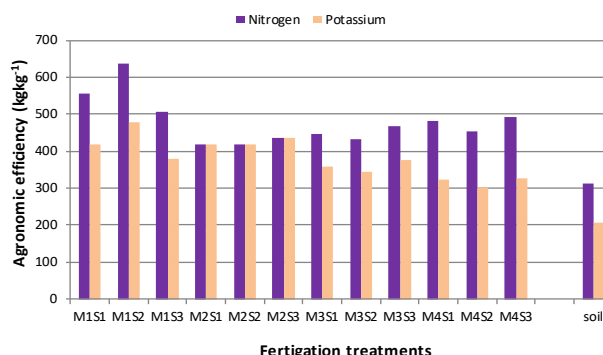


Fig. 15. Agronomic efficiency of nutrients under drip fertigation compared to soil application in elephant foot yam

Drip irrigation and fertigation management in greater yam

Studies on fertigation interval and number of splits in greater yam

The experiment was laid out in split plot design with fertigation interval in main plots (I₁-2 days, I₂-3 days and I₃-4 days) and sub plots as number of splits (S₁-40 splits, S₂-50 splits and S₃-60 splits). A control treatment [soil application of N-P₂O₅-K₂O @ 100-60-100 kg ha⁻¹ at NK basal (40%), 45 (30%) and 90 (30%) DAP) and full P at basal] was also included. The treatments were replicated thrice. Drip irrigation was

given at 80% CPE. Fertilization of N-P₂O₅-K₂O 100-60-100 kg ha⁻¹ was adopted. In fertilization treatments, water soluble fertilizer N- P₂O₅-K₂O was applied. Farmyard manure 10.0 t ha⁻¹ was incorporated in the last ploughing in all the treatments.

The results revealed that increasing fertilization level increased greater yam tuber yield up to I₂ and then decreased (Fig. 16). The treatment I₂ resulted in higher tuber yield of 38.4 t ha⁻¹ and it was followed by I₃ with 36.3 t ha⁻¹. Among number of splits of fertilization, the treatment S₃ resulted in higher tuber yield of 36.2 t ha⁻¹ (Fig. 17). The interaction was found between fertilization interval and number of splits. The treatment I₂S₃ resulted in significantly higher tuber yield (42.7 t ha⁻¹), gross (Rs 641000 ha⁻¹) and net returns (Rs 429800 ha⁻¹) as well as B:C ratio (3.03).

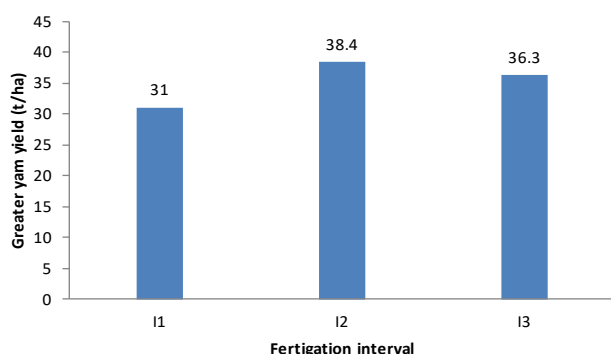


Fig. 16. Drip fertilization interval effects on greater yam tuber yield

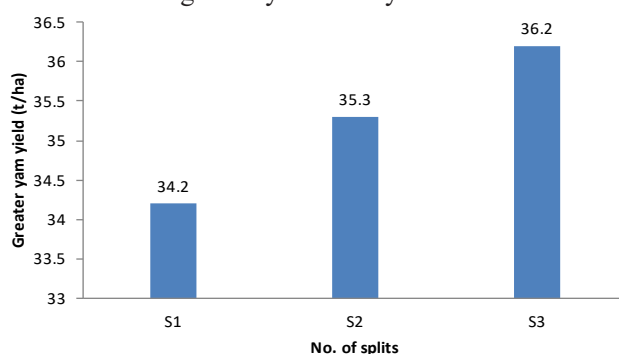


Fig. 17. Effects of number of splits of fertilization on greater yam tuber yield

Sustainable soil fertility management for enhanced production in tropical tuber crops

Response of nitrogen, phosphorus and potassium on soil quality, yield and proximate composition in greater yam + maize system

A field experiment was laid out during *kharif*, 2024-25 to study the effect of inorganic nutrients on soil quality, yield and proximate composition of greater

yam in an Alfisol. The experimental soil is only slightly acidic in reaction, non saline, medium in organic carbon, medium in available N, high in available P₂O₅, medium in available K, high in exchangeable Ca and Mg and low in available S. The field experiment was laid out with 16 treatment combinations *viz.*, control, 40, 80, 120, 160 kg N ha⁻¹, 30, 60, 90 kg P₂O₅ ha⁻¹, 40, 80, 120 kg K₂O ha⁻¹, 10 t ha⁻¹ FYM, FYM + 40-30-40 kg N, P₂O₅ and K₂O ha⁻¹, 40 kg N ha⁻¹ + *Azospirillum*; 30 kg P₂O₅ ha⁻¹ + PSB and 40-30 kg ha⁻¹ N & P₂O₅ + *Azospirillum* + PSB.

The significantly highest tuber yield (29.36 t ha⁻¹) was recorded due to integrated application of FYM + N₄₀P₃₀K₄₀ with a yield response of 67.8% over control and was statistically at par with 120 kg N ha⁻¹ (27.29 t ha⁻¹). Graded doses of N (40, 80 and 120 kg N ha⁻¹) showed an increasing trend in tuber yield of 27.3, 47.4, 55.9 % over control and declined to 49.6% at higher doses of N (160 kg ha⁻¹). Tuber yield of 22.4, 46.8 and 40.3% was observed due to the application of 30, 60 and 90 kg P₂O₅ ha⁻¹. Dual inoculation of *Azospirillum* and PSB along with N₄₀ and P₃₀ showed an increase of 34.5% tuber yield over control. Significantly highest starch (16.79%), total sugars (1.71%) and dry matter (26.76%) were recorded due to integrated application of FYM + ½ NPK, at par with integrated use of *Azospirillum*, PSB, N₄₀ and P₃₀. Highest nitrogen use efficiency (151 kg tubers per kg of applied N) was observed due to integrated use of N₄₀, P₃₀, *Azospirillum* and PSB, whereas, highest phosphorus use efficiency (237 kg tubers per kg of P₂O₅) and potassium use efficiency (114 kg tubers per kg of K₂O) were observed due to integrated application of FYM and ½ NPK (Table 6).

The soil pH significantly improved from the initial status of 6.25. The organic carbon and available N declined from the initial status, except integrated application of FYM + ½ NPK. Highest microbial populations in respect of fungi, bacteria and actinomycetes were observed due to integrated use of FYM + ½ NPK. Highest dehydrogenase (2.668 µg TPF hr⁻¹ g⁻¹), FDA (15.14 µg g⁻¹ hr⁻¹), urease (313.6 µg NH₄-N g⁻¹ h⁻¹) and acid phosphatase activity (21.54 µg PNP g⁻¹ soil h⁻¹) activities were observed due to integrated application of FYM + ½ NPK followed by N₄₀ + P₃₀ + *Azospirillum* + PSB.

Soil bacteria had significantly highest relationship with dehydrogenase ($r = 0.663^{**}$) and urease ($r = 0.554^{*}$), whereas fungi showed significant

Table 6. Effect of INM on yield and proximate composition of greater yam

Treatment	Tubers plant ⁻¹	Tuber wt. (kg)	Tuber yield (t ha ⁻¹)	Starch (%)	Total sugars (%)	Dry matter (%)
1) Control	2.10	1.85	17.504	14.85	1.44	22.15
2) 40 kg N ha ⁻¹	2.37	2.05	22.289	15.89	1.52	24.26
3) 80 kg N ha ⁻¹	2.47	2.21	25.805	16.10	1.59	25.32
4) 120 kg N ha ⁻¹	2.63	2.48	27.285	16.30	1.70	26.06
5) 160 kg N ha ⁻¹	2.43	2.33	26.181	16.36	1.69	26.46
6) 30 kg P ₂ O ₅ ha ⁻¹	1.97	1.96	21.424	15.13	1.49	24.72
7) 60 kg P ₂ O ₅ ha ⁻¹	2.20	2.28	25.698	15.16	1.51	25.37
8) 90 kg P ₂ O ₅ ha ⁻¹	2.30	2.35	24.559	15.58	1.58	25.63
9) 40 kg K ₂ O ha ⁻¹	2.20	2.18	19.309	15.72	1.44	24.78
10) 80 kg K ₂ O ha ⁻¹	2.27	2.49	25.015	14.63	1.47	25.61
11) 120 kg K ₂ O ha ⁻¹	2.47	2.40	26.633	15.26	1.64	26.22
12) FYM @ 10 t ha ⁻¹	2.10	2.30	20.322	16.23	1.53	26.26
13) FYM @ 10 t ha ⁻¹ +½ NPK	2.60	2.51	29.364	16.79	1.71	26.76
14) N ₄₀ + <i>Azospirillum</i>	2.20	2.14	23.143	14.92	1.62	25.49
15) P ₃₀ +PSB	2.30	2.18	22.513	14.79	1.52	25.15
16) N ₄₀ +P ₃₀ + <i>Azospirillum</i> +PSB	2.57	2.29	23.549	16.38	1.66	26.54
CD (P=0.05)	0.27	0.40	1.556	0.83	0.190	0.109

relationship with FDA ($r = 0.630^{**}$) and acid phosphatase ($r=0.446^{*}$), indicating that the bacteria and fungi in the soil mainly contributed to nutrient transformations and thus facilitated the availability of macro and micronutrients to the crop. Tuber yield showed highly significant relationship with urease activity ($r = 0.846^{**}$), followed by DHA ($r = 0.836^{**}$) and FDA ($r=0.741^{**}$). Urease activity significantly correlated with starch, total sugars and dry matter contents ($r = 0.661^{**}$, 0.893^{**} & 0.835^{**}), followed by DHA and FDA.

Organic carbon and available N exhibited highly positive and significant relationship with FDA, DHA, urease, alkaline phosphatase and acid phosphatase. Available K was significantly correlated with DHA, whereas available P showed highest significant relationship with alkaline phosphatase rather than acid phosphatase. Integrated use of organic manures and biofertilizers along with ½ NPK improved the physico-chemical and biological properties of the soil, thereby producing sustainable crop yields in greater yam. Application of soil test-based optimal doses of NPK fertilizers in conjunction with organic sources like FYM and biofertilizers helped to improve the soil quality and productivity of the greater yam cropping system in *Alfisols* of eastern India.

Screening of sweet potato genotypes for potassium use efficiency

The results of the field experiment, as laid out during 2024-25 revealed that Sree Bhadra variety recorded significantly highest tuber yield (17.04 t ha⁻¹), vine yield (23.15 t ha⁻¹) followed by Kanjangad (15.45 and 20.86 t ha⁻¹) and Kishan (15.11 and 20.65 t ha⁻¹). Significantly highest starch (16.96%) and dry matter (26.74%) were recorded by Kishan. Among the potassium management practices, significantly highest tuber yield (17.16 t ha⁻¹) was recorded due to combined application of FYM, potash solubilising bacteria and 25 kg K₂O ha⁻¹ with a yield response of 79.7%. Among the K levels, a yield response of 25.1, 50.2, 65.6, 75.1 and 71.3% cent over control due to application of 25, 50, 75, 100 and 125 kg K₂O ha⁻¹, respectively. Significantly highest vine yield (24.51 t ha⁻¹), starch (17.19%) and dry matter (27.03%) were recorded due to integrated use of FYM + KSB + 25 kg K₂O ha⁻¹.

Significantly highest starch, total sugars and dry matter (17.19, 2.40 & 27.03%, respectively) were noticed due to integrated application of FYM, potash solubilising bacteria and 25 kg K₂O ha⁻¹. Among the potassium levels, significantly highest starch, sugars and dry matter were recorded due to application of 75 kg K₂O ha⁻¹.

Post harvest soils were analyzed for chemical and microbial properties. The soil pH ranged from 5.41 - 5.67; org. C ranged from 0.39-0.62% (mean of 0.50%), available N, P, K varied from 167-253; 68.6-91.9 and 154-346 kg ha⁻¹, respectively. Exch. Ca and Mg varied from 11.6-20.0 and 4.6-6.2 c mol (p⁺) kg⁻¹, respectively. Available Fe, Cu, Mn and Zn contents in the soils were above the critical limits. Significantly highest soil organic carbon content (0.51%) was observed in the soils under Kishan, Kanjangad and Samrat varieties. Combined application of FYM, potassium solubilizing bacteria (KSB), and 25 kg K₂O ha⁻¹ resulted in highest organic carbon (0.60%), available N, P₂O₅ and K₂O (246, 86, and 265 kg ha⁻¹). Significantly highest available nutrients were observed in the soils under Sree Bhadra variety followed by Samrat and Kanjangad. Integrated application of FYM, potassium solubilizing bacteria (KSB) and 25 kg K₂O ha⁻¹ was found to improve the fertility status of the soil.

Highest activities of soil enzymes including dehydrogenase (5.69 µg TPF hr⁻¹ g⁻¹), fluoresce in diacetate hydrolysis assay (29.92 µg g⁻¹ hr⁻¹), urease (366.41 µg NH₄-N g⁻¹ hr⁻¹), acid phosphatase (26.74 µg PNP g⁻¹ hr⁻¹) and alkaline phosphatase (5.05 µg PNP g⁻¹ hr⁻¹) were recorded due to application of FYM + KSB + 25 kg K₂O ha⁻¹. Dehydrogenase activity exhibited highly positive and significant relationship with bacterial populations followed by actinomycetes and fungi. Similarly, FDA showed significant relationship with bacteria, actinomycetes and fungi, indicating that bacteria and actinomycetes were involved in nutrient transformations by influencing soil enzyme activities. Dehydrogenase, FDA and urease activities were found highest in the soils under Sree Bhadra (5.74 µg TPF hr⁻¹ g⁻¹; 28.78 µg g⁻¹ hr⁻¹; 356.36 µg NH₄-N g⁻¹ h⁻¹; and acid phosphatase activity (27.42 µg PNP g⁻¹ hr⁻¹) followed by Kanjangad and Kishan. Tuber yield and biochemical constituents of sweet potato had positive and significant relationship with FDA, urease, dehydrogenase and phosphatase activities. Acid phosphatase activity showed highly significant relationship with tuber yield, whereas alkaline phosphatase activity showed a significant relationship with proximate composition of sweet potato. All the enzyme activities showed positive and significant relationship with yield and proximate composition of sweet potato. In conclusion, integrated application of farmyard manure along with potassium solubilizing bacteria and 25 kg K₂O ha⁻¹ enhances tuber yields and maintain the soil

fertility for sustainable production of sweet potato. Among the elite sweet potato genotypes, 'Sree Bhadra' found superior and exhibited higher K use efficiency followed by Samrat and Kanjangad under Alfisols in eastern India.

Standardization of NPK for biofortified yam

Experiment was conducted for three years from 2022-23 to 2024-25, in order to standardize the NPK requirement for biofortified yam. Superior growth, and higher tuber yield per hectare (36.17) was recorded in with application of NPK @ 90-50-100 kg ha⁻¹ but was statistically at par with T6 (NPK @ 80-50-100 kg ha⁻¹).

Effect of lime on yield performance of biofortified sweet potato

A field experiment was laid out for the second consecutive year during 2024-25 to study the effect of lime on yield and proximate composition of bio-fortified sweet potato varieties planted in October 2024. Bhu Kanti recorded significantly highest tuber yield (19.61 t ha⁻¹) followed by Bhu Krishna (16.07 t ha⁻¹), Bhu Sona (15.22 t ha⁻¹) and Bhu Ja (11.60 t ha⁻¹). Significantly highest vine yield (22.38 t ha⁻¹) was recorded by Bhu Kanti which was at par with Bhu Ja (22.33 t ha⁻¹). Significantly highest dry matter (25.26%), and starch (17.42%) were recorded by Bhu Kanti which was at par with Bhu Ja (24.95 and 17.32 % of dry matter and starch, respectively). Incorporation of lime @ 2.0 t ha⁻¹ has recorded significantly highest tuber yield (16.19 t ha⁻¹) and vine yield (23.15 t ha⁻¹) followed by lime @ 1.0 t ha⁻¹ (15.04 t ha⁻¹ of tuber yield). Significantly highest starch (17.14%), sugars (2.40%) and dry matter (25.24%) were recorded due to application of lime @ 1.0 t ha⁻¹.

Soil carbon quality and conservation studies in tropical tuber crops

Soil Quality Index was estimated with the 16 parameters generated from the soil and plant analysis at first year of study and showed that the average soil quality index (carried out with 13 parameters) values ranged from 1.07 in no manure and 1.25 for manure applications. The second season cassava crop was harvested on 02 May 2025. Highest tuber yield of 27.97 t ha⁻¹ was obtained in the treatment containing soil mixture without manure and containing 50% RDF and 1% zeolite. Additions of zeolite mixtures at 50% RDF and 0.5% zeolites without manures improved the SQI to 1.21 as against

0.88 in control. The soil C pool analysed in different mixture treatments showed that zeolites treated @ 1% dose had a positive influence in the soil labile C content (7.95 in control to 9.75 g kg⁻¹ in the treatment with 50% RDF and 1% zeolite additions) and the corresponding recalcitrant C content (4.04 g kg⁻¹ in control to 22.42 g kg⁻¹ in zeolite mixtures containing 100% RDF and 1% zeolites without manures). Field soil samples collected at 3 MAP from all treatments (total 18 treatments and 2 replications) and incubated at constant soil moisture conditions (50% WHC) and at room temperature for a period of 131 days and monitored for CO₂ evolution at weekly intervals. The influence of zeolites at 50% RDF tends to decrease the C mineralization under no manure whereas it increased the C mineralization under manure added treatments (Fig. 18).

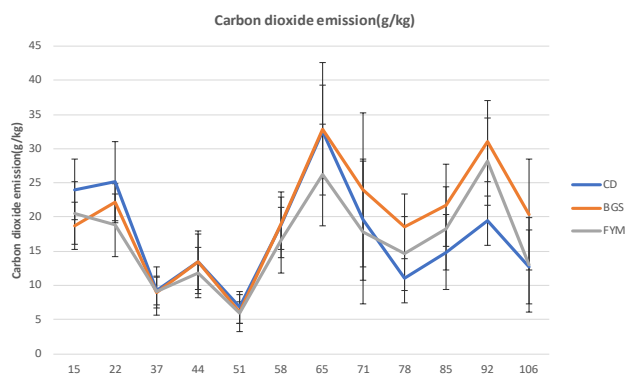


Fig. 18. Cumulative CO₂ mineralisation under different manure, fertilizer and zeolite treatments

Climate change adaptation and mitigation in tropical tuber crops

Role of mineral nutrition in mitigation of drought stress in cassava

Cyanogenic potential increased from 68.8 ppm to 87.7 ppm with solubor at 2% concentration whereas, it was found to be 52.5 ppm with 1% KNO₃ and remained within safe consumption limits. Among physiological traits, KNO₃ (0.5%) and solubor (0.5%) showed the greatest transpiration rates (12 ± 0.05 mmol H₂O m⁻² s⁻¹). Leaf area index (LAI) at harvest was highest (5.31) with MgSO₄ (0.5%) and 4.34 under KNO₃ (1%). The results indicated that, applying the recommended N:P:K @ 100:50:100 kg ha⁻¹ along with four foliar sprays of 1% KNO₃ during mid-growth (120–150 days) can enhance drought resilience, maintain tuber quality and improve yield in cassava and help to mitigate drought in cassava.

Physiological approaches for abiotic stress resilience in tropical tuber crops

Cassava drought stress: Varietal screening for physiological resilience and yield stability

To assess physiological resilience and yield stability under drought conditions, a replicated genotype screening experiment was conducted on cassava. The study evaluated varietal contrasts across well-watered (control) and drought-imposed treatments. Water deficit consistently reduced the net photosynthetic rate (P_n) and stomatal conductance (G_s) across genotypes, highlighting a strong stomatal limitation on CO₂ assimilation (Fig. 19). Despite this general trend, the magnitude of these declines varied significantly among the genotypes, indicating a robust physiological diversity that can be leveraged for breeding stress-resilient varieties.

Drought-induced alterations in the leaf-level microclimate were evidenced by elevated vapor pressure deficits (VPD) and diminished transpiration rates, reflecting an increased evaporative demand synchronized with stomatal closure. Furthermore, chlorophyll fluorescence diagnostics revealed a drought-driven impairment of Photosystem II (PSII) efficiency. This was primarily characterized by reductions in both maximum (F_v/F_m) and operating (PhiPSII) quantum efficiencies of PSII, accompanied by a compensatory increase in non-photochemical quenching (NPQ) (Fig. 20). This shift underscores an enhanced thermal dissipation mechanism that activates when carbon assimilation is metabolically constrained.

At the whole-plant level, drought imposition resulted in significant penalties concerning vegetative shoot growth (Fig. 21) and tuber traits, including both tuber number and weight. However, select genotypes demonstrated superior maintenance of photosynthetic function and tuberization under stress. The integration of these physiological and yield-related metrics establishes a practical framework for identifying resilient cassava accessions, utilizing P_n and PSII indicators as rapid, high-throughput screening traits.

Sweet potato drought stress: Integrating canopy cues, photosynthesis and storage-root yield responses

A complementary drought screening study evaluated six sweet potato genotypes to integrate canopy cues, leaf photosynthesis and storage-root yield responses under controlled and water-deficit conditions. Drought exposure predictably increased both

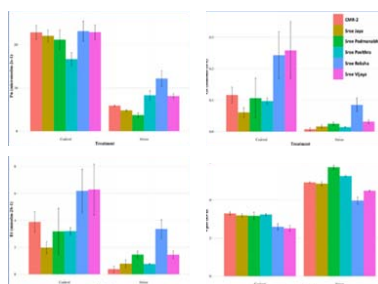


Fig. 19. Effect of drought on gas exchange parameters of cassava genotypes

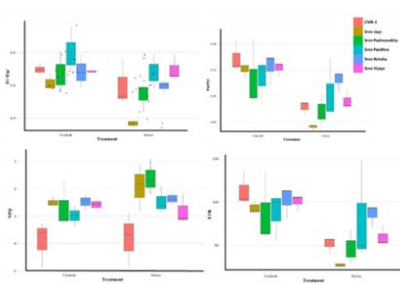


Fig. 20. Effect of drought on chlorophyll fluorescence kinetics of cassava genotypes

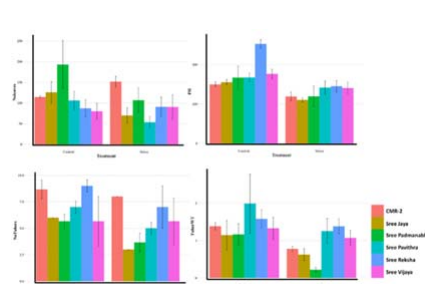


Fig. 21. Effect of drought on plant shoot growth parameters of cassava genotypes

forenoon and afternoon canopy and soil temperatures while simultaneously depleting soil moisture. This demonstrates that straight forward thermal and moisture indicators can serve as rapid, field-level proxies for verifying stress intensity.

Physiologically, water deficit precipitated significant reductions in both P_n and G_s . (Fig. 22). Distinct genotype-by-treatment interactions were observed, effectively differentiating stable-performing accessions from sensitive ones. Analysis of chlorophyll fluorescence parameters indicated that maximum (F_v/F_m) and operational (F_v'/m') PSII efficiencies declined under stress (Fig. 23). This, points to stress-induced constraints on PSII photochemistry and in highly susceptible genotypes, an increased vulnerability to photoinhibition. Consequently, the coupled gas exchange and fluorescence data provide

a coherent mechanistic overview: restricted stomatal conductance and impaired PSII efficiency directly culminate in diminished carbon gain under drought.

These physiological impairments were accurately mirrored in the plant morphometrics and yield parameters. Vine growth, aerial biomass accumulation and leaf retention exhibited genotype-specific penalties under stress, alongside overall shoot and root growth constraints (Fig. 24). Storage-root yield responses displayed wide variance, with certain genotypes experiencing severe yield suppression. Ultimately, this study proposes a multi-trait screening framework - integrating canopy thermal cues, leaf-level physiology and storage-root metrics - to identify drought-resilient sweet potato genotypes and formulate climate-smart varietal recommendations.

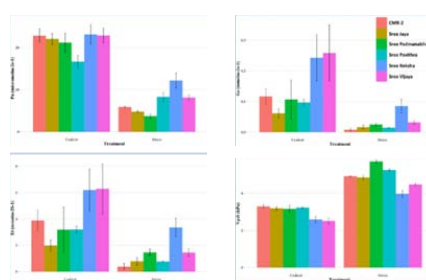


Fig. 22. Effect of drought on gas exchange parameters of sweet potato genotypes

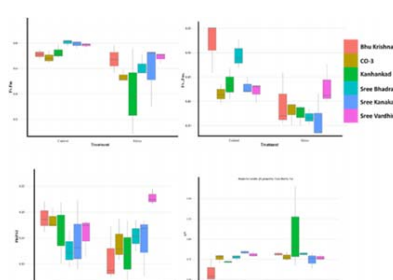


Fig. 23. Effect of drought on fluorescence kinetics of sweet potato

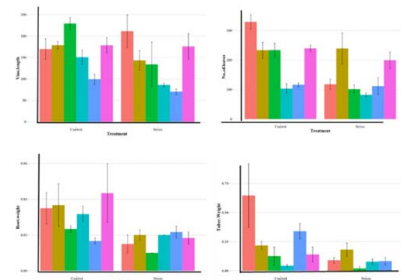


Fig. 24. Effect of drought on plant shoot and root growth parameters of sweet potato genotypes

Photoperiod × plant growth regulators in sweet potato: Regulation of tuberization, pigments and photosynthetic function

A factorial experiment was designed to investigate the interactive effects of photoperiod manipulation (normal light regime versus short-day induction) and plant growth regulators (PGRs; ethephon and salicylic

acid) on tuberization, morpho-physiological growth, pigment synthesis and photosynthetic performance in two sweet potato varieties (Sree Arun and Bhu Krishna). The findings indicated that short-day photoperiods can effectively redirect photo assimilate partitioning toward storage-root development, a response that is highly modulated by targeted PGR applications.

The combination of short-day induction with elevated doses of ethephon and salicylic acid significantly enhanced essential biochemical markers, notably chlorophyll and carotenoid concentrations, while improving overall plant growth parameters (Fig. 25). This synergistic treatment also fortified sink strength, manifesting as increased tuber counts and overall storage-root yields in the responsive variety.

Crucially, treatments optimizing photosynthetic rates also maintained highly favorable PSII efficiency metrics (Fig. 26). Specifically, the effective quantum yield (PhiPSII) and photochemical quenching (qP) were balanced effectively against energy dissipation mechanisms (qN and NPQ). This implies that yield enhancements are mechanistically tethered to the preservation of functional photochemistry alongside modified assimilate partitioning. Overall, this experiment provides actionable evidence that integrating photoperiodic cues with specific PGRs can favourably regulate tuberization physiology, offering promising strategies for controlled-environment cultivation and field-scale hypothesis generation.

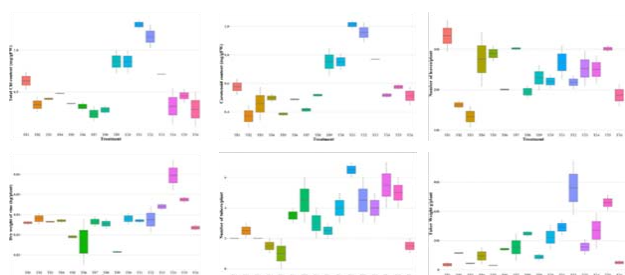


Fig. 25. Effect of day length and PGR on biochemical and plant growth parameters of sweet potato genotypes

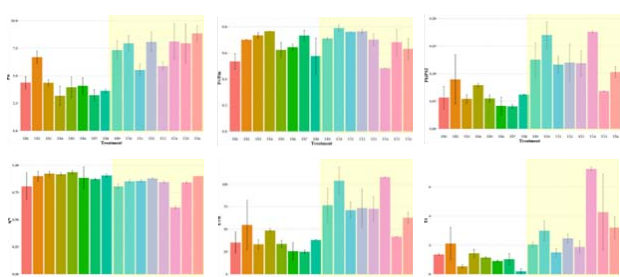


Fig. 26. Effect of day length and PGR on photosynthetic parameters of sweet potato genotypes

Cassava submergence tolerance: Membrane stability, antioxidant responses and photosynthetic recovery signals

To elucidate the physiological mechanisms underlying submergence tolerance, a field-based study evaluated varietal differences in cassava's stability and recovery during transient flooding events. Following short-

duration submergence, plants were assessed for biochemical perturbations, water-status integrity, antioxidant capacity, and photosynthetic functionality.

Submergence stress significantly degraded leaf pigment concentrations and depressed both the membrane stability index (MSI) and relative water content (RWC). This indicates severe cellular disruption and compromised water balance induced by flooding hypoxia. Concurrently, the accumulation of compatible solutes and the upregulation of enzymatic antioxidant activities (e.g., catalase and radical scavenging mechanisms) exhibited distinct varietal specificity. This suggests that the more tolerant genotypes successfully mitigate oxidative stress and preserve cellular membrane integrity.

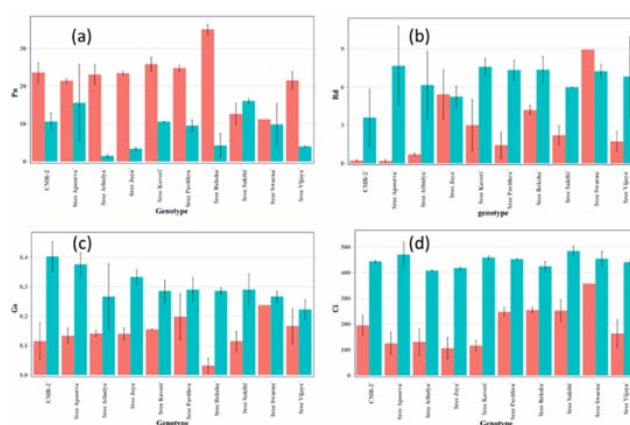


Fig. 27. Impact of submergence on Net Photosynthetic Rate (Pn) (a); Respiration Rate (Rd) (b); Stomatal Conductance (Gs) (c); and Intercellular CO₂ Concentration (Ci) (d) in cassava genotypes

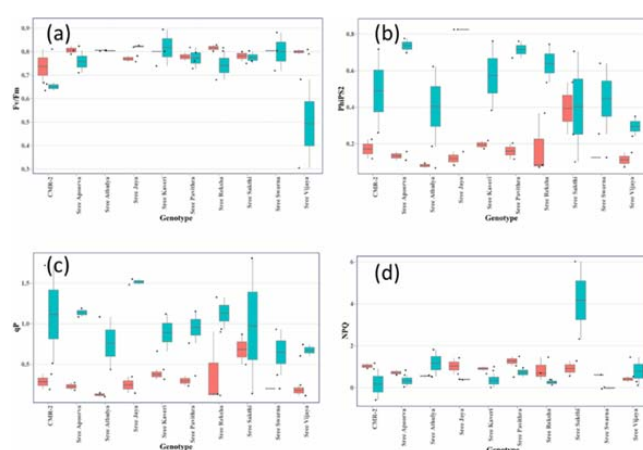


Fig. 28. Impact of submergence stress on Chlorophyll a fluorescence kinetics parameter such as Fv/Fm (a); PhiPS2 (b); qP (c); and NPQ (d) in cassava genotypes

Photosynthetic gas exchange parameters, encompassing Pn, respiration rate (Rd), Gs, and intercellular CO₂ concentration (Ci), generally deteriorated under sub-

mergence (Fig. 27). Parallel chlorophyll-a fluorescence profiling revealed marked reductions in maximal (Fv/Fm) and effective (PhiPSII) PSII efficiencies, alongside a decline in photochemical quenching (qP) and a concomitant rise in protective non-photochemical quenching (NPQ) (Fig. 28). Genotypes capable of retaining superior PSII functionality, coupled with robust antioxidant and osmolyte responses, demonstrated markedly better physiological resilience during the stress phase. Consequently, this study highlights MSI, antioxidant profiles and PSII performance metrics as practical, field-applicable trait markers to accelerate the selection of cassava varieties suited for flood-prone agroecosystems.

Quality planting material production of tropical tuber crops

Investigations on rapid multiplication of greater yam through vine cuttings

For rapid multiplication in greater yam, vine cuttings of var. Sree Nidhi were tested. Comparison of rooting behaviour against the time of vine collection showed significant difference. The maximum percent rooting was obtained at 135 DAP (78%) (Fig. 29A & B) across various pre-treatments and it was lesser for vines collected at 90 and 180 DAP. Similar was the case for length of roots where the length was maximum for cuttings collected at 135 DAP compared to other two stages. The mean tuber weight ranged 695 to 1062 g (Fig. 29C).

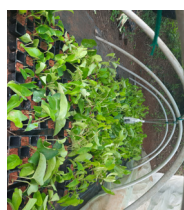


Fig. 29A. Rooting of vine cuttings in low tunnel (mist chamber)



Fig. 29B. Rooted cuttings



Fig. 29C. Harvested tubers of vine propagated greater yam var. Sree Nidhi

Sustainable and climate smart production of tropical tuber crops

Resilient cropping systems and urban farming involving tropical tuber crops

Sequential cropping systems involving Chinese potato and vegetables

Chinese potato was planted on 13 October 2025 in main plots under two nutrient levels and the crop stand was luxuriant. It will be harvested during

February-March 2026. Thereafter, vegetables will be sown during March-April.

Intercropping flowering plants with cassava

A new field experiment was initiated, to assess the performance of intercropping flowering plants with cassava during the initial period of growth. The experiment was laid out in RBD with 10 treatments in three replications during July 2025. The treatments included cassava (90 x 90 cm) + one row of marigold (T1), cassava (90 x 90 cm) + one row of globe amaranth (T2), cassava (90 x 90 cm) + one row of zinnia (T3), cassava (120 x 90 cm) + one row of marigold (T4), cassava (120 x 90 cm) + one row of globe amaranth (T5), cassava (120 x 90 cm) + one row of zinnia (T6), along with sole crops of cassava (T7), marigold (T8), globe amaranth (T9) and zinnia (T10). Intercrops started flowering in 35-40 days and were harvested upto 90 days. Among the flowering plants, performance of marigold was better, both under intercropping and sole cropping, followed by globe amaranth and zinnia. The study is continued for the next season.

Assessment of carbon sequestration potential in tropical tuber crops

In order to assess the carbon sequestration potential of tuber crops in a coconut based perennial cropping system, composite soil samples were collected and analyzed from the cropping systems involving coconut alone and tuber crops such as cassava, lesser yam and tannia keeping the control as coconut grown as a monocrop. Estimation of the diameter of the tree trunk at 1.3 m from the ground (DBH) and tree height of coconut trees under the above 4 treatments were done and further analysis for estimation of soil carbon pools are in progress.

Urban farming of tropical tuber crops: Standardization of soilless cultivation of sweet potato in grow bags

The first season experiment was laid out during 2025 to study effect of soilless cultivation of sweet potato in grow bags in factorial CRD. The factor varieties consisted of V1-Bhu Krishna, V2-Bhu Arunima, V3-SP-95/4, V4-Bhu Sona, V5-Kishan and V6-Kanjangad. The factor media and fertilizers consisted of M1-Soilless media (cocopeat, perlite and vermiculite @ 60-20-20) + customized hydroponic formulation, M2-Soilless media (cocopeat, perlite, vermiculite and sand @ 60-10-10-20) + customized hydroponic formulation and M3-Soil as control +

NPK RDF @ 50-25-50 kg ha⁻¹. The crop was planted on 22 December 2025. The experiment is in progress.

Precision farming system for sustaining productivity

Development of smart nutri-garden for food and nutritional security of urban and peri-urban areas

Standardization of media for smart nutri-garden: An experiment was conducted with five media composition (M1: cocopeat, M2: cocopeat + perlite-1:1, M3: cocopeat + vermiculite-1:1, M4: cocopeat + vermiculite + perlite-1:1:1, M5: cocopeat + Msand + perlite + vermiculite-1:1:1:1) using Sree Kanaka variety of sweet potato in CRD with a view to identify best media for use with sweet potato in smart nutri-garden (SNG) (Fig. 30). The results indicated that the mean length of vines varied from 84 cm in M5 to 59.3



Fig. 30. Sweet potato var. Sree Kanaka in SNG

cm in M2. Mean number of total branches varied from 22 in M1 to 7.8 in M3. Vine multiplication rate varied from 15.4 and 15.2 in M1 and M5, respectively to 10.2 in M2 and M3. Total biomass production ranged from 380.8g in M1 to 256 in M2. Number of tubers varied from 4.0 in M2 to 2.4 in M4. Weight of tubers varied from 585g in M5 followed by 549g in M4 and the lowest

of 497g in M1. Mean harvest index values varied from 0.48 in M5 followed by 0.44 in M4 and the lowest of 0.33 in M1.

Standardization of protected cultivation techniques for sweet potato

Effect of varieties on growth performance of sweet potato grown under protected condition

Twenty varieties were chosen for the study viz., Sree Kanaka (V1), Kalinga (V2), Gouri (V3), Sree Nandhini (V4), Bhu Krishna (V5), Sree Varun (V6), Kishan (V7), SP 95/4 (V8), Sourin (V9), Kanjangad (V10), Sree Arun (V11), Sree Vardhini (V12), Bhu Sona (V13), Sree Bhadra (V14), Sree Arunima (V15), Sree Rethna (V16), Bhu Swami (V17), Bhu Kanti (V18), Bhu Ja (V19) and SR 110-28 (V20) (Fig. 31).

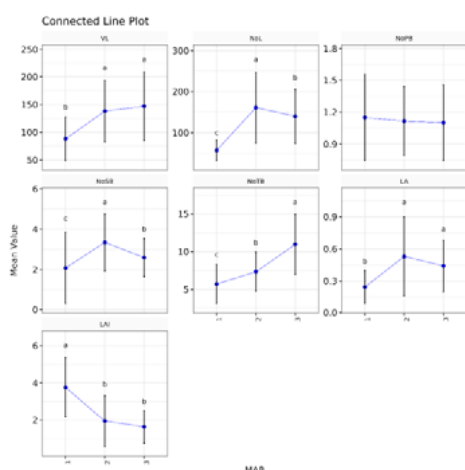
Significant differences were observed among the varieties with regard to the length of vine, number of leaves and leaf area index (LAI). The variety Kishan recorded the highest length of the vine (215.33 ± 47.03) and was on par with Bhu Krishna and Kanjangad. SP 95/4 had the lowest value (58.11 ± 23.27) and was on par with Gowri and Bhu Ja. This indicated that SP 95/4 Gowri and Bhu Ja were the least spreading varieties under protected cultivation and Kishan was the most spreading variety. Number of leaves were highest in Kishan (213.89 ± 109.77) and was significantly different from all other varieties. SP95/4 had the lowest length of vine (47.67 ± 22.59) and was on par with Sree Kanaka, Kalinga, Gouri and Sree Varun. Bhu Swami had the highest mean LAI (3.50 ± 2.64) and was on par with 12 other varieties, whereas SP 95/4 had the lowest mean (0.85 ± 0.39) and was on par with Sree Arunima and SR 110/28.



Fig. 31. Sweet potato varieties tested under protected condition

Effect of stage of growth (1, 2 and 3 MAP) on the performance of sweet potato varieties

Significant differences for stage of growth were observed for length of vine, number of leaves, number of secondary branches, total number of branches, leaf area, leaf area index and total biomass production (Fig. 32).



VL: Length of vine (cm), NoL: Number of leaves, NoPB: Number of primary branches, NoSB: Number of secondary branches, NoTB: Number of total branches, LA: Leaf area, LAI: Leaf area index

Fig. 32. Changes in vegetative parameters during different stages of growth on 20 sweet potato varieties grown under protected condition

Total biomass during 1 MAP was the maximum in Sree Bhadra (380 g) followed by Bhu Krishna (350 g) and the lowest in Sree Arun (75 g) with a mean of 203.1 g. At 2 MAP, the maximum biomass production was recorded in Kishan (680 g) followed by Bhu Sona (540 g) and the lowest in Bhu Swami (115 g). At 3 MAP, the maximum biomass was 1100 g in Sree Kanaka followed by Kishan (1035 g) and the minimum of 200 g in SR 110/28.

The length of vine and number of leaves increased from planting till 2 MAP and then remained almost constant, possibly due to translocation and utilization of photosynthates for tuber bulking than for use in vegetative growth. The number of leaves remained stable through the balancing between the leaves dropped and production of new leaves.

The number of primary branches remained same from 1 MAP till harvest. Secondary branches production continued till 2 MAP and then stabilized. However, the production of tertiary branches continued till harvest resulting in increase in total number of branches. Leaf number increased till 2 MAP and then remained stable.

Yield parameters

Number of tubers: At 1 MAP, varieties Sree Kanaka, Sree Nandini, Sourin, Sree Bhadra, Sree Rethna and Bhu Swami started tuberization. Of these, no. of tubers was four in Sourin and Sree Rethna followed by three tubers in Bhu swami. At 2 MAP, almost all varieties showed tuberization with a maximum number of six tubers in Sree Nandini, Sree Bhadra, Bhu Kanti and SR 110/28. At 3 MAP, the maximum number of tubers was 10 in Sree Varun followed by eight in Sree Kanaka, Kalinga and Kanjangad. The minimum number of tubers was two in Sree Bhadra with a mean number of 5.25 tubers per plant.

Weight of tuber: At 1 MAP, the maximum total weight of tubers was in Bhu Swami (30 g) followed by Sree Kanaka (20 g). At 2 MAP, the maximum tuber weight was 410 g in Sree Arun followed by 365 g in Sree Bhadra. At 3 MAP, the tuber weight of above 1 kg was recorded in Sree Arun (1230 g), Kishan (1020 g), SP 95/4 (1350 g), Sourin (1045 g) and Bhu Swami (1095 g).

Sensory evaluation of the tubers obtained under protected cultivation: The sensory evaluation of the boiled tubers showed that varieties Sree Kanaka, Kalinga, Bhu Krishna, Bhu Sona and Bhu Arunima got maximum score for colour and taste/sweetness. For texture Kalinga, Sree Varun, SP 95/4, Sree Vardhini, Bhu Arunima and Bhu Kanti had higher score. Overall acceptability was higher for Kalinga, Bhu Krishna, Bhu Sona, Bhu Arunima, Bhu Swami and Bhu Kanti (Fig. 33).

Overall acceptability

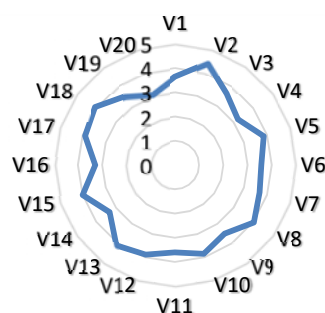


Fig. 33. Overall acceptability of sweet potato varieties grown under protected condition

Water management studies in Chinese potato

The field experiment to standardize a suitable irrigation schedule in Chinese potato was conducted for the second season, with eight treatments in RBD

with three replications. The treatments comprised of drip irrigation @ 50 (T_1), 75 (T_2), 100 (T_3), 125 (T_4) and 150% cumulative pan evaporation (CPE) (T_5); sprinkler irrigation @ 5 mm (T_6); furrow irrigation @ 5 mm (T_7) and a rainfed control (T_8). The crop was harvested in April and analysis of yield data indicated no significant difference in tuber yield between drip irrigation at various levels. Drip irrigation at 125% CPE recorded the highest tuber yield (23.2 t ha^{-1}) (Fig. 34). Sprinkler irrigation and furrow irrigation respectively recorded 24% and 31% reduction in tuber yield compared to T_4 . The third season trial is in progress.

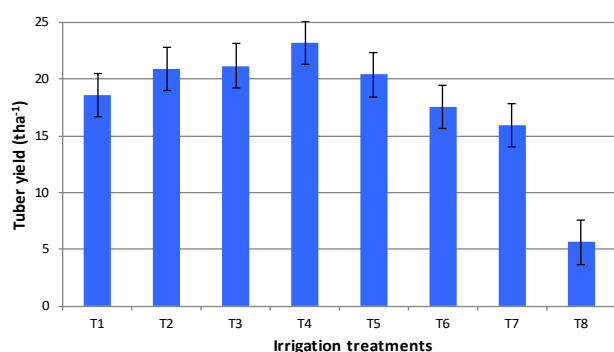


Fig. 34. Tuber yield of Chinese potato under different irrigation treatments

Responsible plant nutrition in tropical tuber crops

Standardization of nanourea in cassava

The second year result on tuber yield revealed significant effect of treatments on tuber yield with 100% N through soil application of ordinary urea along with 50% N through foliar spray of either nanourea (T_4) (46.15 t ha^{-1}) or ordinary urea (T_5) (47.75 t ha^{-1}) giving significantly higher yield and they were on par which was also on par with N @100 kg ha^{-1} as per PoP applied through ordinary urea (T_1) (44.38 t ha^{-1}). Though 50% N through soil application of ordinary urea and 50% N through foliar application of nano urea (T_2) (37.28 t ha^{-1}) produced significantly low yield, it was on par with PoP (T_1). Moreover, 50% N through soil application of ordinary urea along with 50% N through foliar application of nano urea (T_2) gave yield on par with 50% N through soil application of ordinary urea along with 50% N through foliar application of 2% ordinary urea (T_3) (36.53 t ha^{-1}) and 100% N through foliar application of nano urea alone (T_6) (39.97 t ha^{-1}). These results clearly indicated that, for realizing higher yield while

using nanourea in tropical tuber crops like cassava, it is better not to reduce the dose of N as per PoP recommendation. However, 50% N through soil application of ordinary urea can be substituted with 50% N through foliar spray of either nanourea or ordinary urea. Application of foliar spray of nanourea alone substituting 100% N requirement of cassava as per PoP (T_6) too is also giving a yield on par with PoP (Fig. 35). Absolute control resulted in a significantly low yield (29.65 t ha^{-1}) over all other treatments.

Tuber number, cyanogenic glucoside content, chlorophyll a, b and total chlorophyll content in the leaves at 4 and 7 MAP and leaf, stem, tuber and total dry matter production were not affected by treatments. However, T_2 showed a comparatively low HCN among the treatments. In the case of biometric characters, retained leaves at all the three intervals showed significant effect and the trend was random but numerical increase was seen with 100% N through soil application of ordinary urea. Available K status of the soil showed significant difference among treatments during the second year with T_3 giving significantly higher soil available K on par with T_1 and T_2 . Absolute control resulted in significantly low soil available K on par with T_5 . Over the initial K status, in all treatments, a decline was noted during the first year and further decrease during the second year. Over the initial, 100% N

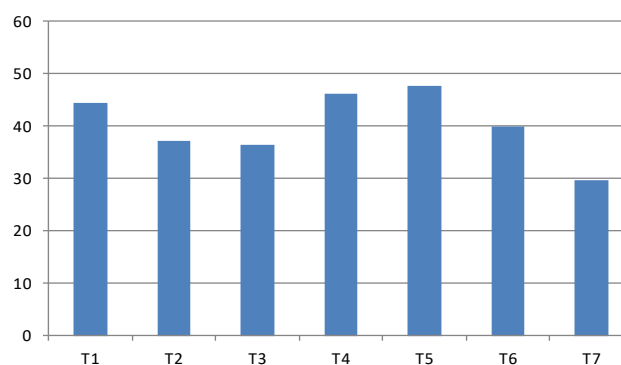


Fig. 35. Effect of nanourea application on cassava tuber yield (t ha^{-1})

through foliar nanourea caused maximum decrease in soil available K during the second year. Though no significant effect of treatments were seen in N, P, K uptake, it was found high during the second year as $244\text{--}310 \text{ kg ha}^{-1}$ N, $35.6\text{--}47.3 \text{ kg ha}^{-1}$ P and $147.7\text{--}208.1 \text{ kg ha}^{-1}$ K. Tuber P alone was significantly affected by treatments with higher tuber P under T_1 on par with all treatments except T_3 and T_6 resulting in significantly lower tuber P.

Standardization of nano DAP in cassava

Studies conducted with Sree Reksha indicated no significant effect of treatments on tuber yield, but the highest yield (44.6 t ha^{-1}) was observed in T1 with the recommended P @ 50 kg ha^{-1} through soil as basal (Fig. 36). The different parameters determined were tuber number, sprouting percentage, leaf, stem, tuber and total plant dry matter production, chlorophyll a, b and total chlorophyll, growth characters. Plant nutrient contents and plant uptake of nutrients were not significantly affected by nano DAP treatments. However, tuber number was maximum with 100% P through soil as basal along with nano DAP treatment, both as sett and foliar application. Sprouting percentage also was highest with nano DAP treatment both with 50 and 100% P as soil basal application. Cyanogenic glucosides were higher with sett and foliar treatments of nano DAP alone. Dry matter production was

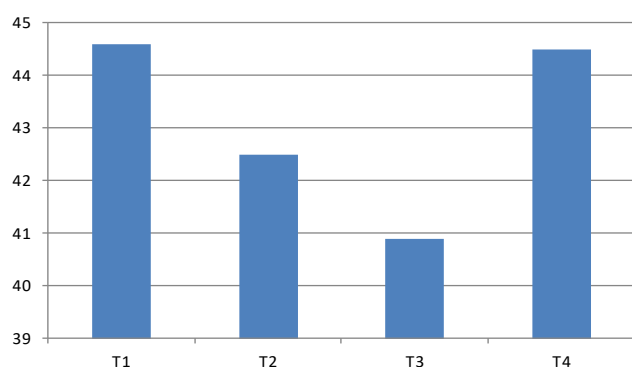


Fig. 36. Effect of nano DAP on cassava tuber yield (t ha^{-1})

seen numerically higher under 100% P through soil application along with nanourea as sett and foliar treatments. Among the post harvest soil properties, soil available K was significantly affected where 50% P along with nano DAP treatments resulted in a significantly higher soil available K and all other treatments were on par.

Long term nutrient management studies in cassava

The result of the fifth season crop of cassava under continuous cultivation for studying the sustainability of advanced INM practices like different nutrient management approaches, organic manure sources, secondary and micronutrients, NUE genotypes and soil and foliar application of nutrients with respect to sustainable yield index (SYI) tuber yield, post-harvest soil chemical properties, plant nutrient contents and plant uptake in addition to the effect of soil and foliar nutrition on percentage disease incidence are described below.

Tuber yield

With regard to the effect of nutrient management practices on tuber yield, soil test based application of N, P, K, Mg resulted in a significantly higher yield (44.5 t ha^{-1}) on par with soil test based N, P, K alone (41.7 t ha^{-1}). All other nutrient management practices like customized fertilizers (CF) (37.3 t ha^{-1}), low input management technology (LIMT) (37.6 t ha^{-1}) and soil test based application of Zn (33.7 t ha^{-1}) were on par to PoP (36.4 t ha^{-1}). Soil test-based application of N, P, K, B (23.7 t ha^{-1}) and absolute control (15.6 t ha^{-1}) were significantly lower in tuber yield. The different organic manures tried viz., FYM (36.4 t ha^{-1}), green manuring *in situ* with cowpea (33.2 t ha^{-1}), crop residue (36.0 t ha^{-1}) as well as application of ash along with farm yard manure (FYM) (34.1 t ha^{-1}) were found equally effective in affecting the tuber yield of cassava. In the case of NUE genotypes, all genotypes except CI 906 at 25% of the recommended dose of NPK (28.1 t ha^{-1}) resulted in a yield on par with H 1687 at 100% recommended dose of NPK (36.4 t ha^{-1}). Application of nutrients viz., P, K, Ca, Zn and Si for CMD management did not significantly affect the tuber yield over POP.

Sustainable yield index (SYI)

The mean SYI was highest under customized fertilizers (CF) (0.807) followed by low input management technology (LIMT) (0.726). Mean SYI showed almost similar values for PoP, soil test based NPK, NPKMg and NPKZn, but significantly lower values for NPKB and absolute control (Fig. 37). Over a period of five years, FYM and green manuring resulted in almost similar mean SYI and comparatively lower values in the case of crop residues (CR) and ash along with FYM (Ash+FYM) (Fig. 38). The SYI with respect to NUE genotypes revealed the same trend in the case of mean SYI, where Sree Pavithra and 7III E3-5 recorded almost similar values compared to CI 905 and CI 906. However, H 1687 showed the lowest mean SYI with 100% recommended NPK (Fig. 39). Si application resulted in lower values even below that of NPK alone and all others were higher than NPK in the order as $\text{P} > \text{K} > \text{Ca} > \text{Zn}$. Absolute control (AC) recorded the least mean SYI.

Post harvest soil nutrient status

Among the chemical parameters studied, significant effect of treatments was observed for pH, P, Mg, Zn and Cu. In the case of nutrient management practices,

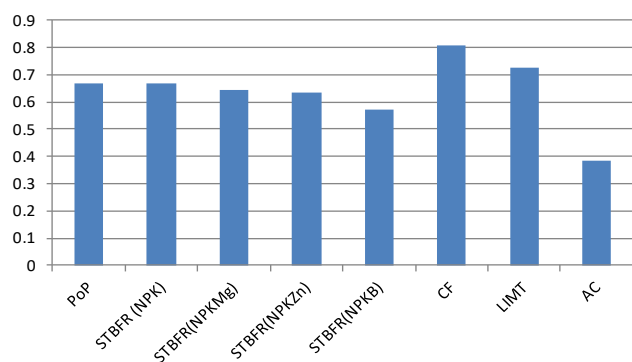


Fig. 37. Mean SYI over a period of five years under different nutrient management practices

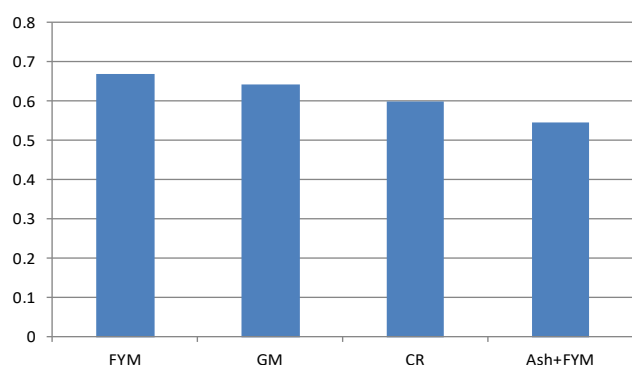


Fig. 38. Mean SYI over a period of five years under different organic manures

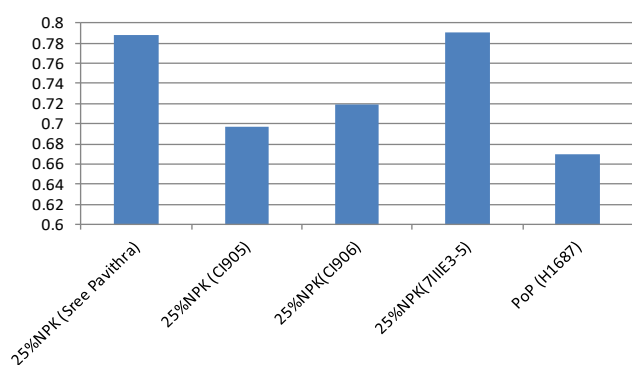


Fig. 39. Mean SYI over a period of five years under different NUE genotypes

except LIMT and AC, which showed a significantly low pH, all were on par with pH values ranging from 5.54 to 5.10. Green manuring resulted in a low pH (4.87) and application of ash + FYM resulted in a significantly higher pH (6.04). The NUE genotype, 7III E3-5 caused a significant reduction in soil pH (4.69) compared to other genotypes. While soil and foliar application of K resulted in a significant increase in soil pH (5.91), Zn application caused a significant reduction in soil pH (4.68). PoP (299.3 kg ha⁻¹) resulted in significantly higher soil available P and

absolute control, the significantly lowest (96.1 kg ha⁻¹). Application of ash + FYM resulted in a significantly higher soil available P (228.1 kg ha⁻¹) on par with PoP and CR incorporation caused a significantly lower soil available P (103.1 kg ha⁻¹) on par with green manuring *in situ* with cowpea. Planting of CI 906 resulted in a significantly lower soil available P (126.2 kg ha⁻¹) over other genotypes which in turn were on par. Soil available Mg was significantly higher under soil test based NPKMg (0.73 meq 100g⁻¹) which was on par with PoP, soil test based NPKZn and NPKB. All other treatments were on par except absolute control which showed a significantly low available Mg status (0.468 meq 100g⁻¹). Ash along with FYM resulted in a significantly higher soil available Mg (0.785 meq 100g⁻¹) on par with PoP (0.73 meq 100g⁻¹). Except 7III E3-5 which recorded a significantly lower soil available Mg (0.498 meq 100g⁻¹), all other genotypes were on par. No significant increase in soil available Mg with soil and foliar application of nutrients over NPK alone application. Soil available Zn was significantly low with soil test based NPKB (1.176 ppm) and all other nutrient management practices resulted in significantly higher soil available Zn. Different organic manures and the different NUE genotypes did not cause any significant increase in soil available Zn. Except soil and foliar application of K, which resulted in a significantly low soil available Zn (3.445 ppm), all other treatments behaved similarly. PoP caused a significantly higher soil available Cu (1.471 ppm) on par with soil test based NPK and NPKB. Absolute control resulted in a significantly low soil available Cu (0.529 ppm) on par with other nutrient management practices. Among the organic manures, FYM application caused the significantly highest soil available Cu (1.471 ppm) and all other treatments were on par. Among the NUE genotypes, H 1687 resulted in a significantly higher soil available Cu (1.471 ppm) on par with Sree Pavithra and CI 906. Though soil available Cu was influenced by soil and foliar application of nutrients, no significant increase over soil test based NPK was seen.

Soil physical properties

Post harvest soil samples collected during July 2025 from twenty four plots representing eight selective treatments including an absolute control and analysed for soil physical constants. Low input management significantly influenced the soil bulk density with lower values (1.37± 0.005 Mg m⁻³) as against ash and FYM which registered a higher value of 1.52± 0.011

Mg m⁻³). This treatment also resulted in higher soil water holding capacity (42.18± 0.312 %).

Plant nutrient contents

Leaf nutrients viz., N, P, Mg and Zn were affected by the different treatments. Nutrient management practices significantly affected leaf N, Mg and Zn. Different organic manures significantly affected leaf N along with green manuring *in situ* with cowpea recording significantly highest leaf N (2.52%). Leaf P and Zn was significantly affected by the different NUE genotypes. Soil and foliar application of nutrients significantly affected leaf N and leaf Zn. Treatments significantly affected stem Ca, K, P. Organic manures significantly affected stem P, K and Ca. NUE genotypes significantly affected stem Ca contents. Stem P was significantly affected by soil and foliar application of nutrients. Treatments significantly affected tuber Zn and among the treatments only nutrient management practices and soil and foliar application of nutrients significantly affected tuber Zn.

Total plant uptake

Treatments significantly affected total uptake of N and Zn. Total plant uptake of N was affected by nutrient management practices, organic manures and soil and foliar application of nutrients. Total plant Zn uptake was affected by nutrient management practices and soil and foliar application of nutrients.

Percentage Disease Incidence (PDI) with soil and foliar application of nutrients

The initial PDI at 3 MAP and the percentage reduction with respect to the studied nutrients viz., K, Zn, P, Si and Ca are depicted in Fig. 40. The reduction followed the order as P>K>Zn>Si>Ca.

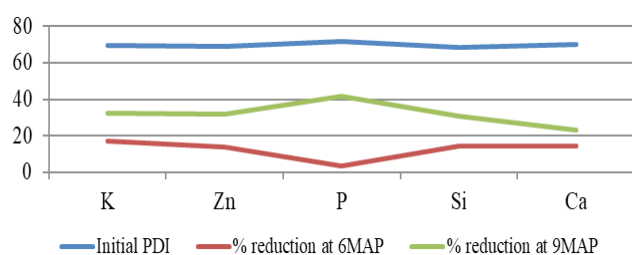


Fig. 40. Percentage reduction in PDI under soil and foliar application of nutrient

Standardization of liming material for naturally biofortified greater yam

After fixing the optimal NPK for naturally biofortified yam as 80:50:100 kg ha⁻¹ through field experiments

from 2022-2024, field investigations were initiated in May 2025, for standardizing the most suitable liming material and its optimal dose as part of developing a comprehensive INM package for the naturally biofortified greater yam variety Sree Neelima with nine treatments. The liming materials being evaluated include calcium oxide (@ 0.5, 1 and 1.5 t ha⁻¹), polyhalite (@ 0.5, 1 and 1.5 t ha⁻¹) and phosphogypsum (@ 0.5 and 1 t ha⁻¹). All the plots were treated with NPK @ 80:50:100 kg ha⁻¹ and FYM @ 10 t ha⁻¹. Exchangeable acidity (Al³⁺ and H⁺) and exchangeable aluminium were estimated at the time of planting as well as 6 MAP. It was observed that treatment variation was non-significant in the initial sampling but at the sixth month of application, phosphogypsum treatment could significantly reduce the exchangeable Al content. The lowest value of 0.81 milli equivalents 100 g⁻¹ was recorded by phosphogypsum @ 1 t ha⁻¹. The crop is due for harvest in January 2026 and post harvest observations will be taken.

Sulphur and boron interaction for tuberization in sweet potato

The influence of the interaction effect of sulphur and boron on tuberization and soil properties in sweet potato grown in laterite soil is being studied in lysimeter with the variety Sree Kanaka. The treatments include S @ 5.6, 11.2 and 16.8 kg ha⁻¹ applied alone and also in combination with boron @ 1 kg ha⁻¹ and PoP alone with B @ 1 kg ha⁻¹ which is maintained as control. The planting was done in the last week of November and the crop is due for harvest in February 2026.

Development of a low cost rapid assessment tool for soil organic carbon

Image analysis and data modeling studies for developing a rapid assessment tool for the laterite soils in AEU-8 was initiated and the work is in progress.

Sustainable soil fertility management for tropical tuber crops in eastern India

INM on soil quality, carbon sequestration potential, yield and proximate composition of greater yam in Alfisols

A field experiment was laid out during 2025-26 to study the effect of graded doses of NPK, secondary and micro nutrients, biological and organic sources on soil fertility, carbon sequestration potential and yield performance of greater yam in Alfisols with 15 treatments in 3 replications in a RBD. The treatments

included 1) Control; 2) 25% NPK 3) 50% NPK 4) 100% NPK 5) 150% NPK 6) FYM @ 15 t ha⁻¹ 7) Vermicompost @ 5 t ha⁻¹ 8) Azospirillum + PSB + KSB 9) FYM @ 15 t ha⁻¹ + ½ NPK; 10) Vermicompost @ 5 t ha⁻¹ + ½ NPK; 11) Azospirillum + PSB + KSB + ½ NPK 12) FYM @ 15 t ha⁻¹ + Vermicompost @ 5 t ha⁻¹ + ¼ NPK; 13) FYM + Vermicompost + ¼ NPK + MgSO₄ @ 25 kg ha⁻¹. 14) FYM + Vermicompost + ¼ NPK + ZnSO₄ @ 10 kg ha⁻¹. 15) FYM + Vermicompost + ¼ NPK + Borax @ 5.0 kg ha⁻¹. The crop will be harvested in March, 2026 and the yield data will be recorded.

Validation trials on INM in sweet potato, taro, yam bean and greater yam was conducted at the farmers' fields in 8 locations (3 locations in Rayagada and 5 locations in Mayurbhanj district) with 3 treatments (Control, recommended dose of fertilizers and RDF + FYM) in 3 replications. Sweet potato and yam bean were harvested, yield data was compiled and the results revealed an increase of 43 and 99% mean tuber yield in sweet potato over control and an increase of 85 and 141% tuber yield in yam bean over control.

Screening of sweet potato genotypes for potassium use efficiency

A field experiment was conducted for the second consecutive *khari* season during 2025-26 to study the potassium use efficiency in elite genotypes of sweet potato. The trial was laid out with 5 genotypes (Sree Bhadra, Kishan, Kanjangad, Samrat and Bhu Sona) of sweet potato and 9 treatments of K management practices (Control, 25 kg K₂O ha⁻¹, 50 kg K₂O ha⁻¹, 75 kg K₂O ha⁻¹, 100 kg K₂O ha⁻¹, 125 kg K₂O ha⁻¹, Potassium solubilizing bacteria (KSB) + 50 kg K₂O ha⁻¹, FYM @ 5.0 t ha⁻¹ + KSB and FYM + KSB + 25 kg K₂O ha⁻¹). The crop will be harvested in February, 2026.

Effect of secondary and micro nutrients on naturally fortified sweet potato

A field experiment will be laid out during *rabi* season, 2025-26 to find out the response of secondary and micro nutrients on bio-fortified sweet potato with 4 varieties of bio-fortified sweet potato (Bhu Krishna, Bhu Sona, Bhu Kanti and Bhu Ja) and 6 treatments (T1: FYM @ 5 t ha⁻¹ + 75-25-75 kg N, P₂O₅ and K₂O ha⁻¹; T2: FYM + RDF + Lime @ 2.0 t ha⁻¹; T3: T2 + MgSO₄ @ 25 kg ha⁻¹; T4: T2 + ZnSO₄ @ 10 kg ha⁻¹; T5: T2 + Borax @ 5 kg ha⁻¹; T6: T2 + MgSO₄, ZnSO₄ and Borax @ 25, 10 and 5 kg ha⁻¹). Organic manure (FYM) was analyzed for nutrient contents, which

contain 0.48-0.36-1.02% N, P and K, respectively. The crop will be harvested in February 2026.

Regenerative farming in tropical tuber crops

Organic farming of taro-based cropping systems

After the harvest of the vegetable intercrops [amaranthus (var. Arun), cluster bean (local) and cucumber (var. KAU Vishal), the main crop of taro (var. Muktakeshi) is being managed and almost ready for harvest. The crop is in good condition.

Characterization of low cost organic sources for developing biomanures

Organic manures, viz. biogas slurry (BGS), cassava digestate (CD) (630 liters each) and farm yard manure (as positive check) were processed from the slurry state to solid form. The liquid: solid manure was found in the ratio of 18.4:1 and 5.7:1 for BGS and CD, respectively when biogas slurry from a biogas plant in Trivandrum district and cassava digestate from SPAC, Erode district, Tamil Nadu was analyzed. An incubation study was initiated in November 2025 with 18 treatments and 3 replications involving organic manures and biofertilizers (purchased from College of Agriculture, Vellayani) maintaining under 50% WHC and at ambient temperature. pH, EC, carbon mineralization at weekly time intervals and carbon pool C were analyzed.

Optimization of biochar production from tuber crop residues

The experiment to utilize the tuber crop residues for biochar production has been initiated in October 2025. Forty per cent recovery of biochar has been recorded with cassava stem base (CSBB) as the feed stock. Studies on the physico chemical and thermal characteristics of the biochar from different crop residues as feed stock are in progress. The average pH of CSBB was 9.2. Elemental composition of CSBB indicated the nutrient contents as: C (69%), N (3.15%), P (1.29%), K (2.75%), Ca (1.26%), Mg (0.21%), Fe (0.17%), Mn (0.15%), Cu (0.48%) and Zn (0.3%).

Physiological approaches for abiotic stress resilience in tropical tuber crops

Selection of PGR and bioagents consortia for abiotic stress tolerance in sweet potato

In the first-season field evaluation of sweet potato cv. Sree Arun, water-deficit stress caused

a pronounced decline in physiological efficiency and yield formation. Stress significantly reduced net photosynthetic rate (Pn) and photochemical quenching (qP), while significantly increasing non-photochemical quenching (NPQ), indicating restricted carbon assimilation and a greater shift toward protective thermal energy dissipation. Stomatal conductance (gs) also declined markedly, suggesting stomatal limitation of photosynthesis, although the reduction was not significant at the 5% level. In contrast, respiration and Fv/Fm remained statistically unchanged, showing that moisture stress affected functional photosynthesis more than it caused irreversible damage to PSII. The bioagent and PGR treatments did not exert significant effects on gas exchange or fluorescence traits, and the Treatment $\times$ Stress interaction was also non-significant for these parameters. Yield responses, however, showed a stronger treatment effect. Water-deficit stress significantly reduced root weight and tuber number per plant and tuber weight declined from 0.421 kg under control conditions to 0.257 kg under stress, a reduction of about 39%. Among the treatments, T3 [consortium + PGR mix 1: NAA + brassinosteroid + GA₃] recorded the highest overall tuber weight, followed by T6 [consortium + foliar PPMs + PGR mix 1], whereas T4 [consortium + PGR mix 2: salicylic acid + ethephon] showed the lowest response. The overall treatment trend for tuber weight was T3 > T6 > T2 $\approx$ T5 > T7 > T1 > T4, indicating that, although physiological traits were not significantly improved by the treatments, consortium + PGR mix 1 provided the most promising support for yield under water-deficit conditions (Fig. 41).

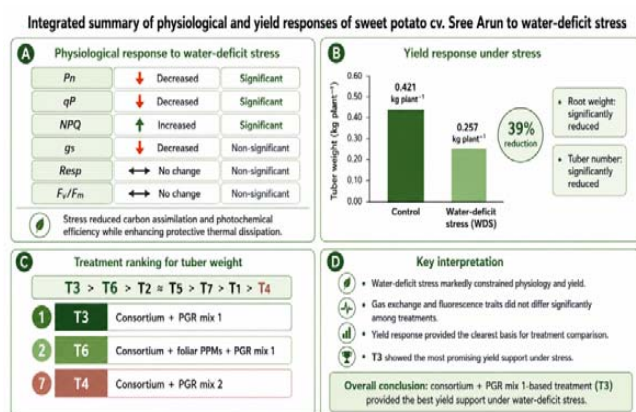


Fig. 41. Integrated summary of physiological, yield and treatment responses of sweet potato cv. Sree Arun to water-deficit stress.

Sustainable seed systems with rapid techniques for quality planting material production of tropical tuber crops

Rapid propagation techniques through single nodes with leaves in cassava

An experiment was initiated during crop season 2025 for rapid propagation techniques through single nodes with leaves in cassava for variety Sree Reksha and Sree Vijaya with 8 treatments in CRD. Single nodes with attached leaves were excised from immature cassava stems at 2 MAP and were placed in the plastic cups with water and initial sprouting started in 3 days (Fig. 43). Treatments comprised (T₁) Node cutting directly planted in water, (T₂) Node cutting with Hoagland solution full strength, (T₃) Node cutting with Hoagland solution half strength, (T₄) Node cutting with Hoagland solution full strength + growth regulator IBA 150 ppm and (T₅) Node cutting with Hoagland solution half strength + growth regulator IBA 150 ppm, (T₆) Node cutting with Soil: FYM (2:1) and transplanted in the field 15 days after



Fig. 43. Single nodes cutting with leaves in cassava

planting, (T₇) Node cutting with Soil: FYM (2:1) and transplanted in the field 30 days after planting and (T₈) Control (planted in the soil). Planting was done immediately after cutting the node. First node sprouting took 3 and 4 days in (T₁) in Sree Reksha and Sree Vijaya, respectively, whereas it took 6 and 7 days in (T₆) in Sree Reksha and Sree Vijaya, respectively. However, in all treatments further node growth was not established in the field as well as room condition.

Ideal stage of stem cutting for planting material production in cassava

A field experiment was initiated during crop season 2025 for determination of ideal stage of stem cutting for planting material production in cassava for variety

Sree Reksha and Sree Vijaya with five treatments in RBD. Treatments comprised (T₁) Stem cutting 4 months before harvesting, (T₂) Stem cutting 3 months before harvesting, (T₃) Stem cutting 2 months before harvesting, (T₄) Stem cutting 1 month before harvesting and (T₅) Stem cutting at the time of harvesting. Planting was done immediately after cutting the stem. First sprouting took 7 and 12 days in (T₁) in Sree Reksha and Sree Vijaya, respectively, whereas it took 6 and 12 days in (T₂) in Sree Reksha and Sree Vijaya, respectively. Field establishment and plant growth were good in (T₁) followed by (T₂) and the experiment is in progress.

Portray raised minisett plants in the field

A field experiment was conducted during the crop season 2025 to evaluate the performance of minisett nursery raised plants in the field for cassava variety Sree Reksha. The minisett seedling was uprooted after one month in the portray and was transplanted in the field. The treatments were replicated thrice. (T₁) Protray raised seedling, (T₂) Nursery raised seedling and (T₃) Control. Protray raised seedling took 6 days, whereas it took 8 days in nursery raised seedling and 11 days in control (T₃). Among the different treatments, plant growth parameter observations in the field revealed that plant height (cm), number of leaves and stem girth (cm) were increased with

(T₁) portray raised seedling as compared to other treatments and the experiment is in progress.

Seed villages for accelerating quality planting material production in tuber crops

As part of the programme, seed villages were established in Kerala, Tamil Nadu, Nagaland and Arunachal Pradesh in a total area of 95 acres covering 105 farmers.

Decentralised Seed Multiplier (DSM) for large scale quality planting material production of tuber crops

To establish the tuber crop farmers' network for production of quality planting materials of tuber crops under the guidance of ICAR-CTCRI, farmers who cultivate tuber crop varieties in less than 1 ha area were approved as Decentralised Seed Multiplier (DSM) of quality planting material of tuber crops.

Ten demonstrations plots were established in Parassala Block, Thiruvananthapuram for cassava, as per the seed rolling plan of tropical tuber crops of ICAR-CTCRI. A total of 59 farmers registered as DSM of quality planting material of tuber crops [cassava (8), sweet potato (21) elephant foot yam (11), greater yam (10), taro (8) and yam bean (1)] in an area of 108.4 acres.

Table 7. Quality planting material production of tuber crops during the season 2025

Sl.No.	Name of the crop	Varieties	Quantity of planting material produced
1.	Cassava (No. of stems)	Sree Kaveri	3000
		Sree Annam	7500
		Sree Vijaya	37,500
		Sree Jaya	37,000
		Sree Reksha	58,000
		Sree Suvarna	14,000
		Sree Sakthi	6,500
		Sree Pavithra	14,000
		Local (M4, Sumo Vellayani Hraswa)	26,500
		Total	2,04,000
2.	Elephant foot yam (ton)	Gajendra	17.00
		Sree Padma	15.00
		Total	32.00
3.	Greater yam (ton)	Sree Keerthi	7.00
		Sree Nidhi	5.50
		Sree Neelima	3.00
		Orissa Elite	7.00
		Total	22.50
4.	White yam (ton)	Sree Dhrona	1.00
		Sree Priya	3.50
		Sree Subhra	3.50
		Total	8.00
5.	Lesser yam (ton)	Sree Latha	3.50
		Total	34.00
6.	Taro (ton)	Sree Telia	2.00
		Sree Hira	1.00
		Sree Reshmi	1.00
		Muktakeshi	3.00
		Total	7.00
7.	Arrowroot (ton)	Sree Adhya	1.00
8.	Sweet potato (No. of vine cuttings)	Bhu Sona	15,50,000
		Bhu Krishna	16,50,000
		Kisan	3,50,000
		Sree Arun	1,55,000
		Sree Kanaka	1,50,000
		Varun	3,000
		Kanjangad	3,000
		Total	38,61,000
9.	Chinese potato (No. of vine cuttings)		25,000
10.	Yam bean (kg)	RM-1	160

CROP PROTECTION

Development of innovative technologies for the intensification of pest management in tuber crops through biorational approach

Management of important pests and documentation of emerging pests in tuber crops

Characterization of emerging tuber crop pests

During the year under report two new pests were identified in cassava. *Tiracola plagiata*, commonly known as the cassava hornworm was identified from Kollam and Thodupuzha regions of Kerala and was found to cause upto 40% shoot damage in cassava (Fig. 44). Soldier fly larva (Stratiomyidae) was observed to cause upto 20% damage in stored sets of cassava in cassava growing regions of Salem, Tamil Nadu (Fig. 45).

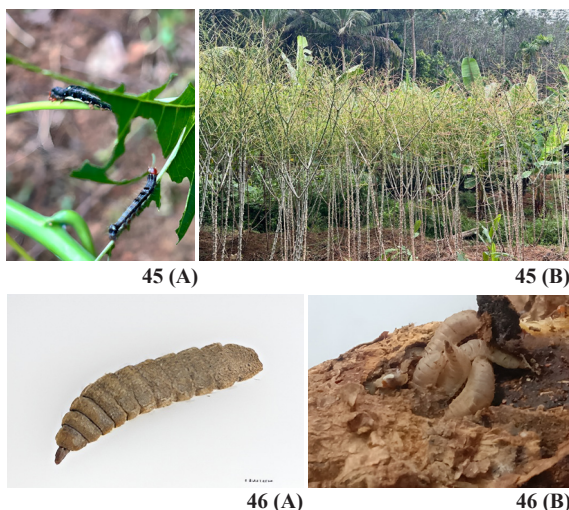


Fig. 45a - 46b. Cassava Hornworm infestation

Effect of mealy bug attack on starch content of cassava

The effect of mealybug infestation on the starch content of cassava was evaluated in the varieties M4, Sree Pavithra, Sree Harsha, Sree Swarna, Sree Athulya and Sree Apoorva. The results indicated no significant difference in starch content between mealybug-infested and uninfested plants. However, sugar content was significantly affected by infestation, with infested cassava plants exhibiting higher sugar levels compared to uninfested plants (3.9 vs 3.5) (Table 8).

(Analysis conducted using AgriAnalytics@R Ver.3.19 (Anova Factorial). Treatment means labeled with the same letter are not statistically significantly different)

Table 8. Effect of mealy bug attack on starch/ sugar content of cassava varieties

Starch % (dry weight)

Variety	Infection		Mean
	Yes	No	
M4	3.90 ^{cd}	3.40 ^{de}	3.650 ^{bc}
Pavithra	7.40 ^a	4.45 ^{bc}	5.925 ^a
Harsha	2.85 ^{ef}	5.20 ^b	4.025 ^b
Swarna	4.50 ^{bc}	3.00 ^{ef}	3.750 ^{bc}
Athulya	3.45 ^{de}	3.10 ^{de}	3.275 ^c
Apoorva	1.55 ^g	2.25 ^{fg}	1.900 ^d
Unknown	3.85 ^{cd}	3.45 ^{de}	3.650 ^{bc}
Mean	3.928571 ^a	3.550000 ^b	

Sugar % (dry weight)

Variety	Infection		Mean
	Yes	No	
M4	3.90 ^{cd}	3.40 ^{de}	3.650 ^{bc}
Pavithra	7.40 ^a	4.45 ^{bc}	5.925 ^a
Harsha	2.85 ^{ef}	5.20 ^b	4.025 ^b
Swarna	4.50 ^{bc}	3.00 ^{ef}	3.750 ^{bc}
Athulya	3.45 ^{de}	3.10 ^{de}	3.275 ^c
Apoorva	1.55 ^g	2.25 ^{fg}	1.900 ^d
Unknown	3.85 ^{cd}	3.45 ^{de}	3.650 ^{bc}
Mean	3.928571 ^a	3.550000 ^b	

Forecasting model for mealybugs infesting cassava

A forecasting model for mealybug infestation in cassava was developed using biotic and abiotic data collected over the last three seasons. The model indicated that an economic threshold level of infestation (>20%) occurs when the optimum average temperature exceeds 29.35 °C, average relative humidity is below 76.86%, average rainfall is less than 0.13 mm, average wind speed is greater than 2.225 km h⁻¹, and mean solar radiation exceeds 245.69 W m⁻² (Fig. 47).

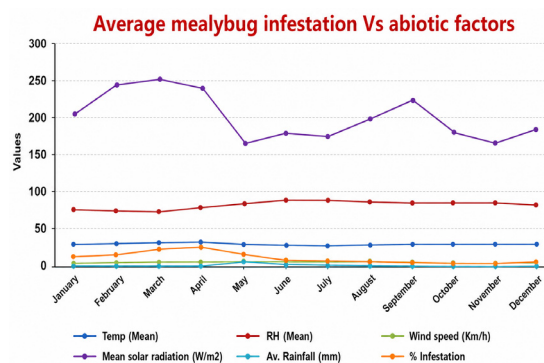


Fig. 47. Comparison of abiotic factors vs mealybug infestation in cassava

Characterization of sweet potato weevil [*Cylas formicarius* (Fabricius)] resistance genes in sweet potato and related *Ipomoea* spp.

Genes related to transcription factor gene (WRKY) and inactive receptor like kinase (RLK) were identified from sweet potato transcriptome sequence data. These genes were validated in Sree Vardhini using gene specific primers. The primer for WRKY got amplified in Sree Vardhini with amplicon size of 1047 bp. Further the transcriptome data was submitted as Sequence Read Archive (SRA) with title 'Transcriptome study of *I. batatas*' for the identification of host plant resistance source against sweet potato weevil with bioProject ID - PRJNA1227893 (Accession No - SAMN46999209, SAMN46999210, SAMN46999211, SAMN46999212, SAMN46999213 and SAMN46999214). Transcriptome sequences of *I. mauritiana* were submitted with title 'Transcriptome study of *I. mauritiana* for the identification of host plant resistance source against sweet potato weevil' with bioProject ID - PRJNA1228266 (Accession No - SAMN47009589, SAMN47009590, SAMN47009591, SAMN47009592, SAMN47009593 and SAMN47009594).

Screening of newer molecules and biocontrol agents for the management of nematodes in tuber crops

Five soil samples from Bhubaneswar, Odisha were baited with last instar greater wax moth larvae to isolate entomopathogenic nematodes (EPNs) and only one sample yielded an EPN isolate, designated as CTCRIH3. Based on morphological and molecular characterization, CTCRIH3 was identified as *Heterorhabditis indica* (Fig. 48) and its 995 bp



Fig. 48. Anterior region of infective juvenile, *Heterorhabditis indica* (CTCRIH3); arrow indicates the excretory pore

sequence was deposited in GenBank (Accession PX529684). In addition, another isolate CTCRIH2, collected from Thiruvananthapuram, Kerala was also identified as *H. indica* using D2-D3 region markers and its sequence was submitted in the NCBI database under the GenBank accession number PX658224.

Development and refinement of integrated disease management and forecasting system for improved tuber crop production

Fungal pathogens and disease management in cassava and yams

Cassava stem and root rot (CSRR) has emerged as a serious constraint to cassava production in Kerala, particularly in wetland ecosystems from 2019. The disease is characterized by rotting of the collar region of stem, root and tubers, accompanied by wilting, and has been widely observed in major cassava growing districts. Pathogen isolation revealed that species belonging to the *Fusarium solani* species complex (FSSC) were predominantly associated with CSRR, with *Fusarium falciforme* identified as the major causal agent. In addition, one isolate belonging to the *Fusarium oxysporum* species complex (FOSC) was also obtained. Soil analysis indicated no significant correlation between disease incidence and soil pH, organic carbon, or macro and micronutrient status. Disease intensity showed a strong positive correlation with total monthly rainfall and number of rainy days, highlighting the critical role of climatic factors in disease development under wetland conditions. Among 16 varieties evaluated for resistance *in vitro* to CSRR, Sree Suvarna, Sree Athulya, Sree Pavithra, Sree Reksha, H-97 and Sree Visakham exhibited resistance. In field trials to identify resistant/tolerant varieties, among seven varieties tested, disease incidence was recorded only in Sree Swarna (72%) and the local variety Aswathy (12%), while no infection was observed in Sree Reksha, Sree Pavithra, Sree Sakthi, Sree Kaveri and another local variety (Aswathy - resistant). Notably, Sree Reksha consistently exhibited resistance in farmers' fields from 2021 onwards. On-farm management of CSRR using *ad hoc* strategies recommended by ICAR-CTCRI, which included removal and burning of severely infected plants, ensuring proper drainage, lime application at 150-250 g plant⁻¹ 10-15 days before planting, use of healthy setts, neem cake application at 20 g plant⁻¹, and application of *Trichoderma asperellum* enriched

FYM, sett treatment with carbendazim (0.1%) for 10 min followed by soil drenching at planting and two subsequent applications at 15 day intervals effectively managed the disease, with no incidence observed in treated plots compared to 10 and 15% incidence in control plots at Sadanandapuram and Pallichal during 2022-2023. An on-farm trial during 2023–2024 at Parasuikal, Neyyatinkara taluk, involving eight treatments recorded the lowest disease incidence with only customized fertilizer application (8%) followed by CTCRI package, only phosphogypsum application and only lime application (10%).

Management of greater yam anthracnose was tested with different fungicides under field conditions for two seasons (2023–2024 and 2024–2025). Pooled analysis showed that all fungicides significantly reduced disease intensity and increased tuber yield. The highest reduction in disease incidence was recorded with Azoxystrobin 18.2% + Difenconazole 11.4 % SC (1 ml l⁻¹) (71%), followed by Carbendazim 50% (one gram l⁻¹) (67%), while the highest yield increase was observed with Carbendazim (74%), followed by Azoxystrobin + Difenconazole (70%). For bio-intensive disease management, an efficient endophytic bacterium isolated from *Aloe vera* was identified as *Bacillus subtilis* through whole genome sequencing. The isolate harboured genes related to antifungal activity and plant growth promotion. GFP tagging using the pEGFP plasmid confirmed its colonization ability in host plants. A vegetable waste based liquid formulation named Sree Jala was developed, and a biocapsule formulation was produced in collaboration with ICAR-IISR.

Virus and phytoplasma diseases of tropical tuber crops and their management

To assess the viruses associated with cassava mosaic disease (CMD) in different cassava growing regions, a survey was carried out in seven districts of Kerala which included Thiruvananthapuram, Kollam, Pathanamthitta, Alappuzha, Kottayam, Ernakulam and Idukki. A total of 325 leaf samples were collected from 35 different locations across these districts. Total genomic DNA was extracted and diagnosed in PCR using virus-specific primers to detect the presence of ICMV and SLCMV. The results revealed that 183 samples were positive for SLCMV, 23 samples for ICMV and 122 samples showed mixed infection of both viruses. These findings confirm that SLCMV is the dominant virus

associated with CMD in Kerala, either occurring alone or in combination with ICMV.

Cassava mosaic disease management strategies

Efficacy of selected microbial stimulants isolated from diverse ecosystems in management of cassava mosaic disease

Nine fungal (T16, PM5RBA2, 18KK1, PM9P1OK2, 10KK1, T11, TrichoG, T30 and TR15) and nine bacterial isolates (B2ALEX4, VCJENR1, PM2KB3, DUB6, 14.57, B2ALEX3, 14.77, 13.17 and KB2) from ICAR-CTCRI biocontrol agents repository and two bio formulations (Arka Microbial Consortium and Arka Actino Plus) having growth promotion and diseases suppression ability were tested to assess their potential to suppress cassava mosaic disease under pot experiment condition using diseased cassava stem cuttings. Among these, two fungal- (10KK1 and PM5RBA2), two bacterial isolates- (14.77 and B2ALEX4) and bio-formulations- AMC and AAP performed better in plant growth and disease suppression. Based on disease score assessment at 90 days, it was observed that 10KK1 and B2ALEX4 were the most effective (62.5% reduction), followed by PM5RBA2, 14.77 and AMC (56.3% reduction), as well as AAP (50.0% reduction) and all of them significantly outperformed over control.

Hot water therapy to manage cassava mosaic disease

Cassava cuttings derived from diseased plants were subjected to five temperatures (35, 40, 45, 50 and 55°C) with four time durations (10, 15, 20 and 25 min). It was observed that cuttings exposed to 40°C for 20 min. showed significant (62.5%) reduction in disease symptom scores, followed by 35°C for 20 min. (55%) as compared to the control at 90 days.

Genome editing approach

Transgenic *Nicotiana benthamiana* lines harbouring multiple and single-site editing CRISPR/Cas9 cassettes targeting replicase (AC1) and BV1 gene of Sri Lankan cassava mosaic virus (SLCMV) were grown under selection pressure, hardened and screened by PCR using marker specific (npt2) and gene specific (Cas9) primers. T1 lines were raised from T0 seeds. One to two week old T1 lines were screened by challenge inoculation of the infectious clones.

Transgenic lines harbouring four and two gRNA TUs targeting replicase gene exhibited reduced/attenuated symptoms of CMD. Single gRNA bearing lines also showed a reduction in symptoms, though not as pronounced as that of multiplex editing TUs harbouring lines (Fig. 49 & 50).

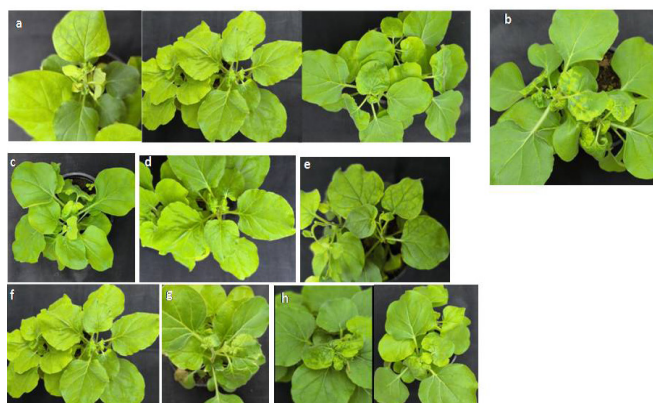


Fig. 49: Agroinoculated *N. benthamiana* 1.a) Transgenic lines harbouring 2 sgRNA TUs 1.b) Agroinfected non transgenic positive control 1.c -1.h) Transgenic lines having single sgRNA TUs single site editing and 2 sg RNA harbouring plants exhibiting moderate symptoms.



Fig. 50. Agroinoculated *N. benthamiana* 2.a) Agroinfected non-transgenic positive control 2.b-2.i) Transgenic lines having 4 sgRNA TUs displaying reduced CMD symptoms (14dpi) compared to non- transgenic positive control

Resistance in transgenic lines was assessed by viral load estimation in systemic leaves by absolute quantification using quantitative real time PCR. Quantification results indicate a significant reduction in viral load in transgenic lines harbouring 4 and 2 gRNA TUs targeting Rep region consistent with their reduced/ attenuated symptoms (Fig. 51 a & b). Resistance in transgenic lines was assessed by viral load estimation in systemic leaves by absolute quantification using quantitative real time PCR. Quantification results indicate a significant reduction in viral load in transgenic lines harbouring 4 and 2 gRNA TUs targeting Rep region consistent with their reduced/ attenuated symptoms (Fig. 52 a & b).

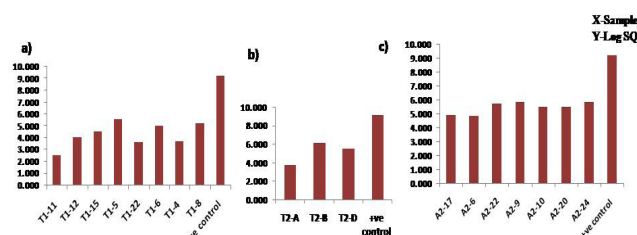


Fig. 51 a & b Log SQ plot of each T1 line at 14dpi 3.a) 4sgRNA TU lines 3.c) single sgRNA TU lines

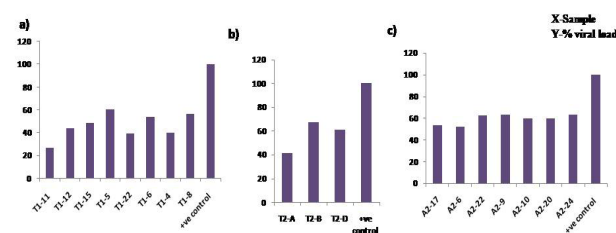


Fig. 52 a & b. Percentage viral load plot of each T1 line at 14dpi 4.a) 4sgRNA TU lines 4.b) 2sgRNA TU lines 4.c) single sg RNA TU lines

Genome editing for sweet potato leaf curl virus resistance

The transgenic *N. benthamiana* plants expressing single or multiple gRNA Tus (2, 4, 6 and 8) which target different genes of the virus was subjected to agroinoculation to test their efficacy in conferring virus resistance. Four-week-old plants were taken for agroinfection. All the T1 plants were tested for T DNA integration by PCR with the nptII and gRNA-specific primers. *A. tumefaciens* strain harbouring partial dimer or dimer of SPLCV-63 strain was used for agroinfection by pin pricking method (10 micro litre of the *Agrobacterium* culture was added to the nodal region of first fully opened leaf from top and pricked the area thrice with a 20G needle) and plants were maintained in an insect free growth chamber. Total DNA was extracted from all the plants and an absolute quantification real-time qPCR was performed (Bio-Rad CFX Opus 96 Real-Time PCR detection system). Full- length SPLCV genome was used as the standard.

The plants which harbour a single gRNA transcriptional unit which targets the intergenic region of the SPLCV showed moderate symptoms 30 days post inoculation. Mild stunting and leaf curling were observed in the plants. 200 ng of DNA was taken for qPCR analysis. The all plants showed reduction in viral load compared to the infected non transgenic *N. benthamiana* (Fig. 53, 54, 55, 56).

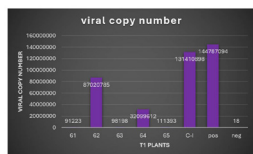


Fig. 53. viral copy number of the agroinfected transgenic plants expressing one gRNA T

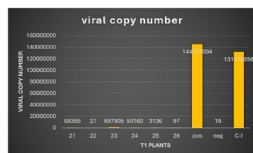


Fig. 54. Viral copy number analysis of the transgenic plants which expresses two gRNA TUs

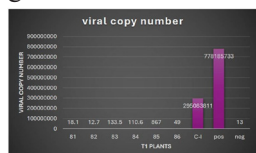


Fig. 55. Viral copy number of the agroinfected transgenic plants expressing four gRNA TUs

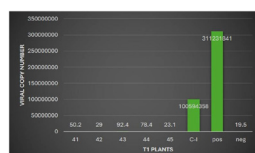


Fig. 56. Viral copy number of the agroinfected transgenic plants expressing eight gRNA TUs

Mass production and effective utilization of bioagents to manage fungal diseases of tuber crops

Endophyte studies and biochemical analysis

An *in vivo* study evaluating **endophytic bioagents** (*Trichoderma asperellum*, *Bacillus subtilis* and *Pseudomonas fluorescens*) in sweet potato showed that *Trichoderma* - treated plants recorded superior growth parameters, including vine length, number of leaves, root length, improved soil pH and significantly reduced disease incidence (11.2%) compared to the control (32.0%). Further, **GC-MS analysis** of sweet potato leaf extracts under 1.0% NaCl stress revealed distinct volatile profiles between control and endophyte-treated plants. Treated samples showed a higher number of bioactive compounds, with Heptacosanoic acid, 25-methyl-, methyl ester as the dominant compound, suggesting a potential role in salinity tolerance and stress mitigation.

Bioagents: Identification, compatibility and formulation

Six bioagent isolates viz., *Trichoderma asperellum* (4 nos), *Bacillus subtilis* (1 no), and *Pseudomonas fluorescens* (1 no) obtained from rhizosphere soil were processed for molecular identification using ITS and 16S rRNA gene sequencing. Culturing, DNA extraction (CTAB method) and Sanger sequencing were completed and results are awaited for confirmation of species identity and genetic diversity. Compatibility studies revealed that Carbendazim, Carbendazim + Mancozeb, Thiophanate Methyl, and Azoxystrobin + Tebuconazole were highly inhibitory

to *Trichoderma*, whereas Mancozeb, selected insecticides and herbicides were fully compatible. Among botanical extracts, betel and clove extracts showed strong inhibitory effects, while neem, garlic, ginger and mint were largely compatible with healthy *Trichoderma* growth. For formulation development, ten carrier materials were evaluated for *Trichoderma* under *in vitro* conditions. Rice bran (37.5×10^8 CFU g^{-1}) and wheat bran (24.2×10^8 CFU g^{-1}) emerged as the most effective substrates, maintaining high spore viability up to 90 days.

Biotic stress management in tropical tuber crops

Ecofriendly management of important and emerging pests of tropical tuber crops

Modified pheromone trap for sweet potato weevil management

A modified pheromone trap for sweet potato weevil management was developed using the lure ((Z)-3-dodecen-1-ol (E)-2-butanoate) in combination with different strains of entomopathogenic fungi (Fig. 57a) at concentrations greater than 10^8 cfu ml^{-1} . Male weevils were attracted and collected in pheromone traps containing mummified insects with surface fungal growth. These infected males subsequently dispersed among female weevil populations during mating, facilitating the spread of the fungi (Fig. 57b). This approach was found to be an effective strategy for weevil management. Fortnightly observations showed a reduction in insect revisitation following treatment.



Fig. 57a. Modified pheromone trap



Fig. 57b. Fungal growth on sweet potato weevil

Plant parasitic nematode management and utilization of entomopathogenic nematodes for pest management in tuber crops

The effects of various nematicidal treatments on gall formation by *Meloidogyne incognita* and yield of elephant foot yam were evaluated at Kayankulam, Alappuzha district, Kerala. Galling differed significantly across treatments, with the highest gall

number in the untreated control (10.0 ± 1.1 galls) and the lowest in T1 (Fluopyram 34.48% SC @ 0.5 ml/l) (4.7 ± 0.72), indicating the best suppression (Fig. 58). T2 (Fluensulfone 2% G @ 1 g plant⁻¹), T3 (Neem cake @ 500 g plant⁻¹) and T4 (*Trichoderma harzianum* @ 20 g plant⁻¹) showed intermediate galling (7.7 ± 1.4 , 9.4 ± 1.6 and 7.9 ± 1.3 , respectively) and were statistically comparable with both the control and T1. Yield was numerically higher in all the treatments than the control (0.76 ± 0.089 kg/plant), with the highest yield in T1 (1.3 ± 0.2 kg plant⁻¹), though differences were not significant ($P > 0.05$) (Fig. 59).

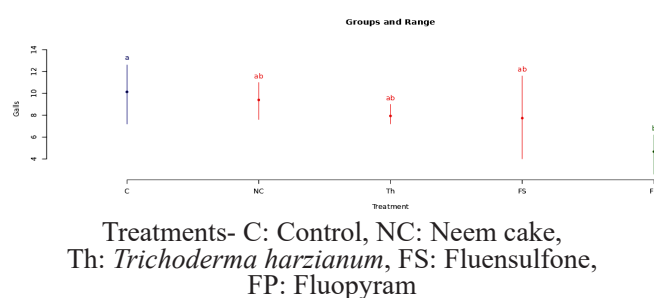


Fig. 58. Effect of different treatments on number of galls in elephant foot yam

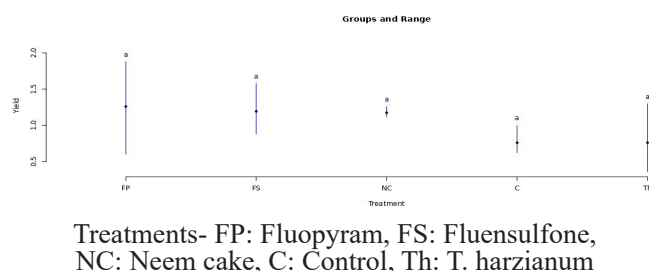
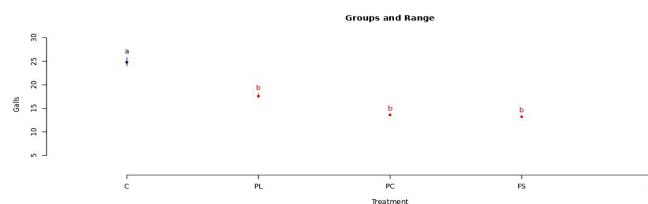


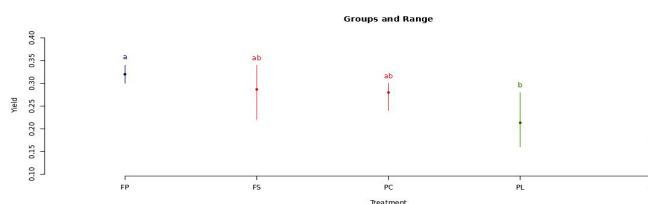
Fig. 59. Effect of different treatments on tuber yield of elephant foot yam

The response of Chinese potato to different nematicidal treatments against *Meloidogyne incognita* was assessed at Kadayam, Tenkasi district, Tamil Nadu. Galling differed significantly among treatments, with the untreated control showing the highest gall number (25 ± 1), while T1 (Fluopyram 34.48% SC, 0.5 ml l⁻¹) recorded the lowest (11 ± 0.61), indicating the best suppression. T2 (Fluensulfon 2% G, 1 g plant⁻¹), T3 (*Purpureocillium lilacinum* @ 5 ml l⁻¹), and T4 (*Pochonia chlamydosporium* @ 5 ml l⁻¹) resulted in intermediate galling (13 ± 0.26 , 14 ± 0.35 and 18 ± 0.57 , respectively), and were statistically comparable with the control and T1 (Fig. 60). Yield improved over the control (0.13 ± 0.013 kg plant⁻¹) in all the treatments. T1 (0.32 ± 0.028 kg plant⁻¹), T2 (0.29 ± 0.026 kg plant⁻¹) and T3 (0.28 ± 0.031 kg plant⁻¹) were significantly higher yield than T4 (0.21 ± 0.024 kg plant⁻¹) (Fig. 61).



Treatments- C: Control, PL: *Purpureocillium lilacinum*, PC: *Pochonia chlamydosporium*, FS: Fluensulfone, FP: Fluopyram

Fig. 60. Effect of various treatments on nematode galling in Chinese potato



Treatments- FP: Fluopyram, FS: Fluensulfone, PC: *P. chlamydosporium*, PL: *P. lilacinum*, C: Control

Fig. 61. Effect of various treatments on tuber yield of Chinese potato

Yam tubers collected from Thiruvananthapuram, Kerala showed surface lesions, and the associated nematode was identified as *Pratylenchus coffeae* based on morphological characterization. Surveys in Chinese potato fields of Kadayam block (Tenkasi district, Tamil Nadu) identified *Meloidogyne incognita* as the predominant nematode, with population densities of 0.8 - 1.1 nematodes g⁻¹ soil.

Integrated management of cassava stem and root rot (CSRR)

Disease incidence and pathogen characterisation: CSRR was observed in Anchal, Kollam (12%), Kuravilankad, Kottayam (46%), Koottilangadi, Malapuram (15%), Thodupuzha, Idukki (10%), Chalakudy, Ernakulam (15%) and Muttakadu and Chenkal, Thiruvananthapuram (46 and 8%). Totally 16 isolates were obtained from different districts of Kerala, viz., Thiruvananthapuram, Kollam, Kottayam, Ernakulam and Idukki and the pathogenicity was proved for 13 isolates. As per the morphological characters 12 were *Fusarium* species and one was *Colletotrichum* sp. which will be confirmed through multigene analysis.

Management in farmers' field: The field level demonstration of ICAR-CTCRI developed package for the management of CSRR in five locations

Aroor (2), Ponganadu, Alathukavu, Vakanchery at Thiruvananthapuram district in collaboration with KVK, Thiruvananthapuram during 2024-2025 showed 54% reduction in disease incidence and 58% increase in the yield of marketable tubers on an average.

The on farm trial with four treatments, [Phosphogypsum (100 g plant⁻¹); Customised fertilizer; ICAR-CTCRI package; Polyhalite (100 g plant⁻¹)] along with farmer's practice was conducted at Kadaplamattom in Kottayam district in collaboration with KVK, Kumarakom, Kottayam showed 25, 50, 75 and 50 per cent reduction in disease incidence over Farmer's practice. There was 20% increase in the yield due to the application of ICAR-CTCRI package compared to Farmers' package.

Utilisation of cassava microbiome against CSRR: The functional potential of the cassava rhizoplane microbiome to suppress *Fusarium falciforme* (Isolate CTCRI- FP), the causal agent of cassava stem and root rot was evaluated under *in vitro* conditions. A dual culture confrontation assay was employed to assess the antagonistic activity of fungal and bacterial isolates obtained from the rhizoplane of healthy and diseased cassava plants grown in wetland ecosystems, as well as from healthy plants in upland fields. A total of 83 fungal isolates were recovered from wetland healthy, wetland diseased and upland healthy samples. The most effective antagonist was identified as *Penicillium oxalicum*, isolated from healthy wetland rhizoplane, which showed approximately 93% inhibition of *F. falciforme*. This was followed by *Talaromyces pinophilus* from healthy upland samples, exhibiting 90% inhibition. In the case of

bacterial isolates, higher antagonistic activity was observed exclusively among isolates from upland rhizoplane samples. Two isolates exhibited 70-80% inhibition, while four isolates showed 60-70% inhibition against the pathogen. Among these, the bacteria demonstrated the highest levels of antagonism were identified as *Bacillus subtilis* and *Bacillus safensis*. The efficient bio-agents will be further evaluated *in vivo* in farmers' field.

Molecular insights for developing resistance mechanisms in *Ipomoea batatas* from wild *Ipomoea* spp. against sweet potato weevil

Expression miRNAs in sweet potato in response to sweet potato weevil infestation

The miRNAs associated with the sweet potato weevil infestation was studied. Thirteen miRNA primers were used (ath-miR319a, gma-miR168b, cpa-miR166e, mtr-miR319a-3p, zma-miR166h-3p, ath-miR396a-3p, osa-miR166g-3p, ath-miR166a-3p, lja-miR166-3p, novel_47, aau-miR168, osa-miR166d-5p, gma-miR396a-3p, ath-miR168a-3p and novel_136). The sweet potato varieties used were Sree Arun and Sree Vardhini. U6 (U6-F: GGGGACATCCGATAAAATT, U6-R: TGTGCGTGTCATCCTTGC) was used as the internal reference gene for the miRNA, and sweet potato Actin F: AGCAGCATGAAGATTAAGGTTGTAGCAC, Actin-R: TGGAAAATTAGAAGCACTTCCTGTGAAC) was used as the internal reference gene for the target gene. Among the thirteen miRNAs five miRNAs (ath-miR319a, gma-miR168b, cpa-miR166e, mtr-miR319a-3p and zma-miR166h-3p) showed upregulation in infested sweet potato Sree Vardhini (Fig. 62).

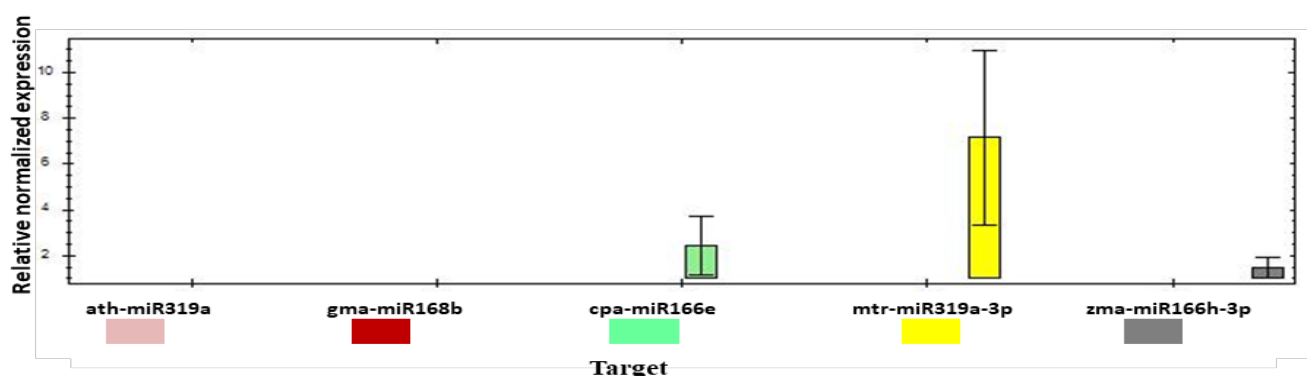


Fig. 62. Expression of miRNA in sweet potato variety, Sree Vardhini in response to sweet potato weevil infestation

Pathogen characterization and integrated disease management in taro and yams

Pathogen isolation and characterization

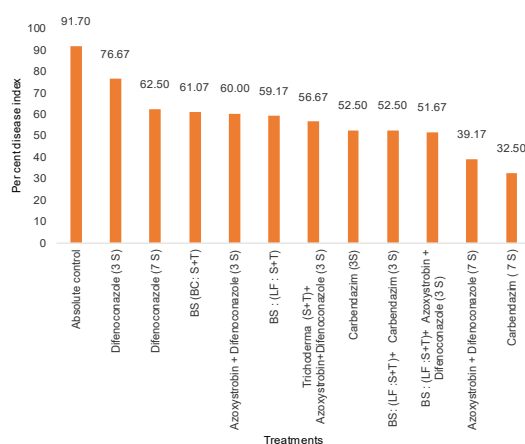
A total of 40 isolates of *Phytophthora colocasiae*, the causal agent of taro leaf blight, were isolated from infected taro leaves and maintained on Carrot Agar under controlled conditions (18 ± 2 °C, 12 h light/dark cycle). Preliminary morphological characterization revealed considerable variability among isolates in colony morphology, growth rate and sporulation. These isolates are being prepared for pathogenicity testing and molecular characterization to assess genetic diversity and virulence. Similarly, 30 isolates of *Colletotrichum gloeosporioides* associated with anthracnose of greater yam were isolated and maintained for further molecular and genetic studies.

Molecular diagnostics and primer development

To enable accurate and rapid detection of pathogens, species- and gene-specific primers were designed. For *P. colocasiae*, primers targeting multiple loci - ITS, β -tubulin, TEF-1 α , TIG, COX, and YPT genes - were developed, along with primer sets for conventional PCR and LAMP-based detection. For *C. gloeosporioides*, primers targeting ITS, GAPDH, β -tubulin 2 and glutamine synthetase genes were designed to facilitate molecular identification and diversity analysis.

Integrated management of greater yam anthracnose

A field trial was conducted at ICAR-CTCRI, Thiruvananthapuram during 2025-2026 with 12 treatments



BS: *Bacillus subtilis*; BC: Biocapsule; LF: Liquid formulation; S+T: Soil and tuber treatment; 3 S: Spraying 3 times; 7 S: Spraying 7 times

Fig. 63. Integrated management of greater yam anthracnose

including different fungicides with three sprays at fortnight interval starting from the first appearance of the symptom and seven sprays with additional four monthly, biocapsule and liquid formulation of an endophytic *Bacillus subtilis*, *Trichoderma asperellum* and combination of three sprays of fungicides with liquid formulation of *Bacillus subtilis* and *Trichoderma*. All the treatments showed reduced PDI which are significantly different from control. The highest reduction was by seven times spraying of Carbendazim 50% (1 g l⁻¹) (65%) followed by Azoxystrobin 18.2% + Difenoconazole 11.4 % SC (1 ml l⁻¹) (57%) (Fig. 63). The crop is yet to be harvested.

Advancing the management of fungal diseases in elephant foot yam and minor tuber crops

Study on the variability in symptom expression and pathogens associated with leaf and pseudostem rot in elephant foot yam

During the year under report, the disease exhibited an unusually early onset with a very high incidence, as primary symptom development was recorded in the third week of May. Four distinct types of leaf spot/lesion symptoms were observed in elephant foot yam (EFY) plants. Irregular lesions eventually coalesce, leading to necrosis of the affected tissue. As these areas desiccate and undergo fragmentation, the foliage takes on a tattered or skeletonized appearance (Fig. 64a); irregular, evenly distributed dull brown spots that gradually enlarge, coalesce, and form larger necrotic patches surrounded by a yellow halo (Fig. 64b); minute spots that gradually enlarge, developing a clear grey centre with a surrounding yellow halo, the lesions subsequently coalesce, dry off and the necrotic tissue becomes brittle and is blown away (Fig. 64c) and evenly distributed dark brown, well-defined spots surrounded by a yellow halo (Fig. 64d) were the four types.

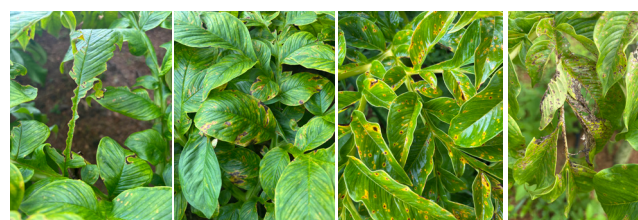


Fig. 64a.
Type 1
symptom

Fig. 64b.
Type 2
symptom

Fig. 64c.
Type 3
symptom

Fig. 64d.
Type 4
symptom

A total of 60 fungal isolates were recovered from 39 infected EFY leaf samples exhibiting symptoms of

leaf and pseudostem rot. Of these, 20 morphologically distinct isolates were selected for pathogenicity testing following Koch's postulates (Fig. 65). Ten isolates successfully fulfilled Koch's postulates, thereby confirming their pathogenicity and virulence on EFY plants. Genomic DNA was extracted from pure cultures of these 10 pathogenic isolates, and PCR amplification was subsequently carried out using universal fungal primers along with genus-specific primers for *Fusarium* and *Colletotrichum*.

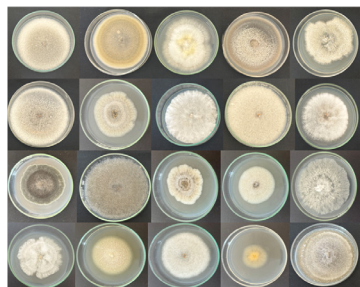


Fig. 65. Mycelial growth of 20 morphologically distinct isolates obtained from elephant foot yam

Decline and leaf yellowing associated with elephant foot yam

Progressive yellowing of leaves, initiating from the margins or interveinal areas and gradually spreading across the lamina, was observed in three varieties of EFY. Affected plants developed chlorotic lesions on the leaves and under severe conditions, dieback occurred, leading to progressive decline and eventual plant death (Fig. 66a). Complete collapse of the plant was typically observed within two months of symptom onset (Fig. 66b). Disease incidence was high, with up to 80% of the plants exhibiting mild to severe symptoms. Further investigations conducted in collaboration with ICAR-IARI revealed an association of phytoplasma with the disease.

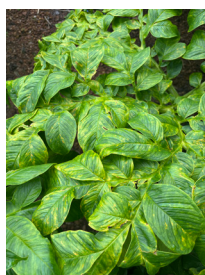


Fig. 66a Chlorotic lesions on EFY leaves



Fig. 66b. Decline and severe foliar yellowing

Management of leaf and pseudostem rot in elephant foot yam

Ten treatments were evaluated for their efficacy in managing leaf and pseudostem rot in elephant foot yam.

Three days prior to planting, all corms were uniformly treated with *Trichoderma asperellum* enriched cow dung slurry. The treatments comprised spraying with Difenconazole 25% EC (0.1%) (T_1), spraying with Micronol (5%) (T_2), Carbendazim (0.1%) (T_3), basal application of 500 g spent mushroom substrate (SMS) of milky mushroom combined with spraying of Sree Syama (2%) (T_4), basal application of 500 g SMS of oyster mushroom combined with spraying of Sree Syama (2%) (T_5), spraying with Carbendazim 25% + Flusilazole 12.5% SE (0.1%) (T_6), spraying with *Bacillus biocapsule* (T_7), spraying with *Trichoderma biocapsule* (T_8), spraying with Sree Syama (2%) alone (T_9), and an untreated control (T_{10}). The variety tested was 'Gajendra'. The lowest disease incidence was recorded in plants treated with *Trichoderma biocapsule* (T_8), with 18.0% incidence, compared to 72.0% in the control (Fig. 67). The highest yield (33.9 t ha⁻¹) was obtained in T_5 (SMS of oyster mushroom combined with Sree Syama), followed closely by T_9 (33.54 t ha⁻¹) and T_8 (33.46 t ha⁻¹).

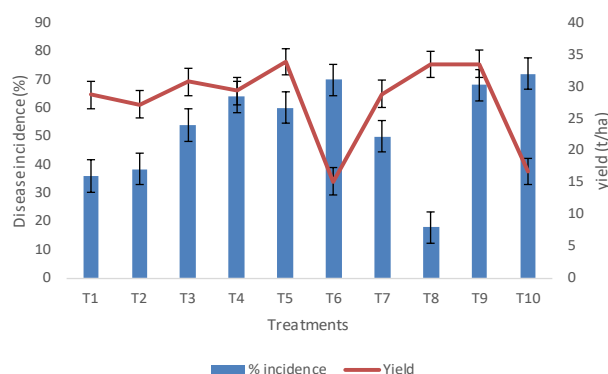
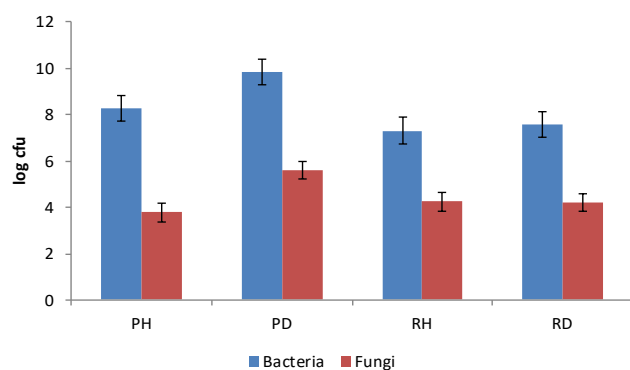


Fig. 67. Disease incidence and yield in elephant foot yam following corm treatment and spraying with various organic and chemical agents

Comparative analysis of microbiome diversity on healthy and leaf and pseudostem rot affected plants of elephant foot yam

Microbiome diversity (culture-dependent) in the phylloplane and rhizoplane of healthy plants and plants affected by leaf and pseudostem rot of elephant foot yam was studied in the variety 'Gajendra'. Both bacterial and fungal populations were significantly higher in the phylloplane. In the case of fungi, the population in the diseased phylloplane was significantly higher than that in the healthy phylloplane as well as in both the healthy and diseased rhizoplane. In the case of bacteria, the phylloplane population was significantly higher compared to the rhizoplane (Fig. 68).



PH-Phylloplane of healthy plant
 PD-Phylloplane of diseased plant
 RH-Rhizoplane of healthy plant
 RD-Rhizoplane of diseased plant

Fig.68. Population diversity of fungi and bacteria in healthy and diseased samples of the phylloplane and rhizoplane of elephant foot yam

The antifungal activity of 139 bacterial isolates obtained from the culture-dependent microbiome was screened against *Fusarium* sp. causing leaf and pseudostem rot in elephant foot yam. High variability was exhibited by the isolates, with inhibition ranging from 0 to 74.4% (Fig. 69). Fifteen isolates (10.8%) showed more than 60% inhibition, whereas 55 isolates (39.57%) exhibited no antifungal activity.

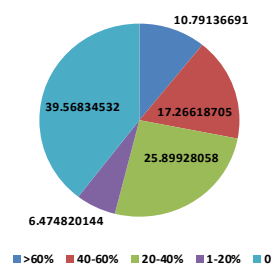


Fig. 69. Percentage of bacterial isolates showing different degrees of inhibition against *Fusarium* sp.

CROP UTILIZATION

Development and refinement of post-harvest handling, storage and processing techniques for minimization of losses in tropical tuber crops and production of value-added products

Development and functional characterization of modified starches of cassava and lesser-known tropical tuber starches for industrial application

Cassava starch monophosphate and cassava distarch phosphate were synthesized, characterized and evaluated for their functional performance in food and non-food applications. Cassava starch monophosphate exhibited low-temperature gelling behaviour, while cassava distarch phosphate functioned as an effective thickener. A wide range of viscosities, from non-gelatinizable to highly viscous starches, was observed among the distarch phosphates, indicating their suitability for application-specific food formulations. Cassava starch phosphate carbamates (CSPCs) with high water absorption capacity were synthesized using urea and phosphoric acid and evaluated for environmental and agricultural applications. CSPCs showed excellent removal efficiency for methylene blue dye from aqueous solutions. The adsorption process followed pseudo-second-order kinetics and the Langmuir isotherm model, with equilibrium adsorption capacities up to 228 mg g⁻¹ and maximum monolayer capacities ranging from 515 to 850 mg g⁻¹. CSPCs also exhibited strong reusability, retaining over 96% of their adsorption capacity after three cycles, highlighting their potential as sustainable and cost-effective adsorbents. Pot experiments demonstrated improved soil quality, with significant increases in nitrogen, phosphorus, potassium, and organic carbon contents compared to the control.

Succinylated cassava distarch phosphate with enhanced viscosity, paste stability, water-holding capacity and emulsifying properties was developed and successfully evaluated as a fat substitute in a no-fat eggless mayonnaise, resulting in reduced fat and sugar contents compared to a commercial control. Additionally, natural dye-based indicator films were developed from cassava starch for visual detection of food spoilage in packaged products. The influence of plant- and animal-derived proteins on the physicochemical, pasting and digestive properties of cassava starch was investigated, revealing that

starch-protein interactions significantly govern functional behaviour. Finally, starches isolated from underutilized tuber crops viz., Chinese potato, *Alocasia* and lesser yam, were characterized to assess their potential for diversified applications.

Quality changes associated with post-harvest storage/processing and development of value-added functional foods from cassava and sweet potato

Development and characterization of naturally coloured sweet potato kulfi

Sweet potato kulfi is an innovative functional frozen dessert developed using anthocyanin- and beta carotene-rich sweet potato puree to enhance both nutritional quality and natural colour appeal. The incorporation of coloured sweet potato varieties provides the product with valuable bioactive compounds, antioxidants, and natural pigments, making it a healthier alternative to conventional kulfi (Fig. 70). Anthocyanin-rich sweet potato kulfi exhibited an anthocyanin content of 12.45 mg 100 g⁻¹, total phenolic content of 2.64 mg GAE 100 g⁻¹ FW, antioxidant activity of 46.03%, and protein content of 3.94%. Similarly, beta carotene-rich sweet potato kulfi contained 5.85 mg 100 g⁻¹ beta carotene, total phenolic content of 2.87 mg GAE 100 g⁻¹ FW, antioxidant activity of 35.65%, and protein content of 4.22%. The developed kulfi combines the traditional sensory characteristics of kulfi with the health-promoting properties of sweet potato, offering a nutritious and naturally enriched frozen dessert with enhanced functional value.



Fig. 70. Naturally colored sweet potato kulfi rich in anthocyanin and beta carotene content

Innovative and industry friendly value added products and post-harvest technologies for tropical tuber crops

Development and promotion of tuber crops-based innovative value-added food products

A nutrient-dense sweet potato-based ready-to-use weaning food was developed to provide a balanced complementary diet for infants during

the transitional feeding period (Fig. 71). The formulation was designed using sweet potato flour as the primary carbohydrate source, complemented with banana flour for natural sweetness and dietary fiber. Sprouted ragi (finger millet) flour was incorporated to enhance calcium, iron and bioavailable micronutrient content, while sprouted green gram flour served as a plant-based protein source to improve the amino acid profile of the product. Milk powder was included to enrich the formulation with high-quality protein and essential fats required for infant growth and development. A small quantity of sugar was added to improve palatability and overall sensory acceptability. Sprouting of ragi and green gram was carried out prior to drying and milling to improve nutrient digestibility, reduce anti-nutritional factors and enhance enzymatic activity. All raw materials were processed into fine flour separately under hygienic conditions and blended in standardized proportions to obtain a homogeneous composite mix. The developed weaning formulation was intended to possess desirable functional properties such as ease of reconstitution, smooth texture and improved digestibility suitable for infant feeding. The effect of sweet potato flour was studied on the nutritional characteristics of ready-to-use weaning foods which include protein, fiber, starch, minerals, fat and sugar contents. The protein content ranged from 7.06 to 7.75 g 100 g⁻¹ dry weight (DW), starch 32.50 to 40.32 g 100 g⁻¹ DW, fiber 3.32 to 3.50 g 100 g⁻¹ DW, ash 2.32 to 2.67 g 100 g⁻¹ DW. Furthermore, ready-to-use weaning food formulations were studied for antioxidant properties (DPPH and ABTS based assays) which were found in the range of 0.45-1.24 and 2.65-3.42 mM Trolox g⁻¹ DW. The final product is expected to serve as a cost-effective, nutrient-rich complementary food with improved protein quality, energy density and micronutrient content. This formulation holds potential as a locally available, functional weaning food to address nutritional deficiencies during early childhood.



Fig. 71. Bofortified sweet potato based weaning foods rich in beta carotene and anthocyanin content

Air fried chips from sweet potato

The air fried chips were prepared from the orange fleshed sweet potato (Variety: Bhu Sona) by varying the temperature from 160 to 180°C by varying the time 9 to 11 min (Fig. 72). The moisture, fat, starch and sugar, colour and sensory properties of the air fried and oil fried samples were evaluated. Moisture content varied from 7.38% for the samples air fried at 160°C for 9 minutes to 2.19% at 180°C for 11 minutes whereas, in the sweet potato slices oil fried at 180°C for 4 minutes, it was 2.15%. Maximum fat content of 14.02% was obtained for the samples air fried at 160°C for 10 minutes whereas, the minimum of 10.45% at 170°C for 11 minutes. For the sweet potato slices oil fried at 180°C for 4 minutes, the fat content was 27.96%. Maximum starch content of 32.81% was obtained for the samples air fried at 170°C for 11 minutes whereas, the minimum of 10.45% at 160°C for 9 minutes. For the sweet potato slices oil fried at 180°C for 4 minutes the starch content was 24.43%. Among the various samples the maximum sugar content of 10.0% was obtained for the samples air fried at 160°C for 11 minutes whereas, the minimum of 9.01% at 160°C for 9 minutes. For the sweet potato slices oil fried at 180°C for 4 minutes the sugar content was 5.39%. Total colour difference varied from 50.54% for the samples air fried at 170°C for 9 minutes to 40.27% at 170°C for 11 minutes. Maximum yellowness index was 80.88 for the sample air fried at 170°C for 9 minutes and minimum YI content of 55.12% for sample prepared at 170°C for 11 minutes. For the sweet potato slices oil fried at 180°C for 4 minutes the TCD was 63.12% and YI was 67.69%. Among the various samples the maximum preference was for the samples air fried at 160°C for 9 minutes and samples air fried at 170°C for 10 minutes.



Fig. 72. Air fried chips from sweet potato

Development, refinement and upscaling of cassava starch based industrial products

The oral mucosa or the lining of the mouth is frequently exposed to infections, inflammatory

conditions and potentially malignant lesions, making local drug delivery an effective treatment strategy. However, the wet and dynamic conditions in the mouth make it difficult to deliver drugs locally for longer durations. To address this challenge, drug-loaded mucoadhesive oral patches were developed from native as well as modified cassava starches (Fig. 73) and evaluated for drug content uniformity, surface pH, hydration, matrix erosion and *in vitro* drug release in simulated saliva. The film composition and drying condition were standardized to produce flexible films suitable to be used as buccal films and oral patch was fabricated using the films. To enhance sustained release, bilayer films and unidirectional drug delivery designs were investigated. Compared to monolayer films, bilayer films showed more sustained release of drugs. Multidirectional systems exhibited a more pronounced initial burst release. The more extended release of drug in uni-directional approach is promising in the application of these membranes on the buccal cavity which ensures prolonged exposure of the mucosa to the drug (Fig. 74).



Fig. 73. *In vitro* drug release from starch films in simulated

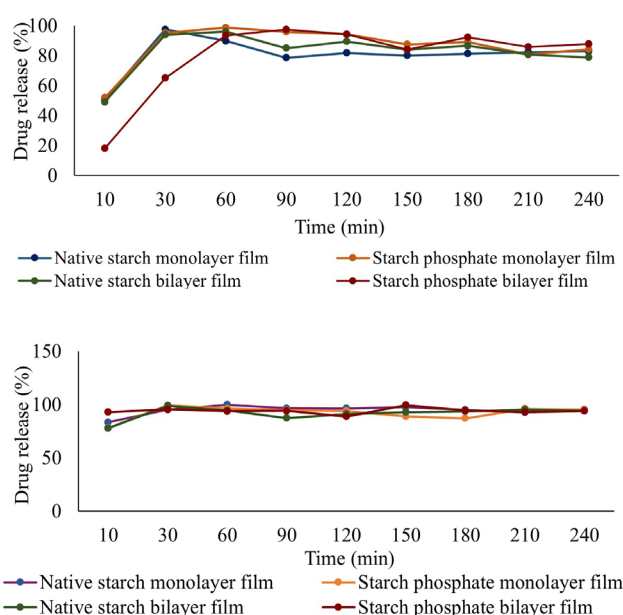


Fig. 74. *In vitro* drug release from starch based mucoadhesive films

Effect of different cooking methods on total phenolic content and *in vitro* digestibility properties of Chinese potato tubers

The content of total phenolics and flavonoids in Chinese potato (*Plectranthus rotundifolius*) tubers were significantly affected by the method of cooking which included boiling, steaming, baking, deep frying, air frying and microwave assisted cooking. The retention of phenolics was significantly higher in steamed, baked and microwaved samples, while lowest in fried samples. Cooking substantially enhanced the glyceamic index of the tubers. Among the different cooking methods, steaming and boiling resulted in the lowest GI of 69.1 ± 1.36 and 68.5 ± 2.83 respectively, which is approximately 8.5% lower than that of the raw tuber.

Development of animal feed formulations from tuber crops

Varietal influence on the physico-chemical properties of cassava tubers, peel and leaves

Physico-chemical properties viz., moisture content, starch, sugar, fat, fibre, protein and total colour difference of tuber, peel and leaves of 15 cassava varieties viz., Sree Suvarna, Sree Reksha, Sree Sakthi, Sree Pavithra, Sree Visakham, M4, Sree Jaya, Sree Vijaya, Sree Kaveri, Sree Athulya, H 226, H 165, KBH 18, MNS 247, MNS 248 and MNS 48 were analysed. For the tubers, peel and leaves of different varieties of cassava, significant difference in the moisture content, starch, sugar, fat, protein and fibre content was observed in the different cassava varieties. Moisture content varied from 81.45% (H 165) to 51.83% (Sree Suvarna) for tubers, 81.12% (Sree Jaya) to 61.99% (MNS 48) for peel and 74.61% (Sree Jaya) to 54.62% (Sree Sakthi) for leaves. Starch content ranged from 65.44% (H226) to 39.48% (Sree Kaveri) for tubers, 42.75% (MNS 247) to 20.35% (Sree Sakthi) for peel and 32.88% (MNS 247) to 8.87% (Sree Kaveri) for leaves. Protein content ranged from 4.38% (MNS 48) to 2.19% (Sree Visakham) for tubers, 9.19% (MNS 247) to 4.38% (Sree Visakham) for peel and 26.47% (Sree Visakham) to 18.81% (KBH 18) for leaves. Sugar varied from 6.95% (Sree Visakham) to 1.93% (Sree Suvarna) for tubers, 12.14% (MNS 247) to 5.12% (MNS 48) for peel, 11.95% (Sree Kaveri) to 4.71% (Sree Shakthi) for peel (Fig. 75). Fat content varied from 3.36% (Sree Reksha) to 1.27% (Sree Suvarna) for tubers, 13.22% (Sree Sakthi) to 6.26% (MNS 48) for peel and 4.35% (H 165) to 2.71% (Sree Pavithra) for leaves. Fibre

content ranged from 10.60% (Sree Jaya) to 1.81% (Sree Suvarna) for tubers, 22.13% (Sree Vijaya) to 3.16% (Sree Visakhm) for peel and 34.30% (M4) to 10.78% (Sree Visakhm) for leaves. Total colour difference varied from 28.58 (Sree Jaya) to 18.66 (Sree Pavithra) for tubers, 49.42 (KBH 18) to 38.97 (Sree Suvarna) for peel and 56.63 (Sree Suvarna) to 47.52 (Sree Pavithra) for leaves.

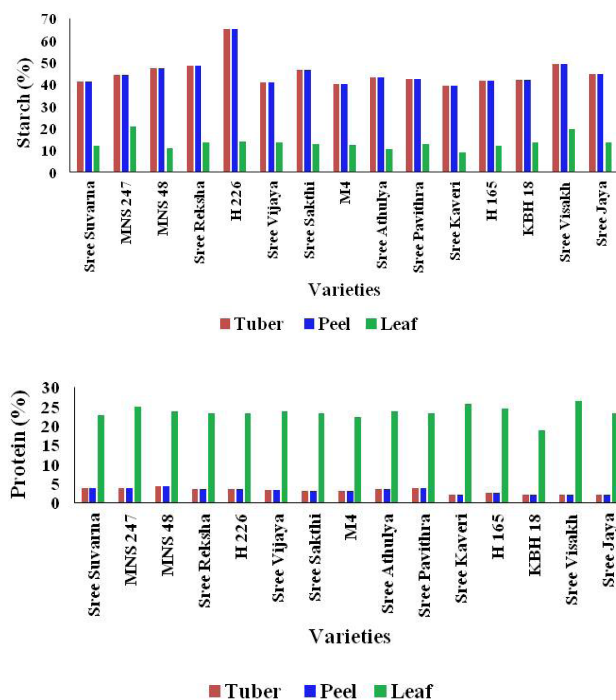


Fig. 75. Starch and protein content in the tuber, peel and leaves of different cassava varieties

Microbial enrichment of cassava peel

Experiments were designed by response surface methods to study the effect of treatment with yeast and curd (as a source of *Lactobacillus*) on the physico-chemical properties of cassava peel. Yeast has been used at the following conditions: Incubation days: 3, 4, 5 days, Yeast: 20, 25 and 30% and Water ratio: 1:3, 1:3.5 and 1: 4. The treatment with yeast increased the starch content of the dried cassava peel from 33.65 to 39.30% at 25% yeast concentration with water ratio of 4 and inoculated for 4 days, sugar from 1.61 to 3.94% at 20% yeast concentration with water ratio of 4 and inoculated for 5 days and protein from 9.49 to 16.36% at 25% yeast concentration with water ratio of 3.5 and inoculated for 5 days (Fig. 76). The true density increased from 1545 to 1710 kgm⁻³ at 25% yeast concentration with water ratio of 4.5 and inoculated for 5 days, bulk density increased from 573 to 660 kgm⁻³ at 20% yeast concentration with water ratio of 4.5 and inoculated for 4 days.

The optimized conditions as obtained by the response surface analysis showed a yeast concentration of 30%, incubation days: 5 and water ratio: 4.36. At these conditions, the cassava peel has starch 35.22%, sugar 2.75%, fibre 14.11%, fat 1.98%, protein 16.13%, moisture content 77.87%, true density 1685 kgm⁻³, bulk density 644 kgm⁻³, tapped density 700 kgm⁻³ and total colour difference 55.50.

By using curd as a source of *Lactobacillus* sp., the experiments were conducted with the following conditions: incubation days: 3, 4, 5 days, curd concentration: 50, 75 and 100%, peel: curd ratio: 0.5, 0.75 and 1. The treatment with curd increased the starch content of the dried cassava peel from 43.50 to 60.01% at 100% curd concentration with peel curd ratio of 0.75 and inoculated for 5 days, sugar from 12.35 to 11.11% at 75% curd concentration with peel curd ratio of 0.75 and inoculated for 4 days and protein from 8.31

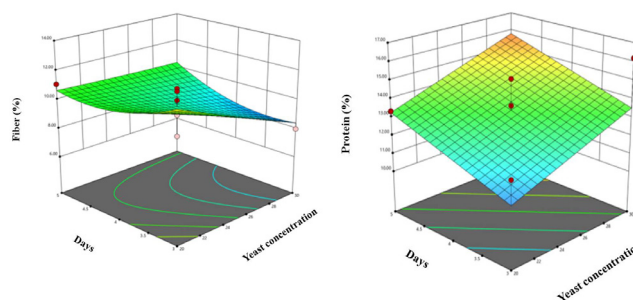


Fig. 76. Protein and fibre content of cassava peel treated with yeast

to 8.75% at 100% curd concentration with peel curd ratio of 0.5 and inoculated for 4 days (Fig. 77). The true density increased from 1660 to 1815 kgm⁻³ at 75% curd concentration with peel curd ratio of 0.75 and inoculated for 4 days, bulk density increased from 415 to 590 kgm⁻³ at 50% curd concentration with peel curd ratio of 1.0 and inoculated for 4 days. The optimised treatment conditions were - curd concentration: 100%, incubation days: 3, peel-curd ratio: 0.77. Under these conditions, the resulting peel has the starch content of 48.67%, sugar 11.19%, fibre 8.35%, fat 14.76%,

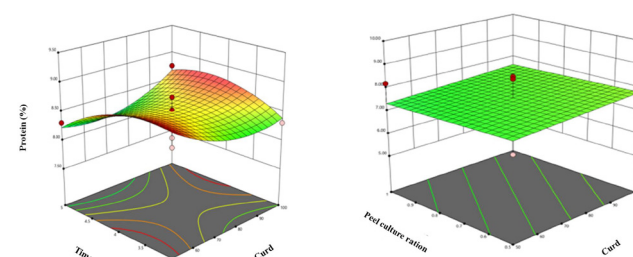


Fig. 77. Protein and fibre content of cassava peel treated with curd as a source of *Lactobacillus*

protein 8.41%, moisture content 41.64%, true density 1584 kgm^{-3} , bulk density 501 kgm^{-3} , tapped density 621 kgm^{-3} and total colour difference 50.72.

Design and development of pre and post-harvest machineries/ storage systems in tuber crops



Performance evaluation of a nylon brush type mechanical peeler for taro and Chinese potato

A nylon brush based type mechanical peeler was designed and fabricated to enable efficient and uniform removal of peel from soft skinned tuber crops, such as taro and Chinese potato. A total of seven nylon brush rollers were used, each with a diameter of 75 mm and a length of 900 mm. The machine was powered by a 2 HP single phase motor. The peeling mechanism operates on a controlled abrasive principle using nylon brushes, which minimizes excessive flesh loss while ensuring efficient removal of the peels from taro and Chinese potato (Fig. 78). Based on observations from preliminary experimental trials, necessary design and operational modifications were incorporated into the peeler to enhance its performance. Following these refinements, a final performance evaluation of the nylon brush type mechanical peeler was conducted using taro and Chinese potato tubers. Process optimization was carried out by systematically varying key operating parameters, namely roller speed (100-200 rpm), time of operation (3-6 min), and batch load (10-20 kg). A Central Composite Design (CCD) was employed using statistical design software to evaluate the combined effects of these variables on peeling performance. For taro, the optimized conditions were speed - 151.65 rpm, time



(a) Root crop peeler in operation (b) Peeled taro tubers



c) Peeled Chinese potato tubers

Fig. 78. Nylon brush based type mechanical peeler for taro and Chinese potato

of operation - 4.54 min, and batch load - 17.06 kg, which yielded a peeling efficiency of 96.04%, peeling loss of 8.15%, and peeling effectiveness of 87.22%. For Chinese potato, the optimized conditions were speed - 151.72 rpm, time of operation - 4.54 min, and batch load - 17.06 kg, which yielded a peeling efficiency of 93.04%, peeling loss of 8.66%, and peeling effectiveness of 84.94%. The machine has a processing capacity of 250 kg h^{-1} for both taro and Chinese potato tubers and requires 1.5 kW of power for operation.

Design and development of an electronic starch indicator for on-site estimation of starch content in cassava tubers

Starch content was determined using a mechanical point scale across 70 cassava varieties and lines. The key varieties included Sree Vijaya, Sree Jaya, Sree Athulya, Sree Pavithra, Sree Reksha, CO 2, CO 5, YTP 1, YTP 2 and Mulluvadi. Mechanical starch yield for each variety was estimated by extracting starch using a mobile starch extractor through a $150 \mu\text{m}$ mesh sieve and compared with the corresponding values obtained using a mechanical platform scale. The platform scale exhibited an accuracy of $92 \pm 2\%$ when validated against the mechanical starch yield. Specific gravity was calculated for all the varieties

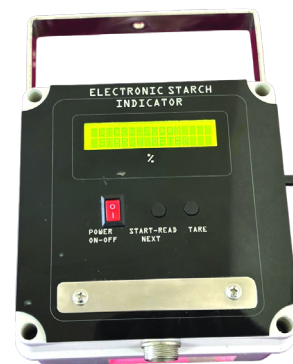


Fig. 79. Electronic starch indicator for on-site estimation of starch content in cassava tubers

using the standard formula based on underwater weight values recorded with a 10 kg digital load cell. A regression equation for starch estimation was developed by correlating specific gravity with mechanical starch yield and this equation was integrated into an electronic starch indicator for estimating starch content in fresh cassava tubers. A prototype of the electronic starch indicator was developed using a 10 kg load cell interfaced with an Arduino microcontroller, programmed in the Arduino integrated development environment using C++ language (Fig. 79). Preliminary trials demonstrated good repeatability of starch estimation compared to the mechanical point scale, and field level validation of the electronic starch indicator in different cassava varieties are currently in progress.

EXTENSION AND SOCIAL SCIENCES

Developing methodologies and tools for assessment and transfer of tuber crops technologies

Technological interventions and documentation of farmers' innovations including ITKs in tropical tuber crops

Frontline Demonstrations (FLDs) and On-Farm Trials (OFTs) on improved varieties and technologies of tuber crops (274 nos. in an area of 94 ha) were conducted during 2020-21 to 2024-2025 in Tamil Nadu, Kerala and Andhra Pradesh for proving the technical feasibility and economic viability for the farmers and other stakeholders. The significant findings are given below.

Improved varieties of cassava: FLDs conducted (73 Nos.) in Salem, Pudukottai and Namakkal districts of Tamil Nadu revealed that Sree Athulya recorded yield increase ranging from 5.05% to 14.19%, with yields varying between 30.92 and 44.06 t ha⁻¹ compared to 27.63 to 40.19 t ha⁻¹ in local varieties. The improved variety also generated higher net income (₹ 97,378 to ₹ 2,40,716 ha⁻¹) and better benefit-cost ratios (1.87 to 2.81) than local checks. The technology gap ranged from 29.40 to 39.08 t ha⁻¹, the extension gap from 1.95 to 3.69 t ha⁻¹ and the technology index from 42.00 to 55.83.

FLDs conducted on Sree Reksha in Andhra Pradesh (10 nos.) and Tamil Nadu (26 nos.) showed that in East Godavari district, Sree Reksha recorded an average yield of 36.96 t ha⁻¹ under irrigated conditions (12.5% higher than local varieties) and 23.68 t ha⁻¹ under rainfed conditions (14.81% higher). Net income under irrigated conditions was ₹ 1.17 lakh ha⁻¹ compared to ₹ 1.00 lakh ha⁻¹ for local varieties, while under rainfed conditions it was ₹ 0.65 lakh ha⁻¹ compared to ₹ 0.48 lakh ha⁻¹ for local varieties. In Tamil Nadu (Namakkal, Salem and Erode districts), yields ranged from 35.42 to 40.21 t ha⁻¹, showing 5.89% to 8.04% increase over local checks. Net income ranged from ₹ 1,03,940 to ₹ 2,41,783 ha⁻¹ with higher B:C ratios (1.86 to 2.88) compared to local varieties (1.67 to 2.59). The technology gap ranged from 39.79 to 44.58 t ha⁻¹, extension gap from 1.97 to 2.88 t ha⁻¹ and technology index from 49.74 to 55.73.

FLDs (21 Nos.) conducted on Sree Kaveri in Salem and Namakkal districts of Tamil Nadu showed that under irrigated conditions, Sree Kaveri recorded yields of 40.21 t ha⁻¹, which was 9.80% higher than

local varieties (36.62 t ha⁻¹), with higher net income (₹ 2,33,566 ha⁻¹; B:C ratio 2.78) compared to local checks (₹ 1,76,813 ha⁻¹; B:C ratio 2.37). Under rainfed conditions, yields ranged from 28.69 to 30.12 t ha⁻¹, showing 7.04% to 7.97% increase over local varieties, along with higher net income (₹ 1,60,197 to ₹ 1,71,626 ha⁻¹) and improved B:C ratios (2.28 to 2.60). The technology gap ranged from 19.88 to 41.70 t ha⁻¹, extension gap from 1.98 to 2.66 t ha⁻¹, and technology index from 39.76 to 52.13.

Improved varieties of sweet potato: Six FLDs on improved varieties of sweet potato viz., Sree Arun, Sree Varun, Sree Kanaka and Bhu Krishna conducted in Thiruvananthapuram district showed that yield of improved varieties was 19.30 t ha⁻¹ which was (9.66%) greater than the yield of local varieties (17.60 t ha⁻¹). Gross income realized from improved and local varieties was ₹ 2.89 and ₹ 2.64 lakhs ha⁻¹ respectively.

Improved variety and Site Specific Nutrient Management (SSNM) in elephant foot yam: Five FLDs on improved varieties of elephant foot yam viz., Gajendra and Sree Padma conducted in Tenkasi district revealed that Gajendra produced the maximum yield (39.6 t ha⁻¹) followed by Sree Padma (37.5 t ha⁻¹). Net income realized from improved and local varieties were ₹ 2.58 lakhs ha⁻¹ and ₹ 1.99 lakhs ha⁻¹ with B:C ratios 1.81 and 1.58, respectively. Results of five OFTs on SSNM in elephant foot yam in Erode district revealed that the yield of SSNM treated plot of Gajendra (29.37 t ha⁻¹) was 11.46% higher than the yield obtained from farmer's practice (26.35 t ha⁻¹). The net income realized from SSNM treated plot of Gajendra was ₹ 6,63,432 ha⁻¹ (B:C ratio: 3.02) when compared to farmer's practice, which was ₹ 5,45,750 ha⁻¹ (B:C ratio: 2.45).

SSNM in greater yam: Five FLDs on SSNM in greater yam in East Godavari district revealed that the yield of greater yam in SSNM treatment was 14.25 t ha⁻¹, which was 10.81% more than the yield obtained from farmers' practices (12.86 t ha⁻¹). Similar trend was observed in the gross income (10.81%) and net income (40.13%) in comparison to farmers' practice.

SSNM in taro: Twelve OFTs conducted on SSNM in taro in Tenkasi and Tirunelveli districts showed that SSNM treated plots recorded a yield of 20.11 t ha⁻¹ (7.96 % increase) compared to 18.63 t ha⁻¹ under farmer's practice. The mean net income realized under SSNM was ₹ 2,85,762 ha⁻¹ with an average

B:C ratio of 2.89, whereas farmer's practice recorded ₹ 2,49,229 ha⁻¹ with a B:C ratio of 2.65.

Improved variety and SSNM in Chinese potato:

Sixty FLDs on improved variety of Chinese potato were conducted in Tenkasi and Tirunelveli showed that the yield of 'Sree Dhara' was 21.36 t ha⁻¹ which was higher than local varieties (18.32 t ha⁻¹) by 16.60%. Net income of ₹ 2.31 lakhs (B:C ratio: 3.06) was obtained from improved variety whereas, it was ₹ 1.81 lakhs from local varieties (B: C ratio: 2.69). Eleven FLDs in Palakkad and Thrissur recorded the yield of improved variety as 13.01 t ha⁻¹ which was higher than local varieties (12.27 t ha⁻¹) by 5.99%. Net income of ₹ 1.26 lakhs (B:C ratio: 1.48) was obtained from improved variety whereas, it was ₹ 1.02 lakhs from local varieties (B: C ratio: 1.40). Technology gap, extension gap and technology index of improved variety of Chinese potato were estimated at 6.65, 3.04 and 23.73 in Tamil Nadu and 15.00, 0.73 and 53.55 in Kerala, respectively.

Forty FLDs in Tamil Nadu showed that the mean yield of Chinese potato under SSNM was 17.61 t ha⁻¹ which was higher than the farmers' practice (15.83 t ha⁻¹) by 11.26%. Net income of ₹ 2.36 lakhs (B:C ratio: 2.73) was obtained from SSNM whereas, it was ₹ 1.96 lakhs from farmers' practice (B: C ratio: 2.48).

Technological interventions through FPGs: Two Farmer Producer Groups (FPGs) on cassava were formed viz., 'Pasumai FPG' at Mettupatti village of Namakkal and 'Vidiyal FPG' at Manmalai village of Salem, Tamil Nadu and five Farmer Producer Groups (FPGs) on Chinese potato were formed in Tirunelveli and Tenkasi districts of Tamil Nadu.

Documentation of farmers innovations and ITKs in tropical tuber crops: Farmers' innovations and ITKs pertaining to varieties, agronomic practices, nutrient management, pest and disease management, mechanization, pre and post-harvest processing, value addition, storage of planting materials and tubers etc. were documented from tuber crops growers of Kerala, Tamil Nadu, Andhra Pradesh, Karnataka and North eastern states.

Upscaling tuber crops technologies for promoting food and nutritional security

This project operationalised a nutrition-sensitive scaling framework for biofortified tuber crops (primarily sweet potato) in India between 2020 and 2025. The strategy integrated four key pathways:

geographic targeting, delivery model implementation, consumer acceptability, and formal scaling strategies.

1. Geographic targeting and consumption

diagnostics: The project utilised a Biofortification Priority Index (BPI), adapted from HarvestPlus, to identify high-impact zones. By combining production data with Vitamin A and zinc deficiency status, the study prioritized states such as Meghalaya (36.62%), Odisha and Mizoram. Consumption studies in Northeast India revealed significant demand; for instance, in Arunachal Pradesh, 95% of interviewed children consume sweet potato regularly, with a per capita annual consumption of 6.31 kg.

2. Implementation of delivery models: The "Anganwadi-based" model proved central to reaching vulnerable populations. Key achievements included:

- Education and training: 100 Anganwadi workers were trained and 2,500 vine cuttings were distributed across 10 schools.
- Field Level Demonstrations (FLDs): High-performing biofortified varieties like Bhu Kanti (20.27 t ha⁻¹) and Bhu Sona (19.03 t ha⁻¹) significantly outperformed local checks.
- Economic viability: These varieties demonstrated impressive Benefit:Cost ratios ranging from 4.25 to 4.53, suggesting strong financial incentives for farmers.
- Infrastructure: The establishment of an Institutional Ethics Committee in 2012 laid the groundwork for the human-subject nutrition research conducted during this period.

3. Consumer acceptability and sensory evaluation:

To ensure long-term adoption, the project conducted rigorous sensory testing using Bayesian preference probabilities and Bradley - Terry models:

- Pasta and porridge: Over 80% of children preferred Orange-Fleshed Sweet Potato (OFSP) pasta over white or purple variants when informed of the health benefits. In porridge trials, "malted ragi" formulations scored higher in mouthfeel and taste than folate-enriched versions.
- Snack competition: Testing showed that purple-fleshed taro chips are competitive with commercial potato chips but are outperformed by purple-fleshed sweet potato chips. This provides a clear "product-positioning" insight for future entrepreneurs.

4. Strategic scaling and systems design: Scaling was formalised through the "Nutriseed Village" framework, covering over 60 farmers in Tamil Nadu and Kerala. Stakeholder Focus Group Discussions (with 76.6% inter-rater reliability) identified a multi-pronged strategy for national expansion:

- Institutionalisation: Linking biofortified crops to Anganwadi centres and kitchen gardens.
- Seed systems: Strengthening grassroots seed production centers to ensure the supply of quality planting materials.
- Awareness: Launching healthy-eating campaigns and promoting value-added products (e.g., pasta, chips) through women-led entrepreneurship.

Policy Recommendations

The project concludes that future interventions should institutionalise production-consumption pathways by training frontline workers and integrating biofortified tubers into integrated farming systems. Leveraging the BPI for investment targeting and supporting rural women in value-added processing are essential steps for sustainable nutritional impact.

Mapping of women's empowerment in tuber crops cultivation for engendering research and development

Women play a major role in tuber crops cultivation across the nation. This study focused to document the extent of participation of women in tuber crops, their empowerment level, their needs, preferences and constraints. The Women's Empowerment in Agriculture Index (WEAI) was employed to assess the level of empowerment and participation of women engaged in major tuber crops across key tuber growing regions of India. The study was conducted in selected districts of Tamil Nadu, Kerala, Karnataka, Odisha and Meghalaya covering women involved in the cultivation of cassava, sweet potato and Chinese potato. Data were collected through using a structured interview schedule. Participation was measured on a three-point continuum scale across 15 selected production and processing practices. Statistical tools such as percentage analysis, mean, standard deviation and Chi-square test were used for data analysis.

The socio-economic profiles of both men and women were documented. In cassava cultivation, the majority of women (61.53%) and men (68.57%) exhibited a medium level of participation. Significant gender

differences were observed in selection of variety, planting of setts, fertilizer application, cropping system and harvesting. In sweet potato cultivation in Karnataka, men showed significantly higher participation than women, with mean scores of 2.01 and 1.59, respectively. Men were more involved in land preparation, variety selection, fertilizer application, pest and disease management and marketing activities. In Odisha, Chi-square analysis revealed significant gender differences in land preparation, variety selection, application of inputs and pest and disease identification. In Chinese potato cultivation, a medium level of participation was reported by most respondents, with higher overall participation among men (mean score 33.23) compared to women (23.03). In Meghalaya, both men and women showed similar levels of participation in cassava cultivation, indicating minimal gender disparity.

The empowerment analysis revealed that while overall empowerment scores of men and women were comparable, significant gender gaps persisted in specific indicators. In cassava disease incidence, climatic aberrations, inadequate marketing facilities, limited access to credit and insufficient extension support were identified as major constraints.

Overall, the study highlights moderate participation of women in tuber crop cultivation, persistent gender disparities in decision-making and financial control and the need for targeted interventions to enhance women's empowerment through improved access to resources, technologies, training, and markets.

Impact assessment of technologies of tropical tuber crops

Tuber crop varieties and technologies released by ICAR - CTCRI since 1971 were reviewed to identify the most widely adopted interventions. Based on adoption extent, eight varieties of two crops (cassava and Chinese potato), along with one key technology (micro food) were selected for analysis. To estimate the economic surplus generated by these technologies, data were gathered on both technological and economic parameters. The technological parameters included yield advantage, cost savings, adoption pattern and the research and development (R&D) lag period. These data were obtained from literature, scientists and primary surveys with farmers, using a well structured questionnaire. The literature survey also helped to determine the extent of technology adoption across different states. The study mainly relied on farm household survey to assess the

impact of ICAR - CTCRI varieties and technologies. Adoption studies were conducted in the states of Tamil Nadu, Kerala, Andhra Pradesh, Karnataka and Odisha, focusing on important tuber crops such as cassava, sweet potato, elephant foot yam and Chinese potato. A total of 1044 farmers were surveyed during the study period from 2021-2022 to 2024-2025. The economic data included cassava prices, area under cultivation and output quantities in the key target states viz., Kerala, Tamil Nadu and Andhra Pradesh were collected from various sources. Data on percentage adoption, maximum adoption ceiling, cost and yield changes due to adoption and demand and supply elasticity for cassava were derived from both primary surveys and published sources. To assess the impact of the micronutrient liquid foliar formulation developed for tuber crops, data on sales volume, prices, production costs, input use patterns, yield increment and technology adoption were collected through both primary and secondary sources. The results showed that ICAR-CTCRI cassava varieties occupied 29.69% of the national cassava area. Sweet potato improved varieties covered 42.45% of the cultivated area, elephant foot yam observed the highest adoption of 81.82% and Chinese potato accounted for 38%. Economic impact of adopting improved cassava varieties generated ₹ 732.47 crores, Chinese potato variety generated ₹ 5.97 crores and micronutrient foliar technology (Micronol) generated ₹ 21.23 crores. Aggregate benefits from eight improved varieties and micronutrient technology accounted for ₹ 759 crores, primarily benefitting marginal and smallholder farmers. Besides, improved cassava varieties enhanced farm income by 17%, reduced the environmental impact quotient from 54.9 to 22.35 and facilitated greater reinvestment in agriculture (56%). Chinese potato adoption improved labor use and women's participation in transplanting and post harvest activities. The high seed cost, poor market access and lack of awareness remained major constraints. Strengthening seed systems, improving extension outreach and promoting gender inclusive, sustainable practices are crucial for scaling tuber crops adoption and maximizing socio economic benefits.

Development of intelligent smart technologies for tuber crops

e-Crop based smart farming technology was developed and demonstrated in sweet potato field by setting up e-Crop Based Smart Fertigation System (eCBSFS).

Field trial to test efficacy of eCBSFS technology for irrigation and fertilizer application was carried out in

sweet potato with five replications. The irrigation and fertilizer applications in the treatments were: T1. eCrop based smart farming recommendation through drip fertigation; T2. PoP recommendation of ICAR-CTCRI through drip fertigation and T3. PoP recommendation of ICAR-CTCRI by manual application. The results showed that through eCBSFS, water requirements were reduced considerably compared to T2 and yield was on par in both treatments T1 and T2. For producing tuber yield, water requirements ($l\ g^{-1}$) during the first second and third season were 8.41, 109.26 and 278, respectively for T1 and 24,559 and 252, respectively for T2.

A digital farm to demonstrate e-Crop Based Smart Farming (eCBSF) and e-Crop Based Smart Fertigation System (eCBSFS) was set up in Anad Farmers Service Co-Operative Bank (AFSCB), Anad, in Nedumangad block. It was launched by Shri. P. Prasad, Honourable Agriculture Minister, Government of Kerala on 12 February 2024. e-Crop was installed on the roof top of AFSCB and e-Crop Based Smart Fertigation System (eCBSFS) was set up in the field of the bank to demonstrate smart farming. The technology is being demonstrated in banana, cassava, bhindi, tomato and brinjal, which were planted in the field.

Another digital farm, to demonstrate e-Crop Based Smart Farming (eCBSF) and e-Crop Based Smart Fertigation System (eCBSFS), was set up in Mar Baselios College of Engineering and Technology, Nalanchira, Thiruvananthapuram. It was launched by Shri. V.K. Prasanth, Honourable MLA, Vattiyookavu on 26 June 2025. The technology is being demonstrated in banana, cassava, and pumpkin, which were planted in the field.

Mobile apps viz., Horticultural Crops Online Marketing System (HOMS) and Tuber Crops Online Marketing System (TOMS) were developed for directly linking the producers, consumers, input suppliers and logistics service providers of all vegetable crops including tuber crops.

Development and application of statistical and bioinformatics tools for tuber crops research

The work integrated artificial intelligence, bioinformatics and statistical genomics for tropical tuber crops, particularly cassava (*Manihot esculenta*) and sweet potato (*Ipomoea batatas*). In cassava, a machine learning-based miRNA prediction approach using HuntMi (random forest with ROC-select

thresholding strategy) was applied to 41,381 transcript sequences retrieved from Phytozome. Using 173 experimentally validated miRNA hairpins from miRBase as the positive dataset and 697 non-miRNA sequences as the negative set, 28 candidate pre-miRNAs (105-357 nt in length) were predicted. Subsequent homology-based validation against viridiplantae mature miRNAs identified 13 conserved mature miRNAs, strengthening their biological relevance.

A comprehensive *in silico* analysis of the carotenoid/apocarotenoid biosynthesis pathway in cassava identified 40 pathway-related genes, conserved protein domains, 18 associated transcription factors (including MYB, bHLH, NAC and BBR-BPC) and three regulatory miRNAs (miR159a, miR171b and miR396a), enabling pathway reconstruction for breeding carotenoid-rich varieties. For sweet potato, a neural network-based SNP-ML pipeline was implemented on RNA-seq data from two genotypes, resulting in the identification of 771,963 high-confidence SNPs distributed across 59,653 genes, addressing the complexity of SNP detection in a polyploid genome. Additionally, a standardized whole genome sequencing (WGS) workflow was developed for cassava, integrating quality control, read preprocessing, alignment, duplicate removal, recalibration, variant calling (GATK4) and filtering, producing high-quality SNP and INDEL datasets for downstream genomic and association studies.

Complementing these analytical pipelines, multiple digital tools and databases were developed to support agricultural research. An interactive genomic variation database, CasGVD, was constructed to host SNP and

INDEL datasets from cassava genotypes Sree Kaveri and 9S-127, integrating IGV for chromosome-wise visualization and retrieval. A web-based statistical platform, AgriAnalytics@R developed using R Shiny (sreejyothi.shinyapps.io/agrianalyticsr/), was created to facilitate ANOVA (CRD, RBD), two-factor ANOVA with interaction and DMRT/LSD comparison, correlation analysis, descriptive statistics and AMMI modelling for genotype x environment interaction studies. Two R packages viz, *baseq* for biological sequence processing and *fixr* for data cleaning and quality assessment were developed and submitted to CRAN, strengthening computational infrastructure for bioinformatics and statistical analysis. Collectively, these contributions demonstrate the generation and application of intelligent machine learning, genomic analysis workflows, statistical tools, and interactive databases to accelerate breeding, genomics, and data-driven crop improvement research in tropical tuber crops

Research-extension framework for strengthening tuber crops through climate adaptations, digital solutions and livelihood empowerment

Developing a stakeholder driven approach for prioritizing tuber crop research and extension

Research priorities in global agricultural research (2000-2025)

Based on recent bibliometric scoping reviews, meta-analyses, and comprehensive literature on crop trait prioritization, the frequency and aspects of the various prioritization techniques were compiled (Table 9).

Table 9. Frequency of prioritization techniques in agricultural research (2000–2025)

Category	Research prioritization technique	Frequency (%)	Primary context / application
1. Multi-criteria methods	Scoring or weighted criteria	35	- Most widely used - Applied in commodity ranking and crop trait prioritisation.
2. Economic approaches	Economic surplus / ROI models	22	- Standard for CGIAR system - For large-scale public investments to calculate social benefits.
3. Participatory approaches	Expert panels & Delphi method	18	- Used for "blue-sky" foresight - For identifying emerging research frontiers.
4. Decision science methods	Analytic Hierarchy Process (AHP)	12	Popular in agribusiness management and complex trade-off analysis.
5. Market-driven methods	Congruence method	8	Quick allocation based on a commodity's current contribution to agricultural GDP.
6. Emerging approaches	Fuzzy logic and machine learning	5	Recent surge (2020–2025) for data-heavy yield prediction and trait mapping.

*Total papers - 746

Research priorities of ICAR-CTCRI (2010-2025)

The research priorities of ICAR-CTCRI were identified from the Annual reports for the period 2010-2025. The weighted network analysis of ICAR-CTCRI research projects reveals the presence of strong thematic linkages within the tuber crops research ecosystem (Fig 83). The highest interaction occurs between Crop Improvement and Production Systems ($w = 12$), indicating the central role of genetic innovations in shaping agronomic practices. Strong connections are also observed between Value Addition and Industrial Products, Production Systems and Value Addition, and Extension Systems and Farmer Livelihoods ($w = 11$), highlighting the integration of crop production with downstream processing, industrial applications and socio-economic outcomes. Moderately strong linkages between Value Addition and Nutrition Impact ($w = 10$) and Crop Improvement and Value Addition ($w = 9$) further emphasise the importance of developing varieties suited for nutritional and processing purposes. Overall, the network structure demonstrates a transition toward an integrated food-systems research framework, linking upstream crop science with value-chain development and livelihood impacts.

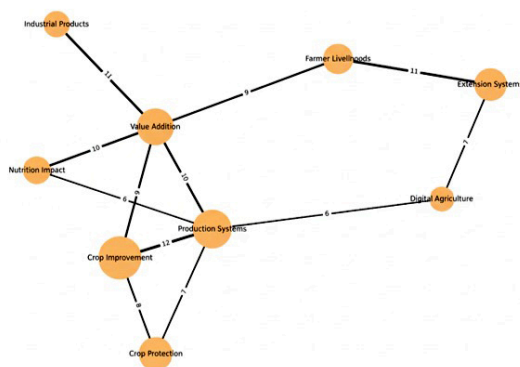


Fig. 83. Network Topology of CTCRI Research Themes (2010–2024)

Assessment of climate change vulnerability and adaptation in tropical tuber crops farming

Intergovernmental Panel on Climate Change (IPCC, 2007) defines ‘climate change’ as a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Kerala’s climate is being altered by rising temperatures, erratic monsoons and extreme weather events linked to global climate change which

prioritizes vulnerability reduction and adaptive capacity building across sectors including agriculture.

In this context, the study on ‘Assessment of climate change vulnerability and adaptation in cassava’ was undertaken in two districts of Kerala viz., Thiruvananthapuram and Kottayam where the climate change related issues have been reported. The research mainly focused on assessing farmers’ perception of climate change vulnerability in cassava, documenting climate smart agriculture (CSA) practices and adaptation strategies practiced by cassava farmers, preparation of climate contingency plans for major climate prone areas and identification of constraints and formulation of strategies for scaling up climate-smart agriculture (CSA) in cassava.

Ex-post facto research design was used. A well structured interview schedule was used for data collection from 90 cassava growers each from Thiruvananthapuram and Kottayam districts, thus the total sample size was 180. The secondary data on area, production and productivity of cassava in Kerala for the period from 2001 to 2024 were collected and weather data (rainfall, temperature, relative humidity, sun shine hours and wind speed) were also collected for the same period for detailed analysis.

Empirical assessment of tuber crops value addition technologies on the livelihood of women and youth

The study was conducted in Thiruvananthapuram district of Kerala, which was purposively selected as the study area. A list of women trainees who had undergone training at the Techno Incubation Centre of ICAR-Central Tuber Crops Research Institute (CTCRI) was obtained. Women who had attended trainings during the last five years were considered for sample selection. A total of 80 trained women respondents were selected. Further data were collected from 40 women who had not undergone any training for comparison, making the total sample size 120. To gain deeper insights, case studies of two women entrepreneurs engaged in tuber crops based enterprises were also conducted. Detailed analysis was carried out primarily for the respondents who had undergone training.

Socio-demographic profile of the respondents

The results revealed that 36.25 per cent of the trained respondents belonged to the middle aged category,

while 11.25% were in the old age group. Youth participation in value addition activities was very low (7.5%). A majority of the respondents (66.25%) were graduates, indicating a relatively high educational status among trainees. With respect to occupation, only 28.75% of the respondents were entrepreneurs and 10% were farmers. The joint family system was observed only among 5% of the respondents.

Knowledge and training impact

The effectiveness of training was evident from the significant improvement in knowledge levels. The mean knowledge score before training was 2.26, which increased to 7.98 after training, indicating a substantial gain in technical knowledge. A majority of the respondents (73.42%) reported that the training enhanced their confidence to start a business. Further, 56.96% of the respondents applied the knowledge gained from training and prepared value added products at the household level.

Enterprise initiation and empowerment

Despite the improvement in knowledge and confidence, only 6.25% of the trained women had started small scale enterprises after the training. A negligible proportion (1.47%) had initiated enterprises but later discontinued due to market related issues. Among those who started enterprises, 45.45% were operating in group mode, highlighting the importance of collective entrepreneurship. In terms of empowerment outcomes, 26.58% of the respondents reported becoming empowered, while 43.03% stated that empowerment was accompanied by improved social networking.

Marketing practices and product adoption

Among the business entrepreneurs, a large majority (83.54%) were not using any online marketing platforms. Only 9% utilized social media for marketing their products. The value-added products with the highest adoption rate were cassava chips and cassava flour, with an adoption rate of 90.90%.

Constraints in enterprise establishment

The major reasons reported for not starting an enterprise included lack of capital (35.50%), inadequate infrastructure (25.50%), time constraint (19.90%), market uncertainty (11.80%) and lack of confidence, knowledge and experience (7.80%).

Post-training support and satisfaction

The impact assessment of training indicated that 68.35% of the respondents experienced an increase in entrepreneurial interest, while 20.25% reported an increase in both entrepreneurial interest and confidence. However, a majority (84%) stated that they did not receive any post-training support, which may have limited enterprise initiation and sustainability. Regarding overall satisfaction, 37.97% of the respondents were highly satisfied, while 59.49% were satisfied with the training programmes.

The study highlights that while training at ICAR-CTCRI significantly enhanced knowledge, confidence and entrepreneurial interest among women, the transition from training to enterprise establishment remained limited. Inadequate capital, infrastructure, market access and lack of post training support emerged as critical constraints. Strengthening follow up mechanisms, providing incubation and marketing support as well as facilitating access to finance could enhance the effectiveness of training programmes in promoting women led value addition enterprises.

Impact assessment and value chain analysis of tropical tuber crops

Value chain analysis of Chinese potato was conducted in Palakkad, Thrissur and Idukki districts of Kerala during 2025-2026 with a sample size of 100 covering 68 producers, eight aggregators, four commission agents, ten wholesalers from different districts and ten retailers. The multistage random sampling method was used for selecting the blocks, villages and farmers. Descriptive and statistical analyses were used to analyze the data. Additional variables like input use, time of sales, month of sales, type of buyers, quantities sold and payment modalities were included for better understanding of price formation of Chinese potato at different levels.

The upstream at producer's level consists of primary farmer producers, who acquire information/materials on new technologies for Chinese potato from research institutes, extension agents, retail input dealers and financial institutions. Value chain channel mapping was used, which is a process of tracing a product flow through an entire channel from the point of product conception to the point of delivery and/or consumption. During mapping, firstly actors involved in this sector with their respective functions are listed and mapped accordingly. Secondly, the institutions which have

been supporting this sector directly or indirectly are listed as enablers. Value chain of Chinese potato in different districts representing various actors at the upstream, midstream and downstream levels along with their function and interrelationships (Fig. 84).

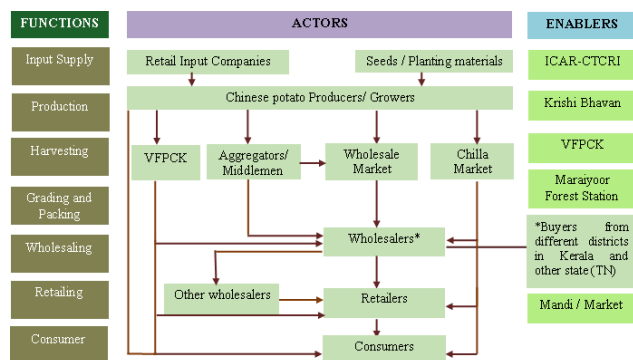


Fig. 84. Chinese potato value chain map in Kerala

Aggregators, wholesale markets, Chilla market, VFPCCK, and wholesalers are the key midstream actors in the Chinese potato value chain. Since Chinese potato is a seasonal crop, aggregators typically cover 5-10 villages per season, procuring tubers directly from farmers' fields while bearing the full transport cost. Aggregators mainly sell to wholesale markets, with only a small share going directly to wholesalers. In wholesale markets such as Thrissur and Palakkad, commission agents facilitate sales through open auction. They charge a commission of 5-10% depending on the market and deal with multiple commodities due to the seasonal nature of Chinese potato. Wholesalers purchase in bulk from these markets and supply local and distant markets in Kerala and Tamil Nadu.

VFPCCK facilitates producer to buyer transactions and charges a 5% commission, of which 2% is paid to farmer agents, 1% retained by VFPCCK and 2% returned to farmers as a bonus. Chilla market, a weekly tribal market organized by the Marayoor Forest Station, follows an auction-based system conducted in the presence of farmers, with profits used for tribal welfare after meeting operational expenses. Downstream actors include retailers and consumers. Retailers sell Chinese potato through green grocers, roadside markets and unorganized mandis, sourcing mainly from traders. Consumers primarily purchase from retailers and use Chinese potato in various culinary preparations.

Chinese potato farmers face constraints such as

seasonal price crashes, lack of improved varieties, pests incidence like root-knot nematode, erratic rainfall, wild animal damage, labour shortages and limited mechanization. Traders also experience price volatility, high transport costs, irregular arrivals and inadequate storage facilities, leading to distress sales. To overcome these challenges, development and promotion of new high-yielding, pest and climate resilient varieties and integrated pest management. Strengthening farmer collectives and institutional support through Vegetable and Fruit Promotion Council Keralam (VFPCCK), improving storage infrastructure, introducing price stabilization measures and promoting value addition and interstate market expansion can enhance income stability and value chain efficiency.

Smart and AI solutions for strengthening tuber crops value chain

e-Crop based smart farming technology was field tested in a cassava field by setting up e-Crop Based Smart Fertigation System (eCBSFS). Field trial to test efficacy of eCBSFS technology for irrigation and fertilizer application was carried out in cassava variety Sree Vijaya in three replications. The irrigation and fertilizer applications in the treatments were: T1. eCrop based smart farming recommendation through drip fertigation; T2. PoP recommendation of ICAR-CTCRI through drip fertigation and T3. PoP recommendation of ICAR-CTCRI by manual application.

A non invasive soil moisture sensor to estimate soil moisture level using IR was fabricated. The device was showed 84% accuracy in predicting soil moisture level.

Integration of multi-omics GIS and AI for advanced data analytics in tropical tuber crops

Post-harvest physiological deterioration (PPD) is a major constraint in cassava, significantly reducing storage life, commercial value and end-use quality. Conventional assessment of PPD relies on manual visual scoring, which is subjective, labor-intensive and unsuitable for high-throughput applications. To overcome these limitations, the present study developed a deep learning-based image classification framework using convolutional neural networks (CNNs) to establish a rapid, objective and standardized system for PPD evaluation. A curated dataset of approximately

1,500 cassava root images was generated from roots stored under controlled conditions and categorized into five classes viz., zero, low, medium, high PPD severity and microbial deterioration (MD) based on visual scoring criteria. Four transfer learning-based architectures, namely ResNet50, EfficientNetV2S, MobileNetV3-Large and YOLOv8s (classification), were fine-tuned and evaluated using standard performance metrics. Among the individual models, the YOLOv8s classification model achieved the highest accuracy of 92.77%, demonstrating strong generalization across all severity classes. To further enhance robustness and class-wise balance, ensemble strategies including hard voting, soft voting and weighted soft voting were implemented. The weighted soft voting ensemble, assigning greater weight to YOLOv8s, achieved the best overall performance. An interactive web application, “CassavAI-PPDVision,” was developed using Streamlit and deployed via Streamlit Community Cloud with GitHub



Fig. 86. The QR Code for trying the application

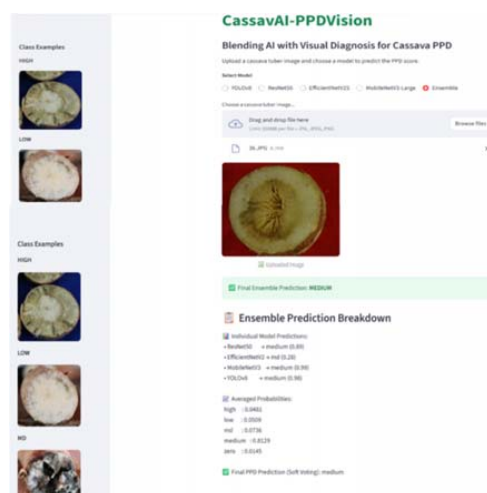


Fig. 85. The interactive web application, “CassavAI-PPDVision,”

integration (Fig. 85). The QR code for accessing and testing the application is provided in fig. 86. The developed framework demonstrates the potential of deep learning in automated post-harvest quality assessment and provides a practical decision-support tool for cassava breeders, processors and researchers.

DEVELOPMENTAL PROJECTS

DEVELOPMENTAL PROJECTS

1. **ICAR-CTCRI - Tribal Sub Plan 'Livelihood improvement of tribal farmers through tuber crops technologies'** (Funding agency: ICAR-CTCRI; PI: M. Nedunchezhiyan, Co-PIs: R. Muthuraj, Kalidas Pati, B.G. Sangeeta, C. Pradeepika, J. Suresh Kumar and K. Hanume Gowda)

During the year 2025, 615 tribal farmers (200 in Gajapati district, 66 in Koraput district and 5 in Kandhamal district of Odisha; 30 in Purulia district and 5 in Jhargram district of West Bengal, 64 in Manyam district of Andhra Pradesh; 5 in Mysore district of Karnataka; 40 from Palakkad district, 30 from Thiruvananthapuram, 40 from Idukki district of Kerala; 80 from Erode and Trichi districts, 50 from Nilgiris district of Tamil Nadu) were adopted for demonstrating tuber crops technologies. Quality planting materials of greater yam 10000 kg, *Colocasia* 8000 kg, sweet potato 19.0 lakh vine cuttings, cassava 21000 stems and yam bean 80 kg and elephant foot yam 1000 kg were distributed to the farmers. Farmers contributed rice 300 kg, maize 60 kg and ragi 60 kg for farming system demonstrations. Tuber crops based-farming system was demonstrated in 200 tribal farmers field (0.2 ha model) covering 40 ha. High yielding variety of greater yam (Orissa Elite) was demonstrated in 25 tribal farmer's field covering 1.0 ha. Biofortified sweet potato varieties (Bhu Sona, Bhu Krishna and SP-95/4) were demonstrated in 175 tribal farmers field covering 12 (1+1+10) ha. High yielding variety of cassava (Sree Jaya) was demonstrated in 175 tribal farmers' field covering 6 ha. Thirteen trainings were organized to empower tribal farmers in tuber crops cultivation and value addition. Tuber crops day was celebrated on 18 January 2025 at Kuttama, Mohana, and Gajapati districts. Sweet potato, yam bean, greater yam, *Colocasia* and cassava were harvested and recorded tuber yield of 12.6 - 13.4, 16.2 - 18.8, 20.4 - 23.2, 17.6 - 19.2 and 16.2 - 18.8 t ha⁻¹, respectively. Rice, ragi and maize were harvested and recorded grain yield of 3.22 - 3.42, 1.26 - 1.48 and 2.92 - 3.10 t ha⁻¹, respectively.

Tuber crops day

The 'Tuber crops day' was organized at Kuttama village, Mohana block, Gajapati district. Around 850

tribal farmers participated in the programme (Fig. 87). Dr. K. Laxminarayana, Dr. M. Nedunchezhiyan, Dr. Kalidas Pati, Dr. T. Jacob, President, PREM (NGO), Dr. S.K. Dash, DDH, Gajapati district and Dr. G. Byju, Director, ICAR-CTCRI, Thiruvananthapuram participated in the program. Mr. Dasarathi Gomango, MLA, Mohana Constituency, Gajapati district was the Chief Guest of the function and he presented the best farmers awards to 10 farmers and distributed small tools like pick-axe, spade, crow-bar and sickle to the tribal beneficiary farmers. In his address, he stressed the needs of tuber crops cultivation in tribal areas. He also urged ICAR-CTCRI to take massive areas of tuber crops demonstrations in Mohana block.



Fig. 87. Glimpses of tuber crops day at Kuttama village, Mohana block, Gajapati district

Hands on training on tuber crops technologies

The ICAR-CTCRI, organized a training programme for TSP farmers at KILA, Agali, Palakkad district, Kerala on 25 January 2025 (Fig. 88). Dr. M.S. Sajeew, Dr. J. Suresh Kumar, Dr. C. Pradeepika, and Dr. B. G. Sangeeta participated in this program, where agri-inputs were distributed to TSP beneficiaries, including 1,000 kg of elephant foot yam seed corms, 40 knapsack sprayers, 40 bundles of 1-inch hoses (30 m each), 40 spades, 80 kg of *Trichoderma* formulations, 120 pheromone traps with lures, 40 sets of hand slicers (plain, corrugated, stick, sheet, and corrugated sheet types) and kits of value-added products to 40 beneficiaries. The



Fig. 88. Glimpses of the hands on training at Attappadi, Palakkad district, Kerala held on 25 January 2025

programme was inaugurated by Shri. Dinesh H., IAS, Executive Director, Kudumbashree, in the presence of local body members from nearby panchayats. More than 300 tribal farmers participated in the event. The scientists conducted hands-on training sessions on the processing of tuber crops such as sweet potato, taro and elephant foot yam; application of micronutrient formulations (Micronol) for sweet potato and elephant foot yam; use of dual-type sprayers (power-operated and manual) for applying micronutrients and other agri-inputs and installation of sweet potato pheromone traps.

Tuber crops day and hands on training on tuber crops technologies

Another training programme was organized by ICAR-CTCRI, Thiruvananthapuram on 27 September 2025 for TSP farmers at Elamdesham, Idukki district, Kerala, under the Tribal Sub Plan (TSP) in collaboration with Kudumbashree, the State Government Mission of Kerala (Fig. 89). The event was inaugurated by Shri. Rarichan Neeranamkunel, Panchayat President in the presence of Dr. G. Byju, Director, ICAR-CTCRI; Dr. V. Arunachalam, Director, JNTBGRI; and Shri. H. Dinesh, IAS, Executive Director, Kudumbashree, along with local body representatives. The training focused on improved technologies for crop production, crop protection and value addition in sweet potato and cassava. Dr. M.S. Sajeew, Dr. B.G. Sangeetha and Dr. C. Pradeepika conducted the trainings. Agri-inputs were distributed to 40 TSP tribal beneficiaries, including improved planting materials of biofortified sweet potato varieties (Bhu Sona and Bhu Krishna) and cassava varieties (Sree Manna, Sree Vijaya and Sree Jaya). Other inputs included micronutrients, knapsack sprayers, hoses, crowbars, *Trichoderma* formulations, biopesticides, pheromone traps with lures and hand slicers of various types. Training materials were also provided to support the establishment of demonstration plots and seed villages under the TSP initiative. Overall, 350 participants including, farmers, entrepreneurs and officials benefited from the programme.



Fig. 89. Glimpses of the programme at Elamdesham, Idukki district, Kerala held on 27 September 2025

2. ICAR-CTCRI - SCSP: Empowerment of tuber crops farmers through sustainable use of resources and tuber crops technologies (PI: K. Sunilkumar, Co-PIs: G. Byju, M.S. Sajeew, V. Ramesh, C. Mohan, E.R. Harish, P.Prakash and S.N. Rahana)

During the year 2025, the SCSP institute project was implemented in 22 panchayaths in 8 Blocks in 6 districts in two States viz, Kerala and Tamil Nadu.

Capacity building: A total of 11 training programmes in Kerala and 3 in Tamil Nadu for the SC beneficiaries were conducted. Through the capacity building programmes, 1048 farmers were benefitted (Fig. 90 A & B). Apart from this, seven skill development training of one year duration was imparted for the educated unemployed on aspects such as germplasm conservation and maintenance strategies, *in vitro* conservation of tuber crops, tissue culture, quality planting materials production, soil and plant nutrition: Production strategies of organic inputs, resource cycling and customized fertilizers, mass production/multiplication of biocontrol agents, value addition and processing technologies and hitech cultivation of vegetable crops.



Fig. 90 A & B Glimpses of SCSP programmes organized in various locations

Supply of inputs: 126000 nos of plants/cuttings including sweet potato vine cuttings, cassava stem cuttings and coleus/Chinese potato vine cuttings, portray nursery of yams, 25,750 kg comprising of elephant foot yam and yams and 66,000 vegetable seedlings comprising of tomato, brinjal, bhindi, chilli and cluster bean, 472 nos. of farm implements such as

spade, pick axe, 15 litre battery operated sprayer and 30 m long ring/suction hose, 10.3 litres biopesticides such as Nanma, Menma and 177 quintals of fertilisers including urea, rajphos and muriate of potash, 118 litres of crop specific multi micro nutrient foliar spary liquid viz., micronol were supplied.

Technology demonstrations: Demonstration pertaining to technologies such as improved tuber crop varieties, BMPs, micronol (multi micronutrient solution), biopesticides from cassava, portray nursery of tuber crops and drought mitigation strategies were demonstrated in 28 ha to 138 farmer's in all the project locations of Kerala.

3. ICAR-CTCRI- NEH: Livelihood improvement of North Eastern Hill Region farmers through tuber crops technologies

(Funding Agency: ICAR-CTCRI; PI: R. Muthuraj, G. Byju, M.S. Sajeew, V.S. Santhosh Mithra, T. Krishnakumar, P. Prakash, R. Arutselvan)

ICAR CTCRI as part of the NEH programme supplied quality planting materials of the improved varieties of tuber crops to Kanubari Village, Arunachal Pradesh and Wokha village, Nagaland in order to strengthen the establishment of seed villages in these regions (Fig. 91 A & B). Apart from that, training programmes on improved varieties, production technologies and value addition in tuber crops were conducted as detailed in Table 10.

Table 10. Details of NEH programmes conducted in Arunachal Pradesh, Nagaland & Thiruvananthapuram

Date	Location	District	Participants	Key Highlights
11.09.2025	Kanubari village	Longding district, Arunachal Pradesh	100	Distribution of planting materials of improved varieties of tuber crops, agro-techniques, hands on training programme on value addition
15.09.2025	Wokha Village	Wokha district, Nagaland	110	Distribution of planting materials of improved varieties of tuber crops, agro-techniques, hands on training programme on value addition, economics and marketing strategies of tuber crops,
25.9.25-27.09.2025	ICAR-CTCRI, Trivandrum		20	Exposure visit and training on improved production technology on tuber crops



Fig. 91 A & B Glimpses of NEH programmes organized in various locations

EXTERNALLY AIDED PROJECTS

CROP IMPROVEMENT

1. **Establishment of varietal gene bank and development of standards of DUS testing for varietal gene bank in sweet potato and cassava** (PPVFRA, New Delhi; Lead Centre PI: C. Visalakshi Chandra; Co-PIs: K.I. Asha, A. Asha Devi, Shirly Raichal Anil and N. Krishna Radhika)

The gene bank of reference varieties of cassava (35) and sweet potato (42) are being conserved in the field. The cassava variety, Manna was registered as the first farmer's variety in cassava during November 2025. DUS characterization of five cassava candidate varieties is in progress for pre-harvest and post-harvest characteristics. Farmers were sensitized on registration of farmer's varieties in cassava and sweet potato.



2. **Establishment of varietal gene bank and development of standards of DUS testing for varietal gene bank in yam bean and greater yam** (PPVFRA, New Delhi; Lead Centre PI: S.N. Rahana; Co-PIs: J. Sreekumar and P. Murugesan)

During the year, the Centre maintained four reference lines, 20 example lines and 10 released varieties and ten reference varieties of yam bean in the National Field Gene Bank. Two farmers' varieties of greater yam, *Inchi kachil* and *Palu vella kachil*, were received for DUS testing. The farmers' varieties are being multiplied at the DUS Centre for further evaluation at the two test locations. For greater yam, twenty characteristics were selected for DUS evaluation. As part of awareness creation and outreach activities, a Malayalam popular article was published to promote farmers' rights and varietal protection: Rahana, S.N. (2025). Our varieties – our rights: Protection of farmers' varieties through the PPVFRA Act (in Malayalam). *Krishijagran (e-publisher)*, 20 December 2025. During the reporting

period, the PI attended the following meetings a) DUS Review Meeting at Plant Authority Bhawan, New Delhi, during 24–25 March 2025 b) Second Stakeholders' Consultation Meeting (online) with scientists from the public sector, organized by the committee constituted to suggest amendments to the PPVFRA Act, 2001 and Rules, 2003, held on 26 October 2025 and c) The 21st Foundation Day of PPVFRA and Plant Genome Saviour Award Function (online) on 12 November 2025.

3. **Establishment of varietal gene bank and development of standards of DUS testing for varietal gene bank in sweet potato and cassava** (PPVFRA, New Delhi; Collaborating Centre PI: Kalidas Pati; Co-PI: K. Hanume Gowda)

The field gene bank at the Regional Station, ICAR-CTCRI, Bhubaneswar, Odisha, included 43 reference lines of sweet potatoes and 17 reference lines of cassava. There were 19 pre-harvest and 6 post-harvest traits for each sweet potato reference line and 22 pre-harvest and 8 post-harvest traits for each cassava reference line that have been identified and documented. The report of one farmer's variety, Manna was submitted from the Co-Nodal Centre and it got registered under the PPV&FR Act on 14 November 2025. Another farmer's variety of cassava was received for DUS testing which was planted in the field for multiplication.

4. **Establishment of varietal gene bank and development of standards of DUS testing for varietal gene bank in yam bean and greater yam** (PPVFRA, New Delhi; Collaborating Centre PI: Kalidas Pati; Co-PI: R. Arutselvan)

The field gene bank at the Regional Station, ICAR-CTCRI, Bhubaneswar, Odisha conserves 10 reference lines of yam bean and 14 reference lines of greater yam. Identified and documented the pre-harvest features of each reference line for greater yam and yam bean. For 15 attributes of greater yam and 17 attributes of yam bean, the unique characteristics of each reference line have been identified and documented. The DUS data is updated for greater yam based on characteristics including stem color, petiole color, pigmentation, tuber form and color and tuber flesh color. In order to keep the data up-to-date for yam bean, factors including stem color, flower density, sepal color, pod length, seed color and shape and tuber morphology were taken into account.

5. Establishment of varietal gene bank and development of standards of DUS testing for varietal gene bank in taro and elephant foot yam (PPVFRA, New Delhi; Lead Centre PI: Kalidas Pati)

In the gene bank located at the Regional Station in Bhubaneswar, Odisha, 21 taro lines and 18 elephant foot yam lines were maintained as reference collections. Thirty-four pre-harvest and 16 post-harvest characteristics for each reference line of taro, as well as 20 pre-harvest and 18 post-harvest characteristics for each reference line of elephant foot yam have been identified and documented. A DUS trial has been carried out for five newly received candidate varieties of taro. Four additional farmer varieties of taro and three farmer varieties of elephant foot yam have been received from PPV&FRA and planted in the field for multiplication to initiate DUS testing and their germination report was submitted to PPV&FRA, New Delhi.

6. ICAR-CIP collaborative work plan activity on crop improvement and varietal selection of sweet potato for biotic/abiotic stress tolerance and biofortification (International Potato Centre (CIP), New Delhi; PI: Shirley Raichal Anil; Co-PIs: C. Visalakshi Chandra; Associates: A.N. Jyothi, V.S. Santhosh Mithra, P. Sethuraman Sivakumar and R. Saravanan Raju)

A total of 210 hybrids were selected and maintained after evaluation from the biofortified hybrid seeds obtained from CIP, Peru through ICAR-NBPGR during 2018. The summer season data of the evaluation of hybrid clones from the last set of 4000 hybrids during 2024 -25 indicated that, 21 hybrids had yield ranging between 10 t ha⁻¹ to 27.5 t ha⁻¹. Amongst these, the dark orange fleshed hybrids, 678/23 and 678/36 gave a yield of 19.7 t ha⁻¹ and 18.9 t ha⁻¹, respectively. The highest yielders during this season were 746/5 (cream-fleshed) and 682/15 (white-fleshed) with a yield of 27.5 t ha⁻¹ and 25t ha⁻¹, respectively. New set of hybrid seeds, for harvest at 90 days (short duration hybrids), were obtained from CIP through ICAR-NBPGR during June 2025 for evaluation and development of short duration varieties

7. DST-SERB project (CRG/2021/001077): Microtuber production and gene prospecting for photoresponsive tuberization in *Ipomoea batatas* (L.) Lam. (Department of Science and Technology-Science and Engineering Research Board; PI: Shirley Raichal Anil; Co-PIs: N. Krishna Radhika and K.M. Senthilkumar)

Protocol for *in vitro* tuberization was standardized in var. Bhu Krishna. A combination of IAA, trans-Zeatin and ABA in 6% and 7% sucrose at 13 hrs photoperiod was found best for *in vitro* tuber formation. *In vitro* germination was also observed in the same media after ten weeks of culture. *In vitro* germination studies were also done using basal MS medium in 13 hrs and 16 hrs photoperiod as well as in dark condition. In 13 hrs photoperiod, callus development was observed with anthocyanin accumulation. Anatomical study of the *in vitro* tubers was done using Safranin and Lugol's reagent which showed starch deposition confirming tuber formation.

In the transcriptome analysis, the gene ontology and the KEGG pathway enrichment analysis of photosensitive genotype during summer and *kharif* seasons showed that circadian rhythm pathway is highly expressed. The comparative study of DEGs of photosensitive genotype showed that the differential expression of *Arabidopsis* flowering inducing genes *FHY3*, *ELF4* and *DET1* were expressed during long days, inhibiting tuberization. The differential expression of *Topless* during short days results in tuber formation. The results also emphasized the role of genes related to heat stress, plant hormone, transcription factors, cell wall expansion, MAPK signaling along with the circadian rhythm pathway. Thirteen genes were selected and the primers were designed for RT-qPCR validation of the transcriptome results. Project is concluded in June 2025.

8. Collection and database creation of important named landraces of tuber crops from southern districts of Kerala (Kerala State Biodiversity Board, Thiruvananthapuram, Kerala; PI: K.I. Asha; Co-PIs: A. Asha Devi, Shirley Raichal Anil and N. Krishna Radhika)

Seven collection trips were carried out during the period to the selected districts and the passport data and germplasm of 50 accessions comprising 24 cassava, 10 taro, 8 greater yam, 6 elephant foot yam and 2 sweet potato were collected from the custodian farmers. Under this project that concluded in September 2025, a total of 309 accessions representing 177 named landraces of tuber crops was collected from the custodian farmers in the traditional cultivated areas of southern districts of Kerala (cassava-154 accessions in 86 named landraces, sweet potato-10 in 7 landraces, greater yam-92 in 65 landraces, taro-32 in 14 landraces, elephant foot yam-16 in 5 landraces and tannia-5 accessions) and these were established in the Field Genebank

(FGB) of ICAR-CTCRI, which serve as the National Active Germplasm Site (NAGS) for tropical tuber crops (Fig. 92). Unique accessions were distributed across Thiruvananthapuram (85), Pathanamthitta (77) and Kollam (39) with cassava and greater yam identified as regional diversity hotspots. The rare and threatened named landraces rescued from extinction strengthened our conservation programmes. Passport data of the collections were documented, digitized and nationally accessioned. To strengthen awareness and effective utilization, eight awareness and training programmes were conducted for custodian farmers on conservation, crop management and value addition of landraces. The final report of the project was submitted to KSBB on 31 October 2025.



Fig. 92.: Collection trips in custodian farmer's fields

9. **Establishment of aeroponics system for production of mini tubers in sweet potato and greater yam to fulfill the quality planting materials requirement of Odisha** (Rashtriya Krishi Vikas Yojana (RKVY), Government of Odisha; PI: K. Hanume Gowda; Co-PIs: M. Nedunchezian, R. Arutselvan and K. Pati)

The RKVY funded project on establishment of aeroponics system for production of mini tubers in sweet potato and greater yam was sanctioned to fulfil the quality planting materials requirement of Odisha with a budget of 1.4 crore. Rs. 85 lakhs was allocated under RKVY-APS project on 16 June 2025. The major initiative undertaken is the establishment of an aeroponics system aimed at the production of mini tubers in sweet potato and greater yam. Through GeM, Saveer Biotech Pvt. Ltd. was awarded the contract for Rs. 79,66,364.00/-, for the establishment of the aeroponics system. The work started during October

2025 and construction of aeroponics facility is under progress. The civil foundation work was completed. The plinth and surrounding ground work are largely finished. The complete multi-span galvanized steel structural framework has been successfully erected. All main columns, roof trusses and side frames are in position. Roof covered by horticultural glass all four sides with 10 mm thickness of UV stabilized polycarbonate sheet with aluminium extrusion and EPDM dubber gasket was done. Side ventilation shutters have been installed for effective air circulation. The constructions of pre entry room and access steps to the facility, construction of underground nutrient solution tank, construction of storage room, utility area and buffer room, installation of energy saving screen systems, air curtain at main entrance of pre-entry room, evaporative cooling system, environmental control panel, dosatron automatic irrigation and fertigation system, genset with shed of 25KVA capacity, RO unit, Ph and Ec sensors, exhaust fans and lighting system were completed (Fig. 93).



Fig. 93. View of the aeroponics facility under construction.

10. **Technological intervention for enhancing the nutrient rich underutilized crop yam bean to improve food quality and health and nutritional security of Odisha** (Rashtriya Krishi Vikas Yojana (RKVY), Government of Odisha; PI: Kalidas Pati; Co-PIs: M. Nedunchezhiyan, K. Laxminarayana, R. Arutselvan and K. Hanume Gowda)

Farmers in Gajapati and Koraput district have been selected for yam bean seed production, and improved variety seeds have been distributed to them for cultivation. Geo-tagging has been completed using the Krishi Mapper platform. A team from RKVY, DA&FE visited the ICAR-CTCRI Regional Station on 27 October 2025 to monitor the on-going projects. Two training programmes, one at Birikote GP, located in Mohana block, Gajapati district, Odisha on 03 January 2026 (Fig. 94) and another at Petta, Lamtaput, Koraput, Odisha on 04 January 2026

(Fig. 95) on ‘Cultivation practices of yam bean for seed and tuber production’ was conducted. During the session, Dr. K. Pati delivered a talk on ‘Cultivation practices of yam bean for seed and tuber production’. Dr. M. Nedunchezhiyan, Principal Scientist and Head, addressed the gathering and highlighted the importance of yam bean cultivation and food and nutritional security. Following the training, the team visited the demonstration fields of yam beans. The overall crop condition was found to be very good. The team also instructed the farmers to monitor the yam bean plants closely and to carry out harvesting as soon as pods mature, to ensure proper seed collection.



Fig. 94. Training programme at Birikote, Mohana, Gajapati, Odisha



Fig. 95. Training programme at Petta, Lamtaput, Koraput, Odisha

11. **Development of DUS test guidelines for Chinese potato (*Solenostemon rotundifolius* (Poir) J. K. Morton)]** (PPV&FRA, Government of India, New Delhi; PI: P. Murugesan; Co-PI: M.R. Sahoo)

The deed of agreement between the Director, ICAR-CTCRI, Thiruvananthapuram and the Registrar, Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA), New Delhi, was executed for the project in the month of August, 2025. Project activities were initiated following the receipt of first-year financial sanction from the funding agency, with effect from 10 October 2025. A total of 25 farmers' varieties/landraces of Chinese potato were collected from Kerala and Tamil Nadu, and varietal characterization has been initiated

by comparing the collected germplasm accessions with ‘Sree Dhara’ and ‘Nidhi’ as reference varieties. One project staff member (Senior Research Fellow) was recruited under the project.

CROP PRODUCTION

12. **All India-Network Programme on Natural Farming (AINP-NF)** (ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut as Lead Centre; PI: Dr. G. Suja; Co-PIs: Drs. G. Byju, S. Sunitha, S.S. Veena, A.N. Jyothi and D. Jaganathan)

The major objectives were to evaluate organic, inorganic and integrated management practices in cropping systems involving tuber crops, to evaluate the response of greater yam varieties to organic production system, to develop integrated organic farming system involving tuber crops and to conduct geo-referenced on-farm characterization of organic growers. Besides cluster-based demonstration of organic package under SCSP and on-station evaluation of natural farming in cassava-based cropping systems are ongoing.

Evaluation of organic, inorganic and integrated management practices in cropping systems involving tuber crops

In the eighth season field experiment, in cassava, tuber yield, net return and B:C ratio was highest under POP. In taro, yield and returns were highest under 100% organic. In vegetable cowpea, groundnut, green gram and black gram, 100% inorganic, 50% organic + 50% inorganic, 25% organic + 25% inorganic + innovative practices and 100% organic respectively were most productive. Only groundnut was remunerative during this year, with highest net return from 50% organic + 50% inorganic, followed by 50% organic + innovative practices (with premium price). In cassava-vegetable cowpea, state PoP (without & with premium price) and cassava-groundnut, 50% organic + 50% inorganic (without premium price) and 100% organic (with premium price) were profitable.

Evaluation of response of different varieties of greater yam to organic farming: During the third year, of the six varieties tested, greater yam var. Sree Swathy yielded highest (22.45 t ha⁻¹) under organic management with highest profit, on par with Sree Keerthi, Sree Karthika and Orissa Elite

Geo-referenced on-farm characterization of organic growers: Geo-referenced survey of 30 farmers practicing natural farming (NF) in

Pathanamthitta and Thiruvananthapuram districts of Kerala was conducted. All surveyed farmers (100%) are members of BPKP and produce different bio-formulations in their farm itself (60%) and sell these inputs through eco-shops and Krishi Bhavans. The market modes were mainly through self-sale (45%), Krishi Bhavans (25%), VFPCCK (20%) and eco-shops (10%). Among the surveyed farms, four hold organic certifications from Indocert, Lacon, and India Organic, covering crops such as vegetables, pepper, nutmeg, mangosteen and rambutan. There was no yield gap in cassava. An increment of 61.69% due to varietal effect (local var. Pullad kappa) and use of other organic manures along with NF manures in natural farming

practices in farmers' fields was observed.

Development of integrated organic farming system (IOFS) model

Tuber equivalent yield of 39.56 tons and net returns of ₹ 187,143 could be obtained from the IOFS involving tuber crops from an area of 75 cents during the reporting period. Averaging over seven years, net returns of ₹ 1,26,625 could be obtained from tuber crop-based farming system from an area of 75 cents (0.3 ha) (during 2018-2025). The marketable equivalent yield (MEY) from the system was 25.68 tons. The key performance indicators of the model are given in Table 11.

Table 11. Key performance indicators (mean of 7 years) of IOFS model for 1 ha

Indicator	Value	Indicator	Value
Equivalent yield (kg ha ⁻¹)	83516.40	Energy input (MJ) of 75 cents	29203
		Energy output (MJ) of 75 cents	160305
		Energy productivity (kg MJ ⁻¹)	0.86
System productivity (kg ha ⁻¹ day ⁻¹)	228.81	Economic Efficiency (Net return per rupee invested)	0.25
Net income (₹ ha ⁻¹)	421661	System profitability (₹ ha ⁻¹ day ⁻¹)	1155.23

Evaluation of natural farming in cassava (on-station)

The fourth season experiment to evaluate natural farming in cassava + vegetable cowpea – green gram indicated that integrated crop management including pest and disease management (ICM 1) produced significantly higher yield in cassava, followed by integrated crop management along with need-based pest and disease management (ICM 2) and natural farming (NF), which were on par in cassava. Yield of the intercrop vegetable cowpea (bushy type) did not

vary significantly among the treatments, but it was highest in ICM 1. Green gram is yet to be harvested. The tuber equivalent yield was significantly higher in ICM 1, followed by ICM 2 and NF, which were on par based on cassava and cowpea yields. Water use efficiency was highest in ICM 1. Weed density was lowest in ICM 1 (Table 12). Significantly highest net income and B:C ratio was obtained in both the integrated practices (ICM 1 & 2) and NF during the fourth year based on cassava and cowpea yields.

Table 2. Productivity, tuber equivalent yield, water use efficiency and weed count in different treatments

Treatments		Yield (kg ha ⁻¹)			WUE (kg m ⁻³)	Weed count (no. m ⁻²)
		Cassava	Cowpea	Tuber equivalent yield		
T1	Control	28225	357.34	29654	1.591	100
T2	Complete NF	48243	445.43	50025	2.684	105
T3	AINPOF Package	40716	440.62	42479	2.279	117
T4	Integrated-1 (ICM 1)	55574	484.11	57511	3.085	97
T5	Integrated-2 (ICM 2)	49462	477.80	51373	2.756	112
	CD (0.05)	7014	NS	6063	NS	NS

13. Adoption of biofortified varieties of tuber crops and promoting entrepreneurship development for livelihood and nutritional security of tribal farmers (Directorate of Horticulture, Government of Odisha; PI: K. Laxminarayana; Co-PIs: M. Nedunchezhiyan, R. Arutselvan, M.S. Sajeev and B.B. Das)

Approval was received from the Directorate of Horticulture, Government of Odisha to continue the project activities up to March 2026 with the balance funds under MIDH project vide Lr. No. F. DHO-NHM-PLAN-0001-2021/5013, dated 07 May 2025. Demonstrations with tuber crops (greater yam, taro, yam bean and sweet potato) were laid out at farmers' fields representing 24 and 30 locations at Kuliana and Bangripasi blocks of Mayurbhanj district and 25 locations each at Bissamcuttack and Kolnara blocks of Rayagada district during 2025-26. The soil pH in 54 nos. of soils representing two blocks of Mayurbhanj district ranged from 4.79 - 6.65, out of which 96.3 and 3.7% of soils were moderately acidic and neutral, respectively in soil reaction. The organic carbon content in the soils ranged from 0.29 - 1.50% with a mean of 0.70% and it was found deficient in 35.2% of soils, whereas 31.5 and 33.3% soils showed medium and high status of organic C, respectively. The available N ranged from 131.9 - 288.2 kg ha⁻¹ and 83 and 17% soils were deficient and showed medium status in available N. The available P in the soils varied from 14.93 - 76.24 kg ha⁻¹ and it was found 61% of soils were medium and the rest 38.9% of soils contained high status of available P. The available K varied from 117.7 - 322.4 kg ha⁻¹ and it was found 89% and 9% of soils showed medium and high status of available K. The exchangeable Ca and Mg ranged from 4.8-14.64 and 1.41 - 6.58 c mol (p+) kg⁻¹, respectively. The available S in the soils ranged from 7.24 - 36.1 mg kg⁻¹. The available Fe, Mn, Cu and Zn in the soils ranged from 18.54-49.0; 42.28-85.12; 0.63-2.64 and 0.42-2.19 mg kg⁻¹, respectively. Majority of soils contained toxic levels of available Fe, Cu and Mn. The soil samples from the demonstration plots from Rayagada district were moderately acidic to neutral in reaction (pH 5.29 - 7.1), non saline (EC 0.119 - 0.503 dS m⁻¹), very low to medium in organic C (0.247 - 0.67 %), low in available N (148.6 - 281.5 kg ha⁻¹), low to high in available P (21.44 - 79.82 kg ha⁻¹) and medium to high in available K (150.8 - 350.9 kg ha⁻¹); high in exchangeable Ca & Mg [8.10 - 22.30 & 4.19 - 16.40 c mol (p+) kg⁻¹]; very low to high in available S (8.97 -

45.26 mg kg⁻¹), moderate to high in available Fe, Cu, Mn and Zn (15.8 - 58; 1.40 - 3.38; 46.1 - 89.40; 0.41 - 1.82 mg kg⁻¹, respectively). Around 56% and 44% of soils were moderately acidic and neutral in reaction. Around 70% of soils were deficient and 30% soils were medium in organic C. Majority of soils (84%) were deficient in available N. Around 28 and 72% soils contained medium and high status of available P, whereas 76 and 24% soils contained medium and high status of available K. All the soils recorded high status of exchangeable Ca and exchangeable Mg. The available S in the soils was found to be low, medium and high status in 4, 20 and 76% soils, respectively. Most of the soils contained toxic levels of available Fe, Cu and Mn. The available Zn was found to be low, medium and high status in 18, 60 and 22% of soils, respectively. 1000 kg each of greater yam and taro, 16 kg yam bean seeds and 2.0 lakhs vine cuttings of biofortified sweet potato were distributed for laying FLDs at farmers' fields in Kuliana and Bangripasi blocks of Mayurbhanj district. A total quantity of 700 kg greater yam, 800 kg cormels of taro, 14 kg yam bean seeds, 1250 nos. of cassava stems and 1.30 lakhs vine cuttings of biofortified sweet potato were distributed to the selected beneficiary farmers for laying FLDs in Rayagada district during 2025-26. Organized 12 nos. of capacity building training programmes on 'Production and value addition in tuber crops' at Saragchhida village, Kuliana Block, Mayurbhanj District on 06 February 2025; Kanchhindavill., Sorisapal G.P., Bangripasi Block, Mayurbhanj on 09 February 2025; Gopi Kankabadivill., Dumuriguda G.P., Kolnara Block, Rayagada on 18 February 2025; Korapadivill., Sahada G.P., Bissamcuttack Block, Rayagada on 19 February 2025; T. Dengasargivill., Dumuriguda G.P., Kolnara Block, Rayagada on 28 July 2025; Karnagudavill., Chatikona G.P., Bissamcuttack, Rayagada on 29 July 2025; Dardaravill., Kutunmari G.P., Kuliana, Mayurbhanj on 04 August 2025; Tangiabasavill., Badagaon G.P., Bangripasi, Mayurbhanj on 06 August 2025; T. Dengasargivill., Dumuriguda G.P., Kolnara, Rayagada on 15 December 2025 and at Block Agricultural Office, Bissamcuttack, Rayagada district on 16 December 2025; Saragchhidavill., Kuliana, Mayurbhanj on 18 December 2025 and Kanchhindavill., Sorisapal G.P., Bangripasi, Mayurbhanj district on 19 December 2025 as facilitated by the associated NGOs i.e. Centre for World Solidarity for Rayagada and Balasore Social Service Society for Mayurbhanj

district. Demonstrated the preparation of value added products from sweet potato and cassava to the participants. Distributed the value added equipments (Stainless steel peelers, oil stainers, chips cutters and lays cutters) to the selected beneficiary farmers.

Tuber yields of greater yam, taro, yam bean and sweet potato in the FLDs at Mayurbhanj district ranged from 13.17 - 23.04; 13.44 - 22.34; 8.56 - 15.25 and 9.58 - 14.25 t ha⁻¹, respectively. However, the tuber yields in respect of greater yam, taro, cassava, yam bean and sweet potato ranged from 15.31 - 24.79; 19.74 - 24.89; 10.00 - 26.00; 10.24 - 17.76 and 8.79 - 14.80 t ha⁻¹ from the FLDs in Rayagada district.

14. Climate-resilient agri-food systems - Integrating bio-fortified sweet potato for sustainable livelihoods in Mayurbhanj District of Odisha (NABARD; Project Leader: G. Byju; PIs: K. Laxminarayana and M. Nedunchezhiyan; Co-PIs: R. Arutselvan, K. Pati and K. Hanume Gowda; Associates: B.B. Das and S.K. Jata)

NABARD Regional Office, Bhubaneswar, Odisha sanctioned a project 'Climate-resilient agri-food systems - Integrating bio-fortified sweet potato for sustainable livelihoods in Mayurbhanj District of Odisha' vide letter No. NB.OD RO/FSDD/CC-CCF-ID/173090/2024-25 dated 27 March 2025 with a total budget of Rs. 289.38 lakhs in which NABARD contributed Rs. 123.21 lakhs under CCF-ID funds for a period of 3 years (2025-2028). Memorandum of Agreement (MoA) was signed between NABARD and ICAR-CTCRI and exchanged on 07 April 2025 in presence of Dr. G. Byju, Director, ICAR-CTCRI and Dr. Sudhansu K.K. Mishra, CGM, NABARD. Interaction meetings were organized with the beneficiary farmers in all the selected villages and the demonstration and biofortified sweet potato nursery plots under the project was monitored.

Around 2.0 lakh vine cuttings of sweet potato was transported and distributed to the nursery growers and nurseries were raised. 80,000 vine cuttings of sweet potato was procured from the institute and transported to Kusumi block, Mayurbhanj district and distributed to 8 nos. of Decentralized Seed Multipliers (DSMs) namely, Sh. Sanjay Kumar Tudu, Padhia village, Badampahar G.P.; Sh. Premanada Soy from Pokharia village, Jorada G.P.; Sh. Bajinath Hembram, Sunaram Hembram, Jitrai Hembram, Binay Bhusan Mohanta, Smt. Basanti Hembram and Smt. Mahi Majhi in Majhigaon village, Dangudimuta G.P., Kusumi block

for raising sweet potato nurseries.

Launching workshop was organized on 17 June 2025 as facilitated by the SAMBANDH NGO in which Dr. G. Byju, Director, ICAR-CTCRI; Shri. Sanjay Kumar Talukdar, CGM, Shri. Biswa B. Mohanty, AGM and Shri. Darshan, GN, Assistant Manager, NABARD Regional Office, Bhubaneswar; Shri. Tankadhar Kalo, DDH, Baripada, Mayurbhanj; Shri. Smarak Mohanty, DDM, NABARD, Mayurbhanj; SMS (Agril. Extn.), KVK-II, Mayurbhanj and Dr. Pushpangini Mohanty, Secretary, SAMBANDH NGO, participated. Around 250 farmers and farm women participated in the workshop. The AGM and CGM of NABARD delivered key note addresses followed by the presidential address by Dr. G. Byju, Director, ICAR-CTCRI.

750 kg Dhaincha green manure seeds @ Rs. 150/- was procured for a total amount of Rs. 1,12,500/- and distributed to 167 nos. of beneficiary farmers for enriching the soil fertility. Initial soil samples were collected from farmers' fields, processed and analyzed for physico-chemical properties. 2400 nos. of mango (cvs. Amrapali and Dasher) grafts was procured for a total amount of Rs. 1,03,200/-, and distributed 16 nos. of mango grafts for planting in one acre land to develop mango-sweet potato cropping system. 1050 kg neem cake was procured for a total amount of Rs. 147000/- and 200 l neem oil for an amount of Rs. 1.00 lakh and distributed to the beneficiary farmers in Kusumi block. Procured laboratory chemicals, reagents and filter papers for a total amount of Rs. 1,49,644/- for analysis of initial soil samples from the FLDs at different villages and the analytical work is in progress. Procured 180 nos. of vegetable (3 Arka hybrids and 5 open pollinated Arka varieties) seed (tomato, brinjal, French bean, cucumber, cowpea, ridge gourd, cluster bean and bottle gourd) kits from ICAR-IIHR, Bengaluru for a total amount of Rs. 47,500/- and distributed to the beneficiary farmers representing Kusumi block, Mayurbhanj district of Odisha. Two nos. of capacity building training programmes on "Biofortified sweet potato-mango-poultry integrated farming system for livelihood and nutritional security" was organized at Jamudihi village, Jorada G.P. on 10 October 2025 and at Gopalpur village, Hatabadra G.P., Kusumi Block, Mayurbhanj district on 11 October 2025. Around 70 and 60 farmers attended the training programmes at the two locations, respectively. Shri. Smarak Mohanty, DDM, NABARD, Baripada, Mayurbhanj graced the training programme.

15. **Use of red mud for soil amelioration and development of red mud area for cultivation at Vedanta Limited, Lanjigarh, Odisha** (Vedanta Limited, Lanjigarh, Odisha; Lead Center PI: Dr. V. Ramesh, Co-PIs: Dr. M. Nedunchezhiyan, Dr. G. Byju and P. Sethuraman Sivakumar)

Under the red mud utilization project, MoU was signed with Vedanta Limited on 11 July 2025 and the project was in operation w.e.f. 09 September, 2025. Afforestation activity was carried out in red mud yard with six different tree species in an area of around 70 cents and field studies with four different treatments for studying the effective amelioration with red mud in soils and proposed with field crops (sweet potato) in farmer's field, Lanjigarh in an area of 60 cents. Two 50 kg samples of red mud and soil samples were received at HQ for studies related to product development. A visit was made to Neyveli Lignite Corporation, Neyveli on 18 September for obtaining information on revegetation of fly ash landfill areas and acidities in CARD facility. Characterization studies in red mud, fly ash, representative soil, defective soil besides textural modification studies was completed

16. **Development of biofortified sweet potato value chain for industrial production in Telangana and Odisha** (Consultancy extended to M.s. Xobu Foods and Beverages Private Limited, Rajahmundry, East Godavari AP; Project Team: Dr. G. Byju, Dr. M. Nedunchezhiyan, P. Sethuraman Sivakumar and Dr. V. Ramesh)

Soil amelioration with fly ash and growth response in sweet potato: With an aim of studying the effects of wet fly ash (WFA) alone and in combination with phosphogypsum (PG) for the amelioration of acid soils, a total of 6 treatments involving wet fly ash (FA), dry fly ash @ 10 t ha⁻¹, FYM @ 12 t ha⁻¹, PG @ 2 t ha⁻¹ and nutrients (NPK) as per PoP of sweet potato crop (var. Bhu Krishna) was taken in pots and studied with 3 replications. The crop was harvested on 07 August 2025. Plant growth parameters, number of leaves, LAI, vine and leaf weight was recorded. The highest average tuber weight was found to be 14.92 t ha⁻¹ under FYM + fly ash + NPK treatment.

17. **Empowering tribal livelihood through cassava value chain development in Kadambur Hills, Erode district Tamil Nadu** (PI: Dr. R. Muthraj Co-PIs: Dr M.S. Sajeev, Dr. T. Krishnakumar, Dr. D. Jaganathan and Dr. P. Prakash)

Project was approved for funding by the Tribal Welfare Department, Government of Tamil Nadu during October 2025 with a total financial outlay of 68.99

lakhs and duration of one year. The major targets of the project include the supply of planting materials, of improved varieties of cassava and nutrient inputs to the beneficiaries, establishment of seed village, imparting training programmes for the farmers and stake holders and the establishment of the village incubation centre for processing and value addition.

18. **Demonstration and Popularization of Smart Nutri Gardens for Food, Nutritional and Livelihood Security in the Urban and Peri-urban Households of Kerala** (PI: Dr. K. Sunilkumar, Co PIs: Dr. J. Suresh Kumar, Dr. Jeena Mathew, Dr. S.S. Veena and Dr. E.R. Harish)

Project was approved in December 2025 with duration of one year. The funding agency is State Horticulture Mission, Government of Kerala and the financial outlay is 22.50 lakhs. The major targets outlined are 1) To demonstrate the Smart Nutri Garden and popularize as a means of producing own safe and fresh vegetables in urban and peri-urban household and 2) To make possible effortless gourmet food production under limited or no land area as well as unfavorable soils.

CROP PROTECTION

19. **Development and application of diagnostics to viruses infecting tropical tuber crops. Disease Diagnostics in Tropical Tuber Crops** (ICAR-CRP on Vaccines and Diagnostics; PI: T. Makeshkumar; Co-PIs: M.L. Jeeva, R. Arutselvan and R. Muthuraj)

Development of multiplex assay for detection of sweet potato viruses

Four sets of primers based on the coat protein region were designed and optimized for multiplex PCR based specific detection of *Sweet Potato Feathery Mottle virus* (SPFMV), *Sweet Potato Chlorotic Stunt virus* (SPCSV), *Sweet Potato Leaf Curl virus* (SPLCV) and *Sweet Potato Mild Mottle virus* (SPMMV). The PCR assay done using field and germplasm samples gave single amplicons of 164 bp for SPLCV, 423 bp for SPFMV, 676 bp for SPCSV and 903 bp for SPMMV. In sensitivity assay, visible amplification of all bands was obtained upto 10⁻⁶ dilutions, revealing that the primers could detect as little as 10 pg of viral nucleic acid (Fig. 96). The developed primer sets successfully detected the pathogen from field samples (Fig. 97). Out of the 55 germplasm samples screened, 9 samples were positive for SPCSV, 3 for SPLCV, 18 had mixed infections by SPFMV and SPCSV, 10

had mixed infections by SPCSV and SPLCV, 11 had triple infections by SPFMV, SPCSV and SPLCV and 4 were virus free.

Standardization of LAMP- LFD assay for

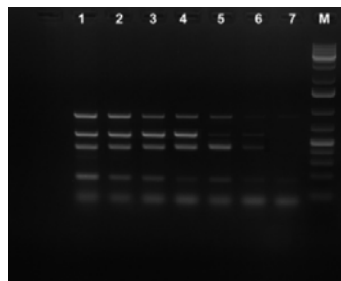


Fig. 96. Sensitivity analysis of multiplex assay for detection of four sweet potato viruses. Lane 1 to 7: template concentrations ranging from 10^{-1} to 10^{-7} ; Lane M: 1 kb plus DNA ladder

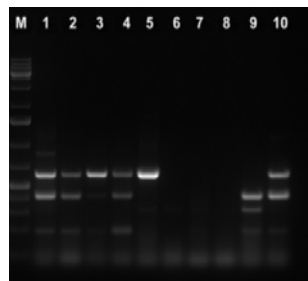


Fig. 97. Amplification of field samples using multiplex assay. Lane M: 1 kb plus DNA ladder; Lane 1: Positive control and Lane 2 to 10: Field samples

detection of SLCMV

FITC and biotin labeled primer sets for LAMP –LFD were synthesized and the amplification conditions of the labelled primer sets were compared with unlabeled primer sets so as to ensure accurate assay performance. Gold nanoparticles were synthesized by Turkevich method and analysed using TEM and UV-visible spectrophotometric analysis which showed the presence of a single peak at 523 nm, indicating that the synthesized AuNPs were about 20 to 30 nm in size (Fig. 98). Following analysis, FITC antibody was conjugated to the AuNP and LFD was prepared. LAMP assay was performed using the labelled primers at the optimized conditions. And the product was diluted with 1 X PBS (1:10 ratio dilution) and applied to the lateral flow strip. Red lines were observed in both test and control lines for positive samples, whereas only control lines were observed

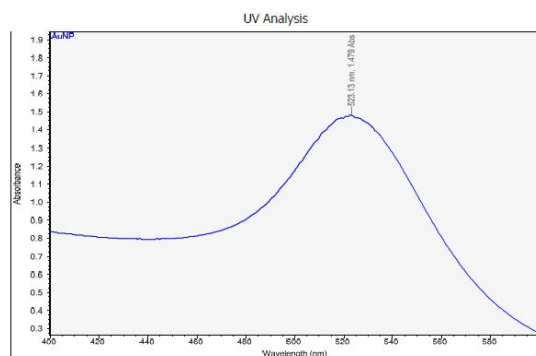


Fig. 98. UV – Visible spectrophotometric analysis of AuNP

for negative samples. The sensitivity assay showed that the detection limit of the LAMP – LFIA strips was upto 0.1 ng of the viral DNA (Fig. 99).



Fig. 99. Sensitivity analysis of LAMP-LFIA A to F: Dilutions ranging from 10^{-1} to 10^{-6}

20. **Establishment of mass production unit of bioagents for ecofriendly disease management in vegetable crops of Odisha** (Rashtriya Krishi Vikas Yojana (RKVY), Govt. of Odisha; PI: R. Arutselvan; Co-PIs: Kalidas Pati, K. Hanume Gowda, M. Nedunchezhiyan and K. Laxminarayana)

The project was initiated to establish biological control mass production unit at Regional Station, ICAR-CTCRI, Bhubaneswar, Odisha, to develop broad spectrum and eco-friendly bio-formulations for integrated disease management for vegetable crops, to improve the antagonistic communities associated with major vegetable crops and product popularization among farming communities in Odisha state. The construction of mass production unit of bioagents and the procurement of equipments were under progress.

21. **ICAR-Bioversity International & CIAT Alliance Collaborative Project No 5.1 Germplasm exchange, improvement and testing advanced clean seed technology in Cassava (*Manihot esculenta* Crantz)** (PI: T. Makeshkumar; Co-PIs: S. Sunitha, C. Visalakshi Chandra, R. Muthuraj, K.M. Senthilkumar)

During 2025-26, field experiments were conducted for evaluation of 5 identified CMD resistant lines (15S-41, 19S-6-4, 19S-4-2, 17S-48 and 17S-247) along with check varieties (Sree Jaya, Sree Vijaya, Vellayani Hraswa, Sree Shakti and Sree Kaveri) for earliness and other important traits. The genotype 17S-48 followed by 19S-6-4 followed recorded good tuber bulking in the sixth month with mean tuber yield of 7.87 kg plant⁻¹ and 7.41 kg plant⁻¹ The multi-

location testing of identified lines was conducted in 5 different locations in Tamil Nadu and results showed that cassava genotypes, 15S-41, 19S-6-4, 19S-4-2, 17S-48 and 17S-247 showed stable performance across different locations in Tamil Nadu on par with check variety (Sree Reksha). 3 genotypes, 19S-6-4, 15S-41 and 17S-48 recorded high yield across locations with mean tuber yield >4.0 kg plant⁻¹. *In-vitro* establishment and multiplication of elite cassava varieties viz. Sree Reksha, Sree Sakthi, Sree Suvarna, PDP-CMR-1 and 8S-501 (Sree Kaveri) with resistance to cassava mosaic disease caused by ICMV and SLCMV was done. 4 cassava genotypes (Sree Kaveri, PDP-CMR1, KBH-18, CTS-48) with low water foot print with drought tolerance under irrigated and rainfed conditions were identified. Lowest nutrient dose was found optimum for the early bulking lines, thus saving 25% each of N and K and 50% of P, through drip fertigation. Project ended by 30 November 2025.

CROP UTILISATION

22. Abiotic stress-hormesis to enhance the phenolic-linked antioxidant protective system in biofortified sweet potatoes for designing functional food ingredients (Department of Science and Technology - Science and Engineering Research Board; PI: C. Pradeepika)

Development of functional sweet potato flour and rava enriched with anthocyanins and β -carotene was pursued through the application of various processing methods (baking, boiling, steaming and microwave cooking) at different drying times. These methods were selected to optimize the retention of bioactive compounds, thereby enhancing the nutritional and functional properties of the resulting flour and rava. The processed sweet potato flour samples along with three control samples [sundried, oven dried and market sample (Mati Farms)] were comprehensively analyzed to assess their nutritional and functional attributes. The evaluations encompassed phenolic-linked antioxidant capacity, antidiabetic potential, anthocyanin and β -carotene content, biochemical composition and rheological properties. The anthocyanin and β -carotene contents in sweet potato functional flour and rava were significantly influenced by the processing methods employed. Raw orange fleshed sweet potato showed 17.47 mg 100 g⁻¹ FW (fresh weight basis) of beta carotene content, whereas orange sweet potato flour treatments showed beta carotene content ranged from

35.53 to 25.51 mg per 100 g⁻¹ DW (dry weight basis) in boiled and baked samples followed by drying for 10 hours respectively. In addition, processed samples in this study compared with control samples such as sun dried, oven dried and commercial sample (Mati Farms) which showed very less amount of beta carotene retention as 2.86, 3.17 and 5.91 mg 100 g⁻¹ DW, respectively (Fig. 98). Similarly, raw purple fleshed sweet potato showed 58.45 mg 100 g⁻¹ FW of anthocyanin content, whereas purple sweet potato flour treatments anthocyanin content ranged from 0.01 to 3.78 mg per 100 g⁻¹ DW in baked and steam cooked samples followed by drying for 12 h, respectively (Fig. 100). In addition, control samples such as sun dried, oven dried and commercial sample (Mati Farms) showed very low retention of anthocyanins as 0.12, 0.09 and 0.28 mg per 100 g⁻¹ DW, respectively.



Fig. 100. Retention of β -carotene and anthocyanins in functional sweet potato flour and rava vs. market samples developed from biofortified sweet potatoes.

23. Development of smart foods, bio composites, green packaging and bioenergy from agro-residues (NASF, ICAR; PI: M.S. Sajeew; Co-PIs: T. Krishnakumar, A.N. Jyothi and S.S. Veena)

Cassava stems of the industrial varieties viz., white Thailand and black Thailand were collected from the major cassava growing areas of Tamil Nadu viz., Salem, Namakkal and Kallakurichi and starch was extracted by wet processing methods with and without cellulase enzymes. The biochemical, functional and viscometric properties of the starch was analysed. In order to compare the properties of starch from cassava tubers and stem, starch was also extracted from the cassava tubers collected from the above locations for the selected varieties. The yield of starch, viscometric properties and colour of the starch significantly varied with respect to varieties and location. Among

the growing locations, starch extracted from the stems collected from Namakkal recorded the highest viscosities and from Kallakurichi, showed the lowest. The higher peak, final, and setback viscosities of White Thailand starch highlight its superior swelling power and stronger retrogradation potential.

The yield of starch, extracted without enzyme (control) varied from 10.44 to 13.16% whereas, with enzyme, yield increased to 14.00 to 17.38% and 15.46 to 20.07% when extracted with enzyme at ambient and 50°C temperature, respectively. Among the viscosity parameters of the tuber starches, peak viscosity ranged from 2121 to 1815 cP, trough viscosity ranged from 838 to 1342 cP, final viscosity from 1177 to 1776 cP, pasting temperature from 73.45 to 76.68°C and peak time from 4.17 to 5.50 min. Stem starches had low viscosity parameters compared to tuber starches for all the extraction methods. For the control sample, peak viscosity ranged from 212-859 cP, trough viscosity 185-734 cP, break down viscosity 27-156 cP, final viscosity 307-956 cP, set back 108-254 cP and peak time 6.75-7 min. For the starch extracted with cellulase enzyme at ambient condition, peak viscosity ranged from 183-892 cP, trough viscosity 171-799 cP, break down viscosity 21-130 cP, final viscosity 236-918 cP, set back 65-252 cP and peak time 6.82-6.99 min. For the starch extracted with cellulase enzyme at 50°C, peak viscosity ranged from 131-764 cP, trough viscosity 188-611 cP, break down viscosity 226-110 cP, final viscosity 198-830 cP, set back 84-184 cP and peak time 6.59-7.0 min.

24 Development of value added products from Mudali (*Colocasia esculenta*) and Kone (*Dioscorea*) (Contract Research Project, M/s Spudnik Foods, Bengaluru, Karnataka; PI: M.S. Sajeew; Co-PIs: T. Krishnakumar and C. Pradeepika)

Gluten-free pasta was prepared from the composite flour of yam, cassava and rice flours. The experiments were designed by response surface methods by Box-Behnken design with yam flour 40-60%, cassava 20-30% and rice flour 20-30%. Nutritional and cooking qualities of the pasta were evaluated. The moisture content ranged from 6.60 to 10.19%, starch 46.92 to 56.25%, sugar 1.23 to 2.18%, fat 0.84 to 4.03%, fibres 0.12 to 0.24%, protein 3.06 to 4.81% and ash 1.25 to 1.65%. Micronutrients such phosphorus ranged from 88.9 to 168.56 mg 100 g⁻¹, potassium from 426.9 to 526.3 mg 100 g⁻¹, calcium from 69.2 to

102.6 mg 100 g⁻¹, iron from 3.56 to 6.16 mg 100 g⁻¹, zinc from 1 to 2.01 mg 100 g⁻¹, copper from 1.45 to 2.09 mg 100 g⁻¹ and magnesium from 34.01 to 42.39 mg 100 g⁻¹. Among the cooking parameters, swelling index ranged from 1.19 to 2.29%, cooking loss 2.85 to 9.91% and cooking time 5.50 to 7.50 minutes.

The optimised process parameters for yam based pasta as analysed by response surface method is yam 48.18%, cassava 30% and rice flour 29%. At these combinations, the resulting noodles have the following properties: starch 52.30%, sugar 1.90%, fat 0.80%, fibre 0.23%, protein 4.25%, ash 1.40%, moisture content 8.38%, cooking time 6.72 min, cooking loss 4.49% and swelling index 2.12.

Gluten-free noodle was prepared from the composite flour of yam, cassava and rice flours. The experiments were designed by response surface methods by Box-Behnken design with yam flour 40-60%, cassava 20-30% and rice flour 20-30%. Nutritional and cooking qualities of the noodles were evaluated. The moisture content ranged from 8.81 to 13.08%, starch 46.18 to 56.25%, sugar 1.43 to 2.18%, fat 0.4 to 1.61%, fibres 0.77 to 2.59%, protein 4.81 to 7.22% and ash 1.75 to 2.59%. Micronutrients such as phosphorus ranged from 38.09 to 90.05 mg 100 g⁻¹, potassium from 499.3 to 629.7 mg 100 g⁻¹, calcium from 89.5 to 116.2 mg 100 g⁻¹, iron from 5.72 to 7.65 mg 100 g⁻¹, zinc from 2.45 to 3.55 mg 100 g⁻¹, copper from 0.87 to 1.77 mg 100 g⁻¹ and magnesium from 20.75 to 36.5 mg 100 g⁻¹. Among the cooking parameters, the swelling index ranged from 1.57 to 2.65%, cooking loss 7.99 to 18.86% and cooking time 5.25 to 6.75 minutes. The optimised process parameters for yam based noodle as analysed by response surface method is yam 60%, cassava 26% and rice flour 26.30%. At these combinations, the resulting noodles have the following properties: starch 51.06%, sugar 1.50%, fat 0.95%, fibre 1.36%, protein 6.13%, ash 1.98%, moisture content 8.93%, cooking time 6.15 min, cooking loss 12.91% and swelling index 2.12.

25. AICRP on Post-Harvest Engineering and Technology (ICAR, PI: M.S. Sajeew; Co-PI: T. Krishnakumar)

Adaptive trial of the taro peeler developed by ICAR-CIPHET, Ludhiana was conducted by varying the feed batch load as 2, 3, 4 and 5 kg taro tubers with peeling time of 1, 2 and 3 min and performance of the machine was evaluated. The peeling efficiency ranged from 46.54 to 55.97%, 38.57 to 71.07%, 49.06 to

64.78% and 40.25 to 66.87% for the feed batch load of 2, 3, 4 and 5 kg of the tubers, respectively. The peeling effectiveness ranged from 42.58 to 49.82% for 2 kg batch load, 32.79 to 55.20% for 3 kg batch load, 35.93 to 43.88% for 4 kg batch load and 31.24 to 46.55% for 5 kg batch load of the tubers. Peeling loss was high (26.75 to 32.20%) for 4 kg batch load followed by 22.4 to 30.4% for 5 kg batch load, 15.00 to 22.33% for 3 kg batch load and the lowest for 2 kg batch load (8.5 to 11.00%).

EXTENSION AND SOCIAL SCIENCES

26 IP & TM Scheme 'National Agricultural Innovation Fund (NAIF)' Component I: Innovation Fund (ICAR, New Delhi; PI: P.S. Sivakumar; Co-PIs: T. Krishnakumar and P. Prakash)

Trademark registration

Eight trademark applications covering institutional logos and campaign identities under different trademark classes were filed. These included the "ICAR-CTCRI ABI Logo" under Classes 35 and 41 (Application Nos. 7102696 and 7102697), the "Rainbow Diet Campaign Logo – Hindi" under Classes 35 and 41 (Application Nos. 7102698 and 7102699), the "Rainbow Diet Campaign Logo – Odia" under Classes 35 and 41 (Application Nos. 7102700 and 7102701) and the "ICAR-CTCRI Logo" under Classes 41 and 42 (Application Nos. 7102702 and 7102703). All applications were filed on 07 July 2025.

IP awareness programmes conducted

National Workshop on "Celebrating tribal ingenuity: Strategies for protecting, valuing, and marketing tribal farmers' varieties, innovations and geographical assets" was organised at Regional Station of ICAR-CTCRI, Bhubaneswar on 1 May 2025. A total of 172 academics, researchers, entrepreneurs, farmers and students took part in the programme.

Technology commercialization

Commercialized 16 technologies encompassing smart farming solutions, value-added food products, nutritionally enriched functional foods and crop nutrient management technologies. These technologies were licensed to industries, entrepreneurs and development agencies including Agripilot Tech Pvt. Ltd., Kudumbasree Mission,

Linga Chemicals, Banaza Enterprises and Muruka Food Products. The commercialized technologies covered areas such as IoT-enabled smart farming devices, cassava- and sweet potato based processed food products, functional and fortified foods, dehydrated tuber products and micronutrient formulations for sustainable nutrient management in tropical tuber crops. Aggregate licensing revenue of ₹18.88 lakhs was generated through these technology commercialization activities during the reporting period.

27 IP & TM Scheme: National Agricultural Innovation Fund (NAIF)' Component II: Incubation Fund (ICAR, New Delhi; PI: P. Sethuraman Sivakumar; Co-PIs: M. Nedunchezhiyan and T. Krishnakumar)

New SIC - The Satellite Incubation Centre (SIC) of the ICAR-CTCRI Agri-Business Incubator (ABI) was formally inaugurated at the Kerala Agricultural University - Regional Agricultural Research Station (RARS), Pattambi on 12-09-2025. A stakeholder workshop on "Strategies for safeguarding and leveraging tribal farmers' genetic resources, traditional knowledge, and innovations in Kerala" sponsored by the Kerala State Biodiversity Board was organized on 12 September 2025 at SIC, RARS, Pattambi. The programme witnessed the participation of about 100 stakeholders, including scientists, state extension officers, academics, FPO representatives, SHG members and tribal farmers. Planning workshop on "Understanding the specific needs and action plan development for farmer-producer companies under CISSA" was organized on 24 June 2025 at ICAR-CTCRI, Thiruvananthapuram where, 44 participants were there. Collaborations established included MoU with CISSA for "Strengthening 36 Farmers Producer Companies (FPCs) under CISSA", which was signed on 15 May 2025. The ICAR-CTCRI represented by its Agri-Business Incubator, in collaboration with Agrinnovate India Ltd., New Delhi, organised a stakeholder interface on "Fostering global partnerships and business models for tropical tuber crops" as part of the ISTRTC 4 NARES symposium on 20 November 2025. The interface brought together over 200 participants including 80 international delegates from over 20 countries scientists, industry leaders, startups, FPOs and policymakers. Incubatee enrolment - TIES Farmer Producer Company, Limited, TIES, Ecological Research Campus, K.K, Road, Velloor P.O 686 501, Kottayam, Kerala, India.

28 Soil health management in coconut based cropping system involving tuber crops for enhanced yield and income (Coconut Development Board, Kochi, Government of India; PI: D. Jaganathan; Co-PIs: G. Byju and G. Suja)

In Kamrup district of Assam, ten coconut gardens with 50 cents each were selected for demonstrating technologies viz., customized fertilizers (SSNM) and organic farming (OF) in cassava var. Sree Reksha and elephant foot yam var. Gajendra. Soil samples were collected prior to the start of the validation trials of the experiment and were analyzed for chemical properties. The soil nutrient status of the coconut gardens before initiating SSNM demonstrations revealed that soil pH was neutral (7.24), organic carbon was high (1.51 %), N was low (42.65 kg ha⁻¹), P was high (38.56 kg ha⁻¹) and K was medium (156.76 kg ha⁻¹). Similarly, the soil nutrient status of the coconut gardens before initiating organic farming demonstrations showed that soil pH was alkaline (7.13), organic carbon was high (1.70%), N was low (55.82 kg ha⁻¹), P was high (59 kg ha⁻¹) and K was medium (153.98 kg ha⁻¹). The ten on-farm demonstrations were laid out during July 2025 and the crops will be harvested by March 2026.

A seminar on “Coconut and tuber crops based agrifood systems for resilience and sustainable income”, sponsored by Coconut Development Board, Kochi, Kerala, was organized on 22 August 2025 at Krishi Vigyan Kendra, Kamrup, Assam by ICAR-CTCRI, Thiruvananthapuram, Kerala in collaboration with ICAR-CPCRI, Research Centre, Kahikuchi, Assam; Krishi Vigyan Kendra-Kamrup, Assam Agricultural University, Kahikuchi campus, Assam and ICAR-Agricultural Technology Application Research Institute, Zone VI, Guwahati, Assam. Exhibition stalls from ICAR-CTCRI and KVK, Kamrup showcased the varieties, technologies, products and publications for the benefit of farmers and other stakeholders. About 200 farmers and other stakeholders attended the seminar.

29 Smart cassava farms: Validation and upscaling of AI & IoT device (Kerala State Planning Board; PI: V.S. Santhosh Mithra; Co-PIs: G. Byju, J. Sreekumar and D. Jaganathan)

A farmer's meeting was conducted on 9 April 2025 at Panavoor Grama Panchayat to explain the objectives and implementation plan of the eCBSF project, following which 162 farmers from the panchayat were selected for participation. Soil samples were collected from the selected farmers' fields for initial soil nutrient

analysis and planting materials were distributed to those identified for the eCBSF field trials. The planting materials were distributed to the farmers during a farmer training conducted on 9 September 2025 at Panavoor Grama Panchayat office. Subsequently, planting cassava, cucumber, bhindi and chilli was completed in 37, 52, 36 and 37 farmers' fields, respectively and the basal dose of fertilizers as per eCBSF recommendations was distributed to the farmers. Students from the College of Agriculture, Vellayani served as cluster leaders and underwent orientation and leadership training to strengthen their capacity to guide fellow farmers. Based on real-time and periodic data, crop-specific agro-advisories related to nutrient management and irrigation scheduling was generated at ten-day intervals and distributed fertilizers. Regular follow-up field visits were conducted to assess crop growth and health and to evaluate the effectiveness of the advisories.

30 Rainbow diet campaign for Odisha development and scaling up customized rainbow diet food matrices for combating malnutrition among children in Keonjhar District, Odisha (District Mineral Foundation, Keonjhar, Government of Odisha; Team Leader : G. Byju; PI: P. Sethuraman Sivakumar and M. Nedunchezhiyan; Co-PIs: T. Krishnakumar, Dr. K. Hanume Gowda and Dr. S.K. Jata)

The area under biofortified sweet potato SP 95/4 (Orange-fleshed rich in Vitamin A) has been expanded to 10.6 acres in Banspal and Sadar blocks of Keonjhar district. Planting materials supplied - 3 lakh cuttings of biofortified sweet potato (SP 95/4, Bhu Sona and Bhu Krishna). The baseline malnutrition survey conducted among 283 Juanga children (6-19 years age) in Banspal has indicated high prevalence of stunting (43.9%) and severe stunting (26.8%), underweight (28.07%) and iron deficiency (43.9%). Marketing of harvested tubers from the farmers through PPP mode was facilitated and the FPOs earned Rs 47060/- through these transactions. Two buy-back agreements for sweet potato planting materials and tubers were signed with two FPOs (1. Sabuja Banani FPC MoA - Signed on 23 September 2026 and (ii) Banspal Farmers Producer Co. Ltd (BFPCL) - MOA signed on 17 October 2026). Three rainbow food products were developed: NutriBar, Purple bread and NutriMix. Satellite Incubation Building has been identified and facilitated the processing of the renovation of the building. Trademark application for two project logos filed.

- 31 Development of cassava value chain-based entrepreneurship through Satellite Incubation Centre to enhance tribal livelihoods in Kalvarayan hills, Kallakurichi District, Tamil Nadu**
(Tamil Nadu Tribal Welfare Department; PI: P. Sethuraman Sivakumar; Co-PIs: G. Byju, T. Krishnakumar, M. Nedunchezhiyan, P. Prakash and C. Visalakshi Chandra)

Under the programme, planting materials covering a total area of 6 acres were distributed, comprising cassava in 3 acres and sweet potato in 3 acres. A total of 22 farmers were directly benefited through

the initiative, while 100 farmers received training on improved cultivation and value-addition practices. Progress was also achieved towards establishing a satellite incubation centre, with site selection, design finalization and Bhumi Puja completed during the reporting period. In addition, a preliminary livelihood and baseline survey covering 20 farmers was conducted to assess socio-economic conditions and project requirements. Efforts towards industry linkage development were also initiated and feasibility assessments were completed with two startup enterprises.

Research-Extension-Farmer linkage

Integrated farming systems involving tuber crops: On a community basis, tuber crop-based integrated farming system was demonstrated in farmers' fields at Harminder Bay, Little Andaman. Following the intervention, net income increased from ₹ 77,000 to ₹ 2,94,400 and the B:C ratio improved from 1.26 to 2.40. In tuber crop-based integrated farming system studies conducted at Ranchi, farm net income increased from ₹ 10,420 to ₹ 2,72,179 ha⁻¹, with the B:C ratio improving from 1.36 to 2.57. Diversification of crops and inclusion of animal components helped enhance employment opportunities from 148 to 290 man-days per ha.

Tuber crop-based farming system studies were initiated at Lumdiengngan village, Barapani. Prior to the farming system intervention, a total area of 0.50 ha was used for farming by Banlumlang V.O., Lumdiengngan, with a net income of ₹ 82,078. After the intervention, total net income increased to ₹ 8,83,232, with a B:C ratio of 2.49, covering an area of 2.30 ha. An IFS model comprising horticulture with tuber crops, piggyery, poultry, fishery, cattle and beehives was introduced in West Tripura over an area of 0.53 ha. After the intervention, net income increased to ₹ 20,106.25, with a B:C ratio of 3.32, covering an area of 0.60 ha. Man-days increased from 65 to 135. Under Research-Extension-Farmer Linkage, seven different programmes were carried out by different centres. Training programmes, demonstrations, webinars, Kisan melas, mass media programmes, scientist-farmer interfaces, farm advisory visits and distribution of farm inputs and implements were taken up regularly by all the 21 centres. All centres also undertook special schemes such as TSP, SCSP and NEH for improving the food, nutritional and livelihood security of these special segments of society.

Planting material production

Planting materials of improved varieties of tuber crops were multiplied and distributed to farmers by all the centres. As part of the planting material production programme, the centres produced a total of 2,56,715 cassava stems; 15,86,150 sweet potato vine cuttings; 15.70 tonnes of elephant foot yam; 7.07 tonnes of taro; 10.19 tonnes of dasheen taro; 2.93 tonnes of greater yam; 0.34 tonnes of lesser yam; 120 kg of aerial yam; 29 kg of tannia; 110 kg of yam bean;

and 6,500 seedlings of swamp taro. The programme covered an area of 171.75 ha and generated a revenue of ₹11,56,794.

25th Annual Group Meeting of AICRP on Tuber Crops

The 25th Annual Group Meeting (AGM) of AICRP on Tuber Crops was held at the College of Horticulture, SKLTGHU, Rajendranagar, from 19 to 20 May 2025 (Fig. 102). Hon'ble Vice-Chancellor Dr. Danda Raji Reddy inaugurated the meeting in the gracious presence of Dr. Sudhakar Pandey, ADG, FVS & MP, Horticulture, ICAR; Dr. G. Byju, Director and Project Coordinator, ICAR-CTCRI; Dr. Shaik N. Meera, Director, ICAR-ATARI, Hyderabad; Dr. Krishna Prasad, Former Principal Scientist (Hort.), IIHR and DOGR; Dr. Vikramaditya Pandey, Principal Scientist, Horticultural Science, ICAR; Dr. S. Sriram, Principal Scientist and Head, Division of Crop Protection, IIHR, Bengaluru and Dr. Uma Devi, Retired Professor, SKLTGHU, Hyderabad. Dr. Sanjay Kumar Singh, DDG, ICAR, the Chief Guest of the function, addressed the gathering online and stated



Fig. 102. The 25th AGM of AICRP on Tuber Crops held at the College of Horticulture, SKLTGHU, Rajendranagar

that tuber crops are an important group of climate-resilient livelihood crops with significant relevance in food and processing sectors. He urged scientists to develop and provide bio-fortified, nutrient-rich varieties to farmers. Dr. Sudhakar Pandey, ADG, FVS & MP, Horticulture, ICAR, New Delhi, stated that an action plan needs to be prepared to significantly increase tuber crop cultivation in the country and suggested that central and state governments should act to substantially increase the commercial cultivation of root crops in all major growing regions. He emphasized the importance of developing orange-fleshed sweet potato with high β -carotene content,

as well as other varieties with high yield and starch content. Dr. Shaik N. Meera, Director, ICAR-ATARI, Hyderabad pointed out the need to develop smart clusters of tuber crop farmers involving KVKs. He also offered the support of KVKs for advanced on-farm trials.

In his presidential address, Hon'ble Vice-Chancellor of SKLTGHU, Dr. Danda Raji Reddy, highlighted the immense potential of tuber crops for Indian farmers and their role in the daily diet. A total of 13 publications, including catalogues, booklets, technical bulletins and folders, were released. During the inaugural function, the Best Centre Award for 2024-25 was conferred to Dr. BSKKV, Dapoli and three Best Revenue Generation Awards were distributed to UHS, Bagalkot, Karnataka (₹ 2,02,575); Dr. BSKKV, Dapoli, Maharashtra (₹ 1,56,670) and NAU, Navsari, Gujarat (₹ 1,46,025), for securing first, second and third positions, respectively. Scientists from all centres presented the salient achievements under 28 different programmes undertaken during 2024-25 and made concrete recommendations in seven technical sessions and plenary session. The plan of action for 2025-26 was also discussed and finalized. A stakeholder interface was organized as part of the three-day programme.

Salient Recommendations of the 25th AGM

- A five-year roadmap needs to be prepared for the collection of germplasm from unexplored areas, including crop, location and time of exploration.
- Crop-wise benchmarks for traits and guidelines for the identification of varieties need to be developed by formulating an expert committee approved by SMD.
- A brainstorming meeting on breeding and improvement of elephant foot yam may be conducted before August 2025.
- For calculating the cost of cultivation, a template with detailed guidelines will be prepared to ensure uniformity in data presentation by all centres.
- For concluding trials, pooled analysis results for each parameter across all centres will have to be presented for better understanding.
- Publications on the impact and achievements of TSP, SCSP and NEH during the past five years may be brought out.
- Selected entrepreneurs or SHGs need to be trained in tuber crop value addition at ICAR-CTCRI, Regional Station, Bhubaneswar.

TECHNOLOGIES ASSESSED, TRANSFERRED, CONSULTANCY AND PATENT SERVICES

Consultancy and Patent Services

Technologies transferred

The Intellectual Property and Technology Management Unit and Professional Service Cell (IPTMU & PSC) under the guidance of the Intellectual Property and Technology Management Committee (IPTMC) has carried out the following technology transfer and contract activities.

Technology commercialisation

Technology licensed

Sl. No.	Technology / Know-How	Name of contracting party	Revenue (₹)
1.	Portable cassava settcutter	M/s Cliff Innovations, Coimbatore - 641 041, Tamil Nadu	59000
2.	Electronic crop- An IoT device for smart farming (in India)	M/s Agripilot Tech Pvt. Ltd., Plot No. 33, Borkute Layout, Behind BSNL Tower, Narendra Layout, Nagpur, Maharashtra -440015	708000
3.	Foliar micronutrient formulations	M/s Linga Chemicals, at 3, B1 Police Station Lane, East Masi Street, Madurai - 625001, Tamil Nadu, India	590000
4.	Fried snack foods and fried chips from cassava	M/s State Kudumbashree Mission, 2nd Floor, TRIDA Building, Chalakuzhy Road, Medical College P.O, Trivandrum - 695011	29500
5.	Functional pasta from cassava/sweet potato		59000
6.	Functional noodles from sweet potato / cassava		59000
7.	Ready-to-cook food products from sweet potato		29500
8.	Fried snack foods from sweet potato		29500
9.	Technology for sweet potato jelly		29500
10.	Functional bakery products from sweet potato		88500
11.	Quick cooking dehydrated tubers of tuber crops		29500
12.	Anthocyanin and beta-carotene rich sweet potato kulfi		59000
13.	Anthocyanin and beta carotene rich sweet potato low calorie gummies		59000
14.	Sweet potato-millet choco filled cookies		29500
15.	Beta carotene containing sweet potato muffins		29500
16.	Technology on fried snack foods and fried chips from Tapioca	M/s Muruka Food Products, Thrikodithanam P.O., Changanassery, Kottayam - 686 105 with Ms. Vrinda S. Viswanathan	29500
17.	Technology on fried snack foods and fried chips from tapioca	M/s Banaza Enterprises, Kottupadam, Vazhayoor P.O., Ramanattukara, Malappuram (Dist.) - 676533 with Mr. Abdunnazir, M.C.	29500
18.	Electronic crop- An IoT device for smart farming (Renewal)	M/s Semilon Technologies Private Limited, Trivandrum - 695 004, Kerala	11800

Technologies/varieties developed

MoU (Memorandum of Understanding)

Sl. No.	MoU signed with	Date of signing	Purpose
1.	Centre for Innovation in Science and Social Action	15.05.2025	To strengthen 36 Farmer Producer Companies (FPCs) associated with CISSA
2.	M/S. Vedanta Limited	11.07.2025	Use of red mud for soil amelioration and development of red mud area for cultivation at Vedanta Ltd
3.	SOVA Foundation Trust	01.09.2025	To strengthen farmers' capacity for participatory biotechnology interventions aimed at improving livelihoods
4.	Nedumangad Block Panchayath	04.11.2025	To address low agricultural productivity and unsustainable farming practices in Nedumangad block through the implementation of ICAR-CTCRI's e-Crop based smart farming technology.
5.	M/S. Orabio Organic LLP	11.11.2025	Development of simulation model for ginger yield improvement and plant growth and its pests and diseases outbreak alert through e-crop based smart farming (eCBSF)

Sl. No.	Application / Registration No.	Product/Author	Date of filing / Registration
1.	7102696 (Class 35) 7102697 (Class 41)	ICAR-CTCRI ABI Logo (Class 35) ICAR-CTCRI ABI Logo (Class 41)	07 July 2025
2.	7102698 (Class 35) 7102699 (Class 41)	Rainbow Diet Campaign Logo- Hindi (Class 35) Rainbow Diet Campaign Logo- Hindi (Class 41)	07 July 2025
3.	7102700 (Class 35) 7102701 (Class 41)	Rainbow Diet Campaign Logo- Odia (Class 35) Rainbow Diet Campaign Logo- Odia (Class 41)	07 July 2025
4.	7102702 (Class 41) 7102703 (Class 42)	ICAR-CTCRI Logo (Class 41) ICAR-CTCRI Logo (Class 42)	07 July 2025

Contract research

Sl. No.	Contract Research	Name of the party	Revenue (₹)
1.	Collaborative research on "Use of redmud for soil amelioration and development of redmud area for cultivation at Vedanta Ltd."	M/s Vedanta Limited, 1st floor, C wing, Unit 103, Corporate Avenue, Atul Projects, Chakala, Andheri (East), Mumbai - 400093, Maharashtra	3029674
2.	Development of simulation model for ginger yield improvement and plant growth and its pests and diseases outbreak alert through e-crop based smart farming (eCBSF)	M/s Orabio Organic LLP, 3rd Floor, No. 7, Wilson Garden House Building, J.P. Nagar, 7th Phase, Bengaluru - 560078, Karnataka	242225

Varieties released/submitted for release

Released by State

- Bhu Arunima: Anthocyanin rich purple flesh sweet potato variety with anthocyanin content ranging from 133-157 mg 100 g⁻¹ fresh weight for the state of Odisha.
- Bhu Shakarkanda-1: First high yielding yam

bean variety, rich in Vitamin C and yield approximately 33 t ha⁻¹ for the state of Odisha.

Technologies certified by the ICAR

- Package of practices for organic production of arrowroot (Lead Developer: Dr. G. Suja; Associate Developers: Dr. S. Sunitha and Dr. V. Ramesh).

- Package of practices for organic production of taro (Lead Developer: Dr. G. Suja Associate Developers: Dr. G. Byju, Dr. A.N. Jyothi, Dr. S.S. Veena and Dr. J. Sreekumar).
- Portable cassava sett cutter (Lead Developer: Dr. T. Krishnakumar; Associate Developers: Dr. M.S. Sajeev and Dr. C. Pradeepika).

Revenue generated through technology commercialization and other professional services

Sl. No.	Activity	Revenue generated (₹)
1	Technology licensing	19,58,800
2	Sale of technological products, machineries and value added products	47,85,792
3	Training/exposure visit programme	6,30,853
4	Students fees	8,98,795
5	ABI incubatee enrolment fees	17,700
	Total	82,91,940

EDUCATION AND TRAINING

Education

ICAR-CTCRI has been recognized as an approved research centre by ICAR-IARI, New Delhi, University of Kerala and Kannur University in Kerala, Tamil Nadu Agricultural University and Manonmaniam Sundaranar University in Tamil Nadu, Utkal University and Odisha University of Agriculture and

Technology in Odisha, as well as Jawaharlal Nehru Krishi Vishwavidyalaya in Jabalpur, Madhya Pradesh for conducting PG and Ph.D. research work in tuber crops. The institute has provided hands-on training to students and offered technical support for Ph.D. research and M.Sc. project work. Staff including scientists were trained in various personality and technical skills. Numerous on campus and off campus trainings have been imparted by the HQ, RS and TIC.

Sl. No.	Particulars of the programme	Number of students/scholars
1.	B.Sc./B. Tech project	25
2.	M.Sc. project	45
3.	Ph.D	34 (1 awarded, 5 joined, 28 ongoing)

M.Sc. projects

Sl. No.	Student name	Subject College University	Thesis title	Name of the guide
1	Ms. S.S. Aryalekshmi	M.Sc. (Genetics and Plant Breeding), Department of Botany, UoK, Thiruvananthapuram	PGR management, breeding and tissue culture studies in elephant foot yam	Dr. A. Asha Devi
2	Ms. G.R. Meenakshi	M.Sc. (Genetics and Plant Breeding), Department of Botany, UoK, Thiruvananthapuram	PGR management, breeding and tissue culture studies in elephant foot yam	Dr. A. Asha Devi
3	Ms. Rishika Harimohan	BS-MS student, IISER, Tirupati, Andhra Pradesh	Molecular characterization of cassava landraces using SSR markers	Dr. K.I. Asha
4	Ms. Anjali B. Nair	M.Sc. (Genetics and Plant Breeding), Department of Botany, UoK, Thiruvananthapuram	Morphological characterization of cassava landraces using standard descriptors	Dr. K.I. Asha
5	Ms. Minarva Majhi	M.Sc. Ag. (Vegetable Science), College of Agriculture, OUAT, Bhubaneswar	Efficacy of endophytes and their bioactive compounds under NaCl mediated salinity stress in sweet potato (<i>Ipomoea batatas</i> L. Lam).	Dr. K. Hanume Gowda
6	Mr. Sujeet Kumar	M.Sc. Ag. (Vegetable Science) College of Agriculture, OUAT, Bhubaneswar	Evaluation and characterization of taro germplasm.	Dr. K. Hanume Gowda
7	Mr. Manjunath Halagi	M.Sc. (Entomology), ICAR-IARI Hub, IIHR, Bengaluru	Characterization of emerging pests of tropical tuber crops, survey of natural enemies and management of important pests of tuber crops	Dr. E.R. Harish
8	Ms. A.R. Adithya	M.Sc. (Microbiology), St. Marys College for Women, Thiruvalla, Pathanamthitta	Isolation and utilization of promising entomopathogenic fungi for sweet potato weevil management	Dr. E.R. Harish
9	Ms. Megha Madhusudhanan	M.Sc. (Microbiology), St. Mary's College, Thiruvalla, MG University, Kottayam	Characterization of fungal pathogens causing Cassava Stem and Root Rot (CSRR)	Dr. M.L. Jeeva

10	Ms. S. Adithya	M.Sc. (Food Technology and Quality Assurance) MACFAST, Thiruvalla	Studies on the nutritional parameters and effect of cooking methods on phenolic content and <i>in vitro</i> digestibility of chinese potato (<i>Plectranthus rotundifolius</i>) tubers	Dr. Jyothi Sreekumar
11	Ms. J. Asheefa	M.Sc. (Microbiology), PGM College of Arts and Science, Kangazha, Kottayam	Characterization of endosymbiotic bacteria associated with entomopathogenic nematode, <i>Steinernema siamkayai</i> (Rhabditida: Steinernematidae)	Dr. H. Kesava Kumar
12	Ms. Renjana G. Nair	M.Sc. (Microbiology), St. Mary's College for Women, Thiruvalla, MG University, Kottayam	Bioactivity of <i>Xenorhabdus stockiae</i> associated with <i>Steinernema siamkayai</i> against pest and pathogens of tuber crops	Dr. H. Kesava Kumar
13	Ms. K. Adithya	M.Sc. (Food Science and Technology), St. Aloysius College (Deemed to be University), Mangalore, Karnataka	Comparative study on physico-chemical and functional properties of starch from short and long duration cassava varieties	Dr. T. Krishnakumar
14	Ms. Bidya Bharati Das	M.Sc. (Biotechnology), Dept. of Biotechnology, Siksha 'O' Anusandhan Deemed to be University, Bhubaneswar	Molecular characterization, soil enzyme activities and yield of greater yam as influenced by INM strategies in Alfisols	Dr. K. Laxminarayana
15	Mr. Swaraj Swadhin Pradhan	M.Sc. Ag. (Soil Science and Agril. Chemistry), College of Agriculture, OUAT, Bhubaneswar	Response of organic and inorganic sources of potassium on yield and quality of sweet potato in an Alfisol	Dr. K. Laxminarayana
16	Mr. Karthik Patel	M.Sc. (Plant Pathology), ICAR-IARI Hub, IIHR, Bengaluru	Assessment of virus diversity in sweet potato accession germplasm using molecular approaches	Dr. T. Makeshkumar
17	Ms. S. Amritha	M.Sc. (Integrated Biology), Mahatma Gandhi University, Kottayam	Genetic diversity analysis in indigenous, exotic and wild species of cassava using Simple Sequence Repeat (SSR) markers	Dr. C. Mohan
18	Ms. Neethu Jose	M.Tech. (Bioengineering), National Institute of Technology, Calicut	Genetic diversity study in Euphorbiaceae species	Dr. C. Mohan
19	Ms. Anupama Venugopal	M.Tech. (Bioengineering), National Institute of Technology, Calicut	Genetic diversity study in Euphorbiaceae species	Dr. C. Mohan
20	Mr. Prakash Paul	M.Tech. (Bioengineering), National Institute of Technology, Calicut	Genetic diversity study in Euphorbiaceae species	Dr. C. Mohan
21	Ms. N.H. Haritha	M.Sc. (Integrated Biology), University of Calicut, Calicut	Protein profiling for CMD resistant clones and standardization of RNA isolation in cassava	Dr. C. Mohan
22	Ms. C.K. Jasbin	M.Sc. (Integrated Biology), University of Calicut, Calicut	Study on the physico-chemical properties and genetic diversity analysis in short and long duration cassava lines using Simple Sequence Repeat (SSR) markers	Dr. C. Mohan

23	Mr. K.G. Kirankant	M.Sc. (Biotechnology), CMS College (Autonomous), Affiliated to MG University, Kottayam	Seedling morphology and molecular characterization of queensland arrowroot (<i>Canna edulis</i>) germplasm	Dr. P. Murugesan
24	Ms. Parul Kashyap	M.Sc. (Vegetable Science), ICAR-IARI Mega University, (ICAR-IIHR Hub)	Genetic diversity and marker trait association in Chinese potato land races and varieties.	Dr. P. Murugesan
25	Ms. Gomathi S	M.Sc. Ag. (Seed Science and Technology), TNAU, AC&RI, Madurai	Elucidating the effect of yam bean seed (<i>Pachyrhizus erosus</i>) extracts on selected other crop/ weed seed germination and bio pesticide properties	Dr. P. Murugesan
26	Ms. Nasya Arputha Sahana	M.Sc. Ag. (Genetics and Plant Breeding), Karunya Institute of Technology and Sciences (Deemed University)	Induction of genetic variability for nutrients and desirable tuber traits in Chinese potato through <i>in vitro</i> gamma irradiation and chemical mutation treatments	Dr. P. Murugesan
27	Mr. Joseph S. Shervin	M.Sc. Ag. (Genetics and Plant Breeding), Karunya Institute of Technology and Sciences (Deemed University)	Morphological and molecular studies in legume tubers: Yam bean and winged bean	Dr. P. Murugesan
28	Mr. D.A. Bharath	M.Sc. Ag. (Plant Breeding and Genetics), College of Agriculture, Kerala Agricultural University, Thiruvananthapuram, Kerala	Induction of genetic variability in yam bean (<i>Pachyrhizus erosus</i> L) for tuber and seed traits through gamma irradiation	Dr. P. Murugesan
29	Mr. K. Nikhil	M.Sc. (Vegetable Science), IIHR, Bangalore, Karnataka	Biological elicitors to enhance wound healing responses in cut sweet potato tubers	Dr. C. Pradeepika
30	Ms. N.T. Adithya	M.Sc. (Food Science and Technology), Kerala University of Fisheries and Ocean Studies (KUFOs), Kochi	Physicochemical and sensory characterization of vegan kulfi developed from orange sweet potatoes	Dr. C. Pradeepika
31	Ms. Sreya A. Sasidharan	M.Sc. (Food Science and Technology), Kerala University of Fisheries and Ocean Studies (KUFOs), Kochi	Evaluation of physicochemical and sensory properties of 9 sweet potato-enriched fruit punches	Dr. C. Pradeepika
32	Ms. A.S. Sneha	M.Sc. (Food Science and Technology), DGMMES Mampad College, Malappuarm	Characterization of purple sweet potato-based vegan kulfi: physicochemical and sensory attributes	Dr. C. Pradeepika
33	Ms. P. Gopika	M.Sc. (Food science and Technology), St. Joseph University, Bangalore, Karnataka	Development of nutribar from functional sweet potato flour	Dr. C. Pradeepika
34	Mr. S.J. Abin	M.Sc. (Food Technology and Quality Assurance), MACFAST, Thiruvalla	Development of french fries from sweet potato and elephant foot yam tubers	Dr. M.S. Sajeev
35	Ms. Nitha	M.Sc. (Food Technology and Quality Assurance), MES College, Malappuarm	Development of air fired chips from Tannia	Dr. M.S. Sajeev

36	Ms. L.R. Swathy	M.Sc. (Climate Change and Disaster Management), University of Kerala	Climate change and disaster management	Dr. V.S. Santhosh Mithra
37	Ms. Yata Manasa	M.Sc. (Molecular Biology and Biotechnology), ICAR-IARI Mega University (ICAR-IIHR Hub)	Genome wide identification and expression analysis of <i>HSP20</i> and <i>HSP70</i> family genes in Sweet potato (<i>Ipomoea batatas</i> [L] Lam)	Dr. K.M. Senthilkumar
38	Ms. R.A. Sneha	M.Sc. (Genetics and Plant Breeding), Department of Botany, University of Kerala	Morphological characterization, tissue culture and molecular biology techniques in tuber crops	Dr. Shirley Raichal Anil
39	Ms. Muhsina Rafeeq,	M.Sc. (Genetics and Plant Breeding), Department of Botany, University of Kerala	Morphological characterization, tissue culture and molecular biology techniques in tuber crops	Dr. Shirley Raichal Anil
40	Ms. Krishnendhu Ashok	M.Sc. (Computational Biology in Machine Learning), University of Kerala	Computer vision based classification of post harvest physiological deterioration in cassava using deep learning models	Dr. J. Sreekumar
41	Ms. Pinkila Bhutia	M.Sc. (Vegetable Science), ICAR-IIHR Bengaluru hub	Standardisation of soilless cultivation of bio fortified sweet potato (<i>Ipomea batatas</i> L. (Lam)	Dr. K. Sunilkumar
42	Mr. K. Vinod Kumar	M.Sc. (Molecular Biology and Biotechnology), IARI (ICAR-IIHR Bengaluru hub)	Molecular characterization of beta-carotenoid metabolism in cassava genotypes with white and yellow tubers	Dr. T.P. Sujatha
43	Ms. Shaik Munishad	M.Sc. (Biotechnology), Vikrama Simhapuri University	Analysis of expression of beta- carotenoid metabolism genes in cassava	Dr. T.P. Sujatha
44	Ms. M.P. Adithya	M.Sc. (Microbiology), St. Mary's College for Women, Thiruvalla, MG University	Identification of multifaceted bacteria for pathogen suppression and growth promotion in tropical tuber crops.	Dr. S.S. Veena
45	Ms. J. Ajolin Jemima	M.Sc. (Genetics and Plant Breeding), Karunya Institute of Technology and Sciences, Coimbatore	Characterization of sweet potato (<i>Ipomoea batatas</i> (L.) Lam) using morphological and molecular approaches	Dr. C. Visalakshi Chandra

Ph.D. awarded

Dr. P.R. Amrutha was awarded the Doctoral Degree in Biotechnology by the University of Kerala, Thiruvananthapuram, on 02 September 2025. Her thesis entitled, 'Eco-friendly management of greater yam anthracnose employing endophytes', was carried out at ICAR-CTCRI under the guidance of Dr. M.L. Jeeva.

Training programmes

The farmers, officials, and students from different parts of the country had undergone training at the Institute. Training was imparted on advanced tuber crops technologies including value addition to increase their income and livelihood.

On campus training programmes

Sl. No.	Particulars of training	Date	Details of participants
1	Training on improved technologies of tropical tuber crops	14-18 January 2025	30 B.Sc. (Hons.) Agricultural students from College of Agriculture, KAU, Thiruvananthapuram
2	Quality planting material production of biofortified sweet potato	5-6 February 2025	35 farmer beneficiaries of Nuagaon, Mukuna and Sandkep villages of Sadar block of Keonjhar district
3	Landraces and varieties of tuber crops, their cultivation and value addition	12 February 2025	25 farmers
4	Production and value addition techniques in tuber crops	15-16 February 2025	20 Rainbow diet project beneficiaries from Keonjhar district of Odisha
5	Improved technologies of tropical tuber crops	21-25 March 2025	18 B.Sc. (Hons.) Agricultural students from College of Agriculture, KAU, Vellanaikkara, Thrissur
6	Protected cultivation for clean seed production of tropical tuber crops	21 March 2025	12 RAWE students from College of Agriculture, KAU, Thiruvananthapuram
7	Improved technologies of tropical tuber crops	28-30 April 2025	14 farmers from Tamil Nadu
8	Value addition and entrepreneurship development in tuber crops	01-30 June 2025	3 rd year B. Tech. (Ag. Engg.) students from OUAT, Bhubaneswar
9	Agro-techniques in tuber crops and value addition	20 June 2025	25 farmers along with Assistant Agril. Officers, Bhubaneswar, Odisha
10	Agro-techniques in tuber crops and value addition	20 June 2025	28 farmers with Asst. Ag. Officer, Keonjhar district, Odisha
11	Soil, plant and water analysis for efficient nutrient management	23-27 June 2025	19 including Assistant Soil Chemists and Scientific Assistants of Dept. of Agricultural development and Farmers welfare
12	Improved technologies of tropical tuber crops	24-26 June 2025	18 farmers from Tamil Nadu
13	Soil and nutrient management techniques in cassava-SCSP experience	25 June 2025	30 farmers from Mayiladuthurai and Nagapattinam districts
14	Soil physical properties: Texture, physical constants estimation for soil testing lab officials	25-26 June 2025	19 students under RAWE program
15	Kantasth 2.0 (Hindi)	30 June 2025	32 officials
16	Improved tuber crops technologies	30 June 2025	55 SCSP farmers from Karimannoor panchayat, Thodupuzha, Idukki
17	Understanding the POSH Act 2013: Prevention, prohibition & redressal of sexual harassment at workplace	14 July 2025	All staff CTCRI
18	Improved production and value addition technologies in tropical tuber crops	17-18 July 2025	20 TSP farmers (Kani tribe) from Keelamylar, Tamil Nadu
19	Prospects of arrow root cultivation	20 August 2025	15 farmers from Thavanoor FPO
20	Protected cultivation for clean seed production in tuber crops as part of training “Advances in integrated pest and disease management”.	21 August 2025	12 researchers and faculty

21	Improved production and value addition technologies in tropical tuber crops for	25-27 August 2025	20 Nagaland farmers under TSP
22	Bharat Darshan Programme by ICAR-CTCRI, Thiruvananthapuram Kerala & IMG, Thiruvananthapuram	11 September 2025	15 Officers of Nagaland Civil Service (On probationary training)
23	Improved varieties and technologies of tuber crops	15 September 2025	20 officials from SPAC, Erode, Tamil Nadu
24	Annual Program 2025-26 (Hindi)	16 September 2025	33 officials
25	Improved agro-techniques of tropical tuber crops	03 October 2025	150
26	Improved technologies of tropical tuber crops	11 October 2025	260 farmers and other stakeholders
27	Indian Constitution (Hindi)	17 October 2025	31 officials
28	Resilient crop production practices in tropical tuber crops	22 October to 26 November 2025	6 B.Sc. (Hons.) Agricultural students from Guru Kashi University, Bathinda, Punjab
29	Tuber crops/cassava production aspects and cultivation scenario in Tamil Nadu	30 October	8 Officers of State Department of Agriculture, Pudukottai District, Tamil Nadu
30	Soil physical properties estimations and STFR facility	03-04 November 2025	8 RAWE students of GKU, Punjab
31	Weed management in tropical tuber crops	22 November 2025	6 Maharashtra farmers
32	Latest crop production technologies in tuber crops	01 December 2025	30 farmers from Tenkasi District, Tamil Nadu
33	Improved technologies of tropical tuber crops	01 December 2025	25 farmers
34	Improved technologies of tropical tuber crops	01-02 December 2025	20 farmers from Tamil Nadu
35	Improved production technologies on tuber crops	02 December 2025	25 farmers
36	Quality planting material production in tropical tuber crops	04 December 2025	45 farmers
37	Improved technologies of tropical tuber crops	9-11 December 2025	32 officials from Odisha
38	Improved technologies of tropical tuber crops (in Hindi)	15-17 December 2025	37 FPO representative farmers from Thane district, Maharashtra
39	Improved technologies of tuber crops	23 December 2025	65 farmers and other stakeholders

On-campus training programmes by Techno Incubation Centre

Sl. No.	Title of programme	Date(s)	Details of participants	No. of beneficiaries
1.	Hands on training on value added products for entrepreneurship development in tuber crops at TIC, ICAR-CTCRI	06 January 2025	Krishi Bhavan, Pallikathod, Kottayam	33 farmers (Male 10 & Female 23)
2.		13 January 2025	Krishi Bhavan, Upputhara, Idukki	43 farmers (Male 19 & Female 24)
3.		15 January 2025	Homebakers group, Trivandrum	19 Entrepreneurs (Male 3 & Female 16)
4.		27 January 2025	Vellanad Farmers Producers Company, Trivandrum	28 farmers (Male 14 & Female 14)
5.		28 January 2025	ATMA Idukki	22 farmers (Male 17 & Female 5)
6.		19 February 2025	Kudumbasree District Mission, Kollam	31 farmers (Male 0 & Female 31)
7.		16 April 2025	We the leaders foundation, Namakkal	14 farmers (Male 11 & Female 3)
8.		22 April 2025	General training	13 farmers (Male 8 & Female 5)
9.		15 July 2025	ADA, Ettumanoor, Kottayam	43 farmers (Male 25 & Female 18)
10.		17 July 2025	Thirunelveli, Tamil Nadu, under TSP program	24 farmers (Male 10 & Female 14)
11.		18 July 2025	Thirunelveli, Tamil Nadu, under TSP program	24 farmers (Male 10 & Female 14)
12.		05 August 2025	General training	32 farmers (Male 14 & Female 18)
13.		07 August 2025	ATMA, Kazhakoottam, Thiruvananthapuram	32 farmers (Male 7 & Female 25)
14.		11-15 August 2025	B.Sc Ag. students, KAU Vellayani	26 Internship students
15.		19 August 2025	ATMA, Kadathurythy Block, Kottayam	26 farmers (Male 11 & Female 15)
16.		20 August 2025	ADA, Ponanai, Malappuram	12 farmers (Male 12)
17.		22 August 2025	ATMA, Sasthamkotta	37 farmers (Male 8 & Female 29)
18.		27 August 2025	TSP program training, SHGs from Wokha, Nagaland	20 tribal farmers (Male 9 & Female 11)
19.		19 September 2025	General training	31 farmers (Male 13 & Female 18)
20.		24-25 September 2025	ATMA, Kannur	30 farmers (Male 16 & Female 14)
21.		30 September 2025	General training	37 farmers (Male 23 & Female 13)
22.		21 October 2025	Kudumbasree, Perumkadavila, Thiruvananthapuram	18 farmers (Male 2 & Female 16)
23.		27-28 October 2025	Kudumbasree, Kollam	14 farmers (Female 14)
24.		2 December 2025	Agricultural Department, Thenkasi, Tamil Nadu	17 farmers (Male 17)
25.		18 December 2025	KVK, Kanyakumari	12 farmers (Male 12)

Off campus training programmes

Sl. No.	Title of the programme	Date	Place	No. of Beneficiaries
1	Tribal farmers meeting and field visit under the Tribal Sub Plan	30 January 2025	Marayoor forest region, Munnar, Idukki district, Kerala	50
2	Improved varieties and technologies of cassava for enhancing productivity and farm income	03 February 2025	Pachamalai Hills, Tiruchirapalli, Tamil Nadu	> 150
3	Soil problems, fertility management and field solutions at Pachamalai hills	03 February 2025	Thonur, Pachamalai, Trichy District, Tamil Nadu	160
4	Clean seed production in sweet potato and elephant foot yam	11 February 2025	KILA, Ollukkara, Thrissur, Kerala	40
5	Soil, plant and water analysis for efficient nutrient management	17-21 February 2025	Assistant Soil Chemists and Scientific Assistants, Dept. of Agricultural Development and Farmers Welfare	20
6	Tuber crops for agrifood systems and sustainable income	21 February 2025	Kanubari, Longding, Arunachal Pradesh.	380
7	Novel processing and value addition in tapioca & 'Ethnic tuber crops festival'	24 February 2025	Tiyi Hall, Wokha Town, Nagaland	100
8	Fertilizer governance and drought management in cassava	28 February 2025	Aanyampatti, Gangavalli Block, Salem District, Tamil Nadu	50
9	Improved tuber crops technologies in the SCSP programme	04 March 2026	Pothukudi, Paoakudi, Ambasamudram, Tirunelveli, Tamil Nadu	102
10	Tuber crops farming for agrifood systems	13 March 2025	Kammapatti, Kayathar Block, Thoothukudi, Tamil Nadu	35
11	Improved varieties and technologies of tuber crops for enhancing farm income	14 March 2025	Department of Forests, Mundanthurai, Tirunelveli, Tamil Nadu	90
12	Farmers training on coconut based tuber crops farming system for higher income	27 May 2025	Bichennala, Rangia, Kamrup, Assam	20
13	Improved tuber crops technologies	30 June 2025	Karimannoor Panchayat, Thodupuzha, Idukki, Kerala	55
14	Improved production technologies on tuber crops	20 June 2025	Kammapatti, Chettikuruchi village, Kayathar Taluk, Thoothukudi District, Tamil Nadu	40
15	Improved tuber crops technologies cum sensitization meeting	20 June 2025	Chenbagaramanputhooor, Thovalai Block, Kanya Kumari District, Tamil Nadu	55
16	Improved production technologies on tuber crops	24 June 2025	Department of Agriculture, Kallakurichi District, Tamil Nadu	50
17	Improved production technologies on tuber crops	25 June 2025	Nagapattinam District, Tamil Nadu	50
18	Training on quality planting material production of tropical tuber crops	04 July 2025	Parassala, Thiruvananthapuram District, Kerala	300

19	Improved production technologies of tuber crops	11 July 2025	Pramadom, Konni, Pathanamthitta District, Kerala	60
20	Exposure visit and Training on Improved production technologies in tuber crops	11 July 2025	Peringamala Panchayat, Thiruvananthapuram under TSP	20
21	Drought management and mid season agro advisory in cassava	16 July 2025	Gangavalli, Salem, Tamil Nadu	34
22	Field diagnostic visits	18 July 2025	Aanayampatti, Gangavalli, Salem District, Tamil Nadu	08
23	Production and value addition in tuber crops	28 July 2025	T. Dengasargi Village, Dumuriguda G.P., Kolnara Block, Rayagada District, Odisha	70
24	Production and value addition in tuber crops	29 July 2025	Karnagudavill, Chatikona G.P., Bissamcuttack Block, Rayagada District, Odisha	62
25	Production and value addition in tuber crops	04 August 2025	Dardaravill, Keutunmari Gram Panchayat, Kuliana Block, Mayurbhanj District, Odisha	65
26	Production and value addition in tuber crops	06 August 2025	Tangiabasa Village, Badagaon G.P., Bangriposi Block, Mayurbhanj District, Odisha	75
27	Awareness programme about ICAR-CTCRI's SCSP programme and importance of tuber crops in sustainable livelihood	25 August 2025	Konni, Pathanamthitta District, Kerala	40
28	Coconut and tuber crops based agrifood systems for resilience and sustainable income	22 August 2025	Krishi Vigyan Kendra, Kamrup, Assam.	200
29	Crop diversification with tuber crops under TSP	22 August 2025	Rumunda Village, R. Udayagiri Block, Gajapati District, Odisha	50
30	Crop diversification with tuber crops under TSP	24 August 2025	Banpukhuria Village, Binpur-I Block, Jhargram District, West Bengal	50
31	Recent production technologies and fertilizer governance in cassava	28 August 2025	Thovalai, Kanya Kumari, Tamil Nadu	46
32	Agro-techniques in tuber crops and value addition	09 September 2025	Kuchinda Block, Sambalpur, Odisha	31
33	Monitoring and diagnostic visit to fields of cassava and elephant foot yam (under SCSP demonstrations)	09 September 2025	Kalanjoor, Pathanamthitta District, Kerala	30
34	Improved production and value addition technologies in tropical tuber crops	11 September 2025	Kanubari Block, Longding District, Arunachal Pradesh	105
35	Livelihood interventions through agriculture in collaboration with KSCSTE, Govt. of Kerala	12 September 2025	Interaction meeting with tribal leaders of Aralam Farm, Kannur, Kerala	25
36	Improved production and value addition technologies in tropical tuber crops	15 September 2025	Wokha District, Nagaland	110
37	Improved tuber crops technologies	15 September 2025	Poonachi, Bhavani, Erode, Tamil Nadu.	25

38	Crop diversification with tuber crops under AICRPTC-SCSP”	18 September 2025.	Karanjia Village, Tangi Block, Cuttack District, Odisha	50
39	Agro-techniques in bio-fortified tuber crops integrated cropping system	18 September 2025	Dhenkanal and Puri Districts, Odisha	30
40	Agro-techniques and value addition in tuber crops	19 September 2025	Vajrapukotturu, Kanchili Sompeta, Ichhapuram, Kaviti Revenue Mandals of Srikakulam District, Andhra Pradesh	42
41	Agro-techniques of sweet potato	26 September 2025	Kollengode, Palakkad, Kerala	50
42	Biofortified sweet potato-mango-poultry integrated farming system for livelihood and nutritional security	10 October 2025	Jamundihi Village, Jorda Gram Panchayat, Kusumi Block, Mayurbhanj District, Odisha	72
43	Biofortified sweet potato-mango-poultry integrated farming system for livelihood and nutritional security	11 October 2025	Gopalpur Village, Hatabadada G.P., Kusumi Block, Mayurbhanj, Odisha	68
44	Improved agro-techniques of tropical tuber crops	29 October 2025	Karunapuram Panchayath, Idukki, Kerala	60
45	Value addition in tuber crops	15 December 2025	T. Dengasargi Village, Dumuriguda G.P., Kolnara Block, Rayagada District, Odisha	60
46	Value addition in tuber crops	16 December 2025	Block Agricultural Office, Bissamcuttack Block, Rayagada District, Odisha	71
47	Value addition in tuber crops	18 December 2025	Saragchhida Village, Kuliana Block, Mayurbhanj District, Odisha	73
48	Value addition in tuber crops	19 December 2025	Kanchinda village, Sorisapal G.P., Bangriposi Block, Mayurbhanj District, Odisha	66
49	Establishment of seed villages and DSM in tuber crops	19 December 2025	ADA office, Parassala Block, Thiruvananthapuram, Kerala	50

Exposure Visit

- One day exposure visit cum trainings on ‘Improved technologies of tuber crops’ was organized for the benefit of 696 farmers, 2568 students and 235 officials during this period at ICAR-CTCRI, Sreekariyam, Thiruvananthapuram.

Revenue generated

- Generated an amount of Rs. 4,85,553/- as revenue for organizing the training and exposure visit programme among various stakeholders at ICAR-CTCRI, Thiruvananthapuram.

Trainings attended by ICAR-CTCRI scientific staff

Sl. No.	Name	Particulars of the training	Period
1	Dr. T.P. Sujatha	International virtual workshop on ‘Programming in R to analyze biological data’ organized by Quaxon Bio & IT Solutions, India	26-30 January 2025

2	Dr. K. Hanume Gowda	CAFT training programme on 'Integration of traditional knowledge and metabolomics approaches in prospecting of wild edible plant genetic resources for food and health' organized for 21 days at the College of Horticulture, UHS campus, Bengaluru.	25 February to 17 March 2025
3	Dr. S.N. Rahana	Capacity building training programme on 'Harnessing crop wild relatives for breeding future crops' in collaboration with ICAR-NIPB, ICAR-NBPGR, Alliance Bioversity International and CIAT at ICAR-NIPB	03-08 March 2025
4	Dr. K.M. Senthilkumar	Three-month Short-Term Training on 'Cassava genome editing' under the mentorship of Dr. Leena Tripathi, Director, East African Hub, IITA. Sponsored under the ICAR-Genome Editing Project in Horticultural Crops, funded by the Ministry of Agriculture and Farmers Welfare, Government of India.	20 March to 17 June 2025
5	Dr. T.P. Sujatha	Short-term (three months) overseas training on plant genome editing on 'Application of CRISPR-Cas9 and CRISPR-Cas12a in crop plants' at CIMMYT, Mexico	28 March to 25 June 2025
6	Dr. N. Krishna Radhika	Three-month Short-Term Training on 'Cassava genome editing' as part of Short Term Overseas training program, under the mentorship of Dr. Leena Tripathi at the International Institute of Tropical Agriculture (IITA), Eastern Africa Hub, Nairobi, Kenya.	20 May to 15 August 2025
7	Dr. K.M. Senthilkumar	GSG & IITA-PBI Management Program Training on Gene editing lab stewardship at IITA, Nairobi, Kenya	16 June 2025
8	Dr. S.S. Veena	Generative AI tools for agriculture, ICAR-NAARM, Hyderabad	26-28 November 2025
9	Dr. C. Pradeepika	Stress management provided by Indian Institute of Technology (Indian School of Mines) Dhanbad	10 December 2025
10	Dr. Manas Ranjan Sahoo	Management Development Programme (MDP) on leadership development (a pre-RMP programme) at ICAR-NAARM, Hyderabad	11-22 December 2025
11	Dr. D. Jaganathan	Training programme for development of Master trainers under Rashtriya Karmayogi jan seva programme phase II (Zone V) organized by ICAR-NAARM, Hyderabad, Telangana	15-17 December 2025
12	Dr. K.M. Senthilkumar	Training for the ASRB exam, Multidata, Thiruvananthapuram	11 November 2025
13	Dr. K.M. Senthilkumar	2 nd International Workshop-cum-Webinar on CRISPR-Cas genome editing in plants, Glostem, Chandigarh	10-12 December 2025
14	All scientists	IGOT Karmayogi courses	2025-2026

Resources persons in training programmes

The scientists handled over 250 classes, catering to farmers, officials, students and various stakeholders nationwide. These sessions covered a wide range of topics, including improved tuber crop varieties, agricultural techniques, nutrient management and

quality planting material production, pest and disease control strategies, value addition, smart farming practices, drone applications, statistical tools and entrepreneurship. Both on campus and off campus classes were conducted to ensure broader outreach and effective knowledge dissemination.

AWARDS AND RECOGNITIONS

Awards

1. Dr. G. Byju, Director, ICAR-CTCRI was conferred with the Lifetime Achievement Award of the International Society for Tropical Root Crops (ISTRC) in the International Symposium on Tropical Root & Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES 2025), 17-21 November 2025 at Thiruvananthapuram, Kerala.
2. Dr. Jyothi Sreekumar was selected as the Fellow of Indian Society for Root Crops (ISRC) 2025.
3. Dr. K. Susan John received the Women Achiever Award of ICAR-CTCRI on International Women's day 2025 on 7 March 2025.
4. Dr. M. Nedunchezhiyan, Kalidas Pati, V.B.S. Chauhan, K.H. Gowda, R. Arutselvan, S.K. Jata and J. Dixit, Regional Station of ICAR-CTCRI, Bhubaneswar, Odisha received the Dr. A. Abraham Award for best research paper titled, 'Spacio-temporal fertigation effect on yield, nutrient use efficiency and economics of greater yam+maize intercropping system' published in the *Journal of Root Crops*, 2023, **49**: 28-32 in the International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food system, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November 2025 at Thiruvananthapuram, Kerala.
5. Dr. M.R. Sahoo, Co-recipient of the Young Scientist Award (Runners up) for the paper 'Molecular characterization of *Xanthosoma* species using ISSR markers and species identification using DNA barcoding', in the International Symposium on Tropical Root & Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES 2025), 17-21 November 2025 at Thiruvananthapuram, Kerala (Authors: Himani B. Patel, Suthar, K.P., Patel, V., Sahoo, M.R. and Rathod, H.R.).
6. Dr. P. Murugesan received the Best Poster Award for the research paper entitled 'Evaluation of Chinese potato (*Plectranthus rotundifolius* (Poir) Spreng) genotypes for phenotypic growth, tuber yield and quality under matured coconut garden' in the National Seminar on Harnessing Plantation Sector for Sustainable Development Goals jointly organised by ICAR-CPCRI and Indian Society for Plantation Crops during 3-5 2025 at Kasaragod, Kerala (Authors: Thangamuniyandi, M., Murugesan, P., Prabhu, T. and Rajangam, J.).
7. Dr. P. Murugesan, Co-recipient of Best Oral Presentation Award for the research paper entitled 'Bio-colours in Vegetable Crops' in the International Conference on Advanced Innovations and Technological Frontiers in Agricultural Sciences, Agricultural Engineering, Sericulture, Food Technology, Biotechnology, Fisheries Science, Veterinary and Animal Sciences 2025, 09-10 January 2025 at Department of Agricultural Engineering, RVS Technical Campus, Coimbatore, Anna University, Chennai, Tamil Nadu (Authors: Thangamuniyandi, M., Rajangam, J. and Murugesan, P.).
8. Dr. P. Murugesan received Certificate of Appreciation for serving as Coordinator of the PPV&FRA-sponsored Awareness Workshop-cum-Seed Exhibition on Traditional/Farmers' Varieties held at the Agricultural College and Research Institute, Tamil Nadu Agricultural University (TNAU), Madurai, during 27-28 March 2025.
9. Dr. P. Murugesan received Certificate of Appreciation for serving as Chairman of the Technical Session on 'Farmers' Varieties of Horticultural Crops/Vegetables' during the PPV&FRA-sponsored Awareness Workshop-cum-Seed Exhibition on Traditional/Farmers' Varieties held at the Agricultural College and Research Institute, Tamil Nadu Agricultural University (TNAU), Madurai, during 27-28 March 2025.
10. Dr. K.M. Senthilkumar bagged the ISRC Young Scientist Award 2025 (Runner-up) for the research paper titled 'Transcriptome sequencing and differential expression analysis of early bulking responsive genes in cassava' in the International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November 2025 at Thiruvananthapuram, Kerala (Authors: Senthilkumar, K.M., Sheela, M.N., Raju, S., Sreekumar, J. and Makesh Kumar, T.).
11. Dr. C. Visalakshi Chandra bagged the Best Research Paper Award for the paper, 'Postharvest physiological deterioration in cassava: Varietal response, genetic variability, genetic parameters, trait associations and transcriptome profiling' in the International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November 2025 at Thiruvananthapuram, Kerala (Authors: Visalakshi Chandra, C., Senthilkumar, K.M., Jyothi, A.N., Amalnath, S., Shameer, P.S., Pooja Krishnan, Ambu Vijayan, Senthil alias Sankar and Sreekumar, J.).

12. Dr. K. Hanume Gowda received the Young Scientist Award for contribution in agricultural and allied sector from Society of Agricultural Research and Management (SARM) in the 27th International Conference on Agriculture for Food Security and Nutrition, 17-19 January 2025.
13. Dr. K. Hanume Gowda received the Best Research Paper for Scientist 2024 in recognition of research paper titled 'Harnessing genotype x environment interaction and advanced selection indices for nutritional enhancement in taro (*Colocasia esculenta* (L.) Schott)' published in *Food Chemistry*, **473**:142938 on the occasion of ICAR-CTCRI Foundation Day 2025.
14. Dr. S.N. Rahana, received the Scientist Excellence Award 2025 in the International Conference - AGRINNOVA 2025 held on 10 January 2025 at Department of Agricultural Engineering, RVS Technical Campus, Coimbatore, Tamil Nadu.
15. Dr. Rahana S.N. bagged the Best Research Paper Award for the poster titled 'Community led revival of native yams: Biodiversity conservation in the Western Ghats' in the International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November 2025 at Thiruvananthapuram, Kerala (Authors: Rahana, S.N., Vinodkumar, M.G., Sreekumar, J., Jyothi, A.N. and Bhagya Prakash).
16. Dr. J. Suresh Kumar received the Best Oral Presentation Award (Runner Up) for the research titled 'Soilless sweet potatoes: Unlocking potential in controlled environments' in the International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November 2025 at Thiruvananthapuram, Kerala (Authors: Suresh Kumar, J., Sunilkumar, K. and Pradeepika, C).
17. Dr. M.L. Jeeva bagged the Best Research Paper Award for the paper, 'Cassava stem and root rot management: Bridging the gap between research and farmer adoption' in the International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November 2025 at Thiruvananthapuram, Kerala (Authors: Jeeva, M.L., Veena, S.S., Susan John, K., Jeena Mathew, Makesh Kumar, T., Arutselvan, R., Karthikeyan, S. and Divya, S.).
18. Dr. S.S. Veena bagged the Best Research Paper Award (Runner up) for the paper, 'Prospective fungal and oomycete disease management strategies for ensuring aroid health and yield' in the International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November, 2025 at Thiruvananthapuram, Kerala (Authors: Veena, S.S., Jeeva, M.L., Arutselvan, R., Asha Devi, A., Santhosh Mithra, V.S., Sreekumar, J., Suja, G. and Karthikeyan, S.).
19. Dr. S.S. Veena bagged the Best Research Paper Award (Runner up) for the poster, 'Harnessing variability in *Trichoderma* isolates to enhance bio-control efficacy against fungal pathogens in tropical tuber crops' in the International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November 2025 at Thiruvananthapuram, Kerala (Authors: Veena, S.S., Linet K. Joseph, Chithra Vinod, Jeeva, M.L., Byju, G., Sreekumar, J. and Karthikeyan, S.).
20. Dr. Jyothi Sreekumar received the Best Research Paper Award for the poster, 'Design and evaluation of cassava starch-derived mucoadhesive films for intraoral drug delivery' in the International Symposium on Tropical Root & Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES 2025), 17-21 November 2025 at Thiruvananthapuram, Kerala (Authors: Jyothi, A.N., Manoj Komath, Anju, V. and Sajeev, M.S.).
21. Dr. T. Krishnakumar was awarded the Best Oral Presentation Award for the paper titled 'Development and performance evaluation of a tractor operated Chinese potato harvester' in the International Conference on Emerging Trends in Agricultural Sciences and Technologies-2.0 (ETAST 2.0) organized by the Department of Agriculture and Agriculture Engineering during 06-07 March 2025, by Kalasalingam Academy of Research and Education, Virudhunagar, Tamil Nadu.
22. Dr. T. Krishnakumar received the Best Oral Presentation Award for the research paper titled 'Development and performance evaluation of a portable self propelled cassava sett cutter' in the International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November 2025 at Thiruvananthapuram, Kerala (Authors: Krishnakumar, T., Sajeev, M.S. and Pradeepika, C.).

23. Dr. C. Pradeepika received Young Scientist Award 2025 for the research paper entitled 'Nutritional synergy of sweet potato puree and vegan/non-vegan milk in the development of functional kulfi' in the International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November 2025 at Thiruvananthapuram, Kerala.
24. Dr. J. Sreekumar received the Best Research Paper Award (First Runner Up) for the poster entitled 'Deep learning based computer vision approach for classification of post-harvest physiological deterioration in cassava in the International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November 2025 at Thiruvananthapuram, Kerala (Authors: Krishnendu Ashok, Visalakshi Chandra, C. and Sreekumar, J.).
25. Dr. J. Sreekumar was nominated as the member of Working Group on Coconut Productivity Survey, by Coconut Development Board, Government of India.
26. Dr. P. Sethuraman Sivakumar was awarded Best Scientist (Resource Mobilization) 2025 (for obtaining the external funded project sanctioned during July 2024 to June 2025 having a total budget of $\geq$ Rs.1 crore) at the ICAR-CTCRI Foundation Day.
27. Dr. P. Sethuraman Sivakumar bagged the Best Oral Presentation Award for the paper entitled 'From farm to plate: Scaling up biofortified sweet potato in the NEH region through the Rainbow Diet Campaign Approach' in the International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November 2025 at Thiruvananthapuram, Kerala.
28. Dr. D. Jaganathan bagged the Best Research Paper Award (Runner Up - Oral) for the research paper entitled 'Enhancing Chinese potato production through farmer participatory demonstrations: Technologies, prospects and way forward' in the International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November 2025 at Thiruvananthapuram, Kerala (Authors: Jaganathan, D., Muthuraj, R., Sheela Immanuel, Prakash, P. and Byju, G).
29. Dr. P. Prakash received the STAR Young Scientist Award during the National Conference on Current Trends in Agricultural Research and Extension Services: Shaping the Future of Sustainable Agriculture and Food Security held at RARI, Jaipur during 23-25 February 2025.
30. Dr. P. Prakash bagged the Best Oral Presentation Award for the research paper titled 'Impact of improved varieties of cassava in Southern India: Adoption, profitability and policy implications' in the National Conference on Current Trends in Agricultural Research and Extension Services: Shaping the Future of Sustainable Agriculture and Food Security, 23-25 February 2025 at RARI, Jaipur, Rajasthan (Authors: Prakash, P., Jaganathan, D. and Sheela Immanuel).
31. Dr. Swathi Sivan bagged the Best Research Paper Award for Student 2025 for the article Genome analysis, identification, and expression analysis of nitrogen and potassium responsive genes in cassava. *Acta Physiologiae Plantarum*, **47**: 1-17 (NAAS Score: 8.4) in the 62 Foundation Day of ICAR-CTCRI 2025 on 11 July 2025 (Authors: Sivan S., Senthilkumar K.M., Sheela, M.N., Arya, K., Revathi, B.S., Abhilash, P.V., Neethu, R.S., Pooja, A. and Prakash Krishnan, B.S.).
32. Ms. Reshma Maria Joseph received the Best Research Paper Award (Runner Up) for the poster, 'Transcriptomic analysis of sweet potato leaves unravels the molecular mechanism of photoperiodic tuberization' in the International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November 2025 at Thiruvananthapuram, Kerala (Authors: Reshma Maria Joseph, Shirly Raichal Anil, Senthilkumar, K.M., Sreekumar, J. and Krishna Radhika, N.).
33. Ms. Lekshmi S. Lal bagged the Best Poster Award for the research work titled "An optimized method for isolating total RNA from different tissue parts of cassava (*Manihot esculenta* Crantz) using a modified CTAB-LiCl method' in the International Seminar on New Horizons in Plant Sciences (NHPS 2025), 8-10 April 2025, organized by the Kerala University Business Innovation and Incubation Centre (KUBIIC) and the Kerala University Botany Alumni Association (KUBAA), Department of Botany, University of Kerala, Kariavattom (Authors: Lekshmi S. Lal, Senthilkumar K.M., Krishna Radhika N. and Makeshkumar T.)
34. Dr. Pravi Vidyadharan received second prize for Best Oral Presentation, for the paper titled

‘Multiplex PCR Assay for simultaneous detection of sweet potato viruses’ in the National Conference on Transforming Plant Health Management: Integrating Traditional Practices with Modern Innovations for Global Food Security (Authors: Pravi Vidyadharan and Makesh Kumar, T).

35. Dr. Akhila P. Subhash bagged the Best Research Paper Award for the poster, ‘Suppression of cassava stem and root rot and mosaic diseases by soil inoculation with root-colonizing beneficial endophytic fungi’ in the International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November 2025 at Thiruvananthapuram, Kerala (Authors: Akhila, P, Subhash, Anith, K.N., Veena, S.S. and Makesh Kumar, T.).
36. Ms. S.U. Shilpa bagged second prize in Prof. M.J. Narasimhan Award contest in IPS (SZ) for the research paper titled ‘Antagonistic behaviour and disease suppressive mechanisms of endophytic *Bacillus* isolates against *Phytophthora colocasiae* in taro’ in the National Conference on Transforming Plant Health Management: Integrating Traditional Practices with Modern Innovations for Global Food Security, 18-19 December 2025, PAJANCOA & RI, Karaikal, Pondicherry (UT) (Authors: Shilpa, S.U., Jeeva, M.L., Veena, S.S., Amrutha, P.R. and Tom Cyriac).
37. Ms. S.U. Shilpa bagged the Best Research Paper Award (Runner up) for the paper, ‘Whole genome sequencing of taro endophyte *Bacillus pumilus* CTCRI PA3: A potential biocontrol agent for the suppression of taro leaf blight disease’ in the International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November 2025 at Thiruvananthapuram, Kerala (Authors: Shilpa, S.U., Jeeva, M.L., Veena, S.S., Amrutha, P.R. and Tom Cyriac).
38. Mr. K.C. Rakshith bagged the Best Research Paper Award for the research paper titled ‘Development of gluten free pasta from yam (*Dioscorea alata*) based composite flour’ in the International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November 2025 at Thiruvananthapuram, Kerala (Authors: Rakshith, K.C., Sajeev, M.S., Krishnakumar, T. and Pradeepika, C.).
39. Mr. P.N. Donn received the Best Research

Paper Award for the poster titled ‘Status of mechanization in cassava harvesting: Challenges and opportunities’ in the International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November 2025 at Thiruvananthapuram, Kerala (Authors: Donn, P.N., Krishnakumar, T. and Sunitha, S.).

Recognition

Crop Improvement

Dr. Manas Ranjan Sahoo

1. Received DBT International Travel Support (DBT-ITS) to attend the International Conference on Agriculture and Plantation Management at Wayamba University, Sri Lanka from 16-18 May 2025.

Dr. P. Murugesan

2. Lead developer in registering unique germplasm of East Indian Arrowroot – unique germplasm (IC641835) registered (INGR 25038) characterized by long primary rhizome (21 cm), highest recorded starch content (16.8%), and short crop duration, registered with ICAR-NBPGR which were higher than released variety Chhattisgarh 1.
3. Chairman, technical session on ‘Farmers participatory breeding and conservation of roots and tubers’ and delivered an invited lecture on ‘Nutritional and health benefits of tubers and their conservation’ in the Workshop cum Mela on ‘Celebrating the diversity and resilience of root and tubers’ (Embracing diversity of root and tubers), Killoguda village, Alluri Seetharama Raju district, Andhra Pradesh on 30 January 2025.
4. Adjunct faculty nominated by Vice Chancellor, TNAU for the academic year 2024-25 for guest lectures to faculties and PG scholars of Directorate of Seed Centre. Delivered a lecture on ‘Seed dormancy and quality in sweet potato: Implications for breeding under abiotic and biotic stresses’ on 18 March 2025.
5. Resource person and delivered a talk on ‘Registration of farmers varieties of tuber crops’ in the technical Session on ‘Farmers’ Varieties of Horticultural Crops/Vegetables’ Awareness Workshop-cum-Seed Exhibition on Traditional/Farmers’ Varieties held at the Agricultural College

and Research Institute, Tamil Nadu Agricultural University (TNAU), Madurai, during 27-28 March 2025.

6. Adjudicator and evaluated the Ph.D. thesis entitled 'Evaluation of M4 generation of moringa (*Moringa oleifera* Lam.) var. PKM 1 for biomass production' and acted as Chairman in the viva voce of Ms. Bharathi S. and delivered a guest lecture entitled 'Advances in breeder seed production in sweet potato - Ensuring genetic purity and quality' at the Horticultural College & Research Institute, TNAU, Periyakulam on 29 April 2025.
7. Adjudicator and evaluated the Ph.D. thesis entitled 'Investigation of hard seed phenomenon and designing the strategies to enhance the seed quality in black gram and green gram', and acted as Chairman in the viva voce of Ms. Pozhilarasi. S., and delivered a guest lecture on 'Physical, physiological, and molecular mechanisms of palm seed dormancy with special emphasis on oil palm hybrid seed production' at Tamil Nadu Agricultural University, Coimbatore on 22 May 2025.
8. External Expert, 37th Kerala Science Congress and evaluated research papers under the theme Agriculture and Food Science organized during 07-10 February 2025.

Dr. Asha K.I.

1. External expert, Pre-submission viva of Smt. Vijaya Lekshmi M.R., Research Scholar, Department of Botany, University of Kerala, Kariavattom, Thiruvananthapuram on 17 January 2025.
2. External Examiner, M.Sc Genetics and Plant Breeding, Third semester, Practical and Viva Department of Botany, University of Kerala during 18-19 March 2025.
3. External Examiner, evaluation of M.Sc. (Ag.) thesis titled 'Evaluation of chemical hybridizing agents (CHAs) for inducing male sterility in chilli' submitted by Ms. Nalam Sindhu Rani, Genetics and Plant Breeding, College of Agriculture, KAU, Vellayani.
4. Resource Person, pre-kharif 2025 activities under Viksit Krishi Sankalp Abhiyan at four venues in Thrissur (Cherpu, Ollukkara, Irinjalakkuda, Kodakara) during 29 May to 2 June 2025.
5. Observer (Server) in the online CBT conducted

for Combined NET-2025 and Preliminary Examination for ARS, SMS (T-6) and STO (T-6) – 2025 held at G20 EDU HUB, during 12 - 13 November 2025.

6. Reviewer, for the work report of a Technical Assistant (T3) for his merit-based promotion to the next higher grade.

Dr. C. Mohan

1. Subject Expert, Selection committee constituted for the Direct Recruitment of Assistant Professor Post in Kerala Agricultural University on 14 May 2025.
2. External Expert, Upgradation of JRF to SRF NFOBC fellowship for Ms. Sruthi R. Ph.D. Plant Breeding and Genetics, Kerala Agricultural University, Vellayani, Trivandrum on 26 August 2025.
3. Facilitator, Registration of two farmers (Mr. Mukilan P. and Mr. Murugan M., Ambasamudram, Pothukudi, Tirunelveli, Tamil Nadu) as Decentralized Seed Multipliers DSM) for supply of *Amorphophallus*, *Colocasia* and coleus.
4. Evaluator, 2 M.Sc. Theses from College of Agriculture, KAU, Vellayani, Thiruvananthapuram.

Dr. Asha Devi A.

1. Member, Board of Studies in Botany (Pass), University of Kerala.
2. Resource person, delivered a lecture on 'Improved Varieties of Tuber Crops from ICAR-CTCRI' in the one-day Farmer's Training Programme on Landraces and Varieties of Tuber Crops Cultivation Practices and Value Addition, on 12 February 2025 for 25 farmers.
3. Resource person, delivered a lecture in Online mode to the UG students of the Department of Botany, Sree Narayana College for Women, Kollam on 'Intellectual property rights and DUS testing for protecting farmers varieties' on 29 March 2025.
4. Reviewer, The Indian Journal of Agricultural Sciences (NAAS score: 6.40) for the article, 'Standardization of tissue culture protocol in Lady Rosetta cultivar of potato (*Solanum tuberosum* L.)'.
5. Resource person, five-day National Workshop on Plant Genome Analysis and took a class on

‘Molecular markers and analysis with special reference to tuber crops’ on 02 April 2025.

6. Convenor, Session on Varietal Evaluation in the 25th Annual Group Meeting of AICRP-TC organized at SKLGHU, Hyderabad on 19 May 2025.
7. Adjudicator, Ph.D. thesis titled, ‘Molecular profiling and *in silico* studies of *Artocarpus altilis* (Parkinson) Fosberg’ by Ms. Meera Sabari V., Manonmaniam Sundaranar University, Tirunelveli, TN.
8. Resource person, DBT STAR programme at the Department of Botany, Govt. College for Women, Thiruvananthapuram, delivered a lecture on the topic, ‘Nurturing resilience: Women in plant biotechnology shaping climate-ready agriculture’ on 1 August 2025.
9. Reviewer, Journal of Root Crops for the article, ‘Exploring cassava genetic diversity through morphological and molecular markers: A comprehensive review’.
10. Coordinator, Exposure visit of B.Sc. and M.Sc. Botany students of UC College, Aluva to Crop Improvement labs for 33 students and 2 teachers on 14 October 2025.
11. Rapporteur, Keynote addresses, Young Scientist Award Competition and Plenary Session in the International Symposium on Tropical Root & Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability organized by ISRC, ISTRC and ICAR-CTCRI, Thiruvananthapuram, Kerala, India during 17-21 November 2025.
12. Co-Chairman, Program committee in the International Symposium on Tropical Root & Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability organized by ISRC, ISTRC and ICAR-CTCRI, Thiruvananthapuram, Kerala, India during 17-21 November 2025.
13. Member, Publication Committee in the International Symposium on Tropical Root Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability organized by ISRC, ISTRC and ICAR-CTCRI, Thiruvananthapuram, Kerala, India during 17-21 November 2025.
14. Runner-up, Best research paper award for the paper ‘Prospective fungal and oomycete disease management strategies for ensuring aroid

health and yield’ in ISTRTC 4 NARES 2025 organized by ISRC, ISTRC and ICAR- CTCRI during 17-21 November 2025 at ICAR-Central Tuber Crops Research Institute, Sreekariyam, Thiruvananthapuram, Kerala, India. (Authors: Veena, S.S., Jeeva, M.L., Arutselvan, R., Asha Devi, A., Santhosh Mithra, V.S., Sreekumar, J. Suja G. and Karthikeyan S.).

15. Member, Selection Committee for Dr. A. Abraham Endowment Award 2025 organized by Kerala Academy of Sciences on 6 November 2025. Virtual Cadre, Kerala State Biodiversity Board, Kerala.
16. Editor and compiler 3As of Crop Improvement Division.
17. External Expert, for reviewing the extended abstracts of the 38th Kerala Science Congress for the subject Agriculture and Food Sciences.

Dr. Shirly Raichal Anil

1. Reviewer, Scientifica.
2. Reviewer, Plant Cell Tissue and organ Culture
3. Presented the annual work report under the ICAR-CIP Collaborative work plan activity on sweet potato in the ICAR-CTCRI and CIP Scientists Interaction meeting with Dr Neeraj Sharma, Country Manager, CIP and Dr Mohinder Singh Kadian, Senior Scientist and Consultant, CIP, in the presence of Dr G.Byju, Director CTCRI. The dignitaries visited sweet potato fields at CTCRI during 19 September 2025 at ICAR-CTCRI
4. Resource person, handled classes on ‘Biofortified sweet potato and its benefits’ in the Farmers’ meeting at Muthalamada Panchayat, Kalliyampara, Kollengode on 26 Sep 2025 and participated in the Harvest festival of the On-farm trials on biofortified sweet potato
5. Co-Chairperson, Cultural programme Committee, ISTRTC 4 NARES 2025.
6. Adjudicator, PhD. Thesis of Shirsat Mahesh Santosh, College of Agriculture, Kerala Agricultural University.
7. Associate developer of technology - Selection index for identification of sweet potato genotypes suitable for processing and value addition with Dr. C. Visalakshi Chandra.

Dr. Kalidas Pati

1. Member, Interview committee for selection of field / lab assistant under RKVY-APS project

at RC of ICAR-CTCRI, Bhubaneswar on 05 February 2025.

Dr. N. Krishna Radhika

1. Co-Developer, registration of *C. angustifolia* germplasm CTCRI-CA-PM-1 (IC641835) of East Indian Arrowroot (INGR25038) (P. Murugesan, Padmakshi Thakur, Deo Shankar, N. Krishna Radhika and A.N. Jyothi, ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram, Kerala), registered by the Plant Germplasm Registration Committee of Indian Council of Agricultural Research on 24 March 2025.
2. Selected for the Short Term Oversees Training Programme at IITA Kenya, under the mentoring of Dr. Leena Tripathy on 'Genome editing in cassava for starch variability and targeted mutant detection.' at the International Institute of Tropical Agriculture (IITA), Eastern Africa Hub, Nairobi, Kenya, from 20 May 2025 to 17 August 2025 with a financial grant of Rs.985821/-
3. Resource person, delivered a talk on 'Genome editing in cassava for starch variability' in the Seminar, in hybrid mode, organized by East African Hub, IITA, Kenya at Ndama Lounge in ILRI campus on 01 August 2025.
4. Editor, Book of Abstracts, International Symposium on Tropical Root and Tuber Crops for Nutrition, Agrifood systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November 2025.
5. Editor and compiler 3As of Crop Improvement Division.

Dr. K. M. Senthilkumar

1. Reviewer, Frontiers in Genome Editing, Transgenic Research, the Indian Journal of Agricultural Sciences, BMC Plant Biology, Frontiers in Plant Science, Molecular Biology Reports and Journal of Plant Biochemistry and Biotechnology
2. Research Topic Co-Editor, Frontiers in Plant Science (NAAS Rating: 10.80).
3. External Examiner, M.Sc. student, Mr. Gowri Sankar M., ICAR-IARI (ICAR-NRRI Hub)
4. Supervisor Invigilator and conducted the online CBT for Combined NET-2025 and Preliminary Examination for ARS, SMS (T-6) and STO (T-6) - 2025.
5. Resource person, delivered a talk on 'Structural,

functional and comparative genomics for crop improvement' at the BeCA Auditorium, at International Institute of Tropical Agriculture (IITA), Nairobi, Kenya to the CGIAR scientists on 13 June 2025.

6. Rapporteur, Workshop on Root, Tuber and Bulbous Vegetable Crops, 11th Indian Horticultural Congress and International Meet on Horticulture for Inclusive, Equitable and Sustainable Growth, 06-09 November 2025, GKVK, Bengaluru.
7. Rapporteur, Session-I on Biodiversity and Crop Improvement (Subtheme C: Biotechnology and Bioinformatics), The International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-Food Systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES) 17-21 November 2025, ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram, Kerala.

Dr. C. Visalakshi Chandra

1. External Expert, evaluated research papers under the Agriculture and Food science theme of 37th Kerala Science congress held during 7-10 February 2025 at Kerala Agricultural University, Vellanikkara, Thrissur.
2. Evaluator, Technical Session II on Climate Resilience and Ecosystem Services through Urban Agriculture on 22 May 2025 in the International Seminar on 'Innovative policies and community-led solutions for sustainable urban and peri-urban agriculture: Strengthening resilient, inclusive and circular urban food systems' held on 21-22 May 2025 at the College of Agriculture, Vellayani,
3. Rapporteur, Keynote addresses, Young Scientist Award Competition and Plenary Session in the International Symposium on Tropical Root & Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability organized by ISRC, ISTRC and ICAR-CTCRI, Thiruvananthapuram, Kerala, India during 17-21 November 2025.
4. Convenor, Program committee in the International Symposium on Tropical Root & Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability organized by ISRC, ISTRC and ICAR-CTCRI, Thiruvananthapuram, Kerala, India during 17-21 November 2025.
5. Editor, Souvenir, International Symposium on Tropical Root and Tuber Crops for Nutrition, Agrifood systems, Resilience, Entrepreneurship

and Sustainability (ISTRTC 4 NARES), 17-21 November 2025.

6. Resource person, presented 'Cassava breeding in ICAR-CTCRI' during the launch of Global Cassava Breeding Network, International Symposium on Tropical Root & Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES 2025) on 21 November 2025.

Dr. Sujatha T.P.

1. Peer Reviewer, Journal of Plantation Crops.
2. Associate Editor, Applied Biochemistry and Biotechnology, Section: Biological processes and Genomics, Springer.

Dr. Rahana S.N.

1. Rapporteur, Session I A on Biodiversity and Genetic Resources during the International Symposium ISTRTC-4 NARES held on 17 November 2025.
2. Jury member, Viksit Bharat Young Leaders Dialogue - state championship organized by Ministry of Youth Affairs at Kerala Institute of Tourism & Travel Studies, Thiruvananthapuram on 21 December 2025.

Crop Production

Dr. G. Suja

1. Member Secretary, QRT and contributed to securing an outstanding rating for ICAR-CTCRI & AICRPTC during the five-year assessment period of 2019-2024.
2. Editor, Journal of Root Crops.
3. Co-Chairperson, Reception Committee, Sixth International Agronomy Congress, 24-26 November, CSIR-National Physical Laboratory, New Delhi.
4. Chaired the technical session on Agrotechniques in the 25th AGM of AICRP on Tuber Crops held at College of Horticulture, Rajendra Nagar, Hyderabad, Sri Konda Laxman Telangana Horticulture University on 19-20 May 2025.
5. Chairperson, Technical Evaluation Committee, International Symposium on Tropical Root & Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), during 17-21 November 2025.

6. Delivered a Lead Paper titled 'Green solutions for safe and sustainable tuber crop-based agriculture-food systems' in the International Symposium for Tropical Root and Tuber Crops ISTRTC 4 NARES, in the session Sustainable Resource Management including Seed Systems on 19 November 2025.
7. Resource person, delivered a lecture on the topic 'Pulses in tuber crop based agrifood systems for healthy soil and life', to celebrate World Pulses Day, organized by Amrita School for Sustainable Futures, Karunagapally, Kerala on 12 February 2025.
8. Convener, Symposium on 'Corporate, policy, civil societies, leveraging and research interface in food system' held on 25 November 2025, in the Sixth International Agronomy Congress.
9. Committee member, for Selection of candidates for ISA Fellow & ISA Associate Awards: Scrutinized 62 applications for ISA Fellow & 16 for ISA Associate.
10. Co-Chairperson, Theme on Efficient Resource Use for Climate Change Adaptation and Mitigation and delivered a lead paper 'Regenerative and resilient production systems involving tropical tuber crops' in the International Seminar on Climate-Weed Nexus: Innovations for Sustainable Farming (CWIS 2025) at College of Agriculture, Vellayani, Thiruvananthapuram, Kerala, India on 28 November 2025.
11. Received two Technology Certificates as Lead Developer for the technologies titled 'Package of practices for organic production of arrowroot' and 'Package of practices for organic production of arrowroot'.
12. Member, Jury Committee, M.S. Swaminathan Award for Agricultural Research (Best Researcher State Award) 2024, nominated by Director of Extension, Kerala Agricultural University.
13. Co-author in two Poster Awards received by Ms. S. Devi Sanjeev, her Ph.D. student, for research papers on Natural Farming, presented in ISTRTC 4 NARES and Sixth International Agronomy Congress 2025.
14. Reviewer, PLOS one (2 nos.), Agronomy Journal, Journal of Agricultural Science, Irrigation and Drainage, Plants People Planet, Indian Journal of Agronomy and Journal of Root Crops
15. External Examiner, 4 Ph.D. students, (University

of Agricultural Sciences, Dharwad; Kerala Agricultural University; Dual Ph.D. Award Programme between Western Sydney University (WSU) in Australia & Kerala Agricultural University; Tamil Nadu Agricultural University).

Dr. Susan John K.

1. Member, CAS committee for the promotion of Senior Scientist GP8000-9000/- at CMFRI, Kochi on 4 February 2025.
2. Chairman, session on 'Agriculture and Food Science' of the 37th Kerala Science Congress held at Kerala Agricultural University, Trichur during 7-10 February 2025 and delivered a lead talk titled 'Kerala agriculture: Challenges, opportunities, way forward and researchable Issues' on 9 Feb 2025.
3. Subject Expert, Selection of Assistant Professor (Soil Science), KAU on 14 May 2025 at KAU, Vellanikkara, Trichur.
4. Convenor, technical session on 'Agrotechniques' of the 25th AGM held at Rajendra Nagar, Hyderabad during 18-20 May 2025.
5. Chairman, Technical Session on 'Circular food systems and sustainable value chain', in the International Seminar on 'Innovative policies and community led solutions for sustainable urban and peri urban agriculture' held at College of Agriculture, Vellayani during 21-22 May 2025.
6. Expert, Technical Committee, Central Soil Analytical Laboratory, Department of Soil Survey and Soil Conservation, Thiruvananthapuram with effect from 21 June 2025.
7. Subject expert, Technical Committee, Central Soil Analytical Laboratory, Department of Agriculture, GoK with effect from July 2025.
8. Subject Expert, CAS, KAU, for the promotion of 8 faculty of KAU under the discipline of Soil Science and Agricultural Chemistry held on 13 August 2025 at KAU, Vellanikkara, Trichur.
9. Subject expert, Technical Committee, Fertilizer quality Control Laboratory, Government of Kerala with effect from September 2025
10. Consultant, IPI Project, Indian Cardamom Research Institute, Myladumpara (Idukki) since 2024.
11. Member, Selection committee, Awardee under IPI-FAI award 2025 for promoting balanced fertilization with emphasis on potassium.

12. Co-author, best oral presentation award, Session on Biotic and Abiotic stresses for the research paper (Jeeva, M L., Veena, S S., Susan John, K., Jeena Mathew, Makesh Kumar, T., Arutselvan, R., Karthikeyan. S. and Divya, S. Cassava stem and root rot management: Bridging the gap between research and farmer adoption, paper presented in the 20 ISTRC held at Thiruvananthapuram during 17-21 November 2025.
13. Chief guest, National Seminar on 'Soil health: Challenges and strategies for urban agriculture' organized in connection with World Soil Day 2025 at College of Agriculture, Padannakkad under KAU on 5 December 2025 and delivered the lead talk on 'Innovative crop nutrient management strategies: Three decades experience in tropical tuber crops'.
14. Reviewer, Abstracts, 38th Kerala Science Congress
15. Reviewer, Journal of Root Crops and Agricultural Research.

Dr. S. Sunitha

1. Expert for Scientific advisory committee held at KVK, Kumarakom on 6 January 2025.
2. Expert, performance evaluation of KVK, Kumarakom as nominated by Director, ATARI.
3. External examiner for 2 Ph.D. and 4 M.Sc.(Ag.) students of Kerala Agricultural University.
4. Chairperson, Finance committee for ISTRC 4 NARES during 17-21 November 2025.
5. Co-chaired the session on Climate change and weed dynamics in crops and cropping systems in the International seminar on Climate-Weed nexus: Innovations for sustainable farming held at college of agriculture, Vellayani on 27 November 2025.

Dr. K. Sunilkumar

1. Academic Council Member, Cochin University of Science and Technology, Kochi representing Indian Council of Agricultural Research.
2. External Expert, assessment promotion (DPC) of 24 technical officers of JNTBGRI, Palode, on 25 April 2025.
3. External Examiner, for qualifying viva of 3 Ph.D. and 5 M.Sc. Hort students of CoH, Anantharajupeta, YSRHU, AP on 15 May 2025.

4. Co-Chairman, International Seminar on Innovative Policies and Community-Led Solutions for Sustainable Urban and Peri-urban Agriculture (session-II) at CoA, KAU, Vellayani during 21-22 May 2025.
 5. Represented ICAR-CTCRI in the Viksit Krishi Sankalp Abhiyan (VKSA) for *kharif* 2025 in 15 gram panchayaths of palakkad district during 03-07 June 2025.
 6. Chairman, session on Livelihood Through Agriculture Interventions in the work shop on 'Sustainable solutions for tribal development' at Aralam on 12 September 2025 organised by KSCSTE at Aralam, Kannur.
 7. Centre Coordinator, ASRB examination combined CBT for NET-2025 and Preliminary Examination for ARS, SMS (T-6) and STO (T-6)-2025 at Trivandrum Centre-II during 11 to 13 November 2025.
 8. Chairman, Poster Committee for International Symposium on Tropical Root & Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES) organised by ISRC, CTCRI and ISTRC, Thiruvananthapuram during 17-21 November 2025.
 9. Runner up, Best oral presentation for the paper 'Soilless sweet potatoes: Unlocking potential in controlled environments' in the International Symposium on Tropical Root & Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES) during 17-21 November 2025. (Authors: Suresh Kumar, J., Sunilkumar, K. and Pradeepika, C.).
 10. Chairman, Advisory committee for M.Sc. (Hort.) candidate Ms. Pinkila Bhutia of IARI-Bengaluru Hub.
 11. Co-Chairman Advisory committee of M.Sc. (Hort.) candidate Mr. Nikhil, K. of IARI-Bengaluru Hub.
 12. Member, Advisory committee of Ms. Pangi Anitha, M.Sc. (Hort.) student, Dept of Plantation Crops, Spices and Medicinal plants, College of Agriculture, KAU, Vellayani, KAU.
 13. Reviewer, CABI Agriculture and Bioscience, Plant Science Today and Journal of Root Crops.
 14. Jury member, for 17 topics under Building a sustainable and green Viksit Bharat theme of Viksit Bharat Young Leaders Dialogue-State championship held at KITTS, Thycaud, Trivandrum on 20 December 2025 organized by Ministry of Youth Affairs and Sports.
 15. Life Member, Society for Promotion of Horticulture Research and Development (SHRD).
 16. External examiner for various Qualifying exams of PG and Ph.D. students at CoA, KAU, Vellayani.
- Dr. K. Laxminarayana**
1. External Examiner, Final thesis viva voce of a Ph.D. student, Mr. Ili. Venkatesh, Department of Soil Science & Agricultural Chemistry, College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad on 01 July 2025.
 2. Technical Expert, verification of certified seed potato for *rabi* 2025-26 under the state plan scheme 'Development of potato, vegetable and spices' on 27 October 2025 at OSSC Ltd., Bhubaneswar.
- Dr. V. Ramesh**
1. Evaluated 4 M. Sc. (Ag.) thesis of College of Agriculture, Vellayani (KAU) under Soil Science and Agricultural Chemistry
 2. Course Director, Training on soil, plant and water analysis for efficient nutrient management, 17-21 February 2025.
 3. Course Coordinator, Training on soil, plant and water analysis for efficient nutrient management, 23-27 June 2025.
 4. Associate Developer, for technology titled, 'Package of practices for organic production of arrowroot'.
 5. Evaluator, for nine oral and 21 poster presentation under the theme Agro ecological restoration, soil health, climate resilience and ecosystem restoration at the international Conference on 'Community agro biodiversity management' organized at the College of Agriculture, Vellayani on 22 December 2025.
 6. Reviewer, Journal of Plant Nutrition (2 nos.) (NAAS score 7.6) and Journal of Indian Society of Coastal Agricultural Research (NAAS score 5.45).
- Dr. R. Muthuraj**
1. Received an appreciation Certificate from Shri Vineet Kumar IAS. Deputy Commissioner,

Wokha, Wokha district, Nagaland on 15 September 2025 as PI NEH Project in the recognition of contribution in promoting improved production and value added techniques in tropical tuber crops

2. Visiting Scientist to KVK, Wokha, Nagaland & KVK, Kanubari, Arunachal Pradesh for providing technological support and establishment of seed villages on tuber crops and strengthening tuber crops area in the states
3. Co-authored the Best research paper award (oral) Runner Up presented to Jaganathan, D., Muthuraj, R., Sheela Immanuel, Prakash, P. and Byju, G. for the research paper entitled 'Enhancing Chinese potato production through farmer participatory demonstrations: Technologies, prospects and way forward' presented in the International Symposium on Tropical Root & Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES) during 17-21 November 2025 at Thiruvananthapuram, Kerala, India.
4. Convener, committee of the stakeholders interfaces programme meetings organised at ICAR-CTCRI, Thiruvananthapuram on 20 November 2025 in the International Symposium on Tropical Root & Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES) during 17-21 November 2025 at Thiruvananthapuram, Kerala.

Dr. Jeena Mathew

1. Received award of appreciation at ICAR CTCRI as part of the International Women's Day on 8 March 2025 for getting the best oral presentation award in the 31st Swadeshi Science Congress held at ICAR-CIFT, Kochi.
2. Co-authored best oral presentation award, for the research paper 'Cassava stem and root rot management: Bridging the gap between research and farmer adoption', in the International Symposium on Tropical Root & Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES) during 17-21 November 2025 at Thiruvananthapuram, Kerala (Authors: Jeeva, M L., Veena, S.S., Susan John, K., Jeena Mathew, Makesh Kumar, T., Arutselvan, R., Karthikeyan, S. and Divya, S.).
3. Best inter disciplinary team award as Co-investigator in the multi institutional multi disciplinary project FARMER FIRST project of

ICAR CPCRI, Kasargod for the year 2025.

4. Evaluator, Trivandrum CBSE School Science Exhibition competition held on 22 November 2025 at Loyola School, Thiruvananthapuram.
5. Evaluator, 2 M.Sc. Ag. (Soil Science and Agril. Chemistry) thesis.
6. Reviewer, Journal of Plantation Crops, Communications in Soil Science and Plant Analysis, Indian Journal of Agricultural Sciences, The Journal of Animal and Plant Sciences, Frontiers in Sustainable Food Systems and International Journal of Plant and Soil Science.
7. Course coordinator, Training on soil, plant and water analysis for efficient nutrient management, 17-21 February 2025 and 23-27 June 2025.

Dr. J. Suresh Kumar

1. Member in TNIAMP delegation to visit Kenya which was aimed at strengthening global partnerships in climate resilient agriculture. Visited key institutions including CIP, KEPHIS, KALRO, IITA, and the University of Nairobi.
2. External evaluator, for Ph.D. thesis of Mr. G. Sidhdharth, titled 'Screening and evaluation of chilli (*Capsicum annum* L.) genotypes for yield and quality under sodic soils' from College of Horticulture, Trichy, TNAU on 12 September 2025.
3. Judge, South Zone Sahodaya Science Exhibition on the theme 'Nurturing Nature', held at Loyola School on 22 November 2025. Evaluated 54 projects by 8-10th standard students from different schools.
4. Adjudicator, M.Sc. (Hort.) thesis titled 'Nanoemulsion of wild ginger (*Zingiber zerumbet* L. Smith) essential oil for postharvest management in banana', by Ms. Anandhu Prakash, Kerala Agricultural University, Vellanikkara on 24 November 2025.
5. Adjudicator, M.Sc. (Hort.) thesis titled 'Fertigation schedule for hybrids in bitter gourd (*Momordica charantia* L.) under open precision farming', by Ms. Ashly Shani, Kerala Agricultural University, Vellanikkara on 25 November 2025.
6. Adjudicator, M.Sc.(Hort.) thesis titled 'Propagation studies in miracle fruit [*Synsepalum dulcificum* (Schumacher and Thonn.) Daniell]', by Ms. Hana V. Anvar, Kerala Agricultural University, Vellanikkara on 06 December 2025.
7. Jury member, for the theme titled 'Building a

sustainable and green Viksit Bharat' in Viksit Bharat Young Leaders Dialogue: State championship at KITTS, Thycaud, Thiruvananthapuram, Kerala on 20 December 2025

Crop Protection

Dr. T. Makeshkumar

1. Chaired a session on 'Conventional and biotechnological approaches in plant resistance to pests and diseases' and delivered the lead lecture on 'Application of CRISPR/Cas genome editing tools in plant pathology: Disease diagnosis and management perspectives' in the International Conference on 'One health perspectives in global plant protection research 2025', organized by TNAU, Coimbatore during 19-21 February 2025.
2. External Member, for conducting qualifying viva voce of IARI Ph.D. student (Plant Pathology) on 12 March 2025.
3. External Examiner, pre-submission presentation of one Ph.D. student of Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram on 18 March 2025.
4. External Member and conducted qualifying viva voce of one M.Sc. (Plant Pathology) student, SRM Institute of Science & Technology, Chennai on 23 May 2025.
5. External Examiner, for one Ph.D. student at Vellore Institute of Technology, Tamil Nadu on 11 June 2025.
6. Resource person, and delivered a talk on 'Pest and diseases in cassava' in the Regional Agricultural Mela and Seminar, organized by Department of Agriculture & Farmers welfare, Govt. of Tamil Nadu and TNAU at Erode on 12 June 2025.
7. External Examiner, final viva voce examination of one Ph.D. (Plant Pathology) student, TNAU, Coimbatore on 28 July 2025.
8. External Examiner, qualifying viva voce examination of one Ph.D. (Plant Pathology) student, IARI, New Delhi on 31 July 2025.
9. External Examiner, final viva voce examination of one Ph.D. (Plant Pathology) student, School of Life Sciences, Jawaharlal Nehru University, New Delhi on 22 August 2025.

Dr. M.L. Jeeva

1. External Examiner, 3 Ph.D. students from Kerala Agricultural University and BCKV, Kalyani

and M.Sc. students from Kerala Agricultural University.

2. Reviewer, Journal of Root Crops and Methods X Journal.

Dr. S.S. Veena

1. External Examiner, 5 M.Sc (Ag.) students of Kerala Agricultural University and 3 Ph. D. students, Kerala Agricultural University, M.G. University and Tamil Nadu Agricultural University.
2. External Examiner, Qualifying viva voce of 12 M.Sc. students, Department of Plant Pathology, College of Agriculture, Vellayani, Thiruvananthapuram.
3. Reviewer, Scientia Horticulturae, Journal of Advances in Biology & Biotechnology, Journal of Microbiology and Antimicrobials (JMA), Plant Science Today, Journal of Horticultural Sciences, Agricultural Research and Indian Journal of Agricultural Sciences.
4. Chief guest, Golden Jubilee Celebration of ICAR-Krishi Vigyan Kendra, Mitraniketan, Vellanad, Thiruvananthapuram

Dr. Harish E R

1. External Examiner, Ph.D. student, Jasti Sri Vishnu Murthy (Agricultural Entomology) for the thesis titled 'Biology and management of cassava mealybug *Phenacoccus manihoti* Matile-Ferre (Hemiptera: Pseudococcidae)', Kerala Agricultural University conducted on 29 August 2025.
2. External Examiner, M.Sc. (Ag.) student Ms. Meera Krishna B. for the thesis titled 'Entomopathogenic fungi-based silver nanoparticles and their efficacy on *Spodoptera litura* (Fab)', Kerala Agricultural University.
3. External examiner for the M.Sc. (Ag.) student Ms. Anisha A. for the thesis titled 'Seasonal biology and parasitism efficiency of *Trichogramma chilonis* Ishii (Hymenoptera: Trichogrammatidae) on caterpillar pests of vegetables', Kerala Agricultural University.
4. External Examiner, M.Sc. (Ag.) student Ms. Anushka S.R. for the thesis titled 'Management of sucking pests of tapioca, *Manihot esculenta* (Crantz).', Kerala Agricultural University conducted on 15 December 2025.
5. External Examiner, M.Sc. (Ag.) student Ms. Shreya Thomas for the thesis titled 'Bioactivity of

essential oils from *Curcuma* spp. (Zingiberaceae) against *Tetranychus truncatus* Ehara (Acari: Tetranychidae) and their safety to natural enemies)', Kerala Agricultural University.

6. Evaluator, Technical Session II on 'Climate resilience and ecosystem services through urban agriculture', on 22 May 2025 at College of Agriculture, Vellayani, Kerala.
7. Reviewer, research papers for Kerala Science Congress Technical Paper Evaluation Committee.

Dr. H. Kesava Kumar

1. External Examiner, one M.Sc. (Ag.) Nematology thesis, College of Agriculture, Vellayani, KAU during June 2025.
2. External Examiner, one M.Sc. (Ag.) thesis at College of Agriculture, Vellayani, Thiruvananthapuram in September 2025.
3. Evaluator, District Level Evaluation of Young Innovators Program 7.0 Category 1 and 2-4 organized by Kerala Development & Innovative Strategic Council.

Dr. B. G. Sangeetha

1. External Expert, Research papers for 37th Kerala Science Congress for the theme, Agriculture and Food Sciences.
2. Member, Advisory Committee, Ph.D. student, Kerala Agricultural University and IARI-IIHR, Bengaluru Hub.
3. Research Guide for Biotechnology, ICAR-IARI (IIHR Bengaluru Hub) and University of Kerala, Thiruvananthapuram.
4. Observer, for the conduct of online CBT for combined NET 2025 and preliminary examination for ARS, SMS(T6) and STO (T6) 2025
5. Reviewer, Journal of Environmental biology and Current Science.

Crop Utilization

Dr. M.S. Sajeew

1. Member, Working Group on Post harvest Engineering and Technology for Horticulture, SMD (Agricultural Engineering), ICAR, New Delhi.
2. Member, Core Committee, Agri Entrepreneurs, FPOs and AgriStarups, Comprehensive Development Mission Programme of Agriculture, Govt. of Kerala.

3. Member, Sub Mission on Agricultural Mechanisation - Committee for Empanelling of Manufacturers, Agricultural Development and Farmers Welfare Department, Government of Kerala.

4. Member, Board of Studies (BoS), Biotechnology & Biochemical Engineering Department, Sree Buddha College of Engineering, Pattoor.

5. Member, Interview Board of Scientist Selection, KSCSTE, Thiruvananthapuram, 22 October 2024

6. Advisory Committee Member, Ph.D. candidate Ms. Midhila Mahendran, on the topic 'Quality evaluation of proso millet and clinical efficiency of the developed smart food', Department of Community Science, College of Agriculture, KAU, Vellayani.

7. External Examiner, Ph.D. candidate Mr. R.K.Gupta from IIT, Kharagpur on the thesis 'Cold plasma modification of taro (*Colocasia esculenta*) starch for development of sustainable active nanocomposite food packaging films infused with betel leaf (*Piper betle* L) essential oil'.

8. External Examiner, Ph.D. candidate Ms. Malini B. on the topic, 'Production and characterization of cellulose derivative from Agro-industrial waste', from NIFTEM, Thanjavur.

9. External Examiner, M.Tech. candidate Mr. Rahul from IARI, New Delhi on the topic, 'Investigation on extrusion technology on functional and physico chemical properties of wet okara for food applications'.

Dr. T. Krishnakumar

1. Advisory Committee Member, M.Tech (Processing and Food Engineering) thesis at TNAU, Coimbatore.

2. External Examiner, M.Tech thesis entitled, 'A study on the waste valorization of cassava (*Manihot esculenta* Crantz) peels for development of bio-based cutlery' from NIFTEM, Thanjavur.

3. External Examiner, M.Sc. (Community Science) Food Science and Nutrition, thesis entitled, 'Nutritional validation of the traditional millet foods of the Tamil society', from the College of Community Science, TNAU, Madurai.

Dr. C. Pradeepika

1. Co-chaired a session on 'Circular economy for sustainable Agriculture' in the International

Seminar on ‘Innovative policies and community-led solutions for sustainable urban and peri-urban agriculture’ organized at College of Agriculture, Vellayani, Thiruvananthapuram on 22 June 2025.

- Supervisory Invigilator, ASRB Examination for Combined NET-2025 and Preliminary Examination for ARS, SMS (T-6) and STO (T-6) – 2025, Thiruvananthapuram during 12-13 November 2025.
- Rapporteur, Session-IV on Secondary Agriculture (Subtheme B: Value addition and Product Development, in the International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-Food Systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES), 17-21 November 2025, ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram, Kerala.
- Chairman, Advisory Committee for M.Sc. (Hort.) candidate Mr. Nikhil, K. of IARI-Bengaluru Hub.
- Co-Chairman, Advisory Committee of M.Sc. (Hort.) candidate Ms. Pinkila Bhutia of IARI-Bengaluru Hub.
- Co-Chairman, Advisory Committee of M.Sc. (Hort.) candidate Ms. Parul of IARI-Bengaluru Hub.

Extension and Social Sciences

Dr. Sheela Immanuel

- Expert, Recruitment Committee, Programme Assistant (Farm Manager) and Programme Assistant (Computer) posts, 20 June 2025.
- Member, Selection Process of state farmer’s award conducted at SAMETI, 8-9 August 2025.
- Co-chairperson, session on ‘Technology Assessment, Refinement and Commercialization’ under the main theme ‘Transfer of technology and commercialization’ in the International Symposium on Tropical Root & Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES) during 17-21 November 2025 at Thiruvananthapuram, Kerala, India

Dr. J. Sreekumar

- Member, Working Group on Coconut Productivity Survey, by Coconut Development Board, Government of India.
- External examiner for four students of Department

of Agricultural Statistics CoA, KAU, Vellayani and conducted the qualifying viva-voce on 20 August 2025.

Dr. V.S. Santhosh Mithra

- Distinguished speaker, INIZIARO 2025, the flagship event of the Entrepreneurship Cell, College of Agriculture, Vellayani, Thiruvananthapuram, on 22 February 2025 at College of Agriculture, Vellayani, organized by E-Cell, KAU.
- Resource person for the session on ‘Hi-Tech Horticulture and AI in Farming’ on 13 January 2025 at Ambalavayal, Wayanad, organized by RARS Ambalayal, KAU in connection with ‘Pooppoli-2025’ celebrations.
- Resource person and delivered a keynote lecture during the Agriculture Science/ Smart Farming session, held on 30 April 2025, as part of the annual science workshop titled ‘Face to Face with Frontiers in Science’, organized by the Swadeshi Science Movement at NIIST, Pappanamcode, Trivandrum.
- Resource person and delivered a talk on ‘Digital Initiatives of ICAR-CTCRI’ on 26 June 2025 during the inauguration of IoT Based Smart Farm in Mar Bacelios College of Engineering and Technology, Nalanchira, Thiruvananthapuram.
- Resource person in the National Cocoa Conclave 2025: Transforming Cocoa with Technology, Sustainable Growth and Self Reliance, held at AAU, Jorhat during 20-21 August 2025 and made a presentation on the topic ‘AI-driven innovations in cocoa farming for enhanced productivity and resilience’.
- Resource person for the FDP on ‘Tech-Harvest: Advancing Computer Science & Agricultural Research for a Smarter Future’, held at St Aloysius (Deemed to be University), Beeri, Kotekar, Mangaluru during 18-23 August 2025 and handled a class on ‘Innovative Agritech for Sustainable Development’ on 23 August 2025.
- Resource person in the International Workshop on Challenges and Solutions in Coffee Farming: Towards a Resilient and Sustainable Wayanad, held during 29-30 September 2025 at MSSRF, Wayanad and made a presentation on the topic, ‘The importance of introducing IoT-based smart farming techniques in coffee farming’.
- The online indent management system,

'Farmapp', was developed and launched for ICAR-CTCRI farm.

Dr. P. Sethuraman Sivakumar

1. External Examiner for adjudication of Ph.D. (Ag.) Agricultural Extension thesis of Ms. Riza Mathew, College of Agriculture, Kerala Agricultural University, Vellayani, Thiruvananthapuram, during January 2025.
2. External Examiner for adjudication of M.Sc. (Ag.) Agricultural Extension thesis of Mr. Baiju G., College of Agriculture, Kerala Agricultural University, Vellayani, Thiruvananthapuram, during January 2025.
3. External Examiner for adjudication of Ph.D. (Ag.) Agricultural Extension thesis and viva voce of Ms. Safna Vatakke Kandy Meethal, College of Agriculture, Kerala Agricultural University, Vellayani, Thiruvananthapuram during February and May 2025, respectively.
4. Resource person, delivered two invited talks on 'Exploring the advanced research methods in behavioural sciences' and 'Applications of modelling techniques in behavioural sciences' at the ICAR-sponsored short course on Advanced Research Methods in Behavioural Sciences for the scientists of State Agricultural Universities, organised by the Central Training Institute, Kerala Agricultural University, Mannuthy, on 18 February 2025.
5. Panellist, 'Agro-Industrial Conclave: Agricultural Innovation and Technology Commercialisation through Bridging Academia-Industry Collaboration' organised by the College of Agriculture, Kerala Agricultural University, Vellayani on 17 March 2025.
6. Resource person, Invited talk on 'Emerging approaches in measurement and scaling in social research' at the 'National Young Professionals Development Program on New Competencies, Career Opportunities and Research Priorities in Agricultural Extension' organised at MANAGE, Hyderabad on 26 March 2025.
7. Advisory Committee Member, Mr. Chandru S., M.Sc. (Ag.) Agricultural Extension student of College of Agriculture, Kerala Agricultural University, Vellayani, Kerala.
8. Doctoral Committee Member, Ms. Sri Vidhya A. P., Ph.D. (Agri-Business Management) student of VIT School of Agricultural Innovations

and Advanced Learning, Vellore Institute of Technology, Vellore, Tamil Nadu.

9. External Examiner, setting question paper for the M.Sc. (Ag.) Extension Course 'EXT-502: Applied Behaviour Change (2+1)' for the End Term 1 Semester Examination 2024-25 conducted in March 2025.
10. Resource person, delivered invited lecture on 'Emerging approaches in measurement and scaling in social research' at the National Young Professionals Development on 'New Competencies, Career Opportunities and Research Priorities in Agricultural Extension' from 9-13 June 2025 at MANAGE, Hyderabad.
11. Panelist, Panel 1 - Innovating together: Advancing root and tuber crops genetic resources and breeding through partnerships at the CIP symposium on 'Root and Tuber Crops Research and Development in India and South Asia' held on 20 May 2025 at New Delhi.
12. Panelist, Panel 3 - IP monetization & technology transfer at the golden jubilee conclave on 'IP Monetization and Technology Transfer' organized by CSIR-NIIST, Thiruvananthapuram on 14 May 2025.
13. External Research Adviser, Divisional Research Committee (DRC) meeting 2025 of Extension, Information, and Statistics (EIS) Division, ICAR-CIFT, Cochin on 15 May 2025.
14. Subject Matter Expert / Resource person, Transfer of Technology section at the 38th IRC meeting of ICAR-DCR held on 4 September 2025.
15. Resource person, delivered an invited lecture on 'Entrepreneurship in agricultural extension - Careers that create change' at MANAGE Agricultural Extension 'Evening4Learning' Webinar Series from 18-23 August 2025.
16. Resource person, delivered an invited lecture on 'ICT and behaviour change communication for nutrition improvement' at the Online Collaborative Training Program on ECHO Strengthening Post-Harvest Management in Agri and Allied Sectors through Farmer-Producer Organisations from 19-23 August 2025, organised by the Extension Education Institute (Southern Region), Hyderabad.
17. Resource person, for an invited lecture on 'Scaling up of biofortified varieties to combat child malnutrition - Methodological perspectives

and experiences of ICAR- CTCRI' at the IIMR-MANAGE Online Training Programme on Biofortification-A Frontier Novel Approach to Enrich Micronutrients in Millets to Encounter Food and Nutritional Security in India from 1-3 September 2025.

18. External Question Paper Setter, College of PG Studies, CAU (Imphal), Umiam for the M.Sc. (Ag.) Extension Course MCA-503: Computer Applications for Agricultural Extension Research (2+1) for August 2025 exams. MCA-613: Multimedia and Applications (1 +1).
19. External Examiner, Ph.D. thesis of ANGRAU, LAM, Guntur.
20. Panellist, Workshop on Root and Tuber Vegetable Crops on 8 November 2025 as a part of the 11th Indian Horticulture Congress and International Meet, 2025 on the theme Horticulture for Inclusive, Equitable and Sustainable Growth, at University of Agricultural Sciences, Bengaluru, India.
21. Resource person, and delivered an invited lecture on 'Partnering with research institutions for product development' at the MANAGE CIA Saturday Webinar series on 29 November 2025.
22. Resource person, and delivered an invited lecture on 'New generation extension research' at the MDP on Leadership Development for Heads of Social Sciences from 8-12 December 2025, organised by NAARM, Hyderabad on 12 December 2025.
23. Resource person, and delivered an invited lecture on 'Sensometrics and applications in social science research' at the ICAR-NAARM Training Programme on Psychometry and Scaling Methods from 15-19 December 2025 on 17 December 2025.

Dr. D. Jaganathan

1. Visiting Scientist to KVK, Idukki, Kerala for providing technological and methodological support for strengthening activities of KVK.
2. Editor, Journal of Traditional and Folk Practices published by Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI), Kerala State Council for Science, Technology, and Environment (KSCSTE), Government of Kerala.
3. Panelist, Land Use Seminar on Coconut Based

Land Use and Changing Climate on 06 January 2025 at Thiruvananthapuram, Kerala.

4. Convenor, session on Role of Print Media in Digital Era - Status, Challenges and Strategies in the Workshop on 'Media in the context of changing agriculture' on 27 January 2025 at ICAR-CPCRI, Regional Station, Kayamkulam, Alappuzha, Kerala.
5. Jury Member, for the theme titled 'Building a sustainable and green Viksit Bharat' in Viksit Bharat Young Leaders Dialogue: State Championship on 20 December 2025 at KITTS, Thycad, Thiruvananthapuram, Kerala.
6. Observer (Registration Desk and other duties), for the conduct of online CBT for combined NET 2025 and preliminary examination for ARS, SMS(T6) and STO (T6) 2025 during 12-13 November 2025 at Thiruvananthapuram, Kerala.
7. External Examiner, for adjudication of four M.Sc., (Ag.) theses of Kerala Agricultural University, Thrissur, Kerala.
8. Member, Advisory Committee for Ph.D., thesis titled 'Critical analysis of export readiness of Farmer Producer Organizations (FPOs) in Kerala' by Ms. Neethu J.S., KAU, College of Agriculture, Vellayani, Thiruvananthapuram.
9. Nodal Officer, Kisan Saarathi 2.0, ICAR & Digital India Corporation.
10. Reviewer, Fishery Technology and Journal of Economics and Development.

Dr. P. Prakash

1. External Examiner, for adjudication of M.Sc., (Ag.) thesis of Ms. Merin Paul, College of Agriculture, Vellanikkara, Thrissur in January 2025.
2. Evaluator, for Ph.D. student Ms. Adrita Dam, Division of Agricultural Economics, ICAR-IARI for change of UGC-NET fellowship to SRF on 04 April 2025.
3. Evaluator, International seminar on Innovative Policies and Community Led Solutions for Sustainable Urban and Peri-urban Agriculture held at KAU, College of Agriculture, Vellayani on 22 May 2025.
4. Member, Advisory Committee, M.Sc. thesis titled 'Farmer collectives in Jack value chains in Kerala: A critical analysis' at the Department of

- Agricultural Extension, College of Agriculture, Vellayani.
5. Rapporteur, session on ‘Socio economic development and capacity building’ under the main theme ‘Transfer of technology and commercialization’ in the International Symposium on Tropical Root & Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES) during 17-21 November 2025 at Thiruvananthapuram, Kerala.
 6. Supervisory Invigilator, online CBT for combined NET 2025 and preliminary examination for ARS, SMS (T6) and STO (T6) 2025 during 12-13 November 2025 at Thiruvananthapuram, Kerala.
 7. External Expert Member, Progress Review Panel for assessing and evaluating the progress of the four Ph.D. IARI students for progression from Junior Research Fellow to Senior Research Fellow on 12 December 2025.
 8. Reviewer, Indian journal of Agricultural Sciences and Sugar Tech.

LINKAGES AND COLLABORATIONS IN INDIA AND ABROAD

International collaborations

LINKAGES AND COLLABORATIONS IN INDIA AND ABROAD

International collaborations

1. International Centre for Tropical Agriculture (CIAT), Cali, Columbia
2. International Potato Centre (CIP), Lima, Peru

Organizations having MoU with ICAR-CTCRI

1. Karunya Institute of Technology and Sciences (Deemed to be University), Coimbatore for Academic and Research collaboration
2. Kalinga Institute of Industrial Technology (KIIT) Deemed to be University, Patia, Bhubaneswar, Odisha
3. Saintgits College of Engineering (Autonomous), Kottayam, Kerala
4. Kerala State Kudumbashree Mission, State Mission, Kerala
5. Vedanta Resources Limited, Odisha and with Sree Chitra Tirunal Institute for Medical Sciences and Technology
6. Sova Trust Foundation, an NGO based in the Sunderbans, West Bengal
7. M/s Xobu Foods and Beverages Private Limited, Rajahmundry, East Godavari, Andhra Pradesh
8. M/s Spudnik Foods, Bengaluru, Karnataka
9. Government Engineering College, Barton Hill, Thiruvananthapuram, Kerala
10. Swadeshi Science Movement, (Kerala Chapter of Vignana Bharathi)
11. M/s., Cliff Innovations
12. M/s., Agripilot Tech Pvt. Ltd.
13. M/s. Linga Chemicals Pvt. Ltd., Madurai, Tamil Nadu
14. Centre for Innovation in Social Science and Action (CISSA), Thiruvananthapuram, Kerala
15. Regional Agricultural Research Station, Pattambi, Kerala
16. M/s., Semilon Technologies Private Limited, Thiruvananthapuram, Kerala
17. M/s., Muruka Food Products

18. M/s., Banaza Enterprises

Organizations having MoA with ICAR-CTCRI

1. Kerala State Kudumbashree Mission
2. M/s Orabio Organic LLP, Bangalore
3. Haritha Lakshmi Krishikkootam, a women SHG in Kollam, Kerala

Linkages through collaborative research and extension activities

1. ICAR-Indian Agricultural Research Institute, New Delhi
2. ICAR-Central Institute of Agricultural Engineering, Regional Centre, Coimbatore, Tamil Nadu
3. ICAR-Central Institute of Fisheries Technology, Kochi, Kerala
4. ICAR-Central Institute of Women in Agriculture, Bhubaneswar, Odisha
5. ICAR-Central Plantation Crops Research Institute, Kasaragod, Kerala
6. ICAR-Central Institute for Research on Cotton Technology, Mumbai, Maharashtra
7. ICAR-Indian Institute of Farming Systems Research, Modipuram, Uttar Pradesh
8. ICAR-Indian Institute of Horticultural Research, Bengaluru, Karnataka
9. ICAR-Indian Institute of Spices Research, Kozhikode, Kerala
10. ICAR-National Academy of Agricultural Research Management, Hyderabad, Telangana
11. ICAR-National Bureau of Plant Genetic Resources, New Delhi
12. ICAR-National Research Centre for Banana, Tiruchirapalli, Tamil Nadu
13. ICAR-National Rice Research Institute, Cuttack, Odisha
14. ICAR Research Complex for NEH Region, Barapani, Meghalaya
15. ICAR-Sugarcane Breeding Institute, Coimbatore, Tamil Nadu
16. Agricultural Technology Application Research Institute, Bengaluru, Karnataka
17. Kerala Agricultural University, Vellanikkara,

Kerala

18. Central Institute of Petrochemicals Engineering & Technology (IPT), Kochi, Kerala
19. CSIR-NIIST, Thiruvananthapuram, Kerala
20. College of PG Studies in Agricultural Sciences, Central Agricultural University (Imphal), Umiam, Meghalaya
21. Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu
22. Department of Agriculture, Government of Kerala
23. Department of Horticulture and Department of Agriculture, Government of Odisha
24. Department of Horticulture, Government of Tamil Nadu
25. Kerala Agricultural University, Thrissur, Kerala
26. Medical College, Thiruvananthapuram, Government of Kerala
27. National Institute of Technology, Trichy, Tamil Nadu
28. Rubber Research Institute of India, Kottayam, Kerala
29. KVKs of Thiruvananthapuram, Kollam, Sadanandapuram, Pathanamthitta, Adimali, Kumarakom and Kottayam
30. KVK, CIFA, Bhubaneswar and Jajpur

Linkages through project funding

1. Coconut Development Board
2. Department of Agriculture and Farmer's Welfare, Government of Kerala
3. Department of Science and Technology, Government of India
4. Department of Biotechnology, Government of India
5. Government of Odisha
6. Government of Kerala
7. ICAR, National Agricultural Innovation Fund (NAIF), Government of India
8. Kerala State Biodiversity Board (KSBB)
9. Kerala State Council for Science, Technology and Environment (KSCSTE), Government of Kerala
10. Kerala State Horticulture Mission, Government

of Kerala

11. Kerala State Planning Board
12. National Bank for Agriculture and Rural Development (NABARD), Government of India
13. Protection of Plant Varieties & Farmers' Rights Authority (PPV&FRA)
14. Rashtriya Krishi Vikas Yojana (RKVY), Government of India
15. Small Farmers Agri-business Consortium (SFAC), Government of Kerala
16. Centre for Development of Advanced Computing (C-DAC), Thiruvananthapuram
17. Indian Cardamom Research Institute, (Ministry of Commerce), Idukki, Kerala

Others

1. Horticulture Department, West Garo Hills and Meghalaya Basin Development Agency
2. National Institute of Agricultural Extension Management (MANAGE), Hyderabad
3. Indian Centre for Research on Innovation and Science Policy (CRISP), Hyderabad
4. Indian Institute of Technology, Roorkee and Central Agricultural University (CAU), Imphal
5. Kerala State Industrial Development Corporation (KSIDC)
6. Kerala Start-up Mission, Department of Agriculture, Government of Kerala
7. Krishi Vigyan Kendra, Tura, Meghalaya.
8. Krishi Vigyan Kendra, Namsai, Arunachal Pradesh
9. Krishi Vigyan Kendra, Thenkasi and Karur, Tamil Nadu
10. Madurai Agribusiness Incubation Forum of NABARD, Madurai
11. North Eastern Hill University, Tura Campus, Meghalaya
12. Sagoserve, Salem, Tamil Nadu
13. Department of Agriculture in Koraput, Kandhamal and Ranchi districts
14. WASSAN & RRA Network
15. Aati Pual Mushroom (opc) Pvt. Ltd.
16. Vegetable and Fruit Promotion Council Keralam

PUBLICATIONS

Research Papers

1. Ajesh, G., Jayaprakas, C.A., Sangeetha, B.G. and Krishnan, J.U. 2025. Assessment of cassava leaf bio-fumigant efficacy against *Tribolium castaneum* and *Rhyzopertha dominica* and their symbiotic bacteria compared to the classical fumigant phosphine: Sustainable stored grain pest management using cassava leaf bio-fumigant. *Journal of Biological Control*, **39**(1): 88-105. (NAAS score: 5.46).
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3. Akilan, L.K., Anuradha, T., Soni, K.B., Swapna Alex and Krishna Radhika, N. 2025. Effective hygromycin concentration for selection of transformed embryogenic calli of cassava variety H-226. *J. Appl. Hortic.*, **27**(1): 24-26. (NAAS score: 5.43)
4. Amrutha Lakshmi, M., Arutselvan, R., Indraj, M., Challa, G.K. and Ramachandrudu, K. 2025. First identification of *Curvularia xishuangbannaensis* *Tibpromma* & K.D. Hyde, sp. nov. as a causal agent of leaf spot in oil palm nurseries and evaluation of fungicidal efficacy. *J. Hortic. Sci.*, **20**(2): 1-8. <https://doi.org/10.24154/jhs.v20i2.3877>. (NAAS score: 6.20).
5. Amrutha Rajeev, Jacob, D., Shalini Pillai, P., Santhosh Mithra, V.S., Nisha, S.K. and Sheeja K. Raj. 2025. Influence of sowing date on fruit yield of okra varieties. *Int. J. Res. Agron.*, **8**(12): 01-06. (NAAS score: 5.20).
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9. Bhattarai, R., Sulochana, G., Maheta, R.G., Severn-Ellis, A., Pati, K., Sruthi, N.U., Samson, A. and Johnson, S. 2025. Comparative analysis of bioactives and protein characteristics in six genotypes of yam bean tubers. *Sustain Food Technol.*, **3**: 2074-2087. DOI: 10.1039/D5FB00398A. (IF: 5.3; NAAS score: 11.30).
10. Byju, G. 2024. Role of plant nutrition in food security: Achievements, aspirations and action plan. *J. Indian Soc. Soil Sci.*, **72** (Supplement): S66-S77. (NAAS score: 5.34).
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13. De, S., Nayak, P.P., Nayak, A., Garnaik, S., Kumar, S., Das, S., Sivakumar, P.S., Raju, S. and Panda, S. 2025. Synergistic control of *Pseudomonas aeruginosa* biofilms using *Limosilactobacillus fermentum* and preservation factors. *Food Biosci.*, <https://doi.org/10.1016/j.fbio.2025.107797>. (NAAS score: 11.90).
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 18. Gowda, K.H., Amarananjundeswara, H., Fakrudin, B., Vasudeva, K.R., Kattagoudar, J. and Doddabasappa, B. 2025. Genetic variability, heritability and divergence analysis for growth, yield and nutritional quality parameters in potato (*Solanum tuberosum* L.). *Int. J. Adv. Biochem. Res.*, **9**(2): 633-647. (NAAS score: 5.29).
 19. Gowda, K.H., Amarananjundeswara, H., Fakrudin, B., Vasudeva, K.R., Kattagoudar, J. and Doddabasappa, B. 2025. Genetic parameters, phenotypic diversity, selection differential and gain analysis through EFA, HCA and multivariate analysis for growth, yield and yield components in potato (*Solanum tuberosum* L.). *Gene Rep.*, **40**: 102225. <https://doi.org/10.1016/j.genrep.2025.102225>. (NAAS score: 7.00).
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 22. Harish, E.R., Chellappan, M., Makeshkumar, T., Mathew, D. and Varghese, E. 2025. Behavioural and physiological responses of whitefly, *Bemisia tabaci* to virus infection in cassava (*Manihot esculenta* Crantz). *Entomologia Experimentalis et Applicata*, **173**: 1034-1047. DOI: 10.1111/eea.13610. (NAAS score: 7.90).
 23. Hasmi Sulain, K.K., Saravanan, R., Makasana, J., Krishnakumar T. and Safia, S. 2025. Comparative study of extraction methods and screening of cassava genotypes for high stem starch yield: A potential industrial source. *Starch-Stärke*, **77**(3): e202400158. (NAAS score: 8.60).
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 25. Kaviyarasu, P., Sujatha, K., Murugesan, P., Alex Albert, V., Ragavan, T., Anand, G. and Elamparithi, R. 2025. Advanced seed invigoration technologies in okra (*Abelmoschus esculentus* L. Moench). *J. Environ. Biol.*, **46**: 1-9. DOI: <http://doi.org/10.22438/jeb/46/1/MRN-5297>. (NAAS score: 6.60).
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 28. Krishnakumar, T., Sajeev, M.S., Pradeepika, C., Muthuraj, R. and Jaganathan, D. 2024. Determination of engineering properties of Chinese potato tubers (*Plectranthus rotundifolius*): Implications for designing a grading equipment. *J. Root Crops*, **50**(2): 61-64.
 29. Krishnan, J.U., Gigi, G., Mathiyil Subramanian, A., Harish, E.R. and Radhakrishnan, R.K. 2025. Where you serve the food matters over the quality and quantity for the insect visitors in the spatially separated male and female flowers within the spadix of banana cultivar, *Musa acuminata* var. Robusta. *Orient. Insects*, **59**(4): 605–618. <https://doi.org/10.1080/00305316.2025.2520579>. (NAAS score: 6.60).
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- RNA from leaves of sweet potato (*Ipomoea batatas* (L.) Lam.), *J. Hortic. Sci. Biotech.*, **100**(6): 695–701. (NAAS score: 7.70).
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 8. Susan John, K. 2025. *Importance of phosphorus in plant nutrition*, in All India Radio, Thiruvananthapuram, 28 March 2025.
 9. Susan John, K. 2025. *Importance of phosphorus in plant nutrition*, in Vayalum Veedum programme of All India Radio, Thiruvananthapuram, 02 April 2025.
 10. Susan John, K. 2025. *Integrated nutrient management at farm and home*, in All India Radio, Thiruvananthapuram, 13 November 2025.
 11. Veena, S.S. 2025. *Diseases of cassava and their management*, in All India Radio, Thiruvananthapuram, 06 May 2025.
 12. Veena, S.S. 2025. *Postharvest disease management in tuber crops*, in All India Radio, Thiruvananthapuram, 22 December 2025.

TV Programme

1. Asha K.I. 2025. *Crop improvement technologies* telecasted ahead of the 'Viksit Krishi Sankalp Abhiyan - Pre-Kharif 2025' campaign conducted from 29 May to 12 June 2025, 23 May 2025.
2. Suja, G. 2025. *Short telecast about PM Dhan Dhanya Krishi Yojana*, Doordharshan News, 18 July 2025.
3. Harish, E.R. 2025. *Pest management using cassava biopesticides in Central government schemes for doubling farmer's income*, in Janam TV, 08 November 2025.

Radio talk

1. Santhosh Mithra, V.S. 2025. *Climate change and its impact on agriculture*, in 'Vayalum Veedum'

PARTICIPATION OF STAFF MEMBERS IN SCIENTIFIC EVENTS/ SEMINARS/SYMPOSIA/CONFERENCE/WORKSHOP/MEETINGS

Sl. No.	Name of the programme	Particulars of the programme	Name of the participants
1	National seminar on Harnessing Plantation Sector for Sustainable Development Goals	ICAR-CPCRI, Kasaragod, Kerala 03-05 January 2025	Dr. D. Jaganathan
2	Scientific Advisory Committee meeting	KVK, Kumarakom, Kottayam 06 January 2025	Dr. S. Sunitha
3	Land use seminar on Coconut Based Land Use and Changing Climate	Mascot Hotel, Thiruvananthapuram, Kerala 06 January 2025	Dr. D. Jaganathan
4	Workshop on LSG-SLNA WDC PMKSY 2.0- IoT Enabled Watershed	Institute of Land Disaster Management, PTP Nagar, Thiruvananthapuram 07 January 2025	Dr. V.S. Santhosh Mithra
5	Final meeting of Quinquennial Review Team (QRT VIII)	ICAR- CTCRI, Thiruvananthapuram, Kerala 08-10 January 2025	All scientists
6	Industry Meet organized as part of QRT meeting	ICAR-CTCRI Thiruvananthapuram, Kerala 08 January 2025	Dr. G. Suja
7	Scientist- farmer- industry meet-cum- workshop on Leveraging Innovation Ecosystems for Building Sustainable Tuber Crops Entrepreneurship in India	ICAR-CTCRI, Thiruvananthapuram 09 January 2025	All scientists
8	7 th International conference on Agriculture for Food Security & Nutrition (Agri Vision-2025)	OUAT, Bhubaneswar 17-19 January 2025	Dr. K. Hanume Gowda
9	National conference on Emerging Issues and Sustainable Strategies in Plant Health Management: A Global Perspective, organised by Indian Society of Phytopathology	Nagpur, Maharashtra 19-21 January 2025	Dr. M.L. Jeeva
10	Workshop on Media in the Context of Changing Agriculture	ICAR-CPCRI, Regional Station, Kayamkulam, Alappuzha, Kerala 27 January 2025	Dr. V.S. Santhosh Mithra Dr. D. Jaganathan
11	Quarterly Review Meeting of Scientists	ICAR-CTCRI, Thiruvananthapuram, Kerala 28-29 January 2025	All Scientists
12	Webinar on the topic Ethics of Research Publication	NAAS-YUVA 31 January 2025	Dr. K.I. Asha
13	National symposium on Nematode Management in Agriculture	Syngenta, Goa 03-04 February 2025	Dr. H. Kesava Kumar
14	41 st Scientific Advisory Committee Meeting of KVK	ICAR-KVK Mitraniketan, Vellanad, Thiruvananthapuram 05 February 2025	Dr. S.S. Veena
15	37 th Kerala Science Congress	Kerala Agricultural University, Trichur, Kerala 7-10 February 2025	Dr. K. Susan John
16	Meeting for submission of QRT Report of ICAR-CTCRI & AICRP TC	NAAS Complex, New Delhi 10 February 2025	Dr. G. Byju Dr. G. Suja

17	Annual Review Meeting of ICAR-ZTMCs/ITMUs/ABIs in the discipline of Hort. Science Division (Online)	New Delhi 13 February 2025	Dr. P.S. Sivakumar
18	30 th Foundation Day of ICAR-CIWA, Bhubaneswar	Bhubaneswar 17 February 2025	Dr. K. Laxminarayana
19	International conference on One Health Perspectives in Global Plant Protection Research 2025	TNAU, Coimbatore 19-21 February 2025	Dr. T. Makesh Kumar
20	17 th Agricultural Science Congress 2025	G.B. Pant University of Agriculture and Technology (GBPUAT), Pantnagar 20-22 February 2025	Dr. C. Visalakshi Chandra Dr. J. Suresh Kumar
21	National Brainstorming workshop on Tuber Crops Mechanization and Strategic Vision for Food Security and Sustainability	ICAR-CTCRI, Thiruvananthapuram, Kerala 21 February 2025	All Scientists
22	National conference on Current Trends in Agricultural Research and Extension Services: Shaping the Future of Sustainable Agriculture and Food Security	RARI, Jaipur, Rajasthan 23-25 February 2025	Dr. P. Prakash
23	Seed Festival	Kanjikuzhi panchayat, Alappuzha district, Kerala 24 February 2025	Dr. Susan John K. Dr. S.N. Rahana
24	Project committee meeting of Rainbow Diet Campaign Odisha project	Office of the DDH, Keonjhar, Odisha 25 February 2025	Dr. P.S. Sivakumar Dr. M. Nedunchezhiyan Dr. S.K. Jata
25	Scientific Advisory Committee meeting	KVK, Tirupathisaram, Kanya Kumari, Tamil Nadu 27 February 2025	Dr. Sheela Immanuel
26	Orientation workshop on Mission Karmayogi	Capacity Building Commission, NASC Complex, New Delhi 27 February 2025	Dr. H. Kesava Kumar
27	14 th National symposium on Coastal Agriculture (NSCA 2025): Harnessing Fragile Coastal Ecosystem for Food and Environmental Security	ICAR-Central Research Institute for Jute and Allied Fibres, Barrackpore, Kolkata, West Bengal 28 February- 03 March 2025	Dr. K. Laxminarayana
28	International conference on Emerging Trends in Agricultural Sciences and Technologies-2.0 (ETAST 2.0)	Department of Agriculture and Agricultural Engineering 06-07 March 2025	Dr. T. Krishnakumar
29	International Women's Day 2025 Celebration	ICAR-CTCRI, Thiruvananthapuram 07 March 2025	All Staff
30	Global conference on Innovations to Impact: Gender Transformative Approach for Sustainable Agri-food System	ICAR-CIWA, Bhubaneswar 08-10 March 2025	Dr. K. Laxminarayana
31	First meeting of X RAC	ICAR-CTCRI, Thiruvananthapuram 10-11 March 2025	All Scientists
32	Webinar on Patents in Agriculture	National Research Institute for Integrated Pest Management, New Delhi 20 March 2025	Dr. H. Kesava Kumar

Participation of Staff Members in Scientific Events



33	Webinar on Copyrights	National Research Institute for Integrated Pest Management, New Delhi 21 March 2025	Dr. H. Kesava Kumar
34	Golden Jubilee Celebration of KVK, Mitraniketan, Vellnad, Thiruvananthapuram	KVK, Mitraniketan, Vellnad, Thiruvananthapuram 24 March 2025	Dr. S.S. Veena
35	DUS review meeting	PPVFRA at Plant Authority Bhawan, New Delhi 24-25 March 2025	Dr. C. Visalakshi Chandra Dr. S.N. Rahana
36	Board of Studies meeting of ICAR-IARI-IIHR, Bengaluru hub	25 March 2025	Dr. T. Makeshkumar
37	Meeting to discuss and finalize domain specific course for hosting on i-GOT Karmayogi platform	ICAR-CTCRI, Thiruvananthapuram 26 March 2025	Dr. Sheela Immanuel
38	Scientific Advisory Committee Meeting	ICAR-KVK, RVS, Urmelalagian, Tenkasi district Tamil Nadu 26 March 2025	Dr. R. Muthuraj
39	38 th Foundation Day celebrations of ICAR-CIFA	ICAR-CIFA, Bhubaneswar 01 April 2025	Dr. K. Laxminarayana
40	CVRC meeting for presentation of proposals for notification of varieties Sree Aadya (Arrowroot) and Sree Dhrona (White yam)	04 April 2025	Dr. K.I. Asha
41	3 rd Utkal Krishi Mela	Centurion University, Parlakhemundi, Gajapati, Odisha 07-08 April 2025	Dr. K. Laxminarayana
42	CGIAR Science Week	UN Headquarters in Nairobi, Kenya 07-12 April 2025	Dr. K.M. Senthilkumar
43	International seminar on New Horizons in Plant Sciences (NHPS 2025)	Department of Botany, University of Kerala, Kariyavattom, Thiruvananthapuram 08-10 April 2025	Dr. A. Asha Devi Dr. Shirly Raichal Anil
44	Webinar on Become a Smart Researcher: Essential Tips and Step-by-Step Guide to ONOS and Springer Nature Platforms (Online)	Springer India 17 April 2025	Dr. H. Kesava Kumar
45	Lecture on Multiple Genome Editing for vegetable Crop Improvement (Online)	Horticulture Division, ICAR, New Delhi 17 April 2025	Dr. S.N. Rahana
46	National workshop on Celebrating Tribal Ingenuity: Strategies for Protecting, Valuing, and Marketing Tribal Farmers' Varieties, Innovations and Geographical Assets	Regional Station, ICAR-CTCRI, Bhubaneswar, Odisha 01 May 2025	Dr. H. Kesava Kumar Dr. D. Jaganathan Dr. T. Krishnakumar
47	51 st IRC meeting of ICAR-CTCRI	ICAR-CTCRI, Thiruvananthapuram 05-07 May 2025	All Scientists
48	38 th Foundation Day of ICAR-CIWA	ICAR-CIWA, Bhubaneswar 13 May 2025	Dr. K. Laxminarayana
49	Webinar on Navigate the World of Scientific Article Writing: From Manuscript Structure to Publication (Online)	Springer India 15 May 2025	Dr. H. Kesava Kumar
50	Board of Studies meeting of ICAR-IARI-IIHR Bengaluru Hub	ICAR-IIHR, Bengaluru 15 May 2025	Dr. T. Makeshkumar

51	XXV Annual Group Meeting of ICAR-AICRP on Tuber Crops	Sri Konda Laxman Telangana Horticultural University, Rajendranagar, Hyderabad 19-20 May 2025	Dr. G. Byju Dr. G. Suja Dr. M.R. Sahoo Dr. J. Sreekumar Dr. A.N. Jyothi Dr. M. Nedunchezhiyan Dr. Susan John K. Dr. S.S. Veena Dr. Shirley Raichal Anil Dr. A. Asha Devi Dr. H. Kesava Kumar Dr. Kalidas Pati
52	Directors' & VC Conference	NASC Complex, PUSA campus, New Delhi 20 May 2025	Dr. T. Makesh Kumar
53	Symposium on Root and Tuber Crops Research and Development in India and South Asia	CIP, ICAR and Ministry of Agriculture and Farmers Welfare, Govt of India at The Oberoi Hotel, New Delhi 20 May 2025	Dr. P.S. Sivakumar
54	Inaugural meeting of Viksit Krishi Sankalp Abhiyan (VKSA 2025) (Online)	24 May 2025	Dr. Sheela Immanuel
55	Inaugural programme of Viksit Krishi Sankalp Abhiyan (VKSA 2025)	KVK, Puri, Odisha 29 May 2025	Dr. K. Laxminarayana
56	Regional Mango Diversity Show at CHES	CHES, ICAR-IIHR, Bhubaneswar 29 May 2025	Dr. K. Laxminarayana
57	VKSA Pre Kharif 2025	KVK, Thiruvananthapuram, Kerala 29 May 2025 to 02 June 2025	Dr. Sheela Immanuel Dr. S.S. Veena
58	VKSA Pre Kharif 2025	KVK Alappuzha, Kerala 29 May 2025 to 02 June 2025	Dr. K.I. Asha
59	VKSA Pre Kharif 2025	KVK, Trissur, Kerala 29 May 2025 to 02 June 2025	Dr. M.S. Sajeew Dr. Shirley Raichal Anil
60	VKSA Pre Kharif 2025	KVK, Pathanamthitta, Kerala 29 May 2025 to 02 June 2025	Dr. C. Mohan
61	VKSA Pre Kharif 2025	KVK, Kasaragod, Kerala 29 May 2025 to 02 June 2025	Dr. V. Ramesh
62	VKSA Pre Kharif 2025	KVK, Kollam, Kerala 29 May 2025 to 02 June 2025	Dr. A. Asha Devi
63	VKSA Pre Kharif 2025	KVK, Wayanad, Kerala 29 May 2025 to 02 June 2025	Dr. P.S. Sivakumar
64	VKSA Pre Kharif 2025	KVK Idukki, Kerala 29 May 2025 to 02 June 2025	Dr. E.R. Harish
65	VKSA Pre Kharif 2025	KVK, Kannur, Kerala 29 May 2025 to 02 June 2025	Dr. R. Muthuraj
66	VKSA Pre Kharif 2025	KVK, Kottayam, Kerala 29 May 2025 to 02 June 2025	Dr. Jeena Mathew
67	VKSA Pre Kharif 2025	KVK, Ernakulam, Kerala 29 May 2025 to 02 June 2025	Dr. S. N. Rahana
68	VKSA Pre Kharif 2025	KVK, Malappuram, Kerala 29 May 2025 to 02 June 2025	Dr. P. Prakash
69	VKSA Pre Kharif 2025	KVK, Rayagada, Odisha 29 May 2025 to 02 June 2025	Dr. Kalidas Pati Dr. Hanume Gowda Dr. R. Arutselvan
70	VKSA 2025	KVK, Rayagada, Odisha 03-07 June 2025	Dr. M. Nedunchezhiyan

Participation of Staff Members in Scientific Events



71	VKSA Pre Kharif 2025	KVK, Kollam, Kerala 03-07 June 2025	Dr. Susan John K.
72	VKSA Pre Kharif 2025	KVK, Kasaragod, Kerala 03-07 June 2025	Dr. V.S. Santhosh Mithra
73	VKSA Pre Kharif 2025	KVK, Kottayam, Kerala 03-07 June 2025	Dr. Saravanan Raju
74	VKSA Pre Kharif 2025	KVK, Palakkad, Kerala 03-07 June 2025	Dr. K. Sunilkumar
75	VKSA Pre Kharif 2025	KVK Kozhikode, Kerala 03-07 June 2025	Dr. H. Kesava Kumar
76	VKSA Pre Kharif 2025	KVK, Ernakulam, Kerala 03-07 June 2025	Dr. B.G. Sangeetha
77	VKSA Pre Kharif 2025	KVK, Kannur, Kerala 03-07 June 2025	Dr. T. Krishnakumar
78	VKSA Pre Kharif 2025	KVK Alappuzha, Kerala 08-12 June 2025	Dr. M. L. Jeeva
79	VKSA Pre Kharif 2025	KVK, Palakkad, Kerala 08-12 June 2025	Dr. J. Suresh Kumar
80	VKSA Pre Kharif 2025	KVK, Kozhikkode, Kerala 08-12 June 2025	Dr. C. Pradeepika
81	VKSA Pre Kharif 2025	KVK, Rayagada, Odisha 09-12 June 2025	Dr. K. Laxminarayana
83	Closing ceremony of Viksit Krishi Sankalp Abhiyan Pre Kharif 2025 (Online)	Surat, Gujarat 12 June 2025	All Scientists
84	National policy dialogue on Scaling up Biofortified Crops to Address Childhood Malnutrition in the Tribal Areas at Keonjhar under Rainbow Diet Campaign project.	18 June 2025	Dr. K. Laxminarayana
85	HH Sree Visakham Thirunal Endowment Lecture 2025	ICAR-CTCRI, Thiruvananthapuram 23 June 2025	All Scientists
86	VKSA final meeting (Online)	24 June 2025	Dr. Sheela Immanuel
87	ICAR- CTCRI Foundation Day	ICAR-CTCRI, Thiruvananthapuram 11 July 2025	All Scientists
88	Understanding the POSH Act 2013: Prevention, Prohibition and Redressal of Sexual Harassment at Workplace	ICAR-CTCRI, Thiruvananthapuram 14 July 2025	All Staff
89	Online training/workshop on Springer nature platforms for ONOS members	Springer India 15 July 2025	Dr. K. Sunilkumar
90	Symposium on Nematodes on the Move: Building Resilience and Sustainability Through International Collaboration and Better Policies (Online)	Society of Nematologists 15-16 July 2025	Dr. H. Kesava Kumar

91	ICAR-CTCRI-PepsiCo interface on Tuber Crops Value Chain Development for Snack Food Innovation	ICAR-CTCRI, Thiruvananthapuram 18 July 2025	Dr. G. Byju Dr. G. Suja Dr. T. Makeshkumar Dr. M.R. Sahoo Dr. M. Nedunchezhiyan Dr. M.S. Sajeev Dr. C. Mohan Dr. P.S. Sivakumar Dr. Saravanan Raju Dr. E.R. Harish Dr. C. Visalakshi Chandra Dr. J. Suresh Kumar Dr. T. Krishnakumar Dr. P. Prakash Dr. C. Pradeepika
92	Institutional Biosafety Committee meeting	21 July 2025	Dr. G. Byju Dr. T. Makeshkumar Dr. J. Sreekumar Dr. M. L. Jeeva Dr. K.M. Senthilkumar Dr. N. Krishna Radhika Dr. T.P. Sujatha
93	Genome Editing project review meeting	ICAR- IIHR, Bangaluru 23 July 2025	Dr. T. Makeshkumar
94	Meeting with Director, ICAR-ATARI, Zone XI, Bangaluru in connection with Viksit Bharat @ 2047 and Viksit Krishi Sankalp Abhiyan (VKSA)	ICAR-CTCRI, Thiruvananthapuram 26 July 2025	Dr. G. Byju Dr. P.S. Sivakumar Dr. D. Jaganathan
95	First half yearly meeting of TOLIC (Office - I), Thiruvananthapuram for the year 2025-26	PMG Office, Thiruvananthapuram 30 July 2025	Dr. A. Asha Devi
96	Inauguration of the Mass Sensitisation Programme of Kerala Climate Resilient Agri Value Chain Modernisation Programme (KERA) project	Hotel Dimora Thiruvananthapuram, Kerala 30 July 2025	Dr. G. Suja Dr. S. Sunitha Dr. V.S. Santhosh Mithra
97	Live web telecast of PM Kisan Samman Nidhi & Scientist -Farmer Interface on Improved Technologies of Tuber Crops (Online)	ICAR-CTCRI, Thiruvananthapuram 02 August 2025	All staff members
98	Meeting with DDG (Hort.) for Vision 2050 presentation	04 August 2025	Dr. T. Makeshkumar
99	UGC scholarship Nodal officers meeting (Online)	06 August 2025	Dr. T. Makeshkumar
100	Stakeholder workshop on identifying priority opportunity crops	MSSRF, Chennai 19-20 August 2025	Dr. V. Ramesh
101	State level seminar on Coconut and Tuber Crops Based Agrifood Systems for Resilience and Sustainable Income sponsored by Coconut Development Board, Kochi, Kerala	Krishi Vigyan Kendra, Kamrup, Assam 22 August 2025	Dr. G. Byju Dr. G. Suja Dr. D. Jaganathan
102	Meeting for preparation of detail cost norms of the vegetables, fruits, spices, aromatics and nurseries, etc. under MIDH (NHM) for the year 2025-26	Directorate of Horticulture, Krushi Bhavan, Bhubaneswar 22 August 2025	Dr. K. Laxminarayana

103	Meeting of the Board of Studies in Botany (UG)	University College, Thiruvananthapuram 22 August 2025	Dr. A. Asha Devi
104	Regional workshop on Climate Resilience in Agriculture under KERA Project	Forte Manor Hotel, Thiruvananthapuram 25 August 2025	Dr. D. Jaganathan Dr. P. Prakash
105	Institute Biosafety committee meeting at ICAR-NRC on Banana	ICAR-NRC, Trichy 28 August 2025	Dr. T. Makeshkumar
106	SeedGram 2025–2030: District-Level Inauguration and Distribution of planting materials, farm tools & equipments for Scheduled Caste Farmers under ICAR-AICRP on Tuber Crops	Cherthala, Kerala 29 August 2025	Dr. G. Byju Dr. G. Suja Dr. J. Sreekumar
107	Final Thesis Viva Voce of Miss. Minerva Majhi, M.Sc. (Ag) student	Department of Vegetable Science, College of Agriculture, OUAT, Bhubaneswar on 29 August 2025	Dr. K. Hanume Gowda
108	Final Thesis Viva Voce of Mr. Swaraj Swadhin Pradhan, M.Sc. (Ag) student	Department of Soil Science & Agricultural Chemistry, College of Agriculture, OUAT, Bhubaneswar on 29 August 2025	Dr. K. Laxminarayana
109	Final Thesis Viva Voce presentation of Mr. Chandra Sekhar Sethy, M.Sc. (Ag) student	Department of Vegetable Science, College of Agriculture, OUAT, Bhubaneswar on 30 August 2025	Dr. Kalidas Pati
110	State level workshop on 'Viksit Krishi Sankalp Abhiyan - Rabi 2025' (Online)	03 September 2025	Dr. Sheela Immanuel Dr. D. Jaganathan
111	Screening committee for scrutinization of new proposals under the State Plan Scheme 'Innovative Projects'	Krusha Bhavan, Bhubaneswar, Directorate of Horticulture, Govt. of Odisha 09 September 2025	Dr. K. Laxminarayana
112	Symposium on Scientific Insight: Pioneering Perspectives for signing of a MoU between 8 leading national institutes	Sree Chitra Tirunal Institute for Medical Sciences & Technology (SCTIMST), Thiruvananthapuram 10 September 2025	Dr. G. Byju Dr. G. Suja Dr. A.N. Jyothi Dr. S. Sivakumar
113	Discussion on Management of Horticultural Genetic Resources under CRP on Agro-Biodiversity for the Phase 2026-31 with a focus on characterizing and evaluating the germplasm conserved at ICAR-CTCRI (Online)	ICAR-IIHR, Bengaluru 11 September 2025	Dr. K.I. Asha
114	Workshop on Smart Krishi: Digital Yugathile Karshaka Munnattathinu	Panavoor, Thiruvananthapuram 12 September 2025	Dr. V.S. Santhosh Mithra
115	KSCSTE workshop on Sustainable Science and Technology solutions for Tribal Development at Aralam, Chaired group meeting on Livelihood through Agriculture Interventions.	Aralam wildlife sanctuary, Valayanchal, Kannur 12 September 2025	Dr. K. Sunilkumar
116	Mid Term Review Meeting of the XXVII ICAR Regional Committee-II (Online)	12 September 2025	Dr. K. Laxminarayana

117	Webinar on Nematode Genomics and Effectoromics- From Sex Determination to Host Manipulation (Online)	Young Nematologists Network 18 September 2025	Dr. H. Kesava Kumar
118	ICAR-CTCRI and CIP Scientists Interaction meeting	ICAR-CTCRI, Thiruvananthapuram 19 September 2025	Dr. G. Byju Dr. T. Makesh Kumar Dr. Shirley Raichal Anil Dr. G. Suja Dr. M.R. Sahoo Dr. A.N. Jyothi Dr. J. Sreekumar Dr. M. L. Jeeva Dr. S. Sunitha Dr. M.S. Sajeev Dr. E.R. Harish Dr. H. Kesava Kumar Dr. B.G. Sangeetha Dr. C. Pradeepika Dr. K.M. Senthilkumar Dr. P. Prakash
119	Kerala Biotechnology Council meeting	26 September 2025	Dr. T. Makesh Kumar
120	First AGM of All India Network Programme on Natural Farming	Agriculture University, Kota, Rajasthan 26-28 September 2025	Dr. G. Suja
121	Interaction meeting between ICAR-CTCRI officials and Government officials of Haryana (Online)	30 September 2025	Dr. Shirley Raichal Anil
122	Review meeting of the project, Germplasm Exchange, Improvement and Testing Advanced Clean Seed Technology in Cassava'	Biovarsity International & CIATA Alliance collaborative, New Delhi 06 October 2025	Dr. T. Makesh Kumar
123	DAESI programme	KVK, Kumarakom, Kottayam 06 October 2025	Dr. S. Sunitha
124	Meeting for discussing the laws and rules of biodiversity and ideas relating to conservation of biodiversity	KSBB, Thiruvananthapuram 07 October 2025	Dr. K.I. Asha Dr. A. Asha Devi
125	Live webcast of the address on the Launching of PM Dhan-Dhaanya Krishi Yojana and Mission for Aatmanirbharata in Pulses' (Online)	ICAR-IARI, New Delhi 11 October 2025	All Staff
126	Stakeholders Consultation Workshop	Sahakarana Bhavan, Thiruvananthapuram 14 October 2025	Dr. S. Sunitha
127	Policy consultation workshop on Wild Edibles with the Review meeting	KSCSTE, Sasthra Bhavan, Thiruvananthapuram 16 October 2025	Dr. K.I. Asha
128	Seminar on Eugene Garfield and the Science of Scientific Communication	KSCSTE, Pattom, Thiruvananthapuram 22 October 2025	Ms. B.S. Deepa
129	Review meeting of CRPVD project	ICAR-IVRI, Bengaluru 23-24 October 2025	Dr. T. Makesh Kumar
130	Second Stakeholders Consultation meeting (Online)	PPVFRA, New Delhi 26 October 2025	Dr. S.N. Rahana
131	Vigilance Awareness week 2025- Integrity pledge	ICAR-CTCRI 27 October 2025	All Staff

Participation of Staff Members in Scientific Events



132	Valedictory function of the vigilance awareness week 2025	ICAR-CTCRI 31 October 2025	All Staff
133	Rashtriya Ekta Diwas pledge and unity walk	ICAR-CTCRI 31 October 2025	All Staff
134	International conference on Libraries Empowering Communities: Global Perspectives	P.N. Panicker Foundation, Thiruvananthapuram 02-03 November 2025	Ms. B.S. Deepa
135	New Project Proposal meeting	KSBB HQ, Thiruvananthapuram 06 November 2025	Dr. K.I. Asha
136	11 th Indian Horticultural Congress and International Meet on Horticulture for Inclusive, Equitable and Sustainable Growth	Indian Academy of Horticultural Sciences, GKV, Bengaluru 06-09 November 2025	Dr. G. Byju Dr. P. Murugesan Dr. K.M. Senthilkumar Dr. T. Makeshkumar
137	Vande mataram, a solemn mass singing	07 November 2025	All Staff
138	Training for the ASRB exam	Multidata, Thiruvananthapuram 11 November 2025	Dr. P. Murugesan Dr. K.M. Senthilkumar
139	International symposium on Tropical Root & Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES)	ICAR-CTCRI, Thiruvananthapuram 17-21 November 2025	All Scientific and Technical staff
140	Stakeholder interface on Fostering Global Partnerships and Business Models for Tropical Tuber Crops (Harnessing science, partnerships, and enterprise for global impact)	ICAR-CTCRI and AgrInnovate India Ltd. 20 November 2025	All Scientific and Technical staff
141	Mid-term review meeting of AICRP on Tuber Crops	ICAR-CTCRI, Thiruvananthapuram 20 November 2025	Dr. H. Kesava Kumar
142	International scientific meeting on Global Cassava Breeding Network	ICAR-CTCRI, Thiruvananthapuram 21 November 2025	Dr. C. Visalakshi Chandra Dr. K.M. Senthilkumar
143	Sixth International Agronomy Congress	CSIR-NPL, New Delhi 24-26 November 2025	Dr. G. Suja
144	Annual meeting of the Board of Studies in Botany (UG)	University College, Thiruvananthapuram 27 November 2025	Dr. A. Asha Devi
145	International seminar on Climate–Weed Nexus: Innovations for Sustainable Farming (CWIS -2025)	College of Agriculture, Vellayani, Thiruvananthapuram, Kerala 27–28 November 2025	Dr. G. Suja Dr. S. Sunitha Dr. V. Ramesh Dr. V.S. Santhosh Mithra
146	Academic Council Meeting	CUSAT, Kochi 29 November 2025	Dr. K. Sunilkumar
147	Stakeholders meet on Climate Resilience in Agriculture under KERA Project	Hotel Appollo Dimora, Thiruvananthapuram 29 November 2025	Dr. D. Jaganathan Dr. P. Prakash
148	Meeting with ATARI, Bengaluru for planning state level workshop under VKSA (Online)	01 December 2025	Dr. Sheela Immanuel
149	Tuber Crops Day	ICAR-CTCRI 04 December 2025	All Staff
150	World Soil Day	ICAR-CTCRI 05 December 2025	All Staff
151	National Seminar on ‘Soil health: Challenges and strategies for urban agriculture’	College of Agriculture, Padannakkad 05 December 2025	Dr. K. Susan John

152	Hindi quarterly review meeting	ICAR-CTCRI 05 December 2025	Dr. A. Asha Devi Dr. H. Kesava Kumar
153	Online meeting to review progress of IGoT courses and development of domain IGoT courses under DARE/ICAR (Online)	05 December 2025	Dr. Sheela Immanuel
154	DG's meeting with scientists of ICAR Institutes (Online)	08 December 2025	All Scientists
155	National conference on Novel Strategies for Biotic Stress Management in Crop Plants	ICAR-NIBSM, Raipur 11-12 December 2025	Dr. T. Makesh Kumar
156	Brainstorming session on Artificial intelligence and its Applications in Agriculture and Agricultural Research' (Online)	NAAS, New Delhi 12 December 2025	Dr. V.S. Santhosh Mithra
157	Preparatory meeting for study visit of Parliamentary Standing Committee on implementation of POSH act (Online)	16 December 2025	Dr. G. Byju Dr. S.S. Veena
158	Swachhata Pakhwada 2025	ICAR-CTCRI, Thiruvananthapuram 16-31 December 2025	All Staff
159	Institutional Biosafety Committee meeting	18 December 2025	Dr. G. Byju Dr. T. Makesh Kumar Dr. J. Sreekumar Dr. K.M. Senthilkumar Dr. N. Krishna Radhika Dr. B.G. Sangeetha Dr. T.P. Sujatha
160	National conference on Transforming Plant Health Management: Integrating Traditional Practices with Modern Innovations for Global Food Security	IPS-SZ, PAJANCOA, Karaikal, Puducherry 18-19 December 2025	Dr. M.L. Jeeva
161	Scientific Advisory Committee meeting	KVK, Mitraniketan, Thiruvananthapuram 19 December 2025	Dr. Sheela Immanuel
162	Reinventing Web3 through AI in BlockHash LIVE 2025, the annual emerging technology summit	C-DAC Auditorium, Technopark, Phase I, Kerala Blockchain Academy 20 December 2025	Dr. V.S. Santhosh Mithra
163	Kisan Diwas 2025 and webcast of the address on Kisan Samman Diwas by the Hon'ble Union Agriculture and Farmer's Welfare Minister (Online)	23 December 2025	All Staff
164	Study visit of the Parliamentary Standing Committee on Empowerment of Women	Lemon Tree Premier, Thiruvananthapuram 29 December 2025	Dr. G. Byju Dr. S.S. Veena Sh. S. Bhadra Kumar
165	Review meeting of Hindi Cell, ICAR-CTCRI by Dr. Sudhakar Pandey (ADG, FVS & MP)	30 December 2025	Dr. A. Asha Devi

VISITS ABROAD

Dr. K.M. Senthilkumar, Senior Scientist, Division of Crop Improvement attended the three-month Short-Term Overseas training program in Genome editing under the mentorship of Dr. Leena Tripathi, Director, East African Hub, IITA, sponsored under the ICAR-Genome Editing Project in Horticultural Crops, funded by the Ministry of Agriculture and Farmers Welfare, Government of India from 20 March to 17 June 2025 (Fig. 103).

Dr. T.P. Sujatha, Scientist, Division of Crop Improvement attended the three-month Short-Term Overseas Training on Genome Editing titled ‘Application of CRISPR-Cas9 and CRISPR-Cas12a in crop plants’ at CIMMYT, Mexico, sponsored under the ICAR-Genome Editing Project in Horticultural Crops, funded by the Ministry of Agriculture and Farmers Welfare, Government of India from 28 March to 25 June 2025 (Fig. 106).

Dr. M.R. Sahoo, Head, Division of Crop Improvement attended the International Conference on Agriculture and Plantation Management at Wayamba University, Sri Lanka, held during 16-18 May 2025 for delivering the invited lecture (Fig. 105).

Dr. N. Krishna Radhika, Senior Scientist, Division of Crop Improvement attended the three-month Short Term Overseas training program in Genome editing under the mentorship of Dr. Leena Tripathi, Director, East African Hub, IITA, Kenya, sponsored under the ICAR-Genome Editing Project in Horticultural Crops, funded by the Ministry of Agriculture and Farmers Welfare, Government of India from 20 May to 15 August 2025 (Fig. 103).

Dr. J. Suresh Kumar, Scientist, Division of Crop Production attended as member of Tamil Nadu Irrigated Agriculture Modernization Project (TNIAMP) delegation visit to Kenya aimed at strengthening global partnerships in climate-resilient agriculture during 3-8 August 2025 (Fig. 104).



Fig. 103 Dr. N. Krishna Radhika and Dr. K.M. Senthilkumar at IITA East African Hub, Kenya



Fig. 104 Dr. J. Suresh Kumar with other members of Tamil Nadu Irrigated Agriculture Modernization Project at Kenya



Fig. 105 Dr. Manas Ranjan Sahoo making a presentation in the International Conference at Wayamba University, Sri Lanka



Fig. 106 Dr. T.P. Sujatha at CIMMYT, Mexico

DISTINGUISHED VISITORS

Headquarters, Thiruvananthapuram, Kerala

- Shri V. Muraleedharan, Former Union Minister of State for External Affairs and Parliamentary Affairs, Government of India
- Shri. S.K. Pathak, Joint Secretary, ICAR, Government of India
- Shri. Babu Jacob IAS, Former Chief Secretary, Government of Kerala
- Dr. Viswanathan Chinnusamy, Joint Director (Research), ICAR-Indian Agricultural Research Institute (IARI), New Delhi
- Dr. V. Arunachalam, Director, KSCSTE-Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI), Thiruvananthapuram, Kerala
- Shri. H. Dineshan IAS, Executive Director, Kerala State Kudumbashree Mission
- Dr. P.S. Indu, Professor of Community Medicine at Government Medical College, Kollam
- Shri. Shojo Lobo, Senior Official Language Manager, Canara Bank Circle Office, Thiruvananthapuram
- Shri. Rajendra Vishwanath Arlekar, Hon'ble Governor of Kerala
- Dr. Sanjay Behari, Director, Sree Chitra Thirunal Institute for Medical Sciences & Technology (SCTIMST), Thiruvananthapuram
- Dr. V. Venkatasubramanian, Director, ICAR-Agricultural Technology Application Research Institutes Zone-XI
- Dr. Neeraj Sharma, Country Manager, International Potato Centre (CIP)
- Dr. Mohinder Singh Kadian, Senior Scientist and Consultant, International Potato Centre (CIP)
- Adv. J. Sandhya, Secretary, Sakhi Women's Resource Centre, Thiruvananthapuram
- Dr. S.D. Shikhamany, Former Vice Chancellor, Dr. YSR Horticultural University, Andhra Pradesh.
- Dr. S.K. Pandey, Former Director, ICAR-Central Potato Research Institute, Shimla, Himachal Pradesh
- Dr. V.S. Korikanthimath, Former Director, ICAR-ICAR-Central Coastal Agricultural Research Institute, Goa

- Dr. Rakesh Pandey, Prof. Emeritus, Academy of Scientific and Innovative Research & CSIR-Central Institute of Medicinal and Aromatic Plants, Lucknow, Uttar Pradesh
- Dr. Jagan Mohan, DSW & Head, Food Science & Nutrition, National Institute of Food Technology, Entrepreneurship and Management, Thanjavur, Tamil Nadu
- Dr. V.A. Parthasarathy, Former Director, ICAR-Indian Institute of Spices Research, Kozhikode, Kerala
- Prof. Harihar Ram, Former Head, Department of Vegetable Science, G.B. Pant University of Agriculture and Technology, Pant Nagar, Uttarakhand
- Dr. George V. Thomas, Former Director, ICAR-Central Plantation Crops Research Institute, Kasaragod, Kerala
- Dr. Jayanta Tarafdar, Former Head, Department of Plant Pathology, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, West Bengal
- Dr. K. Muralidharan, Principal Scientist (Retd), ICAR-Central Plantation Crops Research Institute, Kasaragod, Kerala
- Dr. Kaushik Banerjee, Director, ICAR-National Research Centre for Grapes, Pune
- Er. Babu V., State Agricultural Engineer, Government of Kerala
- Dr. P.R. Jayan, Dean (Agrl. Engg.), Kelappaji College of Agricultural Engineering & Food Technology, Kerala Agricultural University, Tavanur, Malappuram, Kerala
- Dr. P.S. Sreekala, Director of the Kerala Knowledge Economy Mission, Thiruvananthapuram
- Dr. V. Shalom Gnana Thankom, Professor, Department of Environmental Science, University of Kerala, Thiruvananthapuram.
- Smt. K.R. Ranjini, Assistant Director (OL) and Member Secretary, Town Official Language Implementation Committee-I

Regional Station, Bhubaneswar, Odisha

- Dr. P. Panneerselvam, Principal scientist, ICAR-Central Rice Research Institute, Cuttack, Odisha

PERSONNEL

Scientific Staff

Head Quarters, Thiruvananthapuram

Dr. G. Byju	Director
Division of Crop Improvement	
Dr. Manas Ranjan Sahoo	Principal Scientist (Horticulture) & Head
Dr. P. Murugesan	Principal Scientist (Vegetable Science)
Dr. K.I. Asha	Principal Scientist (Economic Botany and PGR)
Dr. C. Mohan	Principal Scientist (Genetics and Plant Breeding)
Dr. A. Asha Devi	Principal Scientist (Genetics and Plant Breeding)
Dr. Shirley Raichal Anil	Principal Scientist (Genetics and Plant Breeding)
Dr. L.K. Bharathi	Principal Scientist (Vegetable Science)
Dr. N. Krishna Radhika	Senior Scientist (Agricultural Biotechnology)
Dr. T.P. Sujatha	Scientist (Agricultural Biotechnology)
Dr. S.N. Rahana	Scientist (Genetics and Plant Breeding)
Dr. C. Visalakshi Chandra	Senior Scientist (Genetics and Plant Breeding)
Dr. K.M. Senthilkumar	Senior Scientist (Agricultural Biotechnology)
Division of Crop Production	
Dr. G. Suja	Principal Scientist (Agronomy) & Head
Dr. K. Susan John	Principal Scientist (Soil Science)
Dr. S. Sunitha	Principal Scientist (Agronomy)
Dr. K. Sunil Kumar	Principal Scientist (Vegetable Science)
Dr. V. Ramesh	Principal Scientist (Soil Science)
Dr. R. Muthuraj	Principal Scientist (Seed Science and Technology)
Dr. Saravanan Raju	Principal Scientist (Plant Physiology)
Dr. Jeena Mathew (w.e.f 13.01.2025)	Senior Scientist (Soil Science)
Dr. J. Suresh Kumar	Scientist (Vegetable Science)
Division of Crop Protection	
Dr. T. Makeshkumar	Principal Scientist (Plant Pathology) & Head
Dr. M.L. Jeeva	Principal Scientist (Plant Pathology)
Dr. S.S. Veena	Principal Scientist (Plant Pathology)
Dr. E.R. Harish	Senior Scientist (Agricultural Entomology)
Dr. H. Kesava Kumar	Senior Scientist (Nematology)
Dr. B.G. Sangeetha	Senior Scientist (Agricultural Biotechnology)
Section of Crop Utilization	
Dr. A.N. Jyothi	Principal Scientist (Agricultural Chemicals) & Scientist in Charge
Dr. M.S. Sajeev	Principal Scientist (Agricultural Structures & Process Engineering)
Dr. Pradeepika Chintha	Scientist (Vegetable Science)
Dr. T. Krishnakumar	Scientist (Agricultural Structures & Process Engineering)
Section of Extension and Social Sciences	
Dr. J. Sreekumar	Principal Scientist (Agricultural Statistics) & Scientist in charge
Dr. Sheela Immanuel	Principal Scientist (Agricultural Extension)
Dr. V.S. Santhosh Mithra	Principal Scientist (Computer Application in Agriculture)
Dr. P. Sethuraman Sivakumar	Principal Scientist (Agricultural Extension)
Dr. D. Jaganathan	Senior Scientist (Agricultural Extension)
Dr. P. Prakash	Scientist (Agricultural Economics)

Technical Staff

Smt. N. Sujatha Kumari	Chief Technical Officer
Dr. L.S. Rajeswari (VRS 29.01.2025)	Chief Technical Officer
Shri. A. Madhu	Chief Technical Officer
Shri. M. Kuriakose	Chief Technical Officer
Shri. V.R. Sasankan (Rtd.30.04.2025)	Assistant Chief Technical Officer
Shri. B. Renjith Kishor	Assistant Chief Technical Officer
Shri. V.S. Sreekumar	Assistant Chief Technical Officer
Shri. A.S. Manikuttan Nair (Rtd.28.02.2025)	Technical Officer
Shri. G. Suresh	Technical Officer
Dr. S. Shanavas (Deputation wef 18.03.2024)	Technical Officer
Dr. B.S. Prakash Krishnan	Technical Officer
Shri. G. Shajikumar	Technical Officer
Smt. B.S. Deepa	Technical Officer
Shri. L. Luke Armstrong	Senior Technical Assistant
Dr. S. Karthikeyan	Senior Technical Assistant
Shri. K. Sunil	Senior Technical Assistant
Dr. P.S. Shameer	Technical Assistant
Shri. B. Satheesan	Technical Assistant
Shri. D.T. Rejin	Senior Technician
Shri. T.M. Shinil	Senior Technician
Shri. T. Manikantan Nair	Senior Technician
Shri. R. Ajithkumar (w.e.f 16.10.2025)	Senior Technician
Shri. K. Chandran	Technician
Smt. S.S. Sneha	Technician
Smt. R. Nijamol	Technician
Shri. Sreenath Vijay	Technician
Smt. Rini Alocious	Technician
Ms. Pooja Krishnan	Technician
Ms. L. Sreelakshmi	Technician

Administrative Staff

Shri. S. Bhadra Kumar	Senior Administrative Officer
Smt. Jessymol Antony	Senior Finance and Accounts Officer (i/c)
Shri. J. Unni	Assistant Administrative Officer
Shri. S. Sasikumar	Private Secretary
Smt. L. Saritha	Personal Assistant
Smt. S. Sunitha	Personal Assistant
Shri. R.S. Adarsh	Assistant
Shri. S. Sreeni Nair	Assistant
Shri. Ashish V.	Assistant
Shri. P. Rajesh (Deputation w.e.f 23.04.2025)	Assistant
Smt. D. Shimla (Deputation w.e.f 23.04.2025)	Assistant
Shri. P.H. Shinaj (Deputation w.e.f 23.04.2025)	Assistant
Smt. V. Sajitha Kumari (Deputation w.e.f 23.04.2025)	Assistant
Smt. Seeja Vijayan (Deputation w.e.f 23.04.2025)	Assistant
Shri. C. Chandru	U. D. C.
Shri. N. Jayachandran	U. D. C.
Smt. C.G. Chandra Bindu	U. D. C.
Smt. Rohini K. Nair	U. D. C.

Shri. D. Arun Raj	U. D. C.
Shri. Stiphin George	L. D. C.
Smt. S. Anjitha	L. D. C.

Canteen Staff

Shri. S. Radhakrishnan Nair (Rtd. 31.05.2025)	Multi-Tasking Staff
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Multi-Tasking Staff

Shri. G. Madhu	Multi-Tasking Staff
Shri. K. Sivadas (Rtd. 31.12.2025)	Multi-Tasking Staff
Shri. L. Samynathan	Multi-Tasking Staff
Shri. S. Sreekumaran	Multi-Tasking Staff
Smt. C.P. Gayathri	Multi-Tasking Staff
Shri. S. Abhishek	Multi-Tasking Staff
Smt. S.L. Jyothi	Multi-Tasking Staff
Smt. P. Vidhya	Multi-Tasking Staff
Shri. S. Sudhish	Multi-Tasking Staff
Shri. P. Aswin Raj	Multi-Tasking Staff
Smt. V.S. Remya	Multi-Tasking Staff
Smt. R. Anuja	Multi-Tasking Staff
Shri. N. Shiju	Multi-Tasking Staff

Regional Station, Bhubaneswar**Scientific Staff**

Dr. M. Nedunchezhiyan (wef 11.04.2025)	Principal Scientist (Soil Science) & Scientist in Charge
Dr. K. Laxminarayana	Principal Scientist (Agronomy)
Dr. KalidasPati	Senior Scientist (Vegetable Science)
Dr. Vijay Bahadur Singh Chauhan (Transferred w.e.f. 24.01.2025)	Scientist (Vegetable Science)
Shri. K. Hanume Gowda	Scientist (Vegetable Science)
Dr. R. Arutselvan	Scientist (Plant Pathology)

Technical Staff

Shri. Bibhuti Bhusan Das	Senior Technical Officer
Shri. Pramod Kumar Mati (Rtd. 31.07.2025)	Technical Officer
Shri. Sushanta Kumar Jata	Technical Officer
Shri. Keshab Paikaray	Senior Technician
Shri. Amit Kumar Dangi (w.e.f 21.02.2025)	Technician
Shri. Ketu Dandapani Reddy (w.e.f 21.02.2025)	Technician

Administrative Staff

Shri. A. Lakshmana Rao	Assistant Administrative Officer
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Multi-Tasking Staff

Shri. Prakash Kumar Nayak	Multi-Tasking Staff
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GENDER MAINSTREAMING AND WOMEN EMPOWERMENT

ICAR-Central Tuber Crops Research Institute (CTCRI), Thiruvananthapuram, continued to promote gender equity and women empowerment through gender-responsive research, technology development and capacity-building initiatives during 2025. The Institute maintained a gender-inclusive work environment with women constituting a substantial proportion of its scientific, technical, administrative and academic community. Women accounted for nearly 60% of the postgraduate and doctoral students pursuing research at the Institute, reflecting its commitment to fostering women's participation in agricultural science and research.

The Institute implemented an extensive programme of farmer capacity building, organizing 112 training programmes under Institute, SCSP, TSP and MIDH/NEH schemes. These programmes benefited 8,784 farmers, including 5,070 women, demonstrating the Institute's strong emphasis on enhancing women's knowledge, skills and entrepreneurial capabilities in tuber crop production, value addition and post-harvest management. A dedicated training programme was also conducted exclusively for 35 women farmers to strengthen their technical competencies and promote income-generating opportunities.

Gender-responsive research remained a key focus area. During the year, the Institute pursued 12

ongoing and completed 10 research projects related to gender issues. An institute-funded project entitled 'Empirical assessment of tuber crops value addition technologies on the livelihood of women' was initiated to assess the adoption, impact and livelihood outcomes of value-addition technologies among women. In addition, six postgraduate and doctoral dissertations by women scholars were completed on frontier areas of tuber crop research.

Significant progress was achieved in the development and promotion of women-friendly technologies. Sixteen technologies, primarily focusing on value-added food products, nutritionally enriched processed foods, precision farming tools and smart agricultural devices, were identified as women-friendly. Four technologies were assessed and two technologies were refined for gender responsiveness, facilitating greater drudgery reduction, value addition and entrepreneurship among rural women.

The Institute further strengthened gender-inclusive institutional mechanisms by continuing the development of a gender-disaggregated database on women's empowerment in tuber crop cultivation and establishing 'She Space', a dedicated facility to promote a safe, inclusive and supportive workplace for women. These initiatives underscore ICAR-CTCRI's commitment to integrating gender perspectives into research, extension and institutional development, thereby contributing to inclusive and sustainable agricultural growth.

Institute/Organization gender factsheet

Year	2025
Institute name	ICAR- Central Tuber Crops Research Institute

1. Staff details as on 31st December 2025

Staff category	Male	Female	Other	Total
RMP	01	00		01
Project Coordinators/ Heads of Divisions/ Heads of Regional Stations	03	01		04
Scientific	23	16		39
Technical	25	07		32
Administrative	22	14		36

2. Academic & Research (Students enrolled)

Category	Male	Female	Other	Total
UG	00	00		00
PG	01	06		07
M. Phil	00	00		00
Ph.D.	02	03		05
Others (specify)	00	00		00

3. Academic & Research (Students passed out)

Category	Male	Female	Other	Total
UG	03	22		25
PG	05	23		28
M. Phil	00	00		00
Ph.D.	00	01		01
Others (specify)	00	00		00

Research and extension activities

Activity description	Total (No.s)	Gender related (No.s)
4. Research projects (completed)	45	10
5. Research projects (ongoing)	67	12
6. Research articles published	56	02
7. Thesis/Dissertation	28	06
8. Technologies developed	30	14
9. Technologies assessed for gender responsiveness	04	04
10. Technologies refined for gender responsiveness	02	02

11. Trainings and capacity building programmes conducted

Programme category	Total (No.s)	Women (No.s)
a. for Farmers (Male/Female)	30 (Male- 492, Female- 633)	05
b. for Farmers (exclusively for women farmers)	01 (35)	01(35)
c. for Scientists	00	00
d. for Technical staff	00	00
e. for Administrative staff	00	00

12. Number of Institute staff trained (HRD) (staff who have attended at least one training)

Staff category	Men	Women	Other	Total
Scientists trained	27	17		44
Technical staff trained	25	07		32
Administrative staff trained	22	14		36

Budget details

13. Annual Budget (₹. in Lakh)	732.50
14. Budget Utilized (₹. In Lakh)	732.50
15. Gender Budget (₹. In Lakh)	-
16. Gender Budget Utilized (₹. In Lakh)	-
Total budget utilization	100.00%
Gender budget utilization	0.00%

17. Details of training and capacity building programmes for farmers (male/female)

Source of fund	Duration (days)	Total trainings	Men	Women	Other	Total farmers	Female (%)
Institute/Organization	Day 1	72	1309	1601	0	2910	55.0
Institute/Organization	Day 2	5	40	51	0	91	56.0
Institute/Organization	Day 3-4	03	37	46	0	83	55.4
Institute/Organization	Day 5-9	07	53	75	0	128	58.6
MIDH	Day 1	13	610	248	0	858	28.9
NEH	Day 1	5	185	500	0	685	73.0
NEH	Day 2	2	18	37	0	55	67.3
SCSP	Day 1	13	654	405	0	1059	38.2
SCSP	Day ≥ 10	7	3	4	0	7	57.1
TSP	Day 1	20	1385	2135	0	3520	60.7
TSP	Day 2	3	48	25	0	73	34.2
TSP	Day ≥ 10	3	1	2	0	3	66.7

18. Research projects related to women/gender

Project No.	Title	Objectives	Duration from	Duration to	Budget (₹ In lakh)
1.	Empirical assessment of tuber crops value addition technologies on the livelihood of women	i. To delineate the profile characteristics of women and youth involved in tuber crops value addition. ii. To determine the extent of adoption of value-addition technologies disseminated to women and youth through training. iii. To assess the impact of these technologies on the livelihood transformation of women and youth. iv. To ascertain the constraints and devise strategies to enhance adoption of value addition technologies.	2025	2028	Institute project

19. List of thesis/dissertation

Sl. No.	Title	Degree awarded	Year
1.	Computer Vision-based Classification of Post-Harvest Physiological Deterioration in Cassava Using Deep Learning Models (Krishnendu Asok)	M.Sc.	2025
2.	Physico Chemical and Sensory Characterization of Vegan Kulfi Developed from Orange Sweet Potato (Adithya N.T.)	M.Sc.	2025
3.	Characterization of Purple Sweet Potato Based Vegan Kulfi: Physico Chemical and Sensory Attributes (Sneha A.S.)	M.Sc.	2025
4.	Comparative Study on Physico Chemical and Functional Properties of Cassava Starch from Short and Long Duration Cultivars (Adithya K.)	M.Sc.	2025
5.	Development of Air Fried Chips from Tannia (<i>Xanthosoma sagittifolium</i>) Tubers (Nitha)	M.Sc.	2025
6.	Eco-friendly Management of Greater Yam Anthracnose Employing Endophytes. (Amrutha P.R.)	Ph.D.	2025

20. Women friendly technologies developed/refined

Title
Electronic Crop - An IoT Device for Smart Farming
Fried Snack Foods and Fried Chips from Cassava
Functional Pasta from Cassava/Sweet Potato
Functional Noodles from Sweet Potato/Cassava
Ready-to-cook Food Products from Sweet Potato
Fried Snack Foods from Sweet Potato
Technology for Sweet Potato Jelly
Functional Bakery Products from Sweet Potato
Quick Cooking Dehydrated Tubers of Tuber Crops
Anthocyanin and β -carotene Rich Sweet Potato Kulfi
Anthocyanin and Beta carotene Rich Sweet Potato Low Calorie Gummies
Sweet Potato-Millet Choco Filled Cookies
β -carotene Containing Sweet Potato Muffins
Micronutrient Foliar Formulations for SSNM of Tropical Tuber Crops
Fried Snack Foods from Cassava
AI-based Soil Moisture Sensor for Precision Agriculture and Input Optimization

21. List of gender disaggregated databases developed

N/A

22. Specific facilities (hostels, crèche, skill development centre, etc. for women)

She Space with all basic facilities for women

23. Other significant information/ achievements

N/A

POSH & WOMEN'S WELFARE

International Women's Day

International Women's Day was celebrated at ICAR-CTCRI with various programmes. Dr. P.S. Sreekala, Director of the Kerala Knowledge Economy Mission, Thiruvananthapuram was the chief guest and delivered the Women's Day speech on the focal theme 'Accelerate Action' for gender equality. She emphasized the role of farm women in many revolutionary movements in

Kerala and the importance of financial independence and education in bridging the gender gap. Dr. G. Byju, Director, ICAR-CTCRI presided over the meeting. Progressive tuber crop farmer, Smt. P. Thahira, along with five scientists and five students who excelled in various research activities during the year 2024 were felicitated on the occasion. Cultural programmes, painting exhibition, and various competitions such as essay writing, collage-making and portraying women achievers of India added vibrancy to the celebration.



7th Poshan Pakhwada

The 7th Poshan Pakhwada was celebrated at ICAR-CTCRI, Sreekariyam, Thiruvananthapuram, from 8-23 April 2025. Key activities included, awareness visits to Anganwadis, a Healthy Food Exhibition conducted in collaboration with 33 Anganwadis,

interactive awareness classes and demonstration-cum-class sessions at Anganwadi centres and a keynote address on 'Anaemia Mukta Bharat: Role of Individuals and Communities' was delivered by Dr. P.S. Indu, Professor of Community Medicine, Government Medical College, Kollam.



Talk on understanding the POSH Act 2013: Prevention, prohibition & redressal of sexual harassment at workplace

The Institute organised a talk on 'Understanding the POSH Act 2013: Prevention, prohibition &

redressal of sexual harassment at workplace' on 14 July 2025. The talk was delivered by Adv. J. Sandhya, Secretary, Sakhi Women's Resource Centre, Thiruvananthapuram and member, Internal Complaints Committee of ICAR-



Talk on understanding the POSH Act 2013: Prevention, prohibition & redressal of sexual harassment at workplace

The Institute organised a talk on 'Understanding the POSH Act 2013: Prevention, prohibition & redressal of sexual harassment at workplace' on 14 July 2025. The talk was delivered by Adv. J. Sandhya, Secretary, Sakhi Women's Resource Centre, Thiruvananthapuram and member, Internal Complaints Committee of ICAR-CTCRI. The talk enlightened the staff and students on legal background of the POSH act, kind of behaviour, which can come under sexual harassment, clarity to the terms, 'workplace' and 'aggrieved woman', three pillars of POSH act, complaint and enquiry process, employer's responsibilities, rights and responsibilities of employees, penalties for false complaints and building a safe and respectful workplace.

Study visit of the Parliamentary Standing Committee on Empowerment of Women

The study visit of the Parliamentary Standing Committee on Empowerment of Women (2025–

2026) to Thiruvananthapuram was held during 29-30 December 2025. The meeting was chaired by Dr. D. Purandeswari, Hon'ble Member of Parliament and Chairperson of the Committee.

Dr. G. Byju, Director, ICAR-CTCRI, presented a detailed overview covering women in key decision-making positions, constitution and functioning of the Internal Committee, and initiatives for ensuring a safe, respectful and inclusive work place, including women welfare measures. Based on the interactions and responses to queries, the Committee expressed satisfaction with the measures adopted by the Institute for implementation of the POSH Act, 2013 and awarded a Certificate of Satisfaction to the Institute.



OTHER INFORMATION

Stakeholders interface meeting-cum-workshop

A Stakeholders Interface Meeting-cum-Workshop on 'Leveraging Innovation Ecosystems for Building Sustainable Tuber Crops Entrepreneurship in India' was organized at ICAR-CTCRI on 09 January 2025. Dr. S.D. Shikhamany, Chairman, QRT, ICAR-CTCRI inaugurated the Technology Pavilion and stakeholders meeting. About 146 participants comprising officials from M/s SVM Tapioca Pvt. Ltd., M/s Precision Grow, Reliance Retail Kerala, and Kudumbasree, along with representatives from Swiggy, VFPC, FPOs, NGOs, SHGs, government departments, farmers and students attended the programme. A Technology Pavilion was set up alongside the event which attracted significant attention of the visitors.

Farmers' seminar on Tuber Crops

A State level farmers' seminar on 'Tuber crops' was organized at Purulia, West Bengal under Tribal Subplan on 21 January 2025 as part of ICAR-CTCRI's new initiative of area expansion of tuber crops in non-traditional areas. Dr. G. Byju, Director, ICAR-CTCRI inaugurated the seminar. Considering their climate analogous suitability as well as potential for value addition, cassava and sweet potato were introduced for the first time here and among the tribal farmers. M/s Aati Pual Mushroom Pvt. Ltd.; CEO of ABI of IIT, Kharagpur and other government organizations collaborated with this maiden attempt.

Quinquennial Review meeting

The Quinquennial Review Team-VIII of ICAR-CTCRI submitted its final report to Dr. Himanshu Pathak, Secretary, DARE & DG, ICAR at New Delhi on 10 February 2025. Dr. S.D. Shikhamany, Chairman, QRT; Dr. G. Byju, Director, ICAR-CTCRI and Dr. G. Suja, Member Secretary, QRT were present.

National brainstorming workshop on 'Tuber crops mechanization: Status, challenges and strategic vision for food security and sustainability'

The ICAR-CTCRI organized a National brainstorming workshop on 'Tuber crops mechanization: Status, challenges and strategic vision for food security and sustainability' on 21 February 2025 to assess the status of mechanization in tuber crops, discuss the challenges stakeholders face in adopting these technologies and create a strategic vision for promoting mechanization.

The workshop aimed to identify research priorities and areas for innovation to address the mechanization needs of tuber crops, ultimately promoting food security, sustainability and improved farmers' livelihoods. The workshop was inaugurated by Prof. V. Palanimuthu, Director, NIFTEM-T, Thanjavur, Tamil Nadu, in the presence of Dr. R.K. Vishwakarma, Project Coordinator, AICRP on Post Harvest Engineering and Technology, CIPHET, Ludhiana, Punjab; Er. V. Babu, State Agricultural Engineer, Govt. of Kerala, Dr. P.R. Jayan, Dean (Agrl. Engg.), Kerala Agricultural University and Dr. T. Makeshkumar, Director (i/c), ICAR-CTCRI.

During the inaugural address, Dr. V. Palanimuthu urged the need for mission mode projects on mechanization needed for small and marginal tuber crops land holdings. Promotion of custom hiring of machinery by departmental agencies is the only solutions for the widespread availability of machinery which helps in reducing production and processing costs. Dr. M.S. Sajeer, Principal Scientist, welcomed the gatherings and Dr. T. Krishnakumar, Scientist, proposed vote of thanks.

Tribal connect programme in collaboration with Kerala Forest Department

A programme on 'Tribal connect: Transformation of tribal food basket by strengthening tuber crops based agri-food system in Marayoor tribal settlements, Idukki' was organized at ICAR-CTCRI in collaboration with Kerala Forest Department on 28 February 2025. The programme was inaugurated by Dr. V. Shalom Gnana Thankom, Professor, Department of Environmental Science, University of Kerala, Thiruvananthapuram. In her inaugural speech, she emphasized the importance of tuber crops under the changing climate. Dr. G. Byju, Director, ICAR-CTCRI, in his presidential address, highlighted the role of tuber crops in improving the livelihood and empowering tribal community. Sh. V.R. Sreekumar, Deputy Range Forest Officer, Marayoor Range, explained about the interventions of forest department in conserving the traditional varieties and improving livelihood of tribal communities along with conserving the forests of Marayoor. During the programme, Dr. G. Byju, Director felicitated Smt. Lekshmi, Oonjamparakudi, Marayoor, for her efforts in conserving more than 40 varieties of yams and obtaining the first 'Stree Sakthikarana' puraskaram of Women's Commission of Kerala. The inaugural programme was followed by a technical session on scientific cultivation of tuber crops and value addition

followed by interaction with scientists. The farmers visited ICAR-CTCRI farms and Techno-Incubation Centre of ICAR-CTCRI.

1st Meeting of X Research Advisory Committee

The 1st Meeting of the X Research Advisory Committee (RAC) was held during 10-11 March 2025 at ICAR-CTCRI, Thiruvananthapuram. The inaugural session of the meeting was held on 10 March 2025 under the chairmanship of Dr. V.A. Parthasarathy, Former Director, ICAR-Indian Institute of Spices Research & Chairman, RAC. The RAC members, Prof. Hari Har Ram, Dr. George V. Thomas, Dr. Jayanta Tarafdar, Dr. K. Muralidharan, Dr. Sudhakar Pandey (virtual mode) and Dr. Rashmi Singh (virtual mode) attended the meeting. The meeting started with a welcome address by Dr. G. Byju, Director, ICAR-CTCRI. He presented the activities and achievements (2024-25) of the Institute. This was followed by release of publications and presentation of action taken report of the recommendations of the third meeting of IX RAC, by the Member Secretary. This was followed by technical sessions, where the megaproject leaders presented the salient achievements of eight Institute megaprojects. All the recommendations were discussed and approved by the committee.

Farmers' workshop on Precision Farming

A farmers' workshop was organized in collaboration with Panavoor Grama Panchayat and Anad Farmers' Cooperative Society, at Panavoor grama panchayat office on 09 April 2025 to make the farmers familiar with e-Crop based smart farming, which is being implemented in this panchayat. The workshop was inaugurated by Smt. S. Mini, the president of the Panavoor Grama Panchayat. Dr. V.S. Santhosh Mithra, Principal Scientist, ICAR-CTCRI, took class on the topic 'Smart Krishi: Digital Yugathile Karshaka Munnettathinu'. The details of the project were explained and 80 farmers participated in the workshop.

National workshop on Celebrating Tribal Ingenuity

On the occasion of World Intellectual Property Day, the Regional Station of ICAR-CTCRI, Bhubaneswar organised a National workshop on 'Celebrating tribal ingenuity: Strategies for protecting, valuing, and marketing tribal farmers' varieties, innovations and geographical assets', in hybrid mode on 01 May 2025. The focus of the workshop was to sensitise the

participants on the legal framework for protection and commercialisation of tribal innovations including varieties, local knowledge and GI. Dr. G. Byju, Director, ICAR-CTCRI inaugurated the workshop. Dr. Shreenivas Desai, Professor (GPB), UAS Dharwad and Former Registrar, PPV&FR Authority, Government of India, New Delhi; Dr. Kavitha Chalakkal, Assistant Professor, Inter University Centre for IPR Studies (IUCIPRS), Cochin University of Science and Technology, Kochi, Kerala; Mr. S. Ravi, Patents, Trademarks and GI Attorney, BizRights, Hyderabad; Dr. R.K. Ravikumar, Scientist F and Head, VARD National Innovation Foundation, Gujarat and Dr. P.S. Sivakumar, Principal Scientist, ICAR-CTCRI delivered classes on legal aspects related to protection of plant varieties and other biological resources. A total of 172 academics, researchers, entrepreneurs, farmers and students took part in the programme.

Farmers' seminar and distribution of farm tools under AINP-OF

A Farmers seminar and distribution of farm tools' was organized at Parakkode Block, Pathanamthitta on 13 June 2025 under All India Network Project on Organic Farming (AINP-OF). Parakkode block panchayat president Smt. M.P. Maniyamma inaugurated the farmers' seminar and distributed water tanks and 'Arbana' for transport of inputs and farm produce to 20 selected scheduled caste farmers. Planting materials of Sree Annam and Sree Manna (cassava), Sree Kanaka (sweet potato) and Sree Aadya (arrowroot) were distributed. Director Dr. G. Byju delivered the keynote address in the programme. Dr. G. Suja, Dr. S.S. Veena, Shri. B. Satheesan and Shri. D.T. Rejin participated. ICAR-CTCRI has been handholding about 200 SC farmers of Parakkode block during the last four years in tuber crops value chain improvement by investing about ₹ 1 crore under institute SCSP and AINP-OF projects.

Launching workshop on Climate Resilient Agri-Food Systems

A launching workshop on 'Climate resilient agri-food systems integrating biofortified sweet potato for sustainable livelihoods in Mayurbhanj district of Odisha' was organized at Kasiabeda village, Kusumi Tehsil, Mayurbhanj district, Odisha on 17 June 2025, which was sponsored by NABARD Regional office, Bhubaneswar. Dr. G. Byju, Director, ICAR-CTCRI was the chief guest. Sh. S.K. Talukdar, Chief General Manager, NABARD, Bhubaneswar; B.B. Mohanty,

AGM, NABARD, Bhubaneswar; S. Mohanty, DDM, NABARD, Mayurbanj; T. Kalo, Deputy Director of Horticulture, Mayurbanj; Dr. (Mrs.) P. Mohanty, Secretary, SAMBANDHNGO (implementing partner); Dr. M. Nedunchezhiyan and Dr. K. Laxminarayana attended. About 220 farmers, mostly Santal tribe, participated in the workshop.

National policy dialogue on scaling up of biofortified crops

The ICAR-CTCRI in collaboration with Horticulture Department, Keonjhar, KIIT, Bhubaneswar and NISER, Bhubaneswar organised a National Policy Dialogue on ‘Scaling up biofortified crops for addressing childhood malnutrition in tribal areas’ at Keonjhar, Odisha on 18 June 2025. The objective of this dialogue was to bring together eminent professionals from across India with extensive experience in planning and implementing nutritional interventions using biofortified crops to combat malnutrition and micronutrient deficiencies. The programme was inaugurated by Shri. Sanjay Kumar Talukdar, Chief General Manager, NABARD RO, Bhubaneswar in the presence of Dr. G. Byju, Director, ICAR-CTCRI, Thiruvananthapuram; Shri. Soumendra Narayan Panigrahi, Deputy Director of Horticulture watershed, Keonjhar; Dr Chandan Goswami, Professor NISER; Dr. Joseph John, Professor, AIIMS, Bhubaneswar and Dr. E. Venkata Rao, Professor, IMS and SUM Hospital, Bhubaneswar. Eminent resource persons like Mr. Binu Cherian, Country Manager, India, HarvestPlus; Dr. Sourav Bhattacharjee, Nutrition Specialist, UNICEF, Odisha; Dr. Rasmi Avula, Research Fellow, IFPRI; Dr. Srinivasalu Rajendran, Agricultural Economist, CIP, Uganda; Dr. Krishnendu Chattopadhyay, Principal Scientist, ICAR-NRRI, Cuttack and Dr. Gopal Chowdhary, Associate Professor, KIIT shared their experiences in scaling up biofortified crops. Over 420 stakeholders including scientists, academics, government agencies, students, farmers from various parts of Odisha and India took part in this event.

H. H. Sree Visakham Thirunal Endowment Lecture

The Indian Society for Root Crops (ISRC), in association with ICAR-CTCRI, organized the H.H. Sree Visakham Thirunal Endowment Lecture on 23 June 2025, spotlighting recent advancements in agricultural biotechnology. Dr. G. Byju, Director, ICAR-CTCRI, in his presidential address, emphasized the crucial role of tuber crops in

ensuring food and nutritional security - from the era of the Travancore kingdom to modern-day India. He highlighted the Institute's continued dedication to research and development in tuber crops. Dr. V. Arunachalam, Director, KSCSTE-Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI) was the Guest of Honour. He spoke about the significant potential of tuber crops in fighting malnutrition and stressed the use of genome editing to improve crop yield and quality.



Inaugural event of H.H. Sree Visakham Thirunal Endowment Lecture 2025

Dr. Viswanathan Chinnusamy, Joint Director (Research), ICAR-Indian Agricultural Research Institute (IARI), New Delhi delivered the endowment lecture. He led the development of the world's first genome-edited rice seed, Pusa DST Rice 1. His lecture, titled ‘Genome editing: India’s trailblazing path to the first edited rice variety’ highlighted how this innovation aligns with India's sustainable development goals. He also projected that within the next 5-6 years, several genome-edited agricultural crops would be ready for large-scale cultivation. Dr. T. Makeshkumar, Secretary, ISRC, delivered the welcome address. The event concluded with a vote of thanks by Dr. H. Kesava Kumar, Joint Secretary, ISRC. The program was conducted in hybrid mode. More than 300 participants attended the program, including the scientists and staff of ICAR-CTCRI, students from Kerala Agricultural University, Kerala University and Loyola School.

62nd Foundation Day celebrations

Sh. Rajendra Vishwanath Arlekar, Hon’ble Governor of Kerala inaugurated the 62nd Foundation Day celebrations of ICAR-CTCRI on 11 July 2025. While addressing the gathering, he emphasized the growing importance of Natural Farming as a sustainable agricultural practice. He opined that all the innovations and research results should reach the farmers and should have a human touch. Tuber crops

can be an important component in doubling farmers' income. The Governor lauded the achievements of ICAR-CTCRI stating that the institute has made commendable contribution in the field of tuber crops during the last 62 years. Dr. Sanjay Behari, Director, Sree Chitra Thirunal Institute for Medical Sciences & Technology (SCTIMST), Thiruvananthapuram offered the special address and mentioned the crucial role of food in maintaining gut microbiota and gut health 'our second brain'. According to him, tuber crops hold great promise for the development of functional foods and medicinal products. He also highlighted the collaboration of SCTIMST with ICAR-CTCRI to develop starch-based scaffolds for controlled drug delivery technology that could have



Sh. Rajendra Vishwanath Arlekar, Hon'ble Governor of Kerala inaugurating the 62nd Foundation Day celebrations of ICAR-CTCRI

significant impact in the pharmaceutical industry. Dr. G. Byju, Director, ICAR-CTCRI highlighted the research achievements of the institute. The Hon'ble Governor released the new publications, honoured progressive tuber crop farmers and meritorious staff and students. Memoranda of Understanding (MoUs) aimed at furthering collaborative research with SCTIMST, Thiruvananthapuram; Vedanta Limited, Odisha and PRS Hospital, Thiruvananthapuram, were exchanged in his presence. The celebration witnessed participation from farmers, students and former as well as current staff of the institute, officials from line departments, KVKs etc. to make it a truly inclusive and celebratory occasion. The event also showcased institute released varieties, technologies, value added products and publications.

Institute Biosafety Committee meeting

The first meeting of 2025 of the Institutional Biosafety Committee (IBSC) was held at ICAR-CTCRI, Thiruvananthapuram on 21 July 2025 and the second meeting was held on 18 December 2025 to review the

rDNA-based research projects. Dr. G. Byju, Director, ICAR-CTCRI and Chairman, IBSC; Dr. S. Manjula, Scientist F, RGCB, Thiruvananthapuram and DBT Nominee; Dr. T. Bindu, Medical Officer, Government of Kerala, Thiruvananthapuram and Biosafety Officer; Dr. E.V. Soniya, Scientist G (Retd.), RGCB, Thiruvananthapuram; Dr. T. Makesh Kumar, Head, Division of Crop Protection and Scientist-in-Charge, PME Cell; Dr. M.R. Sahoo, Head, Division of Crop Improvement; Dr. J. Sreekumar, Principal Scientist and SIC, Extension and Social Sciences; Dr. M.L. Jeeva, Principal Scientist and Dr. K.M. Senthilkumar, Senior Scientist attended the meeting and reviewed the progress of rDNA-based research projects of ICAR-CTCRI. The committee members appreciated the scientists for strict adherence of the biosafety guidelines at the research laboratories of the Institute.

Interaction meeting with Director, ICAR-ATARI Zone-XI

Dr. V. Venkatasubramanian, Director, ICAR-ATARI Zone-XI visited ICAR-CTCRI on 26 July 2025. The visit aimed at developing state-wise rolling plan related to agricultural R&D in achieving the vision of Viksit Bharat@2047 as well as about Viksit Sankalp Krishi Abhiyan (VKSA) action points for future. Convergence and complementarity between ICAR research institutes and KVKs as well as other line departments were the focal points of the discussion. Mr. J. Mathew, SAO, ICAR-NBAIR, Bengaluru also participated besides Dr. Sethuraman Sivakumar, Dr. D. Jaganathan and Sh. S. Bhadrakumar.

Live web telecast of PM Kisan Samman Nidhi & scientist-farmer interface

Live web telecast of PM Kisan Samman Nidhi and a Scientist-farmer interface was organized on 'Improved technologies of tuber crops' on 02 August 2025. The event witnessed enthusiastic participation from over 120 attendees, including farmers from Thiruvananthapuram district and staff members of the institute. Dr. G. Byju, Director, ICAR-CTCRI, delivered the Presidential address, emphasizing the significance of the Lab to Land programme and the importance of exposure visits for farmers to remain updated on the latest varieties and technologies related to tropical tuber crops. He also highlighted the Institute's active role in technology dissemination through various flagship developmental programmes such as Scheduled Caste Sub Plan (SCSP), Tribal Sub Plan (TSP) and North Eastern Hill (NEH)

programme. The interface meeting was inaugurated by Smt. S.R. Bindu, Ward Councillor, Cheruvaikkal, delivered the Inaugural address. The live web telecast of the 20th instalment of the Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) scheme was viewed by the participants. During the national-level programme Hon'ble Prime Minister Shri. Narendra Modi, speaking from Varanasi, Uttar Pradesh, released an amount of ₹ 20,500 crore, benefiting over 9.7 crore farmers across the country. With this release, the total disbursement under PM-KISAN has crossed ₹ 3.90 lakh crore since its inception.

Independence Day celebration

The 79th Independence Day of India was celebrated on 15 August at ICAR-CTCRI, Thiruvananthapuram and at Regional Station, Bhubaneswar. Dr. G. Byju, Director, hoisted the national flag at ICAR-CTCRI, Thiruvananthapuram and delivered the Independence Day address. All staff members, including students and contractual employees, participated in the celebrations.

Seminar on 'Coconut and tuber crops based agrifood systems for resilience and sustainable income'

A state level seminar on 'Coconut and tuber crops based agrifood systems for resilience and sustainable income' sponsored by Coconut Development Board, Kochi, Kerala, was organized on 22 August 2025 at KVK, Kamrup, Assam by ICAR-CTCRI, Thiruvananthapuram in collaboration with ICAR-CPCRI, Research Centre, Kahikuchi, Assam; KVK-Kamrup, Assam Agricultural University, Kahikuchi campus, Assam and ICAR-ATARI, Zone VI, Guwahati, Assam. Dr. Manoranjan Neog, Director of Extension Education, Assam Agricultural University, Jorhat, was the Chief Guest and delivered the inaugural address. Ten innovative coconut farmers were felicitated for their innovations in cropping system approaches in coconut gardens for horticultural development in the country. Dr. G. Byju, Director, ICAR-CTCRI delivered the presidential address. Director emphasized the importance of adopting cropping and farming systems in coconut gardens of Assam for enhancing productivity, nutritional security, profitability and sustainability of the systems. Dr. G. Kadirvel, Director ICAR-ATARI Zone-VI, was the Guest of Honour and delivered the special address. Technical sessions and stakeholders' interface were organized for bringing out recommendations and action plan for promoting

coconut and tuber crops based agrifood systems in Assam. Exhibition stalls from ICAR-CTCRI and KVK, Kamrup showcased the varieties, technologies, products and publications for the benefit of farmers and other stakeholders. About 200 farmers and other stakeholders attended the seminar.

Rainbow diet campaign health camp organised for Juang Tribe in Keonjhar

In an effort to address malnutrition among the Juang tribe of Keonjhar district, the ICAR-CTCRI, Thiruvananthapuram, in collaboration with KIIT and NISER, implemented the DMF-Indradhanush Rainbow Diet Campaign in Odisha. As part of the initiative, two health camps were conducted at Ayushman Arogya Mandir, Sub-Health Centre, Janthari, and at Government Girls' High School (Sikhya Niketan), Department of SC/ST, Gonasika in Banspal block on 18 September 2025. The camps focused on assessing malnutrition and micronutrient deficiencies among children (6-9 years) and adolescents (10-19 years). Based on the malnutrition status, a specialised range of rainbow foods - colourful, micronutrient-rich products - would be developed at the upcoming Satellite Incubation Centre in Gonasika. The Centre would customise nutritionally enriched food products tailored to children's dietary preferences and nutritional needs, ensuring their continuous supply to combat malnutrition effectively.

CIP and ICAR-CTCRI interactive meeting

The ICAR-CTCRI and CIP scientist's interaction meeting was organized at the Institute on 19 September 2026. Dr. Neeraj Sharma, Country Manager, International Potato Center (CIP) and Dr. Mohinder Singh Kadian, Senior Scientist and Consultant, CIP visited the Institute and had detailed discussions with the Director and scientists working on sweet potato. The deliberations focused on strengthening the sweet potato value chain and forging stronger linkages with the industry. Various strategies for enhancing production, processing and market integration were examined and a roadmap for future collaborative actions was finalized. Dr. Shirly Raichal Anil, PI of the ICAR-CIP collaborative work plan on sweet potato presented the annual work report. The dignitaries visited the sweet potato fields of ICAR-CTCRI.

Punarjeevanam 2.0

Punarjeevanam 2.0, a joint initiative of ICAR-CTCRI and Kerala State Kudumbashree Mission

was inaugurated at the state-level function held at Panniyamattom, Thodupuzha, Idukki, Kerala on 27 September 2025. Shri Rarichan N., President, Idukki District Panchayat, formally inaugurated the programme. Sh. H. Dineshan IAS, Executive Director, Kerala State Kudumbashree Mission; Dr. Arunachalam, Director, KSCSTE-JNTBGRI; people's representatives; officials and about 300 members participated in the event. Dr. G. Byju, Director, ICAR-CTCRI, released the Punarjeevanam 2.0 logo and delivered the keynote address. Technical sessions were conducted by CTCRI scientists.

Live webcast of the launching of PM Dhan-Dhaanya Krishi Yojana and Mission for Aatmanirbharta in Pulses by the Hon'ble Prime Minister of India

The ICAR-CTCRI organized a live web telecast of the launch of the PM Dhan Dhaanya Krishi Yojana and the Mission for Aatmanirbharta in Pulses, along with a Scientist-Farmer Interface on Improved tuber crop technologies on 11 October 2025. The programme was attended by over 260 participants, including farmers from Thiruvananthapuram and Pathanamthitta districts and Institute staff.

Dr. G. Suja, Director i/c, ICAR-CTCRI, in her presidential address highlighted tuber crops-based pulse cropping systems for climate resilience, food and livelihood security and emphasized the role of SCSP, TSP and NEH programmes in stakeholder empowerment. Following the inauguration, participants watched the live telecast of the Hon'ble Prime Minister's address, during which agriculture and allied sector projects worth over ₹42,000 crore were launched, including the PM Dhan Dhaanya Krishi Yojana and the Mission for Aatmanirbharta in Pulses. The Prime Minister interacted with farmers, reaffirming the government's commitment to agricultural self-reliance and rural development. Participants later visited key Institute facilities followed by farmer-scientist interactions to promote sustainable tuber crops-based farming systems.

150th birth anniversary of Bhagwan Birsa Munda

The Regional Station of ICAR-CTCRI, Bhubaneswar, celebrated Janjatiya Gaurav Diwas 2025 under the theme 'Janjatiya Gaurav Varsh Pakhwada' to commemorate the 150th birth anniversary of Bhagwan Birsa Munda during 12-14 November 2025 at Koradapankala, Khariguda and Mallipadara villages of Mohana

block, Gajapati district, Odisha. Three programmes were organized: Public awareness campaign at Koradapankala village on 12 November 2025, Tribal agri-entrepreneurship summit at Khariguda village on 13 November 2025 and educational initiatives on the legacy of tribal freedom fighters at Mallipadara village on 14 November 2025. Apart from 163 tribal farmers and farm women, the programmes were attended by Dr. M. Nedunchezhiyan, Head (i/c), and Mr. A. Laxmanarao, AAO, Regional Station, ICAR-CTCRI, Bhubaneswar; tribal religious and community leaders; village leaders; representatives of the Tribal Cultural Academy; ward members; the Nayab Sarpanch of Khariguda Gram Panchayat; headmasters of Koradapankala, Khariguda, and Mallipadara schools; Anganwadi teachers; entrepreneurs and social workers from PREM (NGO).

International symposium on Tropical Root & Tuber Crops for Nutrition, Agri-food systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES)

The 20th International symposium on Tropical Root & Tuber Crops for Nutrition, Agri-food Systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES) was hosted by ICAR-CTCRI, Thiruvananthapuram, Kerala, jointly organized with the Indian Society for Root Crops (ISRC) and the International Society for Tropical Root Crops (ISTRC) during 17-21 November 2025 at Thiruvananthapuram. The symposium brought together over 90 international delegates from 25 countries across six continents, along with 200 Indian delegates, representing scientists, policymakers, industry experts, entrepreneurs, students, and other stakeholders. At the inaugural session, Dr. Sanjay Kumar Singh, Deputy Director General (Hort. Sci.), ICAR, advocated diversified food systems over monocropping, emphasizing zero waste and full utilization of plant parts. He highlighted the role of tropical root and tuber crops in addressing agrarian and climate challenges while enhancing food and nutritional security and promoting entrepreneurship. Prof. Lateef O. Sanni, President of ISTRC and Executive Director, Nigerian Stored Products Research Institute, outlined the broader vision of ISTRC and highlighted the importance of tuber crops and banana as staple foods in Sub-Saharan Africa. Dr. G. Byju, Director, ICAR-CTCRI, reiterated the shared international commitment to improving food security through enhanced production and value-chain development of tropical tubers. During the

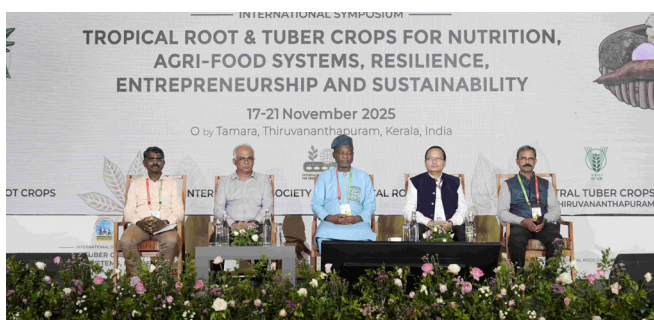
inaugural proceedings, scientists were felicitated with the ISRC Fellow Award and Dr. A. Abraham Award and an important policy-level proposal, the National Mission on Tuber Crops (NMTC), was proposed to mainstream tropical tuber crops into India's food basket and to enhance productivity, farmer income and value-chain development of these climate-resilient crops.



Lighting the lamp and inauguration of ISTRTC 4 NARES



The award winners of the International Symposium



Plenary session of ISTRTC 4 NARES

The five-day programme featured 8 keynote addresses, 31 lead talks, 86 oral presentations, and 94 poster presentations, reflecting strong global participation and scientific depth. Technical sessions were organized across six thematic tracks along with a Young Scientist Award Contest. Keynote and plenary talks highlighted advances in germplasm utilization, precision and climate-smart practices, seed systems, stress resilience, value addition and market-led scaling approaches in root, tubers and banana (RTB) value chains. The plenary session on

21 November 2025 also included presentation of several awards, including the ISRC Young Scientist Award, Pat Coursey Award, Prof. Satish Chandra Award, Best Sweet Potato Scientific Paper Award, best oral, poster and logo design awards.

Stakeholder Interface on 'Fostering global partnerships and business models for tropical tuber crops'

The ICAR-CTCRI in collaboration with AgrInnovate India Ltd. organized a Stakeholder interface on 'Fostering global partnerships and business models for tropical tuber crops' during the International Symposium on Tropical Root & Tuber Crops on 20 November 2025. The event was inaugurated by Dr. Praveen Kumar Singh, Agriculture Commissioner, Ministry of Agriculture & Farmers Welfare, Government of India, as Chief Guest, who emphasized technology-driven growth in the sector. Guests of Honour, Dr. Neeraj Sharma (CIP, New Delhi), Dr. George Ninan (ICAR-CIFT, Cochin) and Sh. V.C. Dhruva (Agrinnovate India Ltd., New Delhi), highlighted opportunities in research, entrepreneurship and international collaboration. The interface brought together global scientists, industry leaders, entrepreneurs and policy experts. It featured panel discussions on business development, export regulations and financing. The programme concluded with a commitment to innovation, value-chain efficiency and strengthened global engagement in tropical root and tuber crops.

Mid-term review meeting of AICRP on Tuber Crops

The mid-term review meeting of AICRP on Tuber Crops was held on 20 November 2025 at ICAR-CTCRI, Thiruvananthapuram, Kerala under the Chairmanship of Dr. G. Byju, Project Coordinator, AICRP TC & Director, ICAR-CTCRI. Principal investigators and co-principal investigators from 21 AICRP TC centres participated and presented their research achievements for the period April-November 2025. On this occasion, a technical bulletin titled 'Tuber crop varieties released in India' was released.

Tuber Crops Day 2025

The ICAR-CTCRI, Thiruvananthapuram in collaboration with the Indian Society for Root Crops (ISRC), celebrated the Tuber Crops Day 2025 on 04 December 2025. The Chief Guest, Shri. Saji John, Mission Director, State Horticulture Mission,

Government of Kerala, inaugurated the event and delivered the inaugural address. He highlighted the importance of climate-resilient smart tuber crops, advocating their promotion in urban and peri-urban areas and proposing a Centre of Excellence for Urban Horticulture at ICAR-CTCRI. The programme was presided over by Dr. G. Byju, Director, ICAR-CTCRI and President, ISRC, who emphasized expanding tuber crops area in Kerala, the nutritional value of sweet potato, cassava as a saviour crop and the need to strengthen seed systems, value addition, marketing and farmer–market linkages. A highlight was the felicitation of Shri. Johnson Mathew, developer of the PPVFRA-registered cassava farmer variety 'Manna'. The event saw participation of Subject Matter Specialists from 25 KVKs of Assam and about 50 farmers from Idukki. As part of the programme, Sh. Saji John inaugurated the Gene Editing Laboratory of Division of Crop Improvement, ICAR-CTCRI. Established at a cost of ₹ 1.25 crore under a plan-funded project, the state-of-the-art facility will strengthen ICAR-CTCRI's capabilities in precision breeding, crop improvement and advanced biotechnological interventions, marking a key milestone for innovation in tuber crops.

World Soil Day 2025

The World Soil Day was celebrated on 05 December 2025 at ICAR-CTCRI, Thiruvananthapuram and Regional Station, Bhubaneswar. At the headquarters, the programme was inaugurated by Dr. C. George Thomas, Former Chairman, Kerala State Biodiversity Board and presided over by Dr. G. Byju, Director, ICAR-CTCRI. Dr. Thomas delivered a lecture on the World Soil Day theme, 'Healthy soils for healthy cities.' The programme was attended by staff, students and trainees of ICAR-CTCRI, as well as students from Loyola School, Thiruvananthapuram. At the Regional Station, Dr. P. Pannerselvan, Principal Scientist, ICAR-CRRI, delivered the Presidential address, emphasizing the urgent need to create awareness among the farming community about the growing challenges in soil management. Around 50 students participated in the programme. Scientists from the Regional Station highlighted the global objectives of World Soil Day and explained the importance of soil health to the students.

National farmer's day 'Kisan Diwas' 2025

The ICAR-CTCRI organized National Farmers Day

(Kisan Diwas 2025) on 23 December 2025. The programme was attended by over 270 participants, including farmers from Thiruvananthapuram district and Institute staff. Dr. T. Makesh Kumar, Director (i/c), ICAR-CTCRI, delivered the Presidential address and he emphasized the provisions of the Viksit Bharat - Guarantee for Rozgar and Aajeevika Mission (Gramin) (VB G RAM G) Bill, 2025 for agricultural and rural development and highlighted ICAR-CTCRI's contributions to nation building through improved tuber crop varieties and technologies. A scientist-farmer interface on improved tuber crop technologies and central government schemes was conducted, followed by the live telecast of the address by Shri. Bhagirath Choudhary, Hon'ble Union Minister of State for Agriculture and Farmers Welfare, who highlighted farmers' contributions and recent agricultural schemes, including the VB G RAM G Bill, 2025. Participants visited key Institute facilities, received training materials and the programme enhanced scientific awareness, dissemination of government schemes and farmer-scientist interactions to promote sustainable tuber crops-based farming systems.

Quarterly review meetings of scientists

Four quarterly review meetings of scientists were conducted on 28-29 January, 7-8 July and 15-16 October 2025 under the chairmanship of Dr. G. Byju, Director, to review the progress achieved during the quarter and to prioritize the targets for scientists of Crop Improvement, Crop Production, Crop Protection, Crop Utilization and Extension & Social Sciences.

Mera Gaon Mera Gaurav programme

Under the MGMG programme, 11 teams were formed and various programs were organized. A group of scientists visited farmers' fields at Thiruvallam Krishi Bhavan, Thiruvananthapuram on 30 January and 20 May 2025 and gave necessary advisories to farmers cultivating ICAR-CTCRI varieties and on good agricultural practises. A programme on 'Establishment of tuber crops seed village: Farmers training and distribution of planting materials' was conducted at Venganoor panchayath, Thiruvananthapuram on 18 June 2025. The programme was inaugurated by Shri. M. Vincent, MLA and Dr. G. Suja, Head, Division of Production, ICAR-CTCRI presided over. Technical sessions were handled by scientists on Seed village and DSM (Decentralised Seed Multiplier) and urban farming.

Participation of ICAR-CTCRI in Viksit Krishi Sankalp Abhiyan (VKSA) 2025 programme

The Viksit Krishi Sankalp Abhiyan (VKSA) 2025, launched by the Ministry of Agriculture and Farmers' Welfare in collaboration with ICAR on 29 May 2025, was a nationwide campaign aimed at promoting science based, climate-resilient and farmer centric agriculture. As part of this initiative, 25 scientists from ICAR-CTCRI Headquarters and 5 scientists from the Regional Station, Bhubaneswar participated in outreach programmes across 14 districts of Kerala and one district of Odisha in collaboration with ICAR-ATARI, Bengaluru, Krishi Vigyan Kendras (KVKs) and State line departments. Dr. G. Byju, Director, ICAR-CTCRI, actively participated in programmes at KVK Ernakulam, KVK Alappuzha and Enadimangalam Panchayat, Pathanamthitta, where he interacted with farmers, highlighted the Institute's technologies for sustainable tuber crop cultivation and distributed protrait plantlets of the newly released cassava varieties Sree Annam and Sree Manna. The campaign successfully covered 1,163 villages, reaching 2,56,517 farmers, of whom 37% were women.

During the campaign, ICAR-CTCRI scientists organized farmer scientist interactions, awareness programmes, technical lectures, field demonstrations, exhibitions and distribution of improved planting materials, focusing on climate resilient agriculture, integrated crop management, soil health, pest and disease management, value addition and integrated farming systems. Field interactions identified several major constraints, including mealybug, scale insects, stem and root rot and boron deficiency in cassava; collar rot in elephant foot yam; non-tuberization in cassava and sweet potato; pest and disease problems in coconut, banana, cardamom and vegetables; soil acidity; delayed soil testing; fertilizer shortages; wild animal damage; and marketing constraints. Farmers' feedback and Indigenous Technical Knowledge (ITKs) were systematically documented and shared with the concerned agencies for follow up action, contributing to location specific research, extension strategies and technology refinement.

Stakeholders' interface on seed gram

Seed Gram, the Seed Village and Decentralised Seed Multiplier project 2025-30 of ICAR-CTCRI was launched in Kerala state by Sh. C.K. Hareendran MLA. Interface meetings and field visits were

organized at Parassala, Thiruvananthapuram on 04 July 2025. Sh. K. Ansalan MLA inaugurated the distribution of improved varieties of tuber crops. Sh. S.K. Bendarwin, President, Parassala block panchayat presided. Smt. Manju Smitha, President, Parassala Grama Panchayat gave the felicitation address. Director, ICAR-CTCRI, Dr. G. Byju delivered the lead talk. The meeting was attended by more than 300 farmers.

As part of Seed Gram, a meeting at Muthalamada Panchayat was organized on 26 September 2025. Planting materials of sweet potato were distributed for trial to ADA, State Orange and Vegetable Farm, Nelliampathy. The scientists interacted with Chinese potato farmers and gave agro advisories on its cultivation especially on season based planting for realizing better yield.

Field diagnostic visits

Field diagnostic visits were conducted on 10 July 2025 and 11 September 2025 in elephant foot yam fields at Aerom, Anchal Grama Panchayat, Kollam district, Kerala, to identify the causal agents of leaf yellowing and rots. A similar investigative visit was undertaken in Punalur, Kollam, to diagnose disease problems in arrowroot. Thirty-five farmers received training on diagnosis and management of tuber-crop diseases at the VFPCCK unit, Aerom, Kollam. On 14 July 2025, a team of scientists and technical staff along with the Agriculture Officer, Krishi Bhavan, Chenkal visited the cassava stem and root rot affected cassava fields in Chenkal village, Thiruvananthapuram district. The team provided management recommendations and collected infected plant and soil samples for further examination.

Academic Cell activities

Two half yearly meetings were conducted on 07 January and 17 September 2025 to review the progress of the research activities of Ph.D. students by the Director and the members of the committee. Individual students presented the research progress during six months which will help them to complete their research programme on time.

Library activities

ONOS portal: ICAR-CTCRI Headquarters and Regional Station were successfully registered in the ONOS (One Nation One Subscription) portal from January 2025, to ensure centralized and seamless

access to national and international scholarly e-resources. The work involved verification of institutional details, completion of registration formalities and implementation of access for all units, enabling effective utilization of ONOS-subscribed journals and databases by researchers and staff.

National Reading Day: The National Reading Day was celebrated at ICAR-CTCRI on 19 June 2025 to promoting reading habits and creating awareness on the importance of libraries and knowledge sharing. Dr. P.K. Suresh Kumar, Former Deputy Librarian, University of Kerala, was the Chief Guest of the programme. Ms. Archana Gopinath, CEO, Reading Room, Cheruvakkal was the guest of honour. Dr. G. Suja, Director (i/c), ICAR-CTCRI presided. The Reading Day Pledge was administered during the function. Dr. V.S. Santhosh Mithra, Principal Scientist and Chairman, Library Advisory Committee welcomed the gathering and Smt. Deepa B. S., Technical Officer (Library) proposed vote of thanks. In connection with this, a Read and Talk competitions in English and Malayalam on the theme “*Vayana Marikkumo?*” and Book Hunt and Mass Reading programmes were organized on 16 June 2025. The prizes for the winners of the competitions were distributed during the function.

Library services and collection development: During the reporting period, procurement of 27 scientific books amounting to ₹ 1,34,738.43 is in progress. To enrich institutional research output, 2 Ph.D. theses and 7 M.Sc. theses were added to the library. A total of 701 books were issued through circulation services, while reference services were provided to 882 users, supporting research, academic and administrative requirements. Additionally, 11 library membership cards were issued to staff members. In support of information dissemination and archival needs, 111 media news items in digital format were organized and made available in the library for reference. The library also conducted a library orientation and user awareness programme for B.Sc. (Ag.) students of Guru Kashi University, Bathinda, Punjab, to familiarize them with library resources, services and information access tools.

Official Language activities

During 2025, the Official Language Implementation Committee (OLIC) of ICAR-CTCRI conducted four quarterly review meetings (25 February, 10 June, 19 August and 5 December) under the chairmanship of the Director, Dr. G. Byju, to review and strengthen

the implementation of the Official Language policy. Key initiatives included distribution of the 22-point programme for promoting Hindi, publication of the second edition of the Hindi e-magazine *Indradhanush*, suggestions for creation of a 'Hindi Corner' on the institute website, discussion of the revised Parliamentary Inspection Questionnaire and Annual Programme (2025–26) for implementation, approval for procurement of Hindi books, updating the staff roster for Hindi proficiency and identifying employees for training and efforts to fill the vacant posts of Assistant Director (Official Language) and Hindi Translator. ICAR Headquarters appreciated the institute's performance in bilingual correspondence, Hindi noting on files, workshops, Hindi Pakhwada celebrations and implementation of incentive schemes, while all quarterly compliance reports were submitted to the Council.

The institute also organized Hindi Pakhwada (14–28 September 2025) both at the headquarters and the Regional Station, Bhubaneswar, featuring competitions for employees and their children. To enhance Hindi proficiency, four one-day workshops covering topics like Quarterly Progress Reports, *Kantasth 2.0*, the Annual Programme (2025–26) and the Indian Constitution was organized where, a total of 69 officers and 50 employees were trained. Additionally, two Official Language inspections was conducted by senior ICAR officials viz., Sh. Ram Dayal Sharma, Joint Director, Official Language, ICAR in October and Dr. Sudhakar Pandey, ADG (FVS&MP), Hort. Sci., ICAR in December 2025. Both commended the institute for its effective implementation of the Official Language policy and expressed appreciation for its overall performance.

Sports @ CTCRI

A total of 26 participants from ICAR-CTCRI participated in the ICAR South Zonal Sports Meet at ICAR-NAARM, Hyderabad during 10-13 February 2026. They participated in various sports events like cricket, basketball, badminton, table tennis, chess, carroms, race (100 m, 200 m, 400 m, 800 m and 1500 m), relay, long jump, shotput, discus throw and javelin.

Recreation Club

The club activities kick started with the New Year celebration on 01 January 2025. The occasion was marked by cake cutting by Dr. G. Byju, Director.

Lucky dip and a cultural programme by staff/club members were organized. The Institute calendar was released by the Director on the New Year day. Onam 2025 was celebrated with Athapookkalam competition and Dr. G. Byju, Director gave away the trophies to winners, followed by a sumptuous Onasadya. The club organised befitting farewell functions for 5 staff who superannuated, in appreciation of their valuable contribution to the Institute development as well as tuber crops research. The Republic Day and 78th Independence Day functions were organized by the club in which Director hoisted the national flag and addressed the staff. A new committee took charge.

HRD cell activities

The HRD training unit is facilitating the staff to attend trainings across the country. Recently the staff members underwent mandatory IGoT trainings in the online mode under the Karmayogi mission. Most of the staff is regularly attending the IGoT training through online platform. Academic trainings were also organised by the Institute and last year, two trainings were successfully completed. Training on Rashtriya Karmayogi Jan Seva Programme was attended by the Nodal Officer at ICAR-NAARM.

Swachh Bharat Abhiyan

The ICAR-CTCRI organized various cleanliness drives at the campus during 2025. During the first two quarters cleanliness drives were conducted in and around the Institute premises covering an area of approximately 10,000 sq. feet. All the trash materials such as paper, plastic, metal and glass waste found in and around the premises were disposed.

Swachhta Hi Seva 2025 was celebrated from 17 September to 02 October 2025 by organizing a series of cleaning drives and awareness activities in Ayurveda Dispensary, Cheruvakkal, Thiruvananthapuram and Vettucadu Church, Thiruvananthapuram. An awareness class on was delivered to the students of Cheruvakkal Upper Primary School, followed by a quiz competition, Swachhta Hi Seva pledge, a human chain, a 'Waste to Art' competition, etc. Swachhta Hi Seva 2025 was celebrated at Regional Station, Bhubaneswar with various activities.

The *Swachhta Pakhwada 2025* was also organized from 16-31 December 2025 which started with a Swachhta Pledge by Dr. G. Byju, Director, ICAR-CTCRI. More than 60 staff and 25 farmers from Maharashtra participated in the pledge. A series of

activities were successfully conducted, including the observance of Farmers' Day (Kisan Diwas), planting of fruit trees, promotion of kitchen gardening, recycling of waste water and community outreach programmes. Other initiatives included weeding out old office records, cleanliness drives across the institute premises, guest house and Veli Beach, signature campaigns within the institute and in public places, plastic waste shramdaan at the canteen and walkathons across the campus.

Exhibitions

During the reporting year, ICAR-CTCRI participated in 21 exhibitions as listed, for the benefit of farmers and other stakeholders. A large number of farmers, students, industrialists and others participated and acquired knowledge on improved technologies of tuber crops.

1. National seminar on Coconut Based Land Use and Changing Climate, by Kerala State Land Use Board on 06 January 2025 at Mascot Hotel, Thiruvananthapuram.
2. Commercial Tuber Crops Technologies, in the Stakeholders Meet on Leveraging Innovation Ecosystems for Building Sustainable Tuber Crops Entrepreneurship in India on 09 January 2025 at ICAR-CTCRI, Thiruvananthapuram.
3. International Conference for Food Security and Nutrition on 17 January 2025 at OUAT, Bhubaneswar, Odisha.
4. National Conference on Seed Chain Management in the Eastern and Northeastern Hill Regions during 21-22 January 2025 at CHES, ICAR-IIHR, Bhubaneswar.
5. Improved Varieties and Technologies of Cassava for Enhancing Productivity and Farm Income on 03 February 2025 at Pachamalai Hills, Tiruchirapalli, Tamil Nadu.
6. 17th Agricultural Science Congress 2025 during 20-22 February 2025 at G.B. Pant University of Agriculture and Technology (GBPUAT), Pantnagar.
7. Stakeholders interface cum training programme on Tuber Crops for Agrifood Systems and Sustainable Income on 21 February 2025 at Kanubari, Longding, Arunachal Pradesh.
8. Seed Festival during 22-24 February 2025 at Kanjikuzhi Grama Panchayat, Alappuzha, Kerala.

9. Novel Processing and Value Addition in Tapioca & Ethnic Tuber Crops Festival on 24 February 2025 at Tiyy Hall, Wokha town, Nagaland.
10. Improved Varieties and Technologies of Tuber Crops for Enhancing Farm Income and Distribution of Critical Inputs on 14 March 2025 at Department of Forests, Mundanthurai, Tirunelveli, Tamil Nadu.
11. Platinum Jubilee Celebrations of College of Agriculture, Vellayani, Thiruvananthapuram during 26-28 May 2025.
12. National Policy Dialogue on Scaling Up Biofortified Crops for Addressing Childhood Malnutrition in Tribal Areas on 18 June 2025 at the SAIL auditorium, Keonjhar, Odisha.
13. Janmabhoomi Golden Jubilee celebrations during 07-11 May 2025 at Thiruvananthapuram.
14. State level inauguration of Seed Village and DSM Programme envisaged for 2025-2030 under SCSP Project on 04 July 2025 at EMS Hall, Parassala, Thiruvananthapuram.
15. Launching of Seed Gram 2025-30 in association with Department of Agriculture, LSGD and Susthira Thrithala project, under Institute SCSP at Thrithala, Palakkad, Kerala on 19 July 2025.
16. Seed Village programme under SCSP of AICRP on Tuber Crops on 29 August 2025 at SSS Shadabdi Auditorium, Cherthala, Alappuzha, Kerala.
17. Education Festival 2025 during 11-12 October 2025 at Lekshmi Vilasom High School (LVHS), Pothencode, Thiruvananthapuram.
18. Value Added Products and Tubers Crops Technologies during 14 and 15 October 2025 under SCSP programme at Mathur and Pattithara in Palakkad district.
19. Kerala Women Entrepreneurs Conclave 2025 on 13 October 2025 at the Lulu International Convention Centre, Thrissur, Kerala.
20. INFIBOT 2025-2026 on 30 October 2025 at St. Thomas Residential School, Mukkolakkal, Thiruvananthapuram.
21. International Symposium on Tropical Root & Tuber Crops for Nutrition, Agrifood Systems,

Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES) organized by Indian Society for Root Crops, International Society for Tropical Root Crops and ICAR-Central Tuber Crops Research Institute during 17-21 November 2025 at Thiruvananthapuram, Kerala.

Exposure visits to ICAR-CTCRI

One day exposure visits cum training were organized at ICAR-CTCRI on topics like 'Improved technologies of tuber crops' and 'Production, value addition and entrepreneurship development in root and tuber crops' for the benefit of farmers (846), students (2642) and officials (235) both at the headquarters and Regional Station.

Agribusiness Incubator activities

The Agribusiness Incubator (ABI) of ICAR-CTCRI undertook several initiatives during 2025 to promote agripreneurship, technology commercialization, startup incubation and stakeholder engagement. A major highlight was the successful conduct of the third edition of the Certified AgriTech Startup Professional (CAgtSP) programme in collaboration with Kerala Agricultural University, which trained 167 undergraduate students in agribusiness and entrepreneurship. In addition, a sensitization programme on technological innovations and commercialization was organized for 25 postgraduate and Ph.D. students from Siksha 'O' Anusandhan University, Bhubaneswar, to enhance awareness of innovation management and technology transfer. During the year, the incubator also enrolled three new agribusiness start-ups, two from Kerala and one from Odisha, to support enterprise development.

The ABI strengthened institutional partnerships and outreach through strategic collaborations with both development organizations and industry. A Memorandum of Understanding (MoU) was signed with the Centre for Innovation in Science and Social Action (CISSA) to enhance the capacity of 36 Farmer Producer Companies (FPCs) in Kerala, accompanied by programmes benefiting farmers and other stakeholders. The institute also inaugurated its fourth Satellite Incubation Centre (SIC) at RARS, Pattambi, Kerala and organized a stakeholder workshop focusing on the conservation and utilization of tribal farmers' genetic resources and traditional knowledge. Furthermore, ICAR-CTCRI initiated discussions with PepsiCo India to explore opportunities for tuber

crop value chain development, particularly for snack food processing, while a planning workshop with FPO representatives helped identify their needs and formulate mentoring strategies. Collectively, these activities strengthened the institute's innovation ecosystem by fostering entrepreneurship, industry partnerships, technology commercialization and farmer-centric development.

On-farm trials (OFT)/ Front line demonstrations (FLD) conducted

During 2025, ICAR-CTCRI implemented a series of on-farm trials (OFTs) to evaluate improved tuber crop varieties and production technologies under farmers' field conditions across Kerala, Tamil Nadu and Assam. The institute monitored 10 on-farm demonstrations in Tiruppur district, Tamil Nadu, on cassava (Sree Reksha), elephant foot yam (Gajendra), Site-Specific Nutrient Management (SSNM) and organic farming technologies under Coconut Development Board funding. Four OFTs were conducted at Parassala, Thiruvananthapuram, to evaluate orange-fleshed sweet potato, anthocyanin- and β -carotene-rich sweet potato genotypes, white-fleshed sweet potato and high-starch sweet potato. Another 10 demonstrations on improved cassava and elephant foot yam varieties along with SSNM and organic farming were established in Kamrup district, Assam. In addition, biofortified sweet potato trials were successfully completed at Bharathanoor (Thiruvananthapuram) and also at Kollengode (Palakkad), while three OFTs on miniset-raised protrait nursery technology for greater yam (Sree Nidhi) were established in farmers' fields in Thiruvananthapuram district to promote quality planting material production.

Front line demonstrations (FLDs) and field monitoring programmes across Tamil Nadu, Kerala and Odisha were also carried out to promote improved varieties, quality planting material production and scientific crop management. Scientists regularly monitored seed village demonstration plots of cassava, taro and sweet potato, conducted farm advisory services on SSNM practices, assessed disease incidence in cassava demonstration fields and evaluated quality planting material production in collaboration with KVKs and state departments. Focused group discussions were organized in Chinese potato-growing regions of Tamil Nadu. Under the Rainbow Diet Campaign, Odisha,

three nutrised villages were established in Keonjhar district, where 30 farmers cultivated biofortified sweet potato (SP-95/4) over seven acres, for quality planting material production. Planting materials of cassava and sweet potato were also distributed for establishing seed village demonstration plots in the tribal areas of Tiruchirappalli district in collaboration with KVK Trichy and the Department of Horticulture, Government of Tamil Nadu, thereby strengthening decentralized seed production and technology dissemination among farming communities.

ICAR-CTCRI in media

During 2025, ICAR-CTCRI received extensive media coverage across national, regional and local print and digital media, with 105 news reports highlighting its research, extension, technology dissemination, institutional collaborations, and farmer outreach activities. Major themes included women farmer empowerment programmes, promotion of advanced agricultural technologies, tribal farmer development initiatives in Jharkhand, Odisha, Kerala and Tamil Nadu, training programmes on scientific cultivation of cassava, sweet potato and elephant foot yam, value chain development, organic farming, seed village programmes, distribution of planting materials, genome-edited crop technologies, nutrition and food security, farmer producer organizations, smart farming, AI-based agriculture, value addition, collaborations with Kudumbashree, NABARD and other agencies, establishment of satellite incubation centres, national and regional seminars, research collaborations among scientific institutions, promotion of tuber crops in the North Eastern states, sustainable agriculture, Soil Day, Tuber Crops Day, and innovations in tuber crop processing and product development. Coverage appeared in leading newspapers and e-papers including The Hindu, The New Indian Express, Indian Express, Malayala Manorama, Mathrubhumi, Desabhimani, Kerala Kaumudi, Janayugam, Deepika, Veekshanam, Kesari, Chandrika, Mangalam, Deccan Chronicle, The Arunachal Times, Nagaland Post, The Morung Express, Dainik Bhaskar, Sakshi, Eenadu, Andhra Jyothi, Avenue Mail, Uditwani, New Ispat Mail, JCR News, The Photon News, Chronicle News Service and several other regional publications, demonstrating the institute's wide public outreach and growing national visibility in tuber crop research, technology transfer, entrepreneurship, and nutritional security.

Viksit Krishi Sankalp Abhiyan (VKSA)

Date	Key activities	No of farmers	Locations	Key outcomes
29.05.2025	- Conducted awareness classes on tuber crops, rice cultivation, integrated pest and disease management. - Farmer-scientist interaction sessions on crop production and bio-inputs. - Organized rally and sensitization workshops on VKSA and Central Schemes. - Training on sustainable cultivation and climate-resilient technologies.	9003	Alappuzha, Ernakulam, Idukki, Kannur, Kasaragod, Kollam, Kottayam, Malappuram, Pathanamthitta, Thirssur, Thiruvananthapuram, Wayanad	- Farmers gained knowledge on scientific rice and tuber crop cultivation. - Demand raised for short-duration cassava varieties and improved access to quality inputs. - Requests made for regular advisory visits and timely information dissemination.
30.05.2025	- Sessions on intercropping of tubers in coconut gardens, monsoon care in livestock, and soil testing. - Technical sessions on cardamom, banana, fish farming, and rain-fed crop management. - Bio-input awareness and farmer interface with line department officials.	9797	Alappuzha, Ernakulam, Idukki, Kannur, Kasaragod, Kollam, Kottayam, Malappuram, Pathanamthitta, Thirssur, Thiruvananthapuram, Wayanad	- Increased interest in soil health management and IPM practices. - Feedback received on pest issues, input shortages, and insurance for crop loss. - Need identified for soil test labs and credit-linked input supply.
31.05.2025	- Awareness sessions on monsoon crop care and do's & don'ts for tuber crops and vegetables. - Field visits for diagnosis of cassava disease and intercrops. - Technology dissemination on nutrient and pest management in vegetables and tubers.	9137	Alappuzha, Ernakulam, Idukki, Kannur, Kasaragod, Kollam, Kottayam, Malappuram, Pathanamthitta, Thirssur, Thiruvananthapuram, Wayanad	- Farmers requested support for timely soil testing and pest diagnostics. - Enhanced knowledge on nutrient disorders and correction methods. - Field issues documented and samples collected for lab analysis.
01.06.2025	- Sessions on coconut and tuber crop technologies by CTCRI and KVK scientists. - Hands-on training on mushroom cultivation - Awareness on sustainable practices in intercropping and crop diversification.	12315	Alappuzha, Ernakulam, Idukki, Kannur, Kasaragod, Kollam, Kottayam, Malappuram, Pathanamthitta, Thirssur, Thiruvananthapuram, Wayanad	- Positive feedback on training and knowledge gained despite weather disruptions. - Emphasis placed by farmers on mobile testing units and advisory. - Farmer queries addressed through sessions platforms.
02.06.2025	- Training on integrated crop management (vegetables, banana, and plantation crops). - Interaction with farmer groups and discussion on tuber crop issues.	18088	Alappuzha, Ernakulam, Idukki, Kannur, Kasaragod, Kollam, Kottayam, Malappuram, Pathanamthitta, Thirssur, Thiruvananthapuram, Wayanad	- Farmers emphasized the need for training on value addition and post-harvest technologies. - Request for training in pest-resistant and climate-resilient varieties. - Strong demand for planting material and bio-input access through KVKs.
03.06.2025	- Sessions on tropical tuber crops, spices, inland fish farming, and processing technologies. - Training by ICAR institutes on coconut, pepper, and fish post-harvest techniques. - Awareness on integrated farming and technology packages.	9574	Kozhikode, Ernakulam, Kannur, Kasargod, Kollam, Kottayam, Palakkad, Pathanamthitta	- Participants showed high interest in diversified farming. - Farmers requested regular expert visits and KVK demonstrations. - Need expressed for organized marketing and training in online selling platforms.
04.06.2025	- Awareness programs on coconut, arecanut, spices, and ornamental fish farming. - Dissemination of leaflets, folders, and training materials. - Sessions by experts on value addition and sustainable pest control methods.	8150	Kozhikode, Ernakulam, Kannur, Kasargod, Kollam, Kottayam, Palakkad, Pathanamthitta	- Feedback on need for pest-resistant coconut varieties and root wilt control. - Farmers called for insurance coverage against wild animal attacks. - Urged inclusion of scientific farming in school curriculum.

Other Information

05.06.2025	• Trainings on Agrotechniques of tuber crops and fisheries. • Street campaigns conducted with school students and public. • Distribution of cassava varieties and vegetable seedlings.	12710	Kozhikode, Ernakulam, Kannur, Kasargod, Kollam, Kottayam, Palakkad, Pathanamthitta	• Farmers requested support for solar fencing and affordable pest repellents. • Emphasis on farm mechanization and support for small tools like weeders. • Strong interest in integrated farming and demand for value chain support.
06.06.2025	• Technical sessions on spices, fish processing, coconut cultivation, and tuber crops. • Field visits for cassava root rot diagnosis. • Sessions on eco-friendly weed and pest management.	7247	Kozhikode, Ernakulam, Kannur, Kasargod, Kollam, Kottayam, Palakkad, Pathanamthitta	• Farmers requested on-site demonstrations and more practical training. • Urged for regulated sale of agrochemicals through government outlets. • Need for local seed hubs and nurseries for quality planting material emphasized.
07.06.2025	• Field visits for soil and plant sampling; farmer consultations on recurring problems. • FPO–Scientist interface meeting to link research with field challenges.	5645	Kozhikode, Ernakulam, Kannur, Kasargod, Kollam, Kottayam, Palakkad, Pathanamthitta	• Demand for inclusion of mussel and aquaculture training raised. • Recommendation to promote cassava-based industries and paddy straw utilization.
08.06.2025	• Conducted farmer training and farmer–scientist interface sessions. • Discussions on issues related to tuber crops, fisheries, and spice crops. • Field visits by multidisciplinary scientific team to assess cropping systems and farmer practices.	2585	Alappuzha, Kozhikode, Palakkad	• Improved understanding of field-level problems in tuber and spice cultivation. • Farmers expressed the need for timely availability of quality planting materials. • Raised concerns regarding wild boar menace and need for effective control measures.
09.06.2025	• Awareness and training programs. • Sessions focused on spice crops, tuber crop technologies, banana, and fish production. • Interactive discussions between scientists and farmers.	4113	Alappuzha, Kozhikode, Palakkad	• Requests for pest-resistant and climate-resilient varieties. • Demand for regularization of pesticide and agrochemical sales through certified outlets.
10.06.2025	• Farmer training and interaction programs. • Focus on crop production, tuber processing, spice crop management, and marine fisheries. • Discussions on integration of crop and fish farming technologies.	4644	Alappuzha, Kozhikode, Palakkad	• Strong interest in value addition and marketing strategies for farm produce. • Farmers demanded affordable and timely access to fertilizers.
11.06.2025	• Farmer-scientist interface meetings and training sessions. • Awareness sessions on integrated nutrient management, crop processing, and fisheries. • Distribution of technical know-how and feedback collection.	4269	Alappuzha, Kozhikode, Palakkad	• Farmers emphasized the need for scientific repulsion methods for wild animals. • Expressed need for faster disbursement of crop insurance benefits.
12.06.2025	• Pre-Kharif campaign • Focused on tuber crops, spices, marine fish production, and government schemes. • Conducted technical sessions and farmer feedback forums.	6355	Alappuzha, Kozhikode, Palakkad	• Farmers demanded timely direct benefit transfers, and effective wild animal control measures. • Highlighted the need for intensified research on coconut diseases and price stabilization

वर्ष 2025 के दौरान इस संस्थान में आयोजित राजभाषा कार्यान्वयन से संबंधित कार्यक्रम

राजभाषा कार्यान्वयन समिति (ओएलआईसी) ने आईसीएआर-सीटीसीआरआई के निदेशक डॉ. जी. बैजु और ओएलआईसी के अध्यक्ष की अध्यक्षता में प्रत्येक तिमाही (25 फरवरी, 10 जून, 19 अगस्त और 5 दिसंबर 2025) में बैठकें आयोजित कीं। बैठकों का संचालन डॉ. ए. आशा देवी, प्रधान वैज्ञानिक एवं संपर्क अधिकारी द्वारा किया गया था और श्री एस. भद्रकुमार, वरिष्ठ प्रशासनिक अधिकारी और सदस्य सचिव (ओएलआईसी) द्वारा समर्थित किया गया था। ओएलआईसी से संबंधित विभिन्न बिंदुओं पर चर्चा की गई और लिए गए निर्णयों को लागू किया गया।

- सीटीसीआरआई की हिंदी ई-पत्रिका "इंद्रधनुष" का पहला अंक 7 मार्च, 2025 को अंतर्राष्ट्रीय महिला दिवस समारोह के अवसर पर, केरल नॉलेज इकोनॉमी मिशन की निदेशक डॉ. पी.एस. श्रीकला द्वारा जारी किया गया।
- हिंदी ई-पत्रिका 'इंद्रधनुष' का दूसरा संस्करण प्रकाशित करने का निर्णय लिया गया। अध्यक्ष ने इसे 'विश्व हिंदी दिवस-2026' के अवसर पर जारी करने का निर्णय लिया।
- अध्यक्ष ने संस्थान की वेबसाइट पर "हिंदी कोना" नामक एक अलग फ़ोल्डर जोड़ने का सुझाव दिया। यहाँ, संस्थान द्वारा आयोजित राजभाषा से संबंधित सभी कार्यक्रमों के समाचार और तस्वीरें अपलोड की जानी हैं।
- संशोधित संसदीय निरीक्षण प्रश्नावली एवं वित्तीय वर्ष 2025-26 के वार्षिक कार्यक्रम के मुख्य बिंदुओं पर, अनुपालन के लिए चर्चा की गई।
- समिति के अध्यक्ष ने वित्तीय वर्ष 2025-26 के लिए हिंदी पुस्तकों की खरीद को मंजूरी दी।
- हिंदी में कार्यसाधक ज्ञान के लिए कर्मचारियों की एक संशोधित सूची तैयार की गई। यह निर्णय लिया गया कि उन कर्मचारियों की सूची तैयार की जाए जिन्हें हिंदी का कार्यसाधक ज्ञान नहीं है, और उन्हें आगामी सत्र में प्रशिक्षण के लिए भेजा जाए। अतः, केंद्र

सरकार के कर्मचारियों के लिए वित्तीय वर्ष 2025-2026 के दौरान आयोजित होने वाले हिंदी प्रशिक्षण हेतु ICAR-CTCRI से आठ कर्मचारियों का चयन किया गया।

- आईसीएआर ने नियम 3(3) के अंतर्गत द्विभाषी प्रारूप में जारी किए गए कुल दस्तावेजों की संख्या के संबंध में सीटीसीआरआई द्वारा किए गए कार्य की सराहना की है। इसी प्रकार, सभी क्षेत्रों (क, ख और ग) को भेजे गए द्विभाषी पत्रों के पत्राचार, फाइलों पर लिखी गई टिप्पणियों तथा इस तिमाही के दौरान आयोजित कार्यशाला की भी सराहना की गई।
- सभी तिमाही कार्य-निष्पादन रिपोर्ट अनुपालन हेतु परिषद को भेज दी गई। सहायक निदेशक (राजभाषा) और हिंदी अनुवादक के पदों को भरने के प्रयास किए जा रहे हैं।

हिंदी पखवाड़ा 2025: हिंदी पखवाड़ा 2025 का आयोजन 14 से 28 सितंबर 2025 तक मुख्यालय में किया गया। स्टाफ़ के लिए कई तरह के प्रतियोगिताएं आयोजित किए गए, जैसे अनुवाद, निबंध लेखन, श्रुतलेख, सुलेख, कविता पाठ, भाषण, 'तस्वीर क्या बोलती है', स्मृति परीक्षा और अंताक्षरी। इनके अलावा, स्टाफ़ के बच्चों के लिए भी प्रतियोगिताएं आयोजित किए गए। सीटीसीआरआई के क्षेत्रीय केंद्र, भुवनेश्वर, ओडिशा में भी 14 से 28 सितंबर 2025 तक 'हिंदी पखवाड़ा 2025' का आयोजन किया गया।

हिंदी कार्यशालाएँ: वर्ष के दौरान, हिंदी प्रकोष्ठ द्वारा चार एक-दिवसीय कार्यशालाएँ आयोजित की गईं।

- प्रशासनिक और लेखा अनुभागों के लिए 'तिमाही प्रगति रिपोर्ट' पर एक आंतरिक हिंदी कार्यशाला 28 मार्च 2025 को आयोजित की गई, जिसमें 14 अधिकारियों और 9 कर्मचारियों को प्रशिक्षित किया गया।
- दूसरी तिमाही के दौरान, 30 जून 2025 को 'कंठस्थ 2.0' पर एक कार्यशाला आयोजित की गई, जिसमें केनरा बैंक, आंचलिक कार्यालय, तिरुवनंतपुरम के वरिष्ठ राजभाषा प्रबंधक श्री षोजो लोबो



OLIC बैठक



हिंदी पखवाड़े का उद्घाटन



हिंदी पखवाड़ा 2025 के दौरान बच्चों की प्रतियोगिता

ने प्रशिक्षण दिया। इसमें 16 अधिकारियों और 16 कर्मचारियों को प्रशिक्षित किया गया।

- 'वार्षिक कार्यक्रम 2025-26' विषय पर आंतरिक हिंदी कार्यशाला का आयोजन 16 सितंबर 2025 को किया गया, जिसमें 20 अधिकारियों और 13 कर्मचारियों को प्रशिक्षित किया गया।
- अक्टूबर-दिसंबर तिमाही के दौरान, 17 अक्टूबर 2025 को 'भारतीय संविधान' विषय पर एक हिंदी कार्यशाला आयोजित की गई, जिसमें भारतीय कृषि अनुसंधान परिषद, नई दिल्ली के राजभाषा संयुक्त निदेशक श्री राम दयाल शर्मा ने कक्षा का संचालन किया। इसमें 19 अधिकारियों और 12 कर्मचारियों को प्रशिक्षित किया गया।

राजभाषा निरीक्षण: साल 2025 में आईसीएआर-सीटीसीआरआई के लिए राजभाषा (ओएल) से जुड़े दो निरीक्षण किए गए। भारतीय कृषि अनुसंधान परिषद (भाकृअनुप) में राजभाषा के संयुक्त निदेशक श्री राम दयाल शर्मा ने 17 अक्टूबर 2025 को राजभाषा से संबंधित निरीक्षण किया। श्री शर्मा ने संस्थान द्वारा किए गए अच्छे काम पर संतोष और सराहना व्यक्त की। दूसरा निरीक्षण 30 दिसंबर 2025 को, डॉ. सुधाकर पांडे, बागवानी विज्ञान विभाग के एडीजी (एफवीएस & एमपी), भाकृअनुप ने किया। निदेशक के साथ-साथ ओएलआईसी के सभी सदस्य बैठक में शामिल हुए और डॉ. पांडे ने भी संस्थान में राजभाषा के कार्यान्वयन में किए गए अच्छे काम पर खुशी और सराहना व्यक्त की।



श्री शोजो लोबो, वरिष्ठ ओएल प्रबंधक, केनरा बैंक द्वारा हिंदी कार्यशाला।



इन-हाउस हिंदी कार्यशाला



श्री राम दयाल शर्मा, संयुक्त निदेशक (ओएल), भाकृअनुप द्वारा ओएल निरीक्षण

IMPORTANT EVENTS

Sl. No.	Name of the event	Date
1	Stakeholders interface meeting-cum-workshop on Leveraging Innovation Ecosystems for Building Sustainable Tuber Crops Entrepreneurship in India	09 January 2025
2	Farmers' seminar on Tuber Crops	21 January 2025
3	Quarterly review meetings of scientists	28-29 January 2025
4	Final report submission of QRT	10 February 2025
5	National brainstorming workshop on Tuber Crops Mechanization: Status, Challenges and Strategic Vision for Food Security and Sustainability	21 February 2025
6	OLIC meeting	25 February 2025, 10 June 2025, 19 August 2025, 05 December 2025
7	Tribal connect programme in collaboration with Kerala Forest Department	28 February 2025
8	International Women's Day	8 March 2025
9	1st meeting of X RAC	10-11 March 2025
10	Certified Agritech Startup Professional Scheme (CAgtSP) - Phase 1 EDP	12-15 March 2025
11	Stakeholders' interface on Tuber Crops Farming for Agrifood Systems	13 March 2025
12	Hindi Workshop	28 March 2025, 30 June 2025, 16 September 2025, 17 October 2025
13	7 th Poshan Pakhwada	08 to 23 April 2025
14	Farmers' workshop organized in collaboration with Panavoor Grama Panchayat and Anad Farmers' Cooperative Society	09 April 2025
15	National workshop on Celebrating Tribal Ingenuity: Strategies for Protecting, Valuing and Marketing Tribal Farmers' Varieties, Innovations and Geographical Assets	01 May 2025
16	Institute Research Council meeting	05-09 May 2025
17	ICAR-CTCRI and CISSA collaboration meeting	15 May 2025
18	25 th Annual Group Meeting of AICRP on Tuber Crops	19-20 May 2025
19	Farmers' seminar and distribution of farm tools at Parakkode Block, Pathanamthitta	13 June 2025
20	Inauguration of Digital Farm at MBCET in collaboration with ICAR-CTCRI and Nadan Agro Farms	June 2025
21	Launching workshop on Climate Resilient Agri-Food Systems Integrating Biofortified Sweet Potato for Sustainable Livelihoods	17 June 2025
22	National policy dialogue on Scaling up Biofortified Crops for Addressing Childhood Malnutrition in Tribal Areas	18 June 2025
23	H.H. Sree Visakham Thirunal Endowment lecture	23 June 2025

Important Events

24	Planning workshop for mentoring FPOs	24 June 2025
25	ICAR- CTCRI Foundation day	11 July 2025
26	Talk on understanding the POSH Act 2013: Prevention, Prohibition and Redressal of Sexual Harassment at Workplace	14 July 2025
27	ICAR-CTCRI and PepsiCo interface meeting	18 July 2025
28	Institute Biosafety Committee meeting	21 July 2025 18 December 2025
29	Interaction meeting with Director, ICAR-ATARI Zone-XI	26 July 2025
30	A training programme on Empowering Agro start-ups	30 July 2025
31	Live web telecast of PM Kisan Samman Nidhi & Scientist-Farmer Interface	2 August 2025
32	Independence Day celebration	15 August 2025
33	Hindi fortnight celebration	14-28 September 2025
34	Swachh Bharat Abhiyan	17 September to 02 October 2025
35	Rainbow Diet Campaign Health Camp	18 September 2025
36	ICAR-CTCRI and CIP scientists interaction meeting	19 September 2025
37	Live webcast of the launching of PM Dhan-Dhaanya Krishi Yojana and Mission for Aatmanirbharta in Pulses	11 October 2025
38	Vigilance Awareness week 2025- Integrity pledge	27-31 October 2025
39	Rashtriya Ekta Diwas pledge and unity walk	31 October 2025
40	Vande Mataram, a solemn mass singing	07 November 2025
41	Janjatiya Gaurav Varsh Pakhwada	12-14 November 2025
42	Inauguration of vacuum frying unit	12 November 2025
43	International symposium on Tropical Root and Tuber Crops for Nutrition, Agri-food Systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4NARES)	17-21 November 2025
44	Stakeholder interface on Fostering Global Partnerships and Business Models for Tropical Tuber Crops	20 November 2025
45	Inauguration of Root Scape Arena	20 November 2025
46	Mid-term review meeting of AICRP on Tuber Crops	20 November 2025
47	International scientific meeting on Global Cassava Breeding Network	21 November 2025
48	Tuber Crops Day 2025	4 December 2025
49	Inauguration of Gene Editing Lab	04 December 2025
50	World Soil Day 2025	05 December 2025
51	National Farmers Day -Kisan Diwas 2025	23 December 2025
52	Swachhta Pakhwada-2025	16-31 December
53	Study visit of the Parliamentary Standing Committee on Empowerment of Women	29-30 December 2025

WEATHER DATA 2025

ICAR-CTCRI, Headquarters, Thiruvananthapuram, Kerala

Month	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	No. of Rainy Days
	Minimum	Maximum	Minimum	Maximum		
January	21.44	34.52	51.71	95.71	14.90	5
February	21.13	35.90	48.04	96.82	0.60	2
March	22.24	35.83	59.68	98.58	50.90	21
April	22.13	34.81	67.87	98.69	37.20	20
May	22.49	34.16	71.25	98.85	121.10	18
June	23.02	33.71	71.92	99.66	8.90	7
July	21.37	33.33	73.23	99.44	63.80	19
August	21.85	33.75	73.49	99.89	42.70	16
September	22.51	34.07	68.43	99.65	73.30	7
October	22.49	33.52	71.01	99.43	179.10	20
November	20.62	32.97	98.31	99.78	79.60	14
December	19.87	33.49	95.86	99.28	1.20	2

ICAR-CTCRI, Regional Station, Bhubaneshwar, Odisha

Month	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	No. of Rainy Days
	Minimum	Maximum	Minimum	Maximum		
January	16.17	27.56	55.70	93.26	0	0
February	21.41	32.24	47.52	91.52	31	3
March	23.21	34.58	54.38	95.63	10	1
April	25.45	35.24	48.26	95.31	105	5
May	26.74	35.36	55.39	94.63	94	8
June	26.40	32.90	69.48	95.78	305	13
July	26.28	31.59	72.61	98.67	361	20
August	26.27	31.53	71.20	99.35	232	17
September	25.67	31.48	72.16	98.42	260	15
October	24.59	31.22	68.45	98.51	223	13
November	18.48	29.14	93.51	99.23	0	0
December	14.80	26.48	95.18	99.15	0	0



LIST OF VARIETIES OF ICAR-CTCRI REGISTERED WITH ICAR-NBPGR

Sl. No.	Crop Name	Botanical Name	National Identity	Donor Identity	Variety Name	Ingr. No.	Year	Pedigree	Developer	Developing Institute	Novel Unique Features
1	Cassava	<i>Manihot esculenta</i>	IC0586850	Triploid Cassava: 4-2	Sree Athulya	10144	2010	OP-4 (2x) x SreeVisakham (4x)	M.T. Sreekumari, K. Abraham, M. Unnikrishnan and S. Ramanathan	ICAR-CTCRI Thiruvananthapuram, Kerala	Higher yield and high extractable starch
2	Cassava	<i>Manihot esculenta</i>	IC0586851	Triploid Cassava: 5-3	Sree Apoorva	10145	2010	Ambakkadan (2x) x SreeSahya (4x)	M.T. Sreekumari, K. Abraham, M. Unnikrishnan and S. Ramanathan.	ICAR-CTCRI Thiruvananthapuram, Kerala	Higher yield and high extractable starch
3	Sweet potato	<i>Ipomoea batatas</i>	IC0593650	ST-14	Bhu Sona	13020	2013	JP-14	S.K. Naskar and Archana Mukherjee	RC, ICAR-CTCRI Bhubaneswar, Odisha	High β carotene (13-14.5 mg 100 g ⁻¹) and salinity tolerance
4	Sweet potato	<i>Ipomoea batatas</i>	IC0593651	ST-13	Bhu Krishna	13021	2013	JP-13	S.K. Naskar and Archana Mukherjee	RC, ICAR-CTCRI Bhubaneswar, Odisha	High anthocyanin (85-90 mg 100 g ⁻¹) and salinity tolerance
5	Sweet potato	<i>Ipomoea batatas</i>	IC0593652	ST-10	Bhu Swami	13022	2013	JP-10	S.K. Naskar and Archana Mukherjee	RC, ICAR-CTCRI Bhubaneswar, Odisha	High extractable starch (20-21%)

Produce Tuber... Reduce Hunger !



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