भाकृअनुप - रावाकृअसं
ICAR - NIRCA

भाकृअनुप
ICAR

वार्षिक प्रतिवेदन
Annual Report 2025

भाकृअनुप-राष्ट्रीय वाणिज्यिक कृषि अनुसंधान संस्थान
ICAR - NATIONAL INSTITUTE FOR RESEARCH ON COMMERCIAL AGRICULTURE
(FORMERLY ICAR-CENTRAL TOBACCO RESEARCH INSTITUTE)
(An ISO 9001: 2015 Certified Institute)
RAJAHMUNDRY - 533 105, ANDHRA PRADESH, INDIA

Transforming Research into Impact • Empowering Farmers • Enriching Lives

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(आईएसओ 9001:2015 प्रमाणित संस्थान)

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राजमन्द्री - 533 105, आंध्र प्रदेश, भारत

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वार्षिक प्रतिवेदन

2025

प्रकाशक

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ICAR-NIRCA

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भाकृअनुप
ICAR

Preface

It is my pleasure to present the Annual Report 2025 of ICAR–NIRCA, highlighting the institute's scientific achievements, technological innovations, and extension initiatives. During the year, the institute strengthened its commitment to sustainable, climate resilient, and farmer centric technologies for tobacco and other commercial crops, while addressing emerging challenges in commercial agriculture.

The year marked a milestone with the renaming of ICAR–CTRI as ICAR–NIRCA and the celebration of NIRCA Formation Day. Significant varieties notified included *CTRI Navya, Sahyadri Swarna,* and *DTV 9,* each producing high yields of 3000 kg/ha notified in 93rd CVRC and Nandyala Pogaku 2 (ABD 132) notified in the 94th CVRC. **Genome editing for less harmful compounds and genetic enhancement of chilli nutraceutical helps for further commercialization.** Seed supply of 19,007 kg generated ₹ 2.60 crore revenue, ensuring national requirements were met efficiently.

Key technological advancements included estimation of GHGs and carbon stocks, nano- biocapsules for soil health, IOTs in irrigation and fertilization, standardizing drone technology, bio enriched coco-peat technology for nematode management, and sensor based LPG and electric heat pump curing systems enabling complete replacement of wood fuel. The year witnessed significant progress in diversified cropping systems, post harvest technologies, and sustainable tobacco curing. Turmeric based cropping systems enhanced economic returns, while intercropping with ashwagandha improved profitability and crop quality. Pre harvest and post harvest interventions strengthened chilli & turmeric quality, and eco friendly processes for bioactive compounds from castor opened avenues for industrial applications.

During the year, our scientific staff undertook 49 institutional projects, 32 externally funded projects, 3 CSR projects, advancing genome editing, precision agriculture, resource management, and value added products. To strengthen research and development collaboration, 19 Memoranda of Understanding and 3 Memoranda of Agreement were signed with research institutes and private sector partners. The institute also continued to provide vital analytical support to the Tobacco Board and industry stakeholders, reaffirming its role as a key contributor to sustainable and farmer centric commercial agriculture.

ICAR–NIRCA scientists actively participated in the nationwide Viksit Krishi Sankalp Abhiyan (May 29–June 12, 2025) in the states of Andhra Pradesh, Karnataka, Tamil Nadu and West Bengal connecting farmers with scientific advancements and promoting adoption of modern agricultural technologies through extensive farmer outreach and awareness campaigns.

The institute strengthened technology dissemination through 17 On-Farm Trials (OFTs), 8 Frontline Demonstrations (FLDs), and 51 capacity-building programmes aimed at enhancing productivity, promoting value addition, and accelerating the adoption of improved technologies in commercial crops. During the year, one technology was commercialized and four technologies were recommended for adoption by tobacco farmers. Timely technical advisories were disseminated through press releases, social media platforms, and the institute's website, ensuring effective outreach and wider stakeholder engagement.

In 2025, the institute's research output comprised 35 research publications, 31 other publications and one copyright, with scientists receiving 10 prestigious awards. Key institutional events included Foundation Day, the Innovators Meet on "Fostering Agri Innovation and Agri Entrepreneurship," the Turmeric Stakeholders' Conclave, Germplasm Field Day, Bidi tobacco stakeholders' meeting, and the XXVII AINPT Workshop. Government Flagship programmes such as SCSP, TSP and NEH were actively implemented, reaffirming commitment to inclusive and sustainable agricultural development. Supported by dedicated scientists and staff, the institute continues to extend its success beyond tobacco, creating new opportunities for chilli, turmeric, ashwagandha, and castor farmers, with the aim of replicating the achievements realized in tobacco cultivation

I express my sincere gratitude to Dr. M.L. Jat, Hon'ble Secretary, DARE & Director General, ICAR and Dr. D.K. Yadava, Deputy Director General (Crop Sciences), Dr. Prasanta Dash, Assistant Director General (Commercial Crops), and all officials of ICAR for their constant encouragement and support. I also place on record my appreciation to the members of the Research Advisory Committee and Institute Management Committee for their valuable guidance. My heartfelt thanks are due to all Heads of Divisions, In-charges of Regional Stations, scientists, technical officers, administrative staff and supporting personnel whose collective efforts made these achievements possible. I also acknowledge the contributions of the Annual Report Editorial Committee, PME Cell, and Library for bringing out this Annual Report in time.

I am confident that the research achievements and technological advancements documented in this report will further strengthen sustainable commercial agriculture, enhance farmers' livelihoods, promote environmental stewardship and contribute significantly towards achieving the national goals of agricultural growth and food, nutritional and economic security.

January, 2026
Rajahmundry

(M. SHESHU MADHAV)
Director

कार्यकारी सारांश

वाणिज्यिक फसल सुधार

- पेडिग्री विधि से विकसित FCV तंबाकू की ज्यादा उपज देने वाली किस्म FCH 248 (CTRI Navya) को 93वीं CVRC द्वारा कर्नाटक की हल्की मृदा (KLS) वाले इलाकों में वाणिज्यिक खेती के लिए जारी किया गया और 13.05. 2025 की गजट अधिसूचना संख्या SO 2128 (E) के जरिए इसे अधिसूचित किया गया। CTRI Navya में 2100 से 2700 कि.ग्रा. प्रति हेक्टेयर तक 'उपचारित पत्ती' (सूखी पत्ती) देने की क्षमता है; इसने 'कंचन' किस्म की तुलना में 'उपचारित पत्ती' की पैदावार में 45% तक सुधार दिखाया है और इसमें 'ब्लैक शंक' बीमारी की असर भी कम देखा गया है।
- कर्नाटक की हल्की मृदा वाले उन इलाकों के लिए, जहां फ्यूजेरियम विल्ट का खतरा रहता है, CMS आधारित FCV तम्बाकू का एक आशाजनक संकर FCHH 2 विकसित किया गया था। कई स्थानों पर किए गए समन्वित परीक्षणों में, इस संकर से उपचारित पत्तियों की पैदावार वाणिज्यिक संकर चेक किस्म की तुलना में 17–21% अधिक (औसतन 2.4 टन प्रति हेक्टेयर) प्राप्त हुई और किसानों के खेतों में प्राकषतिक रूप से संक्रमण वाली स्थितियों में इसमें फ्यूजेरियम विल्ट का कोई प्रभाव नहीं देखा गया।
- दक्षिणी हल्की मृदा (SLS) वाले इलाके के लिए, उन्नत प्रजनन वंशक्रम लाइन FCR 63 ने बेहतरीन परफॉर्मेंस दिखाई। इसने 2.6 टन प्रति हेक्टेयर की औसत उपचारित पत्ती उपज दर्ज की, जो पहले से जारी किस्मों CTRI श्रेश्ठा (2.4 टन प्रति हेक्टेयर) और सिरी (2.2 टन प्रति हेक्टेयर) से बेहतर थी। साथ ही, इसमें खेती और बनावट से जुड़ी जरूरी खूबियां भी देखी गईं।
- काली मृदा वाली स्थितियों में, प्रजनन वंशक्रम RS 47 और RS 55 ने चेक किस्म CTRI सुलक्षणा की तुलना में क्रमषः 2,153 और 2,145 कि.ग्रा./हे. की काफी अधिक उपचारित पत्ती उपज दर्ज की। इसी तरह, उन्नत वंशक्रम V 5149 और V 5150 ने क्रमषः 2,129 और 2,074 कि.ग्रा./हे. की काफी अधिक उपचारित पत्ती उपज दी, जिससे काली मृदा वाले इकोसिस्टम में किस्मीय तौर पर आगे बढ़ने की उनकी क्षमता की पुश्टि हुई।
- प्रजनन प्रविष्टियां, SJ 11, SJ 12, SJ 14, SJ 15 और SJ 16 को NLS स्थितियों में चेक किस्म के मुकाबले काफी अधिक उपचारित पत्ती (2.89-3.49 टन./हे.) के साथ आशाजनक पाया गया।
- तंबाकू पर अखिल भारतीय नेटवर्क परियोजना (AINPT) के तहत कई जगहों पर मूल्यांकन के लिए, शुरूआती किस्मीय परीक्षण (IVT) में पांच FCV किस्मों (RS 47, V-5149, FCH 263, FCH 272 और FCH 276) को शामिल किया गया।
- कर्नाटक की हल्की मृदा वाली स्थितियों में मूल्यांकन के दूसरे वर्ष, प्रजनन वंशक्रम FCH 270, FCH 271, FCH 272, FCH 273 और FCH 276 से 2,098 से 2,242 कि.ग्रा./हे. तक उपचारित पत्तियों की पैदावार मिली, जो सबसे अच्छा प्रदर्षन करने वाली चेक किस्म की तुलना में 24 से 32% अधिक थी। इसी तरह, उन्नत प्रजनन वंशक्रम FCH-279, FCH-282, FCH-283, FCH-284, और FCH-286 ने 26 से 45% अधिक उपचारित पत्तियों की पैदावार और साथ ही बेहतर ब्राइट लीफ यील्ड दर्ज की, जिससे भविश्य में नई वैरायटी जारी करने की काफी संभावना दिखाई दी।
- NIRCA रिसर्च स्टेषन, कंदुकूर में KDB 3, KDB 6, VT 1158 और CTRI श्रेश्ठ जीनप्ररूपों ने सूखे और भरपूर पानी, दोनों ही स्थितियों में स्थिर प्रदर्षन किया, जो जलवायु–अनुकूल तंबाकू उत्पादन के लिए उनकी उपयुक्तता को दर्षाता है।
- बर्ली तंबाकू में, BFC 23, BFC 33 और BFC 36 जैसी प्रजनन वंशक्रमों में पौधे की बनावट के अच्छे गुण देखे गए, जबकि Burley 181, BFC 23–1–12, KY 42–11, BFC 6–1–2 और Leca–10 जैसी किस्मों ने थोड़े समय के लिए जल भराव की स्थिति में भी पौधों के जीवित रहने की बेहतर क्षमता दिखाई। इसके अलावा, Burley 181, Burley 49 और Burley 64 जैसे जीनप्ररूपों ने सूखे और सिंचाई वाली, दोनों ही स्थितियों में पत्तियों की बेहतर पैदावार बनाए रखी।
- चर्वण तंबाकू जीनप्ररूप AOB 359 सभी मूल्यांकन स्थानों में सबसे अधिक उपज देने वाली प्रविश्टि के रूप में उभरा, इसके बाद AOB 962 है। QTL-seq विष्लेशण ने क्रोमोसोम 2, 5, 8, 12 और 19 पर फ्यूसेरियम विल्ट प्रतिरोध से जुड़े आठ महत्वपूर्ण जीनोमिक क्षेत्रों की पहचान की, जो मार्कर–सहायता प्रजनन के लिए मूल्यवान जीनोमिक संसाधन प्रदान करते हैं।
- कैरोटीनॉयड बायोसिंथेसिस में षामिल फाइटोइन डेसैचुरेस (PDS) जीन को टारगेट करने वाले गाइड RNA के सफल डिजाइन और वैलिडेषन से जीनोम–एडिटिंग रिसर्च में एक अहम उपलब्धि हासिल हुई। pKSE401–PDS कंस्ट्रक्ट का इस्तेमाल करके एग्रोबैक्टीरियम–मीडिएटेड ट्रांसफॉर्मेषन से एल्बिनो T• पौधे तैयार किए गए, और मॉलिक्यूलर कैरेक्टराइजेषन से टारगेटेड न्यूक्लियोटाइड डिलीषन के जरिए सफल जीन नॉकआउट की पुश्टि हुई, जिससे तंबाकू में एक मजबूत CRISPR/Cas जीनोम–एडिटिंग प्लेटफॉर्म स्थापित हुआ।
- इस साल तंबाकू की अलग–अलग किस्मों और वन्य *निकोटियाना* प्रजातियों को मिलाकर कुल 1,364 तंबाकू जननद्रव्य परिग्रहणों को फिर से उगाया गया। 1,752 परिग्रहणों के लिए पासपोर्ट डेटा तैयार की गई, और 107 बेहतर तंबाकू किस्में विकसित करने में जननद्रव्य के इस्तेमाल का पूरा रिकॉर्ड रखा गया, जिसमें उनके वंषावली संबंध और आनुवंशिक पैतष्क भी षामिल थे।
- प्री–ब्रीडिंग प्रोग्राम के तहत, बेहतरीन FCV तंबाकू किस्मों में जड़ गांठ सूत्रकषमि, ब्लैक षैंक और टोबैको मोजेक वायरस TMV के प्रति प्रतिरोधक क्षमता लाने के लिए 21

इंटरस्पेसिफिक क्रॉस तैयार किए गए, जिससे संस्थान का लंबे समय तक चलने वाला आनुवंशिक सुधार कार्यक्रम और मजबूत हुआ।

- संस्थान ने 'रिवॉल्विंग फंड स्कीम' के तहत सही लेबल वाले 18,612.9 किलोग्राम तंबाकू के बीज उपलब्ध कराए। इनमें सात FCV, दो बर्ले और एक लंका तंबाकू की किस्में षामिल थीं। इससे ¹ 252 लाख का राजस्व प्राप्त हुआ और साथ ही किसानों को अच्छी गुणवत्तापूर्ण बीज समय पर उपलब्ध हुआ।

वाणिज्यिक फसलों में सुधार

- मिर्च में, आर्थिक रूप से महत्वपूर्ण गुणों के लिए कई बेहतरीन प्रजनन वंशक्रमों की पहचान की गई। DinCh–330 में सूखे फल की सबसे अधिक पैदावार (2,633 कि.ग्रा./हे) दर्ज की गई, DinCh–262 में सबसे अधिक कैप्सैसिन की मात्रा (3,297 ìg g{ ¹) पाई गई, DinCh 68–10–3 में सबसे अधिक एंथोसायनिन (सायानिडिन–3–ग्लूकोसाइड) की मात्रा (645.58 ìg g{ ¹) दर्ज की गई, जबकि DinCh–252–12–6 में सबसे अधिक कैरोटीनॉयड की मात्रा (1,400.3 ìg g{ ¹) पाई गई, ये सभी फसल सुधार और मूल्य वर्धित उत्पाद बनाने के लिए मूल्यवान आनुवंशिक संसाधन प्रदान करते हैं।

- ICAR-NBPGR और ICAR-DMAPR से लिए गए कुल 330 अष्वगंधा जननद्रव्य परिग्रहणों का मात्रात्मक, गुणात्मक और DUS डिस्क्रिप्टर्स के आधार पर मूल्यांकन किया गया। सस्यविज्ञानी और गुणवत्ता से जुड़े अच्छे गुणों वाले आशाजनक जीनप्ररूपों की पहचान की गई, जबकि भविश्य के प्रजनन कार्यक्रम में मदद के लिए 157 परिग्रहणों में विथानोलाइड (Withanoloids) की मात्रा की जांच की गई।

- हल्दी में, 43 जननद्रव्य परिग्रहणों का उनके मॉर्फोलॉजिकल, उपज और क्वालिटी गुणों के आधार पर मूल्यांकन किया गया। ताजे प्रकंदों की उपज 4.3 से 49.3 टन प्रति हेक्टेयर के बीच रही, जिसमें 'असम–2' परिग्रहण की उपज सबसे अधिक (49.3 टन प्रति हेक्टेयर) दर्ज की गई। सबसे अधिक करक्यूमिन की मात्रा (8.9%) 'TCP–115' परिग्रहण में पाई गई, इसके बाद 'TCP–223' (7.3%) और 'TCP–285–2' (5.29%) का स्थान रहा, इससे गुणवत्ता में सुधार के लिए महत्वपूर्ण डोनर वंशक्रमों की पहचान हुई।

अनुसंधान की नई पहलें

- जड़–गांठ सूत्रकृमियों की समस्या का समाधान करने के लिए, प्रतिरोधी किस्मों को विकास करना सबसे टिकाऊ उपाय है। इस संबंध में, जड़–गांठ सूत्रकृमियों के लिए *निकोटियाना टैबैकम* प्रतिरोध के आण्विक और अनुवंशिक निर्धारकों को स्पष्ट करने के लिए एक परियोजना शुरू की गई।

- हेक्साप्लॉइड हल्दी की किस्में विकसित करके हल्दी की पैदावार और न्यूट्रास्युटिकल गुणवत्ता को बेहतर बनाने के लिए अनुसंधान षुरू की गई है, ताकि अधिक कीमत वाली किस्मों के विकास के लिए जेनेटिक आधार को बढ़ाया जा सके।

- इसके अलावा, संसाधन–सीमित वातावरण के तहत उत्पादकता बनाए रखने में सक्षम पोशक तत्व–कुषल तंबाकू जीनप्ररूपों की पहचान करने के लिए सूखे की स्थिति के तहत पोटेषियम–उपयोग दक्षता पर रणनीतिक जांच षुरू की गई है, जिससे जलवायु–लचीला और संसाधन–कुषल वाणिज्यिक कृशि में योगदान दिया जा सके।

फसल उत्पादन का प्रबंधन

कृषि प्रौद्योगिकियां

- उत्तरी हल्की मष्दा (NLS) स्थितियों में, नैनो बायो–कैप्सूल, फार्मयार्ड खाद (FYM) और फर्टिलाइजर की सुझाई गई मात्रा (RDF) के साथ इंटीग्रेटेड न्यूट्रिएंट मैनेजमेंट (एकीकृत पोशक तत्व प्रबंधन) ने फ्लू–क्यूर्ड वर्जीनिया (FCV) तंबाकू की फसल की उत्पादकता में काफी सुधार किया। 100% RDF और FYM के साथ प्रति एकड़ 10 नैनो बायो–कैप्सूल के इस्तेमाल से, केवल RDF के इस्तेमाल की तुलना में लीफ एरिया इंडेक्स, मिट्टी में माइक्रोबियल गतिविधि, फास्फोरस का अवशोषण और उपचारित पत्ती की पैदावार में 5–6.5% की बढ़ोतरी हुई। इस तकनीक ने लाभ लागत अनुपात को भी 1.39 से बढ़ाकर 1.43 कर दिया, जिससे ¹ 12,152 प्रति हेक्टेयर की अतिरिक्त आय हुई, जो इसकी आर्थिक व्यवहार्यता को साबित करता है।

- कर्नाटक की हल्की मष्दा (KLS) वाली स्थितियों में, नैनो बायो–कैप्सूल, FYM और RDF के एक साथ इस्तेमाल से, केवल RDF के इस्तेमाल की तुलना में हरी पत्तियों, उपचारित पत्तियों और चमकदार पत्तियों की पैदावार में 6–9% की उल्लेखनीय बढ़ोतरी हुई। वर्षा पर निर्भर खेती की स्थितियों में जड़ों का बेहतर विकास और पोशक तत्वों का बेहतर अवषोशण यह संकेत देता है कि उत्पादकता या पत्तियों की गुणवत्ता से समझौता किए बिना, खाद की अनुषंसित मात्रा को 25% तक कम किया जा सकता है।

- राजमंड्री की स्थितियों में 45 X 30 cm की दूरी पर हर मोड (ridge) पर पौधों की एक लाइन लगाने और 200 kg K_2O/ha का इस्तेमाल करने से ताजे प्रकंदों की पैदावार 52.1 टन/हे., प्रकंद रिक्वरी 19.68%, सूखे प्रकंद की पैदावार 9.97 टन/हे. और करक्यूमिन की मात्रा 2.53% दर्ज की गई, जो सबसे ज्यादा थी।

- खरपतवार प्रबंधन की एक समेकित रणनीति, जिसमें मैकेनिकल पावर वीडिंग के साथ–साथ फसल उगने से पहले पेंडिमेथालिन 38.7% SC (0.6 kg a.i./ha) और फसल उगने के बाद क्विजालोफॉप–एथिल 5% EC (0.06.kg a.i./ha) का इस्तेमाल किया गया, उससे खरपतवार पर बेहतरीन नियंत्रण (90%) मिला और मिर्च की सबसे ज्यादा पैदावार (2777 kg/ha) हासिल हुई। इस तरीके से पैदावार तय करने वाले मुख्य गुणों में सुधार हुआ और फसल बढ़ने के पूरे समय के दौरान खरपतवार से होने वाली प्रतिस्पर्धा को प्रभावी ढंग से कम किया गया।

- अश्वगंधा में, भेड़ की खाद और बायो–फर्टिलाइजर के इस्तेमाल से सबसे ज्यादा कुल आय (3,23,930 रू/हेक्टेयर) दर्ज की गई और इसके बाद केवल भेड़ की खाद का स्थान रहा। भेड़ की खाद और बायो–फर्टिलाइजर के इस्तेमाल से सबसे ज्यादा शुद्ध आमदनी (2,28,180 रू/हेक्टेयर) दर्ज की गई, जिसके बाद वर्मीकम्पोस्ट और बायो–फर्टिलाइजर के साथ FYM का स्थान रहा।

- सतही सिंचाई (Surface irrigation) के साथ 75%, 100% और 125% ET पर अश्वगंधा की जड़ पैदावार लगभग एक जैसी रही। सतही सिंचाई से 1,34,950 रू प्रति हेक्टेयर का सबसे ज्यादा शुद्ध लाभ मिला, जिसके बाद ड्रिप सिंचाई में 100%, 125% और 75% ET का स्थान रहा। पानी के इस्तेमाल की क्षमता (WUE) 25% ET के साथ सबसे ज्यादा थी, और उसके बाद 50% ET का स्थान रहा।

- पोटेशियम–विलेयीकृत सूक्ष्मजीवों का इस्तेमाल करके, ध ाान की भूसी की राख और बेकार माइका से पोटेशियम से भरपूर एक नया ऑर्गेनिक न्यूट्रिएंट सप्लीमेंट, 'राइस हस्क ऐश-K- फंक्शनल' (RHA-K) तैयार किया गया है। यह पश्चिम बंगाल में हल्दी की उत्पादन बढ़ाने के लिए एक असरदार और टिकाऊ विकल्प साबित होता है।

- मदर राइजोम (मुख्य प्रकंद) से उगाए गए 'डुग्गीराला रेड' कृषिजोपजात में INM {इनऑर्गेनिक RDF (150-50-50 $N-P_2O_5-K_2O$) + ऑर्गेनिक (FYM 5 टन/हेक्टेयर) + बायोफर्टिलाइजर (एजोस्पिरिलम+एजोटोबैक्टर)} के इस्तेमाल से सबसे ज्यादा सूखे प्रकंद की रिकवरी (20.77%), सूखे प्रकंद की पैदावार (11.037 टन/हेक्टेयर) और करक्यूमिन की मात्रा (2.15%) दर्ज की गई।

- सिस्टमिक सकरीसाइड (Suckericide), यानी फ्युमेट्रालिन (SUCKERSTOP™), जिसे एक नए सिंथेटिक तरीके से 17.5% EC के रूप में तैयार किया गया था, उसे NLS क्षेत्र के किसानों के खेतों में FCV तंबाकू की अलग–अलग हाइब्रिड और किस्मों पर परखा गया। इसमें पाया गया कि 25 मिली प्रति लीटर की खुराक सबसे असरदार (95% तक) रही। सिंचाई वाली और बारिश पर निर्भर, दोनों की स्थितियों में इसके अवशेष (residue) की मात्रा GRL (सामान्य अवशेष सीमा) के भीतर पाई गई।

- मोतिहारी तंबाकू पर 64 साल से चल रहे न्यूट्रिएंट मैनेजमेंट (पोषक तत्व प्रबंधन) के तहत दस तरह के न्यूट्रिएंट ट्रीटमेंट्स का मेटाबोलोमिक्स अध्ययन किया गया। नतीजों से पता चला कि संतुलित NPK+10 टन/हेक्टेयर FYM (फार्मयार्ड खाद) के इस्तेमाल से सबसे ज्यादा मेटाबोलाइट विविधता मिली। साथ ही, नाइट्रोजन ने अल्कलॉइड (यानी निकोटीन, ~4.0%) और फेनिल–प्रोपेनॉइड बायोसिंथेसिस को बढ़ावा दिया, जिसका सीधा संबंध पत्ती की अधिकतम पैदावार और लंबे समय तक चलने वाले ह्यूमिफिकेशन से था।

संसाधन अनुकूलन

- बर्ली तंबाकू में, गिद्दलूरू में नमी की कमी वाली स्थितियों में 250 कि.ग्रा./हेक्टेयर नाइट्रोजन (N) के साथ (3.87) और नंद्याल में (2.45) तीसरी बार पत्तियां तोड़ने (pick) के दौरान ज्यादा एल्कालॉइड मात्रा दर्ज की गई; वहीं विनुकोंडा में 'विन 5' किस्म में 200 कि.ग्रा. N/हेक्टेयर के साथ चौथी बार पत्तियां तोड़ने के दौरान 24 पत्तियों पर टॉपिंग करने पर (3.15) मात्रा दर्ज की गई जो उल्लेखनीय जीनप्ररूप X पर्यावरण की पारस्परिक प्रतिक्रियाओं पर प्रकाश डालता है।

- FCV तंबाकू की किस्म FCJ 11 ने किसानों की किस्म की तुलना में बेहतर हरी पत्ती की पैदावार (13.9 टन/हेक्टेयर), उपचारित पत्ती की पैदावार (1,943 किग्रा/हेक्टेयर), ग्रेड इंडेक्स (1,374) और हरी पत्ती से उपचारित पत्ती का अनुपात (7.0) दिया। 135 किग्रा N/हेक्टेयर और 150 किग्रा K_2O/हेक्टेयर की दर से खाद देने पर, नाइट्रोजन के ज्यादा इस्तेमाल वाली दरों की तुलना में नाइट्रोजन–उपयोग क्षमता, एग्रोनॉमिक क्षमता, रिकवरी क्षमता, आंषिक कारक उत्पादकता और आर्थिक मुनाफे में काफी सुधार हुआ।

- NLS FCV तंबाकू राइजोस्फीयर में, एक्टिनोबैक्टीरिया (34-40%) और प्रोटीओबैक्टीरिया (25-28%) बैक्टीरिया के सबसे आम प्रकार थे। इससे पता चलता है कि ये बैक्टीरिया पोषक तत्व चक्र, कार्बन टर्नओवर और रोग नियंत्रण में महत्वपूर्ण भूमिका निभाते हैं। मेटाबोलॉमिक विश्लेषण ने लाभकारी बैक्टीरिया से जुड़े स्थान–विशिष्ट मेटाबोलाइट्स (मैलिक, एसिटिक और फेनोलिक एसिड) की पहचान की, जो फॉस्फोरस घुलनशीलता, नाइट्रोजन परिवर्तन और सल्फर ऑक्सीकरण के तंत्र का प्रदर्शन करते हैं!

- तंबाकू–आधारित उत्पादन प्रणालियों में कार्बन सीक्वेस्ट्रेषन (कार्बन जमा करने की क्षमता) 17 से 96 Mg ha{ ¹ के बीच थी, जिसका औसत 35–40 Mg ha{ ¹ रहा। सबसे ज्यादा सीक्वेस्ट्रेषन क्षमता FYM/मिर्च–तंबाकू और सनई–तंबाकू प्रणालियों में देखी गई, जबकि लगातार परती–तंबाकू प्रणालियों में कार्बन का भंडारण सबसे कम रहा; इससे क्लाइमेट–स्मार्ट खेती के लिए अलग–अलग तरह की फसल प्रणालियों के महत्व का पता चलता है।

- मिर्च में स्वदेषी पौधों के विकास को बढ़ावा देने वाले राइजोबैक्टीरिया (PGPR) फॉर्मूलेषन के अनुप्रयोग ने केवल RDF की तुलना में फलों के पेरिकार्प की मोटाई में काफी वर्षद्धि की है, जो पोशक तत्व प्रबंधन और माइक्रोबियल टीकाकरण के बीच लाभकारी पारस्परिक प्रतिक्रिया की पुश्टि करता है। इसके अलावा, RDF उपचारित नमूनों में भंडारण के दौरान उच्चतम एफ्लाटॉक्सिन बी संदूशण दर्ज किया गया, जबकि कल्टीवर अकाषी ने छह महीने के बाद भी सबसे कम एफ्लाटॉक्सिन संचय प्रदर्षित किया, जो बेहतर भंडारण स्थिरता का संकेत देता है।

- जीवन–चक्र मूल्यांकन से पता चला कि तंबाकू उत्पादन प्रणालियों के भीतर कुल कार्बन उत्सर्जन में तंबाकू उपचार का योगदान लगभग 71.8% है। सनई–तंबाकू अनुक्रम (6.87 टन $CO_2e\ ha^{-1}$) की तुलना में परती–तंबाकू अनुक्रम (7.32 टन $CO_2e\ ha^{-1}$) में कुल कार्बन फुटप्रिंट अधिक था, यह दर्षाता है कि फलियां–आधारित फसल चक्र ग्रीनहाउस गैस उत्सर्जन को काफी हद तक कम कर

सकता है और तंबाकू की खेती की पर्यावरणीय स्थिरता में सुधार कर सकता है।

- मूल्यांकन की गई फसल प्रणालियों में, सनई–तंबाकू अनुक्रम के तहत मिट्टी में उच्चतम कार्बन खनिजकरण (20.9 ग्राम किग्रा$^{-1}$ मृदा) दर्ज किया गया, जो कि बढ़ी हुई माइक्रोबियल गतिविधि और हरी खाद निगमन से प्राप्त प्रयोगशाला कार्बनिक कार्बन की अधिक उपलब्धता को दर्शाता है।

फसल प्रणालियां

- वाणिज्यिक खेती के लिए विकसित की गई अलग–अलग तरह की फसल प्रणालियों ने अलग–अलग कृषि–पारिस्थितिक क्षेत्रों में उत्पादकता, लाभप्रदता, संसाधनों के कुषल उपयोग और पर्यावरण की स्थिरता को बढ़ाने की बड़ी क्षमता दर्शायी हैं।
- अल्फिसोल मष्दा की स्थितियों में, हल्दी + उड़द (खरीफ) – तंबाकू (रबी) – मूंगफली (रिले) फसल प्रणाली से सबसे ज्यादा ₹ 3,25,473 प्रति हेक्टेयर का षुद्ध लाभ मिला। इसके बाद हल्दी + उड़द (4:4) (खरीफ) – तंबाकू (रबी) प्रणाली का स्थान रहा, जिससे ₹ 3,17,110 प्रति हेक्टेयर का षुद्ध लाभ हुआ। ये प्रणालियाँ हल्दी पर आधारित अन्य फसल प्रणालियों की तुलना में आर्थिक रूप से बेहतर साबित हुईं, जो वाणिज्यिक खेती में किसानों की आय बढ़ाने की इनकी क्षमता को दर्शाती हैं।
- सामान्य रोपण (0.7 मी. X 0.7 मी.) की तुलना में, चने के साथ तंबाकू की इंटरक्रॉपिंग के लिए वाइड–स्पेस्ड पेयर्ड रो प्लांटिंग (WSPRP) (0.8 मी. X 0.4 मी. + 1.5 मी.) में तंबाकू की पत्ती के बराबर उपज के आधार पर सिस्टम की उत्पादकता सबसे ज्यादा तम्बाकू पत्ते तुल्य उपज (TLEY) 1864 कि.ग्रा./हे. रही। पोषण प्रबंधन के मामले में, उर्वरकों की 100% सुझाई गई मात्रा से सबसे ज्यादा हरी पत्ती की उपज (12.06 टन/हे), उपचारित पत्ती की उपज (2091 कि.ग्रा./हे.) और ब्राइट ग्रेड पत्ती की उपज (1253 कि.ग्रा./हे.) दर्ज की गई।
- हल्दी और सहजन (मोरिंगा) की इंटरक्रॉपिंग से अलग–अलग फसलों की पैदावार तो कम हुई, लेकिन पूरे सिस्टम का मुनाफा बढ़ गया। सिर्फ मोरिंगा की खेती सबसे ज्यादा मुनाफे वाला सिस्टम रहा, जिसमें सबसे ज्यादा नेट रिटर्न (4,68,272/हे.) और लाभ लागत अनुपात (3.34) मिला। हालांकि, इंटरक्रॉपिंग सिस्टम में 'पेयर्ड रो' मोरिंगा + हल्दी (1:9) से सबसे ज्यादा नेट रिटर्न (3,68,399 रू/हे.) प्राप्त हुआ।
- अश्वगंधा के साथ वार्षिक मोरिंगा और एग्रीगेटम प्याज की मिश्रित खेती (इनऑर्गेनिक तरीके से) करने पर ज्यादा नेट रिटर्न मिला। अश्वगंधा + वार्षिक मोरिंगा और अश्वगंधा + एग्रीगेटम प्याज से मिलने वाला नेट रिटर्न क्रमशः 4,09,656 और 3,99,596 प्रति हेक्टेयर था। अश्वगंधा के साथ मिर्च की मिश्रित खेती करने पर मिर्च की क्वालिटी (जैसे कैप्साइसिन और तीखापन) में बढ़ोतरी हुई। तंबाकू के साथ अश्वगंधा की मिश्रित खेती करने पर निकोटीन की मात्रा में 2.76% की बढ़ोतरी हुई।
- कुल मिलाकर, ICAR-NIRCA द्वारा विकसित विविध फसल प्रणालियों ने खेती से होने वाले मुनाफे को बढ़ाने, संसाधनों का सही इस्तेमाल करने, उत्पाद की गुणवत्ता बेहतर करने और जलवायु के प्रति सहनषीलता बढ़ाने की अपनी क्षमता साबित की है। इस तरह, ये प्रणालियाँ वाणिज्यिक खेती के लिए आर्थिक रूप से फायदेमंद और टिकाऊ उत्पादन मॉडल प्रदान करती हैं।

जैविक स्ट्रैस का प्रबंधन

समेकित नाशीजीव एवं रोग प्रबंधन

- राजमंड्री में खेत और नेट–हाउस स्थितियों में तंबाकू पर सफेद मक्खी *बेमिसिया टबाकी* के बायोकंट्रोल एजेंटों की तेरह प्रजातियां दर्ज की गईं। दर्ज किया गया प्रमुख शिकारी बग *नेसिडियोकोरिस टेनुइस* (प्रति पौधा 2–3) था, फसल के प्रारंभिक चरण के दौरान और फूल आने के दौरान उनकी संख्या 10 से 15 प्रति पौधा थी। दर्ज किए गए अन्य शिकारियों में कोकिनेलिड बीटल *मेनोचिलस सेक्समैकुलैटस, वेरानिया डिस्कोलर वर्निया विन्क्टा, कोकिनेला सेप्टमपंक्टाटा, सी. रेपांडा, क्राइसोपिड क्राइसोपरला कार्निया* और मकड़ियों की तीन प्रजातियां और एक सिरफिड प्रजाति शामिल थीं। सफेद मक्खी के प्यूपा से दो परजीवी दर्ज किए गए यानी *एनकार्सिया* एसपीपी, और *एरेटमोसेरस* एसपीपी।
- डायनामिक हेडस्पेस वोलाटाइल कलेक्शन सिस्टम का इस्तेमाल करके, वन्य जीनप्ररूपों के तंबाकू के पौधों (*निकोटियाना अम्ब्राटिका, एन. बेंथामियाना, एन. गोसेय, एन. रेपांडा, एन. नेसोफिला, एन. टबाकम* (कल्टीवर FCR-15)) से वोलाटाइल्स इकट्ठा किए गए और GC-MS का इस्तेमाल करके उनका विश्लेषण किया गया। इनमें से कुछ पौधे एफिड–मुक्त थे और कुछ एफिड से संक्रमित थे। *एन. बेंथामियाना* के स्वस्थ पौधों से p-cymene, 4-ethy1 benzaldehyde, 3-ethylacetophenone और farnesene जैसे वोलाटाइल्स निकलते हैं, जबकि *माइजस निकोटियाने* एफिड से संक्रमित पौधों से valeric acid, thundergol, exo-2-hydroxycineole, L-tyrosine और N,O-bis (capryloyl)-methyl ester निकलते हैं। ट्रिट्रोफिक इंटरैक्शन में इन वोलाटाइल कंपाउंड्स की कई तरह की भूमिकाएं होती हैं।
- भंडारण में सिगरेट बीटल लैसियोडर्मा वयस्कों के प्रबंधन के लिए कीटनाशक क्लोरफेनेपायर 10 SC, डेल्टामेथ्रिन 11 EC और स्पाइनेटोरम 11.7 SC सबसे प्रभावी (100% मष्त्यु दर) थे।
- तंबाकू की फसल पर ड्रोन से कीटनाशक छिड़कने के लिए स्टैंडर्ड ऑपरेटिंग प्रोसीजर (SOP) का मानकीकरण किया गया। फसल की ऊपरी सतह (canopy) से 2.0 मीटर की ऊंचाई पर 3 मीटर/सेकंड की गति से छिड़काव करते समय, सही स्प्रे के लिए XR11002VP नोज़ल टिप, आमतौर पर इस्तेमाल होने वाले नोज़ल (XR110015VP) से बेहतर पाई गई। बैटरी से चलने वाले नैपसैक स्प्रेयर (BPKS) के लिए बताई गई डोज़ का इस्तेमाल ड्रोन से छिड़काव के लिए भी किया जा सकता है; जैसे *स्पोडॉपटेरा*

लिटूरा के लिए इमामेक्टिन बेंजोएट 5 SG (150 मिली/हेक्टेयर)।

- आंध्र प्रदेश के गुंटूर जिले के कोयावारिपालेम, विंजानमपाडु, तिक्केडीपालेम, प्रत्तिपाडु, अंकीरेड्डीपालेम, बोरावारिपालेम और लिंगायापालेम गांवों में किसानों के खेतों में दक्षिण–पूर्व एशियाई थ्रिप्स (Thrips parvispinus) के प्रबंधन के लिए अलग–अलग IPM मॉड्यूल का प्रदर्शन किया गया। अध्ययन के पहले साल में, नॉन-IPM तरीकों की तुलना में IPM अपनाने वाले गांवों में थ्रिप्स की आबादी में मुल मिलाकर 11.65% की कमी देखी गई।
- NLS क्षेत्र में तंबाकू में 'ब्लैक शैंक' बीमारी का पता लगाने के लिए किए गए एक व्यवस्थित सर्वे (2024–25) से पता चला कि गोपालपुरम प्लेटफॉर्म इलाकों में इसका असर ज्यादा था, जबकि KLS क्षेत्र में, खासकर पेरियापटना में, 'फ्यूजेरियम विल्ट' बीमारी ज्यादा देखी गई। रोग विकास के लिए मृदा में 5-6% (w/w) इनोक्युलम लेवल का इस्तेमाल किया गया और साथ ही पौधे लगाने से पहले जड़ों को 10 मिनट के लिए फ्यूजेरियम स्पोर सस्पेंशन (10^6 स्पोर्स/mL) में डुबोया गया। एज़ोक्सीस्ट्रोबिन 4.7% + मैनकोज़ेब 59.7% + टेबुकोनाजोल 5.6%, कार्बोक्सिन 37.5% + थिरम 37.5%, एजोक्सीस्ट्रोबिन 8.3% + मैनकोजेब 66.7%, और मेटालेक्सिल 4% + मैनकोजेब 64% ने '*फाइटोफ्थोरा निकोटियाने* के खिलाफ 250 PPM और उससे ज्यादा सांद्रता पर माइसेलियल ग्रोथ को 100% तक रोका गया।
- ICAR-NIRCA, RS, जीलुगुमिली के तंबाकू के खतों से एंटोमोपैथोजेनिक सूत्रकृमि *स्टाइनरनेमा पाकिस्तानेंस* (Rhabditida:Steinernematidae) (NIRCA01 स्ट्रेन) को अलग करके पहचाना गया; यह *एस. लिटूरा* के प्रति लार्वा 500 IJs की दर से 48 घंटों में इन विट्रो (प्रयोगशाला में) 100% लार्वा मष्त्यु दर का कारण बनता है।
- KLS क्षेत्र में FCV तंबाकू के साथ जुड़े जड़–गांठ सूत्रकृमि (*मेलायडोगाइन इनकॉगनिटा, रोटीलेंचुलस रेनीफार्मिस, हेलीकोटीलेनचस* एसपीपी, टाइलेनचस एसपीपी) और दूसरे फ्री–लिविंग निमाटोड पाए गए। जड़–गांठ सूत्रकृमियों की सबसे अधिक औसत आबादी (100 cc मिट्टी में 126 J2 यानी II स्टेज के जुवेनाइल) हुंसुर प्लेटफॉर्म पर पाई गई, इसके बाद पेरियापटना (90 J2), चिलकुंडा (78 J2), रामनाथपुरा (75 J2) और HD कोटे (66 J2) का नंबर आता है।
- उन्नत प्रजनन वंशक्रमों में, FCH 261, IET 108, IET 107, IET 103, FCR 71, FCR 73, FCR 74, FCRH 13 का RKI d" 1.5 दर्ज किया गया और KLS क्षेत्र में 'सिक फील्ड' (संक्रमित खेत) की स्थितियों में जड़–गांठ सूत्रकृमियों के खिलाफ ये आशाजनक पाई गईं।
- चेक किस्म (तुलना के लिए इस्तेमाल की गई फसल) की तुलना में, 0.05% सांद्रता वाले फ्लूओपाइरम 400 SC, जड़–गांठ घटनाओं (RKI) को 68% और मष्दा में जड़–गांठ सूत्रकृमियों की आबादी को 57.8% तक कम करने में प्रभावकारी पाया गया। इसके बाद FCV तंबाकू की उपचारित पत्तियों की पैदावार में 24.3% की बढ़ोतरी हुई और लाभ लागत अनुपात 2.31 रहा। KLS स्थितियों में उगाई गई FCV तंबाकू की फसल में, नर्सरी और मुख्य खेत दोनों जगहों पर जड़–गांठ सूत्रकृमियों (*मेलोयडोगाइन इनकॉगनिटा)* के खिलाफ 0.05% सांद्रता वाले फ्लूओपाइरम 400 SC प्रभावकारी पाया गया।
- कुल मिलाकर, वर्श के दौरान संस्थान के षोध ने मेजबान पौधों के प्रतिरोध, जैविक नियंत्रण, सटीक कीटनाषक अनुप्रयोग, निगरानी और पर्यावरण की दृश्टि से टिकाऊ फसल सुरक्षा प्रौद्योगिकियों के संयोजन से एकीकृत कीट, रोग और सूत्रकृमि प्रबंधन रणनीतियों को काफी मजबूत किया, जिससे लचीली और टिकाऊ वाणिज्यिक कृशि में योगदान हुआ।

फसलोत्तर उत्पाद प्रबंधन

पादप–रसायनों का मूल्यांकन

- मिर्च की गुणवत्ता पर कटाई से पहले किए गए अलग–अलग उपचारों के मूल्यांकन से पता चला कि कैल्शियम क्लोराइड (0.5%), जिबरेलिक एसिड (50 पीपीएम) और पोटेशियम नाइट्रेट (1%) के इस्तेमाल से कैप्सैसिन की मात्रा सबसे ज्यादा पाई गई, इसके बाद मैग्नीशियम सल्फेट (1%) का स्थान रहा; वहीं, नीम का तेल (1%) और जिबरेलिक एसिड (50 ppm) के इस्तेमाल से कुल कैरोटीनॉयड की मात्रा में सबसे ज्यादा सुधार देखा गया।
- भंडारण के अलग–अलग पद्धतियों में, डेसिकैंट (नमी सोखने वाले पदार्थ) वाले स्टील कंटेनर में सबसे कम नहीं (6.69%) पाई गई; इसके बाद डीप फ्रीजर और वैक्यूम–सील्ड स्टोरेज का स्थान रहा। इससे पता चलता है कि सूखी मिर्च को कम नमी वाली स्थितियों में बेहतर ढंग से बनाए रखा जा सकता है।
- रिसिनोलिस एसिड से औद्योगिक रूप से महत्वपूर्ण बायोएक्टिव यौगिकों के तौर पर 2–ऑक्टेनॉल और 2–ऑक्टेनोन को सफलतापूर्वक निकाला और संश्लेषित किया गया। इनसे क्रमशः 497.1 μ/g और 11.283 μ/g प्रति ग्राम उपज प्राप्त हुई। साथ ही, यह पाया गया कि उत्प्रेरक या प्रमोटर के तौर पर Pb_2O_3 और रेड लेड की तुलना में यह प्रक्रिया ज्यादा प्रभावकारी थी।
- GC-MS के जरिए बैंगनी और लाल अरंडी के बीजों के तेल में रिसिनोलिक एसिड की पहचान और मात्रा का पता लगाया गया, जो क्रमशः 2961.6 μg प्रति mL और 2621.54 μg प्रति mL था। पर्यावरण के अनुकूल ऑक्सीकरण एजेंट 'ऑक्सोन' (Oxone) का इस्तेमाल करके रिसिनोलिस एसिड से THSA और एजेलिस एसिड को सफलतापूर्वक संश्लेषित किया गया।

कुशल विश्लेषणात्मक प्रोटोकॉल का विकास

- स्टैंडर्ड क्योरिंग शेड्यूल में कोई बदलाव किए बिना, LPG क्योरिंग मॉड्यूल में जरूरी सुधार और नए इनोवेटिव बदलाव लगातार करते हुए, तंबाकू की उपचारित पत्तियों के प्रति कि.ग्रा. पर 430 ग्राम गैस की सबसे कम खपत हासिल की गई।

- तंबाकू में फ्लुबेंडियामाइड के अवशेषों का पता लगाने के लिए LC-MS/MS पर आधारित एक नया एनालिटिकल तरीका विकसित किया गया। इससे पता चलता है कि फ्लुपिराडिफुरोन अवशेषों की स्वीकार्य मात्रा वाला FCV तंबाकू तैयार करने के लिए लगभग 17 दिनों के PHI की जरूरत हो सकती है।
- सूखी मिर्च से कैप्सैसिन और कैप्सैन्थिन निकालने के लिए होमोजेनाइजेशन की तुलना में अल्ट्रासोनिकेशन–आधारित एक्सट्रैक्शन तकनीक ज्यादा पर्यावरण–अनुकूल और किफायती है, क्योंकि इसमें कम सॉल्वेंट, ऊर्जा और समय लगता है और इसे आगे कमर्शियल स्तर पर इस्तेमाल किया जा सकता है। हाइड्रोडायनामिक कैविटेशन पर आधारित ग्रीन तकनीक ने अल्ट्रासोनिकेशन विधि की तुलना में कैप्सैन्थिन की लगभग बराबर शुद्धता और मात्रा 38.14% दर्शाई।
- काली मिर्च से एंथोसायनिन; हल्दी से बीटा–कैरोटीन और करक्यूमिनोइड्स; अरंडी से रिसिनोलिक एसिड, 2–ऑक्टेनॉल और 2–ऑक्टेनोन और अश्वगंधा से विथेनोलाइड्स की मात्रा मापने के लिए एक मजबूत LC-MS/MS आधारित तरीका विकसित किया गया। साथ ही, तंबाकू में कई तरह के कीटनाशकों के अवशेषों (लगभग 1016 और 255 कीटनाशक) की जांच के लिए GC-MS आधारित SIM और LC-MS/MS आधारित MRM तरीकों का इस्तेमाल करते हुए एक सटीक और मजबूत एनालिटिकल तरीका विकसित की।

मूल्य सवंर्धित उत्पादों का विकास

- सूखी मिर्च से प्राप्त कैप्सैंथिन से समष्द्ध षुद्ध अर्क से न्यूट्रास्यूटिकल आधारित पतली फिल्म आधारित न्यूट्रास्यूटिकल उत्पाद विकसित किया गया, जिसमें *कृत्रिम परिवेष (इन विट्रो)* 68.19 प्रतिषत अवरोध के साथ प्रतिऑक्सीकारक सक्रियता प्रदर्षित हुई, जो षुद्ध कैप्सैंथिन से समष्द्ध अर्क के तुलनीय थी। यह जैव–रंगकारक खाद्य उद्योग में प्राकृतिक योज्य के रूप में कृत्रिम रंगकारकों के वैकल्पिक स्रोत के रूप में उपयोग किया जा सकता है।
- सोडियम हाइड्रॉक्साइड (NaOH) सहायित निष्कर्षण तकनीक तथा हाइड्रोडायनेमिक कैविटेशन–आधारित हरित तकनीक द्वारा मिर्च के डंठल (LCA 643) से सेल्यूलोज के निष्कर्षण में यह सर्वोत्तम विधि (28.76%) सिद्ध हुई। रेजिन–शोधित उत्पाद तथा सेल्यूलोज शीट में कच्चे अर्क की अपेक्षा क्रमशः 90.80% और 89.86% अधिक प्रति ऑक्सीकारक सक्रियता पाई गई। क्रिप्टोजैंथिन–समृद्ध एथिल एसीटेट अर्क की जैव–उपलब्धता 1.29% तक प्राप्त हुई।
- संस्थान ने मिर्च और हल्दी से कई नए तरह के खाद्य, चिकित्सीय और न्यूट्रास्युटिकल उत्पाद भी विकसित किए हैं। इसके लिए एक व्यवस्थित, षोध–आधारित उत्पाद विकास प्रक्रिया अपनाई गई, जिसमें एक्सट्रैक्षन (निकालने की प्रक्रिया), षुद्धिकरण, फॉर्मूलेषन, वैलिडेषन और गुणवत्ता मूल्यांकन जैसे चरण षामिल थे। इन मूल्य सवंर्धित उत्पादों का वाणिज्यिकरण से, किसानों की आय बढ़ाने और कृशि–आधारित उद्यमिता को बढ़ावा देने की काफी संभावना है।
- कुल मिलाकर, फसलोत्तर रिसर्च प्रोग्राम ने वाणिज्यिक फसलों में मूल्य संवर्धन, एनालिटिकल क्वालिटी एष्योरेंस, ग्रीन प्रोसेसिंग टेक्नोलॉजी और उत्पाद विविधिकरण को काफी मजबूत किया है। ये इनोवेषन बेहतर मार्केट कॉम्पिटिटिवनेस, एक्सपोर्ट के लिए तैयारी और कृशि उत्पादों के सतत उपयोग में मदद करते हैं, साथ ही एग्री–बेस्ड इंडस्ट्रीज और ग्रामीण एंटरप्रेन्योरषिप के लिए नए मौके भी पैदा करते हैं।

विस्तार कार्य एवं बाजार आसूचना

मूल्य श्रृंखला विश्लेषण

- वाणिज्यिक फसलों पर की गई व्यापक मूल्य श्रंखला अध्ययन से बाजार की कार्यक्षमता को बेहतर बनाने, कटाई के बाद होने वाले नुकसान को कम करने और किसानों की मुनाफा–क्षमता बढ़ाने के लिए महत्वपूर्ण जानकारियां प्राप्त हुई।
- कटाई उपरांत अनुमानित हानि कृषि स्तर पर लगभग 44 हजार टन तथा बाजार स्तर पर लगभग 18 हजार टन है। तेलंगाना में प्रमुख विपणन माध्यम किसान→व्यापारी→थोक विक्रेता→निर्यातक है, जिसकी बाजार में लगभग 90 प्रतिशत हिस्सेदारी है। मूल्य समर्थन प्रणाली लागू करने तथा ग्रेड एवं करक्यूमिन की मात्रा के आधार पर मूल्य निर्धारण अपनाने से किसानों को लाभ हो सकता है।
- खेती की लागत के व्यापक विश्लेषण से यह ज्ञात हुआ है कि प्रमुख व्यय मद श्रम लागत (98,046 रू./हेक्टेयर) थी, इसके बाद सामग्री आगतों की लागत (49,382 रू./हेक्टेयर) तथा ईंधन लकड़ी की लागत (37,322 रू./हेक्टेयर) रही। वर्ष 2024–25 के दौरान कर्नाटक में प्रति हेक्टेयर खेती की औसत लागत 2,32,518 रू./हेक्टेयर थी।
- आंध्र प्रदेश के विभिन्न जिलों में पारिस्थितिकीय सुरक्षा सूचकांक, आर्थिक दक्षता संकेतकों तथा सामाजिक समता के आयामों में व्यापक भिन्नता पाई गई, जो कृषि सततता के स्तर को परिलक्षित करती है। पूर्वी गोदावरी, एलुरू, कोनसीमा, पश्चिम गोदावरी तथा गुंटूर जिले अत्यधिक सतत) SLSI : > 0.80) श्रेणी में पाए गए।
- बेंगलुरु मार्केट में मिर्च की कीमतों के 24 साल के लंबे समय के मार्केट इंटेलिजेंस एनालिसिस (मैन–केंडल नॉन–पैरामेट्रिक ट्रेंड एनालिसिस का इस्तेमाल करके) से पता चला है कि समय के साथ मार्केट में अधिकतम कीमतों में सांख्यिकीय रूप से महत्वपूर्ण बढ़ोतरी हुई है। यह सकारात्मक ट्रेंड किसानों और नीति–निर्माताओं के लिए प्रोडक्षन की प्लानिंग, मार्केट का अनुमान लगाने और रणनीतिक फैसले लेने में बहुत काम की जानकारी देता है।

आईसीटी -आधारित निर्णय समर्थन प्रणाली

- ICAR-NIRCA ने किसानों, विस्तार कर्मियों और अन्य हितधारकों के लिए इनोवेटिव इन्फॉर्मेषन और कम्युनिकेषन टेक्नोलॉजी (ICT) पर आधारित टूल्स विकसित करके डिजिटल एग्रीकल्चर को मजबूत करना जारी रखा।
- HTML, CSS तथा JavaScript का उपयोग करते हुए तंबाकू के रोगों का एक डिजिटल पुस्तकालय विकसित किया गया है। संकलित चित्रों का पूर्वप्रसंस्करण वर्तमान में प्रगति पर है –, जिसे Python का उपयोग करते हुए Vision तथा Swin Transformer प्रौद्योगिकी पर आधारित अनुप्रयोग के विकास के लिए आधारभूत निवेश) (Input) के रूप में माना गया है।
- Android प्लेटफॉर्म पर आधारित एक द्विभाषी स्थिर मोबाइल अनुप्रयोग विकसित किया गया है, जो मष्दा परीक्षण के आधार पर उर्वरक संबंधी अनुशंसाएं प्रदान करता है। यह अनुप्रयोग आंध्र प्रदेश के उत्तरी हल्की मष्दा वाले क्षेत्रों, अंग्रेजी एवं तेलुगु में तथा कर्नाटक के हल्की मष्दा वाले क्षेत्रों, अंग्रेजी एवं कन्नड़ में में अपेक्षित लक्ष्य उपज के अनुरूप तैयार किया गया है।
- अलग–अलग उत्पादन क्षेत्रों में तंबाकू के बीजों के वितरण को आसान बनाने के लिए 'तंबाकू बीज पोर्टल' को पूरी तरह से नया रूप दिया गया है। इस अपग्रेड किए गए पोर्टल में कई नए डिजिटल फीचर षामिल किए गए हैं, जिनसे पारदर्षिता बढ़ती है, कामकाज की क्षमता बेहतर होती है और किसानों को समय पर बीज उपलब्ध कराना आसान हो जाता है।
- कीटनाषकों की कम्पैटिबिलिटी (आपसी मेल) के बारे में तुरंत जानकारी देने के लिए Python और Flask का उपयोग करके एक स्मार्ट केमिकल कम्पैटिबिलिटी चौटबॉट बनाया गया। इस प्लेटफॉर्म में QR कोड, वेब एक्सेस और WhatsApp आधारित सेवाओं को षामिल किया गया है, जिससे किसान और विस्तार कर्मी मोबाइल डिवाइस का इस्तेमाल करके निःशुल्क भरोसेमंद कम्पैटिबिलिटी जानकारी पा सकते हैं।
- टेक्नोलॉजी अपनाने से जुड़े अध्ययनों से पता चला है कि 52% हल्दी उत्पादकों और 57% मिर्च उत्पादकों ने टेक्नोलॉजी को मध्यम स्तर पर अपनाया, जबकि क्रमषः 26% और 31% ने इसे उच्च स्तर पर अपनाया। ये नतीजे बेहतर उत्पादन टेक्नोलॉजी को उत्साहजनक रूप से अपनाए जाने का संकेत देते हैं, साथ ही यह भी बताते हैं कि बाकी किसान समुदाय के बीच इसे अपनाने की दर बढ़ाने के लिए लगातार विस्तार प्रयासों की जरूरत है।

अग्र–पंक्ति विस्तार कार्य

- संस्थान ने वाणिज्यिक खेती में बेहतर तकनीकों को अपनाने की गति बढ़ाने के उद्देष्य से, भागीदारी और मांग–आधारित विस्तार तरीकों के माध्यम से तकनीक के प्रसार को मजबूत करना जारी रखा। मिर्च एवं हल्दी में क्षमता निर्माण तथा प्रौद्योगिकी प्रदर्शन कार्यक्रमों के क्रियान्वयन में सहभागितापरक प्रसार उपागम अपनाया गया।
- मिर्च से जुड़े किसान उत्पादक संगठनों (FPO) के मूल्यांकन से पता चला है कि उनमें उद्यमिता क्षमता सूचकांक (ECI) का स्तर काफी ऊंचा है, मूल्यांकन किए गए 60% FPO उच्च क्षमता वाली श्रेणी (ECI स्कोर : 376–500) में आते हैं। ये नतीजे उत्पादक संगठनों की बढ़ती प्रबंधकीय और उद्यमिता क्षमताओं को दर्षाते हैं, जिससे सामूहिक मार्केटिंग और एग्रीबिजनेस (कृशि–व्यवसाय) के विकास को मजबूती मिलती है।
- मिर्च और हल्दी की फसलों में क्षमता–निर्माण कार्यक्रमों और टेक्नोलॉजी के प्रदर्षन को लागू करने के लिए 'भागीदारी–आधारित विस्तार दृश्टिकोण' (participatory extension approach) को सफलतापूर्वक अपनाया गया। योजना बनाने, प्रदर्षन, मूल्यांकन और फीडबैक की पूरी प्रक्रिया में किसानों की सक्रिय भागीदारी से टेक्नोलॉजी को अपनाने, किसानों में जागरूकता और बेहतर उत्पादन व कटाई–बाद प्रबंधन के तरीकों के प्रसार में काफी बढ़ोतरी हुई।
- समग्र रूप से देखा जाय तो, संस्थान की विस्तार और बाजार की जानकारी से जुड़ी पहलों ने डिजिटल खेती, मूल्य श्रंखला के विकास, बाजार–केंद्रित षोध, किसानों के लिए सलाहकारी सेवाओं और उद्यमिता को बढ़ावा देने में मदद की। इन प्रयासों ने तकनीक को अपनाने, बाजार में प्रतिस्पर्धा की क्षमता बढ़ाने, सबूतों पर आधारित नीतिगत फैसलों में मदद करने और वाणिज्यिक खेती में षोध के नतीजों को व्यावसायिक रूप देने की गति बढ़ाने में अहम भूमिका निभाई।

कृषि विज्ञान केंद्र

ICAR-NIRCA, कृषि विज्ञान केन्द्र, कलवाचर्ला

- कृषि विज्ञान केंद्र (KVK), कलवाचर्ला ने कृशि उत्पादकता और आजीविका सुरक्षा को बढ़ाने के लिए टेक्नोलॉजी के मूल्यांकन, सुधार, प्रदर्शन और क्षमता निर्माण में अहम भूमिका निभाना जारी रखा। वर्ष 2025 के दौरान, KVK ने सफलतापूर्वक 11 ऑन–फार्म ट्रायल (OFT), 24 फ्रंटलाइन डेमोंस्ट्रेषन (FLD), 18 किसान प्रषिक्षण कार्यक्रम, 8 जागरूकता कार्यक्रम और 3 प्रायोजित प्रषिक्षण कार्यक्रम आयोजित किए, जिससे खास जगहों के हिसाब से कृशि टेक्नोलॉजी का बड़े पैमाने पर प्रसार हुआ।
- KVK ने अश्वगंधा, हल्दी, केला, नारियल और कटहल में मूल्य संवर्धन तकनीकों को बढ़ावा दिया, जिससे उद्यम विकास, आय के विविध स्रोत बनाने और ग्रामीण उद्यमिता के लिए काफी संभावनाएं दिखीं। दलहन और तिलहन फसलों की 120 हेक्टेयर जमीन पर क्लस्टर फ्रंटलाइन डेमोंस्ट्रेषन (सामूहिक प्रदर्षन) के जरिए, लगातार तकनीकी सहायता और खेत स्तर पर सलाहकारी सेवाओं से बेहतर उत्पादन तकनीकों को अपनाने में मदद मिली।
- क्षमता–निर्माण कार्यक्रमों ने बेहतर फसल उत्पादन, कटाई के बाद के प्रबंधन और मूल्य संवर्धन के मामलों में किसानों की जानकारी और तकनीकी कौषल को काफी बढ़ाया। देषव्यापी 'विकसित कृषि संकल्प अभियान' (VKSA)

के तहत, KVK ने 134 गांवों में बड़े पैमाने पर आउटरीच कार्यक्रम चलाए और 24,000 से ज़्यादा किसानों से सीधे बातचीत की। इन कार्यक्रमों के जरिए बेहतर कृशि तकनीकों, जलवायु–अनुकूल खेती के तरीकों और सरकार की प्रमुख योजनाओं के बारे में जागरूकता फैलाई गई।

- कुल मिलाकर, KVK कलवाचर्ला की गतिविधियों ने टेक्नोलॉजी के प्रसार, किसानों की क्षमता निर्माण और उद्यमिता विकास को काफी मजबूत किया, जिससे इस क्षेत्र में टिकाऊ व्यावसायिक खेती को बढ़ावा मिला।

ICAR-NIRCA, कृषि विज्ञान केन्द्र, कंदुकूर

- कृषि विज्ञान केन्द्र, कंदुकुर ने टेक्नोलॉजी के मूल्यांकन, प्रदर्षन, स्किल डेवलपमेंट और डिजिटल कृषि सलाहकार सेवाओं के जरिए अपने विस्तार कार्यक्रमों को मजबूत करना जारी रखा। रिपोर्टिंग वर्श के दौरान, KVK ने 24 ऑन–फार्म ट्रायल (OFT), 26 फ्रंटलाइन डेमोंस्ट्रेषन (FLD), 48 किसान प्रषिक्षण कार्यक्रम, 5 खेत दिवस, 6 स्किल डेवलपमेंट कार्यक्रम, 4 इन–सर्विस प्रषिक्षण कार्यक्रम, 4 किसान फील्ड स्कूल और 4 रिसर्च–एक्सटेंषन–फार्मर इंटरफेस (REFI) बैठकें आयोजित कीं।
- KVK को 'CropSuraksha' मोबाइल एप्लीकेषन के लिए कॉपीराइट मिला, जिसे किसानों को डिजिटल सलाह सेवाएँ देने के लिए बनाया गया था। इसने NIRCA केमिकल कम्पैटिबिलिटी चाटबॉट भी विकसित किया, जो कीटनाषकों की कम्पैटिबिलिटी के बारे में तुरंत जानकारी देता है और इसे किसानों तथा विस्तार कर्मियों के बीच बड़े पैमाने पर पहुँचाया गया है।
- इस वर्ष उद्यमिता विकास पर खास जोर दिया गया, जिसमें मूल्य संवर्धन, एकीकष्त कृषि प्रणाली, मषरूम की खेती और नर्सरी प्रोडक्षन से जुड़े आठ एग्रीप्रेन्योर्स (कृशि–उद्यमियों) को बढ़ावा दिया गया। एक नए किसान हॉस्टल और KVK सेल्स आउटलेट की स्थापना से किसानों की ट्रेनिंग, टेक्नोलॉजी के प्रसार और वाणिज्यिकरण की गतिविधियों को और मजबूती मिली।
- KVK ने सफलतापूर्वक जलवायु–अनुकूल मिर्च की किस्में LCA 643 और LCA 657 पेष कीं। अपनी बेहतर पैदावार और अलग–अलग तरह के माहौल में ढलने की क्षमता के कारण किसानों से इन्हें अच्छा रिस्पॉन्स मिला। डिजिटल प्लेटफॉर्म के जरिए सलाह देने वाली सेवाएँ पहुँचाने के लिए 'डिजिटल फार्म स्कूल' का कॉन्सेप्ट भी षुरू किया गया। इसमें मोबाइल ऐप, किसान सारथी, YouTube लाइव प्रोग्राम, छोटे एजुकेषनल वीडियो और इलेक्ट्रॉनिक विस्तार सामग्री षामिल थे, जिससे विस्तार सेवाओं की पहुँच ज्यादा से ज्यादा किसानों तक हो सकी।
- KVK कंदुकूर ने 15 दिनों के 'विकसित कृशि संकल्प अभियान' का भी सफलतापूर्वक समन्वयन किया। इस अभियान के जरिए किसानों के बीच 'राश्ट्रीय कृशि अनुसंधान, षिक्षा और विस्तार प्रणाली' (NARE) के तहत विकसित नई तकनीकों के बारे में बड़े पैमाने पर जागरूकता फैलाई गई और जमीनी स्तर पर उन्हें अपनाने को बढ़ावा दिया गया।
- कुल मिलाकर, KVK कंदुकूर द्वारा किए गए विस्तार कार्यों ने डिजिटल खेती, किसानों के कौषल विकास, तकनीक अपनाने और कृशि–उद्यमिता को काफी मजबूत किया है, जिससे लचीली और बाजार–उन्मुख वाणिज्यिक खेती को बढ़ावा मिला है।

अखिल भारतीय तंबाकू नेटवर्क परियोजना

- 'अखिल भारतीय तंबाकू नेटवर्क परियोजना' (AINPT) ने देश के अलग–अलग तंबाकू उगाने वाले क्षेत्रों में तंबाकू की किस्मों में सुधार, फसल उत्पादन, फसल सुरक्षा और गुणवत्ता बढ़ाने पर समन्वित षोध के लिए राश्ट्रीय मंच के तौर पर काम करना जारी रखा। रिपोर्टिंग वर्श के दौरान, इस नेटवर्क में 14 केंद्र षामिल थे – जिनमें 3 मुख्य केंद्र, 7 उप–केंद्र और 4 स्वैच्छिक केंद्र थे – ताकि अलग–अलग कृशि–जलवायु क्षेत्रों में प्रभावी बहु–स्थानीय मूल्यांकन और समन्वित षोध सुनिष्चित किया जा सके।
- तीन मुख्य केंद्र राजमंड्री, षिवमोग्गा और आनंद में स्थित हैं, जबकि उप–केंद्र निपानी, नंदयाल, बेरहामपुर, अरौल, दिनहाटा, गुंटूर और हंसूर से संचालित होते हैं।
- वर्ष 2025 के दौरान, पूरे नेटवर्क में किस्मों के मूल्यांकन के लिए समन्वित कार्यक्रम सफलतापूर्वक चलाए गए। षुरुआती किस्म/हाइब्रिड परीक्षणों (IVT/IHT) के तहत कुल मिलाकर 13 FCV तंबाकू, 6 बीड़ी तंबाकू, 3 रस्टिका तंबाकू और 2 चर्वण तंबाकू की किस्मों का मूल्यांकन किया गया। इसके अलावा, उन्नत किस्मीय परीक्षण – I (AVT-I) के तहत 10 FCV, 3 बीड़ी, 3 नाटू और 2 रस्टिका किस्मों का मूल्यांकन किया गया, जबकि उन्नत किस्मीय परीक्षण – II (AVT-II) के तहत 2 बीड़ी और 3 रस्टिका किस्मों का मूल्यांकन किया गया।
- किसानों के खेतों की स्थितियों में फील्ड परफॉर्मेंस का आकलन करने के लिए, ऑन–फार्म ट्रायल्स (OFT) के तहत कुल छह आशाजनक तंबाकू किस्मों FCHH-2 (FCV), ABD 241, NyBTH 152, NyBTH 157, NyBTH 171 (बीड़ी) और AR–184 (रस्टिका) का मूल्यांकन किया गया।
- इस परियोजना ने भाग लेने वाले केंद्रों से 'षुरुआती किस्म परीक्षण' (Initial Varietal Trial) लिए प्रस्ताव इकट्ठा करने का काम किया, किस्मों के समन्वित मूल्यांकन के लिए सालाना तकनीकी कार्यक्रम को अंतिम रूप दिया, और सभी भाग लेने वाले रिसर्च सेंटरों को परीक्षण के लिए बीज सामग्री समय पर उपलब्ध कराने और वितरित करने का काम सुनिष्चित किया।
- तंबाकू पर अखिल भारतीय नेटवर्क परियोजन (AINPT) की XXVII कार्यशाला का आयोजन 16–17 सितंबर, 2025 के दौरान कर्नाटक के शिवमोग्गा स्थित Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences में हाइब्रिड माध्यम से किया गया। इस अवसर पर डॉ. डी. के. यादव, उप महानिदेषक (फसल विज्ञान) मुख्य अतिथि तथा डॉ. प्रशांत के. दास. सहायक महानिदेशक (वाणिज्यिक फसलें), विशिष्ट अतिथि थे। डॉ. आर.सी. जगदीश, कुलपति, KSNUAHS,

शिवमोग्गा; डॉ. आर. के. सिंह, अधिष्ठाता, RLB CAU, झांसी, उत्तर प्रदेश एवं पूर्व सहायक महानिदेशक (वाणिज्यिक फसलें), ICAR, नई दिल्ली; डॉ. एम. शेषु माधव, निदेशक, ICAR-NIRCA एवं परियोजना समन्वयक, AINPT; ICAR के अधिकारी, विभिन्न अनुसंधान केंद्रों के वैज्ञानिक, राज्य कृषि विश्वविद्यालयों (SAUs) के प्रतिनिधि, किसान, सभी विषयों के प्रधान अन्वेषक तथा उद्योग विशेषज्ञों ने भाग लिया। इसमें नेटवर्क सेंटर्स के प्रधान अन्वेषक, इंडस्ट्री के प्रतिनिधि और प्रगतिशील किसान शामिल हुए। इस वर्कषॉप ने रिसर्च की प्रगति की समीक्षा करने, भविश्य की रिसर्च प्राथमिकताओं की योजना बनाने और तंबाकू पर सहयोगी अनुसंधन को मजबूत करने के लिए एक प्रभावशाली मंच प्रदान किया।

- इस वर्ष, 93वीं सेंट्रल वैराइटी रिलीज कमेटी (CVRC) ने तंबाकू की चार किस्मों CTRI Navya (FCH 248), Sahyadri Swarna (FCS 4), 1353 (FCRH 11/LSTC 9), और DTV 9 (NBD–316) को अधिसूचित किया। इसके बाद, 94वीं CVRC ने Nandyala Pogaku–2 (ABD 132) को अधिसूचित किया, जो राश्ट्रीय तंबाकू सुधार कार्यक्रम में एक और अहम उपलब्धि है।
- AINPT के तहत समन्वित अनुसंधान प्रयासों ने विविधता विकास, बहु–स्थानीय परीक्षण, प्रौद्योगिकी सत्यापन और राश्ट्रीय सहयोग को मजबूत करना जारी रखा, जिससे भारत के तंबाकू क्षेत्र की सतत वर्षद्धि और प्रतिस्पर्धात्मकता में महत्वपूर्ण योगदान मिला।

कृषिरत महिलाओं का सशक्तिकरण

- संस्थान की विस्तार रणनीति में ग्रामीण महिलाओं का सषक्तिकरण एक अहम हिस्सा रहा है। वर्ष 2025 के दौरान, खेती और उससे जुड़े क्षेत्रों में काम करने वाली महिलाओं की तकनीकी जानकारी, उद्यमिता कौषल और आजीविका के अवसरों को बढ़ाने के लिए महिलाओं पर केंद्रित 15 प्रषिक्षण और क्षमता–निर्माण कार्यक्रम आयोजित किए गए। संस्थान ने तीन महिला उद्यमियों को भी सफलतापूर्वक बढ़ावा दिया, जिससे मूल्य संवर्धन और कृ शि–आधारित उद्यमों के जरिए आय बढ़ाने में मदद मिली, इस तरह संस्थान ने महिलाओं के नेतष्त्व वाले ग्रामीण उद्यम और समावेषी कृशि विकास में योगदान दिया।

कार्पोरेट सामाजिक उत्तरदायित्व (CSR)

- ICAR–NIRCA ने कॉर्पोरेट सामाजिक उत्तरदायित्व (CSR) पहल के तहत रणनीतिक साझेदारी के माध्यम से अपने अनुसंधान और प्रौद्योगिकी विकास कार्यक्रमों को मजबूत करना जारी रखा है। वर्ष 2025 के दौरान, संस्थान ने जलवायु–स्मार्ट कृशि, डिजिटल कृशि और टिकाऊ उत्पादन प्रणालियों पर ध्यान केंद्रित करते हुए तीन CSR वित्त पोशित परियोजनाएं लागू कीं।
- इन परियोजनाओं में 'इंटरनेट ऑफ थिंग्स' (IoT) आध ारित टेक्नोलॉजी के जरिए सिंचाई को ऑटोमेट करना (जिसमें Elitecon International Limited का सहयोग मिला) और तंबाकू उपचार की प्रक्रिया में ऊर्जा की बचत और कार्बन फुटप्रिंट कम करना (जिसमें Philip Morris India Trading Private Limited का सहयोग मिला) षामिल थे। इन परियोजनाओं को लागू करने के लिए संस्थान को रिपोर्टिंग वर्श के दौरान कुल मिलाकर ₹ 1,28,76,123 प्राप्त हुए।
- इन सहयोगिक पहलों ने सटीक सिंचाई, ऊर्जा–कुषल फसल उत्पादन और जलवायु–अनुकूल खेती में नई तकनीकों के विकास और फील्ड वैलिडेषन (व्यावहारिक जांच) को तेज किया है, साथ ही टिकाऊ वाणिज्यिक खेती के लिए सार्वजनिक–निजी भागीदारी को भी मजबूत किया है।

प्रौद्योगिकी आउटरीच गतिविधियां

- इस वर्ष संस्थान का मुख्य ध्यान प्रदर्षनों, क्षमता निर्माण और मानव संसाधन विकास कार्यक्रमों के जरिए टेक्नोलॉजी के प्रसार पर रहा।
- किसानों, विस्तार कर्मियों, वैज्ञानिकों, तकनीकी अधिकारियों और संबंधित विभागों के अधिकारियों के लिए कुल 8 ऑन–फार्म परीक्षण (OFT) और फ्रंटलाइन डेमोंस्ट्रेषन (FLD) आयोजित किए गए। इसके साथ ही, क्षमता निर्माण के 26 कार्यक्रम भी आयोजित किए गए, जिनमें ICAR अनुमोदित एक मानव संसाधन विकास (HRD) प्रषिक्षण कार्यक्रम भी षामिल था। इन कार्यक्रमों में बेहतर उत्पादन तकनीकों, फसल प्रबंधन के तरीकों, कटाई के बाद की तकनीकों, विष्लेशणात्मक सेवाओं और टिकाऊ वाणिज्यिक खेती पर ध्यान केंद्रित किया गया।
- आउटरीच कार्यक्रमों ने संस्थान द्वारा विकसित तकनीकों के हस्तांतरण को काफी मजबूत किया और वैज्ञानिक फसल उत्पादन, गुणवत्ता प्रबंधन, मूल्य संवर्धन तथा जलवायु–अनुकूल कृशि पद्धतियों के बारे में हितधारकों की जागरूकता बढ़ाई।

सेवा संबंधी कार्य

- ICAR-NIRCA ने अपनी मान्यता प्राप्त विश्लेषणात्मक प्रयोगषालाओं के माध्यम से राश्ट्रीय हितधारकों को उच्च–गुणवत्ता वाली विश्लेषणात्मक और तकनीकी सेवाएँ प्रदान करना जारी रखा।
- संस्थान की पत्ती गुणवत्ता मूल्यांकन प्रयोगशाला, कीटनाशक अवशेष विश्लेषण प्रयोगशाला और स्मोक लेबोरेटरी ने टोबैको बोर्ड, तंबाकू व्यापार, अखिल भारतीय तम्बाकू नेटवर्क परियोजना (AINPT) केन्द्र, रिसर्च संगठनों और अन्य संबंधित पक्षों को एनालिटिकल सपोर्ट दिया।
- वर्ष 2025 के दौरान, इन प्रयोगशालाओं ने 3,955 सैंपल का विष्लेशण किया और एनालिटिकल सर्विस गतिविधियों से ₹ 9,41,050 का राजस्व अर्जित किया। इन प्रयोगशालाओं ने क्वालिटी एष्योरेंस, रेसिड्यू मॉनिटरिंग, प्रोडक्ट इवैल्यूएषन और रेगुलेटरी कंप्लायंस में मदद करना जारी रखा, जिससे तंबाकू और वाणिज्यिक फसलों से जुड़ी एनालिटिकल सर्विस के लिए नेषनल रेफरल सेंटर के तौर पर संस्थान की भूमिका और मजबूत हुई।

पुरस्कार एवं सम्मान

- रिपोर्टिंग वर्श के दौरान, ICAR- NIRCA की वैज्ञानिक उत्कृश्टता को कई प्रतिश्ठित पुरस्कारों और सम्मानों के माध्यम से राश्ट्रीय स्तर पर पहचान मिली।
- संस्थान के वैज्ञानिकों को कृशि अनुसंधान, नवाचार और प्रौद्योगिकी विकास में उनके बेहतरीन योगदान के लिए कुल 14 पुरस्कार प्राप्त हुए। खास बात यह है कि ICAR-NIRCA के निदेशक डॉ. एम. षेशु माधव को उनके षानदार वैज्ञानिक योगदान के लिए 9 दिसंबर 2025 को नेषनल एकेडमी ऑफ साइंसेज, इंडिया (NASI) का फेलो चुना गया। उन्हें 16 जुलाई 2025 को राश्ट्रीय कृशि विज्ञान पुरस्कार–2025 भी प्राप्त हुआ।
- इसके अलावा, संस्थान के आठ वैज्ञानिकों को अलग–अलग कैटेगरी में अवॉर्ड मिले, जिनमें बेस्ट साइंटिस्ट अवॉर्ड, बेस्ट ओरल प्रेजेंटेषन, बेस्ट रिसर्च पब्लिकेषन और नेषनल साइंटिफिक फोरम में अन्य प्रोफेषनल सम्मान षामिल हैं। ये अवॉर्ड रिसर्च में बेहतरीन काम और इनोवेषन के प्रति संस्थान की लगातार प्रतिबद्धता को दर्षाते हैं।

ISO 9001:2015 प्रमाणन

- ICAR-NIRCA ने अपने क्वालिटी मैनेजमेंट सिस्टम के लिए ISO 9001:2015 सर्टिफिकेषन हासिल करके एक और अहम संस्थागत उपलब्धि हासिल की है।
- तीन वर्षों के लिए मान्य यह सर्टिफिकेषन, 17 अप्रैल 2025 को संस्थान के संषोधित अधिदेश के तहत क्वालिटी मैनेजमेंट प्रैक्टिस को सफलतापूर्वक लागू करने के लिए दिया गया थाः
- "तंबाकू पर मौलिक, रणनीतिक और व्यावहारिक षोध और मिर्च, हल्दी, अष्वगंधा तथा अरंडी पर रणनीतिक और अनुप्रयोगिक षोध।"
- यह सर्टिफिकेषन रिसर्च, टेक्नोलॉजी डेवलपमेंट, एनालिटिकल सर्विसेज और इंस्टीट्यूषनल मैनेजमेंट में अंतरराश्ट्रीय स्तर पर स्वीकार्य क्वालिटी स्टैंडर्ड्स बनाए रखने के लिए संस्थान की प्रतिबद्धता को दर्षाता है।

NIRCA Nest

- वर्ष के दौरान, ICAR–NIRCA ने 'NIRCA Nest' के जरिए अपने वाणिज्यिकरण के प्रयासों को मजबूत किया। 'NIRCA Nest' संस्थान का एक खास आउटलेट है, जहाँ ICAR–NIRCA और उसके सहयोगी संगठनों द्वारा ''ICAR–NIRCA'' ब्रांड के तहत विकसित मूल्य–संवर्धित कृशि उत्पादों की मार्केटिंग की जाती है।
- इस आउटलेट का उद्घाटन 21 जनवरी 2025 को ICAR के उपमहानिदेशक (फसल विज्ञान) डॉ. तिलक राज षर्मा ने किया। यह संस्थान द्वारा विकसित तकनीकों के वाणिज्यिकरण को बढ़ावा देने और मूल्य सवंर्धित उत्पादों के लिए सीधे बाजार तक पहुँच आसान बनाने की दिषा में एक अहम कदम था।
- रिपोर्टिंग वर्श के दौरान, 'NIRCA Nest' ने मूल्य सवंर्धित उत्पादों की बिक्री से ¹ 1,41,866 का राजस्व अर्जित किया। इसके अलावा, जनजातीय उपयोजना (TSP) के तहत 500 महिला लाभार्थियों को ¹ 3,58,300 की कीमत वाली TSP किट दी गईं, जिससे उनकी आजीविका बेहतर बनाने, उद्यमिता को बढ़ावा देने और समावेषी ग्रामीण विकास में मदद मिली।
- 'NIRCA Nest' तकनीक के वाणिज्यिकरण, उत्पाद के प्रदर्षन और कृशि–आधारित उद्यमों को बढ़ावा देने के लिए एक प्रभावशाली मंच के तौर पर काम करता है। इस तरह, यह टिकाऊ वाणिज्यिकरण के जरिए रिसर्च को सामाजिक–आर्थिक प्रभाव में बदलने के संस्थान के लक्ष्य को मजबूत करता है।

निष्कर्षात्मक टिप्पणियां

- वर्ष 2025 में हासिल की गई उपलब्धियां, विज्ञान–आध ाारित, बाजार–उन्मुख और जलवायु–अनुकूल वाणिज्यिक खेती को आगे बढ़ाने के लिए ICAR-NIRCA की लगातार प्रतिबद्धता को दर्शाती हैं। फसल सुधार, उत्पादन तकनीक, फसल सुरक्षा, कटाई के बाद प्रबंधन, डिजिटल खेती, मूल्य संवर्धन, विस्तार, क्षमता निर्माण और संस्थागत साझेदारी में उल्लेखनीय प्रगति के जरिए, संस्थान ने तंबाकू और अन्य वाणिज्यिक फसलों पर षोध में राश्ट्रीय नेतृत्व के तौर पर अपनी भूमिका को और मजबूत किया है।
- अत्याधुनिक तकनीकों, रणनीतिक पब्लिक–प्राइवेट पार्टनरषिप, सटीक खेती (precision agriculture), संसाध ानों के टिकाऊ प्रबंधन और किसानों पर केंद्रित इनोवेषन को अपनाने से संस्थान ने उत्पादकता, लाभप्रदता, पर्यावरण की स्थिरता और ग्रामीण आजीविका को बेहतर बनाने में अपना योगदान बढ़ाया है। ये उपलब्धियां ICAR–NIRCA के उस विजन को मजबूत करती हैं, जिसका मकसद वैज्ञानिक उत्कृश्टता, तकनीकी इनोवेषन और सभी संबंधि ात पक्षों (स्टेकहोल्डर्स) की प्रभावी भागीदारी के जरिए वाणिज्यिक खेती में बदलाव लाना है। इस तरह, यह संस्थान टिकाऊ कृशि विकास, पोशण सुरक्षा, निर्यात में प्रतिस्पर्धा और 'विकसित भारत @ 2047' जैसे राश्ट्रीय लक्ष्यों को हासिल करने में योगदान दे रहा है।

Executive Summary

Commercial Crop Improvement

- A high-yielding Flue-Cured Virginia (FCV) tobacco variety, FCH 248 (CTRI Navya), developed through the pedigree breeding method, was released for commercial cultivation in the Karnataka Light Soils (KLS) region by the 93rd Central Varietal Release Committee (CVRC) and subsequently notified through Gazette Notification No. SO 2128(E) dated 13 May 2025. The variety possesses a cured leaf yield potential of 2.1–2.7 t ha^{-1}, records up to 45% higher cured leaf yield over the check variety Kanchan, and exhibits improved tolerance to black shank disease.
- A promising CMS-based FCV tobacco hybrid, FCHH-2, was developed for Fusarium wilt-prone regions of Karnataka Light Soils. Under coordinated multilocation trials, the hybrid recorded 17–21% higher cured leaf yield, averaging 2.4 t ha^{-1}, compared with the commercial hybrid check and showed no incidence of Fusarium wilt under naturally infested farmer field conditions.
- For the Southern Light Soil (SLS) region, the advanced breeding line FCR 63 demonstrated superior performance by recording an average cured leaf yield of 2.6 t ha^{-1}, out performing the released varieties CTRI Shresta (2.4 t ha^{-1}) and Siri (2.2 t ha^{-1}), while also exhibiting desirable agronomic and morphological characteristics.
- Under black soil conditions, the breeding lines RS-47 and RS-55 recorded significantly higher cured leaf yields of 2,153 kg ha^{-1} and 2,145 kg ha^{-1}, respectively, compared with the check variety CTRI Sulakshana. Similarly, the advanced lines V-5149 and V-5150 produced significantly higher cured leaf yields of 2,129 kg ha^{-1} and 2,074 kg ha^{-1}, respectively, confirming their potential for varietal advancement under black soil ecosystems.
- In the Northern Light Soils (NLS), the breeding entries SJ-11, SJ-12, SJ-14, SJ-15, and SJ-16 were identified as promising genotypes, recording cured leaf yields ranging from 2.89 to 3.49 t ha^{-1}, significantly exceeding the performance of the standard checks.
- Five elite FCV breeding lines (RS-47, V-5149, FCH-263, FCH-272, and FCH-276) were nominated to the Initial Varietal Trial (IVT) under the All India Network Project on Tobacco (AINPT) for multilocation evaluation across diverse agro-climatic regions.
- During the second year of evaluation under Karnataka Light Soil conditions, the breeding lines FCH-270, FCH-271, FCH-272, FCH-273, and FCH-276 produced cured leaf yields ranging from 2,098 to 2,242 kg ha^{-1}, representing a 24–32% improvement over the best-performing check variety. Likewise, the advanced breeding lines FCH-279, FCH-282, FCH-283, FCH-284, and FCH-286 recorded 26–45% higher cured leaf yield together with superior bright leaf yield, demonstrating substantial potential for future varietal release.
- The genotypes KDB-3, KDB-6, VT-1158, and CTRI Shresta exhibited stable performance under both drought-stress and well-watered conditions at the NICRA Research Station, Kandukur, indicating their suitability for climate-resilient tobacco production.
- Among burley tobacco, the breeding lines BFC-23, BFC-33, and BFC-36 expressed desirable plant architectural traits, while the accessions Burley 181, BFC 23-1-12, KY 42-11, BFC 6-1-2, and Leca-10 exhibited superior seedling survival under short-term waterlogging stress. Furthermore, the genotypes Burley 181, Burley 49, and Burley 64 maintained superior leaf yield performance under both drought and irrigated conditions.
- The burley tobacco genotype AOB-359 emerged as the highest-yielding entry across all evaluation locations, followed by AOB-962. QTL-seq analysis identified eight significant genomic regions associated with Fusarium wilt resistance on chromosomes 2, 5, 8, 12 and 19, providing valuable genomic resources for marker-assisted breeding.
- Genome-editing research achieved a significant milestone through the successful design and validation of guide RNA targeting the Phytoene Desaturase (PDS) gene involved in carotenoid biosynthesis. Agrobacterium-mediated transformation using the pKSE401-PDS construct produced albino T_0 plants, and molecular characterization confirmed successful gene knockout through targeted nucleotide deletions, thereby establishing a robust CRISPR/Cas genome-editing platform in tobacco.
- A total of 1,364 tobacco germplasm accessions, representing diverse tobacco types and wild *Nicotiana* species, were regenerated during the year. Passport information was compiled for 1,752 accessions, and the

utilization of germplasm in developing 107 improved tobacco varieties was comprehensively documented, including their pedigree relationships and genetic ancestry.

- Under the pre-breeding programme, 21 interspecific crosses were generated to introgress resistance to root-knot nematode, black shank, and Tobacco Mosaic Virus (TMV) into elite FCV tobacco backgrounds, thereby strengthening the institute's long-term genetic improvement programme.
- The institute supplied 18,612.9 kg of truthfully labelled tobacco seed comprising seven FCV, two burley, and one Lanka tobacco variety under the Revolving Fund Scheme, generating a revenue of ₹ 252 lakh while ensuring timely availability of quality seed to farmers.

Improvement of Commercial Crops

- In chilli, several elite breeding lines were identified for economically important traits. DinCh-330 recorded the highest dry fruit yield (2,633 kg ha^{-1}), DinCh-262 exhibited the highest capsaicin content (3,297 μg g^{-1}), DinCh 68-10-3 recorded the highest anthocyanin (cyanidin-3-glucoside) content (645.58 μg g^{-1}), while DinCh-252-12-6 registered the highest carotenoid content (1,400.3 μg g^{-1}), providing valuable genetic resources for crop improvement and value-added product development.
- A total of 330 ashwagandha germplasm accessions, procured from ICAR-NBPGR and ICAR-DMAPR, were evaluated for quantitative, qualitative, and DUS descriptors. Promising genotypes possessing desirable agronomic and quality traits were identified, while 157 accessions were characterized for withanolide content to facilitate future breeding programmes.
- In turmeric, 43 germplasm accessions were evaluated for morphological, yield, and quality traits. Fresh rhizome yield ranged from 4.3 to 49.3 t ha^{-1}, with the accession Assam-2 recording the highest yield (49.3 t ha^{-1}). The highest curcumin content (8.9%) was observed in accession TCP-115, followed by TCP-223 (7.3%) and TCP-285-2 (5.29%), identifying valuable donor lines for quality improvement.

New Research Initiatives

- To address the growing challenge of root-knot nematode infestation in tobacco, a strategic research programme has been initiated to elucidate the molecular and genetic mechanisms governing host resistance in *Nicotiana tabacum*, with the objective of developing nematode-resistant cultivars through advanced breeding approaches.
- Research has also been initiated to enhance turmeric productivity and nutraceutical quality through the development of hexaploid turmeric lines, thereby broadening the genetic base for high-value cultivar development.
- In addition, strategic investigations on potassium-use efficiency under drought conditions have been initiated to identify nutrient-efficient tobacco genotypes capable of sustaining productivity under resource-limited environments, thereby contributing to climate-resilient and resource-efficient commercial agriculture.

Crop Production Management

Agro-technologies

- Integrated nutrient management involving nano bio-capsules, farmyard manure (FYM), and the recommended dose of fertilizers (RDF) significantly improved crop productivity in Flue-Cured Virginia (FCV) tobacco under Northern Light Soil (NLS) conditions. Application of 10 nano bio-capsules $acre^{-1}$ along with 100% RDF and FYM enhanced leaf area index, soil microbial activity, phosphorus uptake, and cured leaf yield by 5–6.5% over RDF alone. The technology also improved the benefit-cost ratio from 1.39 to 1.43, generating an additional income of ₹ 12,152 ha^{-1}, demonstrating its economic viability.
- Under Karnataka Light Soil (KLS) conditions, the combined application of nano bio-capsules, FYM, and RDF significantly increased green leaf, cured leaf, and bright leaf yields by 6–9% compared with RDF alone. Enhanced root development and improved nutrient acquisition under rainfed conditions indicate the potential to reduce the recommended fertilizer dose by 25% without compromising productivity or leaf quality.
- In turmeric, planting a single row on ridges at 45 × 30 cm spacing with an application of 200 kg K_2O ha^{-1} recorded the highest fresh rhizome yield (52.1 t ha^{-1}), rhizome recovery (19.68%), dry rhizome yield (9.97 t ha^{-1}), and curcumin content (2.53%) under Rajahmundry conditions.
- An integrated weed management strategy comprising mechanical power weeding, pre-emergence application of pendimethalin 38.7% SC (0.6 kg a.i. ha^{-1}), followed by post-emergence application of quizalofop-ethyl 5% EC (0.06 kg a.i. ha^{-1}), achieved approximately 90% weed control and recorded the highest dry chilli yield (2,777 kg ha^{-1}). The integrated approach effectively minimized weed

competition throughout the crop growth period while improving key yield attributes.

- In ashwagandha, application of sheep manure combined with biofertilizers recorded the highest gross return (₹ 3,23,930 ha^{-1}) and net return (₹ 2,28,180 ha^{-1}), followed by vermicompost and FYM integrated with biofertilizers, indicating the superiority of integrated organic nutrient management.
- Evaluation of irrigation schedules revealed that root yields obtained under 75%, 100%, and 125% evapotranspiration (ET) were statistically comparable. However, surface irrigation recorded the highest net return (₹ 1,34,950 ha^{-1}), whereas the highest water-use efficiency was achieved under 25% ET, followed by 50% ET, demonstrating considerable scope for improving water productivity through deficit irrigation.
- A potassium-enriched organic nutrient supplement (RHA-K) was developed from rice husk ash and waste mica using potassium-solubilizing microorganisms. The technology provides an environmentally sustainable alternative potassium source for enhancing turmeric productivity, particularly under the agro-climatic conditions of West Bengal.
- For turmeric cultivar Duggirala Red, cultivation using mother rhizomes coupled with integrated nutrient management comprising 150:50:50 kg $N:P_2O_5:K_2O$ ha^{-1}, 5 t FYM ha^{-1}, and Azospirillum and Azotobacter inoculation produced the highest dry rhizome recovery (20.77%), dry rhizome yield (11.04 t ha^{-1}), and curcumin content (2.15%).
- The systemic suckericide SUCKERSTOP™ (Flumetralin 17.5% EC), synthesized through a novel process, was successfully validated across major FCV tobacco hybrids and varieties under farmers' field conditions in the Northern Light Soil region. Application at 25 mL L^{-1} effectively controlled sucker growth by up to 95%, while residue levels remained well below the prescribed Maximum Residue Limits (MRLs) under both irrigated and rainfed conditions.
- Long-term nutrient management studies conducted under the 64-year permanent manurial experiment in *Motihari* tobacco demonstrated that balanced fertilization (NPK + FYM @ 10 t ha^{-1}) produced the highest metabolite diversity, enhanced nicotine biosynthesis (approximately 4.0% nicotine), promoted phenylpropanoid metabolism, improved leaf yield, and contributed to long-term soil organic matter stabilization and humification.

Resource Optimization

- In Burley tobacco cultivation, alkaloid content increased under moisture-stress conditions. At Giddaluru, the cultivar Vijetha, supplied with 250 kg N ha^{-1}, recorded the highest alkaloid content (3.87%), whereas at Nandyal, the alkaloid content reached 2.45% in the third leaf harvest. At Vinukonda, cultivar Win-5 recorded 3.15% alkaloids with 200 kg N ha^{-1} and 24-leaf topping, highlighting significant genotype × environment interactions.
- The FCV tobacco variety FCJ-11 produced superior green leaf yield (13.9 t ha^{-1}), cured leaf yield (1,943 kg ha^{-1}), grade index (1,374), and green leaf-to-cured leaf ratio (7.0) compared with the farmer's variety. Fertilizer application at 135 kg N ha^{-1} and 150 kg K_2O ha^{-1} significantly improved nitrogen-use efficiency, agronomic efficiency, recovery efficiency, partial factor productivity, and economic returns compared with higher nitrogen application rates.
- Microbial diversity studies in the rhizosphere of FCV tobacco under Northern Light Soil conditions revealed the predominance of Actinobacteria (34–40%) and Proteobacteria (25–28%), indicating their important role in nutrient cycling, carbon turnover, phosphorus solubilization, nitrogen transformation, sulphur oxidation, and suppression of soil-borne pathogens. Metabolomic analysis further identified site-specific organic acids associated with beneficial microbial communities.
- Long-term cropping system studies demonstrated that cumulative soil carbon mineralization consistently followed the sequence Sunhemp–Tobacco >Bengalgram–Tobacco > Cucumber–Tobacco, indicating superior carbon turnover and enhanced microbial activity under green manure-based production systems.
- Carbon sequestration across tobacco-based production systems ranged from 17 to 96 Mg ha^{-1}, with an average of 35–40 Mg ha^{-1}. The highest sequestration potential was recorded under FYM/Chilli–Tobacco and Sunhemp–Tobacco systems, whereas continuous fallow–tobacco systems exhibited the lowest carbon storage, demonstrating the importance of diversified cropping systems for climate-smart agriculture.
- Application of indigenous Plant Growth-Promoting Rhizobacteria (PGPR) formulations in chilli significantly enhanced fruit pericarp thickness compared with RDF alone, confirming the beneficial interaction between

nutrient management and microbial inoculation. Furthermore, RDF-treated samples recorded the highest Aflatoxin B_1 contamination during storage, whereas cultivar Akashi consistently exhibited the lowest aflatoxin accumulation after six months, indicating superior storage stability.

- Life-cycle assessment revealed that tobacco curing contributed approximately 71.8% of the total carbon emissions within tobacco production systems. Total carbon footprint was higher in the Fallow–Tobacco sequence (7.32 t CO_2e ha^{-1}) than in the Sunhemp–Tobacco sequence (6.87 t CO_2e ha^{-1}), demonstrating that legume-based crop rotations can substantially reduce greenhouse gas emissions and improve the environmental sustainability of tobacco cultivation.
- Among the evaluated cropping systems, soils under the Sunhemp–Tobacco sequence recorded the highest carbon mineralization (20.9 g kg^{-1} soil), reflecting enhanced microbial activity and greater availability of labile organic carbon derived from green manure incorporation.

Cropping Systems

- Diversified cropping systems developed for commercial agriculture demonstrated significant potential for enhancing productivity, profitability, resource-use efficiency, and environmental sustainability across different agro-ecological regions.
- Under Alfisol conditions, the Turmeric + Blackgram (*Kharif*) – Tobacco (*Rabi*) – Groundnut (relay) cropping system recorded the highest net return of ₹ 3,25,473 ha^{-1}, followed by the Turmeric + Blackgram (4:4) (*Kharif*) – Tobacco (*Rabi*) system, which generated a net return of ₹ 3,17,110 ha^{-1}. These systems proved to be economically superior to other turmeric-based cropping sequences, highlighting their potential for improving farm income in commercial agriculture.
- Evaluation of tobacco-based intercropping systems revealed that wide-spaced paired-row planting (0.8 m × 0.4 m + 1.5 m) of tobacco intercropped with chickpea produced the highest system productivity, recording a Tobacco Leaf Equivalent Yield (TLEY) of 1,864 kg ha^{-1}, compared with conventional planting geometry. Application of the recommended dose of fertilizers (100% RDF) further enhanced crop performance by recording the highest green leaf yield (12.06 t ha^{-1}), cured leaf yield (2,091 kg ha^{-1}), and bright-grade leaf yield (1,253 kg ha^{-1}).
- Intercropping studies involving turmeric and moringa demonstrated that although the individual crop yields declined due to interspecific competition, overall system profitability improved considerably. Sole moringa cultivation generated the highest net return (₹ 4,68,272 ha^{-1}) with a benefit-cost ratio of 3.34. Among the intercropping systems, paired-row Moringa + Turmeric (1:9) proved to be the most profitable, recording a net return of ₹ 3,68,399 ha^{-1}, indicating its suitability as a sustainable diversification strategy.
- In ashwagandha-based cropping systems, intercropping with annual moringa and aggregatum onion under inorganic nutrient management significantly enhanced farm profitability. The Ashwagandha + Annual Moringa system recorded the highest net return (₹ 4,09,656 ha^{-1}), followed closely by Ashwagandha + Aggregatum Onion (₹ 3,99,596 ha^{-1}). In addition to economic benefits, intercropping improved crop quality attributes. Capsaicin content and pungency of chilli increased under chilli–ashwagandha intercropping, while nicotine content of FCV tobacco increased by 2.76% when grown in association with ashwagandha, indicating positive crop interactions that enhanced quality parameters.
- Overall, the diversified cropping systems developed by ICAR–NIRCA demonstrated their potential to improve farm profitability, optimize resource utilization, enhance product quality, and strengthen climate resilience, thereby providing economically viable and sustainable production models for commercial agriculture.

Biotic Stress Management

Integrated Pest and Disease Management

- Comprehensive studies on biological control agents associated with tobacco whitefly (*Bemisia tabaci*) revealed the occurrence of 13 species of natural enemies under field and net-house conditions at Rajahmundry. The predatory mirid bug *Nesidiocoris tenuis* was the dominant predator, with populations increasing from 2–3 individuals per plant during the early crop growth stage to 10–15 individuals per plant at flowering. Other important natural enemies included coccinellid beetles (*Menochilus sexmaculatus, Verania discolor, Verania vincta, Coccinella septempunctata* and *C. repanda*), the green lace wing (*Chrysoper lacarnea*), three species of spiders, one syrphid fly species, and the parasitoids *Encarsia* spp. and *Eretmocerus* spp. Collectively, these natural enemies constitute an important biological control complex for sustainable whitefly management.

- Volatile organic compounds (VOCs) released by healthy and aphid-infested wild *Nicotiana* species were characterized using dynamic headspace sampling coupled with GC–MS analysis. Healthy plants of *Nicotiana benthamiana* predominantly emitted p-cymene, 4-ethylbenzaldehyde, 3-ethylacetophenone,* and *farnesene*, whereas aphid-infested plants produced compounds including valeric acid, thunbergol, exo-2-hydroxycineole, L-tyrosine,* and *N,O-bis(capryloyl)-methyl ester*. These findings provide valuable insights into herbivore-induced plant volatiles and their ecological significance in tritrophic interactions, offering opportunities for developing semiochemical-based pest management strategies.
- Laboratory evaluation of insecticides against the cigarette beetle (*Lasioderma serricorne*), a major storage pest of tobacco, demonstrated that chlorfenapyr 10 SC, deltamethrin 11 EC, and spinetoram 11.7 SC achieved 100% adult mortality, indicating their suitability for effective protection of stored tobacco.
- A Standard Operating Procedure (SOP) for drone-based insecticide application in tobacco was developed and standardized. The XR11002VP nozzle operating at a spray height of 2.0 m above the crop canopy and a flight speed of 3 m s^{-1} produced superior spray characteristics compared with the conventional XR110015VP nozzle. The study established that the recommended field doses of emamectin benzoate 5 SG (250 g ha^{-1}) for the management of *Spodoptera litura* and chlorantraniliprole 18.5 SC (150 mL ha^{-1}) against *Helicoverpa armigera* can be effectively applied using unmanned aerial systems, facilitating precision crop protection.
- Integrated Pest Management (IPM) modules for the management of South-East Asian thrips (*Thrips parvispinus*) were demonstrated in farmers' fields across seven villages of Guntur district, Andhra Pradesh. Adoption of the IPM package resulted in an 11.65% reduction in thrips population compared with conventional farmer practices during the first year of evaluation, demonstrating the effectiveness of integrated management strategies under field conditions.
- Extensive disease surveys conducted during 2024–25 revealed that black shank disease was predominant in the Northern Light Soil (NLS) platform areas of Gopalapuram, whereas Fusarium wilt was widely prevalent in the Karnataka Light Soil (KLS) region, particularly around Periyapatna. Reliable artificial disease development was achieved using 5–6% (w/w) soil inoculum in combination with root-dip inoculation using 10v spores mL^{-1} for 10 minutes before transplanting. Among the fungicides evaluated, azoxystrobin + mancozeb + tebuconazole, carboxin + thiram, azoxystrobin + mancozeb, and metalaxyl + mancozeb exhibited 100% inhibition of mycelial growth of *Phytophthora nicotianae* at concentrations of 250 ppm and above, providing effective options for disease management.
- A native entomopathogenic nematode, *Steinernema pakistanense* (NIRCA-01 strain), was isolated from tobacco fields at ICAR–NIRCA Regional Station, Jeelugumilli. Under laboratory conditions, the isolate caused 100% larval mortality of *Spodoptera litura* within 48 hours at an inoculation level of 500 infective juveniles per larva, indicating its potential as an eco-friendly biological control agent.
- Comprehensive nematode surveys in Karnataka Light Soil regions identified root-knot nematode (*Meloidogyne incognita*), reniform nematode (*Rotylenchulus reniformis*), *Helicotylenchus* spp., *Tylenchus* spp., and other free-living nematodes associated with FCV tobacco. The highest root-knot nematode population (126 second-stage juveniles per 100 cm^3 soil) was recorded in Hunsur platform soils, followed by Periyapatna, Chilkunda, Ramnathpura, and H.D. Kote, highlighting the widespread occurrence of nematode infestations in major tobacco-growing areas.
- Among the advanced breeding materials, FCH-261, IET-103, IET-107, IET-108, FCR-71, FCR-73, FCR-74, and FCRH-13 recorded a Root-Knot Index (RKI) < 1.5 under naturally infested field conditions and were identified as promising sources of resistance for future varietal development.
- Field evaluation of Fluopyram 400 SC demonstrated excellent efficacy against *Meloidogyne incognita*. Application at 0.05% concentration reduced root-knot incidence by 68% and soil nematode population by 57.8%, resulting in a 24.3% increase in cured leaf yield with a benefit-cost ratio of 2.31. The treatment proved effective in both nursery and main-field conditions under Karnataka Light Soil environments.
- Overall, the institute's research during the year significantly strengthened integrated pest, disease, and nematode management strategies by combining host plant resistance, biological control, precision pesticide application, surveillance, and environmentally

sustainable crop protection technologies, thereby contributing to resilient and sustainable commercial agriculture.

Post-Harvest Produce Management

Assessment of Phytochemicals

- Research on pre-harvest interventions in chilli demonstrated that foliar application of calcium chloride (0.5%), gibberellic acid (50 ppm), and potassium nitrate (1%) significantly enhanced capsaicin content, while magnesium sulphate (1%) also contributed to increased pungency. Higher total carotenoid content was recorded with neem oil (1%) and gibberellic acid (50 ppm) treatments, indicating the potential of pre-harvest nutrient and growth regulator management for improving quality attributes of chilli.
- Evaluation of post-harvest storage methods for dry chilli revealed that storage in steel containers with desiccants maintained the lowest seed moisture content (6.69%), followed by vacuum-sealed storage and deep-freezer storage. These storage systems effectively preserved product quality by minimizing moisture absorption during storage.
- An eco-friendly process was developed for the extraction and synthesis of industrially important bioactive compounds from castor oil. Efficient conversion of ricinoleic acid resulted in the production of 2-octanol and 2-octanone, yielding 497.1 µg g^{-1} and 11.28 µg g^{-1}, respectively. The developed process demonstrated superior efficiency compared with conventional catalytic methods employing lead-based catalysts, thereby providing a safer and environmentally sustainable alternative.
- GC–MS analysis successfully identified and quantified ricinoleic acid in purple and red castor seed oils at concentrations of 2,961.6 µg mLµ^{1} and 2,621.5 µg mLµ^{1}, respectively. Eco-friendly oxidation using Oxone® facilitated the successful synthesis of 10-hydroxystearic acid (THSA) and azelaic acid, demonstrating the potential of green chemistry approaches for producing high-value industrial chemicals from renewable feedstocks.

Development of Efficient Analytical Protocols

- Continuous refinement of the LPG-based tobacco curing module substantially improved fuel-use efficiency, reducing gas consumption to 430 g per kilogram of cured leaf while maintaining the standard curing schedule and cured leaf quality. The technology offers considerable scope for reducing energy consumption and greenhouse gas emissions during tobacco curing.
- A sensitive and robust LC–MS/MS analytical method was developed for the determination of flubendiamide residues in tobacco. The study established a pre-harvest interval (PHI) of approximately 17 days for producing FCV tobacco with residue levels within internationally acceptable limits, thereby facilitating compliance with food safety and export standards.
- Ultrasonication-assisted extraction was standardized as a rapid, energy-efficient, and environmentally friendly technique for the extraction of capsaicin and capsanthin from dry chilli. The technology required lower solvent consumption and processing time than conventional homogenization methods while achieving superior extraction efficiency. Hydrodynamic cavitation-based extraction also produced capsanthin with a purity of 38.14%, comparable to ultrasonication, demonstrating its potential as a scalable green extraction technology.
- Robust LC–MS/MS analytical protocols were developed for the quantitative estimation of anthocyanins in black chilli, β-carotene and curcuminoids in turmeric, ricinoleic acid and its derivatives in castor, and withanolides in ashwagandha. In addition, comprehensive multi-residue analytical methods based on GC–MS (SIM mode) and LC–MS/MS (MRM mode) were standardized for simultaneous determination of approximately 1,016 pesticides and 255 pesticide residues, respectively, in tobacco, significantly strengthening residue monitoring and quality assurance capabilities.

Development of Value-Added Products

- A capsanthin-rich nutraceutical thin-film formulation was successfully developed from chilli extracts. The product exhibited 68.19% *in vitro* antioxidant activity, comparable to purified capsanthin extract, indicating its potential application as a natural nutraceutical and functional food ingredient. The developed bio-colourant also offers a promising alternative to synthetic food colourants for the food processing industry.
- An efficient NaOH-assisted extraction protocol, integrated with hydrodynamic cavitation, was standardized for cellulose extraction from chilli pedicles (LCA-643). The process achieved a cellulose recovery of 28.76%, while the purified cellulose sheet and resin fractions exhibited antioxidant activities of 90.80% and 89.86%, respectively. Furthermore, the bioavailability of cryptoxanthin-rich ethyl acetate extract reached 1.29%, demonstrating its potential for nutraceutical applications.

- The institute also developed a range of novel food, therapeutic, and nutraceutical products from chilli and turmeric through a systematic research-driven product development pipeline encompassing extraction, purification, formulation, validation, and quality evaluation. These value-added products have significant potential for commercialization, enhanced farmer income, and promotion of agro-based entrepreneurship.
- Overall, the post-harvest research programme significantly strengthened value addition, analytical quality assurance, green processing technologies, and product diversification in commercial crops. These innovations support enhanced market competitiveness, export readiness, and sustainable utilization of agricultural produce while creating new opportunities for agri-based industries and rural entrepreneurship.

Extension and Market Intelligence

Value Chain Analysis

- Comprehensive value chain studies conducted on commercial crops generated critical insights for improving market efficiency, reducing post-harvest losses, and enhancing farmers' profitability.
- Analysis of the turmeric value chain revealed that post-harvest losses were estimated at approximately 44 thousand tonnes at the farm level and 18 thousand tonnes at the market level, indicating substantial opportunities for improving post-harvest management and supply chain efficiency. The dominant marketing channel in Telangana was Farmer --> Trader --> Wholesaler --> Exporter, accounting for nearly 90% of the marketed produce. The study further demonstrated that the introduction of a price support mechanism and quality-based pricing linked to grade and curcumin content would significantly improve farmers' income while promoting production of superior quality turmeric.
- Economic analysis of FCV tobacco cultivation in Karnataka during 2024–25 indicated that the average cost of cultivation was ₹ 2,32,518 ha^{-1}. Labour constituted the largest component of production costs (₹ 98,046 ha^{-1}), followed by material inputs (₹ 49,382 ha^{-1}) and fuelwood used for tobacco curing (₹ 37,322 ha^{-1}). These findings highlight the need for mechanization, energy-efficient curing technologies, and resource optimization to enhance production efficiency and profitability.
- Assessment of agricultural sustainability across the districts of Andhra Pradesh using ecological, economic, and social indicators revealed considerable spatial variation in sustainability indices. The districts of East Godavari, Eluru, Konaseema, West Godavari, and Guntur recorded a Sustainable Livelihood Security Index (SLSI) greater than 0.80, indicating high levels of agricultural sustainability and demonstrating the effectiveness of diversified commercial farming systems in these regions.
- Long-term market intelligence analysis of chilli prices at the Bengaluru market, covering a 24-year period, using the Mann–Kendall non-parametric trend analysis, revealed a statistically significant increasing trend in maximum market prices over time. The observed positive trend provides valuable information for production planning, market forecasting, and strategic decision-making by farmers and policymakers.

ICT-Based Decision Support Systems

- ICAR–NIRCA continued to strengthen digital agriculture through the development of innovative information and communication technology (ICT)-based tools for farmers, extension personnel, and other stakeholders.
- A digital library of tobacco diseases was developed using HTML, CSS, and JavaScript platforms. Image preprocessing and annotation are currently underway to facilitate the development of an artificial intelligence-based disease diagnosis system utilizing Vision Transformers (ViT) and Swin Transformer deep-learning architectures.
- A bilingual mobile application was developed on the Android platform to provide soil test-based fertilizer recommendations for FCV tobacco cultivation in the Northern Light Soil region of Andhra Pradesh and the Karnataka Light Soil region. The application is available in English–Telugu and English–Kannada, enabling location-specific nutrient recommendations and promoting precision nutrient management.
- The Tobacco Seed Portal was comprehensively redesigned to streamline tobacco seed distribution across different production regions. The upgraded portal incorporates several new digital features that enhance transparency, improve operational efficiency, and facilitate timely seed allocation to farmers.
- An intelligent Chemical Compatibility Chatbot was developed using Python and Flask to provide instant information on pesticide compatibility. The platform integrates QR codes, web access, and WhatsApp-based services, enabling farmers and extension personnel to obtain reliable compatibility information using mobile devices free of cost.

- Technology adoption studies indicated that 52% of turmeric growers and 57% of chilli growers exhibited a medium level of technology adoption, whereas 26% and 31%, respectively, demonstrated high adoption levels. These findings indicate encouraging acceptance of improved production technologies while also highlighting the need for continued extension interventions to enhance adoption among the remaining farming community.

Frontline Extension

- The institute continued to strengthen technology dissemination through participatory and demand-driven extension approaches aimed at accelerating the adoption of improved technologies in commercial agriculture.
- Assessment of chilli-based Farmer Producer Organizations (FPOs) revealed a predominantly high Entrepreneurial Competency Index (ECI), with 60% of the evaluated FPOs falling within the high competency category (ECI score: 376–500). The results demonstrate the growing managerial and entrepreneurial capabilities of producer organizations, thereby strengthening collective marketing and agribusiness development.
- A participatory extension approach was successfully adopted for implementing capacity-building programmes and technology demonstrations in chilli and turmeric. Active involvement of farmers throughout the planning, demonstration, evaluation, and feedback processes significantly enhanced technology adoption, farmer awareness, and dissemination of improved production and post-harvest management practices.
- Overall, the institute's extension and market intelligence initiatives strengthened digital agriculture, value chain development, market-oriented research, farmer advisory services, and entrepreneurship promotion. These interventions contributed significantly to improving technology adoption, enhancing market competitiveness, supporting evidence-based policy decisions, and accelerating the commercialization of research outputs in commercial agriculture.

Krishi Vigyan Kendras (KVKs)

ICAR–NIRCA, Krishi Vigyan Kendra, Kalavacharla

- The Krishi Vigyan Kendra (KVK), Kalavacharla, continued to play a pivotal role in technology assessment, refinement, demonstration, and capacity building for enhancing agricultural productivity and livelihood security. During 2025, the KVK successfully conducted 11 On-Farm Trials (OFTs), 24 Frontline Demonstrations (FLDs), 18 farmer training programmes, 8 awareness programmes, and 3 sponsored training programmes, facilitating large-scale dissemination of location-specific agricultural technologies.
- The KVK promoted value-addition technologies in ashwagandha, turmeric, banana, coconut, and jackfruit, demonstrating substantial potential for enterprise development, income diversification, and rural entrepreneurship. Cluster Frontline Demonstrations covering 120 ha of pulses and oilseed crops facilitated the adoption of improved production technologies through continuous technical backstopping and field-level advisory services.
- Capacity-building programmes significantly enhanced farmers' knowledge and technical skills in improved crop production, post-harvest management, and value addition. Under the nationwide Viksit Krishi Sankalp Abhiyan (VKSA), the KVK conducted extensive outreach programmes covering 134 villages and directly interacted with more than 24,000 farmers, creating awareness on improved agricultural technologies, climate-resilient farming practices, and Government flagship programmes.
- Overall, the activities of KVK Kalavacharla substantially strengthened technology dissemination, farmer capacity building, and entrepreneurial development, thereby contributing to sustainable commercial agriculture in the region.

ICAR–NIRCA, Krishi Vigyan Kendra, Kandukur

- KVK Kandukur continued to strengthen its extension programmes through technology assessment, demonstration, skill development, and digital agricultural advisory services. During the reporting year, the KVK conducted 24 On-Farm Trials (OFTs), 26 Frontline Demonstrations (FLDs), 48 farmer training programmes, 5 field days, 6 skill development programmes, 4 in-service training programmes, 4 Farmers' Field Schools, and 4 Research–Extension–Farmer Interface (REFI) meetings.
- The KVK received a Copyright for the mobile application 'Crop Suraksha', developed to provide digital advisory services to farmers. It also developed the NIRCA Chemical Compatibility Chatbot, which provides instant information on pesticide compatibility and has been widely disseminated among farmers and extension personnel.

- Entrepreneurship development received special emphasis during the year, with the promotion of eight agripreneurs engaged in value addition, integrated farming systems, mushroom cultivation, and nursery production. The establishment of a new Farmers' Hostel and KVK Sales Outlet further strengthened farmer training, technology dissemination, and commercialization activities.
- The KVK successfully introduced the climate-resilient chilli varieties LCA-643 and LCA-657, which received encouraging feedback from farmers owing to their superior productivity and adaptability. A Digital Farm School concept was also launched to extend advisory services through digital platforms, including mobile applications, KisanSarathi, YouTube Live programmes, short educational videos, and electronic extension materials, thereby expanding the reach of extension services to a larger farming community.
- KVK Kandukur also successfully coordinated the 15-day Viksit Krishi Sankalp Abhiyan, creating widespread awareness among farmers regarding the latest technologies developed under the National Agricultural Research, Education and Extension System (NARES) and promoting their adoption at the field level.
- Overall, the extension interventions undertaken by KVK Kandukur substantially strengthened digital agriculture, farmer skill development, technology adoption, and agri-entrepreneurship, thereby contributing to resilient and market-oriented commercial agriculture.

All India Network Project on Tobacco (AINPT)

- The All India Network Project on Tobacco (AINPT) continued to serve as the national platform for coordinated research on tobacco improvement, crop production, crop protection, and quality enhancement across diverse tobacco-growing regions of the country. During the reporting year, the network comprised 14 centres, including 3 Main Centres, 7 Sub-centres, and 4 Voluntary Centres, ensuring effective multi-location evaluation and coordinated research across different agro-climatic zones.
- The three Main Centres are located at Rajahmundry, Shivamogga, and Anand, while the Sub-centres operate at Nipani, Nandyal, Berhampur, Araul, Dinhata, Guntur, and Hunsur.
- During 2025, coordinated varietal evaluation programmes were successfully undertaken across the network. A total of 13 FCV tobacco entries, 6 *bidi* tobacco entries, 3 *rustica* tobacco entries, and 2 chewing tobacco entries were evaluated under the Initial Varietal/Hybrid Trials (IVT/IHT). In addition, 10 FCV, 3 *bidi*, 3 *natu*, and 2 *rustica* entries were evaluated under Advanced Varietal Trial-I (AVT-I), while 2 *bidi* and 3 *rustica* entries were evaluated under Advanced Varietal Trial-II (AVT-II).
- A total of six promising tobacco entries, namely FCHH-2 (FCV), ABD-241, NyBTH-152, NyBTH-157, NyBTH-171 (*bidi*), and AR-184 (*rustica*), were evaluated under On-Farm Trials (OFTs) to assess their field performance under farmers' conditions.
- The project coordinated the collection of proposals for Initial Varietal Trials from participating centres, finalized the annual technical programme for coordinated varietal evaluation, and ensured timely multiplication and distribution of trial seed materials to all participating research centres.
- The XXVII Workshop of the All India Network Project on Tobacco was successfully organized in hybrid mode at Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences (KSNUAHS), Shivamogga, Karnataka, during 16–17 September 2025. The workshop was inaugurated by Dr. D. K. Yadava, Deputy Director General (Crop Science), ICAR, with Dr. Prasanta K. Dash, Assistant Director General (Commercial Crops), ICAR, as the Guest of Honour. The programme was attended by Dr. R. C. Jagadeesha, Vice-Chancellor, KSNUAHS; Dr. R. K. Singh, Dean, RLB Central Agricultural University and Former ADG (Commercial Crops), ICAR; Dr. M. Sheshu Madhav, Director, ICAR–NIRCA and Project Coordinator, AINPT; scientists from ICAR institutes and State Agricultural Universities, Principal Investigators from network centres, industry representatives, and progressive farmers. The workshop provided an effective platform for reviewing research progress, planning future research priorities, and strengthening collaborative research on tobacco.
- During the year, four tobacco varieties—CTRI Navya (FCH-248), Sahyadri Swarna (FCS-4), 1353 (FCRH-11/LSTC-9), and DTV-9 (NBD-316)—were notified by the 93rd Central Varietal Release Committee (CVRC). Subsequently, Nandyala Pogaku-2 (ABD-132) was notified by the 94th CVRC, representing another significant milestone in the national tobacco improvement programme.
- The coordinated research efforts under AINPT continued to strengthen varietal development, multi-location testing, technology validation,

and national collaboration, thereby contributing significantly to the sustainable growth and competitiveness of India's tobacco sector.

Empowerment of Women in Agriculture

- Empowerment of rural women remained an integral component of the institute's extension strategy. During 2025, 15 women-centric training and capacity-building programmes were organized to enhance the technical knowledge, entrepreneurial skills, and livelihood opportunities of women engaged in agriculture and allied sectors. The institute also successfully promoted three women entrepreneurs, facilitating income generation through value addition and agri-based enterprises, thereby contributing to women-led rural entrepreneurship and inclusive agricultural development.

Corporate Social Responsibility (CSR)

- ICAR–NIRCA continued to strengthen its research and technology development programmes through strategic partnerships under Corporate Social Responsibility (CSR) initiatives. During 2025, the institute implemented three CSR-funded projects focusing on climate-smart agriculture, digital agriculture, and sustainable production systems.
- The projects included automation of irrigation through Internet of Things (IoT)-based technologies, supported by Elitecon International Limited, and energy conservation and reduction of carbon footprint in tobacco curing, supported by Philip Morris India Trading Private Limited. Collectively, the institute received ₹ 1,28,76,123 for the implementation of these projects during the reporting year.
- These collaborative initiatives have accelerated the development and field validation of innovative technologies in precision irrigation, energy-efficient crop production, and climate-resilient agriculture, while strengthening public–private partnerships for sustainable commercial agriculture.

Technology Outreach Activities

- Technology dissemination remained a major focus of the institute during the year through demonstrations, capacity building, and human resource development programmes.
- A total of 14 On-Farm Trials (OFTs) and Frontline Demonstrations (FLDs), along with 26 capacity-building programmes, including one ICAR-approved Human Resource Development (HRD) training programme, were organized for farmers, extension personnel, scientists, technical officers, and officials of line departments. These programmes focused on improved production technologies, crop management practices, post-harvest technologies, analytical services, and sustainable commercial agriculture.
- The outreach programmes significantly strengthened the transfer of technologies developed by the institute and enhanced stakeholder awareness regarding scientific crop production, quality management, value addition, and climate-resilient agricultural practices.

Service Functions

- ICAR–NIRCA continued to provide high-quality analytical and technical services to national stakeholders through its accredited analytical laboratories.
- The institute's Leaf Quality Evaluation Laboratory, Pesticide Residue Analysis Laboratory, and Smoke Laboratory provided analytical support to the Tobacco Board, tobacco trade, All India Network Project on Tobacco (AINPT) centres, research organizations, and other stakeholders.
- During 2025, these laboratories analyzed 3,955 samples and generated a revenue of ₹ 9,41,050 through analytical service activities. The laboratories continued to support quality assurance, residue monitoring, product evaluation, and regulatory compliance, thereby strengthening the institute's role as a national referral centre for analytical services related to tobacco and commercial crops.

Awards and Recognitions

- The scientific excellence of ICAR–NIRCA received national recognition during the reporting year through several prestigious awards and honours.
- A total of 10 awards were received by the institute's scientists in recognition of their outstanding contributions to agricultural research, innovation, and technology development. Notably, Dr. M. Sheshu Madhav, Director, ICAR–NIRCA, was elected as a Fellow of the National Academy of Sciences, India (NASI) on 9 December 2025, in recognition of his distinguished scientific contributions. He also received the Rashtriya Krishi Vigyan Puraskar–2025 on 16 July 2025.
- In addition, eight scientists of the institute received awards under various categories, including Best Scientist Award, Best Oral Presentation, Best Research Publication, and other professional recognitions at national scientific forums, reflecting the institute's

continued commitment to research excellence and innovation.

ISO 9001:2015 Certification

- ICAR–NIRCA achieved another important institutional milestone by obtaining ISO 9001:2015 Certification for its Quality Management System.
- The certification, valid for a period of three years, was awarded on 17 April 2025 in recognition of the successful implementation of quality management practices covering the institute's revised mandate:
- "Basic, Strategic and Applied Research on Tobacco and Strategic and Applied Research on Chilli, Turmeric, Ashwagandha and Castor."
- The certification reflects the institute's commitment to maintaining internationally accepted quality standards in research, technology development, analytical services, and institutional management.

NIRCA Nest

- During the year, ICAR–NIRCA strengthened its commercialization initiatives through NIRCA Nest, the institute's dedicated outlet for marketing value-added agricultural products developed by ICAR–NIRCA and its collaborating organizations under the brand "ICAR–NIRCA."
- The outlet was inaugurated on 21 January 2025 by Dr. Tilak Raj Sharma, Deputy Director General (Crop Science), ICAR, marking an important step towards promoting commercialization of institute-developed technologies and facilitating direct market access for value-added products.
- During the reporting year, NIRCA Nest generated a revenue of ₹ 1,41,866 through the sale of value-added products. In addition, 500 Tribal Sub Plan (TSP) women beneficiaries were provided TSP Kits worth ₹ 3,58,300, thereby supporting livelihood enhancement, entrepreneurship development, and inclusive rural development.
- NIRCA Nest serves as an effective platform for technology commercialization, product demonstration, and promotion of agri-based enterprises, thereby strengthening the institute's mandate of translating research into socio-economic impact through sustainable commercialization.

Concluding Remarks

- The achievements recorded during 2025 underscore ICAR–NIRCA's continued commitment to advancing science-led, market-oriented, and climate-resilient commercial agriculture. Through significant progress in crop improvement, production technologies, crop protection, post-harvest management, digital agriculture, value addition, extension, capacity building, and institutional partnerships, the institute has further strengthened its role as the national leader in research on tobacco and other commercial crops.
- The integration of frontier technologies, strategic public–private partnerships, precision agriculture, sustainable resource management, and farmer-centric innovations has enhanced the institute's contribution towards improving productivity, profitability, environmental sustainability, and rural livelihoods. These accomplishments reinforce ICAR–NIRCA's vision of transforming commercial agriculture through scientific excellence, technological innovation, and effective stakeholder engagement, thereby contributing to the national goals of sustainable agricultural growth, nutritional security, export competitiveness, and Viksit Bharat @ 2047.

भूमिका

Introduction

India is one of the fastest-growing major economies in the world, currently ranked as the sixth-largest economy. The underlying strengths are indicative of India's potential to achieve a **5 trillion economy** in a couple of years. The current structure of the economy and the emerging dynamics provide grounds to target achieving **US $1 trillion dollars** from **agriculture and allied activities**. This unleashes the immense potential of Indian agriculture, more particularly, high-value commercial crops, for harnessing the untapped export potential. With appropriate R&D support and technological interventions, the sector can significantly contribute towards the ambitious target of generating US $ 1 trillion from agriculture and allied activities. One of the key opportunities in achieving this target lies in strengthening the export potential of **high-value commercial crops**.

In India, the commercial crop sector has gained momentum in the recent past since agriculture is being treated as an agribusiness industry with more focus on agro-processing, value addition, smart marketing and export promotion. India is the largest producer and exporter of several commercial crops, such as chilli, turmeric, castor, and tobacco, and the leading producer of medicinal plants like Ashwagandha. However, despite this strong production base, the export orientation needs to be increased, particularly in terms of value-added and processed products, to augment export competitiveness, accelerate Indian agricultural exports and bring more foreign exchange revenue to the Indian economy.

High-Value Commercial Crops

Chilli

Chilli is one of the most important spices exported from India and contributes about 40 per cent of the total quantity of spice exports. India is the global leader in chilli production, with the production of 26.93 lakh tonnes, which accounts for nearly 48 per cent of global production. Indian chilli has been dominating the international chilli market due to its pungency, high quality, and price competitiveness. Currently, India exports around 7.15 lakh tonnes of chilli, generating nearly ₹ 11,405 crore in foreign exchange earnings. However, only about 24 per cent of total production is exported, which indicates less export orientation at the global level.

Turmeric

Turmeric, often referred to as the "golden spice," is another important commercial crop where India enjoys a strong production advantage. With a production of about 11.16 lakh tonnes, India accounts for nearly 83 per cent of global turmeric production. The country possesses significant diversity in turmeric varieties, with around 40-45 species, offering substantial scope for innovation and product diversification. Global demand for turmeric has increased considerably in recent years, particularly following the COVID-19 pandemic, due to growing awareness about its medicinal and immunity-boosting properties. Despite this strong demand, India exports only around 1.76 lakh tonnes, which represents merely 15 per cent of total production, generating foreign exchange earnings of about ₹ 2,885 crores. Although Indian turmeric is known for its superior quality and high curcumin content ranging from 3 to 5 per cent, the share of processed products in total exports remains relatively low.

Castor

India occupies a dominant position in the global castor production, producing nearly 15.90 lakh tonnes, which accounts for approximately 87per cent of world production. The country enjoys a virtual monopoly in the export of castor oil and related products. Currently, castor exports are estimated at 6.86 lakh tonnes, contributing around ₹ 8675 crores in foreign exchange earnings. However, only about 43 per cent of production is exported, suggesting scope for further expansion. Castor oil is widely used in several industrial applications, including paint, varnishes, lubricants, resins, etc. There is also increasing global demand for value-added castor derivatives. Expanding the production and export of these derivatives would not only enhance export earnings but also help India to sustain its leadership in the global castor market.

Ashwagandha

India is the leading producer of Ashwagandha, which is primarily cultivated in Madhya Pradesh and Rajasthan. As per the available data, the crop has gained significant global attention due to the increasing popularity of herbal medicines and nutraceuticals. Ashwagandha is currently exported to more than 60 countries, including the United States, Canada, and several European nations. The rapid growth of the Ayurvedic and herbal products industry has further strengthened demand for Ashwagandha. The Indian Ayurvedic industry has expanded from around USD 3 billion in 2014 to nearly USD 24 billion in 2024, reflecting strong global interest in traditional health products.

Tobacco

Tobacco is another important commercial crop grown in India on an area of about 4.14 lakh hectares, producing approximately 7.27 lakh tonnes, which accounts for around 13 per cent of global production. Tobacco exports were 3.15 lakh tonnes, which accounts for nearly 43 per cent of production. The sector provides direct and indirect employment to nearly 45.7 million people, making it an important source of livelihood for many rural and urban communities and contributes to ₹ 16,78 crores of foreign exchange as revenue from exports. Although India produces about 12 types of tobacco, the export earnings are mostly derived from FCV tobacco and Burley tobacco.

The ICAR-NIRCA is the premier national organisation mandated to work on high-value crops such as chilli, turmeric, ashwagandha, castor and tobacco within the scope of commercial agriculture in the country. The institute has a network of six research stations situated at Guntur, Kandukur, Jeelugumilli (Andhra Pradesh), Vedasandur (Tamil Nadu), Hunsur (Karnataka), and Dinhata (West Bengal). The research stations have specific mandates pertaining to different mandated commercial crops grown in their respective agroclimatic zones. To strengthen India's global standing in high-value commercial crops and meet rising export demand, the institute focuses on enhancing competitiveness through cost efficiency, quality improvement, and branding *via* targeted research-for-development (R&D). The institute's mandate emphasises agro-processing, value addition, and increasing farm profitability and farmers' income. ICAR-NIRCA drives agricultural exports by strengthening value chain systems, playing a key role in advancing sustainable, innovative, and economically vibrant commercial agriculture toward the vision of a "**VIKSIT BHARAT-2047**" (Developed India).

THRUST AREAS

- Commercial Crop Improvement
- Crop Management in Commercial Agriculture
- Post-Harvest Produce Management
- Extension and Market Intelligence

The institute coordinates the activities of the All-India Network Project on Tobacco and collaborates with the following institutions through All-India Coordinated Research Projects for high-value commercial crops:

- **ICAR-Indian Institute of Vegetable Research, Varanasi:** Chilli lines for value addition
- **ICAR-Indian Institute of Spices Research, Kozhikode, Kerala:** Turmeric phytochemicals and high-value compounds
- **ICAR-Indian Institute of Oilseed Research, Hyderabad:** *Rabi* castor crop in SLS, Andhra Pradesh
- **ICAR-National Bureau of Agricultural Insect Resources, Bengaluru**: Coordinated trials on biological control
- **ICAR-Indian Agricultural Research Institute, New Delhi:** Coordinated trials on nematodes

Besides, the institute coordinates the activities of two Krishi Vigyan Kendras located at Kalavacharla and Kandukur in Andhra Pradesh. As an ISO 9001:2015 certified institute, ICAR-NIRCA is functioning with the vision, mission, and mandate as stated below.

Vision

To emerge as the premier institute of excellence for research on commercial agriculture. Mission to develop and provide science technology innovation-value chain-based vibrant solutions for enhancing profitability, farm income, employment, nutrition and export while ensuring sustainability of the environment and agro-ecological assets.

Mandate

- To conduct research on diverse aspects of commercial agriculture for enhancing farm income, employment, nutrition and export earnings, while ensuring the sustainability of the environment and agro-ecological assets.
- To develop cost-cutting strategies, secondary agriculture technologies and diversified value chain models for increased profitability, competitiveness and sustainability.
- To deliver front-line extension services for technology and market intelligence dissemination, and organise training for stakeholders' capacity and competency building.
- To collaborate, coordinate and liaise with producing, processing, value addition, marketing and exporting agencies for achieving its vision.

Quality Policy

The ICAR-NIRCA shall strive to provide vibrant research solutions in myriad aspects of commercial agriculture for enhancing profitability, nutrition and export while ensuring the sustainability of the environment with a focus on

- Ensuring the production of quality tobacco with reduced levels of harmful constituents
- Enhancing farm income through innovative interventions on diverse aspects of commercial agriculture
- Exploring cost-effective secondary agriculture technologies and diversified value chain models
- Exploiting chilli, turmeric, ashwagandha, castor and tobacco for phytochemicals and value addition
- Effective technology transfer/ consultancy services to address the stakeholders' needs

31.12.2025 को कार्मिकों की स्थिति
STAFF POSITION AS ON 31.12.2025

क्र.सं. Sl. No.	श्रेणी Category	स्वीकृत पद Sanctioned Strength	भJS गए पद In Position	रिक्त पद Vacancies
ICAR-NIRCA, RAJAHMUNDRY AND ITS RESEARCH STATIONS				
1.	वैज्ञानिक Scientific	39+1*	30+1*	09
2.	तकनीकी Technical	113	83	30
3.	प्रशासनिक Administration	31	23	08
4.	कुशल सहायक कर्मचारी SSS	96	08	88
ICAR-NIRCA-KVK, KALAVACHARLA				
1.	वैज्ञानिक Scientific	01	01	-
2.	तकनीकी Technical	11	05	06
3.	प्रशासनिक Administration	02	01	01
4.	कुशल सहायक कर्मचारी SSS	02	-	02
ICAR-NIRCA-KVK, KANDUKUR				
1.	वैज्ञानिक Scientific	01	01	-
2.	तकनीकी Technical	11	07	04
3.	प्रशासनिक Administration	02	01	01
4.	कुशल सहायक कर्मचारी SSS	02	-	02

* (आरएमपी) RMP position

वत्तीय वर्ष 2025 का वित्तीय विवरण
FINANCIAL STATEMENT FOR THE YEAR 2025

रु. लाख मे
Rs.in Lakhs

क्रसं. Sl. No.	लेखा शीर्ष Head of account	व्यय Expenditure 2024-25	जारी निधियां Funds allocated (BE) 2025-26
1	पूंजीगत परिसंपत्तियों के निर्माण के लिए निधियां (पूंजी) Grants for creation of Capital Assets (Capital) SCSP (Capital) NEH (Capital)	100.00	41.00
2	सहायता अनुदान – वेतन (स्थापना) Grant in Aid - Salaries (Establishment)	2365.83	2400.00
3	सहायता अनुदान – सामान्य Grant in Aid - General		
	(a) Pension	3037.10	3000.00
	(b) Others	473.00	451.70
4	SCSP - General	29.00	30.00
5	TSP	25.00	30.00
6	NEH	40.00	20.00
	सकल योग(पूंजी+स्थापना+सामान्य+टीएसपी) Grand total (Capital + Establishment + General + TSP + SCSP)	6069.93	5972.70

Organogram


Secretary, DARE & Director General
ICAR, New Delhi
Deputy Director General (CS)
ICAR, New Delhi
Research Advisory Committee
Quinquennial Review Team
DIRECTOR
ICAR-NIRCA
Institute Management Committee
Research Divisions
Crop Improvement
Crop Management
Post-Harvest & Value Addition
Research Stations
Guntur
Kandukur
Jeelugumilli
Hunsur
Vedasandur
Dinhata
Sections
PME Cell
BSR Farm
SPU
Administration
Audit & Accounts
AKMU & Library
MSU
AINPT
Main Centres
Rajahmundry
Shivamogga
Anand
Voluntary Centres
Jeelugumilli
Kandukur
Ladol
Vedasandur
Sub Centres
Dinhata
Guntur
Hunsur
Nandyal
Nipani
Araul
Berhampur
KVK
Kalavacharla
Kandukur

Research Achievements

I. वाणिज्यिक फसल सुधार

I. Commercial Crop Improvement

I(i). Characterization and enhancement of tobacco genetic resources

1. Augmentation, characterization, evaluation, conservation and documentation of Tobacco genetic resources (PI: Rajappa J.J.)

Conservation, characterization and utilization of tobacco germplasm are essential for addressing global challenges in tobacco cultivation, including disease resistance, environmental adaptability, and sustainable production.

Germplasm characterization

- 470 FCV (exotic) germplasm accessions were characterized for morphological and chemical quality traits and 40 accessions were identified as promising for plant height and number of leaves.
- Preliminary laboratory screening of 131 IPR (insect and pest resistant) lines against aphids revealed three IPR lines IPR-90, IPR-17 and IPR-78 as resistant.
- Preliminary screening of 135 IPR lines for leaf curl (natural condition) and TMV (artificial) under field conditions revealed that 20 IPR lines are resistance to TMV and 15 lines resistant to both leaf curl and TMV.

Germplasm Maintenance: During 2024-25, about 1340 tobacco germplasm accessions were regenerated.

Conservation of germplasm: Processed the seed material of germplasm 3622 accessions and conserved under low and medium storage modules with frequent monitoring.

Pre-breeding

Interspecific crosses (21 nos.) were made between 4 prominent cultivars (FCJ-11, FCR-15, FCH-22 and Siri) with 8 wild *Nicotiana* species (*N. amplexicaulis*, *N. longiflora*, *N. plumbaginifolia*, *N. repanda*, *N. nesophila*, *N. glutinosa*, *N. benthamiana*, *N. nudicaulis*) to develop pre-breeding lines resistant for Root-knot nematode, Black shank and TMV resistance. The crosses among the four wild species (*N. amplexicaulis, N. nudicaulis, N. longiflora,* and *N. repanda*) were also made. The F_1 from all these crosses will be screened for these diseases in ensuing season.

Morphological variability among wild Nicotiana Species: Morphological traits, viz., plant height, internodal length and leaf size, were measured across nine wild species. Plant height ranged from 7 cm (N. *paniculata*) to 41 cm (N. *rustica*), number of leaves ranged from 6 (*N. maritima*) to 16 (*N repanda*) and internodal length ranged from 1cm (*N. paniculata, N. repanda* and NS 22) to 5 cm (*N. debeneyi* and *N. rustica*).

Germplasm Exchange: Upon requests and material transfer agreements, shared the seeds of 171 germplasm accessions (during September 2024 to October 2025) with various organizations (AINPT centres – 53, Within Institute– 104, Other ICAR Institute-12, Universities - 2) for research purposes.

Documentation of germplasm: Documented passport data, germplasm catalogue of FCV tobacco, Germplasm utilization for development of 107 improved varieties, and Genealogy and Genetic Relatedness of FCV and *Bidi* varieties.

At Dinhata, a total of 41 *Jati* tobacco, 176 *Motihari* tobacco lines, one cigar wrapper tobacco, one cigar filler tobacco line were grown and maintained. A total of 30 *Rustica* tobacco lines were received from Ladol centre and 12 from *Bidi* tobacco centre, Anand. Six promising lines of *Motihari* were selected and crossed in half diallel method and seeds of 15 F_1s were grown for further evaluation. A total of 153 *Motihari* tobacco germplasm accessions were screened for resistance to hollow stalk disease reaction and identified SK-101 as moderately resistant.

I(ii) Breeding tobacco varieties with agronomically superior traits, including climate resilience, resistance to biotic and abiotic stresses

2. Genetic Improvement of FCV tobacco genotypes (PI: Dr.K. Sarala)

The breeding initiatives are focused on developing climate-resilient Flue-Cured Virginia (FCV) tobacco genotypes with enhanced yield, superior leaf quality, resistance to Tobacco Mosaic Virus (TMV), tolerance to *Orobanche* spp., and adaptability to various zones.

Evaluation of advanced breeding lines for yield and quality traits

RYT Br.9-2: Replicated Yield Trial was conducted for assessing the yield and leaf quality of 11 ABLs (RS-47 to RS-57), derived from EBI-20- S 500-1, F621 x F615, Siri x VT 1158, Siri x CY 165, Cy-156 x Cy 165, CY 156 x CY161, [(CY 156 x CY 161) x (CY 156 x VT 1158)], {[(CY 156 x CY 161) x (CY 156 x VT 1158)]} x CY 159, JS 136 x CY160, [Pasidi P6 x (Siri x CY 161)] and [(CY 156 x CY 161) x (CY 156 x VT 1158)], for the third consecutive year at Katheru Farm. Three entries, RS-47, RS-54 and RS-55 recorded significantly higher green leaf (16338 - 16791 kg/ha), cured leaf (2723 to 2967 kg/ha), bright leaf (1680-1733 kg/ha) and grade index (1744 -1841) than better control, CTRI- Sulakshana/VT-1158. In pooled analysis of three years data, RS-47 and RS-55 recorded significantly higher cured leaf (2153 & 2145kg/ha, respectively) than better control, CTRI- Sulakshana and thus proposed for advancing for AINPT testing.

RYT Br.9-1: Nine advanced breeding lines (V-5148 to V-5146), derived from crosses involving genotypes TB 70, Siri, TB 100, TB 84, 1129 SR, N-98, CY142, CTRI-Sulakshana etc. were evaluated at Katheru Farm in a replicated yield trial (third year) along with checks Siri, VT-1158 and CTRI Sulakshana. The entries V-5149 and V-5150 recorded significantly higher green (16670 kg/ha & 17128 kg/ha, respectively), cured (2706 kg/ha & 2714 kg/ha) and bright leaf yields (1531 kg/ha & 1587 kg/ha), and grade index values (1784 & 1515). Based on pooled analysis of data for three years, two entries, V-5149 and V-5150 which recorded significantly higher cured leaf (2129 & 2074 kg/ha, respectively) than better control, CTRI-Sulakshana were proposed for testing under AINPT. The entries, RS-49, RS-50, RS-51 and RS-53, RS-55, RS-56, V-5148, V-5149, V-5150, V-5151, VT-1158 and CTRI- Sulakshana showed resistant reaction to TMV under artificial condition.

Row Trial and generation advancement:

Thirty seven interspecific derivatives involving *N. tabacum* (cv. Hema, VT-1158 and Siri) as one parent and aphid resistance species donors viz., *N. gossei, N. excelsior, N. × benthamiana-repanda, and N. umbratica*), 109 F_3 selections involving crosses viz., Siri × Nun; FCR-15 × CM-12; FCR-15 × Hema; SIRI × BA-1; YB-22 × TW-19; BA-1 × TW-7; BA-1 × TW-7; FCK-7 × FCJ-6; FCR-70× FCR-69 and (NLCR × SIRI) × VT-1158; 44 ABLs obtained from Jeelugumilli including the derivatives of crosses, RT-25-1 × Kanchan, FCR-59 × Kanchan, EBI-20- K 400-2, EBI-20- K 500-4, FCR-59 × F-107, FCJ-38 × FCR-59, FCJ-6 × FCR-15, FCJ-36 × FCJ-38, FCK-7 × FCJ- 6, NLCR-7-11-1-4 × NLCR-8-15-9, VLCR-12-15-14 (OP)-5 × [Passidi(RT-37) × Kanchan P2], JS-125 × [RT-33 × Kanchan (cross), (NLCR × Siri) VT-1158 × FCJ-6 and FCR-70 × FCR-69; and 63 electronic beam irradiated (EBI) materials of Siri, Banket A1 and YB-22 were evaluated in row trial. 120 advanced breeding lines were maintained. Two crosses, FCJ-6 × FCR-15 and [Maryland-59 × CTRI Sulakshana] × FCR-4 were raised and seed collected.

Screening for water stress

The seed germination and seedling growth was estimated under 15% high molecular weight Poly Ethylene Glycol (PEG 6000) solution and distilled water (DW). Though there was an increase in germination percentage in some genotypes (RS-50, RS-55 and CTRI Sulakshana), there was definite trend of reduction in seedling length in all the genotypes when treated with PEG 6000 compared to DW. Siri and RS-55 recorded lowest seedling length reduction percentage (<29%) indicating their ability to withstand drought conditions.

Collection of breeder seed: Breeder seed collected from FCV varieties viz., Siri, VT-1158, Hema, CTRI Sulakshana and CTRI Sreshta.

3. Evolving flue-cured tobacco varieties having high yield and better quality, suitable for the NLS area of Andhra Pradesh (PI: Dr. K. Sarala)

Breeding efforts were directed towards developing FCV tobacco cultivars suitable for the Northern Light Soils (NLS) of Andhra Pradesh.

Replicated trials:

RYT-21: A replicated yield trial conducted with 10 entries including seven electronic beam irradiated entries and four breeding lines along with checks, Kanchan, CH-1 and LT-Kanchan for the third year for finding superior entries having higher yield and quality. The entries SJ-11, SJ-14 and SJ-16 found to record significantly higher green (21069 kg/ha -21375 kg/ha) and cured leaf yields (3615 kg/ha -3768 kg/ha) than best control, LT- Kanchan. Based on the results of pooled analysis of data of last three years, the entries, SJ-11, SJ-12, SJ-14, SJ-15 and SJ-16 which recorded significantly higher cured leaf (2891 -3487 kg/ha, respectively) than better control were proposed for multi-location testing under AINPT. Based on the last two years' data, SJ-14 and SJ-16 were already submitted for testing under AINPT.

Row Trial and generation advancement

A row trial with 48 F_3s, 120 F_4s, 75 F_5s, F_6s of various crosses and 25 Kanchan irradiated materials (M_6) were raised and plants with desirable morphology were selected. Around 108 breeding lines were maintained for further use. Three F_2s viz., (A-3 × LT-Kanchan-2) × FCJ-21, (A-3 × LT-Kanchan-1) × (A-3 × LT-Kanchan-2) and EBI-20-K-400 × EBI-20-K-300-7 were raised and superior segregants selected. Three F_1s viz., (RT33 × Kanchan) × RT 85-1, FCJ 59 × RT85-1 and [MUT-24 × FCJ-11 P3] × FCJ-11 raised and seed collected. Selections were also made in two new crosses viz., (A-3 × Kanchan-P 2) × FCJ-11 and FCJ-11 × CTRI Sulakshana.

Collection of breeder seed: Breeder seed of cultivars, Kanchan, LT Kanchan, CTRI Naveena, hybrid CH-3, and their parents were collected.

4. Breeding FCV tobacco varieties for yield and quality characters under SLS conditions (PI: Dr. K. Gangadhara)

Breeding activities to enhance the productivity of FCV varieties under SLS conditions focused on integrating traditional and modern phenotyping tools to develop FCV varieties with biotic and abiotic tolerance.

Hybridization and generation advancement

A total of thirteen crosses (FCR-63×N-98, FCR-63×VT-1158, FCR-63×FCR-15, FCR-39×FCR-15, FCR-39×N-98, FCH-222×CTRI Shresta, Kanchan×CTRI Shresta, (FCR-60×FCR-4) ×VT-1158, (FCR-60 × FCR-47) × N-98, (FCR-60×FCR-47) ×VT-1158, (FCR-60 × FCR-47) × CTRI Shresta, (FCR-60 × FCR-4) × N-98 and (FCR-60 × FCR-47) × Siri) were made for leaf yield and TMV resistance during 2024 at NIRCA Research Station, Kandukur. Nine crosses in F_1 generation were planted during 2024, and four crosses viz., CTRI Shresta × Ratna, CTRI Shresta × Thrupti, CTRI Shresta × NLS 4 and FCR 47 × FCR 63 were advanced to F_2 generation.

A total of 65 selections were made from F_2 generations of fifteen crosses (KRB 6 × Siri, FCR 60 × FCR 4, FCR 39 × FCR 60, FCR 60 × FCR 47, CTRI Shresta× FCR 60, (N 98×NLS 4) × (FCR 47 × FCR 60), N 98× NLS 4, Siri × FCR 4, KB 100 × CTRI Shresta, N98 × CTRI Shresta, CTRI Shresta× N 98, CTRI Shresta× Siri, VT 1158 × TBST 2, TBST 2 × CTRI Shresta, KB 101 × CTRI Shresta.

F_3 generations from seven double and three way crosses were planted and 65 individual plants were selected.

A total of 72 selections were made from eight crosses (12 in Siri × NLS4, 34 in FCR 60 × FCR 47, 11 in CTRI Shresta × NLS 4, 10 in FCR 60× NLS 4, 5 in VT 1158 × NLS 4).

Evaluation of drought-tolerant lines for higher yield and quality

Eleven advanced breeding lines viz., KDB 1 to KDB-11 were evaluated from 2022-23 to 2024-25. Drought stress was induced during grand growth phase of the crop by withholding the irrigation for about 15 days. Advanced breeding lines KDB 3, KDB 10 and KDB 6 showed desirable root traits viz., root length, root diameter, root weight and primary root branches. Genotypes KDB 3, CTRI Shresta and VT 1158 performed better both under drought stress and normal conditions. Based on various drought tolerant indices (Stress tolerance, mean productivity, geometric mean productivity, harmonic mean, Stress susceptibility index, Stress tolerance index, yield index, yield susceptibility index and relative stress index), KDB 3 showed higher ranks productivity (1910 kg/ha) and least susceptibility under drought conditions.

Screening FCV tobacco genotypes for abiotic stresses (drought, waterlogging and nutrient use efficiency)

Another set consisted of thirteen FCV tobacco genotypes (CTRI Sulakshana, VT 1158, Hema, N98, KRB 3, Kanchan, FCH 222, FCJ 11, CTRI Shresta, FCR 63, FR 47 and FCR 39) were screened for combined abiotic stress tolerance (drought, waterlogging) and nutrient use efficiency. The results indicated significant effect of abiotic stresses on leaf yield and quality. Among the abiotic stresses water stress has considerable reduced leaf yield. The results indicated significant reduction of leaf yield by 40% (in drought), 40%, (waterlogging) 87%, 28% (under N and K stress), respectively among the thirteen FCV genotypes.

On-Farm Trial

Entry FCR 63 was identified as a promising line from AINPT trials (2018-19 to 2020-2021) and thus on-farm trials were conducted in five locations in Southern light soils along with CTRI Shresta and Siri. FCR 63 recorded a higher mean cured leaf yield (2600 kg/ha) than CTRI Shresta (2400 kg/ha) and Siri (2200 kg/ha). FCR 63 has shown desirable traits like a greater number of leaves (up to 40), early plant vigour and higher bright leaf compared to popular varieties (CTRI Shresta and Siri).

Field view of FCR 63

Cured leaf of FCR 63

Germplasm maintenance: Maintained 150 germplasm accessions, consisting of exotic collections, wild accessions, drought-tolerant and TMV resistant lines for further breeding programmes.

Collection of Breeder seed

Breeder seed of cultivars FCR-15, Siri, N-98 and VT-1158 were collected.

5. Breeding for developing high yielding and/ or disease-resistant varieties/hybrids and evaluation of advanced breeding lines of FCV tobacco suitable to the Karnataka Light Soil region (PI: Dr. C. Nanda)

Breeding efforts in Karnataka light soil (KLS) region were focused towards enhancing crop productivity through development and deployment of high yielding varieties/hybrids with disease resistance/tolerance and good leaf quality to meet the requirements of farmers and trade.

Variety release

FCH 248 (CTRI Navya) was identified in the XIII AINPT group meeting and released in 93rd CVRC and Notified Through Gazette Notification No. SO 2128 (E) dated 13.05.2025.

FCH 248 (CTRI Navya)

FCHH 2, an FCV hybrid was proposed for identification in VIC, XVII workshop held at KNSUAHS, Shivamogga from 16th -17th Sept, 2025 and was suggested to re-present with additional OFT data.

Field view and Single plant view of FCHH 2

Replicated trials

Six replicated trials were conducted with various advanced breeding lines (ABLs) along with checks to ascertain their yield potential and leaf quality potential and suitability to KLS.

- Among the nine ABLs (FCH 261 to FCH 269) tested in the replicated trial II (RYT II), lines FCH

263, FCH 264 and FCH 267 demonstrated promising performance for cured leaf yield, bright leaf yield, and total grade equivalent (TGE) in the third year of evaluation. Three-year pooled data analysis confirmed that FCH 263, FCH 264, FCH 266 and FCH 267 were significantly superior for all yield parameters except green leaf yield. Lines FCH 263 and FCH 266 were subsequently submitted to AINPT for multi-location testing based on their consistent superior yield performance.

- In RYT III, nine ABLs (FCH 270 to FCH 278) were evaluated for their yield and quality, of which lines FCH 270, FCH 271, FCH 272, FCH 273, and FCH 276 exhibited 24–32% increase in cured leaf yield over the best-performing check during the second year of evaluation. Among these, FCH 272 and FCH 276 with 2500 kg/ha and 2514 kg/ha cured leaf yield, respectively over two years were submitted to AINPT for multi-location evaluation based on their consistent superior performance.
- Nine advanced breeding lines (FCH 277 to FCH 287) were evaluated against checks in the first year of the trial under RYT IV. The lines FCH 279, FCH 282, FCH 283, FCH 284, and FCH 286 achieved 26–45% higher cured leaf yields and superior bright leaf yields compared to the better check indicating strong potential for further yield advancement. FCH 283 and FCH 284 recorded significantly higher cured leaf yield (2355 kg/ha and 2319 kg/ha, respectively), bright leaf yields (1175 kg/ha and 1266 kg/ha, repectively) and TGE (1506, 1516, respectively).
- In RYT V, of the ten entries assessed for their yield potential and suitability to KLS region, M4-13 and M4-25 recorded 18–21% yield improvement in cured leaf yield over the better check FCH 222 in the first year of testing.
- Out of 23 F_1 crosses developed for yield improvement, three crosses M4-21 × FCH 222, M4-23 × FCH 222, and F_5RT13 × FCH 248 exhibited superior yield traits when evaluated against standard checks, marking them as promising genetic combinations for future breeding programs.

Row Trial and generation advancement

Seventy-seven lines (48 lines from FCH 222 × FCH 239 cross, 7 from Kanchan × JL 53#12 cross, 22 lines from {(FCH 222 × FCH 239) × (JL 53#12 × FCH 249)} double cross) selected on the basis of desirable plant morphology were tested in row trial. Eight lines (seven from FCH 222 × FCH 239 cross and one from Kanchan × JL 53#12 cross) with high yield potential were selected for further evaluation in replicated trials.

One hundred and eight selections were made from fifty F_5 progenies (90 lines from Kanchan × A4 cross, seven lines from FCH 222 × A4 cross and eleven lines from PCT 17 × A4 cross) and 49 selections were made from twenty-three F_4 progenies (24 lines from Kanchan × A4 cross, eleven lines from FCH 222 × A4 cross and fourteen lines from PCT 17 × A4 cross) on the basis of desirable plant phenotype. CMS lines were crossed with three testers (FCJ 11, FCH 248 and A4) to study their general and specific combining abilities.

Breeding to develop high-yielding disease resistant lines/hybrids

Back crosses made to incorporate TMV resistance from known sources like VT 1158, FCR 15 and TBST-2 into Kanchan background was screened through artificial inoculation in nursery and resistant plants were back crossed to Kanchan.

On farm trial: On farm trials with promising line FCHH 2 and CH 3 were successfully conducted at four villages. The line recorded an average of 20-22% improvement in cured leaf yield over the hybrid check CH3. Farmers observed that there was no incidence of fusarium wilt in FCHH 2.

Maintenance breeding: 230 germplasm accessions were regenerated during 2024-25 crop season. Seventeen CMS lines and their maintainers were characterised for morphological, yield as well as leaf quality parameters and were maintained for further utilization in tobacco breeding programs. Back Cross programme to transfer CMS into A4 is in progress.

Collection of breeder seed: Breeder seed of Kanchan, FCH 222, CTRI Navya, FCH 252 (5 kg each) etc., was collected.

6. Breeding non-FCV tobacco types for desirable traits (PI: Dr. K. Gangadhara)

Efforts are being targeted at genetic improvement of non-FCV tobacco types.

Hybridization and generation advancement

A total of five crosses (BA 1 × Burley Resistant, BA 1 × Burley 49, RT 8 × Burley 100A, RT 13 × YB 46 and Briarvet × Gold G) of F_1 generation were planted and seeds of desirable F_1s were harvested during 2024-25.

Evaluation of burley farmer collections for distinctiveness and yield traits

A total of 30 burley collections and check Banket A1 were characterized for leaf morphological traits. Plant height ranged from 57 to 144 cm, leaf length ranged from 17 to 44 cm and leaf width ranged from 11 to 24 cm. The nicotine ranged from 0.5 to 2.15 %, reducing sugars ranged from 1.81 to 11.8% and chlorides ranged from 0.13 to 0.88%. The new burley genotypes differed from Banket A1 with respect to root and leaf morphological traits. Three genotypes BFC-23, BFC-33 and BFC-36 showed desirable traits of plant architectural traits. The desirable burley genotypes selected will be further evaluated for leaf yield and its attributing traits.

Thirteen HDBRG farmer selections along with four HDBRG checks were planted for assessing morphological traits to isolate distinct lines. There are significant differences observed among the genotypes for root, shoot and leaf characteristics. The new selections differed with respect to canopy shape, leaf orientation, leaf angle orientation, inflorescence shape and size. The selected new lines will be further evaluated for economic traits.

7. Genetics exploration to harness burley germplasm resources and breeding for water stress tolerance in burley tobacco (PI: K Gangadhara)

The objective is to identify the genotypes with superior leaf yield, quality traits and root characteristics conferring drought tolerance in burley germplasm.

Evaluation of burley germplasm for excess moisture stress

A total of 120 burley germplasm accessions were screened for water logging tolerance naturally during 2024-25. The survival (%) varied from 0 to 65%. The burley accessions, Burley 181, BFC 23-1-12, KY 42-11, BFC 6-1-2, and Leca 10 exhibited higher seedling survival after 2 days of water logging conditions.

Evaluation of burley germplasm for drought tolerance

A total of 60 burley accessions were screened for drought tolerance at grand growth period of the crop. The drought stress reduced the green leaf yield by 61% and cured leaf yield by 49%. The reduction in leaf yield was due to a reduction in plant height (16%), leaf length (20%), leaf width (31%), root weight (50%), and shoot diameter (10%). The drought stress increased the primary root branches, root length and nicotine (%). Differential performance of genotypes under drought and normal irrigated conditions was noticed. Some genotypes Burley 49, Burley 181, Burley 64, Harrow velvet, Burley C 22-1, KY 42, and KY 16 performed well under drought conditions, whereas Apia, BA 21, KY 42, Burley 181, Burley 49 and Burley 64 performed well under protected conditions. Genotypes Burley 181, Burley 49 and Burley 64 which performed well under both conditions were selected.

Genetic variability for leaf architectural traits in 73 burley germplasm accessions

Genetic variability for leaf yield and plant architectural traits was studied in 73 burley germplasm accessions during 2024-25 season

Screening of Burley germplasm for drought tolerance at ICAR NIRCA Research Station, Kandukur. The data analysis showed significant differences among genotypes, indicating the presence of wide variability among the traits studied. The correlation analysis showed a negative correlation between leaf angle and all the traits except internodal distance.

Hybridization

Twelve crosses were attempted for leaf yield and drought tolerance during 2024-25. The list of crosses are Leca-27-2-B × KY-16, BFC-12 × Burley-1, Haronic × Burley-181, KY-42 × Burley-181, Burley-1 × Leca-10, KY-42 × Burley-49, HDBRG LP-2 × Burley-181, HDBRG LP-2 × YB-4, HDBRG-LP-2 × Burley MB-2, Harrow velvet × Burley-181, Burley-1 × Burley-181, and Haronic × KY-16.

8. Development and evaluation of burley hybrids for export promotion (PI: Dr. K. Sarala)

Among the four imported hybrids evaluated, AOB 359 was found to be best performer with significantly higher leaf yields than existing recommended varieties across all three locations. AOB 962 emerged as second-best performer, among the hybrids for yield.

9. Breeding of chewing tobacco for yield, quality and resistance to biotic stresses (PI: P. Manivel)

Breeding work was carried out to develop high-yielding (>3500 kg/ha) chewing tobacco varieties in Tamil Nadu.

Initial Varietal Evaluation Trial: In IVT trial, two test entries and three check varieties were evaluated, significantly higher total leaf yields of 3366.78 kg/ha (IET-122) followed by 3063.33 kg/ha (IET-123) were recorded by test entries as compared to the check varieties Meenakshi (2685.06 kg/ha), Bhagyalakshmi (2694.61 kg/ha), Abirami (2621.78 kg/ha). Similarly, for first grade leaf yield also, the test entry IWT 122 had significantly higher yield (2944.49 kg/ha) than all three check varieties.

Breeding materials: F_1s of four crosses (Abirami × Bhagyalaksmi, Abirami × VR 2, Abirami × I 64 and Abirami × Vairam) were advanced to F_2. Eight cytoplasmic male sterile lines of Bhagyalakshmi, Abirami, VR 2, Maragadam, Thangam, PV-7, I-115, and VR-2 were maintained. Additionally, Abirami male sterile line was used to convert Yasini, a newly released chewing tobacco variety into male sterile line. In cigar tobacco, four lines were crossed with nine testers to produce 36 crosses (in line x tester) and these F_1 crosses were evaluated.

Germplams maintenance: At Vedasandur, a total of 231 chewing tobacco germplasm (85 from Vedasandur and 146 received from Hunsur) were maintained. A total of 170 cigar and cheroot germplasm (59 from Vedasandur and 111 from Hunsur) were maintained.

Seed production of released varieties/hybrids: 250g hybrid seeds of chewing tobacco hybrid "Kamachi" (MS.9: MS.Abirami × KV.1) were produced. Further, seeds of Abirami (78 kg), I.737 (179 kg), Yasini (144.3 kg), I 64 (21.9 kg) and Sendarapatti spl (2.4 kg) were also produced.

10. Development of Distinctiveness, Uniformity and Stability (DUS) Guidelines for FCV (Flue cured Virginia) and Bidi tobacco (DUS Project) (PI: Dr. K. Sarala)

Thirty-five varieties of FCV (16/103, Bhavya, CH-1, CH-3, Chatam, CM 12, CTRI Spl, CTRI Spl (MR), CTRI Sulakshana, Delcrest, Dhanadayi, FCV Special, Gauthami, Godavari Spl, Hema, Jayalakshmi, Jayasri (MR), Jayasri, Kanakaprabha, Kanchan, Mc Nair-12, N-98, Rathna, Siri, Swarna, VT-1158, Thrupthi, Kanthi, Hemadri, Sahyadri, FCH-222, Mammoth Gold, FCJ-11, FCR-15 and LT-Kanchan) were maintained and characterized.

I(iii) Production and distribution of pure seed of ruling tobacco varieties

The institute operates an RF scheme at the main campus for producing and supplying pure seed of released tobacco varieties to farmers through ICAR-NIRCA, Rajahmundry and its research stations. A total of 18,612.90 kg of truthfully labelled tobacco seed varieties comprising 7 FCV tobacco, 2 burley tobacco and one Lanka tobacco varieties were supplied to the farmers under the RF scheme. A total of 38 lakh healthy tobacco seedlings were also supplied to the farmers. An income of ₹ 252 lakh was generated.

I(iv) Biotechnology for tobacco improvement

11&12. Identification of genomic regions conferring resistance to Fusarium wilt for accelerating the development of Fusarium wilt-resistant tobacco cultivars (PI: Dr. M. Sheshu Madhav)

Fusarium wilt is a major fungal disease affecting the FCV tobacco grown as a monsoon crop in light soils of Karnataka. The efforts were made to identify molecular markers conferring resistance to Fusarium wilt and marker-assisted selection to develop *Fusarium* wilt varieties of FCV tobacco.

Collection, morphological and molecular characterization of Fusarium isolates

Fusarium isolates were collected from wilt infected tobacco samples from 11 locations of Karnataka. The fungus was identified as *Fusarium* sp. by observing hyaline, septate mycelia and macro and micro conidia under microscope. *Fusarium* species were characterized at molecular level, sequencing analysis indicated that three of the isolates were *F. oxysporum*, seven were *F. falciformae*, and one remained unclassified.

Raising the F2 population and inheritance studies

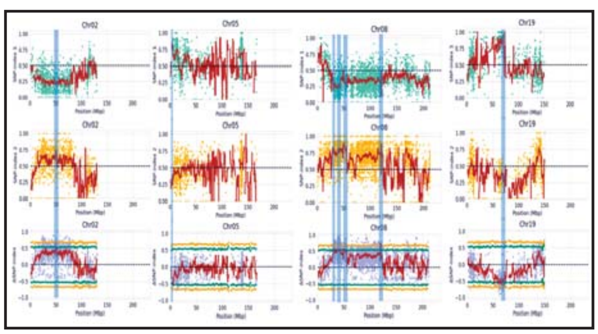
In order to identify the genomic regions governing *Fusarium* wilt resistance, F_2 mapping populations were developed through the crossing of FCJ-11 (resistance to *Fusarium* wilt) with FCH-222 (susceptible to *Fusarium* wilt). Hybridity of F_1 plants was confirmed by SSR marker and were selfed. F_2 seeds were collected by harvesting the capsules. Further, F_1 and F_2 populations were screened for their reaction to *Fusarium* wilt disease reaction using the *Fusarium oxysporum* isolate NIRCAF-9. It was observed that the F_1 plants exhibited susceptibility to the disease suggesting that the resistance to *Fusarium* wilt in tobacco is likely governed by recessive genes. Chi-square analysis of the reaction of 444 healthy F_2 plants indicated that *Fusarium* wilt resistance in tobacco is controlled by two genes with digenic inheritance, exhibiting a 9:3:3:1 ratio for highly susceptible, susceptible, moderately resistant, and highly resistant phenotypes, respectively.

Screening the F_2 mapping population of FCJ-11 × FCH-222 for *Fusarium* wilt using NIRCAF-9 isolate

Identification of molecular markers linked to Fusarium wilt resistance in tobacco

a. By single marker analysis: Single marker analysis utilizing *Fusarium* wilt disease score and genotypic data (obtained from 14 polymorphic primers), identified association of SSR marker PT60988 with *Fusarium* wilt resistance and accounts 6.68% of the total phenotypic variance observed, highlighting the significance of this QTL in mediating resistance to *Fusarium* wilt.

b. By QTL-seq method: Resistant and susceptible bulks (each containing 10 F_2 genotypes) were constituted and high-quality DNA from both bulks (SB and RB) and the two parents (FCJ 11 and FCH 222) was used for library preparation and whole genome sequencing to identify causal SNPs and genomic regions associated with *Fusarium* wilt resistance. Four genomic libraries were generated (two from each bulk and two from the parents) using 1 µg of DNA with the QIAseq FX DNA Library. Whole genome sequencing was executed using the Illumina Novaseq 6000, yielding data volumes of 225.1, 205.4, 215.3, and 191.2 Gb for FCJ-11, FCH-222, SB, and RB, respectively. QTL-seq analysis with parent FCJ 11 and Pools RB and SB revealed eight significant ($P < 0.05$) genomic regions on Chr02 (50.0-50.6 Mb), Chr05 (3.4-4.1 Mb), Chr08 (29.6-30.6 Mb; 38.2-43.2 Mb; 49.5-52.3 Mb), Chr12 (93.0-93.6 Mb) and Chr19 (60.0-61.5 Mb; 64.3-65.7 Mb). Based on location of SNPs, candidate genes governing *Fusarium* wilt resistance were identified.



Genomic regions identified through QTL-seq by comparing bulks with resistant parent, FCJ 11

13. Genome editing to reduce the Tobacco Specific Nitrosamines (TSNAs) towards the production of safer tobacco (PI: K. Prabhakara Rao)

Cloning, construct preparation and transformation of gRNAs targeting CYP82E5 and CYP82E10

Agrobacterium-mediated transformation of Banket A1 with pKS-NtCYP-E5-G1 and pKS-NtCYP-E10-G1 yielded 28 and 18 putative transformants, respectively. Molecular screening with gene specific primers of *Cas* and *Kan* identified 16 positive lines for CYP82E5 and 11 for CYP82E10, but Sanger sequencing showed no edits in the targeted gRNA regions of either gene. Further, a second set of exonic gRNAs targeting CYP82E5 (LOC107780157) and CYP82E10 (LOC107810004) was designed, and off-target analysis was performed using standard CRISPR prediction tools. The gRNAs were synthesized, cloned into the pKSE401 vector, propagated in *E. coli*, confirmed by colony PCR, and five positive clones for each gene were verified by Sanger sequencing (Fig. a–c).

Cloning, construct preparation and transformation of gRNA targeting phytoene desaturase (PDS) gene:

As a proof of concept, the guide RNA targeting PDS gene involved in the carotenoid synthesis was designed, cloned and sequence confirmed in pKSE401 vector. Agrobacterium mediated transformation of burley tobacco with PKS-NtPDS-G2 Construct resulted in T_0 plants with albino phenotype. Molecular screening of albino plants

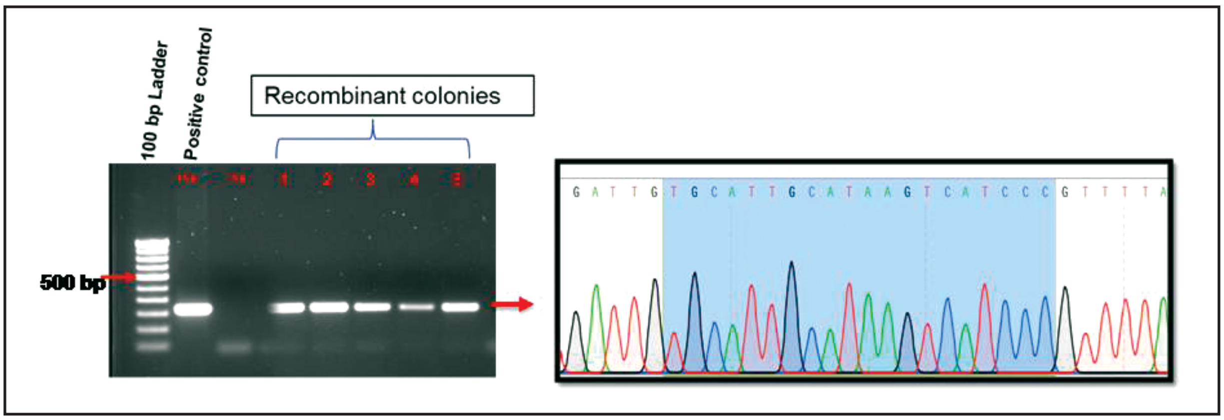


Fig. a: Cloning and sequence confirmation of CYP82E10 gRNA construct in pKSE401 vector

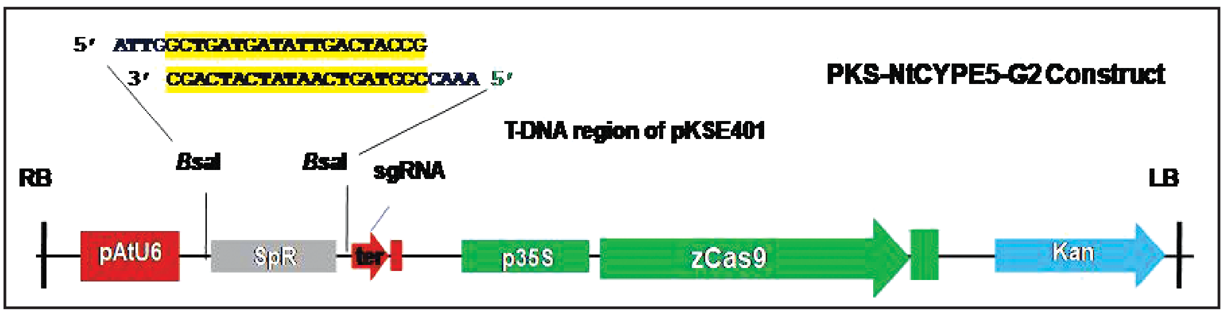


Fig. b: Map of gRNA construct targeting *CYP82E5* gene

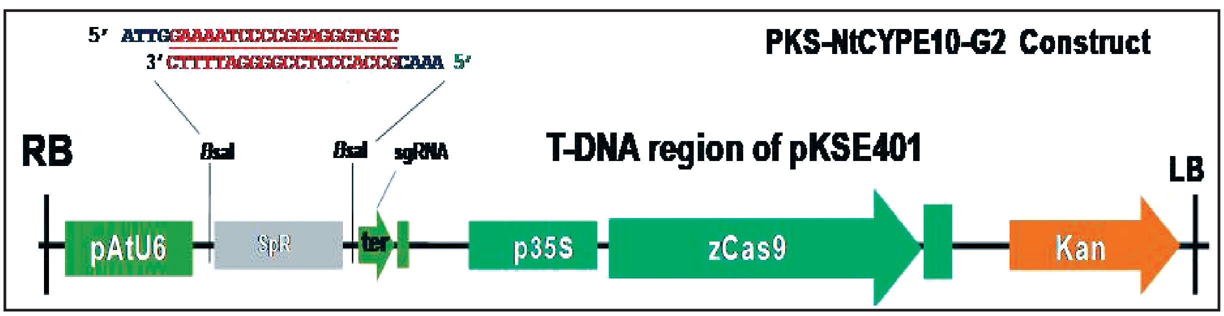
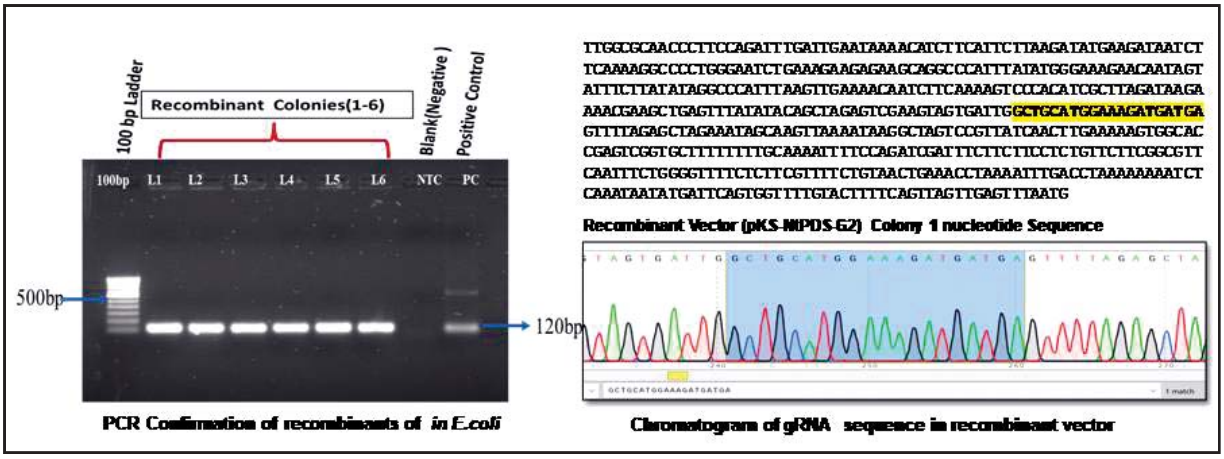


Fig. c: Map of gRNA construct targeting *CYP82E10* gene



The pKS-NtPDS-G2 construct was used for transformation of burley cultivar Banket A1

Transformation of tobacco with gRNA construct PKS-NtPDS-G2 targetting PDS gene

have shown the presence of Cas gene and sequencing of the PDS gene confirmed the knockout of the gene with nucleotide deletions in the targeted gRNA region in albino plants.

Allele mining of CYP82E4 gene in selective tobacco genotypes

Allele mining of CYP82E4 gene was carried out in 25 selective tobacco genotypes from FCV, *burley, bidi, chewing, lanka* and HDBRG types. Six sets of overlapping primers were designed spanning across the complete 2552 base pair gene sequence encompassing exons and intronic region. The PCR amplicons from the selected genotypes were sequenced using Sanger sequencing and analyzed for the sequence variability. A total of 13 single nucleotide polymorphisms (SNPs) in the exonic region and 24 in the intronic region were observed. Among these 14 are transitions (purine-to-purine or pyrimidine-to-pyrimidine substitutions) and 23 are transversions (purine-to-pyrimidine or vice versa). Further majority of these substitutions were observed in intronic regions and chewing tobacco varieties Gandak bahar and Abhirami possess amino substitutions in the exonic regions located outside the key functional domains of the protein.

14. Enhancing climate resilience and ensuring food security with genome editing tools (ICAR Funded) (PI: K. Prabhakara Rao)

Cloning, construct preparation and transformation of gRNAs targeting CYP82E4 and consensus region of CYP82E4, E5 and E10

Agrobacterium mediated transformation of burley cultivar Banket A1 was carried out with pKS-NtCYP-E4-G1 and pKS-NtCYP-CG1 gRNA constructs. A total of 128 putative transformants were obtained with pKS-NtCYP-E4-G1 construct, molecular screening with gene specific primers of Cas and Kan identified 72 positive transformants. Sanger sequence analysis of these 72 transformants revealed that there are four T_0 plants with a sequence addition of T / A at specified targeted gRNA locus of CYP82E4 gene. The addition of these T / A nucleotides disrupted the ORF of CYP82E4 gene leading to the knocking down of the transcript. Further, transformation of Banket A1 with gRNA construct pKS-NtCYP-CG1 generated 78 putative transformants. Among these, 42 were found to be positive with amplicons of Cas and Kan genes. Sanger sequence analysis of 42 transformants revealed that there are no edits in the targeted gRNA regions.

15. Development of Orobanche resistant tobacco through multiomics strategy (PI: Dr. K. Sarala)

Field screening of FCJ-11 and N. umbratica-nesophila genotypes along with their cross derivatives

Under the field condition, *Orobanche* sick field was established during 2024-25. *Orobanche* tolerant species, *N. umbratica-nesophila* and susceptible FCV tobacco cultivar, FCJ-11 and their mapping population were screened in the sick field. *Orobanche* emergence was observed in the FCJ-11 after 35 days of transplantation and in *N. umbratica-nesophila* plot there was no emergence confirming its resistance nature. While, in mapping population the *Orobanche* resistant and susceptible plants were observed in the ratio of around 3:1.

Genome size determination of Orobanche infecting tobacco

Through flow cytometry analysis, *Orobanche* genome size was estimated to be approximately 1Gb. During the meiotic studies, 22 chromosome could be observed in diploid state in *Orobanche* was observed to be around 20-22 and were in diploid state.

I(v) Breeding for enhancement of biochemical compounds in commercial crops

16. Genetic enhancement of chilli for nutraceuticals, value addition, commercial traits and resistance to biotic stress in Terai region of West Bengal (PI: Dr. Partha Saha)

Five promising selections were evaluated in replicated trials for their commercial and quality traits. The highest dry fruit yield (2633.3 kg/ha) was recorded in DinCh-330, while DinCh-181-2 exhibited the highest dry recovery (30.5%). The maximum capsaicin content was observed in check Pant C-1 (3724 $\mu g\ g^{-1}$), followed by DinCh-262 (3297 $\mu g\ g^{-1}$).

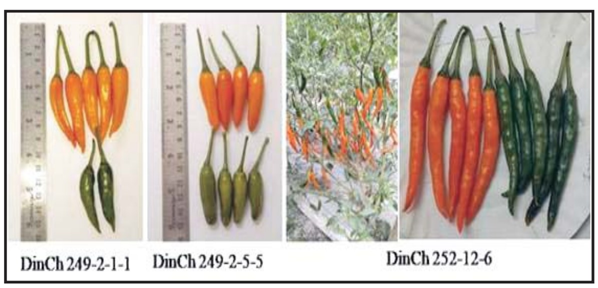
Fruit morphology of chilli line DinCh-330

Two high-yielding chilli selections viz., DinCh254-5-7 (from Mizoram) and DinCh174-6-9-4 (from Manipur) with high pungency (1819 $\mu g\ g^{-1}$ & 3883 $\mu g\ g^{-1}$ capsaicin, respectively), dark red colour and heavy bearing were found to be suitable for dual purpose.

Four anthocyanin rich black chilli selections viz., DinCh 68-10-3, DinCh 68-10-16, DinCh 68-10-5, and DinCh 68-10-9 were identified and profiled for bioactive compounds. The highest anthocyanin (Cyanidin-3-Glucoside) content was recorded in DinCh 68-10-3 (645.58 $\mu g\ g^{-1}$) followed by DinCh 68-10-16 (214.78 $\mu g\ g^{-1}$). The profiling anthocyanin, phenolics and flavonoid in pericarp of these fruit samples showed six different anthocyanin compounds, eleven phenolics and flavonoid compounds were identified in DinCh 68-10-3. These selections can serve as valuable genetic resources for developing chilli varieties with enhanced nutraceutical potential.

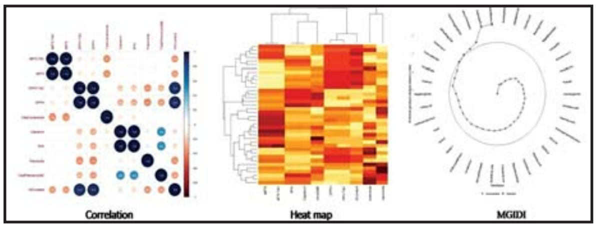
Biochemical profiling of four black chilli land races of West Bengal revealed unique anthocyanin profiles such as delphinidin, malvidin, cyanidin, and pelargonidin derivatives. Quantitative estimation revealed considerable differences in total anthocyanin content, ranging from 262.0 $\mu g\ g^{-1}$ to 1212.47 $\mu g\ g^{-1}$, with DinCh262-3 recording highest value.

Three orange fruited selections (DinCh 249-2-1-1, DinCh 249-2-5-5 and DinCh 252-12-6) were identified from progenies of variable population of Dalle-2- and MC. Of which, DinCh-252-12-6 had dark orange, long slender fruits with highest carotenoids (1400.3 $\mu g\ g^{-1}$).



Fruit morphology of orange chilli selections developed through single plant selection

Chemometric approached based selection of chilli lines for bioactive compounds: Thirty-eight chilli genotypes were evaluated for major bioactive compounds, including antioxidant activity (DPPH, ABTS), total phenolics, carotenoids, flavonoids and vitamin C, followed by chemometric analyses (correlation, AHC and MGIDI). Vitamin C showed a significant positive association with antioxidant activity, while capsaicin-rich genotypes tended to possess higher phenolic content. Agglomerative hierarchical clustering revealed wide biochemical diversity and grouped the genotypes into five clusters, with Cluster II comprising highly pungent lines such as Kamranga Chilli Local, Dinhata Local Okhrabari and Manipur king chilli types. MGIDI analysis identified six superior accessions-Tamenlong King Chilli, Ukhrul King Chilli, Dollekhusani, Mhyco Yasaswini, Kakchai (KC) and Local Market Manipur—as promising donors for simultaneous improvement of bioactive traits in chilli breeding programs.



Correlation, Agglomerative hierarchical clustering-based heat map and Multi-Trait Genotype–Ideotype Distance Index (MGIDI) analysis of chilli genotypes

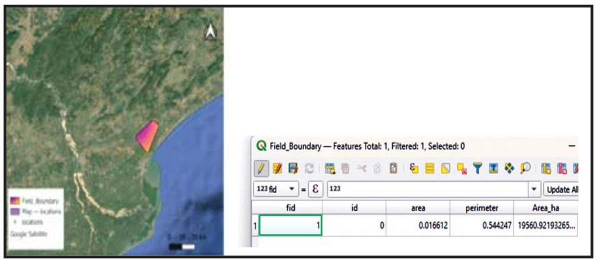
Germplasm maintenance: 100 germplasm were maintained including 2 related species for further breeding programmes. Fifteen new lines were collected and 2 stalk-less (detached stalk) lines augmented from UAS, Bagalkot.

Hybridization and generation advancement: 10 F_3 progenies were advanced to F_4 generation. 78 F_2 plants were advanced to F_3 to develop RILs.

Seed production of local chilli lines: Produced 8.0 kg of seeds of local lines (Akashi, Chaitali).

17. Genetic Improvement of Chilli types amenable for value-added products and GI tagging of Durgada chilli (PI: Dr. B. Rajasekhar Reddy)

Mapping the Durgada chilli growing areas: Based on the collected map locations of the Durgada chilli growing areas a map was drawn (Fig) delimiting the Durgada chilli growing areas using QGIS covering an area of 19561 hectares. Established "Pithapuram Potti Mirchi Farmers Producer Mutually Aided Co-operative Society Ltd.," Pithapuram for facilitating of Durgada chilli GI tagging.



Durgada chilli growing area map developed using QGIS

18. Yield and quality enhancement in turmeric through suitable varietal selection in Terai region of West Bengal (PI: Dr. Partha Saha)

Promising turmeric lines for growth, yield and higher curcumin content

A total of 43 turmeric lines were evaluated for growth, rhizome, yield and quality traits, revealing wide variability for plant height (44 cm to 203 cm), leaf length (30–94 cm), leaf width (10–19 cm), number of shoots (1–9) and number of leaves (9–40). Rhizome traits also showed substantial diversity, with mother, primary and secondary rhizome numbers ranging from 1–6, 3–22 and 2–45, respectively. Whole rhizome weight varied from 88 to 1000 g, while fresh rhizome yield ranged from 4.3 to 49.3 t ha^{-1}, with a mean of 19.87 t ha^{-1}; high-yielding genotypes included Assam-2, Assam-1, Duggirala Red, Lam Swarna, Rupanjana, TCP-153, TCP-196 and Pundibari-2. Curcumin content ranged from 0.81% (Duggirala Red) to 8.9% (TCP-115), with a mean of 5.34%, indicating marked variation in bioactive compound concentration among genotypes.

Visual colour of each turmeric germplasm powder

19. Germplasm evaluation, value addition and development of good agricultural practices of ashwagandha (Withania somnifera Dunal L.) (PI: P. Manivel)

A total of three hundred ashwagandha accessions obtained from national gene bank of NBPGR, New Delhi were evaluated (Second year) for DUS (distinctiveness, uniformity and stability) descriptors, and variability for qualitative and quantitative characters in augmented block design consisting of 15 blocks with four check varieties *viz*., Vallabh Ashwagandha 1 (VA-1), Cim Pushti (CP), Jawahar Ashwagandha 20 (JA-20) and Anand Withania Somnifera 1 (AWS-1). The germplasms were grouped in to different category based on the 29 DUS descriptors.

Additionally, 8 ashwagandha varieties and 30 ashwagandha germplasm were augmented in the germplasm collections. For dry root yield, the accessions WS 4, WS 139, WS 295, WS 162, and WS 296 were identified as higher yielding accessions (>40 g per plant). For efficient and effective selections for higher root yield in ashwagandha, root length, root diameter, leaf dry weight, stem dry weight, and plant height were identified as major direct dry root yield contributing characters.

Distribution of berry colour in 300 accessions of ashwagandha germplasm

20. Genetic improvement of Ashwagandha for root yield and Withaferin A content (PI: Dr. B. Rajasekhar Reddy)

During 2024-25 a total of 330 genotypes of Ashwagandha augmented from NBPGR and 30 genotypes augmented from DMAPR, Anand were evaluated for various quantitative and qualitative characters comprising of all DUS traits. Quantification of withanolides in Ashwagandha was done for 157 genotypes, while the remaining 213 genotypes are in progress at Indian Institute of Chemical Technology (IICT), Hyderabad.

Some of the promising lines identified were: ASG-16 has high root weight (18.51g), root yield (30.85 q/ha), high withanolide A (0.15%), withanone (0.27%) and total withanolides (0.26%); ASG-129 has high root weight (11.01 g), yield (18.35 q/ha) and withaferin-A (0.061%); ASG-124 has high root weight (10.82 g), root yield (18.04 q/ha) and withanolide A (0.143%) and total withanolides (0.18%); ASG-17 has high root weight (18.23 g), Root yield (30.39 q/ha) and total withanolides (0.17%) while the check varieties Jawahar Ashwagandha, Poshita, Vallabha and JA-20 had root weight of 4.53 g, 4.28 g, 4.34 g and 4.69 g with root yield of 7.54 q/ha, 7.13 q/ha, 7.23 q/ha and 7.82 q/ha, respectively. The total withanolide content in Vallabh ashwagandha and JA-20 was 0.07% and 0.10% respectively.

Six cross combinations (Poshita × ASG-09 (yield and withanone); Poshita × ASG-16 (yield and withanone); Jawahar × ASG-16 (Yield and Withanone); ASG-129 × ASG-16 (withaferin A and total withanolides including high withanolide A); Poshita × ASG-129 (Yield and Withaferin A); Poshita × Vallabha (Yield and market preference) were done for improving yield and withanolide content.

II. वाणिज्यिक कृषि में फसल उत्पादन प्रबंधन

II. Crop Production Management in Commercial Agriculture

II. Crop Production Management in Commercial Agriculture

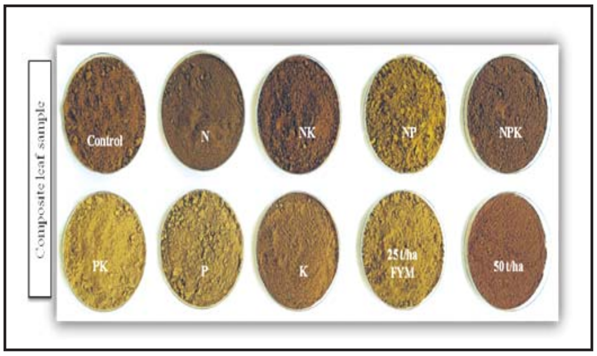
The division has developed sustainable crop management technologies since its inception and conducting strategic and applied research to develop sustainable, climate resilient, resource use efficient crop production and crop protection technologies for enhanced yield and quality in commercial crops.

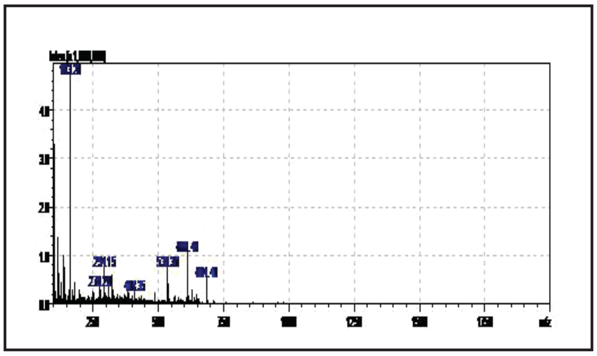
II(i) Development of agro-technologies for commercial crops

1. Permanent manurial trial experiment with Motihari tobacco (PI: Dr. Namita Das Saha)

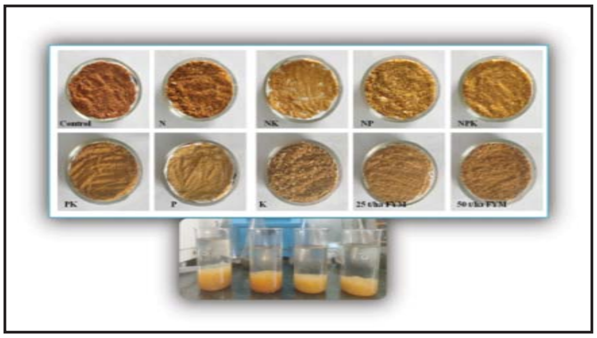
Metabolomics study of cured leaf Motihari tobacco

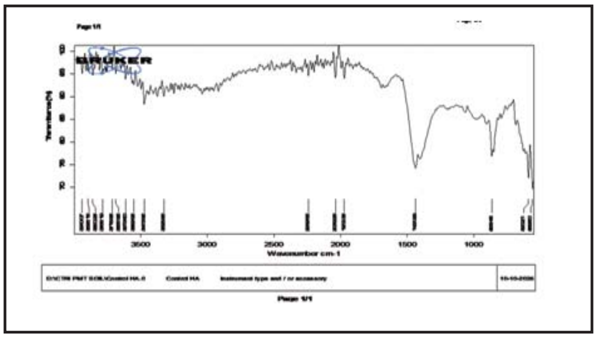
Ten nutrient treatments, including single, combined, and organic applications, were undergone metabolomics study using LC-MS/MS and GC-MS profiling and measurements of nicotine and leaf yield of a 64-year nutrient management study. Nitrogen-based regimes (N, NK, NP, NPK+10 t/ha FYM) boosted nitrogen-dependent alkaloids like nicotine, rutin and quercetin glycosides, with balanced NPK+10 t/ha FYM yielding the highest metabolite diversity and nicotine (~4.0%), correlating with maximum leaf yield. P-alone and K-alone led to more flavan-3-ol derivatives and fatty acid esters but lesser nicotine and yield. Organic inputs produced unique high-molecular-weight flavan-3-ols, indicating soil microbial effects, but had lower nicotine due to limited nitrogen. Controls had simple metabolic profiles and low yields. Overall, balanced nutrients with adequate nitrogen promoted alkaloid and phenyl-propanoid biosynthesis and maximized cured leaf yield. FTIR characterization of humic acid extracted from FYM treatments has band stretch representing abundant hydroxyls from lignin, aromatic stretches explaining long term humification which are much subdued in control treatment.





Representative LC-MS/MS chromatogram representing leaf metabolites





Humic acid extracted from the soil of permanent manurial trial and representative FTIR spectra of humic acids

2. Evaluation of Sulfentrazone 39.6% SC and Sulfentrazone 28% + Clomazone 30% WP herbicide (PI. Dr. S. Kasturi krishna)

Pre-plant application (PPA) of sulfentrazone @ 0.25 kg a.i./ha at 3 days before transplanting reduced weed density and weed dry weight with the highest weed control efficiency in Northern light soils of A.P. and Karnataka light soils grown FCV Tobacco. PPA of Sulfentrazone 0.25 kg and 0.30 kg a.i./ha at 3 days before transplanting recorded on par cured leaf yields with the intercultural operations + hand weeding treatment, indicating it is equally controlling the weeds in FCV tobacco cultivation. Post-plant application of either Sulfentrazone or Sulfentrazone + Clomazone could not control the weeds compared to pre-plant application. Herbicide residues were not detected either in the leaf or soil.

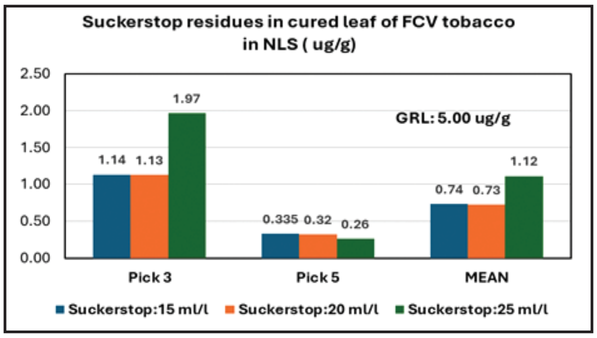
Preplant application of Sulfentrazone herbicide

Post plant application of Sulfentrazone herbicide

3. Synthesis and Evaluation of Specialty Chemicals (Suckericides, Growth Promoters and Plant Nutrition Supplements): In a PPP Mode with M/S MR Biochem Pvt Ltd., Hyderabad. (PI: Dr. L.K. Prasad)

The systemic suckericide i.e. flumetralin (SUCKERSTOP™) synthesized through novel synthetic pathway and formulated at 17.5% EC was validated in FCV tobacco during 2024-2025 crop season to study its effectiveness and estimated residues in the cured leaf. The sucker dry weight was the lowest (39 g/plot) in 25 ml/L compared to control (523 g/plot) and in 4% decanol (303 g/plot). It was confirmed that irrespective of the concentration of the SUCKERSTOP™, sucker control was most effective (93%) with a dosage of 25 ml per litre. It was further validated in varieties and hybrids of FCV tobacco (FCJ 11, CH3, and 1353) in the farmer fields of NLS region and found effective up to 95 % with the same dosage. No adverse changes in nicotine content were observed, while reducing sugar content improved (15.03 to 18.08 %).

The residue analysis of cured leaf tobacco in GC-MS (LOD and LOQ :10 ppb and 40 ppb) revealed that the residues are significantly below the GRL limit *viz.,* 0.74-1.12 ppm in irrigated condition and 0.15-0.22 ppm under rainfed conditions and farmers' fields, applied at the highest dose of SUCKERSTOP™.



4. Alkaloid content enhancement to meet market demand in burley tobacco (PI: Dr. S. Kasturi krishna)

In the field experiment at Rajahmundry, dry situations created (without giving irrigation) have resulted in higher nicotine, 0.17%, 0.17%, and 0.29%, by Vijetha, Win 5, and Banket A1, respectively, than drip irrigation in 2024-25. Higher alkaloid content was recorded under dry conditions at Giddaluru by Vijetha with 250 kg/ha N (3.87%) and at Nandyal (2.45%) in the 3rd pick, but at Vinukonda Win 5 (3.15%) with 200 kg N/ha in the 4th pick with 24 leaf topping. In Banket A1, higher root volume and dry weight are the contributing factors for its adoptability under dry situations.

Effect of varieties on Nicotine content of burley tobacco

Treatment	Vinukonda				Giddaluru		
Varieties	P1	P2	P3	P4	P1	P2	P3
Vijetha	1.18	1.32	2.01	2.39	2.42	3.48	3.66
Win 5	1.21	1.35	2.28	2.52	2.24	3.00	3.35
Banket A1	0.84	1.17	1.87	2.38	2.03	2.63	2.84
SEm ±	0.02	0.04	0.06	0.03	0.05	0.15	0.06
CD (P=0.05)	0.06	0.14	0.20	0.10	0.17	0.53	0.21

5. Evaluation of Nano-Biotech capsules as biofertilizers for FCV tobacco in KLS and NLS (PI: Dr. J. Poorna Bindu)

Nano Biotech Capsules (NBTC) technology was developed by IISR, Calicut and ICAR-NIRCA and evaluated for reducing the fertilizer usage, enhancing FCV tobacco leaf quality and productivity and soil health. Nano Biotech capsules, along with the 100% recommended dose of fertilizers (RDF) and farmyard manure (FYM), enhanced cured leaf yield significantly by 7% over 100% RDF alone in rainfed conditions of Karnataka. In irrigated conditions of Andhra Pradesh, the same treatment resulted in a 5% numerical yield increase, and economically, the application of 10 nano biocapsules per acre with 100% RDF and FYM yielded a higher benefit-cost ratio (1.43) compared to 1.39 with 100% RDF alone, ensuring an additional income of ₹ 12,152 per hectare. ICAR–NIRCA recommended the use of Nano Biotech Capsules to the tobacco farming community. Hence, Nano-Biotech capsules are advocated as a promising component of integrated nutrient management for sustainable tobacco cultivation.

6. Increasing the withanolide content in Ashwagandha through different organic manure (PI: Dr. M. Kumaresan)

To increase the withanolide content in Aswagandha, a fixed plot field experiment was conducted during 2023-24 at the ICAR-NIRCA-RS farm in Vedasandur. Different organic manures, viz., vermicompost (2 t/ha), sheep manure (10 t/ha), and FYM (12.5 t/ha), in combination with biofertilizers, (Azotobacter 5 litres/ha + Phosphorus solubilizing bacteria 5 litres/ha) were applied.

The growth and yield parameters were higher with all the organic manures applied with biofertilizers. A similar trend was noticed with root yield also. There was a yield increase of 80-92% with the different organic manures + biofertilizers. The cost of cultivation was higher with the vermicompost treatments followed by sheep manure and FYM treatments. A higher gross return (₹ 323,930/ha) was recorded with sheep manure + biofertilizers, followed by sheep manure applied alone. A higher net return of ₹ 228,180/ha was recorded with sheep manure + biofertilizers, followed by vermicompost and FYM with biofertilizers.

7. Increasing the withanolide content in Ashwagandha through irrigation management (PI. Dr. M. Kumaresan)

Field experiment was conducted at ICAR-NIRCA-RS farm, Vedasandur, during 2024-25. The treatments comprised 5 irrigation levels, viz., 125%, 100%, 75%, 50% and 25% ET with a surface irrigation treatment. The experiment was conducted in a strip plot design with 3 replications. The growth attributes, viz., plant height, number of branches and yield attributes, viz., root girth, root fresh weight, root volume and root length, were higher with surface irrigation followed by drip irrigation treatments. The root yield was higher with surface irrigation (377 kg/ha), followed by drip irrigation at 100% ET and 125% ET. The root yield with surface irrigation at 75%, 100% and 125% ET are comparable. A higher net return of ₹ 134,950/ha was recorded with surface irrigation followed by drip treatments of 100%, 125% and 75% ET. The water use efficiency (WUE) was higher with 25% ET followed by 50% ET. The quantum of water used was 480 ha-mm for surface irrigation and lower with the drip treatments (222 to 329.9 ha-mm). Drip irrigation saved 31.3 to 53.8% water as compared to surface irrigation.

II(ii)Optimisation of resource use (soil, water, nutrient) for production efficiency and produce quality

8. N and K nutrient use efficiency indices for FCV tobacco grown under drip fertigation in irrigated Alfisols (PI: Dr. S. V. Krishna Reddy)

Nitrogen use efficiency Indices

The pooled analysis indicated that cv. FCJ-11 recorded higher green leaf yield (139 q/ha), cured leaf yield (1943 kg/ha), grade index (1374), and GLY/CLY (7.00), followed by the farmer's variety. The FCJ-11 variety with fertilizer doses of N_{135} and K_{150} recorded higher agronomic use efficiency (9.92 kg cured leaf increase/kg N added), nitrogen use (recovery) efficiency (61.75%), partial factor productivity (17.23 kg cured leaf/kg N added), and economic efficiency of N (₹ 59.00/additional ₹ invested) compared to other varieties. Physiological efficiency (15.11 to 16.07 kg CLY increase/kg N taken up from fertilizer), nutrient harvest index (56.94 to 58.32%), and internal efficiency (20.57 to 22.96 kg cured leaf yield/kg N taken up (soil + fertilizer) of varieties remained almost the same. Nitrogen at 135 kg/ha recorded higher agronomic use efficiency, economic efficiency, and partial factor productivity compared to 180 kg N/ha. Based on pooled results, it can be recommended that a nitrogen dose of 135 kg/ha along with 150 kg K_2O/ha is sufficient for optimum yield.

Potassium use efficiency indices

The pooled analysis indicated that the FCJ-11 variety recorded significantly higher green leaf yield (148 q/ha), cured leaf yield (2106 kg/ha), grade index (1479), green leaf yield/cured leaf yield (6.97), and grade index/cured leaf (69.91%) compared to other varieties.

The FCJ-11 variety with a fertilizer dose of K_{100} along with N_{135} kg N/ha recorded higher agronomic use efficiency (4.41 kg cured leaf increase/kg K added), potassium recovery efficiency (62.84%), partial factor productivity (17.76 kg cured leaf/kg K_2O applied), and economic efficiency of K (₹ 6.40/additional ₹ invested) compared to other varieties. Physiological efficiency (7.01 to 8.18 kg CLY increase/kg K taken up from fertilizer), translocation index (75.36 to 79.19%), and internal efficiency (20.74 to 22.00 kg CLY/kg K taken up from soil + fertilizer) of varieties remained almost the same.

Lower values of nutrient use efficiency indices of potassium were recorded at higher potassium levels and higher values at lower potassium levels. Based on pooled results, it was observed that a potassium dose of 150 kg/ha along with 135 kg N/ha is required for optimum yield.

9. Agronomic management practices for higher productivity, resource use efficiency and value addition of turmeric (Curcuma longa L.) in irrigated Alfisols of Andhra Pradesh.
(PI: Dr. S. V. Krishna Reddy)

Effect of Variety, Crop establishment method and Nutrient management practices for higher productivity, resource use efficiency and value addition of Turmeric (*Curcuma longa* L.)

To find out the best combination of Variety, Crop establishment method and Nutrient management practice for improving productivity, quality and value addition of turmeric (*Curcuma longa* L.), experiments were carried out. Duggirala Red grown with mother rhizome and application of INM {with inorganic RDF (150-50-50 N-P_2O_5 -K_2O) + organic (FYM 5t/ha) + biofertilizer (*Azospirillum* + *Azotobacter*) recorded the highest dry rhizome recovery (20.77%), dry rhizome yields (11.037 t/ha), and curcumin content (2.15%). Similarly, planting one plant row per ridge with 45 X 30 cm and 200 kg K_2O/ha recorded highest fresh rhizome yield, rhizome recovery, dry rhizome yield and curcumin content of 52.1 t/ha, 19.68%, 9.97 t/ha and 2.53%.

10. Enhancing soil carbon sequestration and mitigating Greenhouse Gas (GHG) emissions in FCV tobacco based production systems through residue management
(PI: Dr. T. Kiran Kumar)

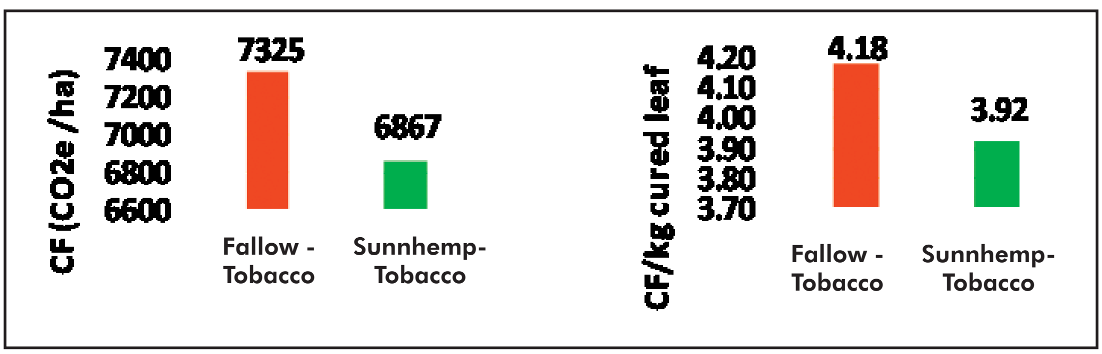
The highest green leaf yield (12563 kg/ha) and cured leaf yield (2183 kg/ha) were recorded under the sunnhemp-tobacco cropping system. However, overall system productivity was highest (2602 kg/ha) under the groundnut-tobacco system due to additional yield received from groundnut pods. Regarding nutrient management, the 100 percent recommended dose of fertilization recorded the highest cured leaf yield (2220 kg/ha) and system productivity (2414 kg/ha).

Total carbon footprint per unit area was higher in the Fallow–Tobacco system (7325 kg CO_2e/ha) compared to the Sunnhemp–Tobacco system (6870 kg CO_2e/ha). Similarly, when expressed on a yield basis, the carbon footprint per kilogram of cured leaf was also higher in the Fallow–Tobacco system (4.18 kg CO_2e/kg cured leaf) than in the Sunnhemp–Tobacco system (3.92 kg CO_2e/kg cured leaf). Tobacco leaf curing contributed 71.8% of the total carbon emissions. Sunnhemp as a preceding crop in tobacco-based systems is an effective strategy for lowering the carbon emissions, and adoption of such legume-based rotations could therefore contribute to more sustainable and climate-resilient tobacco production systems.

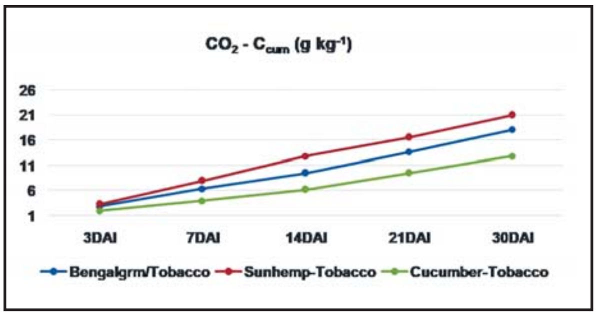
11. Assessment of soil carbon mineralization and carbon stocks in tobacco and tobacco-based cropping systems of different tobacco growing soils
(PI: Dr. J. Poorna Bindu)

Carbon Mineralization Studies

Incubation experiments were conducted to assess carbon mineralization dynamics in soils collected from three predominant cropping systems of the Southern Black Soil region, *viz.*, Bengal gram–Tobacco, Sunnhemp–Tobacco, and Cucumber–Tobacco. Surface soil samples (0–15 cm) were air-dried, sieved (2 mm) and incubated under controlled conditions (27 ± 1°C, field capacity moisture) for 30 days using the alkali



GHG emissions in tobacco-based systems and CO_2e/kg cured leaf trap method (Anderson, 1983). Twenty grams of soil were placed in airtight conical flasks with 10 mL of 1 N NaOH to absorb evolved CO_2. The trapped CO_2 was periodically titrated with 0.5 N HCl at 3, 7, 14, 21, and 30 days after incubation to determine cumulative CO_2-C evolved (g CO_2-C kg^{-1} soil). The results were used to quantify cumulative carbon mineralization (C_{min}) and assess differences among cropping systems. Results indicated that soils under the sunnhemp–tobacco sequence recorded the maximum carbon mineralization of 20.9 g kg^{-1}, indicating the presence of a highly active microbial population and abundant labile organic substrates derived from green manure residues. The Bengal gram/ tobacco cropping system exhibited a carbon mineralization of 18.06 g kg^{-1}, representing moderate microbial activity influenced by legume root biomass and moderate organic matter contribution. The Cucumber–Tobacco sequence (previously continuous fallow-tobacco) showed the least carbon mineralization of 12.76 g kg^{-1}, reflecting low organic residue input and reduced microbial turnover.



Effect of different cropping systems on total and cumulative C mineralization observed for 30 days of incubation

Carbon sequestration Potential under different cropping systems

Soil samples were collected from 11 Tobacco Board auction platforms representing two major FCV tobacco-growing regions, Southern Light Soils (SLS) and Southern Black Soils (SBS), to evaluate carbon sequestration potential. From each auction platform, 80 soil samples were collected at four depths: 0–5 cm, 5–15 cm, 15–30 cm, and 30–45 cm. The sampling locations included Ongole-1, Ongole-2, Vellampalli, Tangutur and Kondapi under SLS; and Kandukur (AP-26), Podili, Kaligiri, D.C. Palli, Kanigiri and Kandukur (AP-27) under SBS regions. The data on the total carbon sequestration potential (Mg ha^{-1}) of 40 farmer field soils from the Southern Black Soils (SBS) region under diverse tobacco-based cropping sequences indicated that cropping diversity, inclusion of legumes and green manures, and long-term organic management strongly influenced soil carbon build-up. Soils under legume-based rotations, such as Bengal gram/ tobacco and sunnhemp–tobacco, recorded carbon stocks (0–45 cm) ranging from 42 to 52 Mg ha^{-1}. The carbon sequestration (0–45 cm) values ranged from 17 to 96 Mg ha^{-1}, with an average of approximately 35–40 Mg ha^{-1} among different cropping systems in SBS. The sequence of increasing carbon sequestration potential was continuous: Fallow-Tobacco < Cucumber / Foxtail Millet-Tobacco < Bengal Gram-Tobacco <Sunnhemp-Tobacco < FYM / Chilli Tobacco rotations.

12. Characterization and Assessment of Functional Capabilities of NLS Rhizo-Microbiome (PI: Dr. J. Poorna Bindu)

Soil microbes identified in NLS rhizo-microbiome using metagenomics

Metagenomics studies for rhizosphere microbiome characterization were done by analyzing the collective genetic material (DNA) of all microorganisms, *viz.,* bacteria, fungi, archaea and actinomycetes present in the NLS FCV tobacco rhizosphere. This approach provides a comprehensive, culture-independent understanding of microbial diversity, structure and functional potential in the soil ecosystem. Rhizosphere soil DNA samples were subjected to shotgun metagenomic sequencing to characterize the microbial community structure and functional potential. Metagenomic analyses across the five FCV tobacco rhizosphere locations resulted in the identification of stable dominance of Actinobacteria (34–40%) and Proteobacteria (25–28%).

All the platform, rhizosphere soil samples microbes status reveals that various percentages of Actinobacteria groups containing *Streptomyces, Pseudonocardiaceae, Mycobacterium* and *Microbacterium* were identified. These microbes play an important role in nutrient cycling, decomposition of organic matter, carbon turnover and disease suppression. Next to the actinobacteria, proteobacterial groups, including *Rhizobiales, Burkholderiaceae, Comamonadaceae,* and *Sphingomonas*, were identified. These microbes play an important role in nitrogen fixation, phosphate solubilization, organic acid production, and pollutant degradation, enhancing rhizosphere health.

Metabolites identified in the NLS rhizomicrobiome using metabolomics

The metabolomic profiling of FCV tobacco rhizosphere soils indicated unique site-specific nutrient-mobilizing signatures among the five NLS locations. Jangareddygudem-II showed higher levels of malic acid, flavonoids and phosphorylated nucleotides (ADP, CTP), that are linked to *Pseudomonas and Bacillus* species, this suggests phosphatase activity. Jangareddygudem-I had more acetic acid, oxalosuccinate and urea, this shows that *Rhizobium and Enterobacter* used organic acids for P solubilization and urease for N transformation. Acetone, acetic acid and dimethyl sulfide were found in Koyyalagudem soils. These chemicals are linked to *Streptomyces and Pseudomonas fluorescens*. Gopalapuram showed succinyl-CoA, acetic acid and dimethyl sulfide, which means that *Burkholderia and Thiobacillus* were releasing organic acids and oxidizing sulfur. Devarapalli, the site with the most organic matter, had acetic acid, succinate and phenolic acids made by *Aspergillus and Penicillium*. These acids helped with acidolysis and chelation-driven solubilization of P and K.

II (iii) Identification of innovative, intensive and diversified cropping systems for enhanced productivity and farm income

13. Turmeric based copping systems for enhanced returns in irrigated Alfisols (PI. Dr. S. Kasturi krishna)

Turmeric being a long-duration crop, the possibility of growing intercrops for short-term monetary returns is explored in this project in irrigated Alfisols. Blackgram as an intercrop during *Kharif* is boosting the yields of turmeric more than Korra & Ashwagandha. Turmeric + Blackgram (*Kharif*) - Tobacco (*Rabi*) – Groundnut relay has given higher net returns (₹ 3,25,473/ha) than other turmeric-based cropping systems, followed by Turmeric + Blackgram (4:4) (*Kharif*) - Tobacco (*Rabi*) (₹ 3,17,110/ha) with tobacco as an intercrop in the *rabi* season. Turmeric + Moringa (₹ 2,28,842/ha), followed by Turmeric + Blackgram-Cauliflower (₹ 2,08,451), are profitable turmeric-based cropping systems without tobacco as an intercrop during the *rabi* season. Sole turmeric has fetched higher net returns (₹ 2,92,217/ha) than the Korra-tobacco (₹ 2,61,193/ha) cropping system.

Turmeric based cropping systems

Turmeric+Moringa cropping system

14. Development of high value commercial crops based remunerative production systems through innovative approaches (PI. Dr. T. Kiran Kumar)

Evaluation of wide-spaced paired-row planting (WSPRP) and nutrient management on tobacco-based production systems

A field experiment was carried out during 2024-25 at the Black Soil Research Farm, ICAR-NIRCA, Rajahmundry. The study followed a split-plot design with four planting configurations as main treatments: WSPRP of tobacco intercropping with chickpea at spacings of 0.6 m × 0.4 m + 1.5 m, 0.7 m × 0.4 m + 1.5 m, and 0.8 m × 0.4 m + 1.5 m, along with conventional tobacco planting at 0.7 m × 0.7 m.

The conventional planting produced the maximum cured leaf yield (1814 kg/ha), bright leaf yield (1091 kg/ha) and grade index (1556 kg/ha) compared to the WSPRP treatments. However, overall system productivity, expressed as tobacco leaf equivalent yield, was highest (1864 kg/ha) under the WSPRP system of tobacco intercropped with chickpea at 0.8 m × 0.4 m + 1.5 m spacing. Notably, system productivity under this integrated planting method was statistically comparable to other planting systems. With respect to nutrient management, application of 100 percent of the recommended fertilizer dose consistently resulted in superior green leaf yield, cured leaf yield, bright leaf yield and grade index across treatments, highlighting its effectiveness in optimizing tobacco productivity.

Enhancing crop productivity and profitability in chilli through farm mechanization and weed management

A field experiment was conducted during 2024-25 at Black Soil Research Farm, ICAR-NIRCA, Rajahmundry. Intercultural operation with a power weeder + pre-emergence application of pendimethalin 0.6 kg ai/ha (38.7% SC) + post-emergence application of quizalofop-ethyl 5% EC @ 0.06 kg a.i./ha recorded better weed control efficiency (90%) and the highest yield of chilli (2777 kg/ha) compared to other intercultural and weed management treatments. Lowest weed density (8.2, 63, and 149 no./m^2) and weed dry matter (1.8, 11, and 61 g/m^2) at 25, 50, 75 DAT, respectively were recorded under the same treatment when compared to other treatments. The highest net returns of ₹ 1,83,815/ha and benefit cost ratio (0.90) were recorded under interculture with a power weeder + pre-emergence application of Pendimethalin 0.6 kg a.i./ha (38.7% SC) + post-emergence application of Quizalofop-ethyl 5% EC @ 0.06 kg a.i./ha, which was significantly higher than all other treatments.

Drumstick (Moringa) and turmeric-based intercropping system for enhancing productivity, income, and resource use efficiency

Sole Turmeric gave the highest turmeric yield (35,962 kg/ha fresh; 6,800 kg/ha dry) and Sole Moringa produced the highest moringa yield (21,848 kg/ha). Among intercropping systems, Moringa + Turmeric (1:9) yielded the highest turmeric yield among intercrops. Moringa paired rows plus turmeric (1:6) yielded the highest moringa yield (7,605 kg/ha). Yield reduction in both crops occurred under intercropping due to competition, but the productivity of both crops together can still enhance overall system efficiency. Sole Moringa gave the highest net returns (₹ 4,68,272/ha) and was economically most profitable, and Sole Turmeric gave high gross returns but a low B:C ratio (1.31) due to the higher cost of cultivation. Among intercropping treatments, moringa paired rows + turmeric (1:9) gave the highest net return (₹ 3,68,399/ha) and B:C ratio (1.69), but other intercropping systems had similar but slightly lower economic returns.

15. Crop intensification for higher farm productivity in chewing tobacco growing areas (PI Dr. M. Kumaresan)

A fixed-plot field experiment was conducted during 2023-25 at ICAR-NIRCA-RS, Vedasandur. Different mandated crops/profitable crops were raised to study the economic viability of the crops/cropping system. The treatments comprised tobacco + ashwagandha, ashwagandha + castor, ashwagandha + chillies, ashwagandha + annual moringa, ashwagandha + aggregatum onion, chillies + aggregatum onion, chewing tobacco (sole), castor (sole), ashwagandha (sole), annual moringa (sole), aggregatum onion (sole), and chilies (sole). The experiment was conducted in an RBD with 3 replications.

Among the intercropping systems, annual moringa and *aggregatum* onion intercropped with ashwagandha grown under inorganic conditions recorded a higher net return. The net return with Ashwagandha + annual moringa and ashwagandha + aggregatum onion was ₹ 4,09,656 and ₹ 3,99,596/ha, respectively. The quality aspects, viz., capsaicin and pungency of chilies, increased when chilli was intercropped with ashwagandha. Nicotine content increased by 2.76% when ashwagandha was intercropped with tobacco. The LER was higher (1.76) with annual moringa + ashwagandha, followed by tobacco + ashwagandha. The system productivity was higher (18.89) with *aggregatum* onion as the sole crop, followed by annual moringa + ashwagandha (18.37).

Ashwagandha +Aggregatum onion

II (iv) Development of effective techniques for biotic stress management in high value commercial crops

16. Physical and chemical interactions of plants, pests and natural enemies in commercial crops (PI: Dr. K. Rajasekhara Rao)

A) Natural enemies of whitefly Bemisia tabaci on tobacco

Thirteeen species of natural enemies were recorded on tobacco feeding or parasitizing whitefly *Bemisia tabaci* in field and net-house conditions during 2024-2025 in Rajahmundry. Major predator recorded was bug *Nesidiocoris tenuis* and its population was 2-3 per plant during

Volatile compounds emitted by aphid-free and aphid-infested tobacco plants.

Plant Species	Volatile compound (aphid free plants)	Area %	Volatile compounds (aphid infested plants)	Area (%)
Nicotiana umbratica	Piperazine, 1,4-bis[2-(2-furoyloxy)ethyl]- Valeranone, (+)- Dihydrohumulinic acid (-)-Isolongifolol, (3-cyan-opropyl)dimethylsilyl ether Heneicosane	0.98 1.98 0.41 0.63 1.98	Butanoic Acid, 2-Propenyl Ester, allyl butyrate 3-methyl-5-phenylpentyl acetate Tridecane, 4-methyl-, root exudate 4-Octenoic acid, ethyl ether Heneicosane, It functions as a recognition signal in termite social behavior	0.41 0.33 0.68 0.26 2.77
N.benthamiana	*p*-Cymene Benzaldehyde, 4-ethyl- 3-ethylacetophenone Farnesane	0.22 1.23 2.37 0.27	Valeric acid Thunbergol Exo-2-Hydroxycineole L-Tyrosine, N,O-bis(capryloyl)-, methyl ester	0.1 1.88 0.13 0.12
N. gossei	Cyclohexane, (4-methyl pentyl)- 1-Heptanol heptanol	12.88 17.46	n-Hexanal NONANE, 3-METHYL-5-PROPYL- Azuleno[4,5-b]furan-2(3H)-one, 9-(acetyloxy)-6-[(acetyl oxy)methyl] decahydro-6-hydroxy-9a-methyl-3-methylene-, Furanone	0.47 1.47 0.76
N. repanda	*trans* Menthone, Longiborneol, Palmitoleyl alcohol. Heneicosane	35.04 35.96 38.15 43.19	Nonanal n-Nonanal Valeric acid, 2-cyano-2-ethyl-3-methyl-, ethyl ester Decanal Alpha.-thujone Butanoic acid, 2-methyl-, methyl ester Neophytadiene	0.37 0.21 0.66 0.63 0.33 0.22
N. nesophila	5-Methyl-2-methyl amino-2-thiazoline Tetradecane, 3-methyl-, Farnesane (Z,E)- Farnesol	0.06 0.05 0.12 0.07	Pentanal Ethyl 3-(methylsulfanyl) propanoate Dodecane, 2,6,10-trimethyl-, farnesane i-Propyl 12-methyl-tridecanoate Terpinylformate	1.06 0.35 1.99 0.18 0.38
***N. tabacum* (FCR-15)**	6-Octen-1-ol, 3,7-dimethyl-, (.+/-.)-, citronellol p-Cymene Cyclohexane, 1-methyl-3-pentyl- Farnesane Pentadecane, 2,6,10,14-tetramethyl-, phytane	0.17 0.26 0.2 0.09 0.23	3-Methyl-4-nonanone	0.22

early stage of the crop to 10-15 when tobacco plants were grown up. Their activity was noticed during the entire crop growth period, however, they are more during January to February months of the year 2025 coinciding with flowering and maturity of the crop. The other predators recorded were coccinellid beetles *Menochilus sexmaculatus*, *Veraniadiscolor Vernaiavincta, Coccinella septumpunctata*, *C. repanda*, chrysopid *Chrysoper lacarnea*, and three species of spiders and one syrphid species. Two parasites were recorded i.e. *Encarsia* spp., and *Eretmocerus spp.* from whitefly pupae. The natural enemy activity was more during morning and evening hours. Whitefly populations were recorded in higher numbers in net house/ conditions irrespective of the crop stage and their number increased progressively from 1st week of August 2024 (10 adults per leaf) to 1st week of October (183 adults/leaf) and thereafter the population declined gradually (5 per leaf) by end of February 2025. The coccinellid predators were recorded in very small numbers during the entire crop growth (maximum 1-2 per 5 plants).

b) Identification of volatile organic compounds or secondary metabolites from wild tobacco genotypes involved in attracting natural enemies

Volatiles from aphid-free and aphid-infested tobacco plants of wild genotypes *Nicotiana umbratica, N. benthamiana, N. gossei, N. repanda, N. nesophila, N. tabacum* (var. FCR-15) were collected during the year 2025 using headspace volatile collection system and were analyzed using GC-MS. Around 100 tobacco aphids *M. nicotianae* were released on leaves of the plant @ 25 numbers on each leaf, of 60-70 day old seedlings of each genotype, two days before the collection of volatiles. Aphids were allowed to feed the leaves for two days. Leaf volatiles were collected on Super-Q adsorbent, eluted with n-hexane (99.999%) and stored in deep freezer till the samples are used for GC-MS analysis.

Headspace volatile collection from tobacco plants

Quantitative and qualitative differences were found between the volatile compounds emitted by plants when they were infested by aphids and free from aphids. These volatile compounds have multifarious functions in tritrophic interactions.

17. Studies on the biology and management of cigarette beetle, Lasioderma serricorne (PI: Mrs. B. Sailaja Jayasekharan)

Insecticide bioassays were conducted against *L. serricorne* in a Completely Randomized Design (CRD) with the treatments *viz*., chlorantraniliprole 18. 5 SC, deltamethrin 11 EC, chlorfenapyr 10 SC, spinetoram 11.7 SC, novaluron 10 EC and lufenuron 5.4 EC in comparison with an untreated control. The results of the experiment were furnished in the Table given below.

Seed treatment at one ml dose per five grams seed

At 1 ml dose, chlorfenapyr 10 SC and deltamethrin 11 EC effected 100% mortality of the beetles by 24 HAT (Hours After Treatment). Whereas, chlorantraniliprole 18.5 SC and spinetoram 11.7 SC resulted in 100% mortality by 72 HAT. Novaluron 10 EC and lufenuron 5.4 EC resulted in beetle mortality of above 80% by 72 HAT.

Seed treatment at 1.5 ml dose per five grams seed

At 1.5 ml dose, chlorfenapyr 10 SC, deltamethrin 11 EC and spinetoram 11.7 SC affected in cent percent mortality of the beetles by 24 HAT (Hours After Treatment). Chlorantraniliprole 18.5 SC resulted in cent percent mortality by 72 HAT. Novaluron 10 EC resulted in 97.78 per cent mortality and lufenuron 5.4 EC resulted in reasonable mortality of 95.56 per cent.

Efficacy of insecticides at 1.5 ml dose on the mortality of L. serricorne

Trt. No.	Insecticide	Formu-lation	Dose per 5 g seed	Per cent Mortality		
				24 HAT	48 HAT	72 HAT
1	Chlorantraniliprole	18.5 SC	1.5 ml	28.89 (32.21)[b]	92.22 (76.54)[a]	100.00 (89.47)[a]
2	Deltamethrin	11 EC	1.5 ml	100.00 (89.47)[a]	100.00 (89.47)[a]	100.00 (89.47)[a]
3	Chlorfenapyr	10 SC	1.5 ml	100.00 (89.47)[a]	100.00 (89.47)[a]	100.00 (89.47)[a]
4	Spinetoram	11.7 SC	1.5 ml	100.00 (89.47)[a]	100.00 (89.47)[a]	100.00 (89.47)[a]
5	Novaluron	10 SC	1.5 ml	22.22 (27.82)[b]	48.89 (44.364)[b]	97.78 (84.66)a
6	Lufenuron	5.4 EC	1.5 ml	16.67 (23.38)b	43.33 (41.11)[b]	95.56 (80.17)[a]
7	Untreated Check	-	-	0.00 (0.523)[c]	0.00 (0.52)c	0.00 (0.52)b
	SEm ±			18.66	38.31	24.64
	CD (p= 0.05)			7.69	11.01	8.83

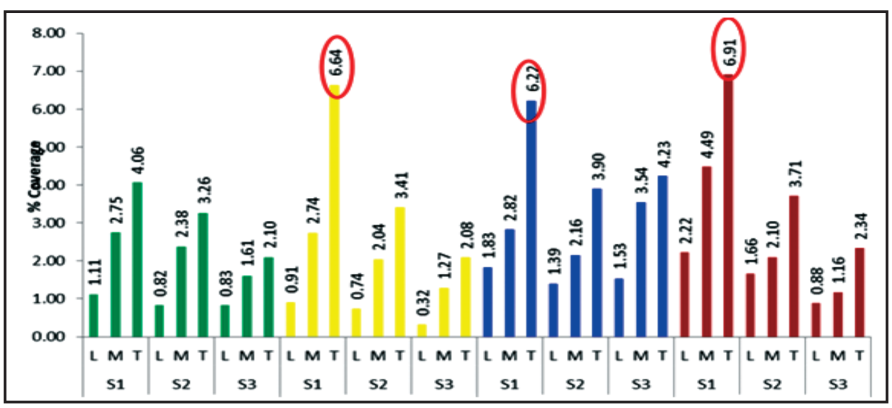
HAT-Hours After Treatment
Note: Values in parenthesis arc-sine transferred

18. Standardization of precise pesticide application utilizing Unmanned Aerial Vehicles (UAVs) for commercial crops (PI: Mrs. B. Sailaja Jayasekharan)

The standard operating procedure (SOP) for application of insecticides in tobacco crop using drone was standardized by conducting spray characteristic study and evaluating bio efficacy against tobacco caterpillar *S. litura* and bud worm *Helicoverpa armigera* at the Black Soil Research Farm, Katheru. The droplet distribution of the spray produced with drone nozzle tips was assessed at various operating heights, speeds at various canopy positions of tobacco crop. Bamboo pegs were fabricated with three small extensions at three levels to simulate leaves of top (T), middle (M) and lower (L) canopies of the tobacco plant called as Droplet Collection Stations. Water Sensitive Papers (WSPs) were placed on these bamboo pegs across the fields in four nozzle treatments with three replications each. Drone was flown over the crop at three speeds *viz.*, S1 (3 m/s), S2 (5 m/s) and S3 (8 m/s) at three heights (H1-2; H2-2.5 and H3-3 meters above the crop canopy).

The swath width experiment was conducted with long horizontal bamboo poles called Droplet Collection Planes. These images were uploaded to the smart phone application named DROPLEAF-Spraying meter (Brandoli *et al.*, 2018). The parameters *viz.*, spray coverage, VMD (Volume Median Diameter) so obtained were manually entered in an Excel spreadsheet and the data was analyzed using IBM SPSS statistical software version 20.

Spray Droplet Characteristics: The nozzle tip XR11002VP when operated at 2.0 m height above crop canopy produced the optimum Volume Median Diameter (VMD) of 300 µm and spray



Influence of different nozzle tips and speeds on droplet Coverage

coverage (6.12 %) compared to the widely used spray tip XR110015VP (VMD 300.77 µm and coverage 3.11 %). Hence, the nozzle tip XR11002VP is used to apply insecticides at a height of 2.0 m from crop canopy at 3 m/s speed to produce desirable spray characteristics.

Bioefficacy with Drone: For the management of *S. litura*, Emamectin benzoate 5 SG @ 250 g/ 25L water/ha is recommended for the management of *S. litura* and chlorantraniliprole 18.5 SC @ 150 g/ 25L water/ha for *H. armingera,* for spraying in FCV tobacco with drone using the nozzle spray tip XR11002VP at a height of 2.0 m from crop canopy at 3 m/s speed to produce desirable spray characteristics. There was no phytotoxicity with the recommended dose.

19. Integrated management of chilli black thrips, Thrips parvispinus Karny (PI: Dr. P. Venkateswarlu)

The experiment on the integrated management of South East Asian thrips on chillies crop was conducted at NIRCA RS, Guntur during 2024-25 in 0.25 ha. Three modules viz., IPM module, Bio module and chemical module were tested along with untreated control plot (each module in 500 m^2).

Thrips population: All *3 modules were superior over untreated control in reducing thrips population.* Maximum count of 165 thrips per 3 leaves was recorded in control plot at 70 days of planting. In IPM module, thrips count was 40 per 3 leaves. After each spray schedule, pest population reducing up to one week but immediately increases its population till next spray schedule. Chemical module is next best and comparatively more effective than Bio module (43 thrips/3 leaves). Thrips population was reduced by 75.76% in IPM, 73.93% in chemical and 70.90% in Bio module over untreated control.

Implementation of IPM module against South East Asian thrips, *T. parvispinus* in chilli growing villages

The IPM module was implemented in 7 chilli growing villages viz., Koyavaripalem, Vinjanampadu, Tikkedipalem, Prathipadu, Ankireddypalem, Borravaripalem and Lingayapalem. In each village, 0.5 acre chilli plot was selected and implemented IPM module along with farmer practice of pure chemical spray in another 0.5 acre (Non-IPM). There was an overall reduction of 11.65% of population in IPM adopted villages against Non-IPM practices.

20. Bio-ecology and management of insect pests in chillies (PI: Dr. V. Venkateswarlu)

The Chilli experiment on the management of major insect pests in Durgada chillies was conducted at Kolanka village, Kajuluru Mandal, East Godavari district during 2024-25 in 0.50 acre. Integrated module recorded the major pest reduction up to 46-48% over control in chilli crop. The average red spider mite infestation of 8% was recorded. Maximum count of 8 *Spilosoma obliqua* hairy caterpillars /plant were recorded. Total dry pod yield was recorded in each treatment plot. Maximum yield of 12.89 q/ha was recorded in chemical plot and in other modules, it varied from 5.80 q/ha (control) to 12.21 q/ha (Integrated plot).

21. Deciphering Resistance Mechanisms against Fusarium Wilt and Black Shank Diseases in Tobacco and Their Management (PI: Dr Mahesha, H. S.)

Survey for the occurrence of Fusarium wilt and black shank

A roving survey was conducted during the 2024–25 cropping season to assess the occurrence of *Fusarium* wilt and black shank diseases of tobacco across 29 fields representing 21 villages under five auction platforms in the Northern Light Soil (NLS). In the NLS region, the highest incidence of black shank was recorded at the Gopalapuram auction platform (10.16%), followed by Devarapalli (8.00%). In the KLS region, *Fusarium* wilt incidence was highest at the Periyapatna auction platform (11.50%), followed by H.D. Kote (9.00%).

Morphological characterization of pathogens

Thirty isolates of *Fusarium* spp. were recovered from wilt-affected tobacco plants and subjected to cultural and morphological characterization. The isolates exhibited considerable variation in colony characteristics, with colony colours ranging from whitish to brown and margins varying from smooth to irregular. Pigmentation ranged from pink to purple. Eight isolates of *Phytophthora nicotianae* were isolated from black shank-infected samples. These isolates produced whitish colonies with hyaline, coenocytic and aseptate mycelium.

Optimization and Standardization of Fusarium Inoculum for Pathogenicity and screening

Standardization of inoculum for inducing *Fusarium* wilt under controlled conditions was carried out. Disease development was achieved with a soil inoculum level of 5–6% (w/w) in combination with root-dip inoculation using *Fusarium* spore suspension (10v spores/mL) for 10 minutes prior to transplanting.

Evaluation of new fungicide molecules against black shank and fusarium wilt pathogen under in vitro condition

The efficacy of new fungicide molecules against *P. nicotianae* and *Fusarium* spp. was evaluated under *in vitro* conditions using the poisoned food technique. Twelve fungicides were tested against *P. nicotianae* at four concentrations (100, 250, 500, and 1000 ppm). Azoxystrobin 4.7% + mancozeb 59.7% + tebuconazole 5.6%, carboxin 37.5% + thiram 37.5%, azoxystrobin 8.3% + mancozeb 66.7%, and metalaxyl 4% + mancozeb 64% showed 100% inhibition of mycelial growth at 250 ppm and above. Against *Fusarium* spp., fluopyram 24.7% + tebuconazole 24.8%, carboxin 37.5% + thiram 37.5%, and azoxystrobin 8.3% + mancozeb 66.7% were most effective, achieving complete inhibition at e”250 ppm.

Survey for the occurrence of *Fusarium* wilt and black shank

Optimization and standardization of *Fusarium* inoculum for pathogenicity and screening

22. Integrated management of root knot nematode and disease complex in FCV tobacco (PI: Dr. S. Ramakrishnan)

Root knot nematode (RKN), *Meloidogyne incognita* continues to be the dominant and wide spread nematode species causing significant reduction in yields and quality of FCV tobacco in KLS. Maximun mean root knot nematode population of 126 J_2 (Second staged juveniles) per 100 cc soil were found in Hunsur followed by Periyapatna (90 J2), Chilkunda (78 J2), Ramnathpura (75 J_2), and HD Kote (66 J_2).

Evaluation of Tobacco Germplasm against root knot nematodes under sick field conditions

A total of 36 advanced breeding lines were screened against mixed population of root knot nematodes under root knot nematode sick field conditions with population load of 118 Juveniles per 100 cc soil. The present ruling cultivars FCH 222, CH3 and Kanchan were included as checks. Among the crosses, R20 x Kanchan, R52 x Kanchan and R52 x Mc Nair recorded RKI < 1.5 and were found promising against root knot nematode under sick field conditions. Whereas, Kanchan, FCH 222 and CH3, as standard checks recorded RKI of < 2.0 under 0 – 5 scale.

Bulk Trial

Fluopyrum 400 SC @ 0.05% concentration found promising against root knot nematodes in FCV tobacco under replicated trials for two seasons, was evaluated under bulk trials along with carbofuran 3G @ 1g per plant as standard check along with one untreated control. Drenching Fluopyrum @ 0.05% in FCV tobacco crop caused 24.3% increase in cured leaf yield as compared to 12.7% increase effected by carbofuran 3G. Similarly, Fluopyrum 400 SC @ 0.05% was found effective in reducing root knot incidence (RKI) by 68% and soil root knot nematode population by 57.8% as compared to untreated check. The cost benefit ratio due to use of Fluopyrum 400 SC @ 0.05% for RKN management in FCV tobacco in KLS is 1: 2.31.

23. Exploring certain millets as preceding *rabi* crops for FCV tobacco against root knot nematodes in light soils of Karnataka (PI: Dr. S. Ramakrishnan)

To study the effect of preceding *rabi* crops on root knot nematode population in FCV tobacco field, the following crops, Sorghum, Ragi, Bajra, Fox tail millet, Chia were raised in *rabi* season after harvesting the *kharif* tobacco in the experimental field. *Rabi* fallow after *kharif* FCV tobacco served as check for comparison purpose. Root knot nematode soil population was assessed after harvesting *kharif* FCV tobacco and it was enumerated as 280 J_2 (Larvae) per 250 cc soil in plots with *rabi* sorghum as preceding crops. The experiment is under progress.

24. Characterization of economically important plant parasitic nematodes in FCV tobacco from NLS region of Andhra Pradesh (PI: Dr. M. Venkatesan)

Characterization and efficacy of entomopathogenic nematode, Steinernema pakistanense against tobacco caterpillar Spodoptera litura and other lepidopteron pests under laboratory condition

The indigenous strains of Entomopathogenic nematodes were isolated from the tobacco fields of ICAR-NIRCA, Regional station, Jeelugumilli and were identified as *Steinernema pakistanense* N. (*Rhabditida: Steinernematidae*) (NIRCA01 Strain) through molecular characterisation. The BLAST search analysis of DNA sequence of native EPN strains showed > 99% matches to authenticated reference sequence of *S. pakistanense*. (GenBank accession no. PX280261).

S. pakistanense NIRCA01 strain applied @ 500 IJs per larva of *S. litura* (3rd instar larvae) resulted in pest mortality by100 per cent, which was observed at 48 hours post inoculation period. After 24 h post inoculation, *S. pakistanense* NIRCA01 strain required only 487 IJs larvae^{-1} (3rd instar larvae of *S. litura* to cause 50% mortality. In contrast, and for exposure time of 48 h post inoculation, only 67 IJs larvae^{-1} to cause 50% mortality.

Efficacy of different concentrations of the Entomopathogenic nematode *Steinernema pakistanense* (NIRCA01 strain) against 3rd larval instars of *Spodoptera litura* under laboratory condition

Nematode Concen trations (IJs/larva)	Mean % mortality of 3rd at different larval instars exposure times		
	24hrs	48hrs	72 hrs
50	21.66±1.67^{d*}	41.67±1.67^{d}	100.00±0.00^{a}
100	25.00±2.88^{d}	55.33±.2.88^{c}	100.00±0.00^{a}
250	43.33±1.67^{c}	85.00±2.88^{b}	100.00±0.00^{a}
500	53.33.±1.67^{b}	100.00±0^{a}	100.00±0.00^{a}
1000	58.33±1.67^{a}	100.00±0^{a}	100.00±0.00^{a}
Control	0^{e}	0^{e}	0^{b}
P value	< 0.001	< 0.001	

* Means within column bearing the same letter are not significantly different (Duncan's test, p > 0.001)

Dead cadaver of *S. litura* infected by *S. pakistanense* (NIRCA01 strain)

III. उत्पाद का सस्योत्तर प्रबंधन

III. Post-Harvest Produce Management

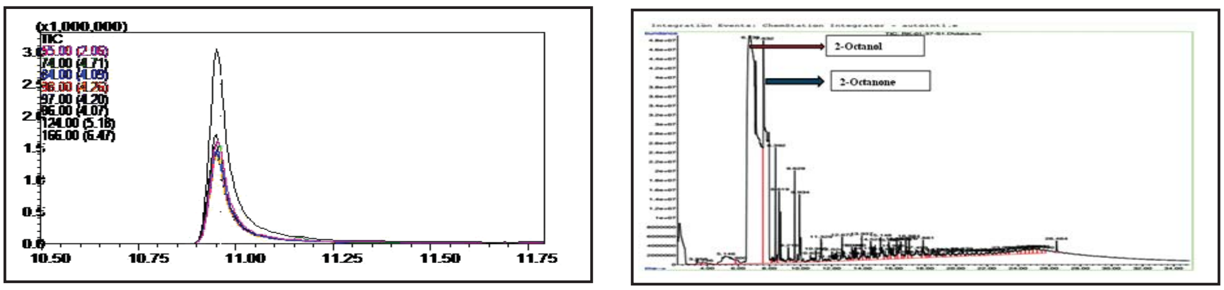
III (i) Assessment of Phyto-chemical profiles in chilli, turmeric, ashwagandha and castor

1. Development of laboratory level methods/ techniques for the extraction of commercially viable bio active compounds of castor oil (PI: Dr. L. K. Prasad)

Fatty Acids Methyl Ester (FAME) method for trans esterification of castor oil was standardized and used for the estimation of ricinoleic acid content in castor oil of purple leaf and green leaf land races. The identification and quantification of ricinoleic acid was achieved by GC-MS. The LOD and LOQ were achieved at 0.005 and 0.0125 mg/L, respectively. The quantified ricinoleic acid content in the purple and green castor seed oil was 2961.6 and 2621.54 μg per mL respectively.

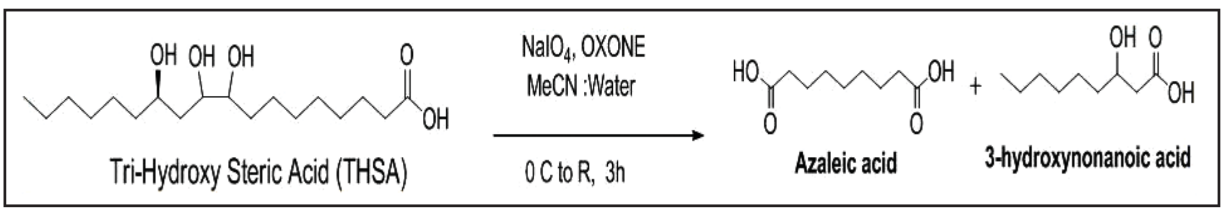
Extraction and synthesis of 2-octanol and 2-octanone were successfully achieved as industrially important bioactive compounds from the ricinoleic acid using Al_2O_3 as catalyst and Cu turnings as promoter, obtained 497.1 and 11.283 μg/g yield respectively which is quantified by GC-MS based robust analytical method and found the process was more effective compared to Pb_2O_3 and red lead as catalysts or promoters.

To identify additional industrially valuable bioactive compounds from castor oil, a novel method was successfully developed for synthesizing Tri-Hydroxy Stearic Acid (THSA) and Azelaic acid from ricinoleic acid using the eco-friendly oxidising agent Oxone and the structure was confirmed by the LC-MS/MS, H^1 and C^{13} NMR.



(a) (b)

GC-MS chromatogram of (a) quantified methyl ricinolate from Purple Leaf Castor and (b) 2 Octanol and 2 Octanone



Synthesis scheme of Azaleic acid from THSA

2. Chemoprofiling of dry chilli by unveiling nutraceutical potential utilizing green chemistry (PI: Dr.Anindita Paul)

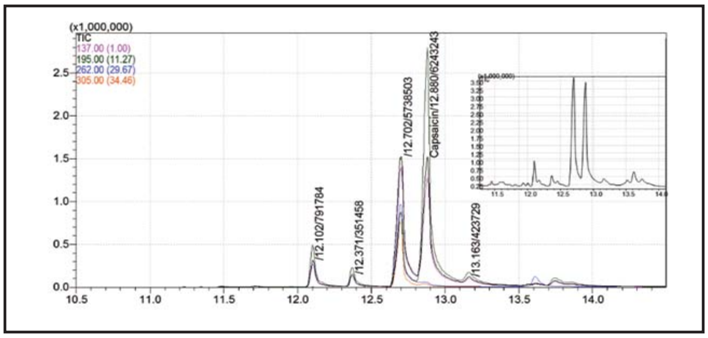
Comparative green extraction techniques in isolating capsaicin and capsanthin

Comparison of extraction techniques of capsaicin done by different approaches, such as ultrasonication and homogenization. Ultrasonication assisted extraction techniques are greener and economic technique than homogenization. Highest capsaicin content recorded in ultrasonication for 15 min (3348 $\mu g\ g^{-1}$) estimated by GC-MS. The ultrasonication (3091-3309 $\mu g g^{-1}$) assisted extraction method yields higher recovery of capsaicin than homogenization (1127-2938 $\mu g g^{-1}$) which is greener technique in terms of less solvent use, energy and time. Hence the extraction efficiency is more economic in case of ultrasonication assisted technique compared to homogenization technique which can be further commercialized.

Hydrodynamic cavitation based green technique showed comparable purity yield of capsanthin (38.14%) in comparison to ultrasonication method.

Nutraceutical based product development of purified capsanthin extract

Purification of capsanthin rich extract done by macroreticular resin having the crosslinking polymer. Technology was developed by optimizing different adsorption parameters followed by elusion of compounds. The pure extract was evaporated to concentrate followed by quantification by LC-MS/MS. The capsanthin rich pure extract was formulated into nutraceutical-based product, thin film-based nutraceutical product from dry chilli showed *in vitro* antioxidant activity of 68.19 % of inhibition which is comparable with the pure capsanthin rich extract.



(a) (b)

(a) Chromatogram of capsaicin identified and capsaicinoids profiling in GC-MS
(b) Thin film-based capsanthin enriched nutraceutical product from chilli

III (ii) Development of efficient protocols for post-harvest processing and storage of high value commercial crops

3. Liquid Petroleum Gas as a Source of Energy Fuel for FCV Tobacco Leaf Curing: In Collaboration with Indian Oil Corporation Limited and M/S Eminent Gas Technologies Pvt Ltd.
(PI: Dr. L. K. Prasad)

The study using LPG as an energy fuel to replace wood completely for curing of rainfed FCV tobacco flue curing trials were conducted to evaluate under three situations i.e. rainfed FCV tobacco based SLS region, irrigated FCV tobacco based NLS region and farmer field during 2024-2025 *rabi* season. LP Gas curing system with sensor-controlled LP gas burner modules designed by the M/S Eminent Gas Technologies

Details of green, cured leaf yield and fuel consumption by LPG barn and Conventional barn in NLS region.

Trail	Flue-curing using gas (kg)		Flue-curing using wood (kg)	
	Green leaf loaded	Cured leaf weight	Green leaf loaded	Cured leaf weight
1	4747 (81.0 %)	950	4290 (80.1 %)	850
2	3700 (82.4 %)	652	3868 (82.5 %)	675
3	4010 (82.8 %)	690	3900 (82.6 %)	678
Mean	**4152**	**764**	**4150**	**734**
	Gas consumption		Wood consumption	
	Total in kg	Per kg cured leaf	Total	Per kg cured leaf
1	404	0.43	3220	3.79
2	425	0.65	2643	3.92
3	352	0.51	2640	3.89
Mean	**414.5**	**0.53**	**2834**	**3.86**

Note: Value in parentheses indicate percentage moisture in green leaf

Pvt Ltd, Mumbai were used by fitting it to the existing barn.

The system was equipped with a recuperator (600 mm diameter x 900 mm length) to facilitate the recirculation of heat to enhance energy efficiency, and a gas flow meter was also installed to get real time gas consumption during the different phases of the curing process. Phase wise observations related to temperature changes and gas consumption were recorded. Green leaf and cured leaf weights were recorded followed by leaf chemical quality analysis.

The lowest gas consumption of 430 g per kg of cured leaf was achieved after continuous upgradation of the LPG curing module with the required modifications and new innovative additions without deviating from the standard curing schedule.

LP Gas curing module with existing FCV tobacco barn at ICAR NIRCA RS, Jeelugumilli and at farmer field.

4. Crop, Water and Post-Harvest Product Management Strategies for enhancing Farm Income and Export potential in Rain fed Ecosystem of Andhra Pradesh (PI: Dr. M. Anuradha)

Evaluation of Different Pre-Harvest Treatments on Chilli Quality

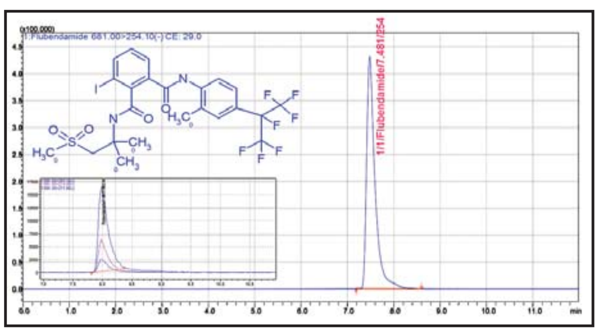
A field experiment was conducted with nine pre-harvest treatments replicated four times at the NIRCA Research Station Farm, Kandukur. Uniform chilli seedlings were planted and grown using the recommended package of practices. The pre-harvest foliar treatments imposed thrice at 10-day intervals from the first flush pod-setting stage. The results indicated that pre-harvest treatments did not influence pod length or diameter across all three harvests. However, the treatments significantly enhanced chilli yield. The highest dry chilli yield was recorded in Potassium nitrate @ 1%, which was on par with Potassium silicate @ 0.2%, Magnesium sulphate @ 1%, Gibberellic acid @ 50 ppm, and Neem oil @ 1%, followed by NAA @ 40 ppm and Calcium chloride @ 0.5%. Regarding quality parameters, Neem oil @ 1% and Gibberellic acid @ 50 ppm showed the highest improvement in total carotenoid content, followed by NAA @ 40 ppm, Potassium nitrate @ 1%, and Magnesium sulphate @ 1%. High capsaicin content was recorded in Calcium chloride @ 0.5%, Gibberellic acid @ 50 ppm, and Potassium nitrate @1%, followed by Magnesium sulphate @ 1%.

Evaluation of Different Storage Methods on Chilli Quality

Ripe chilli pods collected from the field were sun-dried to 10.5 ± 0.55% moisture. The dried pods were subjected to different storage treatments *viz*., gunny bag, polythene cover, zip-lock cover, deep freezer, vacuum sealed, steel container, steel container with desiccant. The initial total carotenoid and capsaicin content were 209.3 ± 10.6 mg/100 g and 2.158 ± 0.11 mg/g, respectively. After 3 months of storage, samples were analysed for moisture content. The moisture content across treatments ranged from 6.69% to 13.35%. The steel container with desiccant recorded the lowest moisture content (6.69%), followed by deep freezer and vacuum-sealed storage, indicating better preservation of quality under low moisture conditions.

5. Pesticide residues in tobacco: Development of analytical methods & monitoring (PI: Dr.Anindita Paul)

Residue Field Trial (RFTs) was conducted with Flubendiamide 480 SC at ((X) recommended dose (2.5 mL per 10L) and (2 X) double the recommended dose (5 mL per 10 L) as per CORESTA guidelines to know the PHI during the



Chromatogram of flubendiamide identified in LC-MS/MS crop season 2024-2025 on FCV tobacco cv. FCR 15. Method standardization was done using technical grade standard of flubendiamide in LC-MS/MS (Shimadzu Ultra-high performance liquid chromatography equipped with Ultra-Fast LCMS-8045 Triple Quadrupole Mass Spectrometer) which is precise having 83.1% recovery with acceptable RSD value of 2% and LOD, LOQ values are 0.04 ng g^{-1} and 0.05 ng g^{-1} respectively. The highest flubendiamide residue (44.84 ppm) at 57 DAP with 2X dose having PHI 13 days and lower-level residue recorded in treatment 5 (sprayed at 54DAP) with X dose. The GRL of flubendiamide is 18 ppm. PHI about 17 days is required for producing FCV tobacco with acceptable levels of flubendiamide residues.

Flubendiamide residue status in tobacco cured leaf for each treatment

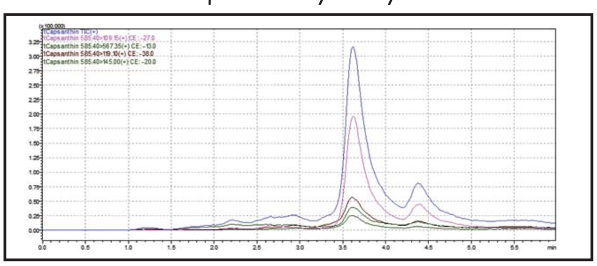
Treatments	Conc. (mg L^{-1})					
	Pick 1	Pick 2	Pick 3	Pick 4	Pick 5	Pick 6
T1 (x)	8.097±0.035	4.527±0.024	0.605±0.008	0.011	0.000	ND
T2 (2x)	17.294±0.017	11.664±0.009	1.392±0.029	0.012	0.000	ND
Control (C1)	ND	ND	ND	ND	ND	ND
T3 (x)	16.958±0.022	3.079±0.011	1.226±0.039	0.000	ND	0.001
T4 (2x)	33.359±0.121	10.010±0.051	2.532±0.210	0.012	0.000	0.004
Control (C2)	0.064±0.012	0.069±0.010	0.071±0.017	ND	ND	ND
T5 (x)	10.286±0.019	2.675±0.011	1.177±0.019	0.000	0.000	0.000
T6 (2x)	24.495±0.130	8.400±0.098	2.894±0.017	0.001	0.000	ND
Control (C3)	0.006±0.001	ND	ND	ND	ND	ND
T7 (x)	16.432±0.099	6.172±0.023	0.648±0.094	0.350±0.009	0.000	0.000
T8 (2x)	35.323±0.064	12.983±0.199	1.283±0.083	0.015±0.002	0.000	ND
Control (C4)	ND	ND	ND	ND	ND	ND
T9 (x)	12.738±0.029	6.364±0.570	0.829±0.039	0.011±0.001	0.000	ND
T10 (2x)	25.564±0.892	10.223±0.036	1.520±0.356	0.013±0.004	0.000	0.000
Control (C5)	ND	ND	ND	ND	ND	ND
T11 (x)	22.968±0.098	7.746±0.928	0.849±0.062	0.450±0.019	0.000	ND
T12 (2x)	44.842±0.158	17.146±0.629	1.120±0.298	0.671±0.009	0.000	ND
Control (C6)	ND	0.017±0.023	0.005±0.009	ND	ND	ND
T13 (x)	11.450±0.298	6.135±0.92	1.283±0.002	0.013±0.001	0.000	0.001
T14 (2x)	27.889±0.892	14.144±0.37	2.254±0.088	0.017±0.002	0.000	ND
Control (C7)	0.038±0.013	0.006±0.029	0.070±0.028	ND	ND	ND

III (iii) Value addition in chilli, turmeric, ashwagandha and castor through product diversification

6. Sustainable waste utilization of chilli pedicel in quest of nutraceutical-based product (External funded project CSIR-EMR) (PI: Dr. Anindita Paul)

Among four different method NaOH assisted extraction technique and hydrodynamic cavitation based green technique followed for cellulose extraction from chilli pedicle (LCA 643) was proved as best method (28.76%). The quality of cellulose sheet is firm and rigid using NaOH based method.

Acetonitrile based extract is promising in extracting cryptoxanthin from chilli pedicle (purity



(a) LC-MS/MS chromatogram of cryptoxanthin enriched extract

(b) Cellulose sheet derived from chilli pedicle

6.9%). The resin purified ethanolic extract and cellulose sheet having more antioxidant activity than crude extract i.e. 90.80% and 89.86%. Bioavailability of cryptoxanthin rich ethyl acetate extract is achieved upto 1.29%.

7. Product Diversification and Value Addition in Turmeric and Ashwagandha (PI: Dr. K. Suman Kalyani)

The novel value-added (food, therapeutic and nutraceutical) products were developed by following a systematic, multi-phase process based on a research-driven scientific approach. Critical steps followed were ingredient selection, product formulation, processing methods, prototype development and testing, product optimization and scale-up, nutritional analysis, pesticide residue testing, quality control, safety evaluation, microbiological assessment, sensory analysis, packaging design, and consumer acceptance studies.

Based on quality and functional attributes, Lambasingi turmeric was identified as a suitable variety due to its high curcumin content (6.8%), superior flavor profile, and intense color characteristics. Similarly, Jawahar Ashwagandha (JA-20) was selected for the development of value-added products owing to its withanolide content of 0.3%, making it suitable for food and nutraceutical applications. Proximate analysis and nutritional profiling following AOAC/FAO standard methods were undertaken to ensure accuracy and reliability. Pesticide residue analyses were conducted for all raw materials, confirming their compliance with food safety standards.

Sensory evaluation indicated a mean consumer acceptance score of >7.2/9, demonstrating good acceptability. Shelf-life studies established a product stability of >3 months under ambient storage conditions. These products have been submitted for FSSAI licensing under the Proprietary Food category.

Food, Therapeutic and Nutraceutical Products

Product Name	Key Ingredients	Product Form	Functional Benefits	Target Audience	Shelf Life (Months)
Curcumin - Beverage Mix License was issued by FSSAI.	Curcumin Extract, Ginger, Pepper, Cinnamon, Cardamom, Sweetener	Powder Mix	Detox, Immune Boost, Anti- inflammatory	Wellness Seekers, Employees	12-18
Ashwagandha Multigrain Biscuits	Wheat flour, Butter, Ashwagandha, Essence, Milk Powder	Snack Item	Regulates metabolism, Overall health	Consumers of all age groups	6-8
Ashwagandha Herbal Tea Bags	Green Tea Leaves, Turmeric, Ginger, Cinnamon, Rose Petals, Tulasi, Mint etc,	Herbal Tea Bags	Antioxidant, Metabolism Boosters, Detox, Gut Health	Tea users, Health-Conscious Consumers	12-18
Turmeric Oatmeal Protein Enriched Bars	Oats, Turmeric, Honey, Peanut Butter, Milk Powder/ Whey Protein	Snack Bars	Satiety, Energy Anti- inflammatory	Atheletes, Prd, Professionals, Youth	6-9
Turmeric Capsules	Turmeric Powder, Piperine & Amla	Nutraceutical Capsules	Inflammation, Joint health, dietary supplement free radical scavenging	Health-Conscious adults	24
Ashwagandha Capsules	Ashwagandha Powder, Piperine, Amla	Powder or extract inserted into capsules	Reduces stress and anxiety Enhances overall health	Health-Conscious adults	8-10

Ashwagandha Biscuits

Ashwagandha biscuits are a functional food/ health supplement (FSSAI, Schedule VI), featuring *Withania somnifera* for adaptogenic benefits. The product uses high-quality wheat flour, sugar, butter, and Ashwagandha powder (<10% moisture, milled to 100–200 ìm). Dry ingredients are mixed, then combined with creamed fat and sugar; milk or water is added to form dough, which is baked at 160–180°C for 40 minutes. Finished biscuits have <5% moisture and are packed in laminated pouches. They meet safety standards and support vitality and stress reduction. Nutritional profile per 100 g: 3% moisture, 12.66% protein, 1% ash, 2.91% fiber, 450 Kcal, 0.2% withanolides, plus Vitamin C & D, Zinc (1.61 mg), Calcium (72.43 mg), and Iron (0.6 mg).

NIRCA Nutri Powder

NIRCA Nutri Powder is a high-protein functional supplement made from ground nuts, greengram, wheat, milk powder, turmeric, and Ashwagandha. Raw materials were separately cleaned, roasted, milled, and blended in optimized ratios for nutritional balance and uniformity, then packed under low humidity. The powder passed proximate composition, microbiological, and sensory tests to meet food safety standards. It provides plant-based protein, carbohydrates, healthy fats, anti-inflammatory turmeric, and key micronutrients: 3% moisture, 12.36% protein, 1% ash, 6.32% fiber, 420 Kcal per 100 g, plus Vitamin C & D, Zinc (2.6 mg), Calcium (56.35 mg), Iron (5.4 mg), curcuminoids (0.3%) and withanolides (0.2%).

Turmeric Oatmeal Protein Bars

Turmeric Oatmeal Protein Bars are designed as a functional snack combining oats, protein sources, peanut butter, and turmeric for added health benefits. The recipe includes rolled oats (40%), peanut/almond butter (15%), whey/milk powder (15%), honey or jaggery syrup (10%), turmeric powder (2–3%), seeds or cranberries (12%), milk/ghee (4%), and flavoring agents. Ingredients are blended, pressed into bar molds, then set at room temperature or baked lightly at 120–130°C for 10–15 minutes. Once cooled, bars are cut and packed in moisture-proof wrappers. Nutrient analysis is currently pending.

8. Development of Value-Added Products through Product Diversification in Chilli (PI: Dr. K. Suman Kalyani)

Chilli chocolate is a novel value-added product developed by ICAR-NIRCA incorporating controlled levels of chilli powder into dark chocolate to enhance sensory appeal and functional properties. The product combines the bioactive compounds of chilli, particularly capsaicinoids, with cocoa polyphenols, offering a unique flavour profile along with potential health benefits. Standardized processing protocols were optimized with respect to chilli variety, particle size, incorporation level and tempering conditions to ensure uniform distribution, desirable pungency and consumer acceptability.

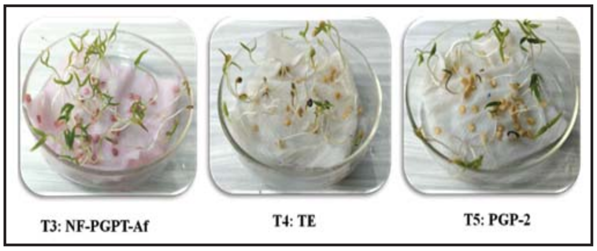
Sensory evaluation indicated that low to moderate levels of chilli incorporation resulted in significantly higher scores for taste, flavour and overall acceptability. The developed chilli-flavoured dark chocolate exhibited good shelf stability under ambient storage conditions and was found suitable for commercialization as a niche functional confectionery product.

9. Microbes based technological intervention for growth, yield, quality improvement and disease suppression in chilli under Terai argon-ecological region of West Bengal, India (PI: Dr. Namita Das Saha)

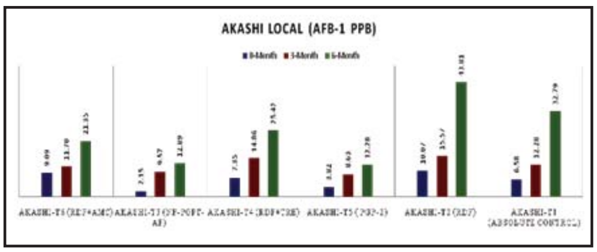
Study on PGPR potential for Aflatoxin suppression in red chilli

During 2024-25 field experiment using indigenous PGPR formulations and other bio-fertilizer with six treatments with two chilli varieties (High yielding variety and Local: Akashi) was conducted to study the effect in terms of growth, yield, quality parameters of red chilli. PGP-2 (indigenously isolated *Pseudomonas sp)* based green formulation applied as chilli seed priming, chilli seedling root dip, soil and foliar spray at different crop stages (*PGP-2 indigenous and in vogue commercial; Arka Microbial Consortia-AMC*) and checked for aflatoxin suppression potential during post-harvest condition of dried red chilli.

Aflatoxin growth analysis was done for stored samples of red chilli varieties/hybrids with respective treatments. The RDF-treated samples consistently had the highest Aflatoxin B1 (AFB1) levels at every interval. All treatments showed a sharp increase in AFB1 concentration after 3 and then 6 months of storage. Akashi persistently contained lesser aflatoxin than Hi-Veg Eagle variety even after 6 months of storage reflecting about varietal influence. NF-PGPT-Af performed maximum suppression. The RDF + NF-PGPT-Af and RDF + PGP-2 showed maximum pericarp thickness in both varieties, reflecting the beneficial role of microbial consortia in enhancing cell wall deposition and fruit firmness. Absolute control and RDF showed lowest pericarp thickness, suggesting that nutrient and bioinoculant synergy is essential for optimum pericarp development.



a. Chilli seed priming with PGP based product and other treatments



b. Temporal dynamics of Aflatoxin-B1 in 'Akashi Local' as influenced by different treatments.

10. Climate resilient technological interventions for enhancing nutraceuticals and other commercial traits for enhancing net income from turmeric (PI: Dr. Namita Das Saha)

Rice husk ash based engineered functional organic nutrient supplement for yield and quality enhancement in Turmeric

A new potassium-enriched organic nutrient supplement, Rice husk ash-K-Functional (RHA-K), was developed from rice husk ash and waste mica using potassium-solubilizing microorganisms. RHA-K combined with the recommended fertilizer dose (100% N, 100 P, 75% K) significantly improved turmeric yield and quality, with *Pundibari Local-2* showing the highest rhizome weight (up to 1.33 kg) and enhanced color (TRI=0.55). GC–MS and FT-IR analyses revealed unique and shared compounds, indicating quality improvements. The study demonstrates that RHA-K is an effective, sustainable option for boosting turmeric production in West Bengal.

Cross section of turmeric rhizome and visual depiction of color differences in *Pundibari local-2 (A) Megha (B) and Lakadong (C)* varieties as influenced by different new general soil amendments.

IV. Extension and Market Intelligence

IV (i) Development of profitable value chains for commercial crops

1. Value Chain Analysis of High-Value Commercial Crops (PI: Mr. K. Viswanatha Reddy)

Dynamics of Indian turmeric exports

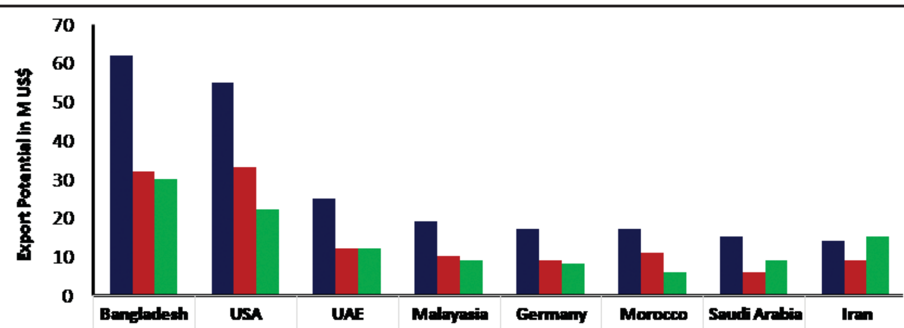
The value of turmeric exports and spices exports increased from ₹ 744 crore and ₹ 14899 crore in 2014-15 to 2885 crore and ₹ 39994 crore in 2024-25. Thus, there is a 288% increase in turmeric export revenue, while in spices, it increased by 168% during the corresponding period. This indicates the demand for turmeric is growing faster than the demand for spices in international markets.

Export Potential of Indian Turmeric:

- Export markets with the greatest potential for India's exports are Bangladesh, the USA, UAE, Malaysia and Germany and Morocco, which account for >80% of India's turmeric exports.
- Based on the economic model, demand for turmeric showed that the markets with the greatest potential for turmeric exports are Bangladesh, the USA and the UAE.
- Bangladesh shows the largest absolute difference between potential and baseline exports in value terms, leaving room to realise additional exports worth 30 million USD, representing unrealised export potential.
- India has the closest export links and ease of trade with Nepal, Bangladesh, UAE, as indicated by the thickness of the lines, which indicates there is a scope to increase the turmeric trade with Bangladesh and the UAE, as these are the major trading partners of India.
- The untapped potential in turmeric exports is nearly 111 million USD (an additional ₹ 997 crores) of exchange earnings.

Projected export demand for Indian turmeric

- Rising global demand for turmeric and turmeric products (functional foods, nutraceuticals, ayurveda, pharmaceutical industry and dietary supplements), the export demand is projected in two possible scenarios based on CAGR from 2025 to 2030.
- Given uncertainties such as changes in tariff rates, trade policies, exchange rates, SPS, quality certification and geopolitical situations, a realistic range could be ~2.80 lakh tons and value of ~5000 crore of exchange revenue.



	Bangladesh	USA	UAE	Malayasia	Germany	Morocco	Saudi Arabia	Iran
Export potential	62	55	25	19	17	17	15	14
Actual exports	32	33	12	10	9	11	6	9
Untapped potential	30	22	12	9	8	6	9	15

Growth scenario	Present scenario 2025	Forecasted scenario 2030
Export volume: moderate growth rate @ 4%/annum	1.76 lakh tons	2.14 lakh tons
Optimistic growth rate @ 7 %/annum	1.76 lakh tons	3.12 lakh tons
Export price (Rs/kg) growth rate @ 4%/annum	164	176
Given uncertainties, a realistic mid-range could be ~2.80 lakh tons		

2. Comprehensive Assessment of the Cost of Cultivation of FCV Tobacco in the KLS Region of Karnataka (PI: Mr. K. Viswanatha Reddy)

In the cost of cultivation of FCV tobacco in the KLS region, the major costs were the cost of labour, the cost of material inputs, and the fuelwood cost. The average cost of cultivation/ha in Karnataka was ₹ 226704/ha during 2024-25; however, it depicted variations across different productivity regions, with the KLS region.

The income realised in low, medium and high productivity regions was ₹ 101843/ha, ₹ 133405/ ha and ₹ 182196/ha, respectively. The average net income in KLS regions was ₹ 139148/ha. In the KLS region, the share of labour cost was high (>40%), followed by the share of material input cost (>20%), and the share of fuel cost (>15%) during 2024-25. Among material input costs, the sulphate of potash (28%) and seedling costs (27%) were the major cost components. In terms of the labour costs, harvesting and post-harvest operations were the major cost components, which account for 57% of labour costs.

Policy implications

- Labour-saving farm mechanisation is immensely needed in both field operations in production and harvesting, and post-harvesting processing.
- Supply of fertiliser, particularly SOP, at subsidised rates to the farmers in the KLS region.
- Energy-saving interventions are needed to reduce wood consumption and adverse effects on the environment by developing environment-smart sources for post-harvest operations.
- Technological and policy interventions are needed to reduce the cost of cultivation, augment farmers' income and sustain FCV tobacco in the KLS region of Karnataka in the long run.

Cost of cultivation, productivity, prices and income realised in FCV tobacco low, medium and high productivity regions in Karnataka during 2024-25

Particulars	Low Productivity Region	Medium Productivity Region	High Productivity Region	KLS region
Gross income (Rs/ ha)	313332	355048	429176	365852
Cost of cultivation* (Rs/ ha)	211489	221643	246980	226704
Net Income (Rs/ha)	101843	133405	182196	139148
Cost of production (Rs/kg)	170	161	149	160
Profitability (Rs/kg)	82	97	110	96

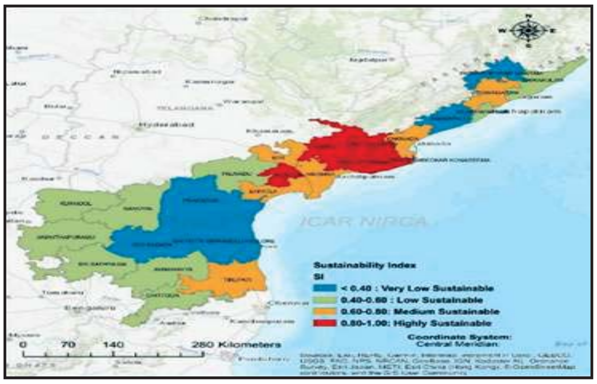
**Excluding the rental value of land and the imputed value of family labour*

3. District-Level Analysis of Agricultural Sustainability in Andhra Pradesh (PI: Mr. K. Viswanatha Reddy)

Diverse agro-climatic conditions of Andhra Pradesh, from the fertile coastal deltas to the drought-prone Rayalaseema region had undergone recent administrative reorganisation into 26 districts. This study is important as it aligns with several UN-SDGs, such as SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 6 (Clean Water), SDG 12 (Sustainable Consumption and Production), and SDG 13 (Climate Action), through examining agricultural indicators through an SDG-aligned framework. A study was taken up to analyse agricultural sustainability at the disaggregated level in Andhra Pradesh.

- The study reveals that there is a wide variation in the ecological security index, economic efficiency indicators, and social equity dimensions, which reflect the degree of agricultural sustainability across the districts in Andhra Pradesh.
- The districts such as East Godavari, Eluru, Konaseema, West Godavari, and Guntur are highly sustainable (SLSI :>0.80).
- The districts such as Vizianagaram, Tirupathi, Krishna, NTR, Kakinada, and Bapatla are moderately sustainable (SLSI: 0.60-0.79).
- The districts such as Palnadu, Nandhyal, Sri Satyasai, Vizag, Kurnool, Chittoor, Srikakulam, Annamayya, and Ananthapuram are low sustainable (SLSI:0.40-0.59).

- The districts such as A.S.R., Prakasam, Cuddapah, Anakapalli, Nellore and Parvathipuram are very low sustainable (SLSI: <0.40).



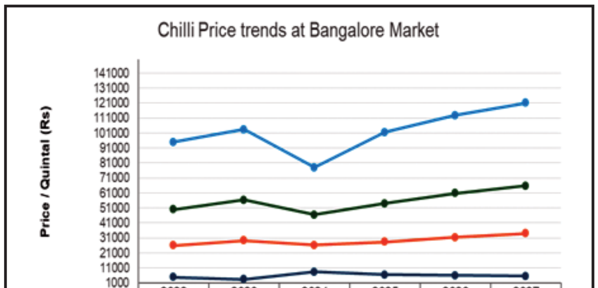
The policy implications are

- SLSI indices at the district level act as an instrument for preparing decentralised agricultural plans for the sustainable development of agriculture in Andhra Pradesh.
- SLSI indices help in the holistic diagnosis of sustainable livelihood systems, designing targeted sustainable policies.
- Serve as monitoring and evaluation tools for fostering integration of economic, social, and ecological dimensions and aid in achieving SDGs related to agriculture and rural development.

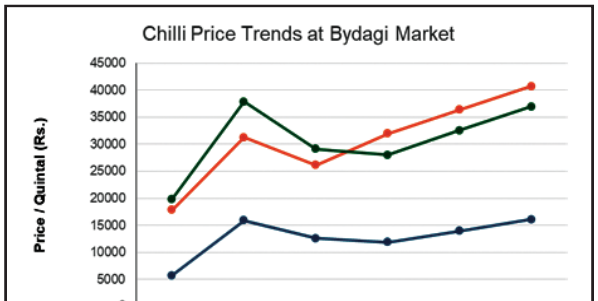
IV(iii) Development of market intelligence-based ICT models for efficient marketing and profit making

4. Data Driven Decision Making on High Value Commercial Crops (PI: Dr. H. Ravisankar)

The main objective of this project is to create a database of high value commercial crops and develop software for forecasting prices of the red chilli using Machine learning and Deep learning algorithms. Variety-wise dry chilli data for a period of 24 years (monthly) for Karnataka (7 varieties) and Guntur (4 varieties) was collected (2000-2024), pre-processed and created a database. The price forecasting model was developed using open-source machine learning algorithms including ARIMA, PROPHET, ETS, and LSM. Of these, the Prophet model demonstrated the highest accuracy, aided by integrating SARIMAX and Light GBM libraries, which improved dataset consistency and multi-variable forecasting. The model achieved mean forecasting accuracy of up to 98% for Bangalore Market, 95.8% for Byadgi Market, and 98.2% for Guntur Market.



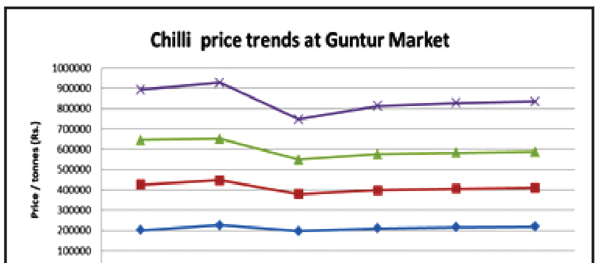
	2022	2023	2024	2025	2026	2027
Byadgi_V	44792	46977	31391	47587	52073	55145
Guntur_V	24068	27074	20338	25630	29230	31916
Mankattu_V	21167	25828	17857	21897	25523	28307
Local_V	4810	3528	8334	6442	6026	5671



	2022	2023	2024	2025	2026	2027
Guntur_V	5725	15875	12594	11881	13961	16081
Dabbi_V	17815	31250	26163	31941	36373	40727
Kaddi	19869	37866	29137	28023	32537	36927

Chilli market analysis in Guntur and Karnataka

In the Bangalore Market, the price of the Byadgi variety is elevated in comparison to the other three varieties, and there is a slight decline in prices observed in 2024. Conversely, the price of the Local variety has been decreasing since 2025. In the Byadgi market, the Kaddi variety commands a high price when compared to the other two varieties. Prices were high in 2023, with a minor decrease noted in 2024. In the Guntur Market, the BYD-335 variety exhibits the highest

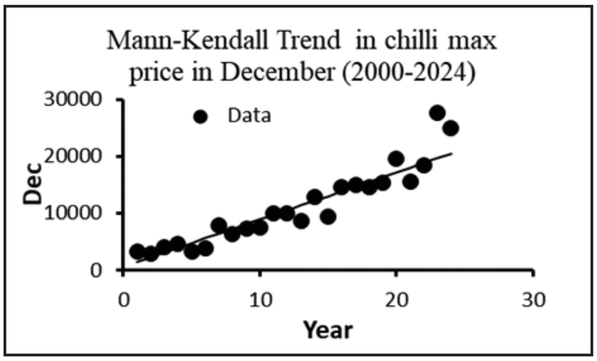


	2022	2023	2024	2025	2026	2027
BYD-335	247568	276950	198465	237053	244258	248552
G-274	221338	203711	169426	177844	178487	177766
LCA-334	223795	221366	181965	187798	190014	190516
Teja	201210	226256	197461	210003	215171	218455

price relative to the other three varieties, with a slight downward trend observed in both 2023 and 2024. Guntur market has high market price, when compared to Karnataka market.

Trend analysis of chilli price

Monthly trend in maximum price of chilli at Bangalore market over a period of 24 years was analysed using Mann-Kendall non-parametric software tool and it was found that there was a significantly increasing trend (S) in chilli max price over the years and in the magnitude of change (Q) in price. The maximum chilli price was highest in the month of December.



5. Development of AI Based Mobile Advisor for Diagnosis of Diseases in Tobacco and Adaption of Suitable Measures to improve the Precision (PI: Dr. H. Ravisankar)

The aim of this project is to develop a mobile application based on Android for the identification of FCV tobacco diseases in both field and nursery settings, utilizing Deep Learning algorithms and Natural Language Processing techniques.

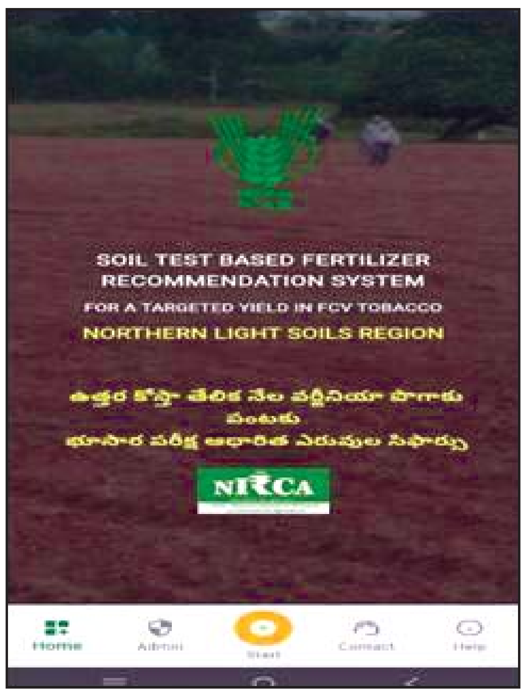
Digital images of tobacco diseases are collected from both the field and nursery. These images are categorized into Stage 1 and Stage 2, with a total of 1000 images for each disease. The image dataset includes details on Leaf Blight and Damping Off in the nursery, along with Tobacco Mosaic Virus, Leaf Curl, Brown Spot, Black Shank, and Frog Eye Spot in field crops.

With this dataset, a digital library of tobacco diseases has been created using HTML, CSS and JavaScript. The pre-processing of the collected images is currently ongoing, which is viewed as a basic input for the application development utilizing Vision and Swin Transformers technology with Python. Budget sanctioned for this project is ₹ 31,75,106/-

Softwares and Mobile apps developed

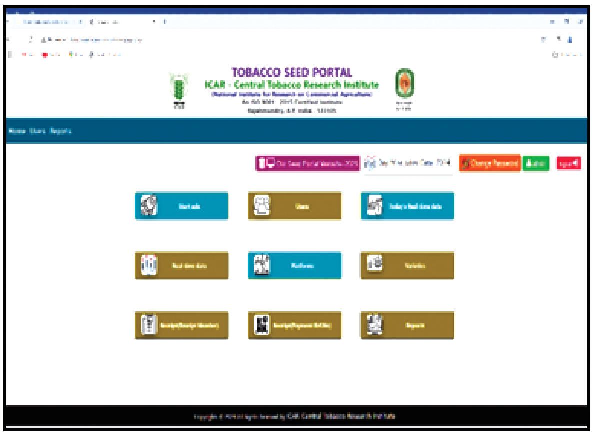
A bilingual static mobile application, built on the Android platform, has been developed to provide fertilizer recommendations based on soil testing, tailored to the anticipated target yield in the northern light soil regions of Andhra Pradesh (in English and Telugu) and the light soil regions of Karnataka (in English and Kannada). Farmers from a specific agro-climatic region can access fertilizer recommendations for their fields by utilizing soil test values aimed at achieving the desired yield target for FCV tobacco, while also ensuring balanced nutrition and improved soil health.FCV tobacco farmers can select their desired yield target based on their field's potential and can generate reports. This mobile application was created using Android Studio, leveraging the Flutter framework and the Dart programming language. It represents a customized software solution for FCV tobacco farmers.

NLS mobile App URL: https://play.google.com/store/apps/details?id=com.nirca.nls&hl=en_IN
KLS mobile App URL: https://play.google.com/store/apps/details?id=com.nirca.kls.



Innovative Decision Support System for sustainable Tobacco Seed Delivery

The 'Tobacco Seed Portal', redesigned by ICAR-NIRCA, streamlines tobacco seed distribution across regions with new features for faster service. This web-based PhP and MySQL platform (tobaccoseed.in) enabled digital payment and real-time sales monitoring, supplying ten FCV and four Non-FCV seed varieties to about 28,000 farmers and generating approximately ₹ 2.53 crores in the 2025 season.



Tobacco Seed Portal

Chatbot on Chemical Compatibility

Developed with Python and FLASK, this tool offers quick access to detailed compatibility information for insecticides and fungicides via QR codes, online links, and WhatsApp—free on mobile devices. It helps farmers and agricultural professionals decide whether to mix agrochemicals, saving costs and improving efficiency. The tool was launched during RAC-2025 at ICAR-NIRCA, Rajahmundry.

IV (iv) Frontline extension for technology transfer, fostering linkages and capacity building for stakeholders

6. A study to explore post harvest management opportunities for enhancing profitability in identified high value commercial crops (PI: Dr. Y. Subbaiah)

The study used an ex-post facto design with both primary and secondary data from 360 participants (240 farmers, 60 traders, 60 scientists and officials). Stakeholder preferences for value-added products in turmeric included dried fingers, powder, rhizome slices, curcumin, oleoresins, jaggery, milk, capsules, soap, and body cream. For chillies, desired products were whole chilli, red and green powders, aromatic powder, paste, flakes, seed (antioxidants), pulp (oleoresin), capsaicin, and capsanthin. Preferred export determinants for turmeric were robust rhizomes (5-6 cm), straight shape, dark lemon yellow color, texture, cleanliness, and packing; for chillies, key factors included pungency (22000–25000 SHU capsaicin), bright color (50-55 ASTA capsanthin), medium-long size (8-10 cm), thin pericarp, low seed-to-fruit ratio, cleanliness, quality processing, and packing. Feasibility analysis for strategic linkages was also conducted as indicated by traders and scientists.

Distribution of farmers according to their adoption level

Over half of turmeric (52%) and chilli (57%) growers had medium technology adoption; 26% and 31% reported high adoption, and 22% and 12% showed low adoption, respectively. No correlation was found in turmeric adoption rankings across regions, while a correlation existed for chilli. Adoption was positively linked to area under crop, knowledge, and land holding. Farmers cited price volatility, labour scarcity, and high labour costs as major constraints.

The interventions identified aim to leverage available opportunities to enhance value addition and exports. These measures include:

- Utilisation of quality traits, export determinants, and advanced packing and branding technologies.
- Implementation of best practice packages and provision of high-quality inputs.
- Classification of farmer groups, gap mapping, and capacity building for stakeholders.

- Value addition tailored to the preferences of middle-class consumers.
- Promotion of Farmer Producer Organisations (FPOs) and farm gate processing.
- Establishment of product-specific entrepreneur models.
- Formation of business consortia for small traders.
- Development of incubation centres for turmeric and chillies.
- On-farm value addition, creation of value-added products, and long-term transfer of technology (TOT) through strengthened linkages.

7. A critical analysis of farmer producer organizations for entrepreneurship in commercial crops (PI: Dr. B. Hema)

To evaluate the entrepreneurial competencies of FPOs, the present study was conducted in Guntur district of Andhra Pradesh and purposive sampling was used in selection of FPOs and random sampling procedure was used for respondent's selection. The turmeric component covered 10 FPOs with 15 respondents each, resulting in a total sample size of 150. For chilli, 15 FPOs were selected with 10 respondents each, constituting a sample size of 150 constituting 300 total sample size.

Developed a robust, indicator-based Entrepreneurial Competency Index (ECI) covering six dimensions *viz.*, technical, operational, financial, marketing, networking, & social and scientifically assessed the competency levels of 25 FPOs (10 turmeric and 15 chilli) in Guntur district of Andhra Pradesh using weighted scoring method.

The overall Entrepreneurial Competency Index (ECI) of chilli-based FPOs indicates a predominantly high level of competence, with 60% (9 FPOs) scoring within the High Competence (413.6) range (376–500). This reflects the strong entrepreneurial orientation and managerial efficiency of chilli FPOs, particularly in Guntur district, where organized market infrastructure, collective procurement, and exposure to export-oriented trade have fostered better performance in technical, financial, marketing, and operational dimensions.

Table: Weighted Descriptive Statistics of Entrepreneurial Indicators

Competency Dimension	Mean	Weighted Mean	SD	CV (%)	Rank
Technical	22.5	90.0	1.9	8.4	I
Operational	21.8	87.2	2.3	10.6	II
Marketing	21.4	85.6	2.5	11.7	III
Financial	20.2	80.8	3.0	14.9	IV
Networking	17.8	35.6	2.9	16.3	V
Social	17.2	34.4	2.7	15.7	VI
Overall ECI		413.6 '! High			

8. NABARD Sponsored Project: Strengthening Chilli Farm Sector through Innovative Drying Interventions (PI: Dr. B. Hema)

A participatory extension approach was adopted in implementing two major capacity-building and technology demonstration programmes, which significantly enhanced farmer awareness, skill developent, and promotion of energy-efficient drying technologies in the chilli value chain. Farmers were actively involved at all stages of the intervention, including identification of training needs, interactive learning during training sessions, hands-on participation in technology demonstrations, and feedback-based evaluation through pre- and post-training assessments, making the programmes demand-driven and context-specific. This approach led to a marked improvement in farmers' technical understanding of scientific chilli drying, post-harvest quality management, and value-addition practices, and strengthened their confidence and readiness to adopt improved drying technologies.

9. NABARD Sponsored Project: Bolstering of turmeric farmers through innovative post-harvest processing in Turmeric (PI: Dr. L.K. Prasad)

A participatory extension approach was used to implement two capacity-building and technology demonstration programs, improving farmer awareness and skills in energy-efficient turmeric drying. Farmers contributed to training needs, participated actively, and evaluated sessions, making the programs responsive and relevant. This method enhanced farmers' technical knowledge in scientific drying, quality management, and value addition, boosting their confidence to adopt improved technologies.

मूल्यांकित, निरूपित एवं हस्तांतरित प्रौद्योगिकी
Technology Assessed and Transferred

The institute systematically assesses and promotes innovative technologies to facilitate their effective adoption at the farm level and to strengthen extension delivery systems. Key interventions include On-Farm Trials (OFTs), Front Line Demonstrations (FLDs), field visits, farmer–scientist interface programmes, field friends' initiatives, and structured capacity-building programmes for farmers and stakeholders. These efforts enable field-level validation of technologies and support their wider dissemination across farming communities. To enhance visibility and outreach, the institute regularly organizes and participates in exhibitions, field days, Kisan Melas, and other awareness programmes, thereby showcasing proven technologies and best practices. The institute also provides timely contingency advisories during droughts, floods, cyclones, and other climatic adversities through expert teams, print and electronic media, digital platforms, social media channels, and its official website. Additionally, through inclusive welfare programmes such as SCSP and TSP, the institute extends critical farm inputs and need-based support to farmers in different regions. The details of technology dissemination activities undertaken during 2025 are presented below.

Technology Recommendations:

- A new locally systemic suckericide, SUCKERSTOP™ was synthesized and its application @ 20 to 25 ml per litre before bud initiation/emergence (around 95% in controlling the growth of suckers) was recommended in FCV and Burley tobacco for effective sucker control.
- Application of nano-biocapsules along with 100% recommended dose of fertilizers (RDF) and 7.5 t/ha farmyard manure (FYM) in KLS and application of nano-biocapsules along with 100% RDF and 3.5 t/ha complemented by sunnhemp incorporation during *kharif* season, in NLS was recommended to enhance soil health sustainably and ensure better economic returns to the farmer.
- Pre plant application of Sulfentrazone 39.6% SC @ 0.25 kg a.i/ha, 3 days before transplanting reduced weed density and weed dry weight with highest weed control efficiency was recommended to Northern light soils of A.P and Karnataka light soil grown FCV tobacco.
- An adhoc recommendation that a Pre-Harvest Interval (PHI) of 17 days is required after flubendiamide pesticide application was given to the farming community through Tobacco Board for safer production of tobacco with acceptable levels of flubendiamide. FCV growing farmers can be benefited by scheduling the harvests as per the waiting period for production of safer tobacco.

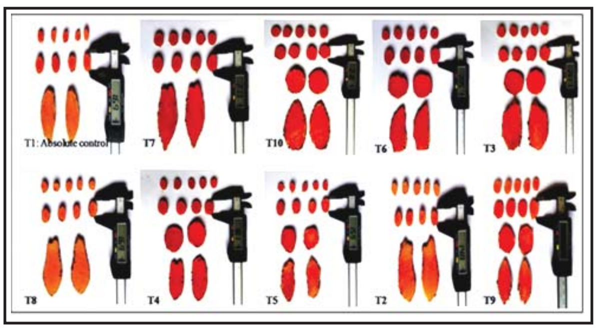
On-Farm Trials / Front Line Demonstrations

1. Entry FCR 63 was identified as a promising line from AINPT trials and thus on-farm trials were conducted in five locations in Southern light soils along with CTRI Shresta and Siri. FCR 63 recorded a higher mean cured leaf yield (2600 kg/ha) than CTRI Shresta (2400 kg/ha) and Siri (2200 kg/ha). FCR 63 has shown desirable traits like a greater number of leaves (up to 40), early plant vigour and higher bright leaf compared to popular varieties (CTRI Shresta and Siri).

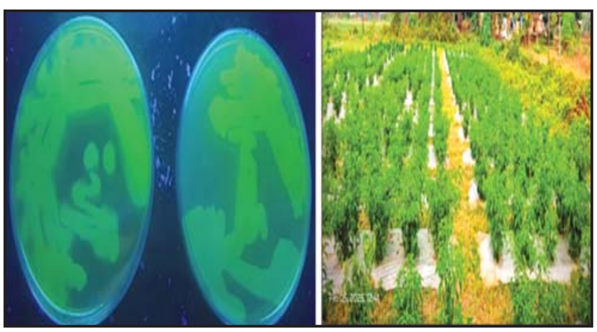
Field view of FCR 63

2. In AINPT trial of *Rustica* tobacco, 3 entries in IVT, 2 entries in AVT-I , 3 entries in AVT-II were evaluated at ICAR-NIRCA RS Dinhata. In Chewing tobacco, 2 entries were evaluated in IVT trial.

3. Rice husk ash based potassium enriched functional organic nutrient supplement (RHA-K-FOF) was developed and tested at ICAR-NIRCA RS Dinhata in turmeric crop for quality and yield attributes enhancement.



4. Indigenous Plant growth promoting (PGP) was isolated and tested at ICAR-NIRCA RS Dinhata in Chilli crop for suppression of aflatoxin contamination potential.



5. Two FLDs on Chewing tobacco variety "Yasini" was conducted in tobacco farmer's field at Muthunayakan patty and Sathyanathapuram at Vedasandur, Tamil Nadu.

6. Initiated trials on LPG based FCV tobacco curing at ICAR NIRCA RS, Jeelugumilli and conducted a field day on 31.05.25.

7. Initiated field trials on effect of biodegradable mulches on yield and quality of FCV tobacco.

8. Front Line Demonstrations were conducted on high yielding variety FCJ 11 (Naveena) at 10 sites in Northern Light Soil zone of Andhra Pradesh.

9. Front Line Demonstrations were conducted on efficacy of new suckericide, Suckerstop and conducted a Field Day on 25.2.25.

10. Two demonstrations were conducted on Chilli heat pump dryer on 24.09.2025 and 15.12.2025 at ICAR-NIRCA BSR Farm, Katheru.

11. Two demonstrations were conducted on Turmeric processor on 27.10.2025 and 19.12.2025 at ICAR-NIRCA BSR Farm, Katheru.

12. Two On-farm Field Trials (OFT) were conducted for FCHH-2 in two villages (Hadya in Peryapattana and Somanahally in Hunsur.

13. Field demonstration of Bio-enriched coco-peat for root knot nematode management was conducted at Kergalkopal, Hunsur on 25.04.2025.

14. Demonstration on Green tech nursery (Tray) technology was conducted at Angatahally, Hunsur on 22.04.2025.

15. Two Frontline Demonstrations (FLD) on FCH 2 (CTRI Navya) were conducted in two villages namely Mantikoppalu village on 25.6.2025 and 28.06.2025 at Agarnahalli village at Hunsur, Karnataka.

FCH 2 (CTRI Navya)

16. Field demonstration on plant position grading in FCV tobacco was conducted at Thiplapura, Hunsur on 15.07.2025.

17. Demonstration of Suckerstop, a new generation sucker control technology in FCV tobacco was conducted at Harve village, Hunsur on 19.08.2025.

संस्थान प्रौद्योगिकी प्रबंधन इकाई
INSTITUTE TECHNOLOGY MANAGEMENT UNIT

The Institute Technology Management Unit is a decentralized, three-tier IP management mechanism that is institutionalized in the ICAR – National Institute for Research on Commercial Agriculture and involved in intellectual property management and the technology transfer and commercialization of agricultural technologies. The unit is engaged in IPR filing (patents, plant variety rights, copyrights, trademarks, etc.), technology commercialization, MoUs with research organisations and industries creating awareness about IPRs.

Research Collaborations and Functional Industry-Institutional linkages

ICAR-NIRCA has signed a total of twelve Memoranda of Understandings (MoUs) viz., comprising two with Syngenta India Pvt Ltd and one each with Blue Door Global Solution, Hyderabad; GPI Ltd., Guntur; Krishna Agro – Bio Products, IDA Hyderabad; MillC (India) Private Limited, Hyderabad; Nutrivele crop solutions company, Karnataka; Eldorado Agritech Limited, Hyderabad; Fertis India Pvt. Ltd, Hyderabad; SURINOVA, Chennai; Owl Techno, Hyderabad and CSIR-CSIO, Chandigarh.

IPR granted

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Technologies identified/commercialized and revenue generated

The Bio-enriched Cocopeat Technology for the management of root knot Nematodes in FCV tobacco was licensed and commercialized to M/s Nutrivele crop solutions company, Karnataka for a licencing fee of ₹ 1,75,000/- on 17.07.2025. A total revenue of ₹ 6,14,950/- was generated during the year 2025.

OUTREACH ACTIVITIES

Innovators Meet

The Innovators Meet was held on April 8, 2025, to promote agri-innovation and agri-entrepreneurship. Experts from ICAR, NABARD, APEDA, and a-IDEA, along with industry representatives from sectors such as Chilli, Turmeric, Ashwagandha, and Castor, as well as entrepreneurs, FPOs, and NGOs, participated in the event. Based on the information gathered from innovators, ICAR-NIRCA identified around 20 rural innovations with significant potential for development into valuable agri-technologies. The stalls featured advanced technologies including smart machinery, drones, agri-robotics, and a variety of innovative products from the institute, FPOs, APCNF, NGOs, and rural innovators.

Turmeric Stakeholder Conclave

Turmeric Stakeholder Conclave was organized on 11th April 2025 at ICAR-NIRCA, Rajahmundry. The event brought together farmers from major turmeric-producing regions viz., Lambasingi, Paderu, Ravulapalem, Duggirala, and Peravali in Andhra Pradesh along with Farmer Producer Organizations, producer associations, women entrepreneurs, self-help groups, NGOs, and Industry leaders. The National Turmeric Board Chairman, Shri Palle Ganga Reddy graced the occasion. The conclave also showcased a range of innovative value-added turmeric products and diverse turmeric varieties.

Brainstorming Session

The ICAR-NIRCA conducted a Strategic Brainstorming Session focused on the European

Green Deal and the competitiveness of tobacco exports, in partnership with ITMU, on 17 December, 2025. This event convened scientists, policymakers, and industry leaders to outline a sustainable future for the Indian tobacco industry. Smt. B. Vishwasree, IAS, Executive Director of the Tobacco Board, presided over the session as the Chief Guest. Industry experts, trade representatives, and farmers actively engaged in this session.

RELAUNCHING NIRCA NEST

The NIRCA NEST was relaunched and inaugurated on 17.12.2025 by the Executive Director, Tobacco Board, Guntur. It showcases the novel value-added products of ICAR-NIRCA developed from Turmeric, Chilli and Ashwagandha. It also displays the millet products developed by Millc, Hyderabad in collaboration with ICAR-NIRCA. All the products are kept available for sale through digital payment systems.

अनुसूचित जातिए जनजातीय उप–योजना और उत्तर पूर्वी पर्वतीय

SCSP, TSP and NEH Programmes

The ICAR-NIRCA implemented the Scheduled Caste Sub-Plan (SCSP), Tribal Sub-Plan (TSP) and NEH programmes to empower targeted communities and regions. These programmes are designed to deliver need-based interventions, aimed at strengthening the livelihoods of Scheduled Caste and Tribal community while fostering agricultural advancement in the targeted regions.

SC Sub Plan

ICAR-NIRCA and its research stations viz., Jeelugumilli, Kandukur, Guntur, Vedasandur, Hunsur, Dinhata implemented the SCSP programme for the intended beneficiaries. Different interventions encompassing the awareness/training programmes on Advanced production technology, processing and value

addition of turmeric, chilli, improved production technology of tobacco, Green manuring for improving soil fertility, importance of Pulses in Soil health and Human Nutrition,Topping Tools, Bale Pressing Machines, Farm Mechanisation in Tobacco, Ashwagandha cultivation/post harvest management and value addition were conducted. Critical inputs such as Turmeric, Dry chilli, Tobacco seed, Sunhemp seeds, Bengalgram seed, Tarpaulins, Ashwagandha seeds were distributed. A total of 2170 farmers and farm women were benefitted.

Tribal Sub-Plan (TSP)

Tribal Sub Plan (TSP) activities were implemented with an outlay of ₹ 30.00 lakhs in tribal areas of Andhra Pradesh, West Bengal, and Karnataka, coordinated by NIRCA and its research stations. ICAR–NIRCA distributed innovative tools and critical inputs including seeds, SuckerStop, Tobacco Topping Tools, NIRCA Nest Nutri Kits, improved chilli and tobacco seed, tarpaulins, and sprayers, to tribal farmers, women, and youth to boost agriculture productivity and livelihoods. Around 1,025 tribal families benefitted from the TSP programme.

NEH Programme

ICAR-NIRCA collaborated with MTTC & VTC, College of Fisheries, Lembucherra, on a project titled “Establishment of Honey Bee Rearing Units at Farmers’ Fields in West Tripura” to promote sustainable beekeeping practices in the region.

शिक्षा एवं प्रशिक्षण

Education and Training

ICAR-NIRCA undertakes extensive extension activities to disseminate improved technologies and best management practices for sustainable commercial crop production. The Institute organizes farmers' training programmes, frontline demonstrations, field days, awareness campaigns, exposure visits, and farmer–scientist interactions to promote the adoption of climate-resilient varieties, balanced nutrient management, integrated pest management, mechanization, and resource-conserving technologies. Through close collaboration with state departments, extension agencies, farmer producer organizations (FPOs), and other stakeholders, ICAR-NIRCA ensures the effective transfer of research innovations to the farming community. The Institute also utilizes digital platforms, technical publications, mobile advisories, and mass media to provide timely, location-specific recommendations, thereby strengthening farmers' knowledge, improving productivity, enhancing profitability, and supporting environmentally sustainable agriculture.

S. No.	Resource person	Training Imparted	Date and place
1.	Dr. Y. Subbaiah	Workshop for NLS tobacco farmers in commemoration of 'Establishment Day of Tobacco Board'	03.01.2025 at Tobacco Board Auction Platform, Gopalapuram
2.	Dr. S. Kasturi Krishna	2nd District Level Training Programme on "Implementation of Crop Diversification" in Eluru district	07.01.2025 at Tobacco Board Auction Platform, Koyyalagudem
3.	Dr. S. Ramakrishnan	Knowledge sharing workshop for KLS FCV tobacco growers in Association with Tobacco Board	04.01.2025 at Hunsur, 06.01.2025 at Periyapatna
4.	Dr. M. Kumaresan Dr. P. Manivel	Training Programme on "Ashwagandha cultivation, value addition, and marketing"	30.01.2025 at ICAR-NIRCA RS, Vedasandur
5.	Dr. Partha Saha Dr. Namita Das Saha	Winter School training (as expert lecturer) on "Impact of Climate change on agriculture and allied sector: adaptation, mitigation towards sustainability and livelihood security"	14.02.2025 & 28.02.2025 at UBKV, Pundibari
6.	Dr. M. Sheshu Madhav Dr. T. Kiran Kumar	Stakeholders meeting on Good Agricultural Practices for *Bidi* Tobacco	11.02.2025 at BTRC, AAU, Anand
7.	Dr. T. Kiran Kumar Dr. M. Sheshu Madhav Dr. K. Rajasekhara Rao Dr. J. Poorna Bindu Mrs. B. Krishna Kumari	Awareness programme on Green manuring for improving soil fertility and crop productivity	16.02.2025 at Bobbilanka

S. No.	Resource person	Training Imparted	Date and place
8.	Dr. P. Manivel	Awareness programme on "Ashwagandha cultivation, Post harvest management and value addition"	19.02.2025 at ICAR-NIRCA RS, Vedasandur
9.	Dr. M. Kumaresan Dr. P. Manivel Mr. V. Annadurai Mr. M. Karthik	FLDs on Chewing tobacco variety "Yasini"	03.03.2025 to 04.03.2025 at Muthunayakan patty and Sathyanathapuram
10.	Dr. S. Ramakrishnan	Training on "FCV tobacco cultivation" to input dealers under Diploma in Agricultural Extension Services (DAESI) course	20.03.2025 at KVK, Gonikoppa
11.	Dr. P. Manivel	Training program on "Ashwagandha cultivation"	26.03.2025 at ICAR-NIRCA RS, Vedasandur
12.	Dr. S. Ramakrishnan Dr. C. Nanda Dr. K.P. Raghavendra	FLD on Green tech nursery (Tray) technology	22.04.2025 at Angatahally, Hunsur
13.	Dr. S. Ramakrishnan Dr. C. Nanda Dr. K.P. Raghavendra	FLD of Bio-enriched coco-peat for root knot nematode management	25.04.2025 at Kergalkopal, Hunsur
14.	Dr. S. Ramakrishnan Dr. C. Nanda Mr. T. Venkatesh	Training programme on "FCV Tobacco Nursery Management"	25.04.2025 at Badagalapura, Gorahalli and Suragalli villages in HD Kote
15.	Dr. S. Ramakrishnan	Training programme on "FCV Tobacco Nursery Management"	30.04.2025 at Sanyasipura and Kirnelli villages in HD Kote
16.	Dr. M. Kumaresan Dr. P. Manivel Dr. K. Suman Kalyani Dr. B. Rajasekhara Reddy Dr. T. Kiran Kumar	15 days training on "Various aspects of commercial crops and value addition" for two Ph.D Agronomy students of TNAU, Coimbatore	06.05.2025 to 20.05.2025 at ICAR-NIRCA RS, Vedasandur
17.	Dr. S. Ramakrishnan Dr. C. Nanda	Training programme on "FCV Tobacco Field Crop Management"	19.05.2025 at Hosakote colony and Honnikupe villages in Hunsur
18.	Dr. Partha Saha	Training lecture on "Cultivation of fruit (mango, litchi, tissue culture of banana etc)" to input dealers under DAESI course	21.05.2025 at The Agricultural Training Centre, Cooch Behar
19.	Dr. C. Nanda Dr. S. Ramakrishnan Dr. K.P. Raghavendra	FLDs on FCH 2 (CTRI Navya)	25.06.2025 and 28.06.2025 at Mantikoppalu village and Agarnahalli village

S. No.	Resource person	Training Imparted	Date and place
20.	Dr. Partha Saha Dr. Namita Das Saha Dr. K.P. Singh	Awareness cum training programme on "Advanced production technology, processing and value addition of turmeric & chilli"	01.07.2025 at ICAR-NIRCA RS, Dinhata
21.	Dr. S. Ramakrishnan Dr. C. Nanda Dr. K.P. Raghavendra	FLD on plant position grading in FCV tobacco	15.07.2025 at Thiplapura, Hunsur
22.	Dr. P. Manivel	Training programme on "Ashwagandha -Simple Value addition and marketing: A profitable business opportunity"	15.07.2025 at ICAR-NIRCA RS, Vedasandur
23.	Dr. Partha Saha	Training lecture on "Advances in Horticultural Technology developed by ICAR" to input dealers under DAESI course	25.07.2025 at KVK, UBKV, Pundibari, Cooch Behar
24.	Dr. Namita Das Saha	Training lecture on "Climate change and impacts in Agriculture " to input dealers under DAESI course	25.07.2025 at KVK, UBKV, Pundibari, Cooch Behar
25.	Dr. K.P. Raghavendra	Training programme on Model Project Area	25.07.2025 at ICAR-NIRCA RS, Hunsur
26.	Dr. M. Sheshu Madhav	Technical enrichment training programme of the Coconut Development Board in association with Department of Horticulture, Govt. of AP.	06.08.2025 at ICAR-NIRCA, Rajahmundry
27.	Dr. M. Sheshu Madhav Dr. S. Ramakrishnan Dr. K.P. Raghavendra Dr. C. Nanda Mr. T. Venkatesh	Training programme on "FCV Tobacco Post Harvest Product Management"	11.08.2025 at ICAR-NIRCA RS, Hunsur
28.	Dr. S. Ramakrishnan Dr. C. Nanda Dr. K.P. Raghavendra	FLD on SUCKERSTOP™, a new generation sucker control technology in FCV tobacco	19.08.2025 at Harve village, Hunsur
29.	Dr. M. Sheshu Madha and Scientists of ICAR-NIRCA, Rajahmundry	Sensitization program on 'Sustainable Practices in Tobacco'	20.08.2025 at ICAR-NIRCA, Rajahmundry
30.	Dr. V. Venkateswarlu	Awareness programme on "Importance of Pulses in Soil health and Human Nutrition" for SC farmers of Turmeric and Tobacco	22.08.2025 at Munnangi and ICAR-NIRCA RS, Guntur

S. No.	Resource person	Training Imparted	Date and place
31.	Dr. P. Manivel Dr. M. Kumaresan Mr. V. Annadurai	Training programme on "Ashwagandha: Sowing and cultivation methods"	29.08.2025 at ICAR-NIRCA RS, Vedasandur
32.	Dr. K. Prabhakara Rao	Training programme on "Good Agricultural Practices on Tobacco Nursery Management" in association with Tobacco Board, Guntur	11.09.2025 at Palantla Village
33.	Dr. T. Kiran Kumar	Workshop on "European green deal sensitization for Sustainable alternatives"	20.09.2025 at Jangareddygudem
34.	Dr. L.K. Prasad Dr. B. Hema Dr. K. Suman Kalyani	NABARD sponsored Training programme on "Chilli drying with heat pump technology"	24.09.2025 at ICAR-NIRCA, Rajahmundry
35.	All Scientists & Technical staff of ICAR NIRCA RS, Hunsur	Farmers Awareness Programme on "Electrical Barn Curing"	03.10.2025 at ICAR-NIRCA RS, Hunsur
36.	Dr. K. Prabhakara Rao Dr. V. Venkateswarlu	Training and workshop programme on "Application of IPM in Management of Major pests and diseases in Burley Tobacco Nursery" to GPI Agronomy team	14.10.2025 at Vinukonda
37.	Dr. K. Suman Kalyani Dr. J. Poorna Bindu Dr. B. Hema Mrs. B. Krishna Kumari	Awareness Programme on "Health and Nutrition"	17.10.2025 at Rampachodavaram
38.	Dr. Partha Saha Dr. Namita Das Saha Dr. K.P. Singh	Awareness cum training programme on "Improved production technology of tobacco"	24.10.25 at ICAR-NIRCA RS, Dinhata and Sitalkuchi, Cooch Behar
39.	Dr. L.K. Prasad Dr. B. Hema Dr. K. Suman Kalyani Dr. T. Kiran Kumar	NABARD sponsored Training programme on "Turmeric processing"	27.10.2025 at ICAR-NIRCA, Rajahmundry
40.	Dr. Partha Saha Dr. Namita Das Saha Dr. K.P. Singh	Training programme on 'Advanced technology in processing, value addition of tobacco and chilli'	10.11.2025 to 12.11.2025 at ICAR-NIRCA RS, Dinhata
41.	Dr. B. Hema Dr. Y. Subbaiah	Training Programme on "Good Agricultural Practices" and Exposure Visit for the Elected Representatives of PRIs and Officials of Odisha State	25.11.2025 to 29.11.2025 at ICAR-NIRCA, Rajahmundry

S. No.	Resource person	Training Imparted	Date and place
42.	Dr. Partha Saha Dr. Namita Das Saha Dr. K.P. Singh	Student's READY programme of BSc Ag. (Hons) of UBKV	01.12.2025 to 28.02.2026 at ICAR-NIRCA RS, Dinhata
43.	Dr. Y. Subbaiah	Workshop on" Good Agricultural Practices" in association with Tobacco Board	11.12.2025 at ICAR-NIRCA RS, Jeelugumilli
44.	Dr. Anindita Paul (Course director) Dr. Hema Baliwada (Co-course director) Dr. L.K. Prasad Dr. K Sarala Dr. K. Prabhakara Rao	ICAR approved HRD Training Programme on "Phytochemical Analysis Techniques in Commercial Crops"	08.12.2025 to 16.12.2025 at ICAR-NIRCA, Rajahmundry
45.	Dr. L.K. Prasad Dr. B. Hema Dr. K. Suman Kalyani	NABARD sponsored and sanctioned Training programme and demonstration on "Heat pump based chilli drying technology"	15.12.2025 at ICAR-NIRCA, Rajahmundry
46.	Dr. M. Anuradha Dr. K. Gangadhara	Workshop on "Integrated Good Agricultural Practices for Sustainable and quality FCV tobacco Production" to Tobacco growers and field staff of Tobacco Board	18.12.2025 at Tobacco Board Auction floor-26
47.	Dr. L.K. Prasad Dr. B. Hema Dr. K. Suman Kalyani Dr. T. Kiran Kumar	NABARD sponsored Training programme & Demonstration "Bolstering of Turmeric Farmers through Innovative Post-Harvest Processing in Turmeric"	19.12.2025 at ICAR-NIRCA, Rajahmundry
48.	Dr. M. Anuradha Dr. K. Gangadhara	Workshop on "FCV tobacco cultivation in SBS region" to Tobacco growers and field staff of Tobacco Board in SBS region	23.12.2025 at Tobacco Board RM Office, Ongole
49.	Dr. P. Manivel Mrs. G. Hemlata	Training programme on iGOT Karmayogi for ICAR-NIRCA headquarters nominated staff	29.12.2025 at ICAR-NIRCA, Rajahmundry

Field visits

- Dr. K. Sarala, Dr. M. Anuradha and Dr. K. Gangadhara visited the farmer fields and seed production plots at SLS and SBS areas on 31.01.25 and 01.02.2025.
- Dr. Partha Saha and Dr. Namita Das Saha organized field visit and demonstration about ongoing research activities on commercial crops at ICAR-NIRCA RS Dinhata in ICAR sponsored Winter School on "Impact of Climate change on agriculture and allied sector: adaptation, mitigation towards sustainability and livelihood security" to the trainee (Assistant Professor, Associate Professor, Scientist, Sr. Scientist and equivalent) on 28.02.2025
- Scientists from ICAR-NIRCA RS Dinhata visited Boro Natabari, choto Natabari, Sitalabas villages to observe the performance of *Jati* tobacco variety DJ-1 and Podali.
- Field visit to Natabari village was conducted by team of scientists at ICAR-NIRCA RS Dinhata to observe the performance of DJ 1 tobacco variety nursery on 20.11.2025.
- Dr. K. Sarala, visited the farmer fields of burley tobacco at Vinukonda, Giddaluru and Nandyal areas on 30.01.2025.
- Field visit to chilli fields of Koonavaram Village of Rajanagaram Mandal on 18.12.2025 to check the growth and black thrips infestation in the Koonavaram chilli landrace and suggested management practices.
- To observe the alternate crops of tobacco, field visit was conducted by ICAR-NIRCA RS Dinhata scientists to Boalmari village on 29.12.2025.
- Dr. K. Sarala, visited the farmer fields of NLS area to observe the performance of FCJ-11 variety and interacted with the farmers.
- ICAR-NIRCA RS and KVK staff of Kandukur jointly conducted diagnostic field visit to tobacco crop on 16.12.2025 at Ramachandrapuram village of Kandukur mandal.

Field Day

- ICAR-NIRCA conducted a Field Day to burley experimental plots and lanka fields at Bobbillanka village on 16.02.2025. Awareness programme on green manuring for improving soil fertility and crop productivity was conducted.
- Germplasm Field Day was conducted at BRS Farm-Katheru on 19.02.2025 showcasing various germplasm accessions three commercial crops (Tobacco, Ashwagandha and Chilli). About 1200 accessions of tobacco germplasm, 350 accessions of Ashwagandha, and 50 accessions of Chilli were showcased during the germplasm field day.



- Field day on "New Suckercide – SUCKER STOP" was conducted on 25 February 2025 at Jeelugumilli (NLS), with participation of stakeholders including MR Biochem Pvt. Ltd., Tobacco Board, trade representatives, and farmers.

- Field day on Ashwagandha conducted at ICAR-NIRCA RS, Vedasandur on 07.03.2026.
- Field day on "Crop Diversification and Soil Health Management" conducted by ICAR-NIRCA RS Hunsur on18.06.2025 at Kalenahalli village, Hunsur.
- Tobacco Field Day was organized at Anivalu, Haliyur villages and Kanagalu in Periyapatna, Harave village of Hunsur on 25.07.2025, 07.08.2025 and19.08.2025 respectively

Field IRC

- Field IRC was organized on 25.02.2025 at ICAR-NIRCA RS Jeelugumilli. All the scientists at headquarters and associated technical staff participated and explained about their field experiments.

Field Friends Programmes

- Field Friends programme was conducted on "Topping, De-suckering and Harvesting/ Curing /PHPM" by Mrs. B. Sailaja Jayasekharan and Dr. S.K. Dam on 09.01.2025 at Jangareddygudem I& II auction platforms.

Exposure visits

- KVK, Kandukur organized exposure visit to more than 500 farmers to tobacco crop and demonstrated the use of drones as precision technology at ICAR-NIRCA RS Kandukur on 19.11.2025.

Radio talks

- Dr. Kiran Kumar delivered radio talk on "Vanijyapantala sagulo aadayanni penchadamlo yantrika panimutla patra" at AIR, Visakhapatnam on 06.08.2025.
- Dr. P. Manivel participated in the Doordarshan Tamil TV live programme on "Ashwagandha cultivation" on 12.09.2025.

Exhibition stall

- ICAR–NIRCA participated in the Kisan Mahotsav organized by the Telangana State Government on 21 April 2025 at Giriraj College, Nizamabad, showcasing innovative value-added products from turmeric, ashwagandha, and chilli. Our exhibits received wide attention and were appreciated by Shri Palle Ganga Reddy, Chairman, National Turmeric Board

Lecture

- Lecture on "Decoding Plant Volatiles: Insights into Plant–Insect Chemical Communications" by Dr. K. Rajasekhara Rao, Head, Crop Management on 26 January 2025 at ICAR-NIRCA, Rajahmundry.

E-advisories

- Digital information services on technologies, advisories and activities are provided by the institute through website and social media platforms.

Viksit Krishi Sankalp Abhiyan

ICAR-NIRCA scientists participated in the nationwide initiative "Viksit Krishi Sankalp Abhiyan" (VKSA) launched by ICAR under the Ministry of Agriculture & Farmers' Welfare, Government of India. The 15 days campaign from 29.05.2025 to 12.06.2025 formed part of the VKSA Pre-*Kharif* Campaign 2025, aimed at educating and mobilizing farmers on climate-resilient and sustainable practices before the onset of the *kharif* season. The visit created awareness, encouraged preparedness, and demonstrated technologies that can help improve crop productivity and farm profitability in the identified villages of selected districts of Andhra Pradesh and other research stations of different state and connected more than 30,000 farmers in each district. The following are the allotted districts and KVKs with regards to the scientists participated in VKSA campaign.

Name of the Participating Scientist	Designation	Allotted District	KVK & State
Dr. K. Sarala	Head Division of Crop Improvement (Discipline: Plant Biotechnology)	East Godavari	East Godavari 1 (Kalavacharla) Andhra Pradesh
Dr. K. Rajasekhara Rao	Head Division of Crop Management (Discipline: Entomology)	East Godavari	East Godavari 1 (Kalavacharla) Andhra Pradesh
Dr. L. K. Prasad	Head Division of Post Harvest & Value Addition (Discipline: Soil Science)	East Godavari	East Godavari 1 (Kalavacharla) Andhra Pradesh
Dr. S. Kasturi Krishna	Principal Scientist (Agronomy)	Alluri Sita Rama Raju	East Godavari 2 (Pandirimamidi), AP
Dr. H. Ravishankar	Principal Scientist (Computer Application)	Alluri Sita Rama Raju	East Godavari 2 (Pandirimamidi), AP
Dr. K. Suman Kalyani	Principal Scientist (Agricultural Extension)	Alluri Sita Rama Raju	East Godavari 2 (Pandirimamidi), AP
Dr. K. Prabhakara Rao	Senior Scientist (Plant Biotechnology)	Anakapalle	Visakhapatnam (BCT), AP
Dr. T. Kiran Kumar	Senior Scientist (Agronomy)	Anakapalle	Visakhapatnam (Kondempudi), AP
Dr. J.J. Rajappa	Senior Scientist (Economic Botany)	NTR	Krishna (Garikapadu), AP
Dr. J. Poorna Bindu	Senior Scientist (Soil Science)	Paravathipuram Manyam	Vizianagaram Andhra Pradesh
Mr. K. Viswanatha Reddy	Scientist (Agricultural Economics)	Paravathipuram Manyam	Vizianagaram Andhra Pradesh
Dr. V. Venkateswarlu	Senior Scientist (Entomology)	Paravathipuram Manyam	Vizianagaram Andhra Pradesh
Dr. Hema Baliwada	Scientist (Agricultural Extension)	Srikakulam	Srikakulam (Amudalavalasa), AP
Mrs. B. Sailaja Jayasekharan	Scientist (Entomology)	Srikakulam	Srikakulam (Amudalavalasa), AP
Dr. Anindita Paul	Scientist (Agricultural Chemicals)	Srikakulam	Srikakulam (Amudalavalasa), AP
Dr. B. Rajashekara Reddy	Scientist (Vegetable Science)	NTR	Krishna (Garikapadu), AP
Dr. P. Venkateswarulu	Principal Scientist (Entomology)	Guntur	Guntur 1 (Lam), Andhra Pradesh

Name of the Participating Scientist	Designation	Allotted District	KVK & State
Dr. H.S. Mahesha	Scientist (Plant Pathology)	NTR	Krishna (Garikapadu), AP
Dr. P. Venkateswarulu	Principal Scientist (Entomology)	Guntur	Guntur 1 (Lam), Andhra Pradesh
Dr. M. Anuradha	Principal Scientist (Plant Physiology)	Nellore	Prakasam (Kandukur), AP
Dr. K. Gangadhara	Senior Scientist (Plant Breeding)	Nellore	Prakasam (Kandukur), AP
Dr. Y. Subbaiah	Principal Scientist (Agricultural Extension)	West Godavari	West Godavari -1 Andhra Pradesh
Dr. M. Venkatesan	Scientist (Entomology)	Anakapalle	Visakhapatnam (Kondempudi), AP
Dr. M. Kumaresan	Principal Scientist (Agronomy)	Dindigul	Dindigul, Tamil Nadu
Dr. P. Manivel	Principal Scientist (Plant Breeding)	Dindigul	Dindigul, Tamil Nadu
Dr. Partha Saha	Senior Scientist (Horticulture)	Cooch Behar	Cooch Behar KVK, UBKV, Pundibari, Cooch Behar
Dr. Namita Das Saha	Senior Scientist (Environmental Science)	Cooch Behar	Cooch Behar KVK, UBKV, Pundibari, Cooch Behar

VKSA - KVK, Kalavacharla

Krishi Vigyan Kendra, Kalavacharla formed 3 scientific teams to cover the erstwhile East Godavari District, Andhra Pradesh. During the 15-day program, they made a total of 89 visits covering 134 villages and reached around 24022 farmers (15849 male and 8173 females) with the help of State Department of Agriculture. They created awareness on central government schemes in agriculture (PM KISAN, PMFBY, etc.,), animal husbandry (NLM, PMEGP, NADCP etc.,) and fisheries (PMMSY) sectors. They also demonstrated new technologies like Kisan drones to the farmers. Officials from State Horticulture Department, ATMA and public representatives also participated in the program.

VKSA - KVK, Kandukur

KVK Kandukur organized the Vikasit Krishi Sankalp Abhiyan (VKSA) from 29 May to 12 June 2025 in Prakasam and SPSR Nellore districts of Andhra Pradesh. All 6 SMSs along with the Head formed 3 teams and visited 45 villages across 15 mandals in the two districts, covering 6,852 farmers, farm women, FPO members, entrepreneurs, and rural youth. The campaign generated awareness on green manuring, improved crop varieties and their best management practices, farm mechanization, balanced use of fertilizers through soil health cards, STBFA, climate-resilient and organic farming practices, natural farming, flagship programmes of the Government of India, MSPs of different crops for decision making, entrepreneurial opportunities for rural youth, and dryland cost reduction technologies.

भाकृअनुप
ICAR

Collage of VKSA

कृषि विज्ञान केन्द्र

Krishi Vigyan Kendra

Krishi Vigyan Kendras

ICAR-NIRCA has two KVKs, located at Kalavacharla, East Godavari district and Kandukur, SPSR Nellore district in Andhra Pradesh. The mandated activities are technology assessment and refinement, frontline demonstration of agro-technologies, capacity building programmes, skill trainings to rural women and youth, production of seed and seedlings, field diagnostic visits and implementation of flagship programmes etc. In addition, they generate substantial revenue by sale of farm produce, seed and seedlings.

KVK, KALAVACHARLA

The KVK is actively engaged in the transfer of viable, need-based, skill-oriented and socially sustainable technologies to cater to the needs of rural people and raise their socio-economic status. The important activities undertaken are briefed below.

On-farm Trials (OFTs)

A total of eight OFTs were conducted, the achievements of some are given below.

- In the field assessment of MTU-1275 rice variety recorded 69.5 q/ha yields against BPT-5204 with 60.20 q/ha with a yield increase of 15.44%.
- Efficacy of foliar spray of Trifloxystrobin + Tebuconazole (0.5 g/L) was evaluated for the management of sheath blight (*Rhizoctonia solani*) and grain discoloration in rice. The treatment recorded the lowest sheath blight incidence (2.66%) compared with the farmer's practice (10.33%), and also resulted in better grain quality and higher yield.
- Novel CSIR-CFTRI turmeric processing technology recorded higher yield (25–30% vs. 20–27%), reduced drying time (12–15 hrs vs. 20–25 days), and better aroma and color compared to traditional methods, ensuring improved hygiene and profitability.

Front-line demonstrations (FLDs)

A total number of 15 FLDs were conducted. Achievements of some are given below:

- IWM in zero-tillage maize was demonstrated in farmers' fields. The treatment consisting of atrazine @ 2 kg/ha, topramezone @ 75 ml/ha, and 2, 4-D @ 1000 ml/ha resulted in a 5.07% yield increase and 11.79% higher net returns compared to the farmers' practice.
- Application of thiamethoxam @ 0.5 g/L and buprofezin @ 1.5 ml/L in mango at pre-flowering stage and again when fruits reached the marble size effectively suppressed leafhopper populations, thereby improving fruit set.
- Value-added products from banana using ICAR-NRCB technology produced flour for cookies and weaning food, with strong consumer acceptance and shelf life of 6–8 months for flour, 2–3 weeks for cookies, and up to 6 months for weaning food.

- Demonstrated turmeric value-addition through preparation of Turmeric Jeera Cookies and Turmeric Shrikhand, which showed high consumer acceptance in taste, appearance, and sensory quality, indicating strong potential for community-level functional food development.

Cluster Frontline Demonstrations (CFLDs)

- Organized CFLDs on pulses (blackgram) and oilseed (sesame) in 12 adopted cluster villages to promote improved crop technologies. The demonstrations covered 100 ha (250 acres) for blackgram and 20 ha (50 acres) for sesame.

Awareness and Demonstrations for Popularization of Fermented Organic Manure (FOM)/ Liquid FOM

An Awareness and Demonstration Programme was conducted on Liquid Fermented Organic Manure (LFOM) in wetland paddy to create awareness among farmers and assess its impact on soil health, crop performance, and farm profitability. The demonstrations were carried out during *Kharif* and *Rabi* 2025 and continued into 2026. A total of 11 demonstration plots were established, including one at the KVK farm and ten in farmers' fields covering an area of 10 acres. Field demonstrations and awareness activities were organised.

Training/Awareness Programmes

A total of 18 training, 8 awareness programmes and 3 sponsored trainings were conducted.

Scientific Advisory Committee (SAC) meeting for 2025-26

Organized SAC meeting on 6th May 2025 under the chairmanship of Dr. M. Sheshu Madhav, Director, ICAR-NIRCA.

Events organized

- Inauguration of FPO outlet of Shresta Green Farms FPO was organized at Kakinada on 12.04.2025.

- Multi-utility agricultural drone demonstration was organized at KVK, Kalavacharla on 13.08.2025 to create awareness among farmers on drone technology in agriculture.
- Parthenium Awareness Week was organized during 16-22 August, 2025 to create awareness among farmers about Parthenium management practices.
- Pradhan Mantri Dhan-Dhaanya Krishi Yojana (PMDDKY) programme was inaugurated at ICAR-NIRCA, Rajahmundry on 11.10.2025.

- World Soil Day was celebrated at KVK, Kalavacharla on 05.12.2025, and a training programme on balanced nutrient application was organized for farmers.
- Krishi Choupal webcast (DD programme for farmers) was organized on 08.02.2025, 09.08.2025 and 13.12.2025.
- National Farmers Day was celebrated on 23.12.2025, and an interaction programme with rice exporters and farmers was organized at ICAR-NIRCA, Rajahmundry.
- Field visits were conducted during January–December 2025, including 48 visits by SMS (Plant Protection), 32 visits by SMS (Crop Production), and 10 visits by SMS (LPM).

KVK, KANDUKUR

On-farm Trials (OFTs) - A total of 21 OFTs were conducted. Achievements of some are given below.

- Antioxidant-rich chocolate bars with 3% turmeric or ashwagandha in milk couverture (38% cocoa) had shelf life of 6 months under refrigerated conditions. Ashwagandha chocolate showed higher acceptability (4.80) than turmeric chocolate (4.67).
- Turmeric powder prepared by no curing and cabinet drying (TO_1) shows higher acceptability (4.93), yield (19.6%) and curcumin content (~1.8% higher than steam curing and solar drying – TO_2 and ~6.7% higher than FP).
- Drone spraying completed operations in 15–20 min/ha with 25 L water, recorded the lowest cost (₹ 1,250/ha), and achieved the highest B:C ratio (1.41).

Front-line demonstrations (FLDs): A total number of 24 FLDs were conducted. Achievements of some are given below.

- Demonstration of the improved Kabuli chickpea variety NBeG-810 over farmers practice NBeG-119 resulted in a yield increase of 2.3q/ha due to its extra-large seed size and superior yield potential.
- IPM was conducted in brinjal for managing fruit and shoot borer. The practices included destruction of infested plant parts, marigold as an intercrop, release of *Chrysoperla carnea* and *Trichogramma* spp., and need-based sprays of Bt, Profenophos, Cypermethrin, and Thiodicarb. Sprays of 2,4-D or NAA during flowering and fruiting resulted in a 12–15% yield increase.
- IDM module reduced soil borne diseases in groundnut, with 6% incidence of collar rot, stem rot, root rot, and nematode damage, compared to 17% in control, promoting healthier plant growth and higher population.

Cluster Front Line Demonstrations (CFLDs)

Organized CFLDs on Oilseeds covering groundnut and sesamum in 50 ha/125 acres area covering 125 farmer fields in 6 cluster adopted villages with budget outlay of ₹ 2, 89,375 lakh with team members of Dr.G.Prasad Babu as PI and all SMSs as CO-PIs.


Fermented Organic Manure (FOM) Project

Demonstrations were conducted during *Rabi* 2025 on groundnut and chilli in farmers' fields of the adopted villages of KVK, covering 10 farmers over 10 acres, to assess the performance and impact of FOM on soil fertility and crop yields over the project period.

ICT Interventions

Initiatives on use of ICTs were taken up to reach the unreached like NIRCA Chatbot, Digital Farm School, mobile apps, social media, Kisan Sarathi portal, TV& Radio Talks, short videos etc. to transfer the latest technologies to the farmers at grassroots level.

NIRCA Chatbot: KVK, Kandukur developed chatbot named NIRCA Chatbot. This chatbot application helps farmers regarding mixing of different insecticides, fungicides and combination products (insecticide + fungicide) formulations for all crops. The Chatbot is useful for all stakeholders in agriculture including students, traders and market.

Scientific Advisory Committee (SAC) meeting for 2025-26

Organized SAC meeting under the chairmanship of Dr. M. Sheshu Madhav, Director, ICAR–NIRCA and Dr. Shaik N. Meera, Director, ICAR–ATARI, Zone-X, Hyderabad on 30.4.2025. Foundation stone for a new Farmers' Building was laid, an exhibition on KVK-promoted agripreneurs and a Selfie Point were inaugurated, and the upgraded Soil Testing Laboratory and Value Addition Incubation Centre were inaugurated.

FPOs Nurtured

KVK, Kandukur is extending technical support on nursery seedlings production on tobacco, chilli, vegetables, seed production in paddy, blackgram, millets, business plan preparation, supply chain management, market linkages, online sale platforms linkages to the following 5 FPOs.

S. No	Name of the FPO
1	Raithunestham Agriculture and Allied Products Mutually Aided Cooperative Society Ltd., Dubagunta, Pamuru mandal, Prakasam district.
2	Skandhapuri Farmers Producers' Company Ltd, Kandukur
3	Ulavapadu Mango Farmers Producers Company Ltd., Ulavapadu
4	Harithaputra Vegetables and Millets Farmers Producers Company Ltd., VV Palem
5	Pakala Fish Farmers Producers Cooperative Society Ltd., Singarayakonda

Capacity building programmes

KVK, Kandukur organised 32 capacity-building training programmes on best management practices such as Integrated Pest Management (IPM) and Integrated Disease Management (IDM) in tobacco, chilli, cotton, rice, chickpea and red gram, along with IPM, INM and ICM in field crops, STBFA, soil health management, ICT-based information sources, etc. Trainings were also conducted on value addition to millets, fruits and vegetables, pro-tray vegetable seedling production, orchard management, value addition to prawns, and allied enterprises, benefiting 2,350 farmers and farm women from 16 villages of 12 mandals.

Skill Development trainings

Organized skill development trainings of 3–5 days' duration for farm men-women and rural youth on mushroom production and honey bee production, along with drudgery-reducing tools and equipment, post-harvest processing and value addition to turmeric rhizomes, etc. The programmes were conducted in five villages across three mandals and benefited 428 farm men-women and rural youth, enhancing skills, productivity, and income-generation opportunities.

In-service trainings: Organized 5 in-service trainings to RSK VAAs, MAOs, AEOs, VHAs and ADAs during 2025, covering 483 participants from 28 mandals of Prakasam district on Good Agricultural Practices in cereals, pulses, oilseeds, commercial crops, horticulture crops and livestock.


Farmers Field School (FFS): Organized FFSs in redgram, groundnut, paddy, tobacco, chilli and rice crops in KVK-adopted villages to demonstrate Good Agricultural Practices and transfer the latest production and cost-reduction technologies to farmers.


Research-Extension-Farmers interface (REFI) meeting: KVK, Kandukur has organized 6 REFI meetings in KVK-adopted villages and addressed the queries raised by farmers on plant protection, nutrition, IPM and IDM practices, postharvest processing, value addition, and marketing.




Entrepreneurs promoted

1. Maneesha Millet Bakery, Kandukur – Mr. Y. Lakshmi Narasimha Reddy
2. Swachhata Wooden Cold Pressed Oils, Kandukur – Mr. E. Ventakeshwarlu

Important days celebrated: Organized the National Farmer's Day and VB G RAM G programme at KVK, Kandukur. Farmers were briefed on the significance of National Farmer's Day and the VB G RAM G Bill and its benefits.


Internship/RAWE: A total of 33 students undertaken internship under Student READY programme during 2025.

Scheduled Caste Sub Plan (SCSP)

KVK, Kalavacharla and Kandukur implemented the SCSP programme during 2025 with a focus on livelihood enhancement, nutritional security and promotion of sustainable agricultural and allied activities among Scheduled Caste beneficiaries and distributed the critical inputs.




पुरस्कार एवं सम्मान
Awards and Recognitions

- Dr. M Sheshu Madhav, Director, ICAR-NIRCA received Rashtriya Krishi Vigyan Puraskar 2025 under the category of 'Outstanding Inter-Disciplinary Team Research in Agriculture, Agricultural Education, Extension and Allied Sciences 2025' on 16.07.2025 by the ICAR and Union Minister of Agriculture and Farmers' welfare, GoI at New Delhi, India.

- Dr. M Sheshu Madhav, Director, ICAR-NIRCA was elected as Fellow of The National Academy of Sciences India (NASI) in the year 2025 on 09.12.2025 at IIT, Guwahati for his pioneering work involving Plant molecular biology, agricultural biotechnology, host-pathogen interactions.

- Dr. J. Poorna Bindu, Senior Scientist, Division of Crop Management received the 'Distinguished Scientist Award' in International Conference on "Global Research Initiatives for Agriculture, Science and Technology" organized by IGKV, Raipur during 20-22.01.2025 in hybrid mode.

- Dr. Namita Das Saha, Senior Scientist, Division of Post Harvest & Value Addition received '*All India Best Publication Award-2024*' by SADHANA, Himachal Pradesh; on 19.02.2025.

- Dr. Anindita Paul, Scientist, Division of Post Harvest & Value Addition as a Nodal officer, Management Representative of ISO of the institute received ISO: 9001:2015 certificate for the first time on the name of ICAR-NIRCA with revision of scope and quality policy on 17.04.2025.

- Dr. T Kiran Kumar, Senior Scientist, Division of Crop Management received best oral presentation award in "National seminar on Climate smart innovations to address the current agronomic challenges" organized by the AP chapter of Indian Society of Agronomy, ANGRAU, during 27-28.06.2025 at RARS, Tirupathi, Andhra Pradesh.

- Dr. M. Kumaresan, Principal Scientist (Agronomy) , ICAR NIRCA, Research station, Vedasandur , received the "Best service award" from the District Collector, Dindigul on 15.08.2025.

- Dr. K. Suman Kalyani, Principal Scientist, Division of Post Harvest & Value Addition announced as Best Scientist Award – (Food Technology), 2024 by Eruvaka Foundation during Kisan Matotsav-2025 at KL University, Guntur, AP dated on 26.09.2025

- Dr. J. Poorna Bindu, Senior Scientist, Division of Crop Management received CSIR-Partial Finance Assistance (PFA) to participate in oral presentation during CORESTA Agro Phyto Conference 2025 (28.09.2025 to 02.10.2025) at Surabaya, Indonesia.

- Dr. B. Hema, Scientist, Division of Post Harvest & Value Addition received ICSSR, CSIR travel grants to participate in oral presentation during "CORESTA Agro Phyto Conference 2025 (28.09.2025 to 02.10.2025) at Surabaya, Indonesia.

- Dr. Anindita Paul, Scientist, Division of Post Harvest & Value Addition awarded CSIR- Partial finance assistance grant to participate in oral presentation during CORESTA AP conference 2025 (28.09.2025 to 02.10.2025) at Surabaya, Indonesia.

- Dr. G. Prasad Babu, Senior Scientist and Head, ICAR-NIRCA-Krishi Vigyan Kendra, Kandukur received 'Best Scientist Award' for the year 2025 from Dr. M. Venkaiah Naidu, former Vice-President of India on 26.10.2025 instituted by Rythunestham Foundation, Guntur, Andhra Pradesh.

- Dr. Namita Das Saha, Senior Scientist, Division of Post Harvest & Value Addition received 'Distinguished Scientists Award-2025' by National Environmental Science Academy (NESA), New Delhi, India on 14.11.2025.

- Dr. Namita Das Saha, Senior Scientist, Division of Post Harvest & Value Addition received 'Gold Medal Award-2025' by Soil Conservation Society of India (SCSI), NASC, New Delhi, India on 07.12.2025.

Dr. M Sheshu Madhav, Director, ICAR-NIRCA - Rashtriya Krishi Vigyan Puraskar 2025

Dr. M Sheshu Madhav, Director, ICAR-NIRCA - Fellow of NASI

Dr. Anindita Paul, Scientist - ISO: 9001:2015 certificate

Dr. T Kiran Kumar, Senior Scientist - Best Oral Presentation Award

Dr. M. Kumaresan, Principal Scientist - Best Service Award

Dr. K. Suman Kalyani, Principal Scientist - Best Scientist Award

Dr. G. Prasad Babu, Sr. Scientist & Head, KVK - Best Scientist Award

Dr. Namita Das Saha, Senior Scientist - Gold Medal Award 2025

Dr. J. Poorna Bindu, Senior Scientist - Participation in CORESTA Conference

Dr. B. Hema, Scientist - Participation in CORESTA Conference


COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Dr. Anindita Paul, Scientist - CSIR partial finance assistance

संपर्क एवं सहयोग

Linkages and Collaborations

ICAR-National Institute for Research on Commercial Agriculture (formerly ICAR-Central Tobacco Research Institute) established in 1947 has been conducting research on myriad aspects of different tobacco types grown in India and also coordinates one All India Network Project on Tobacco and two KVKs. In its pursuit to provide research back-up for Indian tobacco by developing high yielding tobacco varieties, environmentally sustainable region specific agro-technologies, diversified uses of tobacco and technology outreach activities, the institute has developed strong linkages with various organizations at regional and national level. ICAR-NIRCA developed linkages with ICAR organizations like NBPGR, New Delhi; IISR, Kozhikode; NAARM, Hyderabad; IIVR, Varanasi; DMAPR, Anand; IIOR, Hyderabad; NRCG, Pune; CRIDA, IIMR, Hyderabad & IIRR, Hyderabad; CIAE, Bhopal and NBAIR, Bangalore etc.

ICAR-NIRCA is already having 66 collaborations with different organizations from different parts of the country. In the year 2025 it has signed twenty-two (19+3 MoU+MoA) MoUs: four with Tobacco Board, Guntur; two with universities namely Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Pondicherry; Mangalayatan University, Aligarh; one with Nutrieville Crop Sol. Llp, Bangalore for commercialization of technology; one with institute CSIR-CISO, Chandigarh; fourteen (11+3) with private firms *viz.*, DSR Creations LLP, Delhi, Eldorado Agritech, Hyderabad, Fertis India Pvt, Hyderabad, GPI, Guntur (2), Krishna Agro Bio products Ltd, Hyderabad, MillC Ltd, Hyderabad, Owl techno, Hyderabad, Surinova, Chennai, Syngenta, Pune (2), Elitecon International Limited, Delhi, Philip Morris India, New Delhi (2) and 1000 Farm Agri Tech Pvt. Ltd., Tirupathi.

क्र. सं. Sl. No	सहयोगी एजेंसी का नाम Name of the Collaborating Agency	गतिविधि Project title/Activity
a) National Institutes/Organizations/Agricultural Universities/Private organizations		
1.	Tobacco Board, Guntur	On Farm trials, Frontline demonstrations, Training programmes, Diagnostic visits and Collaborative projects
2.	Bureau of Indian Standards, New Delhi	Development of Indian standards for tobacco and tobacco products
3.	Protection of Plant Varieties and Farmers Rights Authority, New Delhi	DUS characterization and registration of FCV and *bidi* tobacco varieties
4.	ICAR-National Bureau of Plant Genetic Resources, New Delhi	National Active Germplasm Site (NAGS), Import of tobacco germplasm and maintenance/ Ashwagandha germplasm
5.	Indian Meteorology Dept., Pune	Maintenance of meteorological observatories at different stations
6.	ICAR-National Research Centre for Grapes, Pune	Pesticide residue analysis
7.	Indian Institute of Spices Research, Kozhikode	Network Project on "Phytochemicals and High value compounds" in turmeric

क्र. सं. Sl. No	सहयोगी एजेंसी का नाम Name of the Collaborating Agency	गतिविधि Project title/Activity
8.	CSIR-Indian Institute of Chemical Technology, Hyderabad	Bio active compounds and tobacco waste utilization
9.	CSIR CISO, Chandigarh	Functional electronic taste sensor for Chilli hotness detection
10.	IIT-Bombay	Collaboration in CSIR project
11.	ICMR-National Institute of Nutrition, Hyderabad	Pre-clinical efficacy and safety evaluation of Refined tobacco seed oil
12.	ICAR-Central Institute of Agriculture Engineering, Bhopal	Inter-institutional project
13.	ICAR- National Bureau of Agricultural Insect Resources, Bengaluru	All India Coordinated trials on biological control
14.	a-IDEA of ICAR-NAARM, Hyderabad	Agri-preneurship for Innovation Development of Entrepreneurship in Agriculture
15.	ICAR-IIVR, Varanasi	All India Coordinated trials on Chilli (Voluntary Centre)
16.	AICRP on Medicinal and Aromatic Plants and Betelvine - ICAR-DMAPR, Anand	All India Coordinated trials on Ashwagandha (Voluntary Centre)
17.	AICRP on Oilseeds – ICAR-IIOR, Hyderabad	All India Coordinated trials on Castor (Voluntary Centre)
18.	State Department of Agriculture	Development of technologies related to different tobacco, types and technology dissemination
19.	Gujarat Agricultural University, Anand	Coordinated trials on tobacco
20.	University of Agricultural Sciences, Dharwad	Coordinated trials on tobacco
21.	University of Agricultural and Horticultural Sciences, Shimoga	Coordinated trials on tobacco
22.	Chandra Shekhar Azad University of Agriculture and Technology, Kanpur	Coordinated trials on tobacco
23.	Odisha University of Agriculture and Technology, Bhubaneswar	Coordinated trials on tobacco

क्र. सं. Sl. No	सहयोगी एजेंसी का नाम Name of the Collaborating Agency	गतिविधि Project title/Activity
24.	M/s. ITC Ltd. ABD-LTD M/s. Godfrey Phillips India Ltd. M/s. VST Industries Ltd. M/s. Fertis India Ltd. Indian Tobacco Association M/s. Gujarat Boron Derivatives Pvt. Ltd. M/s. Krishna Agro Bio Products Pvt. Ltd. M/s Alliance One Industries IndiaPvt.Ltd. M/s RJ Technoquips, Hunsur, Karnataka M/s M R Biochem Pvt. Ltd., Hyderabad M/s SS Enterprise, Gollaprolu, East Godavari, Andhra Pradesh M/s Veerabhadra Rao, Anakapalli, Andhra Pradesh M/s Nutrieville Crop Sol. Llp, Bangalore M/s Braintree Consulting & Business Services LLP, Hyderabad M/S KALAGA Herbal Research Labs Private Limited M/S MillC Ltd, Hyderabad, M/S Owl techno, Hyderabad, M/S Surinova Pvt. Ltd., Chennai M/s Syngenta India pvt ltd M/s IFFCO, IFFCO sadan, Saket Place, New Delhi. M/s Bayer, Thane, Maharastra M/s DSR Creations LLP, Delhi, M/s Eldorado Agritech, Hyderabad IOCL, TAPSO, Moosapet, Hyderabad M/s Elitecon International Limited, Delhi M/s Philip Morris India, New Delhi Grameen Foundation India, Pvt. Ltd, New Delhi DPMU of APCNF, Rajahmundry M/s 1000 Farms Agritech. Pvt. Ltd., Tirupathi	Research and development activities
25.	Adikavi Nannaya University, Rajahmundry	Students training, Post Graduation and Doctoral Research Programmes
26.	Dr.Y.S.R. Horticultural University, Venkataramannagudem	Post-Graduation and Doctoral Research Programmes
27.	Acharya N G Ranga Agricultural University, Guntur	Post-Graduation and Doctoral Research Programmes
28.	Tamil Nadu Agricultural University, Coimbatore	Students training, Post Graduation and Doctoral Research Programmes
29.	Pandit Jawaharlal Nehru college of Agriculture and Research Institute, Pondicherry	Post-Graduation and Doctoral Research Programmes

क्र. सं. Sl. No	सहयोगी एजेंसी का नाम Name of the Collaborating Agency	गतिविधि Project title/Activity
30.	Mangalayatan University, Aligarh	Post-Graduation and Doctoral Research Programmes
31.	Sri Konda Lakshman Telangana Horticulture University, Mulugu	Students training, Post Graduation and Doctoral Research Programmes
32.	Yogi Vemana University, Kadapa	Students training, Post Graduation and Doctoral Research Programmes
33.	NIFTEM, New Delhi	Students training, Post Graduation and Doctoral Research Programmes
34.	Vignan University, Guntur	Students training, Post Graduation and Doctoral Research Programmes
35.	Siksha 'O' Anusandhan (A deemed to be university), Bhubaneswar	Students training, Post Graduation and Doctoral Research Programmes
36.	Mangalayatan University, Jabalpur	Students training, Post Graduation and Doctoral Research Programmes
37.	Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar	Students training, Post Graduation and Doctoral Research Programmes
International Institute		
38.	ISO-TC126, Berlin, Germany	Development of international standards for tobacco and tobacco products

तम्बाकू पर अखिल भारतीय नेटवर्क परियोजना

All India Network Project on Tobacco

All India Coordinated Project on Tobacco was established by ICAR during 1970-71 with the headquarters at Anand (Gujarat) which was subsequently shifted to ICAR-NIRCA, Rajahmundry, Andhra Pradesh on 16-08-1998 and was renamed as All India Network Research Project on Tobacco and kept under the administrative control of the Director, ICAR-NIRCA, Rajahmundry.

A total number of 14 centres (3 Main centres, 7 sub-centres and 4 voluntary centres) are functioning at present. The three main network centres of AINPT are located at Rajahmundry, Shivamogga and Anand; the seven sub-centres at Nipani, Nandyal, Berhampur, Araul, Dinhata, Guntur and Hunsur. AINPT Co-ordination Unit at Rajahmundry co-ordinates activities of all the centres and monitors the research programmes through four Project Investigators located at ICAR-NIRCA, Rajahmundry. It also co-ordinates with ICAR on all the administrative, financial and research issues related to the coordinating centres and ensure implementation of all the mandated programmes as per the guidelines of ICAR.

Mandate

Tobacco improvement through co-ordinated multi-disciplinary and multi-location research on different tobacco types (FCV, *Bidi*, Burley, *Natu*, Chewing and *Hookah* etc.) grown in their respective niche areas in the country.

Important activities

- A total number of 13 tobacco lines in FCV, 06 lines in *Bidi*, 03 in *Rustica* and 02 in Chewing (repeat) were evaluated in IVT/IHT.
- A total of 10 tobacco lines in FCV, 03 lines in *Bidi*, 03 lines in *Natu,* 02 lines in *Rustica* were evaluated in AVT-I and 02 lines in *Bidi,* 03 lines in *Rustica* were evaluated in AVT-II.
- A total of 6 entries *viz*., FCHH-2 (FCV), ABD-241, NyBTH-152, NyBTH-157, NyBTH-171 (*Bidi*) and AR-184 (*Rustica*) were evaluated under OFT.
- Collected IVT proposals of different tobacco types, constituted the Technical Programme for Initial Varietal/Hybrid Trials of FCV and Non-FCV tobacco types, IVT/IHT seed supplied to all the concerned centres.
- The XXVII Workshop of All India Network Project on Tobacco (AINPT) was held in hybrid mode at Keladi Shivappa Nayaka University Agricultural and Horticultural Sciences, Shivamogga, Karnataka during 16-17th September, 2025. Dr. D. K. Yadava, DDG (CS) was the Chief Guest and Dr. Prasanta K. Dash, ADG (CC), as the Guest of Honour, Dr. R.C. Jagadeesha, Vice Chancellor, KSNUAHS, Shivamogga, Dr. R.K. Singh, Dean, RLB CAU, Jhansi, Uttar Pradesh, and Former ADG (CC), ICAR, New Delhi; Dr. M. Sheshu Madhav, Director, ICAR-NIRCA and Project Coordinator, AINPT and officials from ICAR, scientists from various research centres, SAU representatives, farmers, Principal Investigators of all the disciplines and industry experts participated.
- Four tobacco varieties *viz*., CTRI-Navya (FCH-2), Sahyadri Swarna (FCS-4), 1353 (FCRH-11) (LSTC-9) and DTV-9 (NBD-316) were notified by 93rd Central Variety Release Committee (CVRC).
- One tobacco variety viz. Nandyala Pogaku-2 (ABD-132) was notified in the 94th CVRC.
- A Varietal Identification Committee (VIC) meeting was held on 16-09-2025 at Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, and it was recommended that the proposal for the tobacco hybrid FCHH-2 to be resubmitted with additional multi-locational trials.

RESEARCH ACHIEVEMENTS

CROP IMPROVEMENT

Rajahmundry

- In IVT, among the thirteen entries evaluated with checks, IET-124 and IET-128 has recorded significantly superior green leaf yield, cured leaf yield, bright leaf yield and grade index over the better control CTRI Sulakshana. The entries IET-125 and IET-132 along with controls CTRI Sulakshana and CTRI Sreshta have recorded TMV resistant reaction.
- In AVT-I, among the ten entries evaluated with checks, FCR-71 and FCR-73 have recorded significantly superior green leaf yield, cured leaf

yield, bright leaf yield and grade index over the better control CTRI Sulakshana. The entries FCR-71, FCR-72, FCR-73, IET-101 and IET-102 along with controls CTRI Sulakshana and CTRI Sreshta have recorded TMV resistant reaction.

Jeelugumilli

- In IVT on FCV tobacco, among the 13 entries (IET-124 to IET-136) evaluated the tested entries IET-126 & IET-127 recorded significantly higher leaf yields and grade index values than CTRI-Naveena and proposed for advancing to AVT trials.
- In advanced varietal/hybrid Trial-I on FCV tobacco, the entry IET-107 recorded numerically higher green leaf (17139 kg/ha), cured leaf (2988 kg/ha) and grade index (1807) than control, CTRI Naveena and none of the entries were found significantly superior to controls.
- In AVT-I on *natu* tobacco, conducted with 3 entries (IET118, IET 119, IET 121), the entry IET-119 recorded significantly higher green leaf yield (9063 kg/ha), cured leaf yield (1529 kg/ha), Melimi (919 kg/ha) and Gulla (610 kg/ha) an improvement of 19%, 23%, 23% and 22% over better control, Kommugudem, respectively.

Guntur

- In the Initial Varietal Trial on FCV tobacco, four entries *viz*., IET-131, IET-133, IET-124 and IET-128 have performed better with significant high green leaf, cured leaf, bright leaf yields and also grade index over other test entries and checks.
- In advanced varietal Trial-I on FCV tobacco, among ten lines evaluated, IET-103 and IET-109 performed better than other test entries and four checks in respect of yield and quality.
- In advanced trial-1 on *natu* tobacco, out of three lines tested, the performance of two lines, IET-119 and IET-121 was significantly superior to check, WAF in respect of yield and quality.
- Chemical quality parameters *viz*., nicotine, reducing sugars and chlorides were within the permissible limits in all the entries tested under AVT- FCV & AVT *natu* tobacco including checks

Kandukur

- Entry, FCK-10 recorded significantly higher cured leaf yield and grade index compared to checks in AVT-II. FCK-10 recorded 11% higher cured leaf yield (2157kg/ha) and 8% grade index (1578) over the check, Siri (1917 kg/ha cured leaf and 1458 grade index) respectively. FCK-10 is proposed for bulk trials in comparison to CTRI Shresta.
- Under laboratory screening of KRB-3 entry for Aphid tolerance showed that, the least growth rate for aphids was recorded with KRB-3 (0.39) in comparison with CTRI Sulakshana (0.47). The highest growth rate was observed in Lanka tobacco (0.52).

Hunsur

- In AVT I, entries IET-107 and IET-109 recorded significantly higher cured leaf yield over all the three checks while the entry IET-110 recorded significantly high yield over check Kanchan only.
- Leaf nicotine and total reducing sugars of all the entries were well within the limits while chlorides were on higher side.

Shivamogga

- In Initial Variety/ Hybrid Trial of FCV tobacco, out of thirteen test entries evaluated, IET-132 (1648 kg/ha, 24.6%), IET-134 (1632 kg/ha, 23.4%), IET-128 (1610 kg/ha, 21.7%), and IET-125 (1516 kg/ha, 14.6%) recorded higher cured leaf yield (CLY) over the best check Sahyadri (1323 kg/ha).
- In Advanced Variety Trial-I of FCV tobacco, out of five test entries evaluated, IET-104 (1986 kg/ha) recorded significantly superior CLY (kg/ha) (23.5% higher) compared to the best check FCS-4 (1608 kg/ha).
- In Observation Trial-II of FCV tobacco, out of five test entries evaluated, TB-100 ×TB-102 (Sel-5) (1417 kg/ha, 37.8%), NLST-2 × FCH-221 (Sel-1) (1334 kg/ha, 29.8%), and TB-70 × TB-102 (Sel-2) (1197 kg/ha, 16.4%) recorded higher CLY over the best check FCS-4 (1028 kg/ha).
- In Observation Trial-I of FCV tobacco, out of ten test entries evaluated, FCS 23-6(1801 kg/ha) recorded 8.9% higher CLY compared to best check FCS-4 (1653 kg/ha).
- In Multi-Location Trial of FCV tobacco, out of nine test entries evaluated, FCR-68(1850 kg/ha, 57.7%), FCK-10 (1707 kg/ha, 45.5%), ST-8, (1581 kg/ha, 34.8%), FCK-9 (1494 kg/ha, 27.4%), ST-6 (1490 kg/ha, 27.0%), FCH-1 (1489 kg/ha, 26.9%), FCH-2 (1482 kg/ha, 26.3%), and ST-1 (1420 kg/ha, 21.1%)

recorded higher CLY compared to best check Sahyadri (1173 kg/ha).

Anand

- Out of six entries tested in IVT on *bidi* tobacco, none of the entries were significantly superior over better check GABT11 (3723 kg/ha) for yield. None of the lines under testing were free from leaf curl and tobacco mosaic virus diseases.
- The line IET- 113 and checks A 119, GT 7, MRGTH 1 and GABT 11 were free from tobacco mosaic virus disease in AVT-I on *bidi* tobacco.
- Among the three entries evaluated in IVT on *Rustica* tobacco, entries IET-143(4004 kg/ha) and IET 144 (4648 kg/ha) had significant superiority over the best check GC 1 (3206 kg/ha) for cured leaf yield.
- Among the two entries evaluated in AVT-I on *Rustica* tobacco, the entry IET-116 (3647 kg/ha) was found significantly superior over the best check GC 1 (3103 kg/ha) for cured leaf yield.

Nipani

- In AVT-II the test entry ABD-239 (1099 kg/ha) registered numerically higher leaf yield over the popular check A-119 (1091 kg/ha).
- In AVT-I the test entry IET-113 (1796 kg/ha) registered significantly higher leaf yield compared to best check NBD-316 (1514 kg/ha).
- The test entries, IET-137, IET-138, IET-139, IET-140 & IET-141 recorded statistically on par cured leaf yield compared to the best check NBD-209 (1249 kg/ha).
- In the Station Trial the test entry KS-15 (633 kg/ha) has registered higher leaf yield followed by KS-13 (610 kg/ha) and KS-1 (547 kg/ha).
- In the SVT the test entry NBD-407 (2491 kg/ha) has registered significantly higher leaf yield than the check Vedaganga-1 (1479 kg/ha) and proposed for IVT 2025-26.
- In SVT (R) the test entry NBD-360 (1563 kg/ha) has registered significantly higher leaf yield than the best check NBD 209 (1018 kg/ha) and proposed for IVT 2025-26.
- PVT: NBD-430 (3747 kg/ha), NBD-415 (2832 kg/ha) and NBD 426 (2675 kg/ha) have recorded significant superiority for the leaf yield over the best check NBD 209(2347 kg/ha).
- PHT: The test hybrid, NBTH-1121 (MS GT-5 X NBD-343) has recorded highest leaf yield (1967 kg/ha) over the best check NBD 209 (1167 kg/ha).

Nandyal

- Only one *bidi* tobacco entry, IET-142 (2026 kg/ha) was contributed for testing under IVT on *bidi* tobacco coordinated trials.
- Pooled (2023-24 and 2024-25) analysis of AVT-II on *bidi* tobacco cured leaf yield performance of the entry ABD-239 (1724 kg/ha) has recorded significantly higher cured leaf yield, showing a 14.7% improvement compared to the best check, Nandyal Pogaku-2 (1503 kg/ha).
- On-farm trial on *bidi* tobacco: NyBTH-152 recorded higher mean cured leaf yield (2594 kg/ha), showing 20.4% increase over the best check, Nandyal Pogaku-2 (2154 kg/ha). NyBTH 157 (2409 kg/ha) and NyBTH-171 (2400 kg/ha) also performed well, with yield advantages of 11.8% and 11.4%, respectively, over Nandyal Pogaku-2 (2154 kg/ha).
- OVT-II on *bidi* tobacco: The entry NyBD-91 (1793 kg/ha) recorded significantly higher cured leaf yield over the check, Nandyal Pogaku-1 (1619 kg/ha), showing an improvement of 10.7%.
- OVT II on *natu* tobacco: The entry NyNT-103 (1430 kg/ha) recorded significantly higher cured leaf yield, while NyNT-98 (1317 kg/ha) recorded on-par cured leaf yield, showing an improvement of 17.4% and 8.1%, respectively, compared to the best check, Bhairavi (1218 kg/ha).

Berhampur

- In Advanced Varietal Trial-I, two test entries, IET-119 (2711 kg/ha) and IET-121 (3250 kg/ha) produced significantly higher cured leaf yield than check variety Gajapati with a yield advantage of 3.2 and 23.12% respectively.
- In exploratory trial on *Rustica* tobacco the three years, pooled data revealed that variety, DCT-5 emerged as the most consistent and high-yielding variety with the highest overall mean yield (1972 kg/ha) and stable high % IOC values across all years, indicating strong adaptability and resilience.
- In Exploratory trial on *jati* tobacco, pooled data

revealed that the variety, Chama emerged as the most consistent performer with the highest mean cured leaf yield (2977 kg/ha) and a strong % IOC in both years (38.5% in 2023 and 25.4% in 2024).

- In the Burley tobacco exploratory trial conducted with genotypes, YB-22 and Banket A1 maximum cured leaf yield was produced by YB-22 (3587 kg/ha) followed by Banket A1 (2787 kg/ha).

Araul

- In IVT the entries IET-144 and IET-145 showed significant superiority for cured leaf yield over the best check variety Azad Kanchan.
- In AVT-I, entries IET-116 and IET-117 showed significant superiority over check Azad Kanchan for cured leaf yield with yield improvement of 20.85% and 14.13%, respectively.
- In the pooled leaf analysis over two seasons (*rabi* 2023-24, 2024-25), entry ArR-105 found significantly superior over the check. Azad Kanchan and SK-417 in AVT-II with yield superiority of 20.88% and 25.27% respectively.
- The entries ArR-129 & ArR-131 showed significant superiority over check Azad Kanchan in PYT-II trial with yield improvement of 23.60% and 17.08% respectively and nominated for IVT conducted during *Rabi* 2025-26.

Dinhata

- Among the entries tested in IVT on *Rustica* tobacco, entry IET-143 was found superior in respect of cured leaf yield, first-grade leaf. The quality leaf was found to be highest in DD-437.
- Test entry IET-116 tested in AVT-I on *Rustica* tobacco, was found superior in respect of cured leaf yield, first grade leaf and quality leaf.
- Among the 3 entries tested in AVT-II on *Rustica* tobacco, AR-182 was found superior in terms of yield. AR-184 and ArR 105 were found superior to the check DD 437 and Dharla in terms of cured leaf yield.
- Among the 2 entries, in IVT on chewing tobacco, IET-122 was found best in respect of cured leaf yield, first-grade leaf. The highest quality leaf was obtained in IET-123.

Ladol

- In the three state trials, IET (ST-1), PYT (ST-2) and LSVT conducted involving 32 genotypes, LR 22-5, LR 24-10, LR 24-6 and LR 24-4 were found promising with significantly higher cured leaf yield.
- In the IVT on *Rustica* tobacco, the entry IET-144 was found promising with significantly higher cured leaf yield.
- Germplasm involving the 295 genotypes/ varieties comprising both indigenous and exotic materials were regenerated and six single and two multiple crosses were made.

Vedasandur

- In the IVT(R) IET-122 and IET-123 had significantly higher total and first-grade cured leaves than the check varieties.

CROP PRODUCTION & AGRIL. CHEM. & SOIL SCIENCE

Rajahmundry

- Application of 100% RDF (50:50:50 kg ha^{-1}) at 15 days before planting + soil application of Ghana jeevamrutha @ 1 t/ha at the time of planting + soil application of Jeevamrutha @ 500 l/ha for 03 times at an interval of 15 days starting from 15 DAP + KNO_3 @ 2% at 45 and 55 DAP found to perform significantly superior over other treatments.

Shivamogga

- Sowing of leafy and root vegetables *viz.*, Amaranthus, Palak, Radish and flower crop Marigold on the ridge and in alternate rows of FCV tobacco recorded additional yield of these crops without affecting the main crop yield. However, yield obtained from intercrops was low (If calculated by converting to their 100% population) compared to yield recorded in the package of practices of the university (Sole planting of respective crops).
- Inter-cropping of groundnut in alternate rows of FCV tobacco for increased tobacco cured leaf yield, additional intercrop yield and monetary advantage over the sole crop of FCV tobacco.

Anand

- In middle Gujarat, the *bidi* tobacco variety GABTH 2 found superior over GT 7 with the highest yield attributes and cured leaf yield. Application of 180-50-50 kg NPK/ha gave numerically maximum cured leaf yield. The highest nicotine content was observed in variety GABTH 2 as compared to GT 7.

- The *Rustica* tobacco variety GC 1 with application of 200-50-00 kg NPK/ha found superior over GCT 3 with the highest cured leaf yield in middle Gujarat.
- In a trial on evaluation of pre and post emergence herbicides for weed management in *bidi* tobacco, results revealed that significantly lower weed density and dry biomass of total weed at 30 & 60 DATP and at harvest and Weed control efficiency were observed but it remained at par with treatment T2 (Pre-plant application of sulfentrazone 39.6% SC @ 0.30 kg a.i./ha).

Nandyal

- *Kharif* cultivation of sorghum as a sequence crop with tobacco along with Neemcake application at 30 DAT and hand removal of *Orobanche* recorded higher green leaf yield (12688 kg/ha), cured leaf yield (2425 kg/ha), net returns (₹161650/ha) and B:C ratio (2.14) which was significantly on par with Green manuring of black sesame-tobacco, neem cake application at 30 DAT and Hand removal of *Orobanche.*
- Weed free check recorded higher cured leaf yield (3523 kg/ha) and lower weed density. Among the herbicidal treatments Pre-plant application of Sulfentrazone 39.6% SC @ 0.25kg ai/ha (1.5 ml/litre) + Post emergence (PoE) application of Quizalofop ethyl 5 EC @ 50 g ai/ha recorded highest cured leaf yield (3156 kg/ha) whereas net returns (₹304625/ha) and B: C ratio (3.38).

Nipani

- Pre-plant application of sulfentrazone 28%+ Clomazone 30 WP @0.28 kg +0.30 ai/ha a.i/ha (2.0 g/litre) + Post emergence (PoE) application of Quizalofop ethyl 5 EC @ 50 g ai/ha recorded significantly highest *bidi* tobacco yield and less number of weed population .
- The treatment integrated management of *Orobanche* in *bidi* tobacco where Sunnhemp was used as a green manure before planting tobacco with neem cake application to tobacco at 30 DAP followed by hand removal of *Orobanche* produced maximum leaf yield of 1602 kg/ha as compared to fallow tobacco + Non removal of *Orobanche* (1127 kg/ha).
- Water logging of tobacco continuously for 6 days recorded lower yield and quality than 2 days or 4 days. Among foliar sprays, KNO_3 foliar spray @1% after water stagnation and S4: KNO_3 spray @ 2% after water stagnation significantly recorded more yield as compared to control.
- The *bidi* tobacco planted during II fortnight of August produced a maximum leaf yield of 1710 kg/ha as compared to *bidi* tobacco planted during I fortnight of October (1430 kg/ha), II fort night of October (1310 kg/ha) and I fort night of November (900 kg/ha). Delayed planting of tobacco reduced the yield and increased the disease incidence.

Araul

- The higher tobacco equivalent yield recorded by Wheat (2995 kg/ha) followed by Mustard (1610 kg/ha). Wheat crop recorded highest monetory returns of (₹ 68,310) with benefit cost ratio of 1.50.
- The various vegetables grown along with tobacco showed that Potato (2010 kg/ha), Onion (2020 kg/ha) and garlic (2065 kg/ha) recorded maximum vegetable yield and suppressed growth and yield of tobacco (3620 kg/ha).

Vedasandur

- Application of farm yard manure 15 days before planting + RDF (125:50:50 kg NPK/ha) + KCl sprayed at concentration of 2% at 45 and 60 DAP over the control (FYM 12.5 t/ha 15 days before planting + RDF) increased total cured leaf yield by 6.2%. Higher net return of ₹ 1,25,766/ha was recorded with RDF (125:50:50 kg NPK /ha) + Ghana jeevamrutha @ 1 t/ha (soil application at the time of planting) + Jeevamrutha @ 500 l/ha (Soil application for 3 times at an interval of 15 days from 15 DAP.
- Tobacco planted succeeding sesame with neem cake application at 30 days after planting and hand weeding at 90 days was recommended for *Orobanche* management.

CROP PROTECTION

Jeelugumilli

- Among the different modules evaluated against sucking pests, IPM module (Sorghum border crop + setting up of yellow sticky traps @ 25/ha + one spray of NSKE 2% at 30 DAP + one spray of *Lecanicillium lecanii* @ 3 x 10^{12} CFU/ha at 45 DAP + one spray of afidopyropen 50

DC @ 0.03% at 60 DAP) was found to be superior in aphid management (63.60 aphids/ plant) compared to chemical module (One spray of imidacloprid 17.8 SL @ 0.03 % at 30 DAP + one spray of pymetrozine 50 WG @ 0.04 % at 45 DAP + one spray of flonicamid 50 WG @ 0.04 % at 60 DAP) which recorded 71.08 aphids/ plant in comparison with untreated control plots (182.84 aphids/plant).

- The IPM module recorded least whitefly population (3.80/ plant), and lowest TLCV incidence (6.08%) and highest cured leaf yield (1825 kg/ha) over chemical module and untreated control.

Guntur

- IPM module for sucking pests consisting of sowing two rows of sorghum as border/barrier crop one week before planting of tobacco; setting up of yellow sticky traps @ 25/ha; one spray of NSKE 2% at 30 days of planting (DAP); one spray of *Lecanicillium lecanii* @ 3×10^{12} CFU/ha at 45 DAP and one spray of afidopyropen 50 DC @ 0.03% at 60 DAP exhibited 79.78% reduction of infestation by tobacco whitefly (leaf curl), cent per cent reduction of aphid infestation with 13.24% increase of cured leaf yields over untreated control.
- Chemical control module consisting of one spray of imidacloprid 17.8 SL @ 0.03% at 30 DAP; one spray of pymetrozine 50 WG @ 0.04% at 45 DAP and one spray of flonicamid 50 WG @ 0.04% at 60 DAP reduced leaf curl infestation by 75.53%, aphid infestation by 100% and increased cured leaf yields by 10.29% over untreated control.

Shivamogga

- Population dynamics of insect pest complex in tobacco crop ecosystem revealed that the aphid population observed was very high during the experiment due to high temperature and humidity. Natural enemies like *Nesidocoris* sp. and *Ischiodon* sp. were recorded more on aphid-infested plants.
- The Integrated module (IPM) involving sowing of Castor as a trap crop 15 days before planting, collection & destruction of egg masses, installation of pheromone traps (Spodlure/Litlure) @ 4/acre at 15 DAP, erection of bird perches @ 20/acre, need based spraying of Azadirachtin 10000 ppm @ 2ml/ L, Bt. *kurstaki* @ 1.5 g/L, Emamectin benzoate 5SG @ 0.5 g/l was effective for control of *Spodoptera litura* in FCV tobacco.
- Among the different insecticides evaluated, Flonicamid 50 WG was found to be most promising with lowest incidence of aphids and whiteflies and the highest percent reduction over control, followed by Afidopyropen 50 DC and Pymetrozine 50 WG. These insecticides can be used as alternatives for recommended insecticides to reduce the development of insecticide resistance.
- Integrated Module comprising of Foliar spray of seedlings with Imidacloprid 17.8 SL @0.3 ml/l one day before planting, Maize as a barrier crop (sow maize 10 days before tobacco transplanting), Yellow sticky traps @ 10/acre, Two sprays of azadirachtin 1EC @ 2ml/l at 20 and 30 DAT, need based spray of Imidacloprid 17.8 SL @ 0.3 ml/l for management of leaf curl vector whitefly B. *tabacia*.

Anand

- Metalaxyl MZ @ 2.16 kg/ha, azoxystrobin 23 SC @ 230g a.i./ha and azoxystrobin + difenoconazole 29.6 SC @ 372 g a.i./ha was found effective in the management of damping-off in *bidi* tobacco nursery. In laboratory, cent per cent inhibition was observed in *Pythium aphanidermatum* isolated from diseased seedlings indicating absence of resistance in the pathogen to the chemical fungicide.
- Out of 20 lines/varieties, one, six, seven, four and two lines showed highly resistant [ABT 10 (Check)], resistant, moderately resistant, moderately susceptible and susceptible reaction, respectively to root-knot disease in pots.
- Under field condition, seventy-nine entries of advanced breeding materials /crosses of *bidi* tobacco, 29 entries of *Rustica* tobacco and 2 entries of chewing tobacco including respective checks were examined for leaf curl and *Cercospora* leaf spot diseases. Observations revealed that none of the entries were found free from leaf curl infection of *bidi*, *Rustica* and chewing tobacco. Four entries/checks were found free from leaf curl but they were infected in the previous year. During the year very low incidence of frog-eye leaf spot disease was noticed.

- Among the 47 entries of *bidi* tobacco evaluated for TMV through artificial inoculation, 37 entries including segregation materials showed resistance to the disease.
- Variety ABT-10 gave 2437 kg/ha yield and 0.00 root-knot index (RKI) as compared to A 119 which gave 2010 kg/ha with 3.07 RKI. Maximum cured leaf yield was found in the treatment of poultry manure (2467 kg/ha), which was at par with farm yard manure (2382 kg/ha) and vermicompost (2317 kg/ha). The lowest root-knot index was recorded from the treatment with poultry manure (0.84 RKI), which was followed by tobacco spent (1.37 RKI).
- The maximum number of healthy transplantable seedlings (560/m^2) and minimum root-knot index (0.6) were obtained from the treatment of fluopyrum 0.05% in *bidi* tobacco nursery.
- The minimum root-knot index 0.68 was observed in the treatment T4 (Normal Seedlings + Fluopyrum @ 0.05% drenching at planting) and 0.96 in treatment T2 (Planting *Trichoderma viride* @ 30g/kg + *Paecilomyces lilacinus* @ 30g/kg coco-peat enriched seedlings + *T. viride* & *P. lilacinus* enriched coco-peat @ 10 g/plant at planting and at 30 DAP) and both remain at par with each other. The nematode population was gradually decreased in the treatment fluopyrum 0.05% both in nursery and field condition.
- *Bidi* tobacco farmers are advised to grow *bidi* tobacco hybrid GABTH-2 with application of N: P_2O_5: K_2O @ 180-50-50 for getting higher cured leaf yield as well as nicotine and potash contents with maximum net return and BCR.
- *Rustica* tobacco farmers are advised to grow variety GCT 3 with application of N: P_2O_5: K_2O @ 200-50-50 kg/ha for getting the highest contents of N, P, and K in leaves.
- *Bidi* tobacco farmers are advised to continue the practice of spray drenching Azoxystrobin 23 SC @ 0.023% (230 g a.i./ha i.e., 10 ml/ 10 l water / 100 m^2) or Azoxystrobin + Difenoconazole 29.6 SC (372 g a.i./ha i.e., 12.6 ml/10 l water/100 m^2) at initiation of disease and later for the effective management of damping-off disease in *bidi* tobacco nursery as the pathogen has not developed resistance against fungicide at this dose.
- *Bidi* tobacco farmers are advised to spray azoxystrobin 11% + tebuconazole 18.3% SC, (15 ml/10 l water) or zineb 68% + hexaconazole 4% WP (20 g/10 l water) first at initiation of disease and second at 15 days after first spray for effective management of *alternaria* leaf spot and frog-eye leaf spot disease in *bidi* tobacco field.
- *Bidi* tobacco farmers are advised to continue to utilize Metalaxyl MZ 68 WP @ 2.16 kg g.ai/ ha (32 g/200 l water /100 m^2) or Bordeaux mixture 0.6% at initiation of disease and later as drench for the effective management of damping-off disease in *bidi* tobacco nursery as the pathogen has not developed resistance against fungicide at this dose.

Technology outreach activities of State Agricultural University Centres

- A total of 18 Front Line Demonstrations/ On Farm Trials, 11 training programmes, 4 technology demonstrations and 11 field visits were conducted in different centres.
- No. of publications during the year is 25.
- A total quantity of 9500 kg seed (*Bidi* and *Rustica*) was supplied to the farmers.

प्रकाशनों की सूची

List of publications

Abhinay, Sharad Sharma, Arvind Kumar, Rohit Kumar, Anindita Paul, Jaydeep Halder and Sujan Majumder. 2025. Ecological Risks of Chlorantraniliprole Residues in the Brinjal Cultivated Soil. Journal of Experimental Agriculture International,47 (3): 357-366.

Ankita Paul, Arti Bhatia, Julia Drewer, Ritu Tomer, Vinod Kumar, Shikha Sharma, Namita Das Saha, *Bidi*sha Chakrabarti, Y.S. Shivay, Robert M. Rees, Mark A. Sutton. 2025. Sulphur-coated urea reduces greenhouse gas intensity and enhances soil quality in rice cultivation Journal of Agriculture and Food Research., https://doi.org/10.1016/j.jafr.2025.102376

Bappa Das, Sonam Sah, K. Viswanatha Reddy, S.J. Balaji, Sujeet Desai, Gopal Mahajan, Pooja Singh, Saurav Saha, A.R. Uthappa, Parveen Kumar, V. K. Sehgal, Ram N. Singh, Dikshita A. Shetkar, 2025. Assessment of climate change vulnerability of agriculture in coastal districts of India using principal component analysis and entropy-based methods, https://doi.org/10.1007/s00704-025-05623-8, Theoretical and Applied Climatology.

Gadpayle, K. A ., Namita Das Saha, R. Bhattacharyya and M. Pal .2025. Greater application of nitrogen to soil and short-term fumigation with elevated carbon dioxide alters the rhizospheric microbial community of xTriticocereale (Triticale): A Study of a Projected Climate Change Scenario. Nitrogen, 6(3), 67. https://doi.org/10.3390/nitrogen6030067.

Hema, B., A. Srinivas, Y. Subbaiah and S. Kasturi Krishna. 2025. Exploring farmers' perceptions and adoption of orobanche management methods. International Journal of Agriculture Extension and Social Development, 8 (4): 34-37.

Hema, B., M. Sheshu Madhav, Ch. Bindhu, Y. Subbaiah, V.S.G.R. Naidu, H. Ravisankar and L.K. Prasad. 2025. Tribal Farmer Producer Organizations Constraints in Turmeric Value Addition. AATCC Review, 13(2): 61-65.

Hema, B., M. Sheshu Madhav, V. Jyothi, Y. Subbaiah, V.S.G.R. Naidu, H. Ravisankar, L.K Prasad, V. Nikam and S. Subhashree. 2025. A glimpse on farmer producer organizations: Retrospects and prospects. International Journal of Agriculture Extension and Social Development, 8(2): 170-181.

Hema, B., M. Sheshu Madhav, V. Jyothi, Ch. Bindhu, Y. Subbaiah, V.S.G.R. Naidu, H. Ravisankar, L.K. Prasad and S. Ujwala Rani. 2025. Marketing Efficiency and Channel Dynamics of Tribal Turmeric FPOs in Andhra Pradesh. Plant Science Today, 12(1).

Karmakar, B., D. Thakuria, R.H. Begum and J.J. Rajappa. 2025. Recent advances in experimental design of synthetic microbial communities for biocontrol application. Bio Control, 7(11):.229-244 https://doi.org/10.1007/s10526-024-10295-w [I.F. – 2.9].

Kasturi Krishna, S., S.V. Krishna Reddy, K. Sarala and M. Anuradha. 2025. Effect of nitrogen dose and topping level on yield and quality of FCJ-11 under irrigated Alfisols of Andhra Pradesh. Tobacco Research, 51(1): 15-22.

Kishore Babu, K., T. Kiran Kumar, S. Bharati, P. Mohan Rao, M. Aashiq, K. Chandrasekhar, J. Poorna Bindu, S. Kasturi Krishna, M. Sheshu Madhav and K. Rajasekhara Rao. 2025. Preceding legumes and nitrogen management effects on growth, yield and quality of FCV tobacco under irrigated Alfisols. Tobacco Research, 51(1):25-30.

Kumaresan, M., D. Damodar Reddy, P. Manivel, S. Kasturi Krishna, T. Kiran Kumar and V. Annadurai. 2025. Impact of integrated agro-technologies on the weeds and cured leaf yield of tobacco (*Nicotiana tabaccum*) in Southern India. Indian J of Agronomy, 70 (1): 91-98.

Kumari, P., K.P. Singh and P.K. Rai. 2025. Mapping of Major QTLs Conferring Higher Branching Numbers in Backcross Introgression Lines of Sinapis alba + Brassica juncea Somatic Hybrids. Tropical Plant Biol. 18, 6. https://doi.org/10.1007/s12042-024-09375-z.

Lyngdoh, Y.A., P. Saha, B.S. Tomar, R. Bhardwaj, L.L. Nandi, M. Srivastava, B. Gurung, J.K. Ranjan and P. Chaukhande. 2025. Unveiling the nutraceutical potential of indigenous and exotic eggplant for bioactive compounds and antioxidant activity as well as its suitability to the nutraceutical industry. Frontier in Plant Science, 16:1451462. doi: 10.3389/fpls.2025.1451462.

Madiki Ashiq., S.V. Krishna Reddy, K. Chandrasekhar, T. Kiran Kumar, J. Poorna Bindu, K.N. Srinivasulu, S. Kasturi Krishna and M. Sheshu Madhav. 2025. Yield, system productivity and economics of foxtail millet-FCV tobacco cropping system as influenced by different nutrient management practices. International Journal of Research in Agronomy 8(12): 709-711.

Mandi, S., P. Saha, N.D. Saha, J.P. Bindu, J.K.R. Barman, R. Nambari, S.K. Dam, K. Satyanarayana and S.K. Krishna. 2025. Influence of time of planting and spacing on yield and quality of turmeric (*Curcuma longa* L.) in *terai* region of West Bengal. Current Horticulture, 13(3): 37–42.

Meghana, K., J. Poorna Bindu, D. Damodar Reddy, M. Seshu Madhav, I. Usha Rani and K.N. Sreenivasulu. 2025. Optimizing Flue-cured Virginia (FCV) Tobacco Productivity Through Soil Inversion and Innovative Potassium Management Strategies. International Journal of Environment and Climate Change, 15(1): 25-38.

Naik, M.R., R.R. Teja, A.V. Ramanjaneyulu, D.D. Reddy, K.A. Gopinath, V. Ramasubramanian, M.S. Chandran, S. Ghosh, K. Viswanatha Reddy, V. Paramesha and R. Kumar. 2025. Global research dynamics in organic farming: Emerging trends and scientometric insights. Physics and Chemistry of the Earth, Parts A/B/C, p.104223.

Namita Das Saha, Anamika Shrivastava and Partha Saha. 2025. Exploring heavy metal tolerant bacteria from coal combustion residues of thermal power plant as a possible bioremediation candidate. https://doi.org/10.9734/jamb/2025/v25i8981.

Nand,a C., P. Nagesh, K. Gangadhara, K. Sarala, J.J. Rajappa and M.Sheshu Madhav. 2025. Assessment of CMS based Flue Cured Virginia tobacco (*Nicotiana tabacum* L.) hybrids for stability of marketable yield traits in light soils of Karnataka. Indian J. Genet. Plant Breed, 85(1): 1-9. https://doi.org/10.31742/ISGPB.85.1.18 [I.F. – 1.2].

Nandi, L.L., P. Saha, T.K. Behera, Y.A. Lyngdoh, A.D. Munshi, N.D. Saha, R.K. Ellur, R.S. Pan, A. Verma and B.S. Tomar. 2025. Assessing genetic variability in eggplant to determine their resource value and breeding potential for yield and related traits. Journal of Advances in Biology & Biotechnology, 28 (10): 23-35, 2025.

Paul, A., M. Sheshu Madhav, L.K. Prasad, U. Sreedhar, Majumder Sujan, N. Johnson and C. Chandrasekhara Rao. 2025. Indian scenario of pesticide residues in tobacco and its way forward towards precise detection in compliances to trade. Tobacco Research, 49 (1): 37-54.

Paul, A., A. Dutta, A. Kundu, N. Banyal, G. Chawla, A. Dahujaand, S. Saha. 2025. Selective Separation and Characterization of Acylated and Non-Acylated Anthocyanins via Resin Adsorption-Desorption Method. Michrochemical Journal, 219 (115976) https://doi.org/10.1016/j.microc.2025.115976.

Paul, A., S. Majumder, L.K. Prasad, M. Sheshu Madhav, N. Johnson, K. Padmaja and S. Singh. 2025. An improved GC-MS-SIM analytical method for determination of pendimethalin residue in commercial crops (leaf and soils) and its validation PLOS ONE, 10.1371/journal.pone.0328446.

Poorna Bindu, J., M. Sheshu Madhav, D. Damodar Reddy, M. Mahadevaswamy, C. Chandrasekhara Rao, L.K. Prasad, K.S. Kasturi, B. Hema, K. Rajasekhara Rao, R.D. Veda Vyas. 2025. Potassium schoenite: A sustainable potassium source for Flue-Cured Virginia (FCV) tobacco production. Plant Science Today, 12(2): 1-8.

Pulli Bai, P., V. Jayalakshmi, K. Sarala, K. Gangadhara, K. Prabhakara Rao and Shaik Nafeez Umar. 2025. Evaluation of Morpho-physiological Traits, Chemical Quality Parameters and Drought Tolerance Indices In*bidi* Tobacco (*Nicotiana tabacum* L.) Germplasm Lines. Journal of Advances in Biology & Biotechnology, 28(11): 1426-1450.

Pulli Bai, P., V. Jayalakshmi, K. Sarala, K. Gangadhara, K. Prabhakara Rao and Shaik Nafeez. 2025. Selection of elite *bidi* tobacco (*Nicotiana tabacum* L.) genotypes through G x E interaction studies and Stability assessment.The Andhra Agricultural Journal, 72(2):136-144 DOI:10.61657/aaj.2025.189.

Ramakrishnan, S., S.S. Sreenivas and M. Shareef. 2025. Integrated management of root-knot nematode and soil-borne fungal pathogens in Karnataka light soil tobacco nursery. Tobacco Research, 51(1): 10-14.

Rangappa, K., N.R. Singh, J.J. Rajappa, K.P. Mohapatra, P. Chandra, B.U. Choudhury, M. Prabha, S. Debnath, L.J. Chanu, N.P. Devi, N.U. Singh, S. Hazarika, Y.B. Kumar and V.K.Mishra. 2025. Tree crop interactions, productivity and physiological efficiency of understory crops in *Alnus nepalensis* and *Gmelina arborea* based agroforestry systems in Eastern Himalayas.Front. Sustain. Food Syst9:1494371. doi: 10.3389/fsufs.2025.1494371 [I.F. – 3.7].

Reddy, B.R., P. Kalia and P. Saha. 2025. Molecular Characterization of Recombinant Inbred Lines (RILs) in Cauliflower *Brassica oleracea* var. *botrytis* L.). Journal of Scientific Research and Reports, 31 (10): 218-224.

Saha, N.D., A. Shrivastava, P. Saha. 2025. Exploring heavy metal tolerant bacteria from coal combustion residues of thermal power plant as a possible bioremediation candidate. https://doi.org/10.9734/jamb/2025/v25i8981.

Saha, P., P. Kalia, M. Sharma, P. Sharma, C. Ghoshal, A. Verma, N.D. Saha, and B.S. Tomar. 2025. Novel sources of cauliflower for resistance to downy mildew disease, genetic analysis and design suitable breeding strategy using advanced breeding lines. South African Journal of Botany, 184:349361.

Santhiya, S., P. Saha, B.S. Tomar, V. Chinnusamy and N.D. Saha. 2025. Physiological and Biochemical Responses in Novel Eggplant Lines under Heat Stress Condition. Russian Journal of Plant Physiology, 73 (2).

Sunil Mandi, Partha Saha, Namita Das Saha, J. Poorna Bindu, D. Damodar Reddy, S. Kasturi Krishna, J.K. Roy Barman, Ramu Nambari, S.K. Dam and K. Satyanarayana. 2025. Standardization of organic cultivation practice for enhancing yield and quality of turmeric (Curcuma longa) in terai region of West Bengal. Current Horticulture, 13(4): 78-81.

POLICY PAPERS

Sheshu Madhav, M., K. Viswanatha Reddy, H. Ravishankar, L.K. Prasad. 2025: Crafting India's Turmeric Sector for Global Dominance, ICAR-NIRCA, Rajahmundry.

POPULAR ARTICLES

Hema, B., M. Sheshu Madhav, L.K. Prasad, Y. Subbaiah, H. Ravisankar, V.S.G.R. Naidu, Kshitish Kumar Mishra and Ajit. 2025. Mapping Tribal Turmeric Farmer Producer Organizations in Andhra Pradesh: Action Plan and Institutional Interventions. Innovative Agriculture 1(12):13-16.

Kiranmayi, K., and B. Hema. 2025. Youth-Led Digital Marketing of Farmer-Based Products: A Concept. Agri Articles 5(2).

Kumari, P., Namita Das Saha, A. Chaudhary and P. Saha. 2025. Presence of micro and nanoplastics in vegetables. NESA Newsletter, July. 28 (7): 7-9.

Mayank Tiwari, Namita Das Saha and Partha Saha. 2025. Waste to wealth: transformation of agricultural waste into valuable alternative product. NESA Newsletter. 28 (6): 11-13.

Partha Saha, Namita Das Saha, K. Sarala and M. Sheshu Madhav. 2025. Production of healthy chilli seedlings through eco-friendly approach in West Bengal. Agri-India Today, 5(3): 130-132.

Partha Saha, Namita Das Saha, K. Suman Kalyani, K. Sarala and M. Sheshu Madhav. 2025. Turmeric: A Golden Spice for Health and Nutritional Benefits. The Agriculture Magazine, 4(7): 497-500.

Poona Bindu, J., M. Sheshu Madhav, K. Rajasekhara Rao and R.D. Veda Vyas. 2025. Sustainable utilization of oil palm biomass waste in tobacco cultivation. Agriallis: AL04434,7(2).

Poona Bindu, J., M. Sheshu Madhav, K. Rajasekhara Rao and R.D. Veda Vyas. 2025. Role of potassium schoenite in improving yield and quality of FCV tobacco. DOI:10.5281/TrendsinAgri.14725852. Trends in Agriculture Science, 4(1): 2409-2414.

Venkatesan, M., W. Chandramani, T. Sirisha, K. Rajasekhara Rao and M. Sheshu Madhav. 2025. Nematode Infestation in Tobacco: Occurrence, Identification, Genetic Profiling and Implications. Vanijya Krishi, 47 (1): January-June, 2025, Newsletter of ICAR-National Institute for Research on Commercial Agriculture.

TECHNICAL BULLETINS

Sheshu Madhav, M., S. Kasturi Krishna and K. Viswanatha Reddy. 2025. Redefining Research: Transformation from CTRI to NIRCA. Technical Bulletin 01/2025, ICARNIRCA, Rajahmundry. pp. 37.

BOOKS

Kakumanu Babu, Gali Suresh, Priyanka Sharma, Janardhan Namdeo Nehul and J.J. Rajappa. 2025. Frontiers in Biotechnology: Sustainable Agriculture and Environmental Applications. Mahto Publications ISBN:978-93-49005-73-0 India & Australia. pp. 229.

Viswanatha Reddy, K., M. Sheshu Madhav, H. Ravisankar, E. Prashanth Varma and V. Parameswara Rao. 2025. Reflections: Innovators meet - Fostering Agri-innovation & Agri entrepreneurship. ICAR-NIRCA, Rajahmundry. pp 42.

BOOK CHAPTERS

Namita Das Saha, Partha Saha and Anita Chaudhary. 2025. Global climate change scenario and agriculture: Challenges and perspectives. Training Manual: ICAR-Winter School 2025. "Impact of Climate Change on Agriculture and Allied Sector: Adaptation and Mitigation towards Sustainability and Livelihood Security" February 14 - March 6, 2025. Pp 8-12.

Partha Saha and Namita Das Saha. 2025. Research Initiatives and future prospect on Commercial Agriculture for enhancing farmers' income in Terai region of West Bengal. Training Manual: ICAR-Winter School 2025. "Impact of Climate Change on Agriculture and Allied Sector: Adaptation and Mitigation towards Sustainability and Livelihood Security" February 14 - March 6, 2025. Pp 13-14.

Partha Saha, K.H. Sulochana, N. Bhanushree, Namita Das Saha, J.K. Ranjan, B.S. Tomar 2025. Male Sterility in Eggplant, Advances in Research and Its Exploitation in Hybrid Breeding In Male Sterility Systems in Vegetable Crop Improvement (Saurabh Singh, SS Dey & Reeta Bhatia eds). https://doi.org/10.1007/978-981-96-3429-3. Springer Singapore. Pp 209-224.

Partha Saha, K.H. Sulochana, N. Bhanushree, Namita Das Saha, J.K. Ranjan, B.S. Tomar 2025. Male Sterility in Eggplant, Advances in Research and Its Exploitation in Hybrid Breeding In Male Sterility Systems in Vegetable Crop Improvement (Saurabh Singh, SS Dey & Reeta Bhatia eds). https://doi.org/10.1007/978-981-96-3429-3. Springer Singapore. Pp 209-224.

Prabhakara Rao., K. P. Venkata Diwakar, Bishnupriya Gouda, K. Sarala, and M. Sheshu Madhav. "Meta-omics in Tobacco: Spearheading for Trait Tailoring." In Meta-omics in Crop Improvement: Volume I: Methods and Approaches, pp. 265-278. Singapore: Springer *Nature* Singapore, 2025.

Suman Kalyani K., H. Ravisankar and S. Kasturi Krishna. 2025. Human Vulnerability Index: Adaptation & Mitigation to Climate Change among Fisher-Folk in India of Bay of Bengal Region. Environment Pollution and Climate Change. Research Highlights Vol. 9, 49–65. https://doi.org/10.9734/bpi/geserh/v9/4260.

FOLDERS/ LEAFLETS

Hema, B., L.K. Prasad, M. Sheshu Madhav, R. Chakradhar, Y. Subbaiah, Krishna Chandra, Saurabh Kumar, M.N.P. Kumar and Md. Elias. 2025. Standard Operating Procedures of Chilli Heat Pump Dryer. Folder 03/2025, ICAR-NIRCA, Rajahmundry. pp. 8.

Hema, B., L.K. Prasad, M. Sheshu Madhav, R. Chakradhar, Y. Subbaiah, Krishna Chandra, Saurabh Kumar, M.N.P. Kumar, Md. Elias and Ajit. 2025. Role of NABARD and government schemes in strengthening farmer producer

organisations. Folder 06/2025, ICAR-NIRCA, Rajahmundry. pp. 4.

Prasad, L.K., M. Sheshu Madhav, R. Chakradhar, B. Hema, T. Kiran Kumar, Y. Subbaiah, K. Suman Kalyani, S. Simhachalam, Kshitish Kumar Mishra and Ajit. 2025. Turmeric Value Addition: Practices and Pathways at Farmers' Level. Folder 07/2025, ICAR-NIRCA, Rajahmundry. pp. 4.

Prasad, L.K., M. Sheshu Madhav, R. Chakradhar, B. Hema, Y. Subbaiah, T. Kiran Kumar, S. Simhachalam and T. Ramesh. Standard Operating Procedures of Turmeric Processing Technology. Folder 05/2025, ICAR-NIRCA, Rajahmundry. pp. 8.

Ravisankar, H., L.K. Prasad, M. Sheshu Madhav, J. Poorna Bindu, H.S. Mahesha, K.P. Raghavendra and G. Divya. 2025. Soil test based fertilizer recommendation system for a targeted field in FCV tobacco – Karnataka light soils. Folder 02/2025, ICAR-NIRCA, Rajahmundry. pp. 6.

Sheshu Madhav, M., K. Suman Kalyani, J. Poorna Bhindu, B. Hema, B. Krishna kumari and J. Suseela Devi. 2025. Nutritional Deficiencies among Tribal Women: Importance of Balanced Nutrition. Folder 04/2025, ICAR-NIRCA, Rajahmundry. pp. 6.

Sheshu Madhav, M., K. Suman Kalyani, B. Hema, J. Poorna Bhindu and K. Viswanatha Reddy. 2025. Agricultural Small Implements and its uses. Folder 01/2025, ICAR-NIRCA, Rajahmundry. pp. 6.

MANUALS

Anindita Paul, L.K. Prasad, Kaushik Banerjee and Abhishek Mandal (Eds.). 2025. Manual on "Phytochemical Analysis Techniques in Commercial Crops", Training Manual 04/ 2025. ICAR–NIRCA, Rajahmundry, pp.60.

Paul, A. 2025. ICAR-NIRCA Quality Manual 01/ 2025 (Compliant to IS/ISO 9001:2015 Standard). Published by Director, ICAR-National Institute for Research on Commercial Agriculture, Rajahmundry. pp. 70.

Paul, A. 2025. ICAR-NIRCA Standard Operating Procedure (SOP) Manual 02/2025(Compliant to IS/ISO 9001:2015 Standard). Published by Director, ICAR-National Institute for Research on Commercial Agriculture, Rajahmundry. pp.95.

Paul, A. 2025. ICAR-NIRCA Supporting Documents of Standard Operating Procedure (SOP) Manual 03/2025 (Compliant to IS/ISO 9001:2015 Standard). Published by Director, ICAR-National Institute for Research on Commercial Agriculture, Rajahmundry. pp. 122.

Paul, A, Prasad L.K. and Johnson, N. 2025. Division of Post harvest &Value Addition, ICAR- NIRCA: Standard Operating Procedure (SOP) Manual 04/2025 (Compliant to IS/ISO 9001:2015 Standard). Published by Director, ICAR-National Institute for Research on Commercial Agriculture, Rajahmundry. pp. 80.

अनुमोदित चालू परियोजनाओं की सूची

List of Approved On-going Projects

Sl. No	Institute Code	Title of the project and Investigator(s)
CROP IMPROVEMENT		
1.	**Biotech 12**	Identification of genomic regions conferring resistance to fusarium wilt for accelerating the development of wilt resistant tobacco cultivars Dr. M. Sheshu Madhav, Dr. K. Sarala, Dr. K. Prabhakara Rao, Dr. C. Nanda, Dr. S. Ramakrishnan, Dr. S. Madhavan (DFR) and Dr. H.S. Mahesha Associate: Sri S. Bhaskar Naik
2.	**Br.9**	Genetic improvement of FCV tobacco genotype Dr. K. Sarala and Dr. K. Prabhakara Rao Associates: Dr. C. Nanda, Dr. K. Gangadhara, Dr. H.S. Mahesha, Sri M. Srinivas, Smt. P. Srilakshmi and Sri A. Muthyam
3.	**JL.Br.2.1**	Evolving flue-cured tobacco varieties having high yield and better quality suitable for NLS area of Andhra Pradesh Dr. K. Sarala, Dr. K. Prabhakara Rao and Dr. H.S. Mahesha Associates: Sri D. Durga Rao and Sri K. Giribabu
4.	**Biotech-13**	Genome editing to reduce the Tobacco Specific Nitrosamines (TSNAs) towards the production of safer tobacco Dr. K. Prabhakara Rao, Dr. K. Sarala, Dr. M. Sheshu Madhav and Dr. Anindita Paul Associates: Sri S. Bhaskar Naik and Sri K. Giribabu
5.	**Br.20**	Augmentation, characterization, evaluation, conservation and documentation of tobacco genetic resources Dr. J.J. Rajappa, Dr. C. Nanda, Dr. S. Ramakrishnan, Dr. K. Gangadhara, Dr. K. Sarala, Dr. H.S. Mahesha and Dr. M. Venkatesan Associates: Dr. K. Prabhakara Rao, Dr. M. Sheshu Madhav, Dr. K. Rajasekhara Rao, Smt. B. Sailaja Jayasekharan, Smt. K. Santinandivelu, Sri P. Trinadh and Sri Ramu Nambari
6.	**CBrR-1**	Genetic improvement of chilli types amenable for value added products and GI tagging of Durgadachilli Dr. B. Rajasekhar Reddy, Dr. M. Sheshu Madhav, Dr. H.S. Mahesha and Dr. K. Suman Kalyani Associates: Dr. K. Sarala, Dr. L.K. Prasad and Dr. Anindita Paul
7.	**ABrR-1**	Genetic improvement of Ashwagandha for root yield and Withaferin A content Dr. B. Rajasekhar Reddy and Dr. P. Manivel Associates: Dr. K. Sarala, Dr. M. Sheshu Madhav, Dr. Anindita Paul, Dr. K. Suman Kalyani, Dr. H.S. Mahesha, Sri K. Viswanatha Reddy and Smt. K. Santinandivelu
8.	**KBr.6**	Breeding FCV tobacco varieties for yield and quality characters under SLS conditions Dr. K. Gangadhara, Dr. M. Anuradha, Dr. J.J. Rajappa and Smt. B. Sailaja Jayasekharan Associates: Dr. K. Sarala, Dr. C. Nanda and Sri K. Vidyasagar
9.	**Br.19**	Breeding for developing high yielding and /or disease resistance varieties/ hybrids and evaluation of advanced breeding lines of FCV tobacco suitable to Karnataka light soil (KLS) region Dr. C. Nanda, Dr. K.P. Raghavendra, Dr. S. Ramakrishnan and Dr. J.J. Rajappa Associate: Dr. K. Gangadhara, Sri K. Shravan Kumar and Sri B. Suresh Kumar

Sl. No	Institute Code	Title of the project and Investigator(s)
10.	**BiotechH-1**	Elucidating molecular & genetic determinants of *Nicotiana tabacum* to Root-knot nematode and black shank disease Dr. K.P. Raghavendra, Dr. M. Sheshu Madhav, Dr. S. Ramakrishnan, Dr. C. Nanda, Dr. H.S. Mahesha, Dr. K. Prabhakara Rao, Dr. J.J. Rajappa and Dr. K. Sarala Associates: Sri K. Veeranna, Sri Md. Shareef, Dr. S. Bhaskar Naik and Sri M. Suresh Kumar
11.	**B.50**	Breeding non-FCV tobacco types for desirable traits Dr. K. Gangadhara, Dr. K. Sarala, Dr. P. Manivel and Dr. M. Kumaresan Associates: Dr. K. Prabhakara Rao, Sri M. Srinivas and Sri K. Shravan Kumar
12.	**B.51**	Breeding of chewing tobacco for yield, qualities and resistance to biotic stresses Dr. P. Manivel, Dr. M. Kumaresan, Dr. J.J. Rajappa and Dr. M. Venkatesan Associates: Dr. K. Sarala, Dr. K. Prabhakara Rao and Sri M. Karthik
13.	**ABrAV-1**	Germplasm evaluation, value addition and development of good agricultural practices of Ashwagandha (*Withania somnifera Dunal* L.) Dr. P. Manivel, Dr. M. Kumaresan and Dr. B. Rajasekhara Reddy Associates: Dr. K. Sarala, Dr. K. Prabhakara Rao, Dr. Anindita Paul, Dr. L.K. Prasad, Dr. J. Poorna Bindu, Dr. K. Rajasekhara Rao, Dr. M. Sheshu Madhav, Smt. K. Santinandivelu, Sri M. Karthik and Sri V. Annadurai
14.	**CBrD-1**	Genetic enhancement of chilli for nutraceuticals, value addition, other commercial traits in Terairegion of West Bengal Dr. Partha Saha, Dr. Namita Das Saha, Dr. Anindita Paul, Dr. C. Nanda, Dr. K. Prabhakara Rao and Dr. M. Sheshu Madhav Associates: Dr. K. Sarala, Ms. Nandita Sahana (UBKV), Sri K. Satayanarayana and Sri G.N.S. Ganesh
15.	**TBrD-1**	Yield and quality improvement in turmeric through suitable varietal selection in Terai region of West Bengal Dr. Partha Saha and Dr. Namita Das Saha Associates: Dr. K. Sarala, Dr. T. Kiran Kumar, Dr. Anindita Paul, Sri Ram Krishna Sarkar (UBKV) and Sri G.N.S. Ganesh
CROP MANAGEMENT		
16.	**A-87**	Agronomic interventions for enhancement of high valued traits and farm income in commercial crops Dr. S. Kasturi Krishna and Dr. S.V. Krishna Reddy Associates: Dr. T. Kiran Kumar, Dr. J. Poorna Bindu, Smt. G.S.M. Annapoorna and Sri G.N.S. Ganesh
17.	**A-90**	Agronomic interventions for enhancement of nicotine content in burley tobacco Dr. S. Kasturi Krishna and Dr. S.V. Krishna Reddy Associates: Dr. T. Kiran Kumar, Dr. L.K. Prasad and Dr. J. Poorna Bindu
18.	**JLA-40**	Agronomic Management Practices (Standardisation of Agro-techniques) for Higher Productivity, Resource Use Efficiency and value addition of Turmeric (*Curcuma longa* L.) in irrigated Alfisols of Andhra Pradesh Dr. S.V. Krishna Reddy and Dr. T. Kiran Kumar Associates: Dr. S. Kasturi Krishna, Dr. J. Poorna Bindu, Sri Ch. Sudhakar Babu and Sri T. Ramesh
19.	**JLA-41**	N and K nutrient use efficiency indices for FCV tobacco grown under drip fertigation in irrigated Alfisols Dr. S.V. Krishna Reddy, Dr. S. Kasturi Krishna and Dr. J. Poorna Bindu Associates: Sri Ch. Sudhakar Babu and Sri Indrjeet

Sl. No	Institute Code	Title of the project and Investigator(s)
20.	**JLA-42**	Evaluation of alternative sources of potassium on productivity and quality of FCV tobacco in irrigated Alfisols Dr. S.V. Krishna Reddy and Dr. T. Kiran Kumar Associates: Dr. S. Kasturi Krishna, Dr. J. Poorna Bindu, Sri Ch. Sudhakar Babu and Sri T. Ramesh
21.	**A-88**	Development of high value commercial crops based remunerative production systems through innovative approaches Dr. T. Kiran Kumar, Sri K. Viswanatha Reddy and Dr. S. Kasturi Krishna Associates: Dr. J. Poorna Bindu, Dr. K. Rajasekhara Rao, Dr. M. Sheshu Madhav, Sri Indrjeet, Sri Ch. Sudhakara Babu, Sri S. Simhachalam, Sri A. Nageswara Rao and Sri K.V.N. Raju
22.	**A-89**	Carbon sequestration potential and greenhouse gas (GHG) emissions in tobacco-based production systems through sustainable crop residue management Dr. T. Kiran Kumar, Dr. J. Poorna Bindu and Dr. K. Rajasekhara Rao Associates: Dr. M. Sheshu Madhav, Dr. L.K. Prasad, Dr. Anindita Paul, Dr. Dakshina Murthy (ANGRAU), Dr. Ch. Sreenivas (ANGRAU), Sri Indrjeet and Sri S. Simhachalam
23.	**A-106**	Crop intensification for higher farm productivity in chewing tobacco growing areas Dr. M. Kumaresan, Dr. S. Kasturi Krishna, Dr. P. Manivel and Sri V. Annadurai Associate: Dr. M. Sheshu Madhav
24.	**A-107**	Enhancing the bio active components in Ashwagandha through Agronomic management Dr. M. Kumaresan, Dr. P. Manivel and Dr. S. Kasturi Krishna Associates: Dr. Anindita Paul, Dr. J. Poorna Bindu, Dr. M. Jeyabharathi (TNAU), Dr. K. Sujatha (TNAU), Sri V. Annadurai and Sri M. Karthick
25.	**A.108**	Evaluation of "sucker stop" – a new Suckericide on the sucker control efficiency, yield and quality aspects in chewing tobacco Dr. M. Kumaresan, Dr. P. Manivel and Dr. S. Kasturi Krishna Associates: Dr. L.K. Prasad, Dr. Anindita Paul, Sri V. Annadurai and Sri M. Karthick
26.	**SS.36**	Assessment of soil carbon mineralization and carbon stocks in tobacco and tobacco based cropping systems of different tobacco growing soils Dr. J. Poorna Bindu, Dr. T. Kiran Kumar and Dr. M. Anuradha Associates: Dr. K. Rajasekhara Rao, Dr. M. Sheshu Madhav, Smt. K. Sridevi and Sri K. Veeranna
27.	**E.88**	Studies on the biology and management of cigarette beetle, *Lasioderma serricorne* Smt. B. Sailaja Jayasekharan and Dr. V. Venkateswarlu Associate: Dr. K. Rajasekhara Rao and Sri A. Suresh Babu
28.	**E.89**	Bio-ecology and management of insect pests in chillies Dr. V. Venkateswarlu and Smt. B. Sailaja Jayasekharan Associates: Dr. T. Kiran Kumar and Sri Ramu Nambari
29.	**E.90**	Physical and chemical interactions of plants, pests and their natural enemies in commercial crops Dr. K. Rajasekhara Rao, Dr. V. Venkateswarlu, Smt. B. Sailaja Jayasekharan, Dr. Anindita Paul and Dr. S. Madhavan (DFR) Associates: Dr. J. Poorna Bindu, Sri Ramu Nambari and Sri Himanshu Yadav
30.	**E.91**	Standardization of precise pesticide application utilizing Unmanned Aerial Vehicles (UAVs) for commercial crops Smt. B. Sailaja Jayasekharan and Dr. K. Rajasekhara Rao Associates: Dr. V. Venkateswarlu, Dr. L.K. Prasad, Dr. M. Sheshu Madhav, Sri T. Ramesh and Sri A. Suresh Babu

Sl. No	Institute Code	Title of the project and Investigator(s)
31.	**EG.18**	Integrated management of chilli black thrips, *Thrips parvispinus* Karny Dr. P. Venkateswarlu and Dr. V. Venkateswarlu Associates: Dr. K. Rajasekhara Rao, Smt. B. Sailaja Jayasekharan, Sri M.V. Jayakrishna and Sri G. Srinivasa Rao
32.	**PP-83**	Deciphering resistance mechanisms against Fusarium wilt and Black Shank diseases in tobacco and their management Dr. H.S. Mahesha and Dr. S.K. Dam Associates: Dr. M. Sheshu Madhav, Dr. K. Prabhakara Rao, Dr. K. Rajasekhara Rao and Sri Pankaj Kumar
33.	**PPD-1**	Screening for resistance against hollow stalk (*Erwiniacarotovora* sub. sp. carotovora) in Motihari (*N. rustica*) tobacco germplasm accessions Dr. S.K. Dam and Dr. Namita Das Saha Associates: Dr. Partha Saha, Dr. K. Rajasekhara Rao, Dr. H.S. Mahesha, Dr. M. Sheshu Madhav and Sri P. Krishna
34.	**PPD-2**	In vitro efficacy study of Trichoderma isolates for the management of soil borne fungal diseases in Motihari tobacco (N. *rustica*) Dr. S.K. Dam Associates: Dr. Partha Saha, Dr. Namita Das Saha, Dr. K. Rajasekhara Rao, Dr. M. Sheshu Madhav, Dr. H.S. Mahesha, Dr. P.M. Bhattacharjee (UBKV), Sri P. Krishna and Sri Pankaj Kumar
35.	**JMLN-1**	Characterisation of economically important plant parasitic nematodes in FCV tobacco under NLS region of Andhra Pradesh Dr. M. Venkatesan and Dr. T. Sirisha (DFR) Associates: Dr. K. Rajasekhara Rao, Dr. J.J. Rajjappa, Dr. S. Ramakrishnan and Dr. K. Prabhakara Rao
36.	**N.22**	Integrated management of root knot nematode & disease complex in FCV tobacco and tobacco based cropping system in KLS Dr. S. Ramakrishnan Associate: Sri Md. Shareef
37.	**N.23**	Exploring certain millets as preceding *rabi* crops for FCV tobacco against root knot nematodes in light soils of Karnataka Dr. S. Ramakrishnan and Dr. T. Kiran Kumar Associate: Sri Md. Shareef
POST-HARVEST & VALUE ADDITION		
38.	**CaVA-1**	Development of laboratory level methods/techniques for the extraction of commercially viable bioactive compounds of castor oil Dr. L. K. Prasad, Dr. Anindita Paul, Dr. M. Anuradha, Dr. Namita Das Saha and Dr. Suresh Associates: Sri N. Johnson and Sri K. Veeranna
39.	**OC-25**	Pesticide residues in tobacco: Development of analytical methods and monitoring Dr. Anindita Paul and Dr. L.K. Prasad Associates: Dr. V. Venkateswarlu, Dr. K. Rajasekhara Rao, Sri N. Johnson and Sri A.S.S.R. Phani Kumar
40.	**ChVA-1**	Chemoprofiling of dry chilli by unveiling nutraceutical potential utilizing green chemistry Dr. Anindita Paul, Dr. K. Suman Kalyani and Dr. L.K. Prasad Associates: Dr. T. Kiran Kumar, Sri N. Johnson and Dr. M. Sheshu Madhav

Sl. No	Institute Code	Title of the project and Investigator(s)
41.	**PHYK-3**	Crop, water and post-harvest management strategies for enhancing farm income and export potential in rainfed ecosystem of Andhra Pradesh Dr. M. Anuradha, Dr. K. Gangadhara and Dr. Anindita Paul Associates: Dr. J. Poorna Bindu, Dr. L.K. Prasad, Smt. A. Divya and Sri K. Sudhakar
42.	**EVS-1**	Microbes based technological intervention for growth, yield, quality improvement and disease suppression in chilli under Terai agro-ecological region of West Bengal, India Dr. Namita Das Saha and Dr. Partha Saha Associates: Dr. L.K. Prasad, Dr. K. Rajasekhara Rao, Dr. M. Sheshu Madhav, Dr. J. Poorna Bindu, Dr. Anindita Paul, Dr. Somnath Mandal (UBKV) and Sri P. Krishna
43.	**EVS-3**	Climate resilient technological interventions for enhancing nutraceuticals and other commercial traits for enhancing net income from turmeric Dr. Namita Das Saha, Dr. Partha Saha and Dr. K. Suman Kalyani Associates: Dr. L.K. Prasad, Dr. M. Sheshu Madhav, Dr. Somnath Mandal (UBKV) and Sri P. Krishna
44.	**Ag. Extn-53**	A study on opportunities for product diversification in turmeric Dr. K. Suman Kalyani and Dr. Y. Subaiah Associates: Dr. M. Sheshu Madhav, Dr. L.K. Prasad and Dr. J. Poorna Bindu
45.	**Ag.Extn-54**	A study to explore post-harvest management opportunities for enhancing profitability in identified high value commercial crops Dr. Y. Subbaiah, Dr. B. Hema and Dr. K. Suman Kalyani Associates: Dr. S. Kasturi Krishna and Sri T. Venkatesh
46.	**ChVA-2**	Development of value-added products through product diversification in chilli Dr. K. Suman Kalyani Associates: Dr. Namita Das Saha, Dr. Anindita Paul, Dr. L.K. Prasad and Dr. M. Sheshu Madhav
47.	**Ag.Extn-55**	A critical analysis of farmer producer organizations for entrepreneurship in commercial crops Dr. B. Hema, Dr. Y. Subbaiah, Dr. H. Ravisankar, Dr. V.S.G.R. Naidu and Sri K. Viswanatha Reddy Associates: Dr. L.K. Prasad and Dr. M. Sheshu Madhav
48.	**ARIS-17**	Data driven decision making on high value commercial crops Dr. H. Ravisankar, Dr. L.K. Prasad, Sri K. Viswanatha Reddy and Dr. T. Kiran Kumar Associate: Sri M.N.P. Kumar
49.	**Agri.Econ-II**	Value chain analysis of high value commercial crops Mr. K. Viswanatha Reddy and Dr. B. Hema Associates: Dr. L.K. Prasad and Dr. M. Sheshu Madhav
50.	**A-10**	Permanent manurial trial on Motihari tobacco Dr. Namita Das Saha and Dr. Partha Saha Associates: Dr L.K. Prasad, Dr. J. Poorna Bindu, Dr. K. Rajasekhara Rao, Dr. S.K. Dam, Sri J.K. Roy Barman and Sri. P Krishna
Externally funded projects		
Sponsored Projects		
51.	**PPV-FRA-2 (DUS)**	Development of Distinctiveness, Uniformity and Stability (DUS) guidelines for FCV (Flue Cured Virginia) and *bidi* tobacco project Dr. K. Sarala, Dr. K. Prabhakara Rao and Dr. M. Sheshu Madhav

Sl. No	Institute Code	Title of the project and Investigator(s)
52.	**SP-GET-1**	Enhancing climate resilience and ensuring food security with genome editing tools Dr. K. Prabhakara Rao, Dr. K. Sarala, Dr. M. Sheshu Madhav and Dr. Anindita Paul
53.	**SP-BIS**	Study on good agricultural practices for Flue Cured Virginia (FCV) and *bidi* tobacco Dr. M. Sheshu Madhav, Dr. S. Kasturi Krishna, Dr. M. Anuradha, Dr. Y. Subbaiah and Dr. T. Kiran Kumar
54.	**SP-CSIR-1**	Sustainable waste utilization of chilli pedicel in quest of nutraceutical based product Dr. Anindita Paul, Dr. M. Sheshu Madhav, Dr. L.K. Prasad, Dr. Y. Subbaiah, Dr. Supradip Saha (IARI) and Dr. Aditi Kundu (IARI)
55.	**SP-GPI-2**	Genetic exploration to harness burley germplasm resources and breeding for water stress tolerance in burley tobacco Dr. K. Gangadhara, Dr. M. Anuradha, Dr. T. Kiran Kumar and Dr. M. Sheshu Madhav
56.	**SP-ITC-2**	Identification of molecular markers for accelerating the development of wilt resistant tobacco cultivars Dr. M. Sheshu Madhav, Dr. K. Sarala, Dr. K. Prabhakara Rao, Dr. C. Nanda, Dr. S. Ramakrishnan, Dr. S. Madhavan and Dr. H.S. Mahesha
57.	**SP-ITC-3**	Development of Orobanche resistant tobacco through multiomics strategy Dr. K. Sarala, Dr. K. Prabhakara Rao and Dr. M. Sheshu Madhav
58.	**SP-ITC-4**	Characterization and Assessment of Functional Capabilities of NLS Rhizo-Microbiome Dr. J. Poorna Bindu, Dr. M. Sheshu Madhav, Dr. Namita Das Saha, Dr. H.S. Mahesha, Dr. S. Madhavan and Dr. K. Rajasekhara Rao
59.	**SP-TB-7**	Comprehensive assessment of cost of cultivation of FCV tobacco in the KLS region of Karnataka Sri K. Viswanatha Reddy, Dr. M. Sheshu Madhav and Dr. L.K. Prasad
60.	**SP-DBT-1**	Development of AI based Mobile Advisor for diagnosis of diseases in commercial crops and adaption of suitable measures to improve the precision Dr. H. Ravisankar, Dr. M. Sheshu Madhav, Mrs. M. Kamala Kumari, Dr. L.K. Prasad and Dr. H.S. Mahesha
61.	**SP-TB-8**	Introgression of root-knot nematode resistance into elite FCV tobacco variety through marker-assisted backcross breeding Dr. K.P. Raghavendra, Dr. M. Sheshu Madhav, Dr. S. Ramakrishnan, Dr. C. Nanda, Dr. K. Prabhakar Rao, Dr. J.J. Rajappa and Dr. K. Sarala
62.	**SP-TB-9**	Genotype identification and management of drought induced potassium stress tolerance in tobacco Dr. K. Gangadhara, Dr. M. Anuradha, Dr. K. Sarala, Dr. J. Poorna Bindu and Dr. M. Sheshu Madhav
63.	**SP-TB-10**	Efficacy of new fungicide molecules and management of black shank and brown leaf spot diseases of FCV tobacco in NLS region of Andhra Pradesh Dr. H.S. Mahesha, Dr. M. Sheshu Madhav, Dr. K. Rajasekhara Rao, Dr. Anindita Paul, Dr. S.K. Dam and Sri Pankaj Kumar
64.	**SP-TB-11**	Innovative farm machinery solutions for sustainable tobacco farming Dr. M. Sheshu Madhav, Dr. T. Kiran Kumar, Dr. M. Anuradha, Dr. L.K. Prasad, Dr. K. Rajasekhara Rao, Sri K. Viswanatha Reddy, Dr. S. Kasturi Krishna and Dr. Y. Subbaiah
65.	**SP-GPI-3**	Transforming burley tobacco: Achieving low TSNA through innovative genome editing and sustainable management Dr. K. Prabhakara Rao, Dr. K. Sarala, Dr. M. Sheshu Madhav, Dr L.K. Prasad, Dr Kasturi Krishna and Dr. Anindita Paul

Sl. No	Institute Code	Title of the project and Investigator(s)
66.	**SP-GPI-4**	Chloride management for sustainable tobacco development and the consultancy on sustainable burley tobacco production Dr. M. Sheshu Madhav, Dr. L.K. Prasad, Dr. K. Sarala, Dr. S. Kasturi Krishna, Dr. K. Prabhakara Rao, Dr. T. Kiran Kumar, Dr. J. Poorna Bindu, Dr. B. Hema, Dr. M. Anuradha and Dr. J.J. Rajappa
67.	**NABARD-1**	Strengthening the Chilli Farm Sector through Innovative Drying Interventions Dr. B. Hema, Dr. Y. Subbaiah, Dr. L.K. Prasad and Dr. M. Sheshu Madhav
68.	**NABARD-2**	Bolstering of Turmeric Farmers through Innovative Post-Harvest Processing Interventions Dr. L.K. Prasad, Dr. Y. Subbaiah, Dr. B. Hema and Dr. M. Sheshu Madhav
69.	**SP-DS-1**	Alleviation of TSNA in chewing tobacco: An innovative strategy through Genome Editing and sustainable management Dr. K. Prabhakara Rao, Dr. K. Sarala, Dr. M. Sheshu Madhav, Dr L.K. Prasad, Dr. S. Kasturi Krishna and Dr. Anindita Paul
Contract Research Projects		
70.	**CRP-3**	Evaluation of Sulfentrazone 39.6% SC and Sulfentrazone 28% + Clomazone 30% WP herbicides for weed control in tobacco under Northern Light Soils (NLS) and Karnataka Light Soil (KLS) FCV tobacco growing region Dr. S. Kasturi Krishna, Dr. M. Mahadevaswamy, Dr. S. Ramakrishnan and Dr. T. Kiran Kumar
71.	**CRP-4**	Evaluation of Nano bio-tech capsules as biofertilizers for FCV tobacco in KLS and NLS Dr. J. Poorna Bindu, Dr. S. Ramakrishnan and Dr. M. Sheshu Madhav
72.	**CRP-5**	Evaluation of Imported Burley varieties and hybrid Dr. K. Sarala, Dr. K. Gangadhara, Dr. T. Kiran Kumar, Dr. L.K. Prasad, Dr. P. Venkateswarlu, Dr. M. Sheshu Madhav and Sri K. Viswanatha Reddy
73.	**CRP-6**	Bioefficacy of new generation combination insecticides – Emamectin benzoate 5% + Lufenuron 40% WG and Spiropidion 30% + Acetamiprid 24% WG against *Spodoptera litura* and *Bemisiatabaci* Dr. V. Venkateswarlu, Smt. B. Sailaja Jayasekharan, Dr. K. Rajasekhara Rao, Dr. S. Ramakrishnan, Dr. Anindita Paul, Dr. T. Kiran Kumar and Dr. M. Sheshu Madhav
74.	**CRP-7**	Evaluation of IFFCO Nano Urea and Nano DAP in FCV tobacco in Karnataka Light Soil (KLS) Dr. S. Ramakrishnan and Dr. S. Kasturi Krishna
75.	**CRP-8**	Evaluation of IFFCO Nano Urea and Nano DAP in FCV tobacco under Southern Light Soils of Andhra Pradesh Dr. M. Anuradha, Dr. S. Kasturi Krishna, Dr. L.K. Prasad and Dr. J. Poorna Bindu
76.	**CRP-9**	Efficacy evaluation of Spirotetramat 150 G/L OD (Movento) on Tobacco crop Dr. V. Venkateswarlu, Dr. K. Rajasekhara Rao, Mrs. B. Sailaja Jayasekaran, Dr. S. Ramakrishnan, Dr. Anindita Paul, Dr. M. Venkatesan and Dr. M. Sheshu Madhav
77.	**CRP-10**	Bioefficacy of Pydiflumetofen 7.5% + Difenoconazole 12.5% w/v (200 SC) against Brown Spot Disease of Tobacco Dr. H.S. Mahesha, H.S., Dr. K. Rajasekhara Rao, Dr. M. Sheshu Madhav, Dr. S.K. Dam and Mr. Pankaj Kumar

Sl. No	Institute Code	Title of the project and Investigator(s)
78.	**CRP-11**	Evaluation of bio-efficacy of Cyclobutrifluram 45% w/v SC (450 SC) against Root-Knot Nematodes in Tobacco Dr. M. Venkatesan and Dr. M. Sheshu Madhav
79.	**CRP-12**	Evaluation of FIB-SOL microbial consortium for enhanced yield, quality and soil health of FCV tobacco Dr. J. Poorna Bindu, Dr. M. Sheshu Madhav, Dr. S. Kasturi Krishna, Dr. H.S. Mahesha and Dr. K. Rajasekhara Rao
80.	**PPP-1**	Research, development and promotion of specialty chemicals for effective control of suckers, growth promoters and also plant nutrient supplements to enhance the productivity Dr. L.K. Prasad, Dr. M. Anuradha, Dr. S. Ramakrishna, Dr. Anindita Paul and Dr. M. Sheshu Madhav
81.	**PPP-2**	Investigation, facilitation and promotion of liquid petroleum gas as a fuel for curing FCV tobacco green leaf Dr. L.K. Prasad, Dr. Y. Subbaiah, Sri Y. Venkateswara Rao, Sri T. Ramesh, Sri Krishna Chandra and Sri Devanand
82.	**PPP-3**	Evaluation of customized drip fertigation solutions for enhanced yield and quality of FCV tobacco Dr. J. Poorna Bindu, Dr. M. Sheshu Madhav, Dr. S. Kasturi Krishna and Dr. K. Rajasekhara Rao
Corporate Social Responsibility		
83.	**CSR- 1**	Upliftment of Tobacco farmer ecosystem through IoTs and sustainable agricultural practices Dr. K. Rajasekhara Rao, Dr. M. Sheshu Madhav, Dr. J. Poorna Bindu, Dr. T. Kiran Kumar, Dr. Y. Subbaiah, Dr. H. Ravisankar, Smt. B. Sailaja Jayasekharan, Dr. H.S. Mahesha and Dr. S. Kasturi Krishna
84.	**CSR- 2**	Achieving Environmental Sustainability through Carbon Footprint Reduction and Enhanced Sequestration in FCV tobacco Dr. T. Kiran Kumar, Dr. M. Sheshu Madhav, Dr. K. Rajasekhara Rao, Dr. L.K. Prasad, Dr. M. Anuradha, Dr. S. Ramakrishnan, Dr. J. Poorna Bindu, Sri K. Viswanatha Reddy, Dr. B. Hema and Dr. Anindita Paul
85.	**CSR- 3**	Energy Saving Green Interventions for Curing FCV tobacco leaf Dr. L.K. Prasad, Dr. M. Sheshu Madhav, Dr. M. Anuradha, Dr. T. Kiran Kumar, Dr. B. Hema and Sri K. Viswanatha Reddy
Institute Corpus Fund		
86.	**NIRCA. CF-1**	District level analysis of Agricultural Sustainability in Andhra Pradesh Sri K.Viswanatha Reddy, Dr. M. Sheshu Madhav and Dr. L.K. Prasad
87.	**NIRCA. CF-2**	Livelihood analysis of FCV tobacco farmers in Andhra Pradesh and Karnataka Dr. B. Hema, Dr. Y. Subbaiah, Dr. L.K. Prasad and Dr. M. Sheshu Madhav
88.	**NIRCA-CSIO CF-3**	Feasibility study on the development of a sensor to measure and classify Chilli hotness on Capsaicin content (in collaboration with CSIR-CSIO) Dr. M. Sheshu Madahv, Dr. L.K. Prasad, Dr. Anindita Paul, Dr. K. Rajasekhara Rao and Dr. H. Ravishankar

अनुसंधान सलाहकार समिति, संस्थान अनुसंधान परिषद तथा संस्थान प्रबंधन समिति की बैठकें

RAC, IRC and IMC Meetings

अनुसंधान सलाहकार समिति RESEARCH ADVISORY COMMITTEE

Research Advisory Committee of ICAR-NIRCA was constituted by ICAR vide F.No.CS/12/4/2024-CC (e.no. 319457) dated 20.01.2025 with the following members for a period of three years w.e.f. 19.12.2024 to 18.12.2027.

Dr. S. Rajendra Prasad - Chairman
Ex-Vice Chancellor, UAS
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Pr. Sci (PP) Retd, ICAR- NCIPM,
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Member-IMC,
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Dr. L.K. Prasad - Member Secretary
Pr. Scientist & Head,
Div. of PH&VA
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Email : lkprasad123@gmail.com

The Research Advisory Committee of ICAR–National Institute for Research on Commercial Agriculture convened on 4–5 November 2025 at ICAR-NIRCA, Rajahmundry. The committee reviewed the progress of research undertaken at the institute and its research stations, and provided suggestions and recommendations to strengthen ongoing programmes while also identifying opportunities for initiating new research in emerging areas of commercial agriculture relevant to the mandated crops.

RAC Recommendations

1. Identify genes and QTLs for *Orobanche* resistance in wild tobacco species and publish cytogenetics and flow cytometry data prior to whole genome sequencing. Conduct fundamental research on resistance genes and mechanisms in selected germplasm and use Genome-Wide Association Studies (GWAS) with SNPs from re-sequencing for identifying markers linked to stress tolerance traits.
2. Strengthen research programs on enhancing capsaicin, ASTA color values and curcumin content in chilli and turmeric, respectively, and screening for high root yielding germplasm of *Withania somnifera* (Ashwagandha) having better metabolite contents to satisfy industry needs. Promote collaboration with research institutes (e.g., CSIR-NBRI) for genetic resource improvement and use of PGPRs to enhance productivity.
3. Employ bio-agents such as *Bt*, *Beauveria bassiana*, *Metarhizium anisopliae* for insect pests, *Chlamydosporium* and *Paecilomyces lilacinus* for nematodes, and *Trichoderma* spp. and *Bacillus subtilis* for disease management in tobacco nurseries, while Trichoderma spp in turmeric. Register all *Trichoderma* isolates with NBAIM, Mau. Explore any of the plant-based bio-stimulants (amino acid consortia) to improve leaf size, chlorophyll content, and physiological traits in tobacco.
4. Compare LPG or electric curing systems with traditional wood-fired barns in tobacco for economic efficiency, environmental impact, curing time, user convenience, and cost-benefit ratio.
5. Promote agri-entrepreneurship in chilli, turmeric, and other mandated crops possibly by establishing incubation centers. Develop marketing and value addition models for processed and derivative products.
6. Cost-efficient extraction protocol of 2-Octanol from castor need to be amplified in collaboration with other scientific organizations / national chemical laboratories/industries.
7. Undertake market studies using Market chain analysis to assess and forecast India's export share in tobacco, chilli, and castor. Work on establishing quality standards and certification systems for chilli and turmeric to meet international market requirements.
8. Develop agronomic and cropping system interventions suitable to agroclimatic conditions addressing climate change, enhancing bio active compounds, multi-cropping intensity, and sustainability across mandated crops.
9. The RAC members recommended for increasing the scientific cadre strength, especially in the discipline of agricultural chemicals, food processing, agricultural processing engineering and environmental science and recommended that related vacant positions need to be filled up in a priority basis.

संस्थान अनुसंधान समिति की बैठक
INSTITUTE RESEARCH COMMITTEE (IRC) MEETINGS

The Institute Research Committee (IRC) meeting of the ICAR–National Institute for Research on Commercial Agriculture (ICAR–NIRCA) was held from 31st October to 2nd November, 2025. The progress of the research programmes undertaken during 2024–25 was reviewed, and new research programmes for 2025–26 were discussed and finalized.

संस्थान प्रबंधन समिति
INSTITUTE MANAGEMENT COMMITTEE (IMC)

Dr. M. Sheshu Madhav — **Chairman**
Director,
ICAR-NIRCA,
Rajahmundry

Director of Agriculture — **Member**
Govt. of A.P.,
Hyderabad

Director of Agriculture — **Member**
Govt. of Tamil Nadu,
Chennai

Associate Dean — **Member**
Agriculture College,
ANGRAU,
Rajahmundry

Sri Unnam Simhadri — **Member**
1-35, Kandukur Mandalam,
Anantha Sagaram,
Kandukur-523 106
Andhra Pradesh

Dr. M.S.C. Sundaramoorthi — **Member**
Vedaranyam,
Nagapattinam Dist.,
Tamil Nadu

Dr. L.K. Prasad — **Member**
Principal Scientist & Head,
Divn. of PH & VA
ICAR-NIRCA, Rajahmundry

Dr. Kishor Gaikwad — **Member**
Principal Scientist,
ICAR-NIPB, New Delhi-12

Dr. A. Kiran Kumar — **Member**
Dean of Horticulture,
DoE & Comptroller,
SKLTSHU, Mulugu-502 279.
Siddipet District

Dr. C. K. Narayana — **Member**
Principal Scientist (Hort.),
Divn. of PHT & AE,
ICAR-IIHR, Hassaraghatta,
Bengaluru-89

Asst. Director-General (CC) — **Member**
ICAR, New Delhi

Sri Kuldeep Patidar — **Member Secretary**
Administrative Officer,
ICAR-NIRCA,
Rajahmundry

The 59th Institute Management Committee meeting was held on 29.09.2025 at ICAR-NIRCA, Rajahmundry.

सम्मेलन, बैठक, कार्यशाला तथा संगोष्ठियों में वैज्ञानिकों की प्रतिभागिता

Participation of Scientists in Conferences, Meetings, Workshops and Symposia

क्रम सं[I **Sl. No.**	नाम **Participant (s)**	कार्यक्रम **Programme attended**	दिनांक एवं स्थान **Date and place**
1.	Mr. K. Viswanatha Reddy	38th National Conference on Agricultural Marketing	10th January 2025 at UAS, GKVK Bangalore
2.	Dr. Partha Saha Dr. T. Kiran Kumar Dr. Namitha Das Saha Dr. J. Poorna Bindu Dr. Anindita Paul	International Conference on Global Research Initiatives for Agriculture, Science and Technology "GRIAST-2025 (Online)	20-22nd January, 2025 organized by Indira Gandhi Krishi Vishwavidyalaya (IGKV) Raipur (Chhattisgarh) and national Agriculture Development Cooperative Ltd. (NADCL) Baramulla (UT of J&K)
3.	Dr. M. Venkatesan	National Symposium on Nematode Management in Agriculture	4th February 2025 by Syngenta India Pvt Ltd at Goa
4.	Dr. M. Sheshu Madhav Dr. T. Kiran Kumar	Stakeholders meeting on Good Agricultural Practices for *Bidi* Tobacco	11th February BTRC, AAU, Anand
5.	Dr. Anindita Paul	Webinar on CORESTA-Proficiency testing	13th February 2025 by CORESTA-PT group
6.	Dr. S. Ramakrishnan	32nd SAC meeting of ICAR- JSS KVK, Suttur	17th February, 2025 Mysore, Karnataka
7.	Dr. M. Sheshu Madhav	Review meeting of fast-track mission mode project on "Development of Nicotine-less Tobacco Plants through a Genome-Editing Approach	20-21st February, 2025 at CSIR, New Delhi
8.	Mr. K. Viswanatha Reddy	Tobacco Board Meeting to work out the cost of cultivation of FCV tobacco for the NLS region in Andhra Pradesh for the 2024-25 crop season	24th February 2025 at Tobacco Board RM Office, Rajahmundry
9.	Dr. B. Rajasekhar Reddy	32nd AGM of AICRP(MAP&B)	24-26th February, 2025 at ICAR-DMAPR, Anand
10.	Dr. M. Sheshu Madhav	263rd Meeting of the Governing Body of the ICAR Society	27th February, 2025 NASC Complex, New Delhi
11.	Dr. M. Sheshu Madhav	Indian Orchid Festival-2025 themed "Orchids for Beauty and Prosperity" as distinguished Special Guest	2nd March, 2025 Pakyong (Sikkim)
12.	Dr. Partha Saha	Scientific Advisory Committee meeting of Krishi Vigyan Kendra, Cooch Behar	1st March, 2025 UBKV, Pundibari

क्रम सं[ा **Sl. No.**	नाम **Participant (s)**	कार्यक्रम **Programme attended**	दिनांक एवं स्थान **Date and place**
13.	Dr. Anindita Paul	Review meeting on BIS sponsored project on" Good Agricultural Practices on *Bidi* tobacco"	12th March, 2025 by FAD 4, BIS
14.	Dr. M. Sheshu Madhav	Academia-Industry-Farmer Partnerships (AIFPs) Conclave - 2025	15th March, 2025 VFSTR at Vignan University, Vadlamudi
15.	Dr. Anindita Paul	Pesticide Multi residue Analysis in Culinary Herbs and Spices	24th March, 2025 by AOAC, South East Asia
16.	Dr. K. Sarala	Annual Review meeting of DUS Centres	25th March, 2025 New Delhi
17.	Dr. Anindita Paul	"Techniques for Successful Applied Tobacco Field Research"	15th April, 2025 by CORESTA Agronomy and Leaf Integrity & Phytopathology and Genetics Study Groups
18.	Dr. M. Sheshu Madhav	Brain Storming Workshop on Chilli and Tomato	9th May, 2025 Water Resource Centre, Governerpeta, Vijayawada
19.	Dr. K. Sarala Dr. K. Prabhakara Rao Dr. J.J. Rajappa Dr. Anindita Paul	Webinar on "Tobacco Genetic Resources: The Foundation for a Global Industry"	13th May 2025 by CORESTA
20.	Dr. G. Prasad Babu & All 6 SMSs of KVK, Kandukur	Annual Action Plan Meeting of KVKs of Andhra Pradesh for the year 2025-26	14-16th May, 2025 at RARS, Lam, Guntur
21.	Dr. M. Sheshu Madhav	Annual Meet of Vice-Chancellors of Agri. Universities and Directors' Conference of ICAR Institutes	20th May 2025 NASC Complex, New Delhi
22.	Dr. M. Sheshu Madhav	Review meeting on MIDH proposals and SLTP of ANGRAU	21st May 2025 Additional Directorate of Horticulture, Guntur
23.	Dr. Anindita Paul	Green Chemistry Using Smarter Metrics: A Life Cycle Approach	22nd May, 2025 by Agricultural and Food Chemistry Division, ACS
24.	Dr. Anindita Paul	27th meeting of the Tobacco and Tobacco Products Sectional Committee FAD 4	29th May, 2025 by FAD 4, BIS
25.	Dr. M. Sheshu Madhav	Review meeting of VIKSIT BHARATH SANKALP ABHIYAN	5th June, 2025 Rangampeta, E.G.Dt.

क्रम सं[ा **Sl. No.**	नाम **Participant (s)**	कार्यक्रम **Programme attended**	दिनांक एवं स्थान **Date and place**
26.	Dr. Anindita Paul	World Food Safety Day (WFSD) "Research-Driven Standards for Food Safety" (Virtual)	10^{th} June, 2025 by BIS, New Delhi
27.	Dr. T. Kiran Kumar	National seminar on "Climate smart innovations to address the current agronomic challenges"	27-28^{th} June 2025 at RARS, Tirupathi, Andhra Pradesh
28.	Dr. M. Sheshu Madhav	Regional Advisory Committee meeting of NABARD	8^{th} July, 2025 at Vijayawada
29.	Dr. M. Sheshu Madhav	97^{th} Foundation Day and Award Ceremony of the ICAR	16-17^{th} July, 2025 at NASC Complex, New Delhi
30.	Dr. H. Ravi Sankar	"Quantum technologies and their applications: A Comprehensive Survey" in FDP	18^{th} July, 2025 by AKNU at ICAR-NIRCA
31.	Dr. L. K. Prasad Dr. Anindita Paul	29^{th} meeting of the Tobacco and Tobacco Products Sectional Committee FAD 4	24^{th} July, 2025 by FAD 4, BIS
32.	Dr. C. Nanda Dr. K. Gangadhara	International Conference on 'Recent Advances in Agricultural, Biological & Applied Sciences for Eco-Friendly Development (RAABASED-2025)	25-27^{th} July, 2025 at Maya Devi University, Dehradun, Uttarakhand
33.	Dr. V. Venkateswarlu	Transforming Food, Land, and Water (FLW) Systems to Combat the Climate Crisis	14^{th} August 2025 held at ANGRAU, RARS, Lam, Guntur
34.	Dr. Namita Das Saha	VKSA workshop	19^{th} August, 2025 at Barrackpore organised by CIFRI, Kolkata, W.B.
35.	Dr. L. K. Prasad Dr. Anindita Paul	Briefing meeting of Indian delegation for the 40th Plenary of ISO/TC 126	25^{th} August, 2025 by FAD 4, BIS
36.	Dr. K. Rajasekhara Rao	Interaction Meeting with the Scorecard Review Committee for review of existing scorecards of RMP and non-RMP positions of ASRB	26^{th} August, 2025 at NASC Complex, Pusa, New Delhi
37.	Dr. G. Prasad Babu	Attended annual zonal workshop of KVKs of ATARI Zone-X, Hyderabd.	2-4^{th} September, 2025 at VIT, Vellore
38.	Dr. M. Sheshu Madhav	40^{th} Meeting of ISO/TC-126 "Tobacco and Tobacco Products" and its working bodies as a Team Leader of Indian delegation	2-5^{th} September, 2025 at Stockholm, Sweden, Swedish Institute of Standards

क्रम सं[ा Sl. No.	नाम Participant (s)	कार्यक्रम Programme attended	दिनांक एवं स्थान Date and place
39.	Mr. K. Viswanatha Reddy	State level workshop of the coordination committee for convergence of agriculture research and development programme	4th September, 2025 at ANGRAU, Lam, Guntur
40.	Dr. Anindita Paul Dr. L.K. Prasad	31st Meeting of Food and Agriculture Division Council, FADC	4th September, 2025 by BIS, FAD, DG, DARE ICAR, New Delhi
41.	Dr. K. Prabhakara Rao	Virtual Plant Metabolomics Workshop	4th September, 2025 by the University of Johannesburg
42.	Dr. K.R. Sriranga	Dissemination of Novel Technologies for Improved Livestock and Poultry Production and Doubling Farmers' Income	11-12th September, 2025 at Sri Venkateshwara Veterinary University, Tirupati
43.	Dr. K. Sarala Dr. L.K. Prasad Dr. K. Rajasekhara Rao Dr. S. Kasturi Krishna Dr. P. Manivel Dr. M. Anuradha Dr. S. Ramakrishnan Dr. M. Kumaresan Dr. K. Prabhakar Rao Dr. C. Nanda Dr. T. Kiran Kumar Dr. V. Venkateswarlu Dr. Namitha Das Saha Mr. K. Vishwanath Reddy Dr. B. Rajasekhar Reddy Dr. Kaushal Pratap Singh Dr. J.J. Rajappa Dr. K. Gangadhara Dr. M. Venkatesan Dr. Anindita Paul Dr. H.S. Mahesha Smt. B. Krishna Kumari	XXVII Tobacco Workshop of All India Network Project on Tobacco	16-17th September, 2025 held at KSNUA & HS, Shivamogga, Karnataka
44.	Dr. Anindita Paul	Advance Workshop on Mass Spectrometry for Food Safety and Residue Analysis	18-19th September, 2025 by Indian Institute of Mass Spectrometry, Chennai
45.	Dr. M. Sheshu Madhav	National Conference on "Climate change and Horticulture: Impacts, Adaptation and Mitigation strategies"	19th September, 2025 at Sri Konda Laxman Telengana Horticultural University, Mulugu, Siddipet Dist
46.	Dr. T. Kiran Kumar Dr. K. Rajasekhara Rao	European green deal sensitization workshop	20th September, 2025 at Jangareddy Gudem

क्रम सं[I **Sl. No.**	नाम **Participant (s)**	कार्यक्रम **Programme attended**	दिनांक एवं स्थान **Date and place**
47.	Mr. K. Viswanatha Reddy	FICCI Bharat R&D summit 2025	24-27th September, 2025 at New Delhi
48.	Dr. J. Poorna Bindu Dr. B. Hema	CORESTA Agronomy & Leaf Integrity and Phytopathology & Genetics Conference 2025	28th September to 2nd October, 2025 by CORESTA, Surabaya East Java, Shangri-La Surabaya Hotel, Indonesia
49.	Dr. K. Prabhakara Rao	Virtual sessions on "PVP in India"	29th September, 2025 by PPVFRA, New Delhi
50.	Dr. Anindita Paul	Orientation on Online Standards Development (OSD) Module, the New Standards Portal	30th September, 2025 by BIS, New Delhi
51.	Dr. Anindita Paul	Global Scientific Conference 2025 co-hosted by the American Chemical Society and IIT Bombay	8-11th October, 2025 at IIT, Bombay
52.	Dr. K.P. Singh	Research & Industrial Conclave-Synergy 2025	10-12th October, 2025 at Indian Institute of Technology, Guwahati
53.	Dr. T. Kiran Kumar	Workshop on "From findings to Future Planning & collaboration in natural farming Research" with IGGAARL, RySS Partners	13-14th October, 2025 at Hyderabad
54.	Dr. C. Nanda	Two-Day International Symposium on "Colours from VIBGYOR to Earth" (ISCVE2025) (Online)	16-17th October, 2025 by Amity Institute of Biotechnology, Lucknow
55.	Dr. G. Prasad Babu Dr. I. Venkatesh	National Conference on "Enhancing Productivity & Ensuring Food Safety of Chilli (Capsicum spp.)"	27-29th October, 2025 at UHS, Bagalkot, Karnataka
56.	Dr. M. Sheshu Madhav	11th Indian Horticulture Congress and International Meet-2025	8th November, 2025 at UAS, Bengaluru
57.	Dr. K. Rajasekhara Rao	International Conference on 'Environmental shift: Impact on animal biota, food, feed, nutritional security & human health'	11-13th November, 2025 at Institute of Agricultural Science, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar, Odisha
58.	Dr. K. Sarala	Silver Jubilee of PPV& FRA and 21st Foundation Day of PPV &FRA, New Delhi	12th November, 2025 at New Delhi

क्रम सं[ा Sl. No.	नाम **Participant (s)**	कार्यक्रम **Programme attended**	दिनांक एवं स्थान **Date and place**
59.	Dr. M. Venkatesan	9th International conference – "Advances in Agricultural, Biological and Biodiversity Conservation for Sustainable Development"	13-15th November, 2025 University of Mysuru, Mysuru, Karnataka
60.	Dr. K. Rajasekhara Rao	Brainstorming Session on 'Semi Chemicals-Driven strategies for sustainable pest management in Indian Agriculture'(online)	20th November, 2025 by National Academy of Agricultural Sciences (NAAS), New Delhi
61.	Dr. M. Sheshu Madhav	Earth Summit-2025-Empowering Agriculture, Rural Tech & Humanity	21th November, 2025 by NABARD at HITEX, Hyderabad
62.	Dr. S. Kasturi Krishna Dr. T. Kiran Kumar Dr. M. Kumaresan	6th International Agronomy Congress on Re-envisioning Agronomy for Smart Agri-Food Systems and Environmental Stewardship	24-26th November, 2025 at NAAS Complex, New Delhi
63.	Dr. M. Sheshu Madhav	Telangana Rising Global Summit-2025	8th December, 2025 at Bharat Future City, Hyderabad
64.	Dr. Namita Das Saha	National Conference on Land and Water Management for Ecological Restoration and Agricultural Sustainability	08-10th December 2025 at Punjab Agricultural University (PAU), Ludhiana, Punjab by Soil Conservation Society of India
65.	Dr. M. Sheshu Madhav	95th Annual Session and Symposium on "Healthy Brain, Mind and Cognition: From Computers to Clinics" and participated in the meeting to receive the NASI Fellow-2025 Award	9th December, 2025 at IITG, Guwahati.
66.	Dr. Vivek Rajesh Kamat	Precision Agriculture Using Drones and Remote Sensing Data	15-19th December, 2025 at ICAR - NAARM, Hyderabad
67.	Mr. K. Viswanatha Reddy	State level workshop of the Coordination Committee to discuss the finalization of the state action plan for AP	18th December, 2025 at ANGRAU, Lam, Guntur
68.	Dr. M. Sheshu Madhav	Bharatiya Vigyan Sammelan (BVS-2025)	28th December, 2025 at National Sanskrit University, Tirupati

प्रशिक्षण एवं क्षमता निर्माण कार्यक्रम
Trainings and Capacity Building Programmes

क्र. सं. Sl. No.	नाम Participant (s)	कार्यक्रम Programme attended	तारीख एवं समय Date and place
1.	Dr. H. Ravisankar Dr. K. Prabhakara Rao Dr. B. Rajasekhar Reddy Dr. B. Hema Dr. Anindita Paul Dr. H.S. Mahesha Sri Prasanth Varma	Training on "Online IP Awareness Week"	16-17th & 20-22nd January, 2025
2.	Sri Sanjay Vinayak Hegde	ICAR-sponsored 21-day Winter School Programme on 'Recent Advances in Food Processing Technologies for Agri-Horti Produce'	16th January to 5th February 2025 at ICAR-IARI, New Delhi
3.	Sri Raghunandan N.V.	Launch cum Awareness Workshop of FOM / LFOM	11th February 2025 ATARI Zone-X, Hyderabad
4.	Dr. Anindita Paul Dr. B. Rajasekhar Reddy Dr. S. Bhaskar Naik Smt. P. Srilakshmi Sri P. Trinadh Sri Himanshu Yadav Sri Ramu Nambari Sri Pankaj Kumar Sri A.S.R.R. Phani Kumar Sri Kshitish Kumar Mishra Sri Saurabh Kumar Sri Krishna Chandra Sri M.N.P. Kumar Sri I. Arvind Smt. N. Maheswari Sri S.S.K.C. Gowd Ponakalla Sri Kolli Satyanarayana Sri G. Harish	Training programme on "Internal Auditor Training on ISO 9001:2015, Quality Management System"	03-04th March, 2025 at ICAR-NIRCA
5.	Sri Kuldeep Patidar	Module- I of Foundation training Programme (AOs & FAOs)	17th March to 16th April 2025 NAARM, Hyderabad
6.	Sri Kuldeep Patidar	Institute-attached training under Module- II of Foundation training Programme (AOs & FAOs)	17th April to 06th June 2025 ICAR-NIRCA
7.	Sri Kuldeep Patidar	Study tour & Exposure activities under Module- III of Foundation training Programme (AOs & FAOs)	09th June to 04th July 2025 ICAR, New Delhi & Various ICAR institutes

क्र. सं. Sl. No.	नाम Participant (s)	कार्यक्रम Programme attended	तारीख एवं समय Date and place
8.	Dr. B. Nageswara Reddy	Online training programme on 'Analysis of experimental data using R'	21st to 25th July, 2025 at KVK, Kalavacharla
9.	Dr. B. Nageswara Reddy	Training programme on 'Dissemination of novel technologies for improved livestock and poultry production and doubling farmers' income'	11th to 12th September, 2025 at SVVU, Tirupati
10.	Smt. B. Krishna Kumari	eHRMS Organogram (Online)	26th September, 2025 organised by DoPT & Ehrms Team, ICAR
11.	Smt. B. Krishna Kumari	Implementation of e-office -FFNS in ICAR (Online)	13 th November, 2025 organised by ICAR, New Delhi
12.	Smt. B. Krishna Kumari	eOffice – Functional File Numbering System (FFNS): Clarification of Doubts (Online)	18th November, 2025 organised by ICAR, New Delhi
13.	Smt. B. Sailaja Jayasekharan	Drone (UAV) Pilot training	19-25th November, 2025 at PJTAU, Hyderabad
14.	Sri N. Johnson Sri A.S.R.R. Phani Kumar Sri Kshitish Kumar Mishra Sri Ajit Sri Saurabh Kumar Sri P. Trinadh	Training on Phytochemical Analysis Techniques in Commercial Crops	8-16th December 2025
15.	Dr. P. Manivel Smt. G. Hemlata	Igot Karmayogi	15-16th December, 2025 NAARM, Hyderabad
16.	Er. Vivek Rajesh Kamat	5 days training programme on "Precision Agriculture Using Drones and Remote Sensing Data	15-19th December, 2025 at ICAR- NAARM, Hyderabad
17.	Scientific, Technical and Administrative staff of ICAR-NIRCA, Rajahmundry	Rashtriya Karmayogi Jan Seva Programme	29th December, 2025 at ICAR-NIRCA, Rajahmundry

कार्यशाला, बैठक तथा किसान दिवस

Workshops, Meetings and Farmers' Days

ICAR-NIRCA organized seminars, meetings, workshops, farmers' day, and farmer-centric programmes during the year to ensure active participation and interaction among tobacco stakeholders. The major programmes conducted are presented below in chronological order:

- Committee meeting on revisiting guidelines for testing tobacco crop varieties under AINPT was conducted on 08 January 2025

- The live telecast of release of 19th and 20th and 21st installment under PM-KISAN Samman Nidhi was organized on 24.02.2025 and 02.08.2025 and 19.11.2025

- ICAR-NIRCA Innovators Meet was conducted on 08 April 2025 with participation from researchers, agri-entrepreneurs, startups, industry experts, FPOs, NGOs, and policymakers.
- Turmeric Stakeholders Conclave was organized on 11 April 2025 at ICAR-NIRCA, Rajahmundry.
- Seed Production Advisory Committee meeting was organized on 23 May 2025 at ICAR-NIRCA, Rajahmundry.
- International Yoga Day was celebrated on 21 June 2025 at ICAR-NIRCA, Rajahmundry.

- Institutional Biosafety Committee (IBSC) meeting was held on 04 July 2025 at ICAR-NIRCA, Rajahmundry.

- Tobacco Seed Sale Programme was inaugurated on 10 July 2025 at ICAR-NIRCA, Rajahmundry, with participation of farmers, scientists, and stakeholders from FCV tobacco-growing regions.

- Sensitization programme on "Sustainable Practices in Tobacco" for NLS farmers was conducted on 20 August 2025 at ICAR-NIRCA, Rajahmundry.

- The 27th AINPT Workshop was conducted during 16 to 17 September 2025 at KSNUAH, Shivamogga, Karnataka.

- Swachhta Hi Seva campaign was conducted from 17.09.25 to 02.10.2025, followed by Swachh Bharat Diwas on 02 October 2025.

- Hindi Day was celebrated on 29 September 2025 at ICAR-NIRCA, Rajahmundry.

- "PM Dhan Dhaanya Krishi Yojana" and "Mission for Aatmanirbharta in Pulses" programmes were organized on 11 October 2025 at ICAR-NIRCA, Rajahmundry.

- Vigilance Awareness Week was observed from 27 October to 02 November 2025 with the theme "Vigilance: Our Shared Responsibility."

- Constitution Day (Samvidhan Diwas) was observed on 26 November 2025 at ICAR-NIRCA, Rajahmundry.

- ICAR-NIRCA organized Brain storming session on "Navigating the European Green Deal and Sustainability Standards: Implications for Indian Tobacco Production, Export Competitiveness, and Future Directions" on 16 December, 2025

- National Farmers Day (Kisan Diwas) was organized on 26 December 2025, focusing on clean farm practices (Swachh Kheti). Progressive farmers were felicitated with certificates and awards.

ICAR-NIRCA FORMATION DAY

ICAR-CTRI, as a leading institute in the Indian tobacco sector, has embarked on a new chapter as the ICAR-National Institute for Research on Commercial Agriculture (ICAR-NIRCA) on 21st January, 2025. Shri Bhupathi Raju Srinivasa Varma, MoS of Heavy Industries and Steel, graced as the Chief Guest, renaming the building and unveiling the new logo, marking a significant milestone. Dr. M. Sheshu Madhav, Director, outlined the transformation from ICAR-CTRI to ICAR-NIRCA and future research initiatives to support the Vikasit Bharat initiative. He underscored the institute's goal to become a center of excellence in commercial agriculture. Dr. T.R. Sharma, DDG (CS), ICAR, praised the institute's seven decades of excellence in tobacco research and urged scientists to pursue innovative studies on mandate crops. Dr. Shaik N. Meera, Director, ICAR-ATARI-Zone X, Hyderabad, envisioned ICAR-NIRCA excelling through the integration of AI and BCT with advanced research and market intelligence. NIRCA'S Nest, a sales outlet of NIRCA was inaugurated by Dr. Tilak Raj Sharma, Deputy Director General (Crop Science), ICAR during the event.






कृषि में महिला सशक्तिकरण

Empowerment of Women in Agriculture

ICAR-NIRCA stands in the fore front to provide equal opportunities for women for career growth and institute building. To empower women farmers, ICAR-NIRCA, its research stations and associated KVKs organized several women-centric programmes to support women farmers and agricultural workers.

ICAR-NIRCA headquarters

The Women Cell of ICAR–NIRCA, Rajahmundry has been actively engaged in empowering tribal women under the Tribal Sub Plan by organizing awareness programmes on value added products of NIRCA at Nuvganti Palem and Regadi Palem during October and November 2025. Each programme witnessed the participation of fifty tribal women, where the importance of diagnosing nutritional deficiencies, adopting corrective measures, and following balanced diets for improved health and well being was emphasized. The Women Cell highlighted its ongoing initiatives to strengthen knowledge, skills, and livelihood opportunities among tribal women, thereby fostering self reliance and socio economic empowerment. To enhance grassroots awareness, leaflets in Telugu on balanced diets were distributed, and specially prepared NIRCA Nutri Kits containing turmeric powder, chili powder, nutrient powder, sesame chikkies, groundnut chikkies, lemon pickle, mango pickle, turmeric sandal soaps, dhoop sticks, and dhoop cones were provided to all participants. These efforts reflect the institution's commitment to promoting nutritional security, health awareness, and inclusive growth among tribal communities.

KVK, Kalavacharla

Trainings for women farmers at KVK, Kalavacharla, Andhra Pradesh

- Training programme was conducted on Value Addition in Tapioca on 22-02-2025 for 12 women participants. The programme focused on processing and preparation of tapioca-based products to enhance income opportunities and promote diversification.

- A Nutrition Awareness Programme focusing on maternal and child nutrition for pregnant women, lactating mothers, and mothers of children under six years age was conducted in eight different villages during 13-07-2025 to 30-07-2025 with the participation of 248 women. The programme emphasized dietary guidelines, importance of maternal nutrition, and practices for improving child health at the household level.

- Awareness Programme on Nutrition and Care during Pregnancy and Lactation was conducted on the occasion of World Breastfeeding Week at Anganwadi Centres, Kalavacharla and Rajanagaram, East Godavari District on 05.08.2025 and 06.08.2025, respectively. A total of 23 pregnant and lactating women participated.

- An Entrepreneurship Training was arranged on Masala (Spices mix) Powder Manufacturing on 25-09-2025 with the participation of 22 women. Through the programme- analysis of business potential, and details of investment planning, licensing, cost and profit, marketing strategies were taught, including a hands-on preparation session for various masala mixes.

- A demonstration on Coconut Value Addition was conducted with 19 women participants. The programme highlighted preparation of coconut lemonade, desiccated powder, cookies, laddus (sweets), and other products, showcasing opportunities for income enhancement, product diversification apart from reducing waste.

- A demonstration on Value Addition in Turmeric was conducted with 23 women participants. The programme highlighted preparation of turmeric cumin/ jeera cookies and turmeric shrikhand (curd based sweet dessert), both of which were well accepted for taste, appearance, and sensory qualities, confirming scope for functional food development at the community level.

- Training Programme on Value-added Products of Karonda (Indian cherry *Carissa carandas*) was arranged on 22-07-2025 with the participation of 32 girl students from Maris Stella College, Vijayawada.

KVK, Kandukur

Trainings for women farmers at KVK, Kandukur, Andhra Pradesh

Capacity building and skill-oriented training programmes were conducted for women farmers to enhance their technical knowledge and livelihood opportunities. These initiatives focused on skill development, value addition, and promotion of agri-based enterprises among rural women.

The following entrepreneurs were successfully promoted:-

1. Mrs. E. Anitha- Bhoomi Old School Foods, Ongole
2. Mrs. Sridevi- Atthakodalu Instant Millet Mixes, Paluru
3. Mrs. K. Bhagya Laxmi- Lishi Mushrooms, Binginpalle

- A demonstration on tomato value addition *viz*., making of ketchup, sauce, soup mix, dehydrated tomatoes, and fryums was arranged for the benefit of SHG women with focus on preservative-free processing and 4–6 month shelf-life. The products were profitable (28–35%), boosting income and reducing post-harvest losses.

- The bale press machine reduced pressing time and labour drudgery, and its user-friendly design enabled easy operation by farm women, promoting efficiency and inclusiveness.

- Capacity building programme was arranged to *Pashu Sakhis* of Kandukur sub-division in collaboration with MYRADA (Mysore Resettlement and Development Agency) NGO. *Pashu Sakhis* ("Friends of animals") are trained rural woman community worker often from Self-Help Groups who provides essential, doorstep veterinary care, vaccinations, and advice on livestock rearing to villagers. They act as intermediaries, improving animal health and family incomes by managing common diseases in goats, poultry, and cattle.

- Capacity building trainings were also conducted on value addition to millets, fruits and vegetables, pro-tray vegetable seedling production, orchard management, value addition to prawns, and allied enterprises, benefiting 2,350 farmers and farm women from 16 villages of 12 mandals.

- KVK, Kandukur organized skill development trainings of 3–5 days duration for farm men-women and rural youth on mushroom production and honey bee production, along with drudgery-reducing tools and equipment, post-harvest processing and value addition to turmeric rhizomes, fish processing and value addition, mushroom preservation techniques and value addition, scientific management of pig farming, and good animal husbandry practices to improve reproductive efficiency in dairy animals. The programmes were conducted in five villages across three mandals and benefited 428 farm men-women and rural youth, enhancing skills, productivity, and income-generation opportunities.

गणमान्य अतिथिगण

Distinguished Visitors

- Shri Bhupathi Raju Srinivasa Varma, MOS of Heavy Industries and Steel, Dr. T.R. Sharma, Deputy Director General (Crop Sciences), ICAR, Dr. Shaik N Meera, Director of ATARI, Hyderabad, Sri Somu Veerraju, Former MLC and BJP National Executive member, Sri Chidipothu Yashwanth Kumar, Chairman of the Tobacco Board attended ICAR-NIRCA formation day celebrations on 21st January, 2025.

- Shri Palle Gandgahar Reddy, National Turmeric Board chairman, Dr Ch. Srinivasa Rao, Director IARI, New Delhi, Shri Y. Venkateswara Rao, Padma Shri Awardee and Chairman of Rythu Nestham Foundation, Dr. Rajireddy, VC KLSTHU, Telangana, Dr. Ch. Radhika Rani, Director of the National Rural Livelihoods and Management Resource Centre (NRLMRC), NIRDPR, Hyderabad attended the **Stakeholder Conclave** to boost India's turmeric sector farmers at ICAR-NIRCA on 11th April, 2025.

- Dr. C. Tara Satyavati, Director, ICAR-IIMR Hyderabad, Dr. S. Senthil Vinayagam, CEO, a-Idea & Head, ESM Division, ICAR-NAARM, Shri N. Nataraj, DD, IIP, Hyderabad, Dr. Y. Somu Naidu, AGM, NABARD – East Godavari, Shri R. P. Naidu, AGM, APEDA, Secunderabad and Dr. Ranjeet Singh, Head, TOT Division, ICAR-CIPHET have participated in the **Innovators Meet** at ICAR-NIRCA on 8th April, 2025.

- Ms. B. Vishwasree, IAS, Executive Director, Tobacco Board visited ICAR-NIRCA RS Kandukur on 25th April, 2025.

- Shri M. Rajasekhara Reddy, AGM (FSDD), NABARD Regional Office and Shri R. Chakradhar, DDM, NABARD-East Godavari were Chief Guests for 'Launching Programme' of NABARD funded projects.

- Sri G.L.K. Prasad, Regional Manager of the Tobacco Board, Dr. B.S.R. Reddy, Chief Scientist at ITC Ltd., and Dr. G.N. Mohan Raj from MR Biochem Ltd attended the sensitisation program on 'Sustainable Practices in Tobacco' at ICAR-NIRCA on 20th August 2025.

- Shri Somu Veerraju, MLC, Bharatiya Janata Party, Andhra Pradesh attended the "PM Dhan Dhaanya Krishi Yojna" and "Mission of Aatmanirbharta in Pulses" Programmes at ICAR-NIRCA on 11th October 2025.

- Elected Representatives of PRIs and Officials from Odisha State Government attended the training Programme on Good Agricultural Practices and an Exposure Visit under the RGSA scheme of SIRD & PR, Bhubaneswar, Ministry of Panchayati Raj, Government of India, from 25–29 November 2025.

- Participants from different organizations across the country viz., ICAR-CICR, Nagpur; ICAR-CIARI, Port Blair; ICAR-IIOR, Hyderabad; ICAR-NIRCA, Rajahmundry; NTTL Mumbai; ARS Yelamanchili, ANGRAU; Pharma industry; Alliance One Industries India Pvt. Ltd, Guntur and Quality Control Lab, PJTAU, Hyderabad.

कार्मिक

Personnel (As on 31.12.2025)

Dr. M. Sheshu Madhav, Director

DIVISION OF CROP IMPROVEMENT

Dr. K. Sarala	Principal Scientist & Head
Dr. K. Prabhakara Rao	Senior Scientist
Dr. J.J. Rajappa	Senior Scientist
Dr. B. Rajasekhar Reddy	Senior Scientist
Smt. K. Santinandivelu	Chief Technical Officer
Sri M.M. Ali	Senior Technical Officer
Sri P. Trinadh	Senior Technical Assistant
Sri S. Bhaskar Naik	Senior Technical Assistant
Smt. P. Srilakshmi	Senior Technical Assistant
Sri A. Muthyam	Senior Technical Assistant
Sri K. Giribabu	Senior Technician
Sri Montosh Roy	Technician

DIVISION OF CROP MANAGEMENT

Dr. K. Rajasekhara Rao	Principal Scientist & Head
Dr. S. Kasturi Krishna	Principal Scientist
Dr. S.V. Krishna Reddy	Principal Scientist
Dr. T. Kiran Kumar	Senior Scientist
Dr. J. Poorna Bindu	Senior Scientist
Smt. B. Sailaja Jayasekharan	Scientist
Dr. H.S. Mahesha	Scientist
Dr. S.K. Dam	Asst. Chief Tech. Officer
Sri A. Suresh Babu	Technical Officer
Smt. K. Sridevi	Senior Technical Assistant
Sri Ramu Nambari	Senior Technical Assistant
Sri G.N.S. Ganesh	Senior Technician
Sri P. Krishna	Senior Technician
Sri Indrjeet	Technician
Sri Himanshu Yadav	Technician
Sri Pankaj Kumar	Technician
Smt. Ch. Papa	SSS
Sri K. Nageswara Rao	SSS

DIVISION OF POST HARVEST & VALUE ADDITION

Dr. L.K. Prasad	Principal Scientist & Head
Dr. Y. Subbaiah	Principal Scientist
Dr. K. Suman Kalyani	Principal Scientist
Dr. H. Ravisankar	Principal Scientist
Sri K. Viswanatha Reddy	Scientist
Dr. B. Hema	Scientist
Dr. Anindita Paul	Scientist
Sri N. Johnson	Technical Officer
Sri V. Parameswara Rao	Senior Technician
Sri A.S.R.R. Phani Kumar	Senior Technician
Sri Kshitish Kumar Mishra	Senior Technician
Smt. A. Usha Angel	Senior Technician
Sri K. Satyanarayana	Technician
Sri Ajit	Technician
Sri Krishna Chandra	Technician
Sri Saurabh Kumar	Technician
Sri Rajat Malik	Technician

PME CELL

Dr. S. Kasturi Krishna	Pr. Scientist & Nodal Officer
Sri K. Viswanatha Reddy	Scientist
Smt. J. Vasanthi	Asst. Chief Tech. Officer
Sri I. Arvind	Senior Technical Assistant
Smt. Ch. Lakshminarayani	Private Secretary
Sri Ch. Satyanarayana	Technician

ITMU

Dr. H. Ravisankar	Pr. Scientist & Nodal Officer
Dr. K. Prabhakara Rao	Senior Scientist & Co-PI
Dr. B. Hema	Scientist & Co-PI

AINPT

Dr. K. Sarala	Head, Div. of C.I & Nodal Officer
Smt. B. Krishna Kumari	Asst. Chief Tech. Officer

AKMU & LIBRARY

Dr. H. Ravisankar	Principal Scientist & OIC
Sri M.N.P. Kumar	Asst. Chief Tech. Officer
Sri Md. Elias	Senior Technical Officer

SEED PRODUCTION UNIT

Dr. K. Prabhakara Rao	Senior Scientist & OIC
Sri Pappu Satish	Senior Technical Assistant
Sri Ch. Laxman Rao	Technical Assistant
Sri Kolli Satyanarayana	Senior Technician
Sri A. Srinivas	Technician
Sri D. Devanand	Technician

MAINTENANCE SERVICE UNIT

Sri K.V.V. Satyanarayana	Technical Officer & OIC
Sri P. Eswara Rao	Technical Officer
Sri G. Govinda Raju	Senior Technical Assistant
Sri G. Satya Harish	Senior Technician

ICAR-NIRCA BSR FARM, KATHERU

Sri S. Simhachalam	Sr. Tech. Asst. & Farm In-charge
Sri Y.V. Subrahmanyam	Senior Technical Assistant
Sri K. Sankurudu	Technician
Sri A. Nageswara Rao	Technician
Sri K.V.N. Raju	Technician
Sri G.V. Ramana	Technician
Sri Y.S.D. Prasad	SSS

ADMINISTRATION

Sri Kuldeep Patidar	Administrative Officer
Sri K.T.R. Singh	Principal Private Secretary
Sri Arvind	Sr. Finance & Accounts Officer
Smt. G. Hemlata	Finance & Accounts Officer
Smt. P. Mariyamma	Asst. Administrative Officer(E)
Sri A.V.V. Ramana	Asst. Administrative Officer(P&S)
Smt. N. Maheswari	Private Secretary
Sri N. Suryanarayana	Assistant
Sri S. Pradeep Kumar	Assistant
Sri P.J.F. Moses	Assistant
Smt. G.M.B. Sujatha	UDC
Smt. J. Suseela Devi	UDC
Sri Goutam Ghosh	UDC
Smt. Y. Subba Lakshmi	UDC
Smt. M. Srilata	LDC
Sri S.S.K.C. Gowd Ponakalla	LDC
Sri Y.V. Subba Rao	Technician
Smt. P. Surya Kumari	Technician
Sri P. Srinivas	SSS
Sri P. Ramana	SSS

ICAR-NIRCA RS, KANDUKUR (A.P.)

Dr. M. Anuradha	Principal Scientist & In-charge
Dr. K. Gangadhara	Senior Scientist
Smt. Aasi Divya	Senior Technical Assistant
Sri K. Vidya Sagar	Senior Technical Assistant
Sri K. Sudhakar	Technical Assistant
Sri M. Srinivas	Technical Assistant
Sri M. Deepak Kumar	Senior Technician
Sri P.Y. Narasimha Rao	Technician
Sri Vikash Kumar	Technician
Sri D. Koteswara Rao	Technician

ICAR-NIRCA RS, GUNTUR (A.P.)

Dr. V. Venkateswarlu	Senior Scientist & In-charge
Sri M.V. Jayakrishna	Senior Technical Officer
Sri V. Subba Rao	Senior Technical Assistant
Sri B. Yesu	Technical Assistant
Sri Deepak Kumar Patel	Technician
Sri D. Srinivasa Rao	LDC
Sri P. Purna Chandra Rao	SSS

ICAR-NIRCA RS, JEELUGUMILLI (A.P.)

Dr. Y. Subbaiah	Principal Scientist & In-charge
Sri A. Prabhu	Assistant
Sri G. Srinivasa Rao	Senior Technical Officer
Sri T. Srinivasa Rao	Technical Officer
Sri Ch. Sudhakara Babu	Technical Officer
Sri B. Durga Rao	Senior Technical Assistant
Sri D. Yesuratnam	Senior Technician
Sri E. Veerabhadra Rao	Senior Technician
Smt. G.S.M. Annapoorna	Senior Technician
Sri T. Ramesh	Senior Technician

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Dr. M. Kumaresan	Principal Scientist
Dr. M. Venkatesan	Scientist
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Sri V. Annadurai	Asst. Chief Tech. Officer
Sri M. Karthick	Technical Assistant
Sri S. Siva Veeraiah	UDC
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Dr. Namita Das Saha	Senior Scientist
Dr. K.P. Singh	Senior Scientist
Sri S.K. Sarkar	Personal Assistant
Sri G. Hemasundara Rao	Senior Technician
Sri Ayush Kasyap	Technician
Sri Raj Kumar Jha	Technician
Sri A.K. Chisim	SSS

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Dr. K.P. Raghavendra	Principal Scientist
Dr. C. Nanda	Senior Scientist
Sri T. Venkatesh	Chief Technical Officer
Sri Gopala Rao	Technical Officer
Sri B. Suresh Kumar	Technical Officer
Sri K. Shravan Kumar	Senior Technical Assistant
Sri Muhammed Shareef	Senior Technical Assistant
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Sri Sanjay Vinayak Hegde	SMS/ T-6
Dr. Bashyam Nageswara Reddy	SMS/ T-6
Dr. Ajmal, K.K.	SMS/ T-6
Sri Ganni. Sandeep	Assistant
Sri S. Nageswara Rao	Technician

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Dr. Jyoti Jadipujari	SMS/ T-6
Dr. B. Neeharika	SMS/ T-6
Sri Mayank	SMS/ T-6
Sri Vivek Rajesh Kamat	SMS/ T-6
Dr. Venkatesh Iddumu	SMS/ T-6
Sri Vishal Mudgal	Steno Grade-III
Sri Divi Malakondaiah	Technician

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