वार्षिक प्रतिवेदन
ANNUAL REPORT

2024

भाकृअनुप
ICAR

भा.कृ.अनु.प. – काजू अनुसंधान निदेशालय
ಐ. ಸಿ. ಎ. ಆರ್.- ಗೇರು ಸಂಶೋಧನಾ ನಿರ್ದೇಶನಾಲಯ
ICAR-DIRECTORATE OF CASHEW RESEARCH
Darbe (P.O), Puttur – 574202, Karnataka, India

काअनि
DCR

NETHRA GANGA

NETHRA JUMBO – 1

Hon'ble Prime Minister of India dedicated two Jumbo Cashew nut Varieties of ICAR – DCR to the Nation

ICAR – DCR Received Best stall Award at National Horticulture Fair 2024

Drone Technology demonstration

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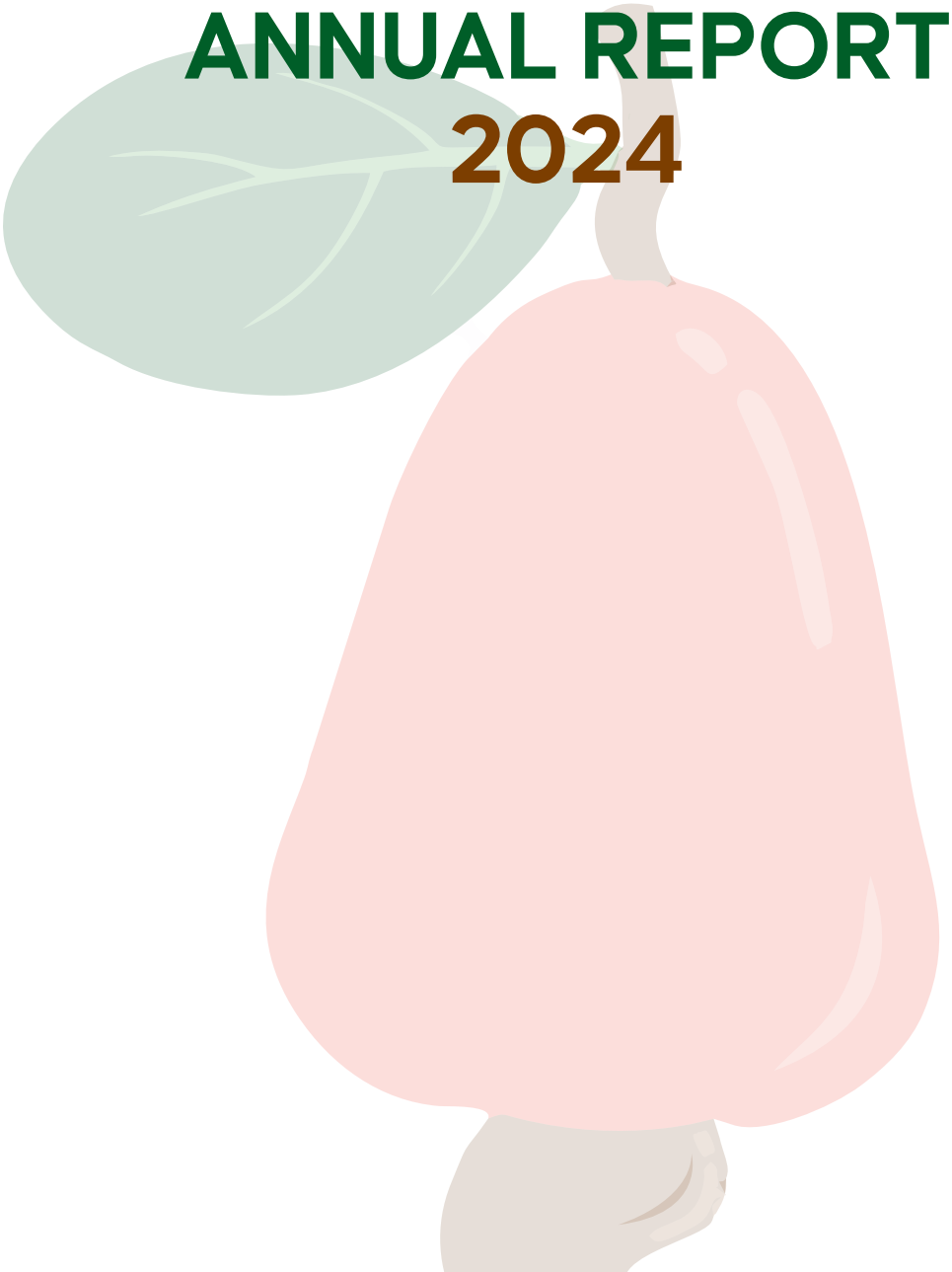
ANNUAL REPORT
2024



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Front cover
Front view of ICAR - DCR Puttur

Back cover
Images: Cashew Prash, Cashew Apple, Mufins, Cashew Sprouts Cookies,
3in1 Cashew Fruit & Nut Seperator

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प्रस्तावना

मुझे आईसीएआर-काजू अनुसंधान निदेशालय, पुत्तूर की वार्षिक रिपोर्ट-2024 प्रस्तुत करते हुए खुशी हो रही है। वार्षिक रिपोर्ट में वर्ष के दौरान विभिन्न अनुभागों जैसे फसल सुधार, फसल प्रबंधन, फसल सुरक्षा, कटाई उपरांत प्रौद्योगिकी और प्रौद्योगिकी हस्तांतरण के साथ-साथ अन्य संस्थागत गतिविधियों में की गई उपलब्धियों और विभिन्न गतिविधियों को शामिल किया गया है।

काजू की तीन किस्मों अर्थात नेत्र गंगा, नेत्र जंबो-1 और नेत्र उभया को सीवीआरसी द्वारा अनुमोदित किया गया और भारत सरकार के राजपत्र अधिसूचना में अधिसूचित किया गया। नेत्र जंबो-2 (एच-125) की पहचान की गई और इसे संस्थान स्तर पर विमोचन किया गया। इसे एनआरसीसी सेल-2 और भेडासी के संकरण से विकसित किया गया है। यह, जंबो नट (करीब 14 ग्राम) के साथ एक आशाजनक संकर है. इसे समय से पहले पकना, क्लस्टर वाली आदत, 29.30 प्रतिशत से अधिक छीलन के साथ उच्च उपज और 3.40 ग्राम औसत का कर्नेल वजन के साथ एक आशाजनक संकर के रूप में पाया गया, जो डब्ल्यू 130 के कर्नेल ग्रेड के लिए फिट बैठता है। निदेशालय में राष्ट्रीय काजू फील्ड जीन बैंक में वर्तमान में 584 जर्मप्लाज्म अक्सेशन् हैं. जिनमें से 25 नए एकत्रित किए गए हैं और 58 अक्सेशन् शांतिगोडु जर्मप्लाज्म मूल्यांकन ब्लॉक में रोपे गए हैं। चार जर्मप्लाज्म को अद्वितीय लक्षणों के लिए आईसीएआर-राष्ट्रीय पादप आनुवंशिक संसाधन ब्यूरो (एनबीपीजीआर) के साथ पंजीकृत किया गया था। काजू में अंतर-जेनेरिक संकरण का पहला प्रयास दो अलग-अलग प्रजातियों को क्रॉस करके किया गया था, ताकि आनुवंशिक पूल को व्यापक बनाया जा सके, ताकि काजू (एनाकार्डियम ऑक्सीडेंटेल एल.) और सेमेकार्पस कुर्ज़ी वाइल्ड जीनोटाइप, जो एनाकार्डियासी परिवार से संबंधित है, को शामिल करते हुए विविध विशेषताओं वाले संकर बनाए जा सकें। TMB नमूनों की डी नोवो ट्रांसक्रिप्टोम असेंबली ट्रिनिटी के साथ सभी उत्पन्न TMB ट्रांसक्रिप्टोम को पूल करके की गई थी। एकत्रित ट्रांसक्रिप्टोम की कुल लंबाई 461 एमबी थी जिसमें 38.58% जीसी सामग्री थी, और N50 मान 2066 बीपी और L50 57.88 केबी था।

इन विट्रो पराग अंकुरण-आधारित स्क्रीनिंग तकनीक द्वारा उच्च तापमान तनाव के लिए काजू किस्मों को स्क्रीनिंग किया गया। अध्ययन की गई किस्मों में अधिकतम पराग अंकुरण की कार्डिनल तापमान सीमा (टी $_{\text{मिन}}$, टी $_{\text{ऑप्ट}}$ और टी $_{\text{मैक्स}}$) 9.7 डिग्री सेल्सियस से 11.1 डिग्री सेल्सियस, 23.3 डिग्री सेल्सियस से 32.6 डिग्री सेल्सियस और 44.1 से 48.5 डिग्री सेल्सियस थी। अध्ययन की गई किस्मों में, भास्कर और प्रियंका ने 40 डिग्री सेल्सियस पर भी अपेक्षाकृत उच्च पराग अंकुरण दर बनाए रखी, जो उच्च तापमान के लिए उनके व्यापक अनुकूलन को दर्शाता है।

टेरेब्रेंटिया और ट्यूबुलिफेरा सहित 12 प्रजातियों के अंतर्गत काजू पर कुल 18 थ्रिप्स प्रजातियाँ दर्ज की गईं और काजू को 12 थ्रिप्स प्रजातियों के लिए एक नया होस्ट् के रूप में पाया गया। थ्रिप्स सबनुडुला प्रचुर मात्रा में (44.92%) था, उसके बाद हैप्लोथ्रिप्स एसपीपी. (34.10%) और एस. डोर्सालिस (7.43%) थे. जनवरी और अप्रैल, 2024 के दौरान थ्रिप्स का चरम प्रकोप देखा गया। बेलट्रेनिया रोम्बिका के कारण होने वाली पौध सड़न की बीमारी की रिपोर्ट की गई और रोगज़नक़ के सांस्कृतिक, सूक्ष्म और आणविक लक्षण वर्णन के आधार पर इसकी पुष्टि की गई। नियोपेस्टालोटिओप्सिस का पूरा जीनोमिक डेटा क्लेविस्पोरा को इल्युमिना प्रौद्योगिकी का उपयोग करके उत्पन्न किया गया था, जिसका कुल संयोजित जीनोम आकार 59.25 एमबी था, जिसकी आधार जोड़ी लंबाई 60576399, एन50 कॉन्टिग आकार 129039 बीपी और जीसी सामग्री अनुपात 50.05% था।

काजू की फल से कम जीआई और बिना किसी परिरक्षक से मूल्यवर्धित उत्पाद जैसे काजू फल स्क्वैश, डाइट काजू फल मफिन और काजूप्राश विकसित किए गए, काजू फल पाउडर आधारित स्नैक फूड को चावल और मकई के आटे के साथ मिलाकर सिंगल स्क्रू एक्सट्रूडर और संबंधित मशीन का उपयोग करके तैयार किया गया और सामग्री मापदंडों को अनुकूलित किया गया। छोटे और सीमांत किसानों के लिए उपयुक्त पेडल संचालित, अर्ध-स्वचालित और पूरी तरह से स्वचालित काजू फल और बीज सपरेटर का विकास और मूल्यांकन किया गया। उपज की कटाई के लिए बैटरी से चलने वाला शाखा शेकर और संग्रह उपकरण डिजाइन और विकसित किया गया था। एक नया सॉफ्टवेयर, काजू किसानों की ट्रैकिंग प्रणाली (CFTS), काजू के बागानों के विवरण को ट्रैक करने के लिए QR कोड और डेटा एनालिटिक्स को एकीकृत करके विकसित किया गया।

निदेशालय ने काजू किसानों और काजू क्षेत्र से जुड़े विभिन्न हितधारकों के लाभ के लिए नियमित आधार पर अग्रिम पंक्ति प्रदर्शन, प्रशिक्षण, प्रदर्शनियां, प्रदर्शन दौरे और अन्य विस्तार गतिविधियां आयोजित कीं।

मैं डॉ. हिमाशु पाठक, सचिव (डेयर) और महानिदेशक आईसीएआर; डॉ. संजय के सिंह, उप महानिदेशक (बागवानी) और डॉ. वीबी पटेल, अतिरिक्त महानिदेशक (बागवानी) का उनके निरंतर प्रोत्साहन, मार्गदर्शन और समर्थन के लिए आभारी हूँ। मैं निदेशालय द्वारा की गई प्रगति में उनके बहुमूल्य योगदान के लिए सभी वैज्ञानिकों और कर्मचारियों का आभारी हूँ।

मैं वार्षिक रिपोर्ट-2024 के प्रभावी संकलन और संपादन के लिए संपादकीय और प्रकाशन समिति के अध्यक्ष और सदस्यों द्वारा किए गए प्रयासों के लिए हृदय से आभार व्यक्त करता हूँ।

स्थान: आईसीएआर-डीसीआर, पुत्तूर
दिनांक: मार्च, 2025

(**जे. दिनकर अडिगा**)
निदेशक

PREFACE

I am happy to present the Annual Report 2024 of ICAR-Directorate of Cashew Research, Puttur. The annual report covers the achievements and different activities made during the year in different sections *viz*., Crop Improvement, Crop Management, Crop Protection, Post Harvest Technology and Transfer of Technology along with the other institutional activities

Three cashew varieties *viz*., Nethra Ganga, Nethra Jumbo-1 and Nethra Ubhaya were approved by the CVRC and notified in the Government of India Gazette notification. Nethra Jumbo-2 (H-125) was identified and released at institute level. It is developed through hybridization by crossing NRCC sel-2 and Bhedasi. It was found as a promising hybrid with a special character *viz*., jumbo nut (up to 14g), precocious and cluster bearing habit, higher yield with more than 29.30 per cent of shelling and the average kernel weight of 3.40 g which fits in to the kernel grade of W 130. The National Cashew Field Gene Bank at the Directorate currently possesses 584 germplasm accessions, with 25 new accessions collected and 58 accessions planted at the Shantigodu germplasm evaluation block. Four germplasm accessions were registered with the ICAR-National Bureau of Plant Genetic Resources (NBPGR) for unique traits. First attempt on intergeneric hybridization was made in cashew by crossing of two different genera to broaden the genetic pool, for creating hybrids with diverse characteristics involving cashew (*Anacardium occidentale* L.) and *Semecarpus kurzii* Engl. wild genotype, which belongs to Anacardiaceae family. *De novo* transcriptome assembly of TMB samples was done with Trinity by pooling all the generated TMB transcriptomes. Total length of the assembled transcriptome was 461 Mb with 38.58 % of GC content, and N50 value of 2066 bp and L50 of 57.88 kb.

Cashew varieties were screened for high temperature stress by *in vitro* pollen germination-based screening technique. In studied varieties, the cardinal temperature ranges (T_{min}, T_{opt} and T_{max}) for maximum pollen germination were found to be 9.7°C to 11.1°C, 23.3°C to 32.6°C and 44.1 to 48.5°C. Among the studied varieties, Bhaskara and Priyanka maintained relatively high pollen germination rate even at 40°C indicating their wide adaption to high temperature.

A total of 18 thrips species were recorded on cashew under 12 genera including *Terebrantia* and *Tubulifera* and cashew is found to be a new host for 12 thrips species. Thrips *subnudula* was abundant (44.92 %) followed by *Haplothrips* spp. (34.10 %) and *S. dorsalis* (7.43 %). The peak incidence of thrips was noticed during January and April, 2024. The seedling rot disease caused by *Beltrania rhombica* was reported and the confirmation was done based on cultural, microscopic and molecular characterization of the pathogen. The complete genomic data of *Neopestalotiopsis clavispora* was generated using Illumina technology with a total assembled genome size of 59.25 Mb with base pair length of 60576399, N50 contig size of 129039 bp and GC content ratio of 50.05%.

Cashew apple powder-based snack food was prepared blending with rice and corn flour using single screw extruder and related machine and material parameters were optimized. Value added products from cashew apple with low GI and no preservative viz. cashew apple squash, diet cashew apple muffin and cashewprash were developed. The pedal operated, semi-automatic and fully automatic cashew fruit and nut separator suitable for small and marginal farmers was developed and evaluated. The battery-operated branch shaker and collection device for harvesting of produce was designed and developed. A new software, Cashew Farmers' Tracking System (CFTS), was developed, integrating QR codes and data analytics for tracking plantation details of cashew.

The Directorate conducted frontline demonstrations, trainings, exhibitions, exposure visits and other extension activities on regular basis for the benefit of cashew farmers and different stakeholders involved in cashew sector

I am grateful to Dr. Himashu Pathak, Secretary (DARE) & DG ICAR; Dr. Sanjay K Singh, DDG (Hort.) and Dr. V. B. Patel, ADG (F&PC) for their constant encouragement, guidance and support. I am thankful to all the scientists and staff members for their valuable contribution in the progress made by the Directorate. I sincerely acknowledge the efforts made by the Chairman and members of the editorial and publication committee for the effective compilation and editing of Annual Reoprt-2024

Place : ICAR-DCR, Puttur
Date : March, 2025

(J. Dinakara Adiga)
Director

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1. कार्यकारी सारांश

ICAR-काजू अनुसंधान निदेशालय, पुत्तूर, काजू पर अनुसंधान और इनके विस्तार गतिविधियों में काम कर रहा है। यहां, वर्ष 2024 के दौरान फसल सुधार, फसल प्रबंधन, फसल सुरक्षा, कटायी उपरांत प्रौद्योगिकी और प्रौद्योगिकी हस्तांतरण और अन्य पहलुओं के तहत किए गए अनुसंधान गतिविधियों की उपलब्धियों और प्रगति को संक्षेप में प्रस्तुत किया गया है। इस वर्ष के दौरान, कुल 42 अनुसंधान परियोजनाएँ, जिसमें छह बाहरी वित्तपोषित परियोजनाएँ शामिल थीं, संचालित थीं।

तीन काजू किस्में यानी, नेत्रा गंगा, नेत्रा जंबो-1 और नेत्रा उभय को CVRC द्वारा स्वीकृत किया गया और भारत सरकार की गजट अधिसूचना में अधिसूचित किया गया। नेत्रा जंबो-2 (H-125) संस्थान स्तर पर पहचानी गई और विमोचित की गई, इसे NRCC sel-2 और भेड़ासी की क्रॉसिंग के जरिए हाइब्रिडाइजेशन द्वारा विकसित किया गया है। यह कई विशेषता के साथ एक प्रभावशाली हाइब्रिड पाया गया, यानी, जंबो नट (14 ग्राम तक), जल्दी फल देने वाला और गुच्छेदार आदत, 29.30 प्रतिशत से अधिक का शेल्लिंग पर्सेंटेज और 3.40 ग्राम का औसत कर्नेल वजन जो W 130 के कर्नेल ग्रेड में फिट बैठता है, इनका विशेषता है। निदेशालय के राष्ट्रीय काजू फील्ड जीन बैंक में वर्तमान में 584 अक्सेशन् हैं, जिनमें 25 नए अक्सेशन् एकत्र किए गए हैं और 58 अक्सेह्सन् शांतिगोडू जीन पूल मूल्यांकन खंड में लगाए गए हैं। कुल 31 अक्सेशन् विभिन्न एआईसीआरपी अनुसंधान केंद्रों को आपूर्ति किए गए, और आठ अक्सेशन् (एच-125, एनआरसी-301, एनआरसी-121, एनआरसी-552, एनआरसी386, एनआरसी577, एनआरसी579 और एनआरसी580) जिनमें अद्वितीय गुण हैं, उनको आईसीएआर-नेशनल ब्यूरो ऑफ प्लांट जेनेटिक रिसोर्सस् (एनबीपीजीआर), नई दिल्ली के साथ पंजीकृत किया गया।

निदेशालय में राष्ट्रीय काजू फील्ड जीन बैंक में वर्तमान में 584 जर्मप्लाज्म अक्सेशन् हैं, जिनमें से 25 नए अक्सेशन् एकत्रित किए गए हैं और शांतिगोडु जर्मप्लाज्म मूल्यांकन ब्लॉक में 58 अक्सेशन् रोपे गए हैं। कुल 31 अक्सेशन् अनुसंधान केंद्रों को आपूर्ति किए गए, और चार अक्सेशन् आईसीएआर-राष्ट्रीय पादप आनुवंशिक संसाधन ब्यूरो (एनबीपीजीआर) के साथ पंजीकृत किए गए। प्रजनन प्रयासों के परिणामस्वरूप नेत्रा गंगा, नेत्रा जंबो-1 और नेत्रा वामन के हाफ-सिबस् (half-sibs) ने पौधे की ऊंचाई, तने की परिधि और छत्र फैलाव में व्यापक भिन्नता दिखाई। छह पीढ़ियों में वृद्धि लक्षणों में काफी भिन्नता देखी गई। अवलोकन केलिये एक ग्राफ्टिंग परीक्षण शुरू किया गया। 35 नए माइक्रोसैटेलाइट मार्कर विकसित किए गए, साथ ही 32 किस्मों के लिए डीएनए फिंगरप्रिंटिंग प्रोटोकॉल भी विकसित किया गया। डी नोवो (De novo) ट्रांसक्रिप्टोम असेंबली पूरी की गई, और जीन अभिव्यक्ति पर अध्ययन के लिए 20 संदर्भ जीन की पहचान की गई।

सेमेकार्पस कुर्ज़ी के क्रायोप्रिजर्व्ड पराग का उपयोग करके काजू में अंतर-जेनेरिक संकरण का अध्ययन करने का पहला प्रयास किया गया। काजू के एक आशाजनक पौधे, पौधा सं. 480 ने पांच कटाई में, प्रति पेड़ में 21.0 किलोग्राम की उच्चतम संचयी बीज उपज दर्ज की। काजू में थ्रिप्स प्रजातियों पर किए गए अध्ययनों में 18 प्रजातियों को दर्ज किया गया, जिनमें जनवरी और अप्रैल के बीच सबसे अधिक प्रकोप देखा गया। एनाकार्डियम प्यूमिलम के साथ इंटरस्टॉक ग्राफ्टिंग तकनीक बौनेपन को प्रेरित करती पाई गई। नारियल का रेशे का खाद (coir pith compost) को नर्सरी में काजू के ग्राफ्ट उगाने के लिए सबसे अच्छा मिट्टी रहित मीडिया के रूप में पहचाना गया। उच्च तापमान सहिष्णुता के लिए जिन किस्मों की जांच की गई, उनमें भास्कर और प्रियंका को सबसे अधिक गर्मी सहिष्णु किस्मों के रूप में पहचाना गया। भास्कर और वेंगुर्ला-4 को नमक सहिष्णुता के लिए सबसे अधिक सहनशील किस्मों के रूप में पहचाना गया, जो नमक सहिष्णुता से जुड़े विशिष्ट बायोकैमिकल लक्षणों के माध्यम से जांच की गईं।

थ्रिप्स सबनुडुला प्रचुर मात्रा में पाया गया (44.92 %) इसके बाद हैप्लोथ्रिप्स spp. (34.10 %) और स्किरटोट्रिप्स डॉर्सालिस (7.43 %) थे। बेल्ट्रानियारहॉम्बिका द्वारा उत्पन्न बीज अंकुर सड़न रोग की रिपोर्ट की गई और इस की पुष्टि सांस्कृतिक, सूक्ष्मदर्शी और आणविक विशेषताओं के आधार पर की गई। नियोपेस्टालोटियोप्सिस क्लैविस्पोरा का पूर्ण जीनोमिक डेटा इल्यूमिना प्रौद्योगिकी का उपयोग करके जनित किया गया जिसमें कुल जुड़े जीनोम का आकार 59.25 मेगाबाइट है, जिस में बेस पैर लेंग्त 60576399 है, N50 कोंटिग साईज 129039 है और 50.05% की GC कंटेंट् अनुपात है।

मूल्य-वर्धित उत्पादों के विकास में बेहतर पोषण सामग्री वाले काजू फल आधारित एक्सट्रूडेट (Extrudates)शामिल थे। काजू के कच्चे बीजों को लागत-प्रभावी प्रसंस्करण के लिए तैयार करने के लिए एक प्रयोगशाला स्तर का मॉडल स्थापित किया गया है। काजू फल की शेल्फ-लाइफ बढ़ाने के बारे में प्रारंभिक परीक्षण किए गए. कम-जीआई वाले काजू फल-आधारित उत्पाद विकसित किए गए। अभीयांत्रिकी के विकास में पेडल-संचालित, अर्ध-स्वचालित और पूरी तरह से स्वचालित काजू फल और बीज प्रसंस्करण मशीनों के साथ-साथ बैटरी से चलने वाले शाखा शेकर और संग्रह उपकरण का विकास शामिल था।

काजू के बागों में छिड़काव के लिए व्यापक एसओपी (SOP) के विकास के साथ ड्रोन प्रौद्योगिकी में प्रगति हुई और किसानों में इस विषय के बारे में जागरूकता पैदा करने के लिए कुल 20 प्रदर्शन आयोजित किए गए।। ऑनलाइन प्रशिक्षण अपनाने का आकलन करने के लिए "प्रौद्योगिकी की स्वीकृति और उपयोग के एकीकृत सिद्धांत" पर आधारित एक सैद्धांतिक रूपरेखा विकसित की गई। लक्षद्वीप में काजू की खेती शुरू की गई, कदमत द्वीप को 500 ग्राफ्ट की आपूर्ति की गई और किसानों को तकनीकी सहायता प्रदान की गई।

नेत्र गंगा का डस् (DUS) परीक्षण पूरा हो गया है, जबकि अन्य किस्मों का परीक्षण जारी है। काजू की तीन किस्मों नेत्र गंगा, नेत्र जंबो-1 और नेत्र उभया को सी.वी.आर.सी. द्वारा अनुमोदित किया गया है तथा भारत सरकार के राजपत्र में अधिसूचित किया गया है। काजू किसानों की ट्रैकिंग प्रणाली (Cashew Farmer Tracking System)) नामक एक नया सॉफ्टवेयर विकसित किया गया है, इसमें काजू के बागानों के विवरण को ट्रैक करने के लिए क्यू.आर. कोड और डेटा एनालिटिक्स को एकीकृत किया गया है। इस अवधि के दौरान यह उल्लेखनीय है कि, छह पेटेंट को फाइल किए गए और भारत सरकार के कॉपीराइट कार्यालय द्वारा 10 कॉपीराइट प्रदान किए गए। 'NETHRA' नामक एक ट्रेडमार्क भारत सरकार के ट्रेडमार्क रजिस्ट्रार द्वारा ट्रेडमार्क संख्या 5366651 के अंतर्गत वर्ग 99 में जारी किया गया।

EXECUTIVE SUMMARY

ICAR-Directorate of Cashew Research, Puttur is involved in research and extension activities on cashew. The achievements and progress of research activities carried out during the year 2024 under crop improvement, crop management, crop protection, post-harvest technology and transfer of technology and other aspects are summarized. During the year, a total of 42 research projects including six externally funded projects were in operation.

Three cashew varieties viz., Nethra Ganga, Nethra Jumbo-1 and Nethra Ubhaya were approved by the CVRC and notified in the Government of India Gazette notification. Nethra Jumbo-2 (H-125) was identified and released at institute level, it is developed through hybridization by crossing NRCC sel-2 and Bhedasi. It was found to be promising hybrid with a special character viz., jumbo nut (up to 14g), precocious and cluster bearing habit, higher yield with more than 29.30 per cent of shelling and the average kernel weight of 3.40g which fits in to the kernel grade of W 130. The National Cashew Field Gene Bank at the Directorate currently houses 584 germplasm accessions, with 25 new accessions collected and 58 accessions planted at the Shantigodu germplasm evaluation block. A total of 31 accessions were supplied to different AICRP research centres, and eight accessions (H-125, NRC-301, NRC-121, NRC-552, NRC386, NRC577, NRC579 and NRC580) with unique characters were registered with the ICAR-National Bureau of Plant Genetic Resources (NBPGR), New Delhi. Developed 35 new microsatellite/simple sequence repeat (SSR) markers and developed DNA fingerprinting protocol using a core set of 20 highly polymorphic and reproducible markers in 32 cashew cultivars. De novo transcriptome assembly of TMB samples was done by pooling all the generated TMB transcriptomes. The total length of the assembled transcriptome was 461 Mb with 38.58 % of GC content, and N50 value of 2066 bp.

First attempt was made on intergeneric hybridization in cashew by using cryo preserved pollens of Semecarpus kurzii, a wild related genus of Anacardiaceae family. The seedling selection, No. 480 continued to perform as best promising type recording highest cumulative nut yield of 21.04 kg per tree from 5 harvests. The inter-stock grafting technology with Anacardium pumilum was found to induce dwarfness. The coir pith compost was identified as the best soil-less media for growing of cashew grafts under nursery conditions. The varieties screened for high temperature tolerance, Bhaskara and Priyanka identified as most heat-tolerant varieties. Bhaskara and Vengurla-4 identified as most resilient varieties for salt tolerance through screening technique, with specific biochemical traits linked to salt tolerance.

Studies on thrips species in cashew recorded 18 number of species with peak incidence observed between January and April months. Thrips subnudula was abundant (44.92 %) followed by Haplothrips spp. (34.10 %) and Scirtothrips dorsalis (7.43 %). The seedling rot disease caused by Beltrania rhombica was reported and the confirmation was done based on cultural, microscopic and molecular characterization of the pathogen. The complete genomic data of Neopestalotiopsis clavispora was generated using Illumina technology with a total assembled genome size of 59.25 Mb with base pair length of 60576399, N50 contig size of 129039 bp and GC content ratio of 50.05%.

Nutritional advancements included the standardization of protein-rich cashew sprout cookies and the identification of Lactobacillus gasserii as a potential probiotic for cashew-based beverages. Value-added product development included cashew apple-based extrudates with improved nutritional content. A lab-model for conditioning raw cashew nut towards cost-effective processing

has been established. Preliminary trials on cashew apple shelf-life enhancement were conducted, and low-GI cashew apple-based products were developed. Engineering advancements included the development of pedal-operated, semi-automatic, and fully automatic cashew fruit and nut processing machines, as well as a battery-operated branch shaker and collection device.

Drone technology progressed with the development of comprehensive SOPs for cashew orchard spraying and a total of 20 demonstrations were conducted to create awareness among farmers during the period. A theoretical framework based on the "Unified theory of acceptance and use of technology" was developed to assess online training adoption. Cashew cultivation was introduced in Lakshadweep, with 500 grafts supplied to Kadmat Island and technical support provided to farmers. A new software, Cashew Farmers' Tracking System (CFTS), was developed, integrating QR codes and data analytics for tracking details of cashew plantation.

During the period it is noteworthy to mention that, six patents were filed and 10 copyrights were granted by Copyrights office, Govt. of India. A trademark entitled "NETHRA" was issued by Trademark Registry, Govt. of India in class 99 under trademark No 5366651.

2. INTRODUCTION

2.1. History

Cashew (*Anacardium occidentale* L.) is an introduced crop to India by the Portuguese in the 16th Century which is a Native of Eastern Brazil. Cashew is a crop with high economic value and is earning considerable foreign exchange for the country. During 1950's the research on cashew initiated. *Ad hoc* schemes for cashew research were sanctioned by the Indian Council of Agricultural Research (ICAR), which were located at Kottarakkara (Kerala), Ullal (Karnataka), Bapatla (Andhra Pradesh) and Vengurla (Maharashtra). In 1971, ICAR also sanctioned an All India Coordinated Spices and Cashew Improvement Project (AICS & CIP) with its headquarters located at ICAR-Central Plantation Crops Research Institute (CPCRI), Kasaragod. The CPCRI Regional Station, Vittal, Karnataka was given the mandate to carry out research work on cashew while four centres under different Universities (*viz*. Bapatla, Vridhachalam, Anakkayam and Vengurla) were assigned the research component on cashew under AICS & CIP. During the Vth and VIth plan periods, three more Centres (*viz*. Bhubaneswar, Jhargram and Chintamani) came under the fold of AICS & CIP and with shifting of work of Anakkayam Centre to Madakkathara. The recommendations made by the Quinquennial Review Team (QRT) constituted by ICAR in 1982, the working group on Agricultural Research and Education constituted by the Planning Commission for VII Plan Proposals and the Task Force on Horticulture constituted by ICAR resulted in the establishment of National Research Centre for Cashew (NRCC) at Puttur on 18th June 1986. During the VIIth Plan period, AICS & CIP was bifurcated into two separate projects, one on cashew and another on spices. The headquarters of independent AICRP on Cashew was shifted to the newly established NRCC, Puttur in 1986. NRCC was upgraded and renamed as Directorate of Cashew Research (DCR) by ICAR on 23 March 2009 under XI Plan. At present, the AICRP on Cashew is operating at 14 centers which were distributed in major cashew growing areas of the country. As per the instruction of ICAR-New Delhi, the institute name was prefixed with ICAR since 2014.

2.2 Location

The main campus of ICAR-DCR is situated 5 kms away from Puttur town at Mottethadka village of Kemminje (12.45°N latitude, 75.15°E longitude and 90 m above MSL). The main campus has an area of 69.02 ha consisting of an administrative block, research laboratories and field experiment plots. Besides, the Directorate has an Experimental Station at Shantigodu, located 13 km away from the main campus which has an area of 80 ha. The institute is conducting and coordinating research on different aspects of cashew such as germplasm collection and conservation, crop improvement, crop production, crop protection, post-harvest technology and transfer of technology.

2.3 Vision, Mission and Mandate

Vision

- Accomplishing self-sufficiency in raw cashewnut production and manufacturing the premier position as the largest producer, processor and exporter at the global level.

Mission

- To promote overall growth through the enhancement of production and productivity in cashew

Mandate

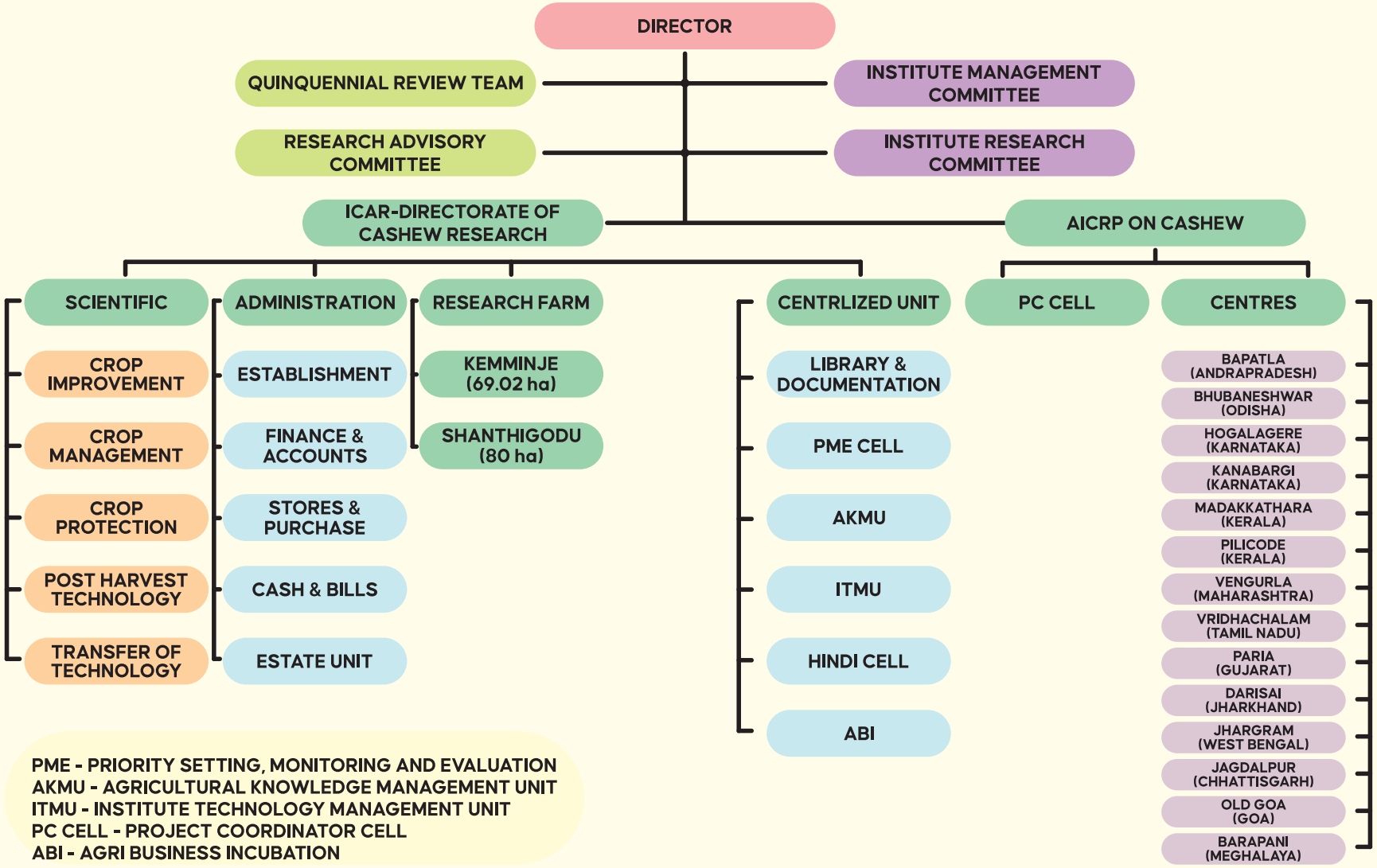
- To undertake strategic, basic and applied research for enhancing productivity, quality, processing efficiency and value addition of cashew.
- To serve as a national repository of genetic resources and scientific information on cashew.
- To coordinate All India Coordinated Research Project on Cashew for addressing location and region-specific problems.
- To promote capacity building through the transfer of technology and consultancy services to stakeholders.

2.4 Organogram

The Director is the administrative head of the Directorate. The Institute Management Committee (IMC), Research Advisory Committee (RAC) and Institute Research Committee (IRC) assist the Director in the matters relating to the management and research activities of the directorate respectively (Fig. 2.1). The research and extension on various aspects of cashew are conducted in five sections viz., Crop improvement, Crop management, Crop protection, post-harvest technology and Transfer of technology. The institute also has different laboratories for sections of Horticulture, Soil Science, Plant Breeding, Plant Physiology, Biotechnology, Plant Protection and Postharvest Technology. The other facilities available at the directorate include Audio Visual Laboratory, Priority Setting, Monitoring and Evaluation Cell (PME), Institute Technology Management Unit (ITMU), Agri Business Incubation Centre (ABIC), Agricultural Knowledge Management Unit (AKMU), Vigilance Cell, Women cell, Library and Museum.

The Directorate also functions as headquarter for the All India Coordinated Research Project on Cashew.

ICAR - Directorate of Cashew Research



PME - PRIORITY SETTING, MONITORING AND EVALUATION
AKMU - AGRICULTURAL KNOWLEDGE MANAGEMENT UNIT
ITMU - INSTITUTE TECHNOLOGY MANAGEMENT UNIT
PC CELL - PROJECT COORDINATOR CELL
ABI - AGRI BUSINESS INCUBATION

2.5 Library/AKMU/ITMU/ABI

The Directorate has got a well-established library in the field of cashew research. The library is serving as an Information Centre on all aspects of cashew research and development in the country. The CD database *viz. CABHORT, CABPEST, AGRICOLA* and *AGRIS, SOIL CD, CROP CD, PLANTGENE CD* and *TROPAG CD* and online CAB database are also available. The library is equipped with automation software and barcoding facility. The library has 1991 books and 2255 back volumes of various journals. The library subscribes 35 national and 2 international journals. The library is a member of Consortium of Electronic Resources on Agriculture (CeRA), New Delhi.

The Agricultural Knowledge Management Unit (AKMU) was established with the responsibility of developing Information and Communications Technology (ICT) in agricultural research, maintaining the Institute's network, the website, and the webserver administration.

The AKMU is managing the internet facilities and wi-fi connectivity at the Directorate. The Institute Technology Management Unit (ITMU) was established for intellectual property management and for commercialization of agricultural technologies. At this Directorate, ITMU takes care of commercialization of technologies developed by ICAR-DCR, Puttur.

Agri Business Incubator (ABI) operated in this institute funded by the National Agricultural Innovation Fund (NAIF) under the Division of Intellectual Property and Technology Management, Indian Council of Agricultural Research, New Delhi has the 'State-of-the-Art' processing facility for promotion of entrepreneurship and business environment in the cashew eco system.

2.6 Staff

The Institute has a sanctioned strength of 22 scientific, 19 technical, 16 administrative and 19 skilled support staff, of which 15 scientists, 7 technical staff, 8 administrative staff and 12 skilled support staff are in position and the remaining are vacant as on 31st December 2024. (Table 2.1).

Table 2.1: Staff strength at ICAR-DCR, Puttur

Category	Sanctioned	Filled	Vacant
Director (RMP)	1	1	-
Scientific	22	15	7
Technical	19	7	12
Administrative	16	8	8
Skilled support staff	19	12	7
Total	**77**	**43**	**34**

2.7 Budget

During the financial year (FY) 2024-25, the total budget allotted till December 2024 to the Directorate was Rs. 944.82 Lakhs of which Rs. 684.99 Lakhs was utilized (Table 2.2). Under externally funded projects, the total receipts were Rs. 68.44 Lakhs, of which Rs. 16.09 Lakhs was utilized (Table 2.3). The revenue generation during FY 2024-25 was Rs. 71.50 Lakhs till December 2024 (Table 2.4).

Table 2.2. Budget and expenditure details of ICAR-DCR from April 2024 - Dec 2024 (Rs. in Lakhs)

Particulars	Allocation	Utilization
GIA capital	25	1.94
GIA salary	339	227.29
Pension	127.07	122.75
GIA general	380	281.25
TSP	20	14.98
SCSP	53.75	36.78
Total	**944.82**	**684.99**

Table 2.3. Receipts and expenditure under externally funded schemes at DCR for April 2024- Dec 2024 (Rs. in Lakhs)

Particulars	Allocation	Utilization
RKVY - RAFTAAR, Govt. of Karnataka	44.8	4.26
PPV&FRA, New Delhi	5.04	0.84
DCCD, Cochin	0.5	0.5
DCCD (Training)	5.92	0.00
ABI	6.03	4.98
ITMU	6.15	5.51
Total	**68.44**	**16.09**

2.8 Infrastructure and assets

The major infrastructures developed during the year 2024-25, Insect-proof cum glass house was established for insect and diseases screening under artificial conditions. The instrumental facilities like Laminar air flow cabinet, Compound microscope, Volatile collection unit, HPLC, GCMS, drones, sensors, software's, a post-hole digger, a self-propelled power weeder, brush cutters, battery sprayers, tractor-operated aero-blast sprayers, a PPE kit, telescopic tree pruners, etc. These equipment's were purchased to strengthen the laboratory to create advanced facilities funded by RKVY- RAFTAAR, Govt. of Karnataka.

Table 2.4. Revenue generation at ICAR-DCR from April- 2024 to December- 2024 (Rs in Lakhs)

Revenue target (2024-25)	Revenue Generated (2024-25)
87.00	71.5

2.9 Production of planting materials

ICAR-DCR has cashew nurseries at both of its campuses: Kemminje and Shantigodu, accredited by Directorate of Cashewnut and Cocoa Development (DCCD), Kochi, Kerala with four-star rating to cater the need of planting material. Softwood grafts of varieties like Bhaskara, NRC Selection-2, Ullal-1, Ullal-3, Ullal-4, VRI-3, Madakkathara-2, Priyanka, Vengurla-7, Vengurla-4, Nethra Ganga, Nethra Jumbo-1, Nethra Ubhaya, Dhana etc. are produced in the two nurseries between June and August, every year for supplying to the farmers. During the year 2024, a total of 199490 nos. of cashew grafts were produced from Shantigodu (80000 nos.) and Kemminje (119490 nos.).

3. Research Achievements

3.1 Crop Improvement

Priority area I: Genetic improvement of cashew for productivity, quality, and resistance to biotic and abiotic stresses through conventional and biotechnological approaches

3.1.1 Collection, conservation, characterization, and evaluation of cashew genetic resources [1986 – Long term]

Germplasm collection

The National Cashew Field Gene Bank at the Directorate houses 584 number of germplasm accessions. During the year 2024, twenty-five new accessions have been collected from Jagadalpur, Goa, and the Biotechnology section of this Directorate. A total of 58 number of germplasm accessions were planted at the Shantigodu germplasm evaluation block along with the 33 number of accessions which were collected earlier (Table 3.1.1).

Table 3.1.1: Accessions planted in Shanthigodu germplasm evaluation block during 2024

Newly collected accessions (25 Nos)	Earlier collected accessions (33 Nos)	
Indira Caju-1	H-130	BH-85
Cars -3	H-126	RP-4
Goa Cashew-5	H-125	RP-5
Goa cashew-6	Tree No. 130	RP-6
Goa Cashew-7	Tree No. 163	JGM-282 (Bidhan Bonsai Kaju)
Goa Cashew-8	T. No. 186	RFRS-195
Goa Cashew-9	T. No. 480	BBSR Cluster-1
Goa Cashew-10	BDB-58	BH-6
Cars -10	DB-626	
Cars -12	TR-8	
Cars -13	OUAT Kalinga Cashew-1	
Cars -14	Ransigjpur bold nut	
Cars -15	Kalyanpur bold nut	
Cars -16	Lokipur - 1	
Cars -17	Khurda-1	
Cars -18	Selection-8	
Cars-21	Selection-36	
Puttur Col No. 9	Koraput cluster	
Puttur Col No. 10	Dutiyanappalli	
Puttur Col No. 11	Selection-25	
Puttur Col No. 12	Selection-24	
Puttur Col No. 13	Selection-21	
SS-1-Compact	Selection-19	
SS-2- Cluster	RP-3	
Kittur SS Col No. 1	BBSR Cluster-2	

Germplasm maintenance

During the period, a total of 13 unique types (dwarf types, wild species, etc.) and 512 germplasm accessions were maintained in the conservation block. The core collection of 61 cashew germplasm accessions was also taken care of.

Germplasm database

The cashew germplasm database was maintained during the year and it was visited 6751 times as on December 2024.

Registration of the germplasm

During the year, four germplasms have been approved by the Plant Germplasm Registration Committee and registered at the ICAR- National Bureau of Plant Genetic Resources, New Delhi (Table 3.1.2 & Fig. 3.1.1)

Table 3.1.2: Germplasms registered under NBPGR, New Delhi during 2024

Sl. No	Name of the Germplasm registered	Reg. Number
1	H-125	INGR 24041
2	NRC-121	INGR 24040
3	NRC 301	INGR 24044
4	Tree No - 480	INGR 24042

H-125

NRC-121

NRC 301

Tree No- 480

Fig. 3.1.1 Germplasm accessions registered at ICAR-NBPGR, New Delhi

Germplasm supply

During the year, a total of 19 accessions were supplied to the Horticultural Research Station, Hogalagere, and 12 accessions were supplied to AICRP – Jagadalpur centre as part of various experiments.

Estimation of Cashew Nut Shell Liquid (CNSL) in germplasm accessions

The CNSL content of 32 nos. of accessions were estimated. The range of CNSL content among 32 nos. of accessions, varied from 0 to 32.22% (Table 3.1.3).

Table: 3.1.3 Estimation of CNSL content of germplasm accessions

Sl. No	NRC No.	CNSL (%)
1	285	0
2	116	0
3	189	22.41
4	188	0
5	RFRS 195	11.37
6	Poornima	16.45
7	Amrutha	23.29
8	NRC-470	8.78
9	NRC-183	10.64
10	NRC-458	11.4
11	NRC-478	11.93
12	Ransingpur bold nut	18.89
13	BH-85	15.54
14	BBSR cluster-2	11.51
15	BH-6	32.22
16	C 26	13.90
17	Dutiyanappalli	11.57
18	Selection-21	16.57
19	RP-5	19.84
20	Koraput cluster	9.56
21	Selection-19	13.03
22	BH-105	10.37
23	Kalyanpur	18.05
24	Selection-25	10.16
25	RP-6	15.65
26	Khurda-1	19.53
27	RP-3	12.05
28	RP-4	16.17
29	BBSR Cluster-1	11.74
30	Selection-36	19.08
31	Selection-8	15.68
32	Lokipur	15.33

3.1.2 Genetic improvement of cashew through hybridization and seedling selection approaches [1986 -Long Term]

Nethra Jumbo-2 (H-125) was identified and released at institute level. It is developed through hybridization by crossing NRCC sel-2 and Bhedasi. It was found as a promising hybrid with a special character *viz*., jumbo nut (up to 14g), precocious and cluster bearing habit, higher yield with more than 29.30 per cent of shelling and the average kernel weight of 3.40g which fits in to the kernel grade of W 130.

Eight promising types *viz.,* 163,186, 32/4, 493, 16/16, 480, 125 and 126 were evaluated for major kernel quality and quantitative parameters. T. No. 480 was found to have the highest shelling percentage (30.00 -33.00 per cent) with a kernel weight of 2.30 g followed by 32/4 (32.00 per cent) and 163 (30.98 per cent). The highest protein content was observed in 32/4 (28.88 per cent) followed by 493 (28.20 per cent) and 480 (28.14 per cent). The crude fat content was also analysed among the promising types. The highest fat content was observed in 32/4 (45.00 per cent) followed by T. No. 480 (40.0 per cent).Tree No. 480 was superior over the other promising bold and medium nut types likes H 32/4, NRC 493, H1616 and Bhaskara (check) for yield.

First Attempt on Intergeneric Hybridization in Cashew

Intergeneric hybridization is a process of crossing of two different genera to broaden the genetic pool, for creating hybrids with diverse characteristics. With this objective an attempt was made in cashew (*Anacardium occidentale* L.) crossed with *Semecarpus kurzii* Engl. (wild genotype) belongs to the family Anacardiaceae (Fig 3.1.2). *Semecarpus kurzii* is wild in habit and early flowering type. Initially it was observed that there was no fruit set when the pollen of *Semecarpus kurzi* directly crossed with *Anacardium occidentale*, due to intergeneric crossing barrier which hinders the successful pollen germination and fertilization. Therefore, different pre-treatments were tried to break the crossing barrier to get successful fruit set. After preliminary treatment, hybridization was carried out and successful fruit set was obtained. The fruits and nuts were subjected for morphological and biochemical characterization, later the harvested seeds were sown to raise F_1 progenies. The obtained F_1 progenies are being evaluated for morphological characters. The leaf venation pattern of parents and hybrids obtained were also studied.

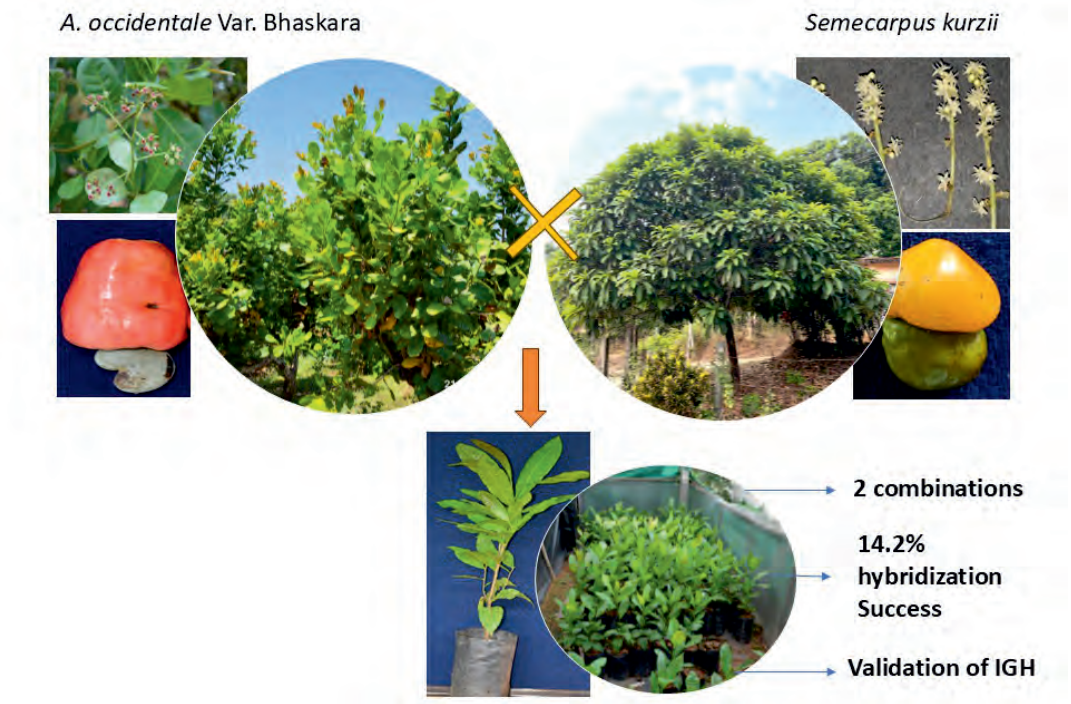


Fig: 3.1.2: Intergeneric hybridization in cashew

Cryopreservation and Pollen studies

Along with commercial cultivars, the wild related genera of Anacardiaceae family *Semecarpus kurzii* was cryopreserved and pollen morphology and viability were studied. The *in vitro* viability of *S. kurzii* was observed to be 78.0 per cent of fresh pollen whereas the cryopreserved pollens after four months of cryopreservation recorded 70.4 per cent of *in vitro* germinability.

Development of polyclonal hybrids from core collections

Based on the results obtained through core collection of 61 nos. of accessions during the year 2016-17, following a new technique i.e., Advanced Maximization Strategy with a Heuristic Approach it is planned to develop polyclonal hybrids from the core accessions. In quantitative genetics, it is a well-known fact that polygenic/oligogenic traits will follow a normal distribution if the sample size is 30 nos. and hence, it is planned to collect seeds arising out of random mating among core accessions,10 each from 61 no. of accessions for continuous three years. This will develop for three years to capture the diverse progeny (1830 No. of seedlings) possible with the core accessions (Fig 3.1.3).

During the year, a total of 172 nuts were collected from 20 accessions in the core, and out of these, 42 nuts belonging to 9 accessions (NRC 101, NRC 160 NRC 318, NRC 319, NRC 342, NRC 401, NRC 458, NRC 463, NRC 470) were germinated. These were planted in Augmented Block Design with checks viz., Bhaskara and Vengurla-4 at a spacing of 6 m x 6m

Fig: 3.1.3: View of the core collection block

3.1.3 Polyploidy breeding in cashew [10/2020-09/2030]

Planting of colchicine-treated plants:

During the year 2024, ten suspected polyploids were selected based on their height, spread, leaf shape, vigour, branching pattern, leaf size, etc. for carrying out studies on flow cytometry (Table 3.1.4 & Fig 3.1.4).

Table 3.1.4: Morphological characterization of colchicine treated plants

Sl. No.	Treatment	Tree habit	Leaf shape	Tree height (m)	Girth (cm)	Branching pattern	Twig diameter (mm)	No. of leaves per twig	Colour of young leaves	Mature leaves	Leaf size (cm^2)
1	BD/0.8/12/5	Spreading	Obovate	0.9	11	Intensive	7.22	16	Red	Green	126.83
2	BD/0.8/12/10	Upright & compact	Obovate	1.9	12	Intensive	6.96	11	Yellow red	Green	115.07
3	BD/0.8/24/6	Upright & open	Obovate	2.3	12	Intensive	7.45	12	Yellow red	Green	139.09
4	BD/1/24/10	Spreading	Obovate	1.6	10.5	Intensive	7.23	13	Yellow red	Green	158.30
5	BD/1.5/12/2	Upright & open	Obovate	1.58	12	Intensive	6.55	10	Yellow red	Green	152.31
6	BD/0.4/48/6	Spreading	Obovate	1.3	10.4	Intensive	4.86	11	Red	Green	152.90
7	BD/0.8/48/4	Spreading	Oval	1.5	10.5	Intensive	5.54	12	Yellow red	Green	185.70
8	BD/1/96/3	Spreading	Obovate	1.45	10.3	Intensive	7.91	10	Green yellow	Green	174.90
9	BD/1/36/2	Upright & compact	Obovate	1.68	10	Intensive	5.70	13	Yellow red	Green	165.21
10	BD/1.5/24/12	Upright & compact	Obovate	2.4	10	Intensive	6.21	11	Red	Green	152.17

BD/.8/12/10 | BD/0.8/24/6 (Seeding treated) | BD/1/24/10

BD/08/24/4 | BD/1/48/8 | BD/1/48/6

Fig. 3.1.4: Suspected polyploids based on morphological traits

3.1.4 Evaluation of dwarf and semi dwarf accessions and their seedling progenies for high density planting system [09/2021-08/2032]

During the year 2022, 16 nos. of dwarf and semi-dwarf accessions collected from different AICRP centres and are planted in the field in a split-plot design with three replications for evaluation. However, only a few accessions have started yielding during the year. The lowest mean plant height, girth, and spread was recorded in Nethra Vaaman. The highest yield was recorded in the accession BDB-58 (Table 3.1.5 & Fig. 3.1.5).

Table 3.1.5: Overall mean of accessions in the experiment

Accessions	Plant height (m)	Girth (cm)	Tree Spread (m)	Nut weight (g)	Yield (Kg/plant)
HC-6	1.15	8.00	0.60	-	-
Nethra Vaaman	0.77	7.69	0.37	5.00	0.01
BDB-58	1.48	12.00	0.89	7.20	0.17
DB-626	1.33	10.72	0.89	8.00	0.03
VRI-3	1.37	9.21	0.62	6.37	0.05
H-3831	1.23	9.58	0.68	6.00	0.02
Taliparamba	1.03	11.10	0.73	6.20	0.04
NRC 312	1.27	9.90	0.73	-	-
NRC 314	1.23	10.26	0.73	5.34	0.02
NRC 415	1.78	12.97	1.11	7.20	0.04
NRC 315	1.24	12.39	0.89	5.40	0.04
NRC 313	0.91	9.31	0.60	-	-
NRC 214	1.59	13.63	0.93	7.60	0.02
NRC 306	1.67	12.26	0.75	5.80	0.04
JGM 282	1.02	9.67	0.59	6.20	0.03

Fig.3.1.5: Field view of the plants in the dwarf and semi-dwarf variety trial

Fig.3.1.6: BDB-58 accession in fruiting

Fig 3.1.7: JGM-282 accession in fruiting

Genetics of traits: Purple coloration

During 2024, the progenies obtained by crossing Bhaskara and Nethra Ganga (as females) with purple mutant (as male) were maintained with required agronomic practices (Fig 3.1.8).

Fig 3.1.8.: Progenies of Bhaskara x Purple Mutant

Geitonogamy in dwarf varieties

A study on geitonogamy in dwarf varieties i.e. Nethra Vaaman and KAU- Nihara was taken up to uncover the genetic diversity present in these varieties. Though more than two hundred geitonogamy events were carried out, only 16 nos. of plants for two varieties could be obtained (Table 3.1.6). This may be due to inbreeding depression caused by geitonogamy. These 16 nos. of plants were planted in the field in an augmented design for further evaluation (Fig 3.1.9).

Table 3.1.6: Observation recorded on study of geitonogamy in dwarf varieties

Particulars	Nethra Vaaman	KAU – Nihara (Taliparamba)
Total crosses made	242	302
Total nuts obtained	42	36
% seed setting	**17.35 %**	**11.92 %**
Nos. of germinated seeds	13	15
Germination (%)	30.95	41.67
Nos. available for planting	10	6

Fig 3.1.9: Geitonogamy in a) Nethra Vaaman b) KAU-Nihara varieties

Back cross progeny evaluation

The preliminary observations on six accessions selected from back cross progenies were planted in the replicated trial during 2022 along with four checks viz., Nethra Ganga, Nethra Jumbo-1, Vengurla-4, and Vengurla-7.

Table 3.1.7: Data on vegetative traits

Accessions	Plant Height (m)			Plant Girth (cm)			Tree Spread (m)		
	R-1	R-2	Mean	R-1	R-2	Mean	R-1	R-2	Mean
BDB-372-23	0.00	1.63	1.63	0.00	17.25	17.25	0.00	0.33	0.33
BDB-372-60	1.25	1.66	1.46	12.00	15.00	13.50	1.23	1.63	1.43
BDB-372-84	1.83	1.87	1.85	15.00	15.67	15.33	1.86	0.51	1.18
BDB-626	1.30	0.95	1.13	12.00	10.00	11.00	1.08	1.16	1.12
BDB-626-113	1.09	0.88	0.98	11.38	9.00	10.19	1.03	0.63	0.83
BDB-626-58	1.30	3.16	2.23	12.67	13.00	12.83	1.20	1.89	1.54
BDB-626-97	1.20	1.31	1.26	11.75	12.63	12.19	1.07	0.98	1.02
Bhaskara	2.13	0.82	1.48	15.67	7.83	11.75	1.44	0.99	1.22
Nehra Ganga	1.64	1.64	1.64	14.5	14.5	14.5	1.59	0.51	1.05
Nethra Jumbo-1	1.08	0.93	1.00	9.00	9.00	9.00	0.66	0.64	0.65
Nethra Vaaman	0.98	0.68	0.83	12.25	6.88	9.56	1.14	0.42	0.78
Vengurla-4	1.39	0.88	1.13	12.5	8.88	10.69	1.22	0.86	1.04
Vengurla-7	1.08	0.63	0.86	10.00	7.00	8.50	0.58	1.06	0.82

Table 3.1.8: Data on reproductive traits

	Nut weight (g)			Yield (Kg/plant)		
Accessions	R-1	R-2	Mean	R-1	R-2	Mean
BDB-626-97	7.60	7.60	7.60	0.03	0.25	0.142
Vengurla-7	-	-	-	-	-	-
BDB-372-60	5.20	5.20	5.20	0.17	0.21	0.191
BDB-626-58	7.20	7.20	7.20	0.07	0.13	0.101
BDB-626	-	-	-	-	-	-
Bhaskara	-	-	-	-	-	-
Vengurla-4	6.20	6.20	6.20	0.01	0.02	0.018
Nethra Jumbo-1	-	-	-	-	-	-
BDB-372-84	-	-	-	-	-	-
Nethra Vaaman	5.2	-	5.2	0.04	-	0.04
BDB-626-113	-	-	-	-	-	-
Nehra Ganga	-	-	-	-	-	-
BDB-372-23	-	-	-	-	-	-

Fig. 3.1.10: View of the selected trees from back cross progeny block

Fig 3.1.11: Fruiting in one of the accessions - BDB-372-60

Externally funded projects

3.1.5 Development of morphological descriptors and DUS test guidelines for cashew

At the ICAR- Directorate of Cashew Research, Puttur, during the year 2024, DUS testing of Nethra Ganga has been completed and compiled data transferred to PPV-FRA, New Delhi for further processing. Nethra Vaaman variety is in the third year of DUS testing and the data has been recorded. Further, Nethra Jumbo -1 (H-126) and Vengurla-9 are in the second year of DUS testing and data has been recorded on these varieties. Another variety Nethra Ubhaya is in the first year of DUS testing

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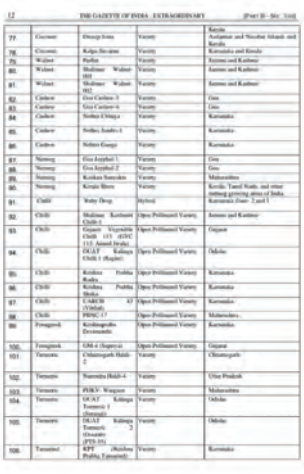


During the year 2024, three varieties released by the Directorate i.e. Nethra Ganga, Nethra Jumbo-1 and Nethra Ubhaya were approved by the Central Variety Release Committee and thereafter were notified in the Gazette of the Government of India.

3.1.6 Genetic dissection of QTLs governing nut yield and cashew nut shell liquid (CNSL) content in cashew [06/2018-05/2025]

a. Development of Novel SSRs and DNA FP

Lack of genetic purity of the planting material result in great economic losses. Therefore, efforts were made to develop a reliable method for the identification of cultivars and the protection of cultivars by the breeders. We developed 35 new microsatellite/simple sequence repeat (SSR) markers and developed DNA fingerprinting protocol using a core set of 20 highly polymorphic and reproducible markers in 32 cashew cultivars. The polymorphic information content (PIC) of newly generated SSR markers varied from 0.19 to 0.67, with an average of 0.44. The probability of identifying any two cultivars with identical fingerprints using the 20 SSR markers was less than 2.8×10^{-11}. Further, just eight of the 20 markers were sufficient for distinguishing all the tested cultivars (Fig. 1). The findings of this study are useful for the conservation and protection of cultivars under the PVP Act and to ensure trading of quality planting in cashew.

b. Registration of Germplasm accessions

Six germplasm accessions with unique characters were characterized and submitted for registration of trait specific germplasm at ICAR- ICAR-National Bureau of Plant Genetic Resources, New Delhi and 4 were approved (NRC386, NRC577, NRC579, NRC580) and one was not approved (NRC578) in the 53rd Meeting of Plant Germplasm Registration Committee (PGRC) meeting held on September 18, 2024 at ICAR-NBPGR, New Delhi and the four approved accessions were given the IC numbers (INGR24070, INGR24071, INGR24072, INGR24073) (Fig. 2).

C. Morphological, biochemical, and molecular characterization mapping populations

The BDxV7 and V7xNRC116 populations were characterized for morphological, biochemical, and molecular and biochemical characteristics. The analysis of the progeny from the two crosses evaluated for morphological characteristics reveals a wide range of variations in the traits such as nut weight, apple weight, kernel weight, shelling percentage, juice TSS, and juice pH. The nut weight ranged from 4.49 g (4-8-7) to 10.04 g (4-9-4, BDxV7), with several progeny showing relatively higher weights, especially those derived from BDxV7 crosses, such as 4-1-7 (9.54 g) and 4-9-4 (10.04 g). The apple color varied from orange, yellow, and red to more complex combinations like yellow-orange. Apple weight also showed diversity, with some crosses producing heavier apples, such as 4-9-4 at 77.17 g. Kernel weight ranged from 1.18 g (4-10-2, V7xNRC116) to 3.12 g (4-9-6, BDxV7). Shelling percentage, which is an indicator of kernels recovery, ranged from 21.12% (4-9-9, BDxV7) to 34.43% (4-7-7, BDxV7). The total soluble solids (TSS) in the cashew apple juice varied among progeny, ranging from 8.7 (4-19-1, V7x NRC116) to 18.6 (4-2-6, BD x V-7). The cashew apple juice pH also varied, 3.73 (4-10-2, V7xNRC116) to 4.81 (4-17-5, V7xNRC116).

3.1.7 Deciphering the molecular basis of Cashew-Tea Mosquito Bug (TMB) interactions to understand host response and TMB effectors (09/2022-09/2026)

De novo transcriptome assembly and Comparative transcriptomics of TMB

De novo transcriptome assembly of TMB samples was done with Trinity by pooling all the generated TMB transcriptomes. Total length of the assembled transcriptome was 461 Mb with 38.58 % of GC content, and N50 value of 2066 bp and L50 of 57.88 kb. Over 2000 transcripts showed differential expression between the nymphal stages and the adults of TMB insects and 2010 expressed differentially between the male and female insects of TMB.

Isolation of shoot RNA from TMB infested plant at different intervals and reference genes (RGs) identification for gene expression in cashew

We standardized the protocol for RNA isolation from shoots of cashew and isolated RNA from the shoot samples at 6h, 18 h, 30 h, and 48 h after infestation with TMB for studying the TMB-cashew interactions.

Identification of candidate reference gene for gene expression studies in TMB

We identified the 20 reference genes (PS3A, Actin, Tb,

PL13A,18S, ATP, E1a, UBQ, G6PDH, GAPDH, TBP, Histone3, NADH, HEL, SDHA, Myosin, 28S, HSP70, AK and ARF1) for normalization in gene expression studies and synthesized the primers for the qRT-PCR experiments.

Characterization of simple sequence repeats (SSRs)

SSRMMD (Simple Sequence Repeat Marker Discovery) is a valuable tool for identifying and characterizing simple sequence repeats (SSRs), also known as microsatellites, within genomic sequences. A total of 167,399 were mined and 82.2 % were mononucleotides, followed by dinucleotide (11.63%), trinucleotides (3.54%), tetranucleotides (1.62 %) and the others (1.01%).

3.1.8 *In-vitro* pollen germination and pollen tube growth of cashew varieties in response to high temperature stress [05/2019 – 04/2024 & 10.2025 to 09.2027]

The differential effect of low and high temperature stress on pollen germination and pollen tube length were investigated in six cashew varieties. The maximum values of pollen germination rate (PGR), pollen tube length (PTL) and their cardinal temperatures (T_{min}, T_{opt} and T_{max}) were estimated by using quadratic equation and modified bilinear model under the conditions of 10–45 °C. The pollen germination rate in six cashew varieties ranged from 34.1% (Dhana) to 75.5% (Kanaka) and the pollen tube length ranged from 42.4 µm (Dhana) to 58.8 µm (Priyanka). The cardinal temperature ranges (T_{min}, T_{opt} and T_{max}) of pollen germination were 9.7°C to 11.1°C, 23.3°C to 32.6°C and 44.1 to 48.5°C. Among the studied varieties, Bhaskara and Priyanka maintained relatively high pollen germination rate even at 40°C indicating their wide adaptive temperature range. The influence of high temperature on pollen germination and pollen tube of Bhaskara, observed under compound microscope were presented in Fig. 3.1.12 & 3.1.13.

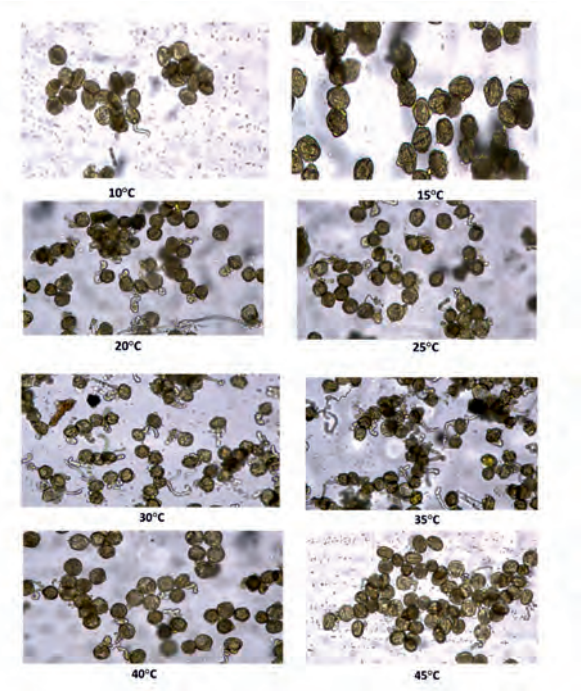
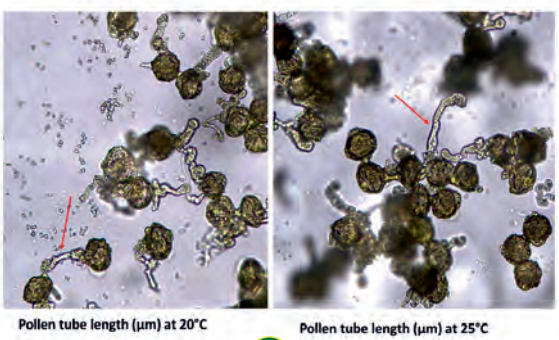


Fig.3.1.12: Microscopic view of pollen germination of Bhaskara (temperature tolerant variety)



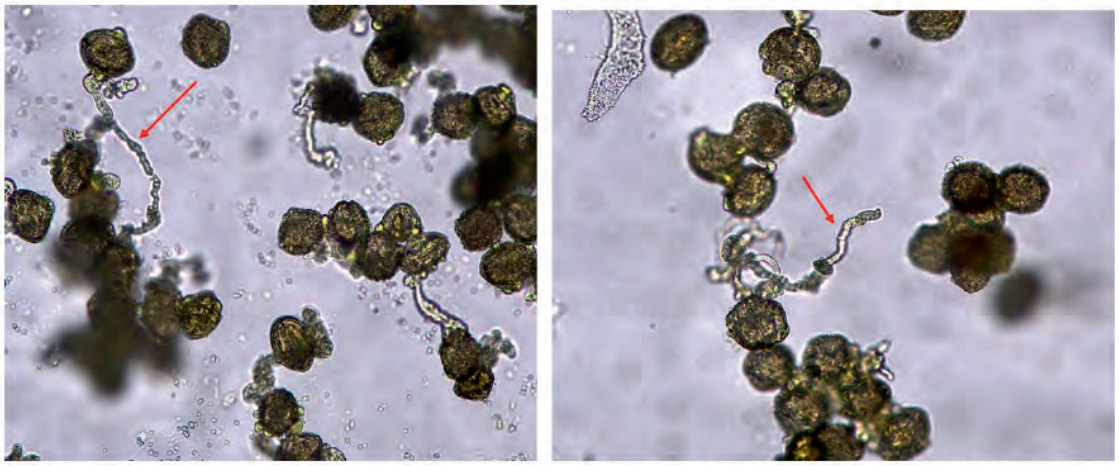


Fig.3.1.13: Microscopic view of pollen tube length of Bhaskara (temperature tolerant variety)

3.1.9 Physiological and biochemical basis of salinity tolerance in cashew accessions [09/2021-08/2026]

The salinity tolerance levels of the six cashew varieties were evaluated through the analysis of multiple traits. The results indicated that the diverse responses of cashew varieties to salt stress offering a thorough comprehension of their performance across a range of physiological and biochemical parameters. Visual plant damage in terms of leaf necrosis was also scored in all the six varieties to assess the severity of salt susceptibility (Fig 3.1.14). Higher susceptibility for plant damage was observed in Madakkathara-2 (72.1 per cent total leaf necrosis) and Ullal-3 (70.2per cent) at higher salt stress (250mM NaCl). However, lower leaf necrosis was observed in Bhaskara (49.8 per cent) at 250mM NaCl. Overall, Madakkathara-2 showed severe salt stress injury symptoms compared to Bhaskara.

Salt stress significantly reduced relative water content (RWC), membrane integrity and photosynthetic pigments in all the studied cashew varieties. The reduction in RWC was 38.1 per cent in Madakkathara-2 and 20.8 per cent for Bhaskara at 250mM NaCl. A significantly higher increase in membrane leakage was also observed in Madakkathara-2 (79.6 per cent) compared to Bhaskara (48.7 per cent) at the higher salt level (250mM NaCl).

The salt stress significantly increased Na^+ accumulation in both leaves and roots of all studied varieties under all salt treatments as evident by higher Na^+ ion content. However, Na^+ content was significantly higher in sensitive variety, Madakkathara-2 (1.96 per cent dry weight in leaf and 1.58 per cent dry weight in root) than tolerant variety Bhaskara (1.77 per cent dry weight in leaf and 1.28 per cent dry weight in root) in both leaves and roots at 250mM NaCl. On the other hand, K^+ content decreased with increasing NaCl levels in all the varieties. Consistently, it was shown that Bhaskara accumulated more K^+ in both leaves and roots compared to Madakkathara-2 even at higher salt levels of 250mM NaCl.

In order to a tolerant and sensitive variety from six cashew varieties, salt screening indices namely stress tolerance index (STI) and stress susceptibility index (SSI) were employed under salt stress (Fig 3.1.15). A significant decrease in STI was observed in all the varieties under salt stress, with maximum reduction was noticed at high salt level (250mM NaCl). Maximum STI was observed Bhaskara while, it was minimum in Madakkatahra-2 at 250mM.

Fig.3.1.14 Leaf necrosis symptoms of six cashew varieties after 40 days of NaCl treatments: A) Bhaskara; B) Vengurla-4; C) VTH-174; D) VTH 30/4; E) Ullal-3; F) Madakkathara-2

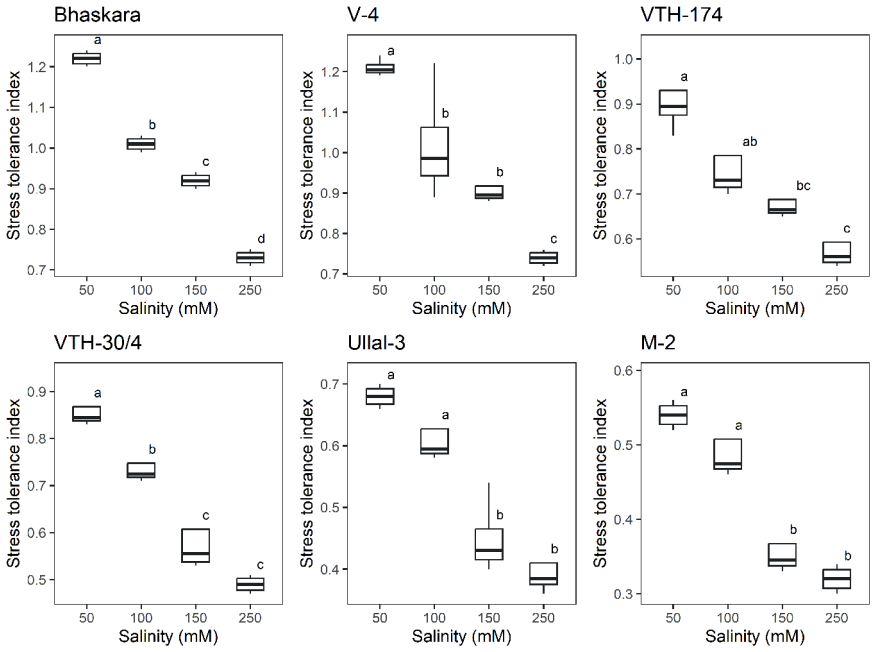


Fig.3.1.15: Effect of NaCl concentration on Stress Tolerance Index (STI) of six cashew varieties after 30 days of salinity treatments

3.2 CROP MANAGEMENT

Priority area II: Development and Refinement of Production Technologies in Cashew

3.2.1 Developing nutrient management strategies for cashew based on soil and leaf status

Micronutrient application plays a critical role in improving the nutritional status of cashew leaves, influencing growth, productivity, and overall plant health. Foliar application of micronutrients such as zinc and boron were carried out during flushing and flowering periods in cashew trees of age 10 years during 2023-24. Leaf samples were collected from cashew plants subjected to micronutrient foliar spraying. The concentration of macronutrients (N, P, K, Ca, Mg) and micronutrients (Mn, Fe, Cu, and Zn) was analyzed. Nitrogen (N) levels ranged from 0.47 to 0.63per cent, while phosphorus (P) levels varied between 0.10 and
0.15 per cent, and potassium (K) levels showed variation from 0.49% to 0.75 per cent. The calcium (Ca) content ranged between 0.03 and 0.04 per cent and magnesium (Mg) values varied from 0.04 to 0.08 per cent. Among the micronutrients, copper (Cu) varied between 4.72 ppm and 6.97 ppm, and zinc (Zn) content ranged from 36.68 ppm to 40.58 ppm.

Encouraging results were obtained with respect to per cent increase in fruit retention (29.80) (Fig 3.2.1); and yield (19.61 per cent). Uniform apple, nut size, absence of cracking of fruits and emergence of additional flowering laterals were documented.

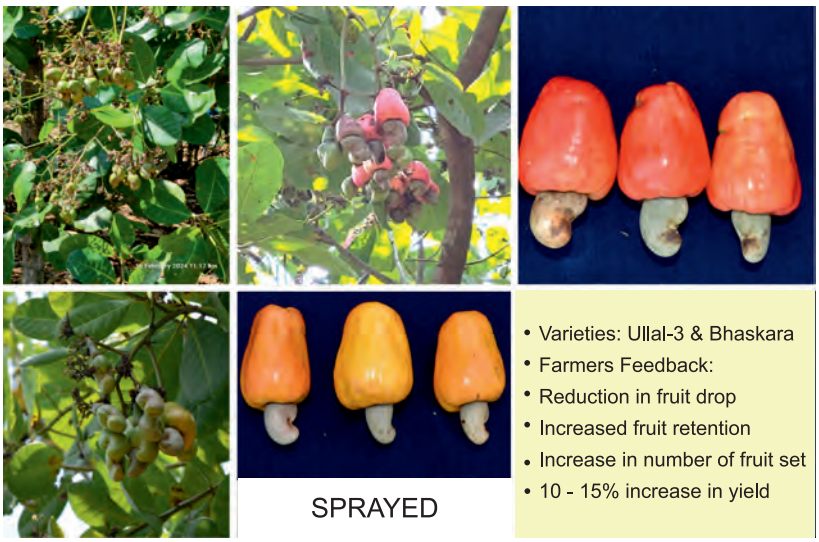


Fig 3.2.1: Effect of micro nutrient special spray on fruit set

3.2.2 Biochemical and mineral composition studies in relation to phenology of fruit development and maturity in cashew

The total phenols showed a decreasing trend throughout the fruit maturity period like in other fruit crops, because of the oxidation of phenols by the enzyme, polyphenol oxidase. Similar trend was noticed with respect to antioxidants activity and total phenols. The tannin was in bound form during fruit developmental stages and its concentration starts increasing during fruit maturity period. In other varieties, after flavonoids synthesis through condensation and polymerization phases the condensed tannins are formed but these hydrolysable tannins are the derivatives of gallic acids which was completely absent in CNSL free types. The protein and fat content showed an increasing trend with respect to developmental stages. The protein content was varied between 11-15per cent in 711 stage and it was 15-18 per cent at nut maturity stage 719 (Fig 3.2.2 & 3.2.3). However, the accumulation of kernel protein content was observed to be highest between 817 and 819 stage with a range of 25-30 per cent.

Fig 3.2.2: Fruit maturity stages selected for the study

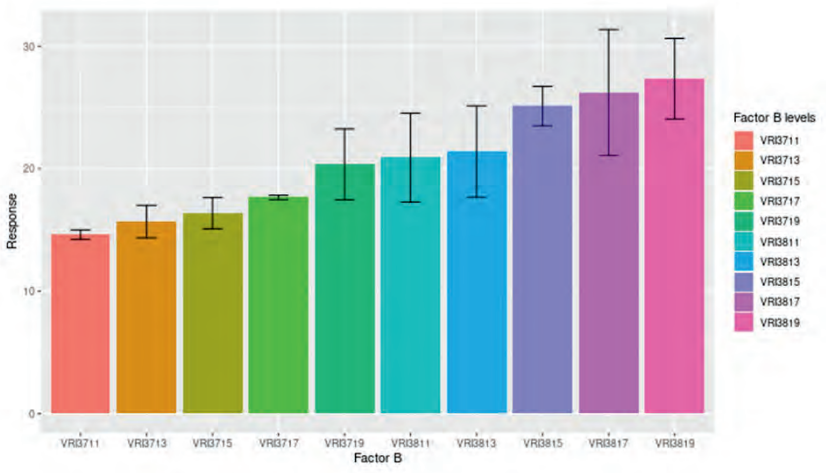


Fig.3.2.3: Accumulation of protein content throughout the phenological growth stages of cashew kernel

3.2.3 Influence of weather parameters on growth dynamics of apple and nut in selected varieties of cashew

Adopting the technique of modified BBCH scale in cashew varieties *viz.*, Vengurla-4, Vengurla-7, Vridhachalam 3, NRCC Selection-2, Madakathara-2, Nethra Ganga, and Bhaskara were screened to assess the growth dynamics of cashew nut and apple (BBCH code 711 to 719 and BBCH code 811 to 819) stages. The nut and apple parameters were recorded for all the early, mid, and late varieties. Further, the mineral composition at phenological stages were analyzed for major nutrients (Fig. 3.2.4). The nitrogen accumulation pattern (N) showed an increased content at stage 811 in most of the varieties. However, the minimum and maximum content of N at all the stages were 1.70 and 3.94 per cent, respectively. It was observed that stage 811 determines the highest content of nitrogen accumulation, wherein it will be the stage that determines the protein content at the later stage of nut maturity (indirect method). Vengurla-4 had the highest concentration of N at maturity stage 819 (4.92 per cent). The phosphorus (P) content was also studied considering the nut maturity stages; the minimum and maximum P contents were 0.30 and 0.96 per cent, respectively. It was observed that the P content varied at different stages of nut maturity. The highest concentration of P at final maturity (819) was recorded in variety NRCC Selection 2 (0.60 per cent). The distribution pattern of Potassium (K) varied across the stages of maturity. However, the minimum and maximum content were 0.34 and 0.72 per cent respectively. The variety, Nethra Ganga, showed a higher K content at the final maturity stage, 819 (0.52 per cent). The pattern of flowering and sex ratio of all the varieties were recorded to relate to the weather variables.

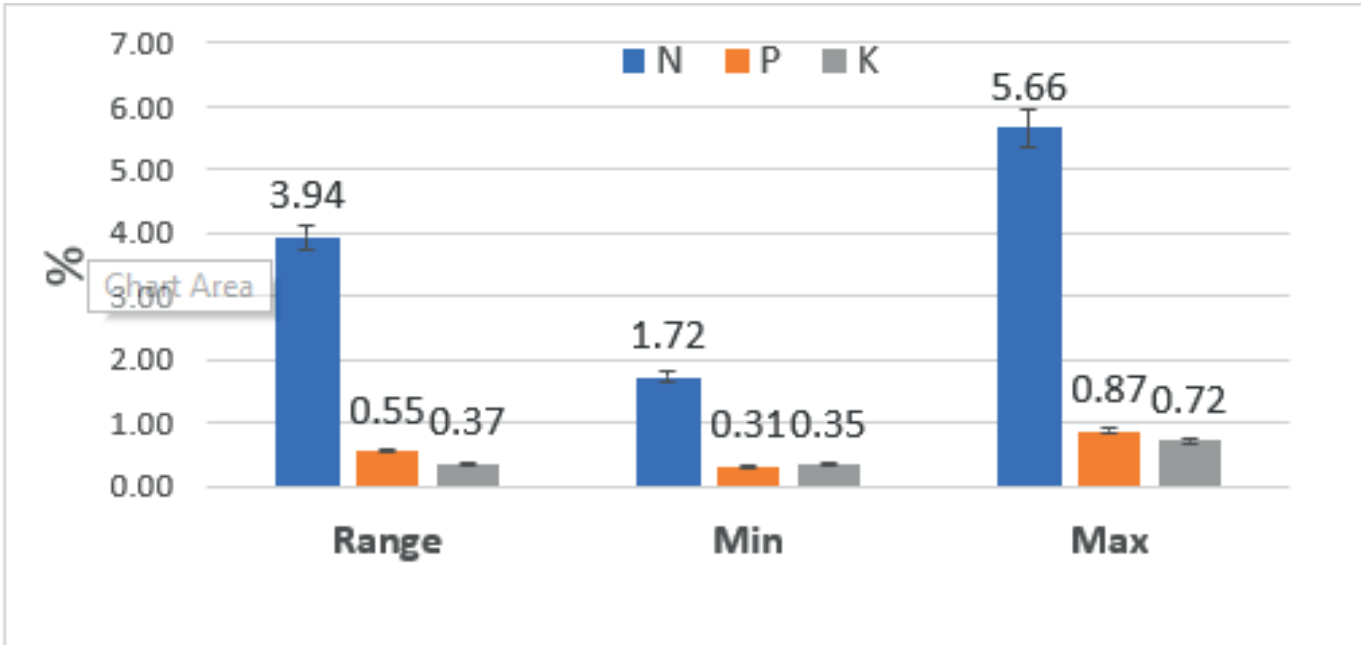


Fig.3.2.4: Elemental composition of cashew apple and nut across growth and maturity stages

3.2.4 Studies on training and pruning in cashew for better canopy management

This trial was initiated to standardize pruning and training technology under the ultra-high density planting system (UHDP) with VRI-3 variety having spacing of 3x3 m during the year 2023-24. Different pruning treatments were followed in the field, with two, three, and four branches retained in primary branches. Branch pruning was applied to primary and secondary branches at the rate of 25 per cent and 50 per cent, respectively (Fig. 3.2.5).

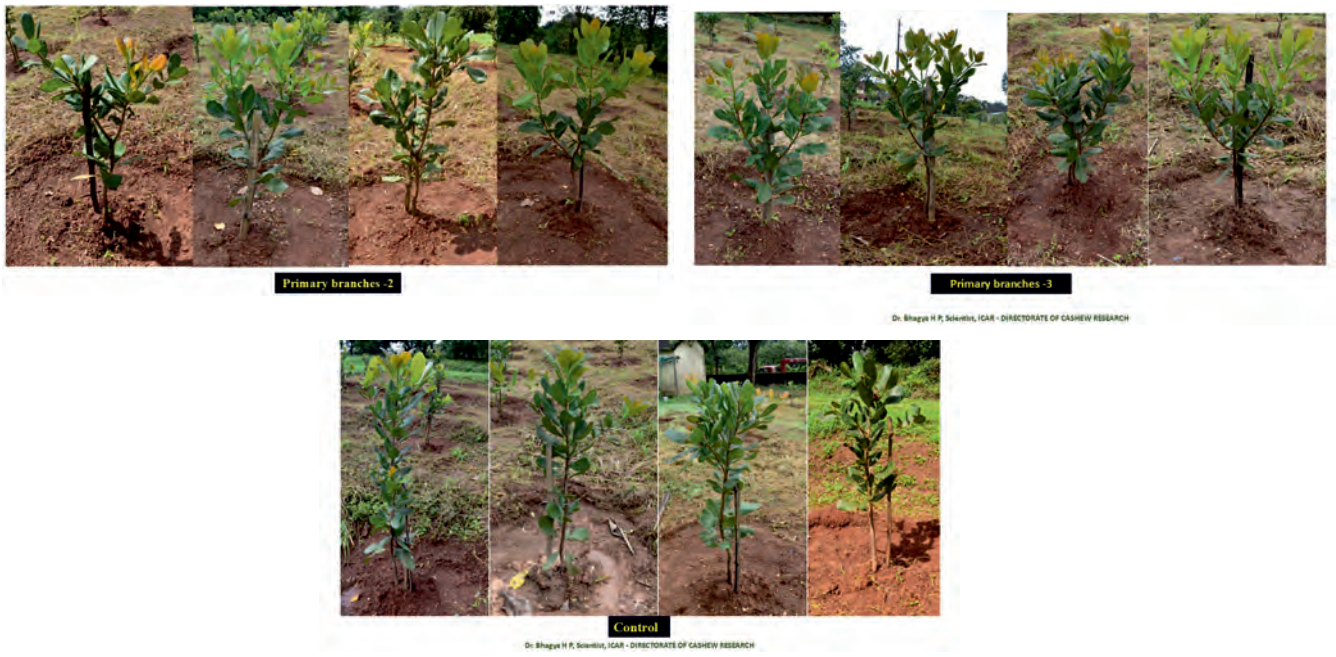


Fig. 3.2.5: Field view of pruned grafts in canopy management

3.2.5 Development of cashew (*Anacardium occidentale* L.) based cropping system for west coastal region

Cashew was planted with various fruit crops in order to create a cashew-based cropping strategy for costal Karnataka. In September 2022, cashew and fruit crops such as mango (var. Amrapali), guava (var. Allahabad Safed), acid lime (var. Balaji), rambutan (var. N-18), mangosteen (var. local), and *Stylosanthes hamata* cover crops were planted, and growth parameters were recorded(Fig.3.2.6). The height of the cashew tree ranged from 1.51 to 1.76 m, the girth from 2.63 to 2.97 cm, the average canopy spread from 0.93 to 1.03 m, and the canopy area was larger in cashew alone (0.96 m^2) (Table 3.2.2). *Stylosanthes hamata* biomass production was estimated and reported as 25 tonnes/ha. It was observed that, the leaf miners, leaf-twisting weevils, shoot tip caterpillars, tea mosquito bug, and flower caterpillar pests in cashew, as well as red rust and sooty mold diseases. it was also observed that, the anthracnose and red rust disease incidence in mango; spiderwebs and caterpillars were found in acid lime; and tip drying was observed in rambutan during 2023-24.

Table 3.2.2. Growth parameters of cashew under cashew-based cropping system during 2023-24

Treatments	Height (m)	Girth (cm)	Canopy Spread (m)		Average Canopy Spread(m)	Canopy area (m^2)
			N-S	E-W		
T1-Control (Cashew alone)	1.64	2.74	1.02	1.04	1.03	0.96
T2-Cashew + Mango	1.62	2.88	0.97	1.03	1.00	0.84
T3-Cashew + Guava	1.57	2.69	1.00	1.09	1.04	0.90
T4-Cashew + Mangosteen	1.59	2.63	0.90	0.95	0.93	0.71
T5-Cashew + Acid lime	1.61	2.79	0.99	1.00	1.00	0.83
T6-Cashew + Rambutan	1.51	2.67	0.99	1.01	1.00	0.80
T7-Cashew+Cover crop (*Stylosanthes hamata)*	1.76	2.97	0.98	1.03	1.01	0.46
CV	10.43	9.95	12.07	11.36	11.01	32.25
CD @5 %	NS	NS	NS	NS	NS	NS

Fig.3.2.6: Field view of cashew based croping systen

3.3 CROP PROTECTION

Priority area III: Integrated Insect Pests and Diseases Management in Cashew

3.3.1 Characterization and synthesis of female sex pheromone of Tea Mosquito Bug; (*Helopeltis antonii*) and its bioassay (IXX16224)

The procedure for collection of sex pheromone volatiles from virgin females of TMB was further amended to facilitate more adsorption of the sex pheromone volatiles. The adsorbents were washed with several rinses of di-chloromethane and heated up to 80 – 100° C prior to usage. Those of the TMB virgin females which showed attraction to the field populations of TMB males within 30 min to 60 min after trap installation were utilized for the volatile collection apparatus and the vacuum pump was operated at a flow rate of 0.8 to 1.0 L per hour for 5-6 hrs. The volatiles were adsorbed onto either Tenax® or Porapak® cartridges prepared as per the standardized protocol by plugging the ends of 4.0 mm dia. glass tubes of 6.0 to 8.0 cm length with glass-wool and filled loosely with either of the activated adsorbents {approx.1.0 – 1.2 g}. These were carefully removed from the set up and stored in a deep freezer. After obtaining sufficient number of samples the adsorbents were eluted with di-chloromethane and the eluate was collected into stoppered vials, labelled and stored in deep freezer for further analysis at NBAIR, Bengaluru.

Further, in order to assess the retention of attraction of the whole-body extracts (WBE) of virgin females of TMB, those samples [prepared by whole-body crushing in di-chloromethane from calling virgin females] ranging from 15 to 60 days after extraction (DAE) were evaluated using circular sticky traps. The mean trap catches indicated that across the different samples tested; there was no explicit trend in attraction levels indicating that the samples would have retained their activity [in terms of stability of the response inducing volatile profiles] over the total period (Table 3.3.1).

Table 3.3.1. Mean No. of TMB males attracted / trapped in 60 mins

Trap location	Days after WBE preparation							
	15		25		40		60	
Scion Bank	22/4	5.5	19/4	4.75	22/6	3.67	19/6	3.17
Ent. Block	28/6	4.67	33/5	6.6	18/4	4.50	22/5	4.4
Gene Bank -I	29/5	5.8	27/6	4.5	28/6	4.67	31/6	5.17
Gene Bank -II	24/5	4.8	24/4	6.0	31/5	6.2	27/5	5.4

Similarly, it was observed that the attraction response from the field populations of male TMB to the WBE baited traps; showed a diurnal response similar to that observed in case of the virgin female baited trap catches. The cumulative maximum catches were recorded from 1100 to 1300 h during the cropping season, which indicated the possibility of male responses being higher during the mid part of the day (1100 to 1300 h) (Table 3.3.2). This can assist in determining about the time of trap placement for pest population estimation and trapping in the TMB infested plots.

Table 3.3.2. Total number of TMB males trapped in WBE baited traps (15-30 DAE) (Cumulative of all plots)

Month	Time Intervals			
	0900 – 1100	1100-1300	1300-1500	1500-1700
Oct 2023	20	63	38	28
Nov 2023	13	79	60	37
Dec 2023	22	92	46	33
Jan 2024	25	109	57	46
Feb 2024	17	72	38	292

3.3.2 Assessing the field effectiveness of entomopathogenic nematodes (EPN) and indigenous strain of entomopathogenic fungus (EPF) in management of cashew stem and root borers (*Plocaederus ferrugineus* and *Plocaederus obesus*) (IXX16225)

These trials for evaluation of EPN are being conducted in the experimental plots of KCDC plantations at Sowthadka division; [Onithaaru, Mastikallu and Kadeera] which have different edaphic characteristics and also with a varied topography; in order to determine the effect of these parameters on the survival and retention of virulence by the IJs of the different test EPN species (Coleopteran strains). The test solutions of the IJs of EPN of two different species *viz.*, *Heterorhabditis indica* and *Steinernema carpocapsae* were used for the evaluations, at 10 LE /L and the soil samples were collected after 30 – 45 days after treatment and the retention of virulence by the EPN species was studied. It was observed that better levels of virulence (> 80 % mortality within 24 h) and longer duration of survival (>150 days after application) was observed in soils having shaded zone and higher organic matter. Further, it was noticed that none of the treated trees in any of the experimental plots had any infestation by the CSRB over the past two years and hence it is proposed to have detailed and extensive trials for providing recommendation for inclusion of EPN in plant protection measures of the IPM of cashew.

3.3.3 Cashew - tea mosquito bug interactions and the defensive responses

Screening for tolerance in cashew for TMB infestation

To understand about the tolerance in cashew for TMB infestation, changes in the plant phenological stages after TMB infestation were recorded in the reference cashew varieties block of ICAR-DCR, Puttur, Karnataka. The plot suffered severe TMB infestation till December 2023 and almost all 29 reference varieties had TMB damage grade of 2.0 to 4.0 depending on the plant phenological stage. These plants were observed for subsequent production of flushes and flowers. All reference varieties produced new flushes after severe TMB infestation, however the percentage of flowering varied as shown in Fig 3.3.1. Though majority of the varieties had less than 1 % flowering during January 2024, the varieties like Taliparamba, VRI-1 and VRI-2 had 50-75 % flowering. More than 50 % flowering was noticed in six cashew varieties during February 2024 including VRI-3, VTH 174, MDK-2. During March 2024, > 50 % flowering was recorded in nine varieties including VTH 30/2, V-2, V-7, Bhaskara. However, nut set was less in most of the varieties. Comparatively more productive panicles were noticed in Bhaskara, VRI-3, VTH 30/2 and V-7, but very less in Taliparamba, NRC 406, Ullal-2, Ullal-1, VTH 30/4, V-1, VRI-2 etc. These observations give an indication that different varieties respond differently to TMB infestation depending on the period of infestation and the plant phenological stage during the infestation.

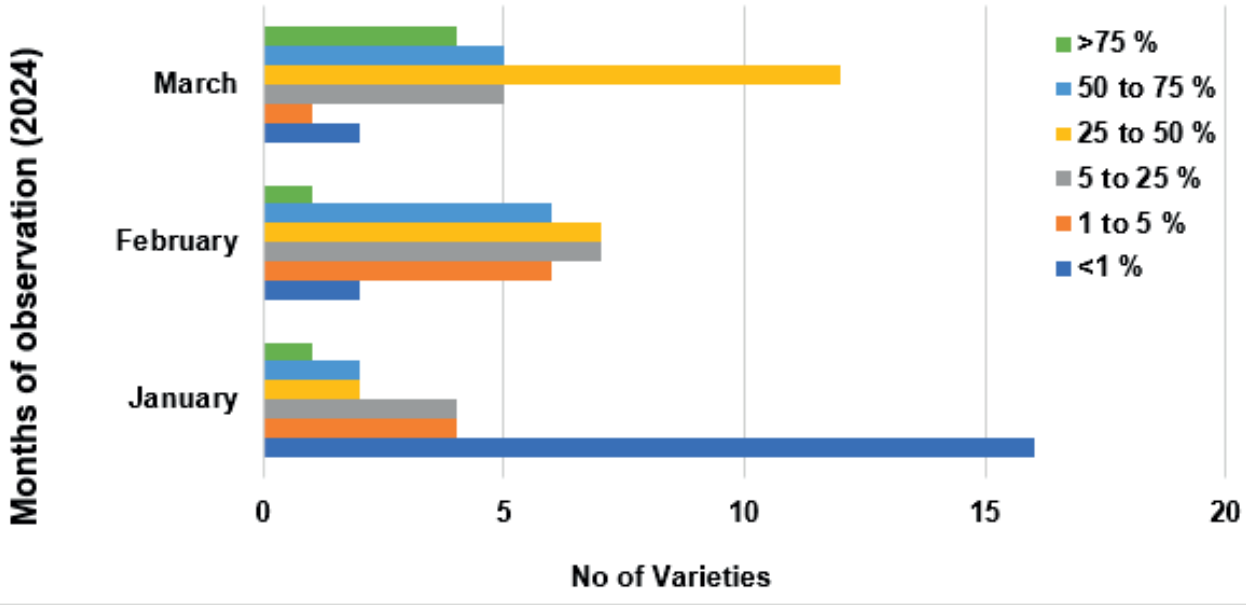


Fig.3.3.1: Distribution of flowering percentage in reference varieties

Physicochemical quality parameters:

Changes in secondary metabolites in shoots upon TMB infestation

The changes in physicochemical quality parameters upon TMB infestation were recorded in cashew shoots, apples and nuts. Compared to the uninfested shoots, there increase trend was observed in the total phenols content, total flavonoids and total anti-oxidant activity in the shoots of Bhaskara after 24 hours of TMB infestation (Table 3.3.3), but no significant difference was recorded in total tannin content. The highest phenol content was recorded in infested semi matured shoots (95.14 GAE mg/100g) of Bhaskara, the highest flavonoids was recorded in infested tender shoots (60.68 QE mg/100g) and highest total antioxidant activity was recorded in infested tender shoots (159.6 mg/100g).

Table 3.3.3. Changes in secondary metabolites in cashew shoots upon TMB infestation

Cashew shoots	Total Phenols (GAE mg/100g)	Total Flavonoids (QE mg /100g)	Total tannin (mg/100g)	Total antioxidant activity (mg/100g)
Bhaskara (TU)	74.27	51.54	4.15	109.8
Bhaskara (TI)	84.21	60.78	5.22	159.06
Bhaskara (SMU)	47.33	43.55	4.31	129.05
Bhaskara (SMI)	95.14	47.35	4.84	144.9
CV	5.21	2.08	NS	0.24
CD (0.01)	18.056	4.866	-	1.544

*(T-tender, U-uninfested, I-infested, SM-semi matured)

The profile of phenolic acids and flavonoids of tender and semi matured shoots of Bhaskara were also recorded in the uninfested and TMB infested shoots (24 hours after infestation). A total of 15 no.of phenolic acids were detected in the cashew shoots. In the uninfested tender shoots, gallic acid content was more (8.28 µg/g) followed by *p*-Coumaric acid (5.1). In the infested tender shoots, increased gallic acid content of 10.65 µg/g was recorded. Whereas in the uninfested semi-matured shoots, 3-hydroxy benzoic acid (8.14 µg/g) and *p*-hydroxy benzoic acid (8.64 µg/g) were more among the phenolic acids, and after TMB infestation, their levels were 17.21 µg/g and 7.81 µg/g, respectively. The flavonoids profile indicated the higher contents of quercetin, luteolin and myricetin in the cashew shoots among the 13 flavonoids recorded. An increase in the level of flavonoids was noticed in the shoots upon TMB infestation. Among the flavonoids, quercetin was recorded high in the infested tender shoots (1080.3 ug/g) and in infested semi-matured shoots (350.05 ug/g).

Changes in defense enzymes in shoots upon TMB infestation

In general, tender shoots had higher phenyl alanine ammonia lyase (PAL), polyphenol oxidase (PPO), catalase and superoxide dismutase (SOD) content compared to semi-matured ones. There was significant increase in phenyl alanine ammonia lyase (Fig. 3.3.2) and polyphenol oxidase in the infested shoots after 24 hours of infestation (Fig 3.3.3) but no such increase in SOD and catalase activity.

Kernel quality in relation to TMB infestation

The phenological nut (BBCH scale) stages of 619, 711 and 713 were found to be highly vulnerable to TMB infestation, which upon TMB infestation fell prematurely. The stages of 715 and 717 sustained TMB infestation and matured, while the nuts of 719 stage were not damaged by TMB. Hence, the nuts of 715 stage of VTH 30/4 were subjected for TMB infestation and those infested nuts upon maturity were analysed for physico-chemical qualities. In the infested nuts, kernels remained free of any damage symptoms. There was reduction in apple weight and nut weight by 15-25 per cent and 6-10 per cent, respectively in the infested nuts compared to the uninfested ones. Similarly, reduction in total sugars (4.5-7.5 %), protein (14-17 %), fat (15-30 %) and CNSL content (29-41 %) were observed in the infested cashew nuts compared to the uninfested ones.

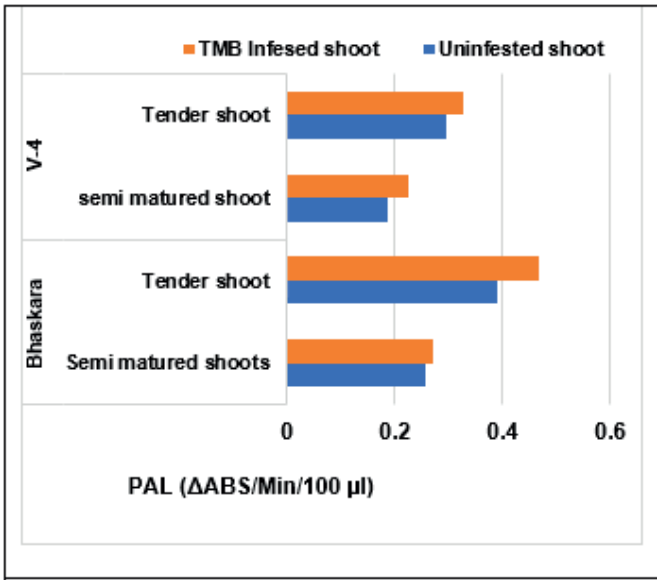


Fig 3.3.2: Changes in PAL in cashew shoots

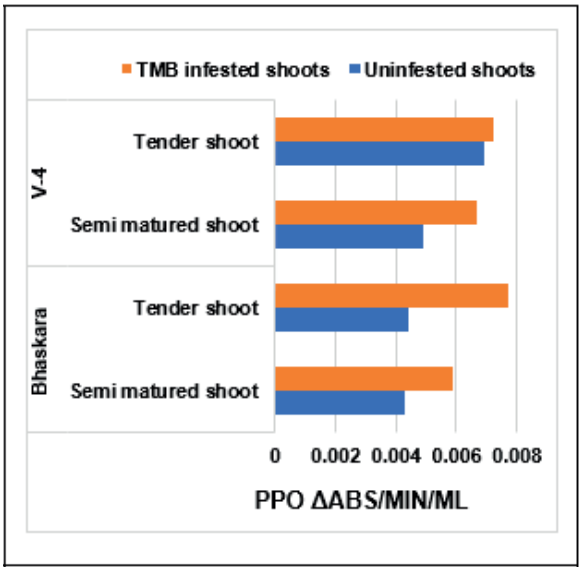


Fig 3.3.3: Changes in PPO in cashew shoots

Herbivore induced plant volatiles

The studies on herbivore induced cashew volatiles (HIPVs) work was continued at IIHR, Bengaluru. GC-EAD analysis indicated the differential response in virgin female TMB to different HIPV compounds. The compounds elicited response in TMB females were identified using GC-MS. Dual choice bioassays showed significant attraction of gravid TMB females towards healthy plant volatiles. Bioassays were also carried out with the commercially available synthetic analogues of EAD responsive compounds. There was significant attraction of gravid TMB females to beta caryophyllene, *p*-xylene, carene and cuminaldehyde. Further extensive studies with the synthetic analogues and the blends of HIPVs will lead to formulate attractants / deterrents for TMB.

3.3.4 Species complex of thrips infesting cashew, molecular characterization, and their management measures

Species complex of thrips occurring in cashew

Through extensive surveys, over 7000 thrips specimens have been collected from cashew plants during this cropping period. The molecular characterization of thrips species was taken up at ICAR-NBAIR, Bengaluru for a few abundant species. A total of 18 nos. of thrips species were recorded on cashew under 12 genera including Terebrantia and Tubulifera. Only three species were recorded on the cashew leaves *viz*., *Selenothrips rubrocinctus, Retithrips syriacus* and *Mecynothrips simplex,* while the rest 15 nos. of species were from the cashew flowers. Genus *Thrips* was dominant with six species, followed by *Scirtothrips* and *Haplothrips* with two species each. Cashew is found to be a new host for 12 thrips species during this investigation, including *Thrips parvispinus* (Karny), which is an invasive pest species.

Diversity indices

During 2023-24, as only eight thrips species were recorded species richness was 8, whereas in 2024, the richness was 18. During 2023, *Haplothrips ganglbaueri* was abundant (70.38 per cent) followed by *Thrips subnudula* (13.59 per cent) and *Scirtothrips dorsalis* (8.44 per cent). Whereas during 2024, *T. subnudula* was abundant (44.92 per cent) followed by *Haplothrips* spp. (34.10 per cent) and *S. dorsalis* (7.43 per cent). During 2024, the Simpson's dominance was less (32.7 per cent) compared to the previous year (47.6 per cent) (Table 3.3.4). The present observations indicate that *T. subnudula* is one of the prominent species in cashew, however, during 2017-19, *S. dorsalis* was recorded as dominant species at Puttur. Besides, *T. hawaiiensis* which was recorded earlier at Puttur was not observed during the present surveys. Hence, documentation of species is imperative to understand the changes in species complex and their abundance.

Table 3.3.4. Diversity of thrips species in cashew

Diversity indices	2023	2024
Richness	8	18
Berger parker index (%)	61.1	44.9
Simpson dominance (%)	47.6	32.7
Shannon Wiener index (%)	0.9296	1.4507

Seasonal incidence of thrips

Number of thrips collated per panicle ranged from 1 to 18 per inflorescence during different months. The peak incidence was noticed during January and April, 2024 (Fig.3.3.4). However, the seasonal incidence of thrips varied between the months for different species. The predatory insects found on the inflorescences were recorded, however no predatory thrips species was recorded in both the years of collection.

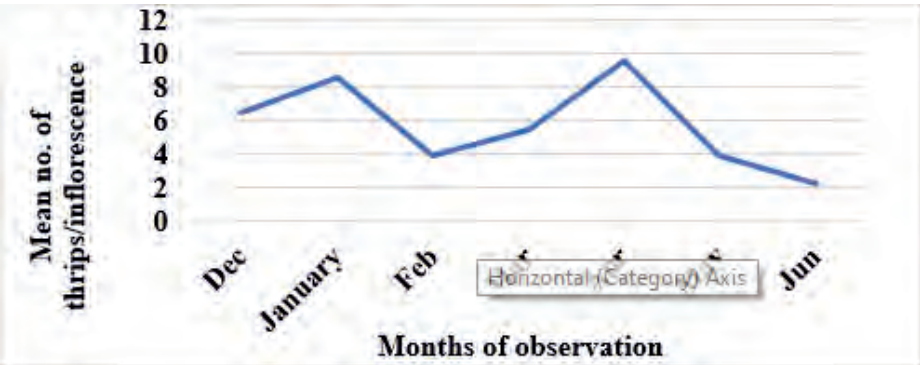


Fig 3.3.4. Seasonal incidence of thrips occurring in cashew

Many of the species recorded under this investigation are polyphagus, but the role of prominent species in cashew as pest or pollinator or mycophagous needs to be documented. Preliminary trials were conducted on management of thrips using botanicals, entomopathogenic fungi and insecticides, however observations could not be continued as flower drying was noticed in all the treatments.

On *Semecarpus kurzi* (Fam: Anacardiaceae), which is a wild relative of cashew, five species of thrips have been recorded in which four species are common with cashew including *T. subnudula* and *T. coloratus.* Besides, the thrips species occurring on common weed species in the cashew plantations are also being documented to understand the host range of thrips occurring on cashew.

3.3.5 Survey and diagnosis of diseases occurring in cashew crop and their morphological and molecular characterization

Seedling rot disease of cashew-A New report

The seedling rot disease samples of cashew were collected from the nurseries of ICAR-Directorate of Cashew Research, Puttur, Karnataka during August 2023. The typical symptoms were observed during the monsoon season as initial water-soaked lesions in the leaves and later developed as necrotic spots of irregular size and severely affected leaves showed blight appearance and complete rotting of seedling was also observed. The leaf spot disease incidence of 25-30 % was recorded in cashew nursery (Fig 3.3.5 A & B). The mycelial growth on potato dextrose agar media appeared whitish to yellow in colour on the upper surface and brown to dirty white on reverse side of plates. The growth pattern developed a distinctive layer by overlapping one above the other with an open flower appearance and surrounded by lobed margin (Fig 3.3.5 C). The fungal isolates produced biconical, rostrate, and pale brown conidia with a hyaline to sub-hyaline equatorial transverse band and hyaline apical appendage (Fig 3.3.5 D). Morphological and cultural characteristics confirmed the pathogen as *Beltrania* sp.

Fig 3.3.5: (A) & (B)-Typical symptoms of leaf spot disease, (C) - Pathogen growth on PDA media, (D) - Conidia of pathogen at 20x magnification

Establishment of pathogenicity under artificial conditions

The pathogenicity test was done through detached leaf assay on healthy leaves of cashew. The mycelial mat disc of *Beltrania* sp. was kept on the healthy leaves, and kept in BOD chamber by covering with white polythene sheets. The temperature (25 °C) and relative humidity (85 percent) were provided throughout the incubation period. The cashew leaves were recorded for symptoms development and showed similar symptoms (Fig 3.3.6) after 7-10 days post inoculation (dpi).

Fig.3.3.6: Disease symptom expressions under artificial conditions
(A)-Before inoculations; (B)- Symptoms of disease

Molecular characterization and phylogenetic analysis

Further, molecular characterization with internal transcribed spacer (ITS) was done to confirm the species identity. The ITS gene sequence was analyzed using nucleotide BLAST in NCBI database and confirmed the species as *Beltrania rhombica*. ITS gene sequence was submitted to NCBI with the GenBank accession No. PQ144276. A phylogenetic tree was generated from the ITS sequences obtained from NCBI database. Based on cultural, microscopic and molecular characterization the pathogen was confirmed as *Beltrania rhombica* (Fig 3.3.7). To best of our knowledge this is first confirmed report of leaf spot disease caused by *Beltrania rhombica* from India

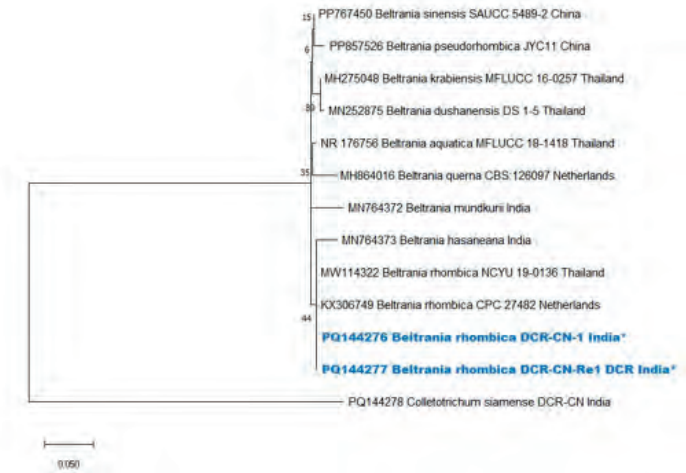


Fig.3.3.7: Phylogenetic tree produced using partial ribosomal DNA (*rDNA*) gene sequences showing the phylogenetic relationship of *Beltrania rhombica* isolated from cashew (Bold with asterisk mark) with other *Beltrania rhombica isolates and Colletotrichum siamense* as out-group retrieved from GenBank, using the Maximum-likelihood (ML) method.

Whole genome sequencing and comparative analysis of *Neopestalotiopsis clavispora* causing cashew leaf blight disease

A pathogenic ascomycetes fungus, *Neopestalotiopsis clavispora* is a major causal agent of cashew leaf blight pathogen affecting the seedlings under nursery conditions. Studies on the pathogenic mechanism of *N. clavispora* at molecular and genetic levels were hindered due to lack of complete genome sequence data. To address the research gap, the complete genomic data of *N. clavispora* was generated by Illumina technology. A total assembled genome size of 59.25 Mb with base pair length of 60576399, N50 contig size of 129039 bp, GC content ratio of 50.05% with genome coverage of 716.16x. The blast annotation was performed against all the known gene sequences of family Sporocadaceae, a total of 23069 gene sequences were predicted with 15767 annotated gene sequences. A total of 3997 perfect simple sequence repeats (SSRs) were identified with relative abundance and relative density of 66.09 and 1231.07 respectively (Table 3.3.5).

Table 3.3.5: Assembly statistics of *Neopestalotiopsis clavispora* CLBP1

Genome features	Values
Assembled Genome Size (MB)	59.25
Total length of sequences	6,05,76,399
Total Gene Sequences	23069
Annotated Gene Sequences	15767
Unannotated Gene Sequences	8302
Unknown bases (Ns) in sequences (Bp)	95100
Percentage of unknown bases (%)	0.16
GC content (%)	50.05
Total number of sequences	11179
Relative abundance	66.09

The comparative genomic analysis was performed with the available genomes in database of same pathogen and closely related pathogenic fungi with in the same group, it was found that a higher number of 14055, 23069 and 4370 of clusters, proteins and singletons were predicted in comparison to other genomes used in the analysis respectively. The phylogenetic tree was also constructed to know the evolutionary relationships between the species and based on analysis, it was found that the *N. clavispora* infecting cashew formed a separate cluster which is closely related to *Neopestalotiopsis* spp. and *Neopestalotiopsis clavispora* IHI 201606 isolates (Fig 3.3.8). The availability of high-quality genetic resources will serve as a foundation for the studies on pathogen biology, molecular pathogenesis and virulence of *N. clavispora* infecting cashew.

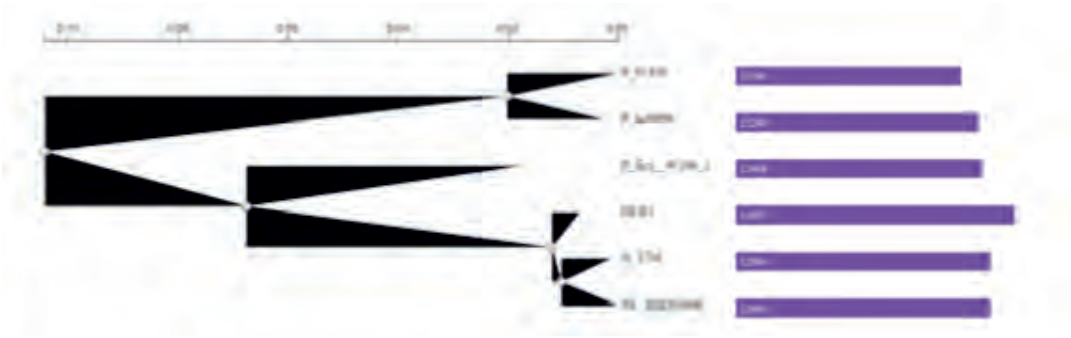


Fig 3.3.8: Phylogenetic tree based on the identification of highly conserved single-copy genes to describe the evolutionary relationships between species.

Externally funded Project

3.3.6 Establishment of Farmer-Centric Pest Diagnostic and Bio-Control Laboratory to Achieve Sustainable Cashew Health Management (RKVY-RAFTAAR)

A pest diagnostic laboratory with different facilities like Laminar air flow cabinet, compound microscope with attached camera, Thermal Cycler, Refrigerated Centrifuge, Nanodrop, BOD incubator, volatile collection unit etc., has been established. The insect proof net house and glass house for insect and artificial disease screening facilities were also created (Fig 3.3.9)

3.3.7 Establishment of state of art facilities for chemical ecology studies targeting ecofriendly pest management and demonstration in cashew (2024-26) (RKVY- RAFTAAR)

The project is initiated during May 2024 and the laboratory facilities are being established to study the chemical ecology. The procurement of the equipments like GC, EAD, volatile collection unit etc., are in progress.

3.4 POST-HARVEST TECHNOLOGY

Priority area IV: Development of Food Products and Machinery for Pre and Post Harvest Management and Processing

3.4.1 Development of ready to eat alternate snack food using cashew apple - Extrusion and Vacuum frying approach

To validate the snack food preparation of Cashew Apple Powder (CAP) blended with rice corn mixture using double screw extruder with single screw extruder, various trials were conducted following 'Response Surface Methodology' (RSM) to optimize the material and machine parameters. Based on the experience gained with double screw extruder machine parameters *viz.,* Barrel temperature, Feeder speed and Cutter speed were kept constant and only the screw speed varied between 30 to 35 Hz. As far as the material parameters concerned, proposition of rice flour varied from 25 to 35 per cent and CAP from 5 to 15per cent and the moisture content kept at different level of 14,16 and 18% d.b. In order to maintain the puffing of the product, corn flour was added to blend to the extent of 60 per cent. Cashew apple powder-based snack food obtained with various experiments by RSM are shown in Fig 3.4.1. Setting first barrel temperature in the beginning of the process, while extrusion takes place for different blends, plays a crucial role for the given barrel length and screw diameter. Extrusion conditions of 12per cent cashew apple powder, 28per cent rice flour, 60per cent corn flour and 30 Hz screw speed were determined as optimum conditions for development of cashew apple powder incorporated rice-corn based extrudates.

Fig 3.4.1. Cashew apple based extrudate prepared with rice-corn mixture

A lab scale (customized design) vacuum frying unit procured and installed. Preliminary trials were conducted with vegetables (Bhendi); fruits (Banana) and pulses (Bengal gram) to understand the influence of frying oil temperature, rotational speed during frying and period of frying on textural quality of snack food. Sensory quality also assessed for the plain and flavored snack food prepared for consumer acceptance.

3.4.2 Optimizing processing parameters in cashew for enhancing whole kernel recovery

Based on the data obtained earlier in Industrial scale processing of cashewnuts in India and training conducted at ICAR-DCR for the Incubatees or beneficiaries using small scale twin boiler system for better whole kernel recovery (WKR) in deshelling operation, influential parameters identified with its minima and maxima. Generally raw cashewnuts are exposed to steam pressure maintained at a level of 90 - 120 PSI (6.30 to 7.03 kg cm^{-2}) for a duration of 6-12 min depending on physical quality of raw cashewnuts. Viewing the experimental cost, number of experiments drastically reduced to 17 nos. by following RSM to achieve optimum values for better WKR after deshelling. Similarly, range of influential parameters during drying, moisture infusion and peeling process of unpeeled cashew kernels are also worked out. Range of values fixed for testa removal process for enhancing white whole kernels after mechanical peeling are drying temperature (62-85°C); drying period (6-8 h) and kernel moisture (2.5 to 3.5 % d.b).

3.4.3 Development of value-added products from cashew apple and sprouts

During the process of harvesting, the abandoned or unnoticed RCN accounts for about 10-20 per cent of the RCN yield and starts germinating after the monsoon. Many local inhabitants of Karnataka and Kerala in India use those sprouted cashews in their traditional cuisines, which accounts for 1-2 per cent of RCN utilization. There is a statement from the inhabitants that the sprouts of cashew are tastier and healthier than the processed kernels. To utilize the nutritive value of sprouts, heat cooking/processing would be one of the most promising techniques by eliminating surface contamination. Keeping these points in view a new food product, cashew sprouts cookies was developed and standardized (Fig. 3.4.2) by fortifying with other healthy nutritional components, like sprouts of green gram, finger millet and horse gram. The commercially available cookies in the market are predominantly prepared by using refined flour, wheat, oats and refined sugar, which are less in protein and high in calories. But the cashew sprouts cookies are a nutri mixture of other sprouts that serve as a vital source of beneficial fat, protein, fiber, ash and other mineral components, which are lacking in commercially available cookies. As the cashew sprouts cookies are enriched with protein (10-12 per cent), fiber, and other beneficial minerals viz., Potassium (0.48per cent), Phosphorus (0.19per cent), Calcium (2.87per cent), Magnesium (0.98per cent) and sodium (4.73Per cent). Since it is preferred by people of all age groups, this can be utilized as one of the sources to address the issue of malnutrition.

Fig.3.4.2: Cashew Sprouts Cookies

3.4.4 Development of Probiotic Food Products from Cashew Apple

To develop fruit juice-based probiotics along with cashew apple, seasonally available fruits like watermelon, muskmelon, pomegranate, oranges, and cashew kernel milk was blended in different proportion (Fig 3.4.3). Among the blends, having good taste and less acidic were selected for screening of probiotic cultures. While testing six strains of *Lactobacillus viz., L. fermentum*, *L. rhamnus, L. acidophilus*, *L. cassei* and *L. gasserii* in the preliminary trial, *L. gasserii* was identified as the effective probiotic strain for the preparation of cashew based probiotic beverage.

Fig.3.4.3: Different blends of fruit juices with cashew apple for screening of probiotic strains

3.4.5 Enhancing the shelf life of cashew apple to increase the market potential

Cashew apple is a potential source of many nutrients including vitamin-C, polyphenols, sugars, fibers, amino acids, and minerals. The present study was carried out to extend the shelf life of cashew apples to meet the consumers' demand of fresh cashew apples for table purpose and to develop food products from cashew apples.

Based on the preliminary analysis of the fruits, two phenological stages *viz.*, 817 and 819 of the variety, VTH-174 were selected for conducting shelf-life studies. Storage studies were conducted to evaluate the effect of temperature and packaging materials (LDPE, PP and HDPE) on physicochemical, biochemical, microbial, and sensory properties of the fruits. Fruits of 817 stage packed in LDPE bags and stored at 5C revealed good textural and physicochemical properties even after 20 days (Fig 3.4.4;3.4.5). Further confirmatory studies with next season fruits are required to standardized the storage conditions.

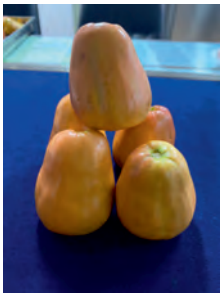


Fig.3.4.4 Cashew apple – 0 day

Fig.3.4.5 Cashew apple – After 20 day

Diet Cashew Apple Muffin

Cashew apple being a potential source for dietary fiber and sugars can be utilized in replacing fat and sugar content of processed foods like breads, cakes and muffins (Fig 3.4.6). With this hypothesis a cashew apple muffin was standardized where part of fat and sugar was successfully replaced with cashew apple juice. Furthermore, refined flour and sugar were substituted with low-glycemic index flour and natural sweeteners. The process is also notable for being entirely vegan, as no eggs were used in the preparation.

The product has low fat and glycemic index in the range of low GI (55) with polyphenolic content of 201 mg GAE/100g and antioxidant activity of 5.44 µmol trolox/g. Comparison with market samples depicted 6% to 67% less fat in the developed muffin. Total dietary fiber and ascorbic acid content of muffin is 1.33% and 99.6 mg/100g, respectively. Cashew apple muffin is a healthier alternative with huge market potential.

Fig.3.4.6 Diet Cashew Apple Muffin

CashewPrash

CashewPrash is a nutraceutical rich formulation with cashew apples and spices as the main components. The product has polyphenols (620.23 mg GAE/100g), ascorbic acid (1.36 mg/100g) and crude fiber (1.48 per cent). It positions cashew apple as a powerhouse in promoting holistic well-being and meets the consumer demand of health promoting natural product (Fig 3.4.7).

Fig.3.4.7 Cashew Prash

CASH- Cashew Apple Squash

A nutritionally rich cashew apple based squash (CASH) was developed, offering a nutritious option for hydration. The product has a TSS of 40°Bx, acidity of 0.75%, polyphenolic content of 79.92 mg GAE/100g, ascorbic acid content of 1.12 mg/100g and ash content of 11.88%. The product is free from artificial flavor and color. It also provides an easy way to enjoy cashew apple flavor year-round, even when fresh apples are not available. It offers a convenient alternative to fresh fruit and can be diluted to taste, making it a versatile beverage choice (Fig 3.4.8).

Fig.3.4.8 CASH- Cashew Apple Squash

3.4.6 Phytochemical characterization of cashew (leaf and apple) nutraceuticals for their utilization in the development of functional foods.

The phytochemical diversity of cashew leaf and apple was performed in cultivars (Nethra Ganga, Bhaskara, Nethra Jumbo-1, VTH-174, and Purple type) through LC-MS/MS profiling. The study resulted in the identification of 18 phenolic acids and 15 flavonoids in five cashew cultivars of leaf and apples, respectively. The targeted metabolite profiling of phenolic compounds significantly differed among the cultivars, which could influence the morpho-biochemical properties of the pseudocarp. Targeted quantification of cumulative phenolic compounds was highest in cultivar Purple type in leaves and VTH-174 in pseudocarp at horticulture maturity. The multivariate analysis with the orthogonal partial least squares discriminant analysis resulted in a good fit of the model with 89%, Thus, cashew pseudocarp and leaves of these cultivars could be excellent sources for nutraceutical values with biological significance for the development of functional foods.

The biochemical analysis of total flavonoids was conducted in the leaves and cashew apples of five cultivars, revealing significant differences among them. In the leaves, the total flavonoid content was ranked in descending order as follows: VTH-174, Bhaskara, Nethra Ganga, Nethra Jumbo-1, and Purple type. The highest concentration of total flavonoids was observed in VTH-174 (10.9 ± 0.24 mg/g) and Bhaskara (8.73 ± 0.53 mg/g). Similarly, significant variation in total flavonoid content was noted in the cashew pseudo-fruits, with Nethra Jumbo-1 having the highest level (0.74 ± 0.01 mg/g), followed by Bhaskara (0.34 ± 0.06 mg/g) and Purple type (0.25 ± 0.04 mg/g) (Fig 3.4.9).

Among the 15 flavonoid compounds quantified by LC-MS/MS in the leaves, quercetin and hesperetin were the most abundant across all cultivars. The highest cumulative flavonols were found in Purple type (1411.54 µg/g), followed by Nethra Jumbo-1 (881.97 µg/g), and VTH-174 having the lowest concentration at 89.70 µg/g. Flavones were most concentrated in Nethra Jumbo-1 (89.00 µg/g), followed by Nethra Ganga (50.39 µg/g), while the Purple type had the lowest concentration (4.24 µg/g). The content of hydroxycoumarins (umbelliferone) was highest in VTH-174. A significant variation in cumulative flavonoid content was observed across cultivars, with Purple type showing the highest levels of flavonoids, particularly quercetin, myricetin, hesperetin, and epigallocatechin. The flavonoid profiles in cashew apples also varied significantly between cultivars, with flavonols being the most abundant flavonoid class. The highest cumulative flavonols were found in Purple type (4355.75 µg/g), followed by VTH-174 (132.99 µg/g). Flavanones were most concentrated in Purple type (47.10 µg/g) and VTH-174 (12.41 µg/g). Flavanols were highest in VTH-174 (47.72 µg/g). The cumulative flavones were highest in VTH-174 (2.12 µg/g) and lowest in Bhaskara. In summary, the Purple type cultivar exhibited the highest levels of flavonoids, with major compounds in the following order: myricetin, quercetin, hesperetin, and catechin. Cultivar VTH-174 had the highest concentrations of quercetin, myricetin, catechin, and epicatechin.

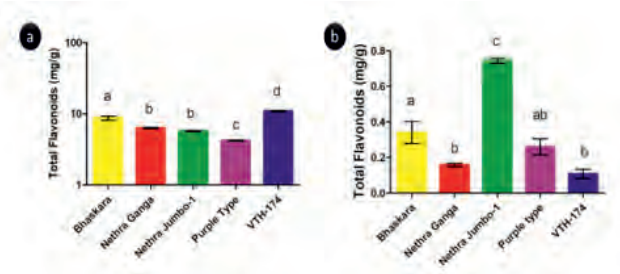


Figure 3.4.9. Total flavonoid diversity (spectrophotometric analysis) in cashew leaves (a) and cashew apple (b) among cultivars of cashew nut

3.4.7 Design, development and performance evaluation of cashew fruit and nut separator

The separation of Raw Cashew Nut (RCN) from cashew apples is traditionally a labor-intensive, time-consuming, and tedious task, as the process is carried out manually due to the lack of mechanized solutions. To address these challenges, efforts were made to develop machinery for separating nuts from cashew apples. With a focus on meeting the needs of small, marginal, and large-scale farmers, pedal-operated, semi-automatic, and fully automatic machines were designed and developed.

Pedal-operated cashew fruit and nut separator

A prototype pedal-operated cashew nut and fruit separator was designed and developed. The machine consists of a main frame, shear cutting blades, a spring-retractable mechanism, and separate outlets for nuts and apples. The overall length, width and height of the nut separator were 770, 771 and 1030 mm, respectively. Performance evaluations showed that the pedal-operated separator has an average separation capacity of 15.0 kg h^{-1} (RCN) with a separation efficiency of 82.74%. The nut damage was found to be less than 5%, making it an effective and farmer-friendly solution (Fig 3.4.10).

Fig. 3.4.10 Pedal-operated cashew apple and nut separator

Portable semi-automatic cashew apple and nut separator

A portable semi-automatic cashew apple and nut separator prototype was also developed, featuring a twisting mechanism. This machine comprises of main frame, a prime mover, a power transmission system, and a nut separating mechanism. The overall length, width and height of the semi-automatic cashew apple and nut separator were 1170, 705 and 925 mm, respectively (Fig 3.4.11). Performance evaluations revealed an average separation capacity of 29.48 kg h^{-1} with a separation efficiency of 91.45%.

Fig. 3.4.11 Portable semi-automatic cashew apple and nut separator

Fully automatic 3-in-1 cashew nut separator

A versatile 3-in-1 machine was developed to perform three operations *viz*: nut separation, pulp extraction, and fibrous material separation (Fig 3.4.12). This fully automatic machine demonstrated exceptional performance during evaluations, achieving an average separation capacity of 307 kg h^{-1} (RCN) with a separation efficiency of 99.32%. Additionally, the nut damage was remarkably low, at just 0.57%, highlighting its suitability for large-scale cashew processing operations. These innovations represent significant advancements in cashew processing technology, providing scalable and efficient solutions to reduce labour requirements and improve productivity across different farming scales.

Fig. 3.4.12: 3-in-1 cashew nut separator, juice & pulp extractor, and fibrous material separator

3.4.8 Design and development of gadgets for cashew fruit harvesting and collection

A prototype of a battery-operated branch shaker and fruit collection device was developed and initially tested under laboratory conditions. Based on the performance observed during testing, several modifications were made to improve operational efficiency. These included increasing the mounting bracket diameter up to 60 cm, adjusting the collector chassis height from 1.9 to 2.4 ft, and modifying the collector chassis width from 4.10 to 6.10 ft. These enhancements aim to improve the effectiveness of fruit detachment and ease of collection, thereby increasing overall operator efficiency. The modified prototype is now better suited for practical use and is expected to deliver improved performance under actual field conditions. Further testing and evaluation of the improved device will be carried out during the next fruiting season.

Externally Funded Projects:

3.4.9 Mechanization of pesticide and nutrient sprays in cashew orchards through drones (KA/RKVY-AGRE/2021/1272)

Funded by: RKVY-FAFTAAR, Government of Karnataka [2021-22 to 2024-25]

To develop standard operating procedures (SOPs) for aerial application of pesticides and micronutrients in cashew orchards, a series of spray experiments were conducted using a hexacopter drone. These experiments were designed using the Box–Behnken Design (BBD) methodology, which employed three key factors—flight speed, flight height, and spray volume—each tested at three levels. A total of 17 treatment combinations were evaluated in an experimental cashew orchard to optimize drone operational parameters. The performance of the UAV-based sprayer was assessed using critical response variables, including volume mean diameter (VMD), droplet density, droplet deposition penetration, and droplet distribution uniformity. Water-sensitive papers (WSPs) were used across the orchard to capture droplet patterns, and image processing software was utilized to analyse the spray characteristics accurately. Following the optimization of operational parameters, additional experiments were conducted to standardize pesticide and micronutrient concentrations suitable for aerial application. These trials focused on evaluating the efficacy of various concentrations under the optimized drone settings to ensure effective and uniform coverage across the orchard. The research is progressing toward the development of comprehensive SOPs tailored specifically for cashew orchards, which will serve as a benchmark for efficient and sustainable aerial spraying practices.

3.4.10: Drone Technology Demonstration (DTD)
Funded by: Central Sector Scheme of Dept. of Agriculture & Farmers Welfare, GoI.
[24-06-2022 to 31-03-2025]

In 2024, we conducted 20 demonstrations showcasing drone technology for spraying agricultural chemicals, micronutrients, and organic pesticides directly in farmers' fields. These demonstrations covered a total area of 23 acres and engaged 786 farmers. The majority of participating farmers expressed a strong interest in adopting drone technology for crop protection applications. They highlighted several benefits of drone spraying, including significant time and labour savings, reduced production costs, efficient use of inputs such as water and chemicals, and enhanced safety for operators. However, some farmers also pointed out challenges associated with drone technology. These included the need for frequent battery recharging, limited tank capacity, shorter flight durations, the requirement for skilled operators, and the high cost of obtaining a pilot license. The field demonstrations provided valuable insights into the potential and limitations of drone technology in agriculture, paving the way for further research and improvements to address farmers' concerns.

3.5 TRANSFER OF TECHNOLOGY

Priority area V: Developing Methodologies and ICT Tools for Capacity Building and Transfer of Technologies in Cashew

3.5.1 Knowledge management and technology transfer in cashew

Development of a theoretical model to analyze farmers' behavioral intention to adopt online training

There is a rapid increase in use of ICTs and online platforms like zoom, Webex etc., for imparting online trainings to farmers and other stakeholders in agriculture especially post Covid-19 pandemic. A series of online training programmes for farmers, entrepreneurs, department officials and students during the period 2022-23, organized at this Directorate. An attempt was made to explore the factors influencing farmers behavioral intention to adopt online training within the agricultural sector. To achieve this goal, an extended version of Unified Theory of Acceptance and Use of Technology model was developed as a theoretical framework that assesses the impact of Performance Expectancy (PE), Effort Expectancy (EE), Anxiety (ANX), Facilitating Conditions (FC), Perceived content quality (PC), Satisfaction (SAT), Self-Efficacy (SE) and Social Influence (SI) on the Behavioral Intention (BI) to use online trainings (Table 3.5.1). An online survey was conducted using a pretested questionnaire and responses were collected from 344 participants who attended the training. The empirical analysis confirms positive associations between the independent constructs (PE, EE, ANX, FC, PC, SAT, SE and SI) and BI. The integration of PC, SAT, SE and SI constructs represents a significant contribution to the existing literature, as it offers a novel approach for a deeper understanding of the adoption process. The study's findings determine significant implications for policymakers and platform developers providing valuable insights into driving technology adoption for sustainable and successful ecosystems

Table 3.5.1: Reliability and validity of the measurement model

	Operational definition of the construct	Cronbach's alpha (>0.70)	Composite reliability (rho_a)	Composite reliability (rho_c)	(AVE) (>0.5)
Anxiety (ANX)	Emotional reaction when it comes to using online training	0.902	1.120	0.920	0.699
Behavioral Intention (BI)	Degree to which an individual is willing to use the technology and recommend to others in future	0.978	0.978	0.985	0.957
Effort Expectancy (EFF)	Degree of ease associated with the use of online training	0.944	0.946	0.960	0.856
Facilitating conditions (FC)	Degree to which external factors help an individual to use online training	0.949	0.950	0.967	0.907
Perceived Content quality (PC)	Degree to which the information provided through online training fits individual's needs	0.961	0.961	0.975	0.927
Performance Expectancy (PERF)	Degree to which an individual believes that attending online training will help in increasing his/her productivity	0.896	0.955	0.931	0.777
Satisfaction (S)	Degree to which an individual is happy attending online trainings	0.932	1.012	0.947	0.783
Self-Efficacy (SE)	Degree to which an individual perceive that he/she can complete the online training	0.768	0.856	0.868	0.693
Social Influence (SI)	Degree to which you perceive that people important believe you should use online trainings	0.863	0.865	0.917	0.786

3.5.2 Socio-economic and innovation system analysis in Cashew sector

Trend analysis of the raw cashewnut production scenario of India

India first commercialized cashew as a horticulture crop, however a huge gap between domestic production and raw cashewnut requirement pose a major challenge to the sustainability of the processing capacity established in the country. There are huge differences in the way each state has organized, promoted and facilitated cashew cultivation. In this context, a study was conducted to analyse the trend and instability of the raw cashewnut production in major cashew growing states and at the national level for the past five decades.

As a first-hand information, the area, production and yield dynamics of raw cashewnut in India during the overall period TE 1971-72 to TE 2020-21 and for the 5 decades TE 1971/72 to TE 1980/81, TE 1981/82 to TE 1990/91, TE 1991/92 to TE 2000/01, TE 2001/02 to TE 2010/11, TE 2011/12 to TE 2020/21 (Table 3.5.2). The raw cashewnut production increased significantly in the country at a decelerated rate with CAGR 4.01 % during the overall period and this growth was mainly caused by a significant increase in area and yield (Fig. 3.5.1). It is noteworthy that the area expansion under cashew gained momentum at the global level with the introduction of National Horticulture Mission in 2005-06 (NABARD, 2006).

Table 3.5.2: Area, production and yield dynamics of raw cashewnuts in India

Periods	Area		Production		Yield	
	Growth rate	Acceleration/ Deceleration	Growth rate	Acceleration/ Deceleration	Growth rate	Acceleration/ Deceleration
TE 1971/72 to TE1980/81	3.96* (24.07)	0.01* (0.20)	4.15* (19.56)	0.01* (0.12)	0.19* (0.54)	0.00** (0.04)
TE1981/82 to TE1990/91	1.72* (2.18)	-0.67* (-3.13)	7.46* (7.58)	0.93* (4.15)	5.77** (3.88)	1.49* (5.43)
TE1991/92 to TE2000/01	3.55* (15.10)	0.02 (0.27)	1.23** (1.10)	1.08* (4.72)	-2.31** (-2.17)	1.06* (5.36)
TE2001/02 to TE2010/11	2.55* (48.48)	-0.03** (-1.95)	4.18* (13.18)	-0.09 (-0.72)	1.62* (4.66)	-0.04 (-0.30)
TE2011/12 to TE2020/21	1.65* (8.88)	0.09 (1.32)	0.84* (2.20)	-0.26* (-2.09)	-0.78* (-1.79)	0.36* (-2.87)
TE 1971/92 to TE2020/21	2.52* (43.13)	-0.01* (-3.06)	4.01* (33.05)	-0.04* (-6.61)	1.48* (10.81)	-0.03* (-3.41)

*Significant @ 1%, ** significant @ 5 % Note: Figures in parentheses shows two-tailed t-statistics

Fig. 3.5.1: Trends in area and production of raw cashewnut in India for different time period

Table 3.5.3: Percentage share of cashewnut to the net sown area of the Major cashewnut growing states of India

States	Cashew area as percent of net sown area (2019-2020)
Andhra Pradesh	3.27
Goa	45.71
Karnataka	1.24
Kerala	4.88
Maharashtra	1.13
Odisha	5.22
Tamil Nadu	3.17
India	1.70

The percentage allocation of area under cashewnut out of the net sown area of the region, during 2019-20 is presented in Table 3.5.3 to ascertain the scope of spread of cashewnut to newer areas. With area allocation being less than five percent of their net sown area in all the cashew producing states except Goa, there is still scope for area expansion with appropriate policy interventions and adoption of improved cashew cultivation practices. The percentage share of the major cashewnut producing states in area and production has shown a declining trend as this group accounted for 94.76 percent of India's area under cashew during 2001-2020 (as against 98.77 percent during 1969-1980) (Fig. 3.5.2) and 93.93 percent of total production (as against 98.62 percent during 1969-1980) (Fig. 3.5.3). The percentage share of other states which includes West Bengal, Chhattisgarh, Gujarat, Jharkhand, and North eastern states have increased from 1.23% to 5.24% as a result of the State Government's efforts to bring more area under cashew by providing financial assistance to the farmers.

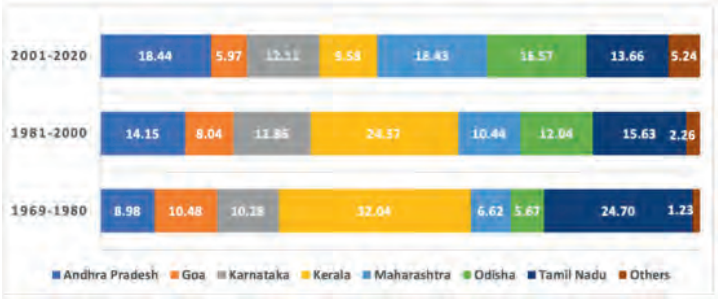


Fig. 3.5.2: Changing share of states in area under cashew in India

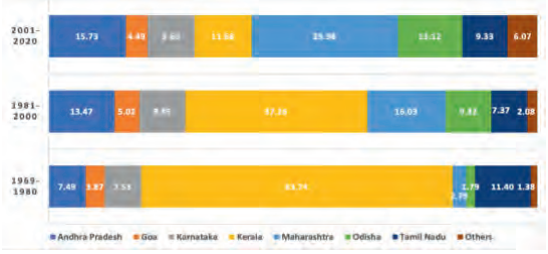


Fig. 3.5.3: Changing share of states in country's production of raw cashewnut

Components of change in mean production

The results of decomposition analysis have been summarized in Table 3.5.4. A close perusal of the table suggests that increase in mean area contributed to 54.57 per cent of the total increase in the cashewnuts production while increase in mean yield contributed to 24 per cent of the increase in production. The interaction between change in mean yield and change in mean area accounted for 22 per cent of the increase in raw cashewnuts production.

Table 3.5.4: Components of change in mean production of Cashew (1969-70 to 2020-21)

COMPONENTS/STATES	Andhra Pradesh	Goa	Karnataka	Kerala	Maharashtra	Odisha	Tamil Nadu	India
Change in mean yield (%)	12.29	61.33	24.62	-10.99	3.32	14.84	66.14	24.08
Change in mean area (%)	65.70	19.76	50.42	106.56	76.73	51.91	14.93	54.57
Interaction between changes in mean area and mean yield (%)	25.68	20.11	23.84	3.18	11.75	37.73	17.70	22.11
Change in area yield covariance (%)	-3.67	-1.21	1.12	1.25	8.21	-4.48	1.23	-0.76
Total change in mean production (%)	299.65	161.37	188.44	-27.16	606.96	407.60	265.41	164.27
Total contribution of state to change in mean production of cashew at National level	19.61	4.69	10.43	-8.61	39.98	16.78	11.05	100.00

A cursory look at the table also reveals that an incremental percent share in the average production of raw cashewnuts in India is contributed by Maharashtra (39.98 %) followed by Andhra Pradesh (19.61 %), Odisha (16.78 %), Tamil Nadu (11.05%) and Karnataka (10.43%). Change in mean area accounted for a very large proportion of increase in the average production in almost all states except Goa and Tamil Nadu. With a much lower share of yield effect on output growth, the negative growth of output in Kerala is explained largely by the declining rate (-1.02 per cent) in area during the study period.

3.5.3 Cashew Farmers' Tracking System (CFTS)

The Cashew Farmers' Tracking System (CFTS) was developed which has two parts: 1) a QR code system for farmers to access information on purchased varieties and 2) Data Analytics for tracking the location of plantings, farmers, and varieties for a specific period. Any institute or private firm selling plants can profitably deploy this software.

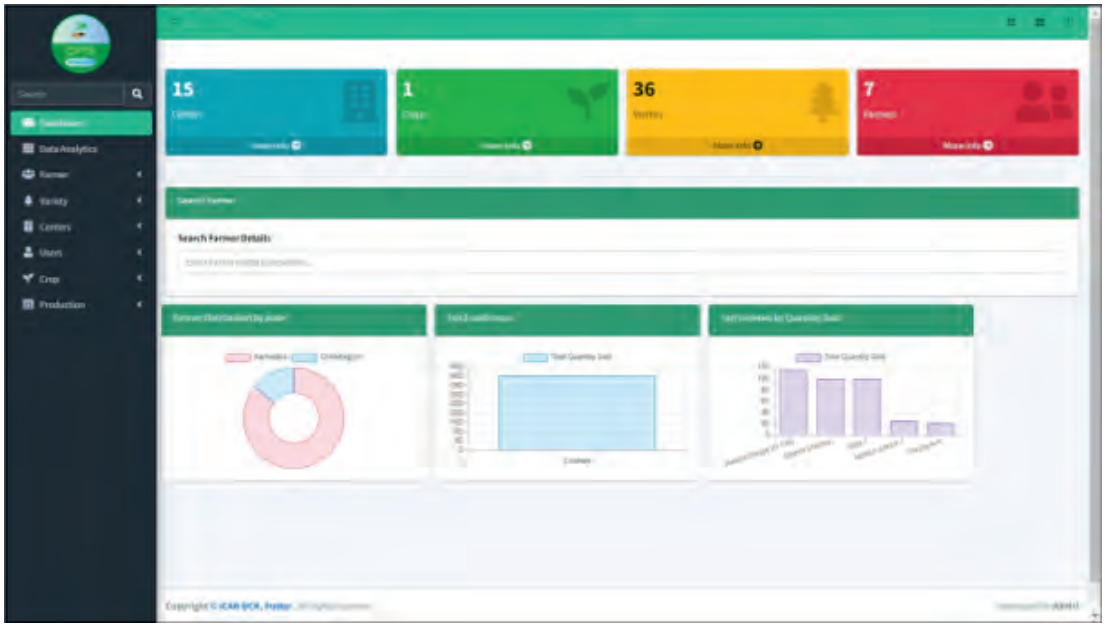


Fig. 3.5.4 Dashboard of Cashew Farmers' Tracking System

Farmers often purchase cashew grafts from the nursery and plant them in the field. However, most often, they forget the identity of the variety purchased and many a time, end up with the wrong identification. In perennial crops like cashew, unless the plants flower and fruit, it is also difficult to identify the specific varieties. In such a scenario, it is beneficial to have a system wherein farmers can easily track the purchased varieties. This can be done by the QR code system, which is extensively utilized in accessing information such as the source of origin and details of usage of various goods and services. It is very crucial to keep track of the farmers who have purchased the plants, the location of planting, survival rate, which eventually helps in estimating the area occupied by a crop/variety for an institute or nursery selling plants. This helps in assessing the impact of the institute as far as the spread of varieties is concerned. Keeping these in view, the CFTS was developed (Fig 3.5.4;3.5.5).

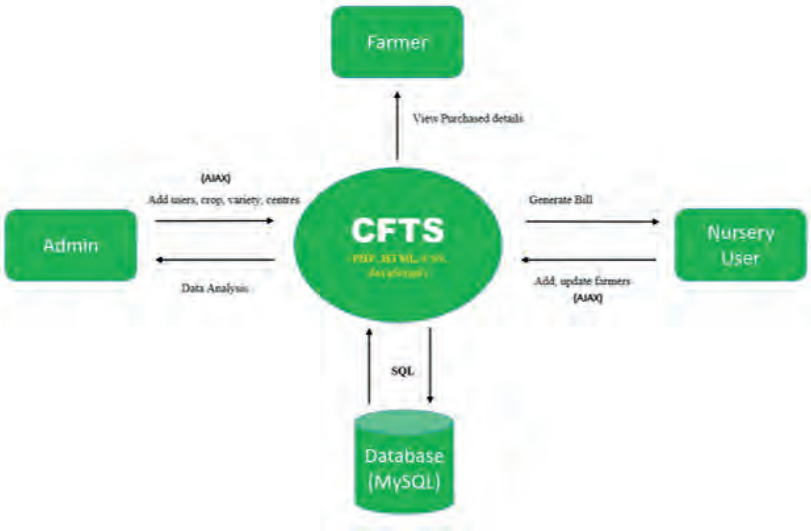


Fig. 3.5.5 Schema of CFTS

QR Code system

Whenever a farmer comes to the nursery to purchase plants, his details such as name, address, mobile number, email, etc. will be entered. The crop and variety details along with the price of the cashew grafts will also be entered in the data entry form of the CFTS. Then a billing invoice will be generated. This will have a unique QR code printed on the bill. Farmers can scan the QR code to access the information on the purchased varieties.

The information includes salient features of the variety in terms of yield, nut weight, leaves, and fruit characteristics along with photos. To access more information on cashew, links to the Cashew India app, the Cashew Protect app, and the website of ICAR- Directorate of Cashew Research are provided. A feedback form is also provided for solving the doubts of farmers. In addition, the contact number and address are provided so that farmers can reach the experts for any queries. In case of requirement, the user can also save the QR code on his mobile for further use at a later date

Data Analytics

In this section, it is possible to generate data by various queries. For instance, the number of grafts sold for a particular period or Information on the farmers who have taken the variety can easily be obtained. It is possible to generate data on grafts sold pertaining to state, district, taluk, and village levels variety-wise. Further, the query field for obtaining information on the particular range of number of grafts sourced is also provided. The CFTS is built in such a way that it includes nurseries from All India Coordinated Research Project centers in various states of the country. Hence it is also possible to generate all the above information center-wise. The data generated can be copied/printed/taken to Excel for further analysis.

This software helps farmers easily identify and source information on the purchased varieties through a QR code system. It also helps the researchers to generate data on farmers, varieties, and locations of planting concerning specific periods. For instance, the number of farmers along with their details and location in a particular state/district can be obtained with the click of a button. The spread of a specific variety during a particular period at the district/taluk/village level can be easily ascertained. It is also possible to assess the farmers' priority for different varieties.

The sales statistics in a year can provide crucial insights into the future production of varieties. Currently, the software is being implemented in the cashew nurseries of ICAR-Directorate of Cashew Research, Puttur, and its All India Coordinated Research Project centers spread across the country. So, the Directorate can assess the demand and spread of different varieties along with other datasets at the national level. By this, it is possible to assess the impact of the institute.

The software can also be profitably deployed by DCCD-accredited cashew nurseries in different states. Further, ICAR institutes and agriculture universities selling plants of different crops can adapt this software with suitable customization. Moreover, the software can be suitably altered to cater to the needs of private nurseries selling a range of plants.

With the available data, it is possible to connect with farmers to assess the current situation on the ground. The approximate survival percentage of different varieties can be obtained along with spacing details. Through this, it is possible to estimate the area under each variety in a given state/district/taluk/village this has implications for production forecasts. It can also offer leverage for channeling efforts toward further area expansion.

3.6 CONCLUDED PROJECTS

3.6.1 Studying comparative performance of cashewnut processing systems in India (IXX13683)

Background information

India's position in the global market is declining due to increased competition, primarily from Vietnam. At this juncture, it is the utmost important to strengthen cashewnut processing in this country. Present investigation envisaged to investigating on influence of essential components such as men, material and machine combination on quality index of cashewnut processing. Technologically superior system of processing is deployed and cost-effective mode of processing is employed in Vietnam. But processing in India ranges from totally manual to mechanized processing. Variation in degree of skill; quantitative and qualitative efficiency of adopted machines; processing parameters; knowledge level etc., are the contributing factors to assess the performance of the agro processing system. This project was contemplated with the aim of comparing the performance of cashewnut processing industries in India primarily, the facility located in Karnataka, Kerala, Andhra Pradesh, Orrisa and Tamil Nadu. Besides, it is also envisaged to identify associated problems and suggest probable solutions.

In view of declining market for Indian kernels primarily due to higher cost of processing (Compared with Vietnam) and high kernel price, a special mission-oriented project was assigned to work out the cost in conversion process and assess problems and suggest remedial measures to make it globally competitive ***(Ref. Letter from Additional Secretary, DARE & Secretary, ICAR, New Delhi vide Dy. No478/F/2017 dated 17.07.2017 forwarded to this Directorate from SMD on 19th July, 2017)***

Objectives

This project was contemplated with following objectives:

·To identify cashewnut industries adopting different mode of processing.
·To conduct diagnostic study to work out the performance of processing.
·To identify inherent problems and suggest probable measures.
·To work out the cost of processing.

Expected Output

- Primarily to understand variation in the cost of processing with respect to degree of mechanization and man power deployed for the specified quantity. It aids in identifying grey areas to minimize the cost.
- Diagnostic investigation elucidates the performance of the system in attaining the qualitative and quantitative efficiency.
- Pertinent problems usher the researchers to develop more efficient system with better economics.
- It makes India to stabilize its processing system and auger prime position in the global market.

Method and Materials:

Diagnostic investigation carried out with cashewnut processing system deployed in various regions viz., Kerala, Karnataka, Tamil Nadu, Andhara Pradesh and Orissa, selectively in three different modes of processing viz., Manual, semi mechanized and fully automatic.

- Manual: Labourers are engaged to extract kernels at all stages of operation except conditioning raw cashewnuts and drying unpeeled cashew kernels.
- Semi-mechanized: Men and machine are deployed in a balanced way for ultimate goal.
- Fully Mechanized: Manually operated, but machine does the job continuously. All machines controlled electronically and continuous process through material transport system.

Pertinent information is collected with pre tested questionnaire which covers the management aspects viz., Procurement of raw nuts including source, quantity and method; Employees information in terms of strength, wages and facilities provided and technical aspects viz., Storage of raw cashew nuts; Drying of nuts; Conditioning/preliminary roasting; Curing / Cooling; De-shelling; Kernel drying; Humidification and Peeling; Grading and packing and CNSL extraction.

Diagnostic investigation of Cashewnut processing units in Karnataka

Certain identified cashewnut processing units located in Karnataka state viz., M/s Vijaya Lakshmi Cashew industries; M/s Reliable Cashews; M/s Dinesh Cashew processors; M/s Srinivasa Cashews and M/s BRK Cashews, are visited with pre tested questionnaire to investigate on technical problems at different stage of operation in the conversion process of raw cashewnut in to edible kernel. In general, these cashew factories adopting semiautomatic / fully automated system and primarily follows steam boiling mode of conditioning prior to de-shelling to make it amenable for extraction of whole kernels. As a first step in mechanization, grading of raw cashewnuts is carried out into 5 different grades viz., A, B1, B2, C1 and C2. Grading efficiency varied w.r.t product outlet and the associated parameters need to be optimized for improving its performance (Fig 3.6.1).

Graded nuts are steamed for different timing and decided based on the personal experience of the operator. Scale of production varied with installation capacity of processing machinery in the line of processing, financial strength and market potential. Compartmental rotary sieve drum is utilized for segregation of nuts based on its intermediate dimension. Qualities of the nuts are assessed by nut count and outturn every day to set target output in the shelling section. Although moisture meter is available, while testing, observed inconsistent value for the same sample.

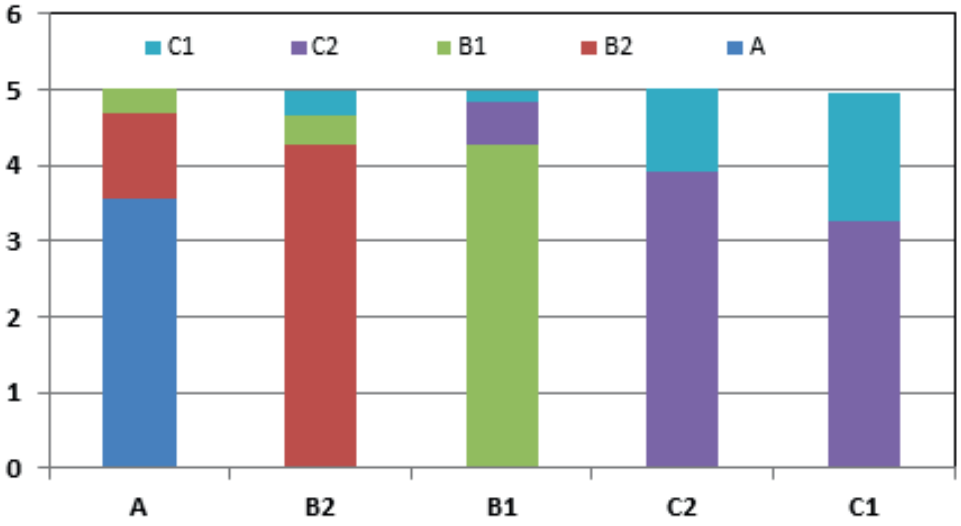


Fig. 3.6.1. Performance of rotary sieve grader for raw cashewnuts in CPU's located in Karnataka

The absolute moisture was verified with chemical distillation method. Values are deviating between 1.0 – 4.0 % d.b leading to improper conditioning either under steaming or over steaming. Centralized steam generation system / heat exchanger is utilized for supplying steam to condition raw cashewnuts and to assist drying process of unpeeled cashew kernels. Cashew shell cake / wood logs is utilized as fuel and densified cashew shell cake in combination with saw dust is prepared as fuel briquettes / pellets and also used as fuel in many industries towards increasing heat utilization efficiency and economics of processing.

Scaling of steam boiler is the major problem to be tackled in this section and it is related to quality of water used for the purpose. Depending on the origin of the nuts and grade size / category, nuts are exposed in static steaming unit for 6- 15 min. depending on its dryness. After steaming, the nuts are tempered in gunny bags due to non-availability of space for curing to make it hard and brittle. Shelling is carried out using vertically operated i.e. Buddhi type shelling machine or horizontally operated i.e. Vietnam type shelling machine.

In order to understand the comparative performance of the two different type of shelling machine for the same origin nuts, experiments were conducted and the results is shown in Fig 3.6.2. Machines were evaluated in terms of operational capacity, whole kernel recovery, shelling efficiency, TBS (To be scooped), broken kernels etc., both men and women laborers are engaged in this section. Primarily women are engaged to separate the kernels from TBS and segregation of shelled mass.

Online kernel separation unit after deshelling, is installed to tackle the problem of growing man power scarcity and to increase production capacity. Shelled nuts are allowed to pass on to reciprocating sieves to separate unshelled nuts, whole and broken kernels, shells, unscooped nuts (TBS) and partially shelled nuts. Experiments conducted revealed that change in the design is required to overcome the problems of lower efficiency and minimize oil adherence to kernels. Technical personnel are available to attend to repair and maintenance of the machine at once as it is related to production output.

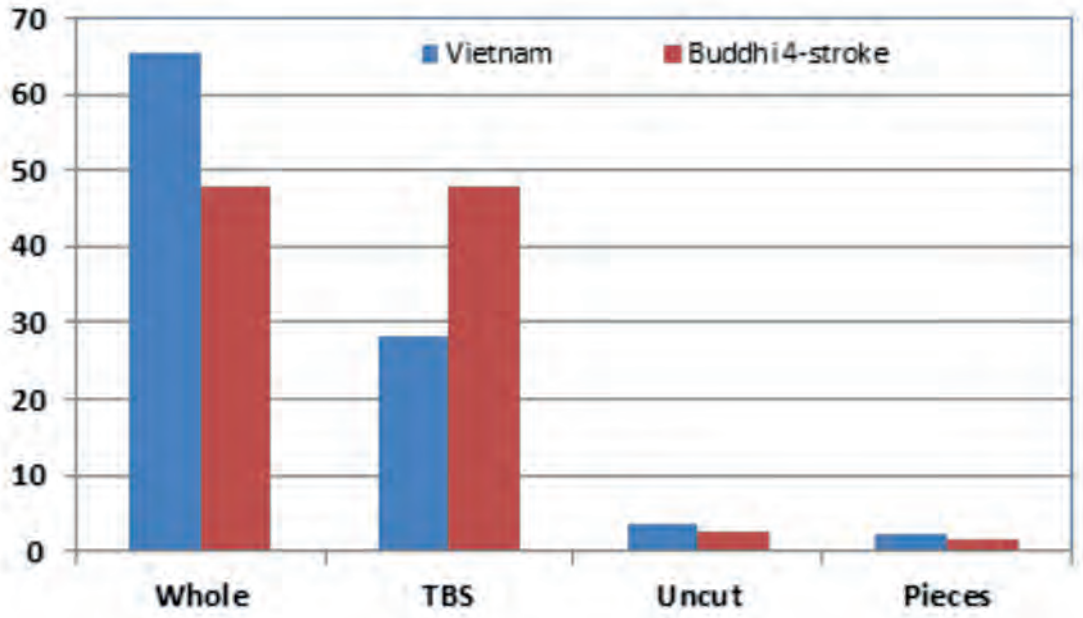


Fig. 3.6.2. Comparative performance of deshellers in CPU's located in Karnataka

Steam assisted 'Borma dryer' is used for reducing the moisture content of the unpeeled kernels (UPK). Improper drying is the major problem to ensure higher whole kernel recovery (WKR) after machine or manual peeling. An experiment was conducted to understand the uniformity in drying of UPK loaded in different trays of the same trolleys. After drying the UPK for 8-10 h, it is exposed to high humid environment to infuse moisture and make it amenable for machine peeling. Due to non-uniformity in moisture infusion process, it lowered whole kernel recovery. Qualitative efficiency also related to performance of peeling machine and kernel parameters and evaluated in terms of completely, partially and unpeeled kernels. Altogether, a right combination of drying, moisture infusion and machine and material parameters have to be set for better performance in peeling section.

Preliminary grading of kernels is done either in-house or distributed to home level. Minimum quantity is fixed for segregation for the prescribed wages. High degree of cleanliness is maintained in the separation and grading sections. After preliminary level grading, quality inspection is strictly followed based on the specification of kernels and various grades viz., white whole kernels, scorched whole kernels, Indian whole kernels, broken kernels as per regulations of CEPCI and Indian market demand. After grading kernels, it is transported to centralized packing centre and packed either in tin containers or Moulded vacuum packaging depending on the market destinations.

In general, industry depends on domestic nuts for processing. Off late, due to shortage of raw nut supply domestically produced nuts have become inadequate and it depends on imported raw cashewnuts, mostly from African countries. Raw nuts are imported throughout the year depending on the availability at export destination. It was emphasized that the quality of raw cashewnuts varies widely from location to location or country to country and to involvement of intermediaries is increasing day by day and development of quality-based pricing system become need of the hour. Tests are conducted to analyze the quality of raw cashewnuts currently processed viz., outturn (OT) and nut count (NC). As such there is no moisture meter is available to determine the moisture content of the raw cashewnuts and subjective method is followed to assess the moisture content. Although, moisture content has strong bearing on the qualitative and quantitative efficiency of processing, no measure is taken up to assess the moisture at any level, due to which qualitative efficiency found to be lower at packaging stage i.e. either broken kernels or discoloured kernels. Wages to labour force is disbursed based on the prevailing practice in Dakshina Kannada district. Information pertaining to man, thermal and electrical power consumed are also collected. Pertinent information on PF contribution, ESI contribution and Bonus distribution are collected for working out cost of processing. Cost of processing has been worked out for the prevailing practice at this industry and it ranges from Rs 17 to Rs 19/- kg of raw cashewnuts, which need to be verified

Diagnostic investigation report of CPU located in Tamil Nadu

Semi-mechanized and fully mechanized processing units located in Cuddalore district of Tamil Nadu visited for evaluating its performance. Major issues related to cashew nut processing in this region is summarized as i) Inadequate domestic production of raw cashewnuts; ii) Imposed duty /Tariff on raw cashewnuts imported from African country; iii) Non-availability of quality standards for raw cashewnuts and pricing; iv) Non-availability of moisture meter for raw cashewnuts to enhance its shelf life; v) Financial support from GoI towards modernization of cashewnut processing (CPI's in Vietnam compared); vi) Improvisation of processing system to reduce the cost of processing; vii) Channelizing trading of raw cashewnuts through GoI as followed in Vietnam etc., Diagnostic study conducted with M/s Srinivasa Cashews located, Panruti revealed that on an average 3.2 T of raw cashewnuts is processed in this unit per day and shelling, peeling and grading of cashew is carried out manually. Steam boiling is followed using IBR boiler of 320 kg capacity. Around 1.5 man power is required to shell 80 kg of RCN per day and their performance in terms of whole kernel recovery to broken kernel is 80:20. Borma dryer is used for drying unpeeled kernels to facilitate peeling. Although peeling machine is used to some extent, unpeeled and partially peeled kernels are manually peeled. Around 15 grades are segregated in grading section and vita packing system is followed for packaging. Apart from wages, travel allowance is given as per actual, limited to Rs 30/- day. Bonus (8.33%), PF @ 13%, incentives for festival etc., are certain extra cost other than wages. As such there is no medical allowances or leave salary as implemented in the neighbouring state i.e. Kerala. After detailed discussion, accounting the cost involved, the processing cost worked out to be Rs 1400-1500 per bag of raw cashewnuts in this region engaging labourer in the line of processing. Major technical issues are identified as i) Lower whole kernel recovery at packaging; ii) Discoloration of kernels (compared to processing in Mangalore); iii) Operational capacity and performance of labourer in shelling, peeling and grading; iv) Operational parameter of the machine and v) Quality of raw cashewnuts, primarily the moisture content in relation to storage.

M/s Regal Cashew Industry located in Panruti is categorized under semi- mechanized system. Basically, machineries are used for conditioning raw cashewnuts i.e. static steam boiler of 320 kg capacity, shelling to extract kernels i.e. vertical Y-blade cutting system, steam assisted dryer / electrically operated convective dryer for moisture diffusion from cashew kernels, dehumidifier, pneumatic peeling machine (SKJL) and packaging machine i.e. vita packing and molded vacuum packaging machine. Initially quality of the raw cashewnut i.e. Gambia origin is assessed in terms of nut count and outturn. Based on the investigations conducted with steaming system, it is confirmed that raw cashewnuts are exposed to 5 kg cm-2 pressure for a period of 10-12 min. Physically it was observed that slight oozing of CNSL from the surface of the steamed nuts indicating over steaming of raw cashewnuts. It is then confirmed from the shelling outturn in terms of oily kernels. Technical discussion with manager and supervisor revealed that the quality of the raw cashewnuts itself was inferior and long-term storage could be the reason for the change in the surface colour of the kernels.

Data analyzed with shelling output of the pressing type shelling (PTS) and hand cum pedal operated machine (HPS) showed that whole kernel recovery in the former case was 95.9% with 2.2% broken compared to HPS wherein it was registered only 92% whole kernels and 4.4% broken. Recorded shelling data of these two machines indicated that kernel breakage registered to the tune of 10% in the case of HPS. It was observed that capacity of fully mechanized shelling machine ranged between 30-35 kgh^{-1}. Its performance recorded as 92% wholes, but mostly with kernel intact shells i.e. to be scooped (TBS) needing extra labour force. As the nuts are graded after steaming and the blades are set for medium size nuts, depending on the proportion of the nuts based on the size (intermediate axis), broken varied. Operational capacity of the steam assisted dryer was around 1000 kg per batch and unpeeled kernels were exposed to hot air maintained at 80□C for a total period of 7.5 to 8 h. Uniform drying is not ensured in this dryer as temperature at top tray position used to be higher than bottom most tray. Conventional method of humidifying cashew kernels with wet gunny bags is followed. Due to increased moisture, discolouration of moisture took place which is quite evident in lower outturn of white whole kernel recovery in the packaging. Pneumatic type cashew kernel extracting machine is utilized for peeling outer layer testa after moisture conditioning. Although moisture meter is provided by the machinery supplier, its performance is gauged as low in terms of consistency. Trails conduced with mechanized peeler indicated that the whole kernel recovery is in the range of 52 to 60%, but partially peeled kernels share is on higher side due to improper set parameters of machine and material. Standard specifications for cashew kernels prescribed by CEPCI, Kerala not followed, but market driven grading is carried out manually. High degree of cleanliness is followed in grading section and packaging. Wages are influenced by local processors and as such recommended wages by state government is not in practice.

Cashewnut processing units owned by C Ramakrishna

Padayatchi (CRP) Group of companies located in Panruti (5 Nos.) indicated that the mechanization introduced to overcome labour shortage and need for bulk production. Operational capacity of these units ranged from 30 to 60 bags per day depending on the raw nut availability. It is learnt that more than 90% of the raw nut requirements of the industry sourced from African countries. Various processing machinery utilized in the line of processing were i) Static steam boiler; ii) Mechanized cashewnut shelling machine (both vertical and horizontal feed); iii) Borma dryer (Electrically operated); iv) Peeling machine (both pneumatic and spring-loaded type); iv) Size grader (reciprocating sieve type); vii) Colour sorter (Angular feed type); viii) Packaging Machine (Tin container and brick packing type) and ix) Value addition (Coating machine). Need for moisture meter was very much emphasized during the discussion with management as loss incurred due to moisture is huge and influenced profitability. Various problems associated with mechanized industry are listed as i) Inadequate production of raw cashewnuts domestically and relying on imported nuts from Africa; ii) Escalation in the cost of raw cashewnuts in an uncontrollable way without rise in the selling price of the kernels; iii) Improving the performance of grading system suiting to mechanized shelling operation; iv) Comparative performance of static and revolving type steam boiler in obtaining white whole kernels with minimal breakage; v) Optimizing drying cycles in different versions of dryers viz., Convection dryers operated with externally generated hot air, electrically operated convection dryers, steam assisted dryers; vi) Optimizing moisture content of unpeeled cashew kernels suitable for mechanized peeling machines; vii) Optimizing material and machine parameters while operating peeling machines for better recovery of whole kernels; viii) Improving the performance of size and colour sorters; ix) Investigation on increasing quantity of dotted kernels and brown patches; x)Value addition to cashew shell cake; xi) Cause for water mark on the surface of the kernels; xii) Quality standards for raw cashewnuts to fix up price structure.

Basic experiment conducted with static steam boiling unit indicated that kernel breakage observed to the tune of 10-12% which is influenced steam boiling parameters and shelling machine parameters. In the same manner, drying of unpeeled kernels in combination of humidification and machine parameters of peeling should be studied to understand the relationship towards better end product. Peeling machine output ranges from 55-62% of wholes with discoloration of kernels. Breakage of kernels while peeling may be due to moisture content of unpeeled kernels in combination of feed rate and machine parameters like drum speed, spring shaft speed and conveyor speed in the case of spring-loaded type. On an average, Rs 1600/- is said to be expended to process a bag of 80 kg raw cashewnuts. Influence of flushing of inert gases while packaging cashew kernels, its control on microorganism and shelf life are explained. Plain cashews are value added for better business value by this industry. High degree of hygienic standard is followed as the company is exporting cashew kernels to primarily Middle East and Arabian countries. It is emphasized that development of moisture meter and global quality standards for raw cashewnuts need to be developed to position India's pride in the future years to come.

Diagnostic investigation report of CPU located in Orissa

A total area of 1.83 lakh Ha (16 % of the national production) is under cashew cultivation in Orissa with an annual production of 0.93 lakh MT (14% of India's annual production) of raw cashewnuts. Major cashew producing districts in Orissa Khurda, Ganjam, Koraput, Nabarangapur, Puri, Dhenkanal, Cuttack, Jajpur, Nayagarh, Rayagada, Gajapati, Angul, Sundargarh, Mayurbhanj. Demand from cashew processing units located in Orissa is much more than production in the state and balanced quantity is derived by import especially from African countries to the tune of 0.35 lakh MT. There are about 400 registered units located in Rambha, Chhatrapur, Behrampur, Angargaon, Jaipur, Puri, Cuttack, Dhenakal. Gajapathi, Angul, Mayurbanj, Koraput, Khurda etc., About 50 no. of units are operating with capacity > 5 TPD; 50 units with 3-5 TPD, 200 units between 1 and 3 TPD and 100 units < 1 TPD. Cashewnut processing in the state has generated 88 lakh man days and livelihood for 32,000 rural women. Cashewnut processing is taught as a part of Industrial Training Institute (ITI), Behrampur and Ganjam supported by Industry development, Government of Orissa on Public Private Partnership (PPP) mode. Altogether, 1.25 lakh MT of raw cashewnuts processed in the facility developed in the state and about 7-10% of the total end produce is exported to other countries.

Operation of automated cashewnut processing units

Various machinery deployed in the line of processing are, rotary sieve grader for raw cashewnuts; centralized steam boiler (IBR) with steam cooker; curing trolleys; shelling machine with mechanized scooping of intact kernels, steam assisted dryer for unpeeled cashew kernels; humidification system; mechanized peeling coupled with colour grader; size grader for finished goods; continuous quality checking system; molded vacuum packaging/ vita packaging / band sealing for pouch packaging; automatic labelling unit; carton box strapping unit and conveyor system to ease flow material from section to section. M/s Gopala Krishna Cashew Industries, Rambha and M/s Maa Cashew Industries, Jahame, Angargaon, Rambha are visited to conduct diagnostic investigation primarily to work out the cost of processing at various stages and problems associated with processing system. Cost of labour in these units ranged from 300 to 350 per head per day and deployment based on total quantity of processing in a day. Major problem associated with highly mechanized units are i) Discoloration of cashew kernels due to various degree of thermal exposure at SB and KD; ii) Higher breakage of kernels; iii) No energy budget; iv) Non-compliance of food quality; v) Negligence on human safety; vi) Improper flow of material from beginning to end (Plant layout); vii) Non-availability of skilled service for repair and maintenance; viii) Improper packaging without inert gas flushing to increase shelf life; ix) Inadequate supply of quality raw cashewnuts at reasonable price; x) Non-compliance of quality assessment of raw cashewnuts due to large gap between demand and supply etc., On an average processing cost worked out to be below Rs10 per kg of raw cashewnuts irrespective of location indicating an increase in volume of production proportionately reduces the cost incurred.

Processing under semi-automated cashew nut processing system

Semi-mechanized system comprises of steam boiler, shelling machine, kernel dryer (Steam or hot air borma) and peeling machine of pneumatic or spindle with hook system. M/s Morli food production, Ganjam and M/s Sri Durga Cashews, Gondola are visited having operational capacity of 5 and 3 TPD. Women work force involved in scooping kernels from intact shell, Segregation of kernels after machine peeling and manual peeling of unpeeled and partially peeled kernels, grading of kernels according to specification and packaging. Processing cost worked out to be in the range of Rs 12 per kg of RCN due to labour wages per head i.e., 300-350 per head per day in this region. As there is an increase in the production of whole kernels, processors are continuing with the semi mechanized system and it out numbered other classification of cashew processing units i.e., fully mechanized and labour oriented. Discoloration and more breakage of kernels and low degree of cleanliness are the primary problems identified with these units.

Status of labour-oriented cashew processing

As such, there are no cashewnut processing units operating completely labour-oriented processing except conditioning the nuts with steam and kernel drying by hot air convection. Most of the processing units having operational capacity ≤ 1 TPD have peeling machine apart from steam boiler and kernel dryer. Women work force deployed in all other stages in the kernel extraction process. It is learnt that due to availability of women workforce in this region (Rambha and Jaipur) and non-availability of financial support for machinery, these units are continuing for several years. Processing cost worked out to be ₹13-15 per kg of RCN depending on the location. These units are mostly depending on large scale units for supply of raw cashewnuts during lean period to operate the unit round the year.

Byproduct utilization and its scope

Around four numbers of fully automated cashewnut shell liquid (CNSL) extraction plant in Orissa. M/s Senapathi Agro, Keshpur, Rambha was visited on the way to cashewnut processing unit visit in the adjoining region. Mechanical expellers of operational capacity ranging from 40-50 T capacity (3 Nos.) are installed requiring 195 hp electrical power supply in a area of 10,000 sqft. Bucket elevator and belt conveyors are used for material handling specially to transfer cashew shell to steaming chamber. After softening the shell, it is passed on to screw expellers to extract crude oil and by gravity it is transferred through channel to settling tank (100 T capacity). Later, supernatant oil syphoned to heating tank to evaporate excess moisture preset in the liquid (200 T capacity). Afterwards, it is stored in crude oil tank to supply to axillary industries. Ruling price of CNSL oil is around ₹33/- and it is mostly exported to USA, Korea, Japan etc., Cashew shell cake is procured @ ₹8.50 per kg and after expelling oil, byproduct i.e., cashew shell cake is sold to cashewnut processing industries for ₹6.00 per kg.

Issues of cashewnut processing units in Orissa

Cashewnut processing units in Orissa has installed capacity of approximately 3 lakh MT and only 0.93 lakh MT is derived from domestic production. Around 40, 000 MT of RCN imported from African countries every year. I) Inadequate supply of raw cashewnut is the major problem of the cashew industry; ii) Processing parameters at

various stages primarily at steaming of RCN and drying of CK are not optimized. Machinery parameters need to be matched with material parameters to efficiently extract white whole kernels; iii) Cleanliness in processing line need to be improved. Since finished goods are destined to various cities in India itself and hardly <10% is exported, processors are not serious about it and iv) Intervention of 'Government of Orissa' is essential for supporting processors to start up 'Cashew Cluster' to operate in a combined way towards supply of quality and quantity of cashew kernels as it proved to be successful in this region.

Diagnostic investigation report of CPU located in Andhra Pradesh

Diagnostic investigation carried out in cashewnut processing units located in Andhra Pradesh state and certain problems associated with labour oriented or mechanized processing units identified. Palasa and Kasibugga located in Srikakulam district having a total number of 173 units serves as processing hub for this region. All the three different system of processing viz., labour oriented, semi mechanized and fully automated units are under operation in this region. Scale of production and kernel percent recovery varies with type of unit and operational efficiency. Inadequate supply of raw cashewnuts, non-availability of skilled work force and higher labour wages are the major problems irrespective method of processing. Although traditional method of drum roasting method is followed in the state, cost effective steaming method is dominant in majority of processing units. Discolouration of cashew kernels, increased broken kernels and oily kernels during automated shelling are the major challenges to be tackled. Fully automated unit showed lesser processing cost incurred for unit weight of the nuts (₹11.46), compared to other mode of processing. This is primarily due to bulk production and lesser manpower in the line of production. Processing cost incurred for various category revealed that the lowest cost incurred for fully automated unit located in Odisha state operating with a capacity of 8 TPD whereas processing cost per unit weight of RCN found to be the highest in Kerala state i.e., ₹34.50 due to labour law in force and other mandatory benefits to employees. In general, depending on the degree of mechanization in semi mechanized sector, the processing cost ranged from ₹12 - 20/- per kg of RCN. Therefore, processing cost is directly related to the skill level, degree of mechanization and quantum of processing. Profitability in cashewnut processing relies on obtaining white whole kernels, sold at better price irrespective of market and control on the discoloration leading to secondary or tertiary grades of final produce.

Cashewnut processing units located in this region is categorized in to labour oriented, semi mechanized and fully automatic processing units depending on the deployed labour force, degree of mechanization and quantum of production. Accordingly, selected cashewnut processing units were visited for want of information. M/s SSS Cashew factory located in Industrial area is having machineries deployed at various stages of processing having operational capacity up to 16 MT per day. Demand of RCN is derived to the extent of 95% from import and balance from domestic origin. Drying of RCN is not practiced due to non-availability of floor area and grading the first phase of work in this industry. Graded nuts are steamed using 1.0 MT capacity nut chamber connected with IBR boiler. Briquettes /Wood/Cashew shell cake (CSC) is used as fuel for the steam generation to be supplied for two different unit operations viz., steaming RCN and drying UPK. Vietnam based shelling machines are installed for deshelling nuts for different sized nuts and major issue in this section is the contamination of kernels with CNSL. Optical sorters are used to segregate shelled kernels and cashew shells to overcome the scarcity of labour force. Convective dryer is utilized for moisture diffusion from cashew kernels to make it amenable for mechanized peeling. Major problems identified with cashewnut processing system existing in Andhra Pradesh are

- Inadequate supply of quality RCN is one of the major issues to be addressed with utmost priority.
- Discolouration cashew kernels at packaging stage is a serious issue lowering the sale price demanding optimizing technical parameters at every stage of processing.
- Plant and personnel hygiene are not up to the expectation of food industries. Packaging cashew kernels using used oil tin containers need to be discouraged.
- Processing units are categorized under fully automated (2%) semi-mechanized (72%) and labour oriented (26%) respectively. Non-availability of skilled personnel is also major issue and skill development centre is proposed for creating employment and fulfil the requirement of cashew industry.
- Value addition of cashew kernels for enhancing its sale and nutritive value is rarely followed in this region.
- Byproduct utilization is taking place in this region by extracting CNSL from shell and without any value addition, crude oil exported through agencies.

Diagnostic investigation report of CPU located in Kerala

Chandra cashews commenced its operation almost 3 decades ago, following 'Drum roasting' process for pre

conditioning to extract kernels. Accordingly, facilities developed to process raw cashewnuts. In order to keep pace with the changing scenario, this unit shifted to steam boiling system, deemed to be cost effective mode of extracting cashew kernels and introduced mechanization in the line processing viz., grading raw cashewnuts, steaming raw cashewnuts, shelling, peeling, sorting and packaging. Since, year 2015, this processing unit adopted once again drum roasting with manual processing due to inadequate supply of raw cashewnuts and insufficient financial support. Availability of cheap labour force from Assam, Bihar and Jharkhand is also mentioned as contributing reason for falling back to old mode of processing cashewnuts.

Drum roasting of raw cashewnuts involves coordination of four skilled personnel to have control on feeding the nuts, rotation of roasting drum, temperature of drum and roasting of nuts (residence time). Smoke emanating from cashew shell due to presence of inflammable oil commercially known as Cashew Nut Shell Liquid (CNSL), pollutes air and loss of this industrial liquid, avoiding additional income through byproduct are the major disadvantages of the system. As it is a traditional method and women forces are highly skilled to extract kernels, this is followed for a quiet long period and it is claimed that cashew kernels extracted by this mode adds up taste. But as such there is no preference to drum roasted kernels either domestic of export market.

Around 2.4 MT of raw cashewnuts are processed per day and operational parameters for drum roasting are decided based on origin of the nuts, moisture content, size etc., It is informed that due to non-availability of moisture meter to assess moisture content of the raw cashewnuts, optimum roasting become a crucial issue. Whole kernel recovery after shelling and discoloration of the kernels are the related issues to be tackled based on moisture content. Shelling of roasted nuts is carried out by both manual and semi-automatic process. Highly skilled women force (Kerala State) is deployed in manual shelling whereas men Labourers are engaged in machine shelling (Assam state). Shelled kernels are exposed to hot air environment in electrically operated borma dryer. Period of exposure and hot air temperature are fixed arbitrarily based on the experience of the operator. Manual peeling is followed and due to availability of mechanical peeling machine, it is utilized after humidification of unpeeled kernels. Steam cooling of unpeeled kernels attempted for steam boiled nuts, but success rate was not appreciable. Operational capacity ranged between 9-12 kg per day per head in the case of manual process whereas it ranged between 30-35 kg per hour in the case of mechanical peeling. Whole kernel recovery found to be in the range of 65-68 % in mechanical peeling against 85-90 % in manual process. Kernels are graded in to White Whole kernels (180 – 450); Scorched whole (180-450); SSW, PW/DW and broken viz., S, LWP, SS, SP, SWP, SSP, SPS, PKP, KCP, KU, DP, DK. It is mentioned that around Rs 3000/- per bag is expended in comparison to processing cost in Vietnam which is in the range of Rs 800- 1000/- per bag. It is explained that the increase in the cost of processing is primarily due to PF (12%), Bonus (22%), ESI (4.75 %), Welfare fund, Holiday wages etc., apart from regular wages and dearness allowance. It is higher in Kerala state than any other states in India and more over the import tariff of 2.5% is another issue fueling the cashew industry in Kerala as far as raw material cost is concerned.

Mr Babu Oommen and Mr Abin, Proprietor of the processing units under the brand name Alphonsa Cashews revealed that presently less than 80 nos. of units are functioning in Kollam, which was considered to be 'Cashew Hub' in this country long ago, due to inadequate supply of raw cashewnuts, financial support from GoK, increased labour wages, kernel market competition, low productivity in labour-based system etc., It is indicated that recent hike in the labour wages i.e., 23%, the cost of processing increased to more than ₹45 per kg of raw cashewnuts. Most of the processing units are following 'Drum roasting' as preliminary conditioning for raw cashewnuts due to its premium value (claimed to be) in the market. Highly modernized packaging system followed by the factory which includes, Convection drying, Infrared thermal exposure and Ultraviolet heat treatment to supply the end product for export and domestic market. Stringent steps are followed to maintain personal and plant hygiene by the concerned authorities due to awareness on food contamination on raise among the consumers irrespective of countries following HACCP and strictly following FSSAI standards for packaging cashew kernels. A team of food technologists are conducting 'Organoleptic evaluation' for the cashew kernels utilizing modern system for almost all grades of cashew kernels, as it is preferred by overseas market.

Mr Johnson Oommen and Mr Joseph Oommen, Proprietor of M/s St Mary's Cashew industries, Puthoor, Kollam mentioned that a total of 20 processing units are owned by this group and about 65-70 T of raw cashewnuts are processed in their units following drum roasting mode and spent cashew shells are used as fuel. Height of chimney is increased to 21 m (Minimum). As recommended by Pollution Control Board (PCB), a system of lateral firing is followed to minimize air pollution and details are not known. This is one of the largest group of cashew company in this region, holding a market share of around 20%. Centralized packaging facility is available at head office premises and cashew kernels are subjected to fumigation for 48 h (AlPO4 @ 8g per MT) to kill or inactivate pathogens in cashew. Moulded Vacuum Packaging (MVP) is followed for export whereas Vita Packaging (VP) system is practiced for domestic market with N2 and CO2 are flushed for enhancing shelf life of cashew kernels.

Hand cracking and semi mechanized shelling are followed to extract cashew kernels from drum roasted process by

women laborers (Kerala) and Men Labourers (Bengal) and production capacity ranges from 15 to 22 kg depending upon degree of skill. Externally generated hot air supplied borma is used for drying unpeeled cashew kernels and air temperature and duration of drying varied with origin of nuts. Processing factors are fixed based on experience of operators. Although manual peeling is employed, mechanical peeling is predominant and the wholes to broken ratio is 72:28 and kernels are subjected to moisture addition before peeling process. Women are engaged for grading of cashew kernels (Whole kernels: 30-35 kg pd; Broken kernels (20-25 kgpd). Wages are fixed based on stipulated rates fixed by GoK which includes 0.75 % ESI; 12 % GPF; Welfare contribution: ₹2 per working day and Bonus: 20%)

Basically, drum roasting process generate air pollution and it need to be rectified. Increasing the height of chimney or lateral firing system will not reduce the thick smoke emanating from drum roasting process. In this regard, water scrubber can be inducted in the chimney to minimize the air pollution. A innovative technology developed at ICAR-DCR, Karnataka is recommended to have control on drum roasting process as it is operated by three persons at present needing coordination, otherwise it may lead to scorching of kernels. Contamination of kernels are taking place in shelling process due to shell oil, a conveyor system with sieve shaker can be introduced to segregate kernel and shell in short period to avoid oil contamination. A suitable machine working on the principle of impact cracking of highly porous drum roasted nuts need to be developed to extract kernels in shelling section to reduce the cost of processing to the greater extent. Simple modification in the existing hand cum pedal operated machine is suggested.

Processing parameters have to be optimized in the operation of peeling machine to maximize whole kernel recovery and the method is taught to the operators. As moisture content play important role at every stage of processing, it is advised to use instrumentation technique to assess moisture content of material prior to processing. Necessity of Infrared and Ultraviolet ray's treatments need to be ascertained towards control on pest or insect attack before packaging. Change in the nutritional and sensory quality of drum roasted cashew kernels need to be analyzed to find out the quality of kernels as it claimed better than steam conditioned cashew kernels. Tip scorching of cashew kernels is taking place and it is one of the demerits of DR system and it needs scientific investigation to rectify the issue. As such there is scientific investigation report on stock (smoke) emanating from DR process is unavailable and lot of complaints are lodged by residents hailing from areas neighboring cashew processing units. Therefore, a complete investigation on DR process and its effect on human health has become imperative.

Overall analysis of CPU in India

Production, processing, export scenario of cashew processing units located in selected cashew growing regions and cashew processing units concentrated states are given in Table 3.6.1. As far production is concerned, these states contribute to the tune of 72% to the total and 65 % to the national production. About 33% of the total processing units in the country are functioning in this region consuming maximum domestic production and import of raw cashewnuts from African region.Diagnostic investigation carried out with randomly selected cashewnut processing units located in major cashew growing states viz., Karnataka, Kerala, Tamil Nadu, Odisha, and Andhra Pradesh and processing cost worked out for various category such as labour oriented, semi-mechanized and fully automated and presented in Table 3.6.2. The lowest cost incurred for fully automated unit located in Odisha state operating with a capacity of 8 TPD whereas processing cost expended for unit weight of raw cashewnuts found to be the highest in Kerala state i.e., ₹34.50 having employment strength of 215. As the labour law is in force strictly in Kerala state and other mandatory benefits are extended to employees, hiked processing cost. Depending on the degree of mechanization in semi mechanized sector in Indian cashewnut industry, the processing cost ranged from ₹12 to ₹20/- per kg of RCN. It explains that the processing cost is directly related to, skill level of employees, degree of mechanization and quantum of processing. But profitability of these industry rely on conversion of raw cashewnuts in to white whole kernels sold at better price irrespective of market and control on the discoloration leading to secondary or tertiary grades of final produce.

Table. 3.6.1. Production, processing and export of cashew in identified states In India.

Region	Andhra Pradesh	Karnataka	Kerala	Tamil Nadu	Odisha	Total
Area of production (lakh ha)	1.98 (17%)	1.38 (12%)	1.08 (9.0%)	1.75 (15%)	2.23 (19%)	11.92
Annual production (Lakh MT)	1.27 (16%)	0.75 (10%)	0.72 (9.0%)	0.77 (10%)	1.21 (16%)	7.82
Import of RCN (Lakh MT)	2.1 (16%)	3.4 (26%)	0.72 (9.0%)	2.4 (18%)	1.35 (10%)	13.25
Total processing units (Nos.)	228 (4%)	365 (6%)	445 (7%)	545 (9%)	400 (7%)	6200
Employment generated (Lakh Nos.)	0.385	0.765	1.125	0.925	400 (7%)	
Export of kernels (Lakh MT)	Nil	0.212	0.102	0.114	0.037	
Major processing regions	Palasa and Kasibugga; Vetapalem; Tuni	Dakshina Kannada; Udupi; Kundapura; Honnavar	Kollam; Kasaragod; Kannur	Panruti; Pudukkottai; Kandarva Kottai	Rambha; Behrampur; Jaipur; Koraput	

Table 3.6.2. Processing cost per unit weight (₹ per kg of RCN) for various category of cashewnut processing units in defferent states.

State	Mode of processing	Ave. Capacity utilization (TPD)	Strength of labour force	Average processing cost (₹ Per kg)	Location
Keralam	Labour oriented	2.40	215	37.50	Kollam
	Semi-Mechanized	4.00	200	34.00	
	Fully automated	15.00	150	30.00	
Karnataka	Labour oriented	3.00	200	22.50	Dakshina Kannada
	Semi-Mechanized	4.20	210	20.20	
	Fully automated	15.0	140	17.50	
Tamil Nadu	Labour oriented	1.50	250	16.50	Cuddalore
	Semi-Mechanized	2.00	200	19.50	
	Fully automated	10.00	160	16.00	
Andhra Pradesh	Labour oriented	1.50	75	24.00	Srikakulam
	Semi-Mechanized	4.00	190	16.00	
	Fully automated	10.00	200	12.00	
Odisha	Labour oriented	1.50	<75	15.00	Ganjam
	Fully automated	8.00	75	**10.00**	

Conclusions

- Diagnostic investigation was carried out in cashewnut processing units located in West Coast (Kerala and Karnataka) and East Coast (Tamil Nadu, Andhra Pradesh and Odisha) and compared.
- Industry oriented technical problems are identified based on the diagnostic study conducted with cashew processing units representing labour oriented, semi-mechanized and fully mechanized mode of processing in selected regions. Cost of processing varied between ₹ 800/- to ₹ 3000/- per bag of 80 kg.
- A video of mechanized cashewnut processing in India is prepared and presented during scientific council meetings as per the recommendation.
- Optimization of processing parameters influencing the quality of end product found to be the prime issue of the industry. Efficient utilization of human, thermal and electrical energy is the secondary issue to be tackled to minimize the cost.
- Stage wise problems have been identified in the line of fully mechanized processing and probable solutions suggested. Contamination of cashew kernels with CNSL during shelling is one of the major problems to be addressed.
- As the moisture plays vital role at all stages of processing, moisture-based processing technique need to be optimized for better qualitative and quantitative efficiency.
- Accounting labour wages, cost of raw materials and overhead charges in the highly energy intensive processing, cost of production found to be lower in fully mechanized mode than labour-oriented system.
- Although, drum roasting method conditioning is expected to yield consumer accepted quality fo cashew kernels, pollution caused is a serious problem to be tackled. Problems related to drum roasting process need to be addressed to protect employment generated through cashew sector in Keralam state.
- Majority of the semi mechanized and fully mechanized units are in compliance with ISO standards pertaining to quality and safety.

3.6.2 Influence of *Apis cerana* indica and *Braunsapis* spp. on pollination and fruit set of cashew

1.Institute Project Code	: IXX14974
2.Project Title	: Influence of *Apis cerana indica* and *Braunsapis* spp. on pollination and fruit set of cashew. (Old title: Influence of *Apis cerana* and *Braunsapis picitarsis* on pollination and fruit set of cashew, approval for change of title is recorded in 33 IRC).
3.Key words	: Cashew flowers, bees, pollinators, pollination efficiency
4.Name of the Lead Institute	: Directorate of Cashew Research, Puttur, Karnataka
5.Project Team	: PI: Dr. K. Vanitha, Scientist (Agric. Entomology), ICAR-DCR, Puttur Co-PI: Dr. Veena, G.L., Scientist (Hort.), ICAR-DCR, Puttur
6.Project Duration	: Date of Start:17.06. 2019 Date of Completion:16.10. 2023

Objectives

- To examine the efficiency of *Apis cerana indica* in increasing cashew yield.
- To establish breeding sites of *Braunsapis picitarsis,* to record the biology and the natural enemies in those breeding sites and its management.
- To examine the efficiency of *B. picitarsis* in increasing cashew yield along with *A. cerana indica* and alone.
- To devise methods to conserve pollinators of cashew and develop bee cafeteria.

Achievements/ Output of the project

Documentation of *Braunsapis* species

Documentation of *Braunsapis* species occurring on the cashew flowers in Puttur region during 2020 resulted three species namely *B. picitarsis*, *B. mixta* and *B. malliki* showing diversity in *Braunsapis*.

DNA barcoding of *B. mixta*

The bee specimen of *B. mixta* was subjected for molecular identification at NBAII, Bengaluru. DNA extraction was done using a hind leg of adult using Qiagen DNeasy® kit, following the manufacturer's protocols. The sequences showed 100 % similarity to *B. mixta* (GenBank Acc. No. KY072614) through BLAST sequence analysis and the sequences were submitted to NCBI and accession numbers were retrieved (GenBank Acc. No. MW135190).

Artificial bee nests for wild bees

Artificial breeding sites in the form of wooden blocks having drilled holes of varying sizes arranged over an ant well stand was found to attract different bee species esp. *Braunsapis mixta* and *B. picitarsis*, besides wasps and parasitoids. The thin sticks of bamboo also served as efficient nesting sites for these bees followed by Jhonson's grass, lantana and cashew.

Nesting biology of *B. mixta*

Nests of *B. mixta* consisted of a simple tunnel without any partitions. Nest walls were smooth, without particular lining. Length of nest burrow widely varied between 1.2 and 17.4 cm. Number of adults in the active nest during collection varied from 1-11, but majority had single adult. A significant positive correlation was obtained between number of adults and brood (0.61) as well as with eggs (0.58, $P<0.001$ %).

Pollination efficiency of *Apis cerana indica* in cashew under field conditions

In nature, bees from feral colonies besides several wild bees visit cashew flowers aiding in cashew pollination. Bee colonies of *Apis cerana indica* (4 & 8 nos) were shifted to the cashew plantations at around 20-30 % flowering of trees, and the bee visit patterns were recorded. Bees visited more on the nearby flora compared to cashew, and there was no significant increase in bee visits in the plots even when higher number of colonies were kept. However, the nut yield was slightly higher (7-10 %) in the plants of plots with bee colonies compared to the plots without bee colonies.

Efficiency of pollinators on cashew pollination under net cage conditions

Bee confinement method was adopted in comparison to open pollinated trees and net caged ones. For testing the pollination efficiency of *B. mixta,* a single tree was confined with bee nest having approx. 130 active nests. Similarly, for *T. iridipennis,* a tree was confined with its hive. For *A. cerana indica*, two trees were confined with three framed bee colony and sugar feeding was done at weekly intervals to provide sufficient food to the bees).

All the three bee species actively foraged on cashew flowers even under confinement and successfully pollinated the flowers. Number of nuts set/tree was 257, 333, 167 in cashew trees confined with colonies of *T. iridipennis, B. mixta* and *Apis cerana indica*, respectively. Number of nuts set/tree in open pollinated trees was 415 / tree. Besides, the biochemistry of pollen grains of cashew and the pollen load of *Apis cerana indica* were also assessed..

Quality parameters of bee pollinated fruits

Apple, nut and kernel weight of cashews resulted by pollination of bees were estimated. The mean apple weight (52.83±14.21 g), nut weight (8.27 ±0.75) and kernel weight (2.33±0.2 g) were higher in *Braunsapis* pollinated ones compared to the ones which were pollinated by *A. cerana indica* (40.65 ± 8.79, 6.56 ±0.86, 1.97±0.29), *T. iridipennis* (48.46 ±12.99, 7.73 ±0.70 and 2.26± 0.17) and open pollination (44.85 ±12.00, 8.02 ±0.77 and 2.25±0.37), respectively. Similarly, the biochemical parameters of cashew apples indicated higher content of Vit C, Total phenols, TSS and tannins, with less acidity in *Tetragonula* pollinated ones. While, acidity was more in *Braunsapis* pollinated ones.

Toxicity of insecticides to bees

Activity of pollinators including wild bees was very less during first two days of spraying. After spraying, dead bees were noticed on the leaves, bees upon direct pesticide contact died in the field. Periodical tagging of inflorescences - nut set was low during 1st week of insecticidal spraying compared to later period. Bee toxicity to specific dose of insecticides was also studied at laboratory by dry film method. The insecticides namely lambda cyhalothrin and acetamiprid were tested at half and 1/4th of the field dose by dry film method. Among which, lambda cyhalothrin was highly toxic to bees followed by acetamiprid.

Natural enemies of *B. mixta*

Several spiders and wasps especially Sphecids were noticed in the artificial bee nests. Adults of a parasitic bee species *viz., B. kaliago* were seen along with *B. mixta*. *Neochalcis breviceps* (Masi) (Chalcidoidea: Chalcididae) has been recorded as parasitoids. Adults of *Diomorus* nr. *indicus* were seen at the nest entrance trying to oviposit on guarding female. Nevertheless, no pathogenic infection or moribund dead bees were found in any of the active nests. The adult parasitoid collected on *B. mixta* was identified as *Zodiomyia sumbaensis* Camras (Conopidae) and its hyperparasitoid was *Tetrastichus girishi* Narendran (Eulophidae). The DNA sequences of mtCOX1 gene of both parasitoid and its hyperparasitoid were obtained and submitted in NCBI.

Bee conservation park

A bee conservation park is established in the farm premises of ICAR-DCR, Puttur integrating diverse bee flora (more than 20 flora) and three bee species for conservation of the bees. Bee hives and the artificial nesting sites are provided. Besides, nesting sites for the stem nesting bees are provided by regular pruning of lantana, bamboo and ixora shoots to make the cut ends for easy occupation by the bees like *Braunsapis* spp and *Ceratina* spp.

3.6.3 An Artificial Intelligence (AI) based website and app for the identification of pests, diseases and nutrient deficiencies in Cashew

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RKVY Project ID: KA/RKVY-AGRE/2021/1206

Project Budget: 16 lakhs

Duration: 2 Years (2022-2024)

Objectives:

1) To develop an exclusive AI app for the identification of cashew pests and diseases including nutrient deficiencies
2) To collate data on pests,diseases, and nutrient deficiencies of cashew across India in addition to other parts of the world
3) To help farmers to make proper decisions to improve the production and productivity of cashew

Cashew farmers often need expert advice for proper management of pests and diseases in addition to nutrient deficiencies. However, due to the remote nature of villages and farms, advice is not easily available when it is most required. Recent advances in mobile technologies can help to a greater extent in this connection. Apps and websites based on technologies such as artificial intelligence, visual recognition and deep learning are being developed worldwide for the identification of plants/animals/insects including pests/diseases/nutrient deficiencies. These tools have been found very useful and are regularly used by farmers in different parts of the world.

CASHEW PROTECT

In the project, the Cashew Protect website and app for identification of pests and diseases of cashew along with nutrient deficiencies were developed. The progress made in the project is outlined here.

1) Comprehensive website i. e. Cashew Protect for AI-based diagnosis was developed using Tensor Flow software and others (https://cashewprotect.icar.gov.in/)

2) Cashew Protect app was also developed (https://play.google.com/store/apps/details?id=com.tosall.cashewprotect)

3) The website and apps were released during the Annual Group Meeting of All India Coordinated Research Project on Cashew -2022 held at Dr.YSR Horticultural University, Venkataramannagudem, Andhra Pradesh.

4) As of now, the software identifies 9 major pests and two diseases disease (pests namely TMB, CSRB, leaf miner, Mealybug, Aphids, Apple and Nut borer and two diseases i.e. leaf blight and gummosis) and one nutrient deficiency (Zinc)

5) Text pertaining to insect morphology, management and precautionary measures is developed for 23 pests and 2 diseases. Content writing for both website and app has been accomplished in all local languages in addition to English.

6) Images (more than 3000) of various diseases, pests and nutrient deficiencies have been assembled from different scientists and also from centers of All India Coordinated Research Project on Cashew spread across the country

7) Cashew protect brochure was developed for distribution to stakeholders

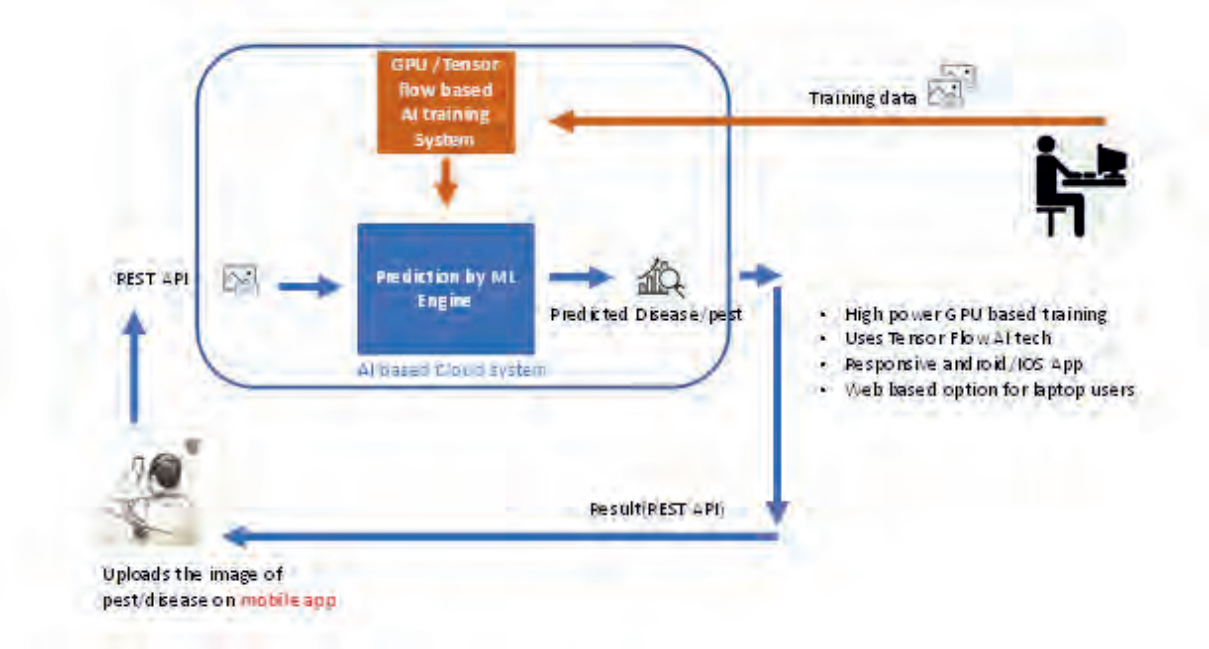
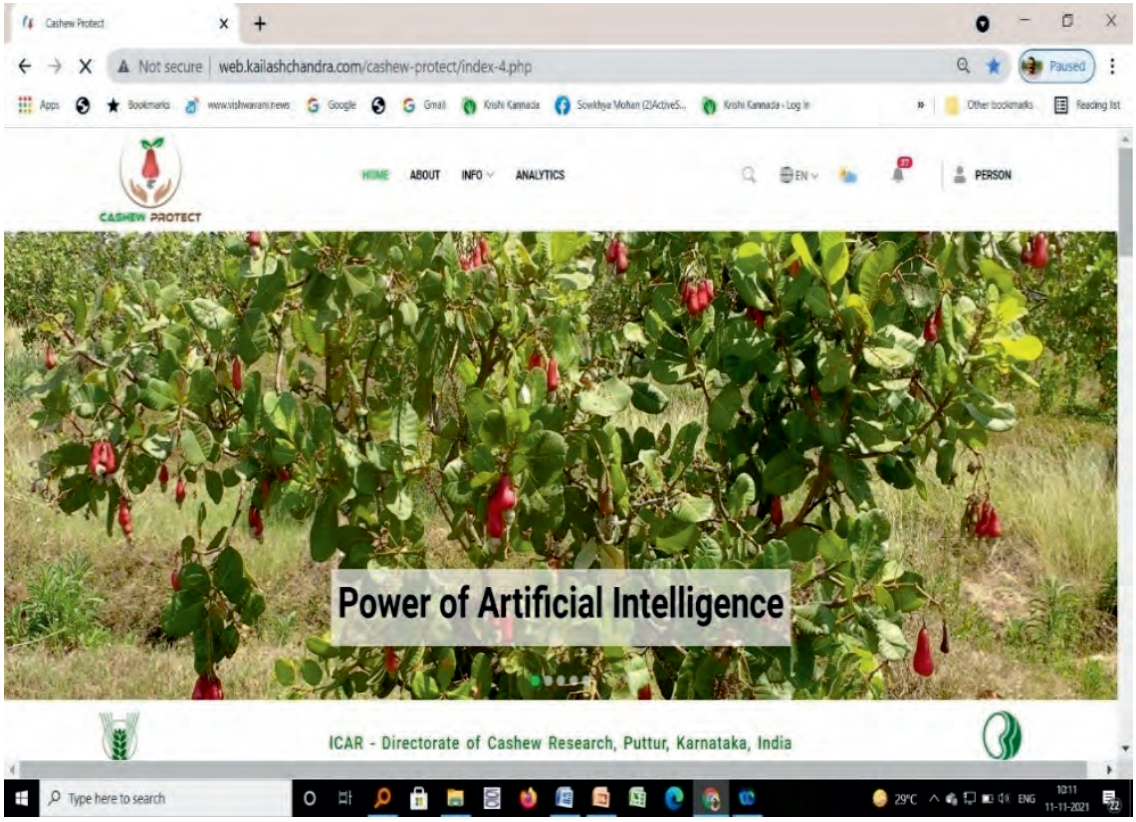


Fig. 3.6.3 Schema architecture of Cashew Protect app

Technology stack:

Artificial Intelligence (AI) and computer vision-based techniques are deployed here. The website/app is constantly being trained with additional data and gets more accurate with time. In the backend application, PHP Laravel framework, MySQL, Windows OS, Apache/NGINX are deployed. React Native/Flutter is deployed in mobile phone application. The AI machine learning system included Python, Windows OS, Tensor Flow as AI framework and GPU server for training. This website/app is available in 11 languages i.e., English, Hindi, Kannada, Gujarati, Marathi, Malayalam, Tamil, Telugu, Bengali, Odia and Garo to cater to the needs of farmers in the local language. Options for contacting experts and sharing photos in social media have been provided in case of no detection or dissatisfactory results. Most interestingly, it is possible to capture data via users on the number and type of pests, diseases and nutrient deficiencies observed in different countries/regions/districts/taluks during different time periods through this website/app. This will eventually help in early forecasting of these problems and alert farmers in a particular region in time. Further, it also helps to channelize efforts and inputs required for management by the concerned agencies in an area/region of the country.

This is probably the first ever attempt of developing an AI based app/website in the world and in the ICAR system for cashew. The team behind developing this app/website included the scientists of ICAR- Directorate of Cashew Research, Puttur and the scientists of AICRP- Cashew centers spread across the country. This work is funded by the RKVY-RAFTAAR program of Government of Karnataka.


Cashew Protect
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ICAR - Directorate of Cashew Research, Puttur, Karnataka, India
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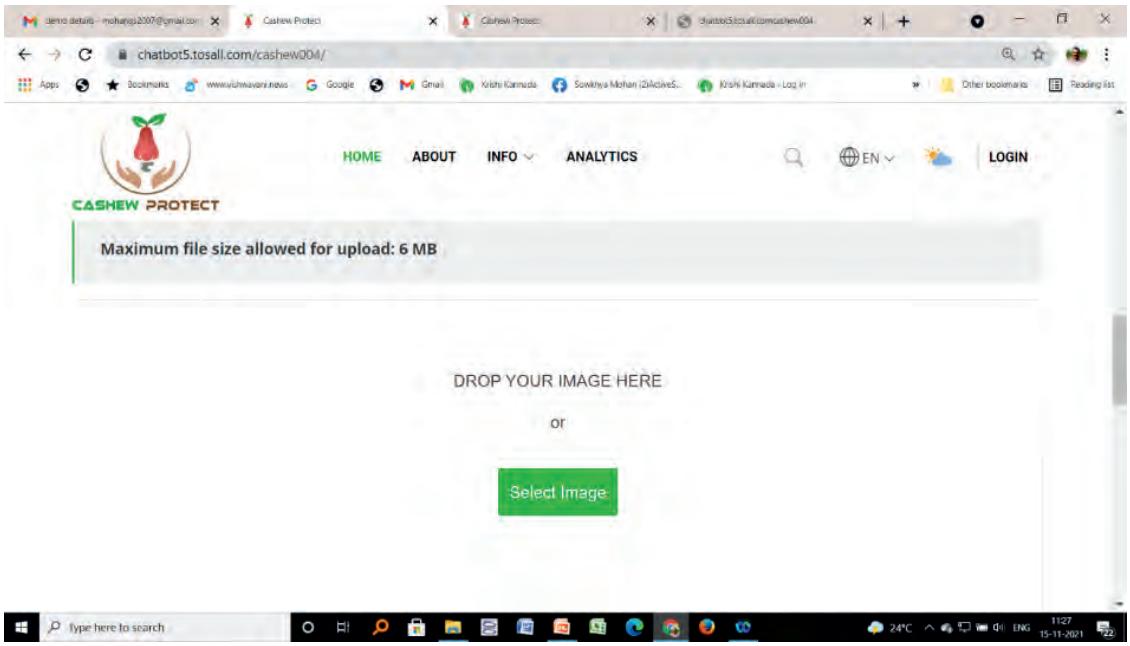
chatbot5.tosall.com/cashew004/
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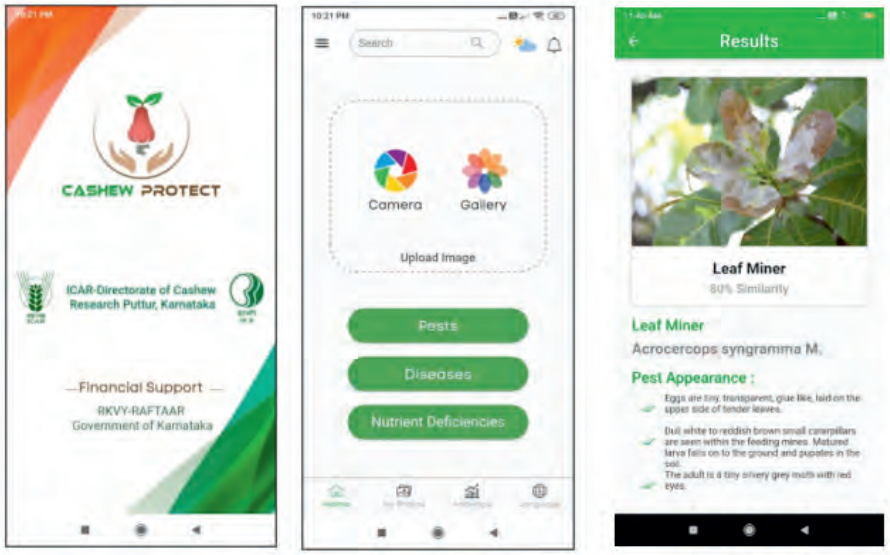
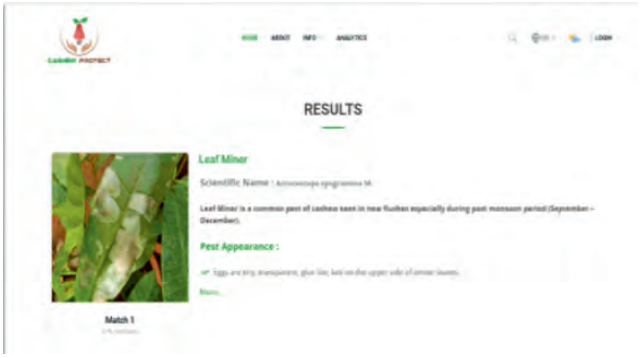


3.6.4: Screenshots of the Cashew Protect App

Impact:

Release	Jan 19, 2023
# of downloads	785 (as on 31st December 2024)
	4.9
Countries (10)	India, Nigeria, USA, Ghana, Cambodia, Brazil etc



References:

Cashew Protect Website :	https://cashewprotect.icar.gov.in/
Cashew India app :	https://play.google.com/store/apps/details?id=com.cashew.icar
Cashew Leaf Analysis :	https:/cashew.icar.gov.in/leafanalysis/
Cashew Pest Database :	https://cashew.icar.gov.in/pestsite/
Plantix – Your crop doctor :	https://play.google.com/store/apps/details?id=com.peat.GartenBank
ICAR- Directorate of Cashew Research :	https://cashew.icar.gov.in/

Future line of work:

Accuracy improvement in the diagnosis of pests, diseases, and nutrient deficiencies by the app is planned and the funding for this purpose is sought from the external funding agencies.

4. EXTENSION ACTIVITIES

4.1 Advisories/ Field Visits/ Consultancy

Name of the Scientist	Title and Venue	Date
Dr. Aswathy Chandrakumar	Field visit for monitoring and evaluation of FLD plots established in Puttur and advisories were given to farmers. 10 FLD plots were visited.	23rd January, 2024
	Advisory on the establishment of a Cashew orchard to Shri. Krishna Murthy Rao at Moodabidre, DK, Karnataka.	13th February, 2024
	Resource person and explained the activities of ICAR-DCR, Putturand explained about Cashew Museum in the training programme "Entrepreneurship opportunities in Cashew" organized under SCSP in ICAR-DCR, Puttur.	21st May, 2024
	Technology of Cashew" organized under SCSP programme in collaboration with Chully Farm Club, Vellarikundu, Balal Panchayath, Kasaragod Dist., Kerala.	13th August, 2024
	Field visit for monitoring and evaluation of 7 FLD plots established in Parappa block of Kasaragod district and advisories were given to farmers	27th November, 2024
	Monitoring of demo plot established in Cashew Progeny Orchard, Galimukha, Kasaragod.	29th November, 2024
	Field visit for monitoring and evaluation of 7 FLD plots established in Kasaragod and advisories were given to farmers.	11th December, 2024
Dr. Balasubramanian, D	As members of Expert Committee for Cashew Unit Assessment with the objective to assess the actual / Expected yield per year and recommend for feasible tariff to hire forestry cashew plantations under TAFCORN.	8th July, 2024
	"Checking the Quality of Raw Cashewnuts and issuing Quality Assessment Certificate and Valuation Report"- Mr. Vijaya Kumar, Branch Manager, Central Bank of India.	

Name of the Scientist	Title and Venue	Date
Dr. Balasubramanian, D Dr. Bhagya H P Dr. Eradasappa E	Field survey has been taken up to identify suitability of cashew cultivation as apart of consultancy project of MBMA for area expansion of cashew in Garo hills of Meghalaya. Provided consultancy service to government of Meghalaya for ' Scaling up of Cashew supply chain in Meghalaya through area expansion and improving value addition processes' by post care planting and nursery management training to the farmers and officials of Meghalaya	23rd to 25th June, 2024 14th to 18th October, 2024
Dr Balasubramanian, D. Dr. Rajasekhara, H Dr. Veena G L	Nominated for testing the physical, microbial, and quality parameters of the cashew kernel samples received by Mr. Rahul Pro. Foodiot, Bangalore in accordance with the corporate client's requirement Nominated for testing the physical, microbial, and quality parameters of the cashew kernel samples received from Shri Mohan Nachiyappan, Deputy Commissioner, Govt. of India, Office of the Commissioner of customs, Chennai Nominated for testing the physical, microbial, and quality parameters of the samples received from Dr. Nithin Krishna Shenoy, P., Deputy Director, Directorate of Revenue Intelligence, Ministry of Finance, Bengaluru, Govt. of India	13th August, 2024 16th August, 2024 24th June, 2024

4.2 Exposure visits

Sl. No.	Name & Address	Purpose of visit	Date of visit	No. of Participants	Coordinators
1	University of Horticultural Sciences, Bagalkhot	Educational Tour	19th Januray, 2024	50 students	Dr. Aswathy Chandrakumar and Dr. Babli Mog
2	Madhusudhan D L Horticulture University Hassan	Educational Tour	29th February, 2024	30 students	Dr. Aswathy Chandrakumar, Dr. Veena G.L. and Dr. Manjesh G N
3	III BSC (Hons) College of Horticulture, Mysore, UAHS, Bagalkhot	Educational Tour	26th March, 2024	56 Student	Dr. Bhagya H.P and Dr. Veena G.L

Sl. No.	Name & Address	Purpose of visit	Date of visit	No. of Participants	Coordinators
4	Ms. Vijitha V DAESI Facilitator ICAR-KVK ,Mangalore	Educational Tour	17th May, 2024	40 Trainees	Dr. Aswathy Chandrakumar and Dr. Bhagya H P
5	T. Nadana S Dept of Agriculture Cuddalore, Tamil Nadu	Exposure Visit	28th May, 2024	9 Officials	Dr. Aswathy Chandrakumar, Dr. Thondaiman V
6	Dr. Vengopal BEST University Gorantta Andra Pradesh	Educational Tour	15th June, 2024	155 Student	Dr. Eradasappa E and Dr. Vanitha K
7	Dr. Shivanand Gowda BEST University Gorantta, Andra Pradesh	Educational Tour	17th June, 2024	115 Student	Dr. Aswathy Chandrakumar and Dr. Jyoti Nishad
8	K M Thomas Charman Paithal fills FPO	Exposure visit	19th July 2024	9 Board of Directors, Paithal Hills FPO	Dr. Aswathy Chandrakumar, Dr. Veena G.L., Dr. Manjesh G N, Dr. Siddanna Savadi
9	Ms. Prithvi M Lecture Besant women's college	Educational Tour	06th September, 2024	29 students	Dr. Aswathy Chandrakumar, Dr. Jyoti Nishad
10	Mrs. Harinakshi Teacher Vivekananda Central School Neharu Nagara	Educational Tour	10th September, 2024	36 students 2 Teachers	Dr. Aswathy Chandrakumar
11	Dr. Shivashankar N Scientist KVK Hassan	Educational Tour	11th September, 2024	46 Farmers	Dr. Bhagya H P, Dr. Aswathy Chandrakumar
12	Dr. Bharath Kumar T. P Assistant Professor College of Horticulture Mudigere KSNUAHS Shivamogga	Educational Tour	13th September, 2024	43 Students	Dr. Bhagya H P, Dr. Aswathy Chandrakumar
13	Gowtham Pai B Assistant Professor Dept of BBA, VC of Arts, Science	Educational Tour	30th October, 2024	45 students	Dr. Aswathy Chandrakumar, Dr. Jyoti Nishad
14	Dr. Ramyashree S Assistant Professor East West College of Engg, Bengaluru	Educational Tour	20th November, 2024	24 Students	Dr. Aswathy Chandrakumar, Dr. Bhagya H P

4.3 Exhibitions

Exhibitions attended

- ICAR-DCR established a stall for showcasing cashew production technologies in the Horticulture Fair organized by ICAR-CPCRI, Regional station, Vittal on 28th February, 2024 at Vittal. Dr. Aswathy Chandrakumar, Dr. Jyoti Nishad, Dr. Bhagya H P, Mr. Chetan (Contractual staff) were deputed to set up the stall.
- ICAR-DCR participated in the National Horticulture Fair organized by ICAR-IIHR, Bengaluru from 5th – 7th March, 2024. The stall was awarded 2nd Best prize.

4.4 Students guided

Dr. Siddanna Savadi guided thesis works of six M.Sc. (Biotechnology) students of St. Berchamans college, Chenganassery, Kerala and one M.Sc. (Biotechnology) student of Chinmaya Arts and Science College for Women, Govindagiri, Kannur, Kerala were guided at CoE for Biotechnology.

Dr. Veena G L guided the following students for project / thesis/ internship

Sl. No.	Name of the student guided	Institute	Project/Thesis / Internship report Title	Year of award
1	Ms. Poojashree, D. M.Sc. (Food Science and Nutrition)	Mangalore University	Development of Cashew apple Sauce	2024
2	Ms. Vaishnavi, K.B. M.Sc. (Biochemistry)	Mangalore University	Estimation of major bioactive components in leaf and roots of cashew rootstocks	2024
3	Ms. Poorvika, G.K. B.Sc. (Biotechnology and Botany)	Sri Dharmasthala Manjunatheswara College Ujire	Internship for Hands on experience in estimation of bioactive components through spectrophotometric method.	2024
4	Ms. Amrutha H. M.Sc. (Food Science and Technology)	St. Aloysius College Mangalore	Evaluation of Cashew Sprouts based Cookies	2024

5. IMPLEMENTATION OF STC/TSP AND SCSP

STC/TSP

5.1 Training on Capacity Building of farmers on Scientific Cashew Production Technologies organized

ICAR-Directorate of Cashew Research, Puttur in collaboration with WASSAN NGO from Vizag, Andhra Pradesh organized two days training programme for the ST farmers of Parvathipuram Manyam district and Vizianagaram district on scientific cashew production technologies from 1st -2nd February, 2024. The training programme aimed to create awareness among the ST farmers on recommended packages of practices for cashew as the yield was very low in their farms. The training programme aimed at sensitizing the farmers about the improved varieties of cashew and providing information on cashew production technologies such as softwood grafting, canopy management, management of Tea Mosquito Bug, Cashew Stem and Root Borer and disease management. Farmers were given hands-on training on softwood grafting and pruning techniques. As a part of the training programme, farmers were also taken for an exposure visit to the field of Shri Natesh Moodayur, who is a progressive farmer. Drone technology was also demonstrated to the farmers to create awareness. A total of 25 no's farmers attended the training.

5.2 Distribution of Secateurs

ICAR-DCR, Puttur, distributed 20 no's secateurs to cashew-growing farmers on 12th February 2024 under the Tribal Sub-Plan (TSP) scheme to promote efficient pruning practices. This initiative aims to enhance orchard management, improve tree health, and boost cashew yield, contributing to better productivity and income for tribal farmers.

5.3 Training Programme on "Cashew Production and Processing Technologies" to the ST beneficiaries under the TSP scheme

As a part of the Tribal Sub-Plan (TSP/STC) scheme of this Directorate, in collaboration with KVK, Rastakuntubai, Acharya N.G. Ranga Agricultural University, Guntur organized a five-day training programme on "Cashew Production and Processing Technologies" from 12th to 16th February 2024. In this programme, Dr. J.D. Adiga, Director, ICAR-DCR, Puttur chaired the programme and addressed the gathering about the training programme of this Directorate and emphasized the scientific cashew cultivation and processing technologies. Dr. Manjunatha K., Scientist (FMP), Nodal Officer TSP, briefed about the implementation of the programme. Dr. S. Srinivasa Raju, SMS (Hort.) KVK, Rastakuntubai, introduced the trainee farmers and briefed them about the problems in cashew cultivation practices in Andra Pradesh. A series of lectures and exposure visits to various progressive farmers' fields and cashew processing industry visits were organized.




5.4 Training Programme on Scientific Cashew Cultivation at Agatti Island, Lakshadweep under the TSP scheme

ICAR-DCR, Puttur, in collaboration with KVK Lakshadweep, organized a one-day training programme on Scientific Cashew Cultivation at Agatti Island, Lakshadweep, on 11th March 2024 under the Tribal Sub-Plan (TSP) scheme. The training aimed to equip Scheduled Tribe (ST) farmers with knowledge of improved cashew farming practices, including varietal selection, planting techniques, nutrient management, pest and disease control, and post-harvest handling. Scientists and experts provided hands-on demonstrations and addressed farmers' queries, ensuring practical learning. The initiative focused on enhancing productivity, promoting sustainable cashew farming, and improving the income of tribal farmers in Lakshadweep. Farmers actively participated, gaining valuable insights to adopt modern techniques for better yield and profitability.


5.5 Distribution of Solar Lights

ICAR-DCR, Puttur, distributed 22 solar lights to TSP beneficiaries on 8th March 2024 under the Tribal Sub-Plan (TSP) scheme to improve rural lighting and enhance the quality of life. This initiative aims to provide sustainable energy solutions, support agricultural activities after dusk, and promote eco-friendly living among tribal communities.

5.6 Distribution of Tarpaulins

ICAR-DCR, Puttur, distributed 57 tarpaulins to TSP beneficiaries on 8th March 2024 under the Tribal Sub-Plan (TSP) scheme to support post-harvest management and drying of agricultural produce. The tarpaulins will help farmers protect cashew nuts and other crops from moisture, dirt, and adverse weather conditions, ensuring better quality and reduced post-harvest losses. This initiative aims to enhance productivity, improve income, and promote sustainable farming practices among tribal communities.

5.7 Distribution Battery-Operated Knapsack Sprayers

ICAR-DCR, Puttur, distributed 22 battery-operated knapsack sprayers to TSP beneficiaries on 18th June 2024 under the Tribal Sub-Plan (TSP) scheme to enhance agricultural efficiency and pest management. These sprayers will help farmers apply pesticides and fertilizers more effectively, reducing labour efforts and ensuring uniform spraying. The initiative aims to improve crop health, increase productivity, and support sustainable farming practices among tribal communities. By adopting modern equipment, farmers can enhance their yields and overall income.

5.8 Distribution of Cow Mats

ICAR-DCR, Puttur, distributed 25 cow mats to TSP beneficiaries on 24th June 2024 under the Tribal Sub-Plan (TSP) scheme to promote better livestock management and animal welfare. These mats provide comfort, reduce stress, and help prevent injuries and infections in cattle, leading to improved milk production and overall health. The initiative aims to support tribal farmers by enhancing dairy farming conditions, ensuring higher productivity, and improving their livelihoods. This effort aligns with sustainable and efficient livestock rearing practices.

5.9 Training programme on "Scientific Cashew Cultivation" and quality planting material distribution at Babadam, West Garo Hills, Meghalaya under the TSP scheme

ICAR-Directorate of Cashew Research, Puttur, in collaboration with All Garo Hills Multipurpose Cooperative Society Ltd., Meghalaya, organized a training program on "Scientific Cashew Cultivation" under the TSP scheme to promote cashew cultivation in the NEH region. Conducted on 31st July and 1st August 2024, the program covered crop management, protection, varietal selection, mechanization, post-harvest processing, and value addition. A total of 162 tribal farmers from 18 villages across West Garo Hills and South West Garo Hills attended. Scientists from ICAR-DCR, Puttur, led the sessions, coordinated locally by Mr. Joash Varghese. During the program, 9,000 high-yielding Bhaskara cashew grafts were distributed to establish 62 ha of new orchards. Additionally, three Front Line Demonstrations (FLDs) introduced Nethra Jumbo-1, Nethra Ganga, and Nethra Ubhaya varieties in Urenggre village. Scientists also assessed existing orchards and found them to be of seedling origin, senile, and poorly managed, leading to low yields. Recommendations for orchard rejuvenation, pest control, and scientific management were provided to enhance productivity.




5.10 Distribution of Cashew Grafts to ST Farmers of Lakshadweep under TSP Scheme

ICAR-DCR, Puttur, distributed 1,000 high-yielding cashew grafts to Scheduled Tribe (ST) farmers of Lakshadweep Islands on 28th August 2024 under the Tribal Sub-Plan (TSP) scheme to promote cashew cultivation and enhance farmers' livelihoods. The distribution included Bhaskara (500), Ullal-3 (100), Nethra Jumbo-1 (50), Nethra Ganga (50), VRI-3 (200), and Nethra Ubhaya (100) varieties, known for their superior yield and quality. This initiative aims to improve cashew production in the region, ensure better income for farmers, and promote sustainable farming practices. By introducing improved varieties, the programme supports long-term agricultural development, enhancing productivity and economic stability for tribal communities in Lakshadweep.


5.11 Distribution of Cashew Grafts to ST Farmers of Meghalaya under TSP Scheme

ICAR-DCR, Puttur, in collaboration with All Garo Hills Multipurpose Cooperative Society Ltd. (AGHMPCS), Meghalaya, distributed 14,610 high-yielding cashew grafts to Scheduled Tribe (ST) farmers of Meghalaya on 7th October 2024 under the Tribal Sub-Plan (TSP) scheme. The distribution included Vengurla-7 (8,000 grafts) and Vengurla-4 (6,610 grafts), both known for their high productivity and adaptability to local conditions. This initiative aims to expand cashew cultivation in Meghalaya, enhance farmers' income, and promote sustainable agricultural practices. By introducing superior varieties, the programme supports long-term economic growth, ensuring better livelihood opportunities for tribal communities in the region.

5.12 Farmer-Scientist Interface Programme under TSP Scheme at KVK Lakshadweep

ICAR-DCR, Puttur, in collaboration with KVK Lakshadweep, organized a Farmer-Scientist Interface Programme for Scheduled Tribe (ST) farmers under the Tribal Sub-Plan (TSP) scheme during COCO FEST 2024 on 21st November 2024 at KVK Lakshadweep. The programme aimed to facilitate direct interaction between scientists and farmers, providing insights into advanced agricultural practices, pest and disease management, and value addition in cashew crop. Experts addressed farmers' queries and shared knowledge on improving productivity and income through scientific interventions. The event emphasized sustainable farming techniques, promoting self-reliance and better livelihood opportunities for tribal farmers. The initiative strengthened knowledge exchange and encouraged the adoption of modern agricultural practices among the participants.

5.13 Inputs Distribution Programmes Organized by ICAR-DCR, Puttur under the TSP Scheme

ICAR-Directorate of Cashew Research (DCR), Puttur, organized an Inputs Distribution Programme under the Tribal Sub-Plan (TSP) scheme to support tribal farmers. Essential agricultural inputs, including high-yielding cashew varieties, secateurs, sprayers, cow mats, tarpaulins, kitchen garden tools and solar lights were distributed to enhance productivity and livelihood opportunities. The initiative aimed to promote sustainable farming practices and improve socio-economic conditions among tribal communities.

5.14 Distribution kitchen garden tools

ICAR-DCR, Puttur, distributed 38 sets of kitchen garden tools to TSP beneficiaries on 23rd December 2024 under the Tribal Sub-Plan (TSP) scheme to promote household-level vegetable cultivation. These tools will help farmers efficiently manage their kitchen gardens, ensuring better soil preparation, planting, and maintenance. The initiative aims to encourage self-sufficiency in vegetable production, improve nutritional security, and enhance livelihoods. By adopting better gardening practices, beneficiaries can grow fresh, chemical-free vegetables, contributing to food sustainability and economic well-being.

SCSP

5.15 Hortipreneurship for livelihood improvement in rural youths and Promotion of Nutrition Garden and providing inputs under SCSP at ICAR- K H Patil KVK, Gadag

As a part of the scheduled caste sub-plan programme of this directorate in collaboration with ICAR-K.H. Patil, KVK, Hulkoti, Gadag, Karnataka organised a five days training programme on Hortipreneurship for livelihood improvement in rural youths from 16th to 20th January 2024. Dr. Sri Narayan H Bhandi, SMS, (Soil Science) briefed about the five-day training programme and selection of beneficiaries under the SCSP scheme. Dr. Suresh Kumbar, SADH, Shirahatti, Gadag, chief guest addressed the participants by highlighting the importance of horticulture in entrepreneurship development and advanced technologies and opportunities available for rural youth to achieve self-sustenance. Dr. Manjesh G. N. Scientist, (SPMAP), Nodal officer SCSP, briefed about the implementation of the programme. He emphasized about horticulture sector contributing towards agriculture GDP, the scope, and opportunities to take up entrepreneurship in horticulture. Further, Dr. Veena G.L., Scientist (Fruit Science), addressed the gathering and highlighted the nutritional importance of Cashew apple and the layout of the kitchen garden in the backyards. She also highlighted the technologies for cashew apple value addition available at ICAR-DCR Puttur for commercialization to become a horticulture entrepreneur. Dr. Jyoti Nishad, Scientist (Food Technology) spoke about the nutritional aspects of fruits and vegetables in daily diet. She also briefed about the importance of labelling, packaging, and food licenses in commercialization. Dr. Sudha V. Mankani, Head and SMS (Home Science) gave a presidential address about the importance of balanced nutrition in the daily diet and emphasized the benefits of the kitchen garden. In this programme the inputs for kitchen gardening [garden tools - 9 inputs], Vegetable seed kits of 8 different vegetable seeds and vegetable special a nutrient mixture to promote nutrition/kitchen garden were distributed to 25 beneficiaries. A series of lectures and exposure visits to various progressive farmer's fields, nurseries, and the Hi-tech horticulture unit, UAS, Dharwad were organised.

5.16 Demonstration cum hands-on training in cashew apple-based technologies of ICAR-DCR, Puttur to SC beneficiaries of Gadag under SCSP

In collaboration with ICAR-K.H. Patil, KVK, Hulkoti, Gadag, Karnataka, the cashew apple-based technologies of this Directorate [Cashew apple jam, jelly, pomace powder cookies, and fruit bar] were commercialized through the ITMU unit of this Directorate to Three small-scale entrepreneurs of Gadag District under SCSP. As a part of the commercialization of technologies, demonstrations cum hands-on training were organized under the SCSP scheme from 19th to 23rd February 2024. In this programme, Dr. J. D. Adiga, the Director, ICAR-DCR, Puttur interacted with the beneficiaries about the technical know-how of cashew cultivation, the area expansion of cashew at Gadag District and emphasized the DCR technologies especially the cashew apple utilization and their value addition in the context of huge wastage of cashew apples in the fields. Further, the lead developers of technologies Cashew apple Jam and Jelly by Dr Rajkumar A.D, Scientist, [Food Technology, ICAR-DOGR, Pune] and Cashew apple pomace powder cookies and fruit bar developed by Dr. Veena GL, Scientist, [Fruit Science, ICAR-DCR, Puttur] have briefed about the scope of cashew apple-based products and given an overview of the preparation of products, labelling, and marketing strategies and demonstrated the respective technologies developed to the licensees and hands-on training was provided to them.

5.17 Training Programme on "Cashew Cultivation and Cashew Apple Utilization" cum Distribution of inputs to the SC beneficiaries of Thrissur, Kerala

As a part of the Scheduled Caste Sub Plan (SCSP) scheme of this Directorate, the training programme was organized in collaboration with Cashew Research, Station, Madakkathara, Kerala and Department of Agriculture and Farmers Welfare, Ollukkara Block, Thrissur on 2nd March 2024. In this programme Dr. Jalaja S. Menon, Assistant Prof and Head, CRS, Madakkathara chaired the programme and addressed the gathering about the training programme of this Directorate, and emphasized the use of cashew cultivation and cashew apple utilization by preparation of value-added products. Mr. Ravi (President, Ollukkara Block panchayath), the chief guest, spoke about the importance of the training programme in today's context to become self-reliant by generating additional income out of cashew apples and encouraged Women farmers to take up small-scale processing of cashew apple for value-added products. Ms. Sathyavathi Varma, Assistant Director of Agriculture, Kerala State Agriculture Department, Ollukkara Block. spoke about various state government schemes under Agriculture and emphasized to get benefitted. Further, Dr. Manjesh G N, Scientist, [SPM&AP, Nodal officer SCSP] highlighted the Central government schemes available for farmers under SCSP and briefed them about the training programme. Besides, Dr. Rajasekhara, H Scientist, [PI. Path. The co-Nodal officer SCSP] emphasized to the trainees the proper use of inputs and to get the maximum benefit out of the training programme. As part of a training series of lectures covering aspects of cashew cultivation and cashew apple utilization, demonstrations were organized on cashew apple value-added products and softwood grafting techniques. Field visits were also covered as a part of the training programme to Bee Park, the cashew museum, the cashew varietal block and the cashew nursery of CRS, Madakkathara. This training programme was benefitted by 35 SC farmers of 4 Panchayaths of Ollukkara Block, Thrissur, Kerala. The beneficiaries were also provided with a training kit, cashew grafts and other inputs [cashew apple-based products.].

5.18 Distribution of Inputs to SC beneficiaries of Puttur taluk, Dakshina Kannada, Karnataka on Cashew Day held at ICAR-DCR, Puttur

The institute celebrated Cashew Day 2024 on 16th March 2024. On this occasion under the SCSP scheme of this Directorate inputs like brush cutters and chain saws were distributed to the SC beneficiaries of Puttur Taluk, Dakshina Kannada. A total of 24 brush cutters and 13 chain saws were provided to the beneficiaries. Further, the beneficiaries also took part in the Cashew Day celebration and visited the exhibition stalls, they were briefed about the value-added products from cashew apple, the recent varieties, and other technologies of this Directorate.

5.19 Training Programme on "Attracting Rural Youths towards Horticulture" and Distribution of Vegetable seed kits and Garden tools to SC beneficiaries under the SCSP scheme at Anegunda, Chikkamagaluru, Karnataka

As a part of the Scheduled Caste Sub Plan (SCSP) scheme of this Directorate, one-day training programme on "Attracting Rural Youths towards Horticulture' was organized followed by the distribution of vegetable seed kits and garden tools to SC beneficiaries in collaboration with K.S.N UA &HS, Agricultural and Horticultural Research Station, Anegunda, Sringeri, Chikkamagaluru district on 22nd June 2024. In this programme Dr. Narayana Swamy, Professor and Head, AHRS chaired the programme. The Chief guest of the programme Shri Vittala Hegde addressed the gathering and briefed them about the importance of growing vegetable crops in the kitchen garden. Shree Gopala K M guest of the programme highlighted about importance of agriculture for rural youths rather than shifting towards city life. ICAR-DCR Scientists delivered the lectures pertinent to the training. The trainees were taken to a progressive farmer's field at Koppa where trainees had an exposure to mixed cropping systems and fruit crop nurseries. Later the inputs were distributed to 50 beneficiaries to promote Kitchen gardening. [Organisers: Drs Manjesh G.N., Veena GL., and Thondaiman V.]

5.20 Training Programme on "Entrepreneurship opportunities in Cashew" and promotion of Nutrition gardening for farm women under the SCSP scheme

Organized a training programme for the farm women under the SCSP scheme on 25th June 2024. The training aimed to impart awareness of the entrepreneurial opportunities in cashew, emphasising scientific nursery management and cashew apple value addition for doubling their income. Dr. J Dinakara Adiga, Director, ICAR-DCR, Puttur, provided an overview of Cashew cultivation. Further series of lectures on cashew nurseries, entrepreneurship opportunities in cashew apple processing and the importance of nutrition gardening for human health were delivered. A total of 35 farm women attended the programme, and seed kits were distributed to the participants.

5.21 Training Programme on cashew production technology and promotion of nutrition garden cum input distribution at Vellarikundu, Kerala

The ICAR-Directorate of Cashew Research, Puttur in collaboration with the Chully Farmers Club, the social welfare department, and the agriculture department organized a training programme on cashew production technology in Vellarikundu for the SC farmers on 13th August 2024. The program was inaugurated by Shri. Shoby, block panchayat member and Assistant Director of Agriculture, Parappa block, Shri. Arun T. During the inaugural function Shri Nikhil, Agricultural officer, Balal panchayat and Shri Rahul, SC promoter conveyed their wishes for the success of the program. Dr. Manjesh G N, Scientist (Spices, Plantation Medicinal and Aromatic Plants) and nodal officer for SCSP, ICAR briefed about the implementation of the SCSP scheme by the Directorate. The training programme aimed to create awareness about the importance of nutrition gardens and the prospects of growing cashew in Kerala. A talk was delivered by Dr. Manjesh G N, Scientist (SPM and AP) on the scientific cultivation of vegetables and fruits for nutritional security. He also demonstrated the use of different garden tools.

Dr. Aswathy Chandrakumar, Scientist (Agricultural extension) explained the outreach activities of the institute and the services available for the farmers from the institute. This was followed by a brief interaction with the farmers where they expressed their concerns about increasing the productivity of cashew orchards. Farmers were advised to plant grafts of high-yielding cashew varieties and adopt scientific cultivation practices for better yields. The training concluded with the distribution of inputs containing seed kits of hybrid varieties of vegetables and garden tool kit to the participants. A total of 100 farmers from 7 panchayats of Parappa block participated in the programme.

5.22 Training on Cashew production technologies and distribution of Cashew grafts at Gallimukha, Kerala as a part of the plantation drive campaign

In collaboration with the Cashew Progeny Orchard, Gallimukha organized a training cum distribution of Cashew grafts for SC farmers on 20th August 2024 at Cashew Progeny Orchard, Gallimukha. The training aimed to impart scientific knowledge on planting and aftercare of cashew. The programme commenced with the introductory remarks by Shri. Sooraj N Agriculture Officer and Cashew Development Officer-In-Charge emphasized the areas where future collaboration is required with ICAR-Directorate of Cashew Research, Puttur. Dr. Manjesh G N, Scientist (Spices, Plantation, Medicinal and Aromatic Plants) and Nodal officer SCSP explained about the scheme and about the campaign launched by the Government "Ek Ped Maa Ke Naam" which is a plantation drive announced on the World Environment Day, 5th June 2024. This was followed by a talk by Dr. Rajashekara H, Scientist, Plant Pathology where he emphasized the importance of cashew and the need for value addition of cashew apple. Dr. Aswathy Chandrakumar, Scientist, Agricultural Extension briefed the audience of the services provided by the Directorate and the need for future collaborations for the betterment of the farming community. Further, Dr. Manjesh G N, Scientist (Spices, Plantation, Medicinal and Aromatic Plants) delivered a lecture on planting and aftercare of cashew grafts where he emphasized the importance of quality grafts and quality planting material. He also demonstrated how to plant the cashew grafts. This was followed by a brief lecture on the effective management of disease and pests by Dr. Rajashekhara, Scientist (Plant Pathology). The training was attended by 25 farmers and the farm staff.


5.23 Training Programme on "Good Agricultural Practices in Cashew Cultivation" and Providing inputs under the SCSP scheme at Kanabargi, Belgaum

As a part of the Scheduled Caste Sub Plan (SCSP) scheme of this Directorate, the training programme on "GAP in Cashew" and Agri-inputs for the Scheduled caste community was provided in collaboration with UHS-HR&EC, Kanabargi, Belgaum on 13th September 2024. The program was chaired by Dr. J Dinakara Adiga, Director of ICAR-DCR Puttur. Dr. Maheswarappa H. P., (Director of Research) UHS, Bagalkot, was the chief guest. In this program, Dr. Manjesh G N, Nodal officer SCSP briefed about the scheme of the Scheduled Caste sub-plan (SCSP) of ICAR-DCR and its implementation and the basis of selection of beneficiaries and conducted the training programme on "GAP in Cashew." Dr. Maheswarappa H. P., (Director of Research) UHS, Bagalkot addressed the participants and spoke about the efforts of ICAR-DCR in Cashew research and Extension activities and collaborations with the University and emphasized the Cashew sector in India. Presidential address by Dr. J.D. Adiga the Director (ICAR-DCR, Puttur) addressed the beneficiaries and informed them about the proper use of the inputs for their utilization and stressed the importance of cashew cultivation in India. Dr. Anasubai, Head, HR&EC, Kanabargi gave a detailed lecture on "Intercropping in Cashew" This was followed by the distribution of vegetable seed kits and garden tools to identified beneficiaries (35 Nos.).


5.24 Training Programme on "Nutrition Gardening and Distribution of Vegetable Seed Kits to SC beneficiaries of Andasura, Sagara Taluk, Shivamogga

As a part of the Scheduled Caste Sub Plan (SCSP) scheme of this Directorate, a day training programme on "Nutrition Gardening' was organized followed by the distribution of vegetable seed kits to SC beneficiaries at Andasura village of Sagara Taluk on 10th October 2024. In this programme, Mr. Shivaraj Basur, Assistant Horticulture Officer Sagara briefed about the Horticultural schemes for the benefit of farmers from the Government of Karnataka. Dr. Manjesh G. N. Scientist & Nodal Officer SCSP briefed about the implementation of SCSP activities and overview of Directorate and emphasis on promotion of nutrition garden. As a part of the training programme, Seed kits were distributed to the participants to promote Kitchen gardening. A total of 40 participants attended this programme.

5.25 Training programme on "Entrepreneurship Opportunities for Rural Youth in the Horticulture sector" under SCSP Programme at ICAR- KH Patil KVK, Gadag, Karnataka

As a part of the scheduled caste sub-plan programme of this directorate in collaboration with ICAR- K.H. Patil, KVK, Hulkoti, Gadag, Karnataka organized a three-day training programme on Entrepreneurship Opportunities for Rural Youth in the Horticulture sector from 7th to 9th November 2024. The program started with a welcome address by Mrs. Hemavati H. SMS, Horticulture, Co-Ordinator, of this program. During the inaugural session, Dr. Manjesh, G. N. Scientist, (SPMAP), Nodal officer SCSP, ICAR-DCR, Puttur, briefed about the implementation of SCSP programs, emphasized horticulture sector contributing towards agriculture GDP, the scope, and opportunities to take up entrepreneurship in the horticulture sector like commercial nurseries in fruits, and vegetable crops, value addition in non-food products from horticulture crops, value addition in fruits and vegetables, dry flower technologies. Later, Dr. Veena G.L., Scientist (Fruit Science), ICAR-DCR, Puttur addressed the participants and highlighted the nutritional importance of Cashew apple and highlighted the technologies for cashew apple value addition available at ICAR-DCR for commercialization to become horticulture entrepreneur and said to get benefitted by the 3 days training program.

Further, Dr. L.G. Hiregoudar, Advisor, ICAR-K.H. Patil KVK, Hulkoti, Gadag, gave a presidential address about the importance of the Horticulture sector in India and special reference to Karnataka. He inspired the participants by highlighting the successful entrepreneurs in the horticulture sector. The programme was organized for 25 participants from Gadag, District. In this program training manual on “Grameena Yuvakarige Totagarikeyalli Udyamasheelathe Avashagalu” was released for the benefit of participants.

5.26 Development of Horticulture-Based Entrepreneurship for Livelihood Improvement and Distribution of Inputs at Gadag, Karnataka

Two days training Programme on "Development of Horticulture-Based Entrepreneurship for Livelihood Improvement" and distribution of Inputs under the SCSP scheme to Schedule caste (SC) beneficiaries of Gadag District was organized from 28th to 29th November 2024 in collaboration with ICAR-K.H. Patil, KVK, Hulkoti, Gadag, Karnataka. In this program, Dr. J. D. Adiga, Director, ICAR-DCR, Puttur addressed the gathering with examples of horticulture-based entrepreneurship opportunities for improving the economic income of rural farmers.

. He also briefed about the entrepreneurship opportunities in the Cashew sector. Further, Mr. Suresh Kumbar, Retired SADH, GoK, Gadag spoke about the importance of horticulture crops in Gadag and Govt. schemes for an entrepreneur. Later Dr. Manjesh G N, Scientist, and Nodal officer SCSP briefed about the implementation of SCSP activities in Collaboration with KVK, an overview of the Horticulture sector in Agriculture GDP, and technologies available at ICAR-DCR for becoming entrepreneurs. The president of the program Dr. Sudha V. Mankani, Senior Scientist and Head ICAR-K.H. Patil KVK, Hulkoti, Gadag, briefed about the efforts of ICAR-DCR in collaboration for the implementation of the scheme and advised the participants to take up cashew-based entrepreneurship activities. The program ended with a vote of thanks by Mr. Narayan H. Bandi, SMS, Soil Science, KH Patil KVK, Gadag. Followed by the distribution of inputs (Tarpaulins 100 Nos, Vegetable seed kit 25 Nos, and 2 in1 battery sprayers 80 Nos) to the SC beneficiaries of Gadag District. The program was moderated by Mrs. Hemavathi H., SMS, Horticulture, ICAR-K.H. Patil KVK, Hulkoti, Gadag.

5.27 Training programme on "Cashew Cultivation, Plant Protection, and Value Addition and Distribution of Cashew Grafts at Sagara, Shivamogga, Karnataka

A three-day training Programme on "Cultivation, Plant Protection, and Value Addition in Cashew and Distribution of Cashew Grafts to Schedule caste (SC) beneficiaries of Sagara Taluk, Shivamogga was organized from 29th November to 01st December 2024 in collaboration with MAHRS, K.S. UAHS, Iruwakki, Shivamogga, Karnataka. In the inaugural session Dr. Sadashiva Nadukeri, Associate Professor, SPMAP, MAHRS, Iruvakki, Shivamogga briefed about the training program and its implementation. Further, Dr. J. D. Adiga, Director, ICAR-DCR, Puttur addressed the gathering and stressed upon scope and opportunities in the area expansion of Cashew in Shivamogga, Karnataka, and its relevance in the context of future horticulture farming considering the Cashew at national and international level. He also briefed about the entrepreneurship opportunities in the Cashew sector. Later Dr. Manjesh GN Scientist, Nodal officer SCSP briefed about the implementation of SCSP activities in Collaboration with the University, and an overview of Cashew technologies available at ICAR-DCR for farmers. Further, the president of the program Honourable Vice Chancellor Dr. R C Jagadeesha, KSN UAHS, Shivamogga, Karnataka briefed about the present status of cashew production, RCN requirements for industries, import, and export statistics, and value addition in Cashew and appreciated the efforts of ICAR-DCR in collaboration for the implementation of the scheme and advised the participants to take up cashew cultivation and based entrepreneurship activities.

The inaugural program ended with a vote of thanks by Dr. Siddappa, K Asst. Prof. MAHRS, Iruvakki. Shivamogga. This was followed by the distribution of Cashew grafts to the SC beneficiaries (30 No) of Sagara Taluk, Shivamogga District. The program was moderated by Dr. Sadashiva Nadukeri. Associate Professor, SPMAP, MAHRS, Iruvakki, Shivamogga, Karnataka.

5.28 Celebration of World soil day 2024 cum Seed kit distribution at Puttur

ICAR-Directorate of Cashew Research Puttur celebrated World Soil Day 2024. The theme of this year's World Soil Day is "Caring for Soils: Measure, Monitor, Manage." On this occasion, an awareness programme was organized for farmers on the topic Importance of Soil health, on 05th December 2024. A total of 42 participants attended this programme which included 24 Male and 18 Female participants. On this occasion Dr. J. Dinakara Adiga, Director, ICAR, DCR, Puttur addressed the gathering by mentioning the importance of World Soil Day, and measures to keep the soil in good health. Dr. Veena, G.L. Scientist (Nodal officer Soil Health Programme) addressed the gathering by delivering a lecture on the importance of soil tests in crop cultivation and key points to be followed during soil sampling. She also highlighted the facilities available at ICAR-DCR Puttur for testing of soil.

Dr. Thondaiman V., Sr. Scientist (SPM&AP) delivered a lecture on the Importance of Kitchen gardening and the importance of balanced nutrition in the daily diet. He also emphasized the benefits of the kitchen garden. Ms. Prajna, (YP-I), briefed about compost preparation by utilizing kitchen waste. As a part of the programme Soil health cards and vegetable seed kits were distributed to the farmers, to create awareness about the importance of soil tests and encourage kitchen gardening.

5.29 Training programme on "Scientific Cashew Cultivation," and Agri- Inputs distribution Kanker District, Chhattisgarh

The training program on "Scientific Cashew Cultivation, and Distribution of Agri-inputs" to Schedule caste (SC) beneficiaries of Kanker District, Chhattisgarh, was organized on 10th December 2024in collaboration with S.G. CARS, Jagdalpur, Chhattisgarh. In the inaugural session, Dr. Birbal Sahu, Senior Scientist, and Head, KVK, Kanker proposed a welcome note and briefed about the agricultural activities of Kanker Dist. and Dr. Vikas Ramteke, Scientist, and PI- AICRP on Cashew, S.G CARS, Jagadalpur briefed about the implementation of SCSP activities and the beneficiary selections. Later, Dr. Manjesh G.N. Scientist, SPM&AP, Nodal officer SCSP delivered a lecture on "Cashew Cultivation" and its potential in the nontraditional areas. Further, Dr. M.C. Mandawi, Scientist, Agril. Entomology briefed about the pest occurrence and its management strategies in Cashew. Dr. Devchand Salam, Scientist, Agri. Pathology delivered a lecture on "Diseases of Cashew." Further, the president of the program Dr. J. D. Adiga, Director, ICAR-DCR, Puttur addressed the participants and stressed upon scope and opportunities in the area expansion of Cashew in Chhattisgarh and spoke about the overview of Cashew in India and its relevance in the context of future horticulture farming considering the Cashew at national and international level. He also briefed about the entrepreneurship opportunities in the Cashew sector. The inaugural programme ended with a vote of thanks by Dr. Vikas Ramteke, Scientist, SG CARS, Jagadalpur. This was followed by the distribution of Cashew grafts and Agri inputs to the SC beneficiaries of Kanker Dist. The program was moderated by Dr. Devchand Salam, Scientist, Agri. Pathology, SG CARS, Jagdalpur. Chhattisgarh.

5.30 Field Day cum Training programme on "Scientific Cashew Cultivation, and Agri-Inputs distribution at Bastar District, Chhattisgarh

The "Cashew Field Day" and training programme on "Scientific Cashew Cultivation, and Distribution of Agri-inputs" to Schedule caste (SC) beneficiaries of Rajnagar, Bakwanda block, Bastar District, Chhattisgarh, was organized on 12th December 2024 in collaboration with S.G. CARS, Jagdalpur, Chhattisgarh. A field day was conducted at the farmers' field at Rajnagar, Bastar, District, Chhattisgarh. In the field day program, the practical aspects of cashew pruning technique, application of insecticides, rejuvenation/ top working techniques, and cashew soft wood grafting were carried out. This was followed by the training program on "Scientific Cashew cultivation" was organized at Rajnagar, Bastar, Dist. In the inaugural session, Dr. Bhujendra Kumar, Scientist, Agronomy, SG CARS, Jagdalpur proposed a welcome note and briefed about the agricultural activities of Bastar Dist. and Dr. Vikas Ramteke, Scientist, and PI- AICRP on Cashew, S.G CARS, Jagadalpur briefed about the implementation of SCSP activities, and scope of Cashew cultivation in the district. Later, Dr. Manjesh GN Scientist, SPM&AP Nodal officer SCSP, ICAR-DCR, Puttur delivered a lecture on "Cashew Cultivation.". Further, Dr. Bhojendra, STO, Agri. Entomology, SG CARS briefed about the pest occurrence and its management strategies in Cashew. Later, Dr. Devchand Salam, Scientist, Agri. Pathology delivered a lecture on "Diseases of Cashew and its management."

The programme ended with a vote of thanks by Dr. Vikas Ramteke, Scientist, SG CARS, Jagadalpur. This was followed by the distribution of Cashew grafts and Agri inputs to the SC beneficiaries of Rajnagar, Bastar Dist. In the presence of the Panchayat President. The programme was moderated by Dr. Dr. Bhujendra Kumar, Scientist, Agronomy, SG CARS, Jagdalpur, Chhattisgarh.

6. AGRI BUSINESS INCUBATION

6.1 ICAR IP & TM Scheme: Agri Business Incubation (ABI), ICAR-DCR, Puttur

An Agri-Business Incubation Centre (ABIC) is operating at the ICAR-Directorate of Cashew Research, Puttur, Karnataka, and supported by the Intellectual Property and Technology Management Unit, Indian Council of Agricultural Research (ICAR), New Delhi. This Centre facilitates registered incubatees to initiate business activities in the cashew ecosystem. A total of eighteen Incubatees / Companies have registered with ABIC and attended a three-day intensive incubation training on raw cashewnut processing and value addition to enrich their knowledge of scientific, technical and financial aspects.

Incubatees who had undergone training and availed incubation facility on hiring basis are; Mr. K. Purushotham, Mr. Gnanesh Karva, and three incubatees, namely Mr. Raja Arapukottai, Mr. Dhandapani, and Mr. V. Kumaran, are in the process of setting up processing units and have registered their companies under MSME/Udyam viz. M/s Prakruthi Cashews, Markanja, Sullia; M/s Kumer lakshmi Overseas AgriFood Private Limited, Siddipet District, Telangana; and M/s VM Cashew, Virudhunagar, Tamil Nadu. Budding entrepreneurs like Mr. Ashwath Hebbar and Mr. Ritesh Ram Kumar, who have registered with ABIC and underwent training with the intention of venturing in to business related to cashew nut processing and value addition of cashew apples and kernels, availed the State-of-the-art processing facility for a stipulated period, on a custom-hiring basis, after signing Memorandum of Understanding (MoU).

Various business promotional activities were undertaken during the reporting period, including conducting awareness programs at KVKs and for Women Self-Help Groups, participating in the Caju Fest organized by the Karnataka Cashew Manufacturers Association in collaboration with Fiza by Nexus Mall, Mangalore and attending the Jackfruit Fest in Puttur, Karnataka. Additionally, ABIC activities and ICAR-DCR technologies were showcased at the National Horticulture Fair and the Industrial Meet organized by the ICAR-Indian Institute of Horticultural Research, Bangalore, to inspire audiences to undertake business activities related to cashew. Two numbers of Entrepreneurship Development Programmes on cashew nut processing and value addition were conducted for 35 nos. of Farmers and 30 nos. of Scholars from M.S. Ramaiah University of Applied Science, Bangalore. A website (https://cashew.icar.gov.in/abi/) was exclusively designed for more visibility and publicity on Agri-Business Incubation activities during this period. During the reporting period, a total of 18 nos. of 3-days trainings offered under ABI for registered incubatees generating revenue to the extent of ₹4,50,330/-

Incubatees receiving certificate from Director, ICAR-DCR, Puttur

Received best stall award from Ms. Shobha Karandlaje, M.P and Minister of State for Agriculture and Farmers' Welfare

Village-level awareness program at Karnataka

At NITTE University, Karnataka

Technoloagy mentoring session for Officials from Paithal Hills FPO, Kannur, Kerala

EDP on Cashewnut processing and Value addition for university scholars

Mr. Purushotham and Mr. Vasanth performingmanual peeling of cashew kernels

Caju fest at Fiza byNexus mall Karnataka

Incubation training on Value addition of cashew kernels

Incubatee working with mechanized de shelling m/c

Incubatees learning about steam boiling process

Mr. Ritesh Ram Kumar exchanging MoU for utilizing cashewnut processing facilities at ICAR-DCR, Puttur

EDP on Cashew Value Added Products Formulation

Awareness program at KVK, Mangalore, Karnataka

7.AWARDS/RECOGNITIONS/RESOURCE PERSONS/LECTURES

7.1 Awards and Recognitions

Name of the Scientist	Title	Photo
Dr. Aswathy Chandrakumar	• Acted as external thesis evaluator and evaluated a PG thesis entitled "Dynamics of labour in-migration in agriculture development: A case of Ernakulam district, Kerala" from Kerala Agricultural University. • Reviewed a research article entitled "Assessing the Continuing Education Needs of InACC Rice Farmers in Agroforestry Systems in Benue and Nasarawa States of Nigeria" for Indian Journal of Agroforestry in October, 2024. (2024 NAAS rating 5.19)	
Dr. Balasubramanian D	• II BEST stall award for the exhibition stall put up at National Horticulture Fair – 2024 conducted at ICAR-Indian Institute of Horticultural Research, Hesaraghatta, Bangalore, Karnataka (5th -7th March, 2024) • Acted as 'Panel Member' during National Technology Day conducted at Nitte University, University Enclave, Mangalore, Karnataka (11th May, 2024) • Acting as 'Nodal officer' and 'Member of Expert Committee' for the Contractual Project on 'Scaling up of Cashew Value Chain through Area Expansion and Improving Value Addition Processes' (3rd May, 2024) • Technology Certificate issued by ICAR, New Delhi for Textural properties of coconuts for designing and developing processing machineries.Pandiselvam R, M R Manikandan, D Balasubramanian, Shameena Begum and S V Ramesh 16th July 2024.	
Dr. Babli Mog	• Inducted into PG faculty member of regional academic hubs of IARI-Bengaluru hub of ICAR-IARI in Plant Physiology. • Received Scientist of the year award in the International Conference on Multidisciplinary approaches in Engineering, Science, Agriculture and Social Studies through hybrid mode during 3th to 4th June, 2023 organized by Dr. Bhimrao Ambedkar University, Agra • Received 2nd Best ORAL presentation award (Online mode) in the technical session THEME 1 for the topic "Pollen morphological study and the effect of temperature on the pollen germination of cashew (Anacardium occidentale L.) varieties" during the "International Conference on Agriculture, Environment and Sustainable Development (ICAESD – 2024)" from 20th to 21st March 2024, organized by the Department of Horticulture, Rajiv Gandhi University, Arunachal Pradesh, India. • Received Best Women Scientist Award in the 1st international conference on 'Natural Resource Management and Environmental sustainability for future generations' on 20th April, 2024 (applied online) organized by Government college, Hisar and Vital Biotech, Kota • Received Women Young Scientist Awardconferred by Society of Plant Research,VEGETOS, Springer during National Conference on 'Good Agricultural Practices of SelectedMedicinal Plants and SPR- Mini Symposium onBiotechnological and Genomic tools to combatclimate change' organized by Aligarh MuslimUniversity, Aligarh, UP, India during November16-18, 2024 • Received Young Women Scientist Award conferred during International Conference on 'Current Innovations and Technological Advances in Agriculture and Allied Sciences jointly organized by Guru Kashi University, Talwandi Sabo (ICAR accredited) and Just Agriculture Education Group and ISASTR, Noida during 29-31 August, 2024 • Life Member of Indian Society of Agriculture Science and Technology Research (ISASTR), Noida, India (Enrolled on date 29 August, 2024 and membership No: L/2038 • Received Best Research Scientist of the Year-2024during International Conference on Agritech. Intelligence and Beyond: Cutting EdgeInnovations in Agriculture and Allied Sciencesorganized by SKUAST-Kashmir, Vital BiotechKota and Agriculture Forum for TechnicalEducation of Farming Society, 15-17th October,2024	

Name of the Scientist	Title	Photo
Dr. Bhagya H P	• Recognized as ICAR-IARI PG faculty member in Horticulture discipline for IARI-IIHR Hub on 23rd January 2024 onwards • Nominated from ICAR-DCR, Puttur, to coordinate with ICAR-NBSS&I.UP. Nagpur for the preparation of commodity ATLAS for collaboration • Nominated as Expert for cashew area expansion at Meghalaya • Reviewed Research Article in Journal of Advances in Biology and Biotechnology on 18th April, 2024 • Reviewed research article in Journal of Horticultural sciences on 07th June 2024. • Participated and acted as a resource person in the cashew awareness campaign and area expansion programs organized in collaboration with Assam Agricultural University under the NEH funding of the AICRP on cashew from March 27 to March 30 at HRS, Kahikuchi. • Act as resource person Training and pruning in cashew during capacity building of farmers on scientific cashew production technologies to ST farmers during 31st January to 2nd February, 2024 • Act as Resource person for 5 days training programme on "Cashew Production and Processing Technologies" organized at ICAR-DCR Puttur for ST farmers from Andhra Pradesh during 12th -16th February, 2024.	
Dr. Eradasappa E	• Acted as external expert for Selection committee for the selection of Project fellow (01 Post) on contract basis under the project "Seed production in coconut, arecanut. cocoa (Under ICAR project on seed production in agricultural crops)" held on 25th October 2024 at I0:00 AM at ICAR-CPCRI-RS, Vittal. • Acted as external member of selection committee for the selection of Project fellow (01 Post) and Project Assistant (08 Post) on contract basis under the Revolving Fund Scheme (10th January 2024 at 10.00 a.m. at ICAR- Central Plantation Crops Research Institute-Coconut Research Center, Kidu, D.K District. • Acting as Expert Committee Member, BIS-FAD10 Panel-IV (12th March 2024 to till date) and working on underutilized fruits and vegetables standards (for cashew)	
Dr. Jyoti Nishad	• Inducted into PG faculty member of regional academic hubs of IARI-Bengaluru hub of ICAR-IARI in Food Technology. • Received Commendation letter from ICAR-CIRCOT, Mumbai for best presentation during the short course on "Advances in Applications of Nanotechnology in Agriculture" • Served as Business Coach for two teams in a government of Delhi initiative Business Blaster 2023, New Delhi • Qualified All-India Agricultural Research service with second rank and selected as Scientist, Food Technology at ICAR-Directorate of Cashew Research, Puttur, Karnataka in 2023. • Life member of Association of Food Scientists and Technologists (AFSTI), India • Member of Society for Advancement of Human and Nature SADHNA, Dr. YS Parmar University of Horticulture and forestry, Nauni, Solan, Himachal Pradesh, India • Member of International Multidisciplinary Research Foundation (IMRF), India • Received Women Scientist Award 2024 conferred by PISRF, India, 21st October 2024. • Inducted into PG faculty member of regional academic hubs of IARI-Bengaluru hub of ICAR- IARI. • Recognized as research guide for PG programmes of regional academichubs of IARI-Bengaluru hub of ICAR-IARI.	

Name of the Scientist	Title	Photo
Dr. Manjesh G N	• Recognized as Question Paper Setter for B.Sc. (Hons) of Odisha University of Agriculture and Technology, Bhubaneswar for the course FS-226- Plantation Crops. • Recognized and deputed as an expert on "Cashew Production and Processing Technology" during the "Horticulture Fair" organized by ICAR-CPCRI, Vittal on 28th February 2024 • Recognized and served as Rapporteur in the theme on "Biodiversity conservation related to horticulture" At the International Conference on Precision Horticulture (ICPH-2024) held at HCRI, Periyakulam, Tamil Nadu from 22-24th Aug 2024 • Recognized and deputed as an expert on the topic "'Recent Advances in Cashew" at UHS-College of Horticulture, Mysore, Karnataka on 15.10.2024	
Dr. Manjunatha K	• Received Best Research Paper Award for the research paper entitled "Evaluation of fruit detachment forces and related characteristics reveal differential fruit detachments at developmental stages and cultivar differences in cashew" published in Scientia Horticulturae" (Authored by Drs. Manjunatha K., Siddanna Savadi, J.D. Adiga, D. Balasubramanian, Ravindra Naik, Muralidhara B.M., Chethan C.R	
Dr. Mohana G S	• Recognized as a member of the Doctoral Advisory Committee of Mr. Kedar Sawant, Ph.D. Scholar at the Dept. of Information and Communication Technology, MIT, Manipal. • Recognized as the guide for carrying out the group mini project by three B.Sc. students of St. Philomina College, Puttur on Basic Cashew Breeding Techniques • Recognized as a member of the IMC of CPCRI, Kasaragod from 09th February 2024 for three years External Expert, SRF upgradation committee, Department of Biosciences, Mangalore University, Konaje, Mangalore • Expert Member in the Assessment Committee for Technical Staff Category-III (Lab Technician) at NRC- Banana, Trichy, Tamil Nadu • Chairman, Departmental Promotion Committee, ICAR- DCR, Putturfor promotion of UDC • External Member for selection of YP-II in the project on DUS center for Cocoa at CPCRI, Vittal Regional Station on 09th September 2024 • External Member for selection for the selection of SRF in the AICRP, PC, Palms at CPCRI, Kasaragod during 27th August 2024	
Dr. Rajashekara H	• Nominated as Data Officer from the Directorate for participation in the Round-II study on evaluation of innovation excellence indicators by CII • Acted as reviewer in reputed journals of Plant Pathology in national and international like Plant Disease, Pest Management Science, Frontiers in Plant Science (Plant Pathogen Interactions), Indian Phytopathology, European Journal of Plant Pathology, Cogent Food and Agriculture, Discover Life. • Acted as Course Associate in PL PATH 509- Disease Resistance in Plants (2+0) for MSc students from ICAR-IIHR hub.	
Dr. Siddanna Savadi	• Awarded Young scientist award in recognition of the excellent quality paper presentation titled "Identification and comprehensive genetic characterization of cashew (Anacardium occidentale L.) accessions with special characters as genetic stocks for genetic improvement" in the International Conference on Advances and Applications of Biotechnology (ICAAB 2024) organized by School of Life Sciences, B.S. Abdur Rahman Crescent Institute of Science and Technology, Chennai in association with University of East London, UK., Tamil Nadu State Council for Science and Technology, National Council for Science & Technology Communication, Department of Science and Technology, Govt. of India held on July 30 & 31, 2024. • IARI Faculty and Research Guide ship in IIHR academic hub of IARI.	

Name of the Scientist	Title	Photo
Dr. Vanitha K	• Received ICAR certification for the technology 'Artificial nests for native bee pollinators (Braunsapis spp.) of cashew during 16 July 2024. Team consists of Dr. K. Vanitha, Dr. T.N. Raviprasad, Dr. Veena, G.L., Dr. Babli Mog and Dr. H. Rajashekara. • Bagged 'Best Researcher Award – 2024' by Society of Agricultural Research and Social Development (SARSD), New Delhi conferred during 7th International Conference on Advances in Agriculture Technology and Allied sciences (ICAATAS-2024) at the Neotia University (ICAR Accredited), West Bengal, 15th-16th September, 2024. • Acted as invited speaker in 'International Conference on Bees and other arthropods: Influence sustainable crop yield' on 16th October, 2024 organized by the School of Agriculture, Bharath Institute of Higher Education and Research, Selaiyur, Tambaram, Chennai -73. • Served as Rapporteur in the 'International Conference on plant protection in Horticulture (ICPPH – 2024): Advances and challenges' held at ICAR-Indian Institute of Horticultural Research, Bengaluru during 25th -27th September 2024.	
Dr. Veena G L	• Inducted as research guide for P.G. programmes in the discipline of Fruit science IARI-IIHR Bengaluru Hub on 8th August 2024 (No. TGS-I/1-421/AC/2024). • Nominated as a Member of the executive Committee of Indian Society lor Plantation Crops journal biennium 2024-25. • Nominated as Member of the Board of Examiners for MSc (Food Science and Nutrition) the examination in Department of Biosciences Mangalore University • Acted as Question Paper setter for Food science and Nutrition Course of Mangalore University for the period of 2024-25 • Nominated as Question Paper Setter for B.Sc. (Hons) of Odisha University of Agriculture and Technology Bhubaneswar for the course FSC 123- Tropical and Sub tropical fruits • Discharged the duties as presiding officer for Karnataka legislative assembly election in April 2024 • Cleared Parangat examination conducted by Rajbhasha Vibhag, Hindi Shikshan Yojana Government of India • Deputed as resource person for the DAESI batch- VI programme for delivering lecture on Entrepreneurship opportunities and value addition in cashew apple on 02nd August 2024. • Awarded as Young Pomologist by the Indian Pomological Society during International conference on Precision Horticulture ICPH 2024 from 22nd to 24th August 2024 • Acted as rapporteur for Biodiversity conservation related to Horticulture session in international conference on precision Horticulture on 22nd to 24th August 2024. • Acted as external member for selection of young professional-II for contractual research held at ICAR-CPCRI, Regional station Vittal on 8th October 2024.	
Mr. Prakash G Bhat	• Nominated as Industry/Corporate Sector/Allied Areas Representative of the Board of Studies (BoS) for the subject Hindi by St. Philomina College (Autonomous) Drabe, Puttur and Vivekananda College of Arts Science and Commerce(Autonomous), Nehru Nagar, Puttur by the respective colleges.	

7.2 Resource Person / Lecture delivered

Name of the Scientist	Title and Venue	Photo
Dr. Aswathy Chandrakumar	• Field visit for monitoring and evaluation of FLD plots established in Puttur and advisories were given to farmers. 10 FLD plots were visited	23rd January, 2024
	• Resource person and explained the activities of ICAR-DCR, Puttur and explained about Cashew museum in the training programme "Capacity building of farmers on scientific cashew production technologies" organized under TSP in ICAR-DCR, Puttur	1st February, 2024
	• Resource person and delivered a lecture on "Prospects of Cashew cultivation in India" during the 5 days training program on "Cashew Production and Processing Technologies" organised under TSP at ICAR-DCR, Puttur	13th February, 2024
	• Advisory on the establishment of a Cashew orchard to Shri. Krishna Murthy Rao at Moodabidre, DK, Karnataka.	21st May 2024
	• Resource person and explained the activities of ICAR-DCR, Puttur and explained about Cashew museum in the training programme "Entrepreneurship opportunities in Cashew" organized under SCSP in ICAR-DCR, Puttur	25th June 2024
	• Deputed as a Resource person and delivered a lecture on "Research Paradigm of Farmer Organisation" during the online training programme on ""Farming Futures: Nurturing Extension Professionals for Empowering Farmer Organization" organised by KAU-CTI in collaboration with MANAGE, Hyderabad.	26th July, 2024
	• Deputed as a Resource person and delivered lecture on "Prospects of Cashew cultivation and briefed about the activities of ICAR-DCR, Puttur during the one-day training programme on "Promotion of Nutrition Cardening and Production Technology of Cashew" organized under SCSP programme in collaboration with Chully Farm Club, Vellarikundu, Balal Panchayath, Kasaragod Dist., Kerala	13th August, 2024
	• Field visit for monitoring and evaluation of 7 FLD plots established in Parappa block of Kasaragod district and advisories were given to farmers.	27th November, 2024
	• Monitoring of demo plot established in Cashew Progeny Orchard, Galimukha, Kasaragod	29th November, 2024
	• Field visit for monitoring and evaluation of 7 FLD plots established in Kasaragod and advisories were given to farmers.	11th December, 2024
Dr. D. Balasubramanian	• Delivered lecture on Processing Mechanism and Value addition in Cashew in the National Level Training (NLT) conducted by Directorate of Cashew and Cocoa development (DCCD), Cochin at Cashew Research Station, KAU, Madakkathara, Thrissur, Kerala	27th to 29th January, 2024
	• One day stakeholders' consultation workshop on 'Unlocking opportunities of Plantation Crops sector in Meghalaya conducted at Shillong, Meghalaya.	2nd February, 2024

Name of the Scientist	Title and Venue	Date
	• Delivered lecture on 'Cashewnut processing in India - Scope and Challenges' during 5 days training programme on "Cashew Production and Processing Technologies" conducted at ICAR-Directorate of Cashew Research under TSP.	14th February, 2024
	• Delivered lecture on 'Entrepreneurship development in cashew ecosystem & role of Agribusiness Incubator.' during 5 days training programme on "Cashew Production and Processing Technologies" conducted at ICAR-Directorate of Cashew Research under TSP.	14th February, 2024
	• Exhibition stall put up for ICAR-DCR and ABIC at National Horticulture Fair – 2024 conducted at ICAR-Indian Institute of Horticultural Research, Hesaraghatta, Bangalore.	5th to 7th March, 2024
Dr. Bhagya H P	• Delivered a lecture on Training and pruning in cashew during capacity building of farmers on scientific cashew production technologies to ST farmers	1st to 2nd February, 2024
	• Delivered a lecture on canopy management in cashew during 5 days training programme on "Cashew Production and Processing Technologies" organized at ICAR-DCR Puttur for ST farmers from Andhra Pradesh	12th to 16th February, 2024
	• Organized a training program on cashew-based cropping systems in collaboration with the Rotary Club, Puttur at ICAR-DCR, Puttur.	20th February, 2024
	• Coordinated and exhibited ICAR-DCR technology during Cashew Day 2024, celebrated at ICAR-DCR Puttur	16th March, 2024
	• Participated in the training on "Plant Quarantine Procedure for Import and Export'' conducted at National Institute of Plant Health Management, Hyderabad	6th to 10th May, 2024.
	• Participated and Exhibited ICAR-DCR technologies at Jackfruit mela conducted at Jain Bhavan Puttur.	24th to 26th May, 2024
	• Field survey has been taken up to identify suitability of cashew cultivation as apart of consultancy project of MBMA for area expansion of cashew in Garo hills of Meghalaya.	23rd to 27th June, 2024
Dr. D. Balasubramanian Ms. Divya and Mr. Annu	• Exhibition stall put up for ICAR-DCR and ABIC at Cashew Fest, organized by Karnataka Cashew Manufacturer Association (KCMA) in collaboration with Fiza Mall at Mangalore, Karnataka	20th to 21st April, 2024
Dr. D. Balasubramanian Dr Veena G. L. and Dr. Jyoti Nishad	• Exhibition stall put up for ICAR-DCR and ABIC at National Technology Day conducted at Nitte University, University Enclave, Mangalore, Karnataka	11th May, 2024
Dr. D. Balasubramanian Dr. Bhagya, H. P, Dr. Jyoti Nishad, Mr. Prakash G. Bhat and Ms. Divya	• Exhibition stall put up for ICAR-DCR and ABIC during Jack Fruit Fest-2024 conducted at Jaina Bhawana, Puttur, Karnataka	24th to 26th May, 2024.
Dr. Jyoti Nishad	• Lecture was delivered on "Value addition of Cashew nut" in 5 days training programme on "Cashew Production and Processing Technologies"	12th to 16th February, 2024
	• Lecture on value addition of cashew kernels was delivered to college students of MS Ramaih college	20th February, 2024
	• Lecture on Labelling & Packaging of Processed Cashew Apple and Kernels was delivered to college students of MS Ramaih college	20th February, 2024
	• Exhibited the products and technologies developed at ICAR-DCR in horticulture fair organized by ICAR-CPCRI regional station, Vittal	28th February, 2024
	• Delivered guest lecture on "Freezing of Food" to Postharvest Engineering students of AMITY University, Noida	03rd April, 2024
	• Exhibited the products and technologies developed at ICAR-DCR in NITTE Mangalore: National Technology Day celebration at NITTE University, Paneer campus, Deralakatte	11th May, 2024

Name of the Scientist	Title and Venue	Date
	• Exhibited the products and technologies developed at ICAR-DCR and Agri Business Incubation Center of this Directorate in Fruit celebration day organized at Jaina Bhawan, Puttur	24th to 26th May, 2024
	• External member of paper setting for B. tech. Food Technology, RPCAU, Pusa, Samstipur Bihar (Shift to recognition)	June, 2024
	• Lecture was delivered on "Importance of Cashew Apple and its Value Addition" in 1 day training programme on "Importance of cashew apple for nutritional security and scope of value addition"	6th September, 2024
	• Delivered online lecture on "Cashew Apple Valorization: A Waste to Wealth Approach"	16th September, 2024
Dr. Manjesh G.N.	• Delivered lecture on the Importance of micronutrients in Cashew under project "Drone Technology Demonstration" funded by Central Sector Scheme of A&FW, GoI. to farmers of DK, Karnataka.	10th January, 2024
	• Delivered a lecture on "Entrepreneurship opportunities in Horticulture" during the programme on "Hortipreneurship for livelihood improvement in rural youths" held at Hulkoti, Gadag, Karnataka.	16th January, 2024
	• Delivered a lecture on "Commercial nursery management in Cashew" during the programme on "Hortipreneurship for livelihood improvement in rural youths" held at Hulkoti, Gadag, Karnataka.	16th January, 2024
	• Participated and displayed the exhibits at the Horticulture Fair held at ICAR-CPCRI, Kidu, DK, Karnataka.	28th February, 2024
	• Delivered a lecture on Cashew Production and an Overview of ICAR-DCR activities in the training programme on "Cashew Cultivation and Cashew Apple Utilization" at Thrissur, Kerala.	02nd March, 2024
	• Exhibited DCR technologies during the celebration of Cashew Day 2024.	16th March, 2024
	• Advisory on the establishment of a Cashew orchard to Shri. Krishna Murthy Rao at Moodabidre, DK, Karnataka.	21st May, 2024
	• Delivered a lecture on "Opportunities in Horticulture Sector" during the programme on "Attracting the rural youths towards Horticulture held at Sringeri, Karnataka.	22nd June, 2024
	• Acted as a resource person and delivered a lecture on "Entrepreneurship opportunities in Cashew Nursery" during the programme on "Entrepreneurship opportunities in Cashew" and promotion of Nutrition Gardening" held at ICAR-DCR, Puttur	25th June, 2024
	• Delivered a lecture on "Nutrition gardening for human health" during the programme on "Entrepreneurship opportunities in Cashew" and promotion of Nutrition Gardening held at ICAR-DCR, Puttur	25th June, 2024
Dr. Manjunatha K	• Demonstrated a drone technology in Cashew in the training programme entitled "Capacity building of farmers on scientific cashew production technologies under TSP scheme" at ICAR-DCR, Puttur	02nd February, 2024
	• Delivered a guest lecture on the topics entitled "Mechanization in Plantation Crops" and "Applications of UAV for Crop Protection" in a five-day training program for Andhra Pradesh's ST farmers on "Cashew Production and Processing Technologies," held at ICAR-DCR, Puttur	12th to 16th February, 2024
	• Delivered a guest lecture on the topics (1) Farm Mechanization – Scope and Importance, (2) Repairs and Maintenance of Farm Implements and Machinery and (3) Custom hiring of Farm Machinery in the programme "Diploma in Agriculture Extension Services for Input dealers (DAESI)" for Batch-VI organized by ICAR - Krishi Vigyan Kendra, Mangaluru.	03rd May, 2024
Dr. Mohana, G.S	• Lecture delivered on 1) Cashew Genetic resources in India and 2) ICT applications in cashew during the 5-day training program under TSP on cashew production and processing technologies at ICAR- DCR, Puttur	12th to 16th February, 2024

Name of the Scientist	Title and Venue	Date
Dr. Rajashekara H	• Resource person for District Level Seminar on wilt and anthracnose: emerging diseases of cashew in the DCCD sponsored program held (online) at Shaheed Gundadhur College of Agriculture and Research Station, Kumhrawand, Jagdalpur, Chattisgarh • Delivered a lecture in training program organized under TSP Scheme of the Institute on Cashew Diseases: Identification and their Management	12th February, 2024 14th February, 2024
Dr. Vanitha K	• Delivered an online lecture on 'insect pests of cashew and their management' to the M.Sc., graduates of ICAR-CICR Education Hub on 15th July 2024. • Delivered a lecture on 'Bees are vital for sustained food supply and biodiversity conservation' in the 'International Conference on Bees and other arthropods: Influence sustainable crop yield' on 16th October, 2024 organized by the School of Agriculture, Bharath Institute of Higher Education and Research, Selaiyur, Tambaram, Chennai -73. • Delivered a lecture on the topic of "Pest and Disease Management in Cashew crop" to the trainees of MANAGE sponsored Programme "Diploma in Agriculture Extension Services for Input Dealers (DAESI) Batch-VI" organized by ICARKVK (DK), Kankanady, Mangalore on 13th September 2024.	15th July 2024 16th October, 2024 13th September 2024
Dr. Veena G L	• Delivered a lecture in Hindi at DCCD sponsored District level seminar on Cashew Cultivation programme of Jagadalpur held on 12th February 2024 • Delivered a lecture on Value addition of Cashew apple in 5 days training programme on Cashew production and processing technologies • Delivered a lecture on Utilization of Cashew apple and quality testing and Hands on training on cashew apple processing in a training programme on Raw Cashewnut processing and value-added products of cashew apples at ICAR-DCR Puttur from 19th to 21st February 2024. • Acted as resource person and delivered a special lecture on "Waste to wealth adding value to Cashew Apple" on occasion of Cashew Day 2024 at ICAR-DCR Puttur • Participated and displayed the ICAR-DCR developed technologies in National Technology Day at NITTE University Mangalore • Delivered a lecture on "Opportunities in Fruit Crop Sector" one day training programme on Attracting Rural Youths towards Horticulture collaboratively with K.S.N.UA and HS- Agricultural and Horticultural Research Station Anegunda Sringeri to SC beneficiaries • Acted as Resource person and delivered a lecture on Valorization in Cashew apple waste to wealth in Entrepreneurship opportunities in cashew and promotion of nutrition gardening cum seed kits distribution at ICAR_DCR Puttur	12th February, 2024 14th February, 2024 20th February, 2024 16th March, 2024 11th May, 2024 21st June, 2024 25th June, 2024

8. PUBLICATIONS

8.1 Research Paper/ Review Articles

International and National

Anitha Pedapati, Mathur R K, Ravichandran G, Suresh, K, Kalyana Babu, B and Bhagya H.P, 2024.Assessing D×D oil palm (Elaeis guineensis) genotypes for relevant bunch traits: Implication for promising breeding lines development. Indian Journal of Agricultural Sciences. 94(9): 964-970.

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Chethan, C. R., Manjunath, K., Sreekanth, D., Pawar, D. V., Dubey, R. P., Singh, P. K, Mishra, J. S., 2024. Opportunities for Improved Mechanical Weed Management in India. Weeds – Journal of Asian-Pacific Weed Science Society, 6 (1): 34-52. Francis, F., Alimudeen, S., Valsalan, N., Dominic, D. M., and Chandrakumar, A, 2024. Stress and its Sources among Professional Students of Kerala. Biological Forum – An International Journal, 15(6): 715-719.

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8. 2 Book / Book Chapter

Asna, A.C., Jalaja S. Menon, Nasiya Beegum, A.N., Mohana, G.S., T.N. Raviprasad and J.D. Adiga, 2024, Minimum descriptors of cashew germplasm accessions, Catalogue-II. 43 p. Cashew Research Station, Madakkathara, Thrissur, Kerala.

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8.5 Technical/Popular articles/ customized instruction materials

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Balasubramanian, D. 2023. 'Road map for developing quality value-added products from cashews and popularizing and commercialization for domestic market to reduce dependence on export'. Submitted to Director's Office in response to ATR for Review Meeting of ICAR Institutes under the Horticulture Science Division of ICAR conducted on 29th May, 2023.

Balasubramanian, D. 2024. Technical report on the issues related to pollution due to drum roasting process of raw cashewnuts in practice at Kollam, Kerala. Responded to letter from Director, Directorate of Cashew and Cocoa Development, Kochi, Kerala on 12th September, 2024.

Bhagya H. P, Dinakara Adiga J, Shamsudheen M, Veena G L, Thondaiman V., Babli Mog, Vanitha K, Manjesh G N, Manjunatha K and Aswathy C, January, 2024. Canopy Management in Cashew through Training and Pruning Techniques. Agri Gate- An International Multidisciplinary monthly e magazine (ISBN: 978-81-965582-9-1). 4(1): 24-33.

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8.6 E-PUBLICATIONS

Bhagya H.P., Adiga, J.D., Shamsudheen, M., Veena, G.L., Thondaiman, V., Babli Mog, Vanitha, K., Manjesh, G.N., Manjunatha, K and Aswathy, C., January, 2024. Canopy Management in Cashew through Training and Pruning Techniques. Agri-Gate-An International Multidisciplinary monthly e-magazine (ISBN: 978-81-965582-9-1).4(1):24-33.

Vanitha, K.,T.N. Raviprasad, Rajashekara H. 2024. Cecidochares connexa an introduced biocontrol agent for Siam weed, Chromolaena odorata, Kerala Karshakan - e journal: 34-38.

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8.7 Participation and presentation in Symposia/Workshops/Seminars

Name of the Scientist	Title
Dr. Aswathy Chandrakumar	• ICAR-DCR established a stall for showcasing cashew production technologies in the Horticulture Fair organised by ICAR-CPCRI, Regional station, Vittal on 28th February, 2024 at Vittal. Dr. Aswathy Chandrakumar, Dr. Jyoti Nishad, Dr. Bhagya H P, Mr. Chetan (Contractual staff) were deputed to set up the stall. • ICAR-DCR participated in the National Horticulture Fair organised by ICAR-IIHR, Bengaluru from 5th – 7th March, 2024. The stall was awarded 2nd Best prize.
Dr. Balasubramanian, D.	• Attended training program on 'Innovation Management' conducted by ICAR-National Academy of Agricultural and Research Management, Hyderabad from 8th to 12th July, 2024. • Attended one training on 'Grafting plants and other perennial crops' conducted at Yashasvi Nursery, Puttur, Karnataka on 17th July, 2024. • Attended "Working Group on Post-Harvest Engineering and Technology for Horticulture" held in New Delhi on 31st July 2024 at the Lecture Hall, NASC Complex, ICAR, New Delhi. • Participated in the 2nd ICAR-IIHR, Industrial Meet 2024 conducted at ICAR-Indian Institute of Horticulture Institute (ICAR-IIHR), Hesaraghatta, Bangalore on 24th October 2024.
Dr. Bhagya H P	• Participated in XIVth Scientific Advisory Committee (SAC) Meeting of ICAR-Krishi Vigyan Kendra (D.K), Mangalore on 6.01.2024. • Participated in AGM, 2023 on Cashew at Kerala Agricultural University, Thrissur, Kerala organized by Cashew Research Centre, Madakkathara (AICRP centre) during 17th to 19th January, 2024 • Participated and acted as a resource person in the cashew awareness campaign and area expansion programs organized in collaboration with Assam Agricultural University under the NEH funding of the AICRP on cashew from March 27th to March 30th at HRS, Kahikuchi. • Participated in the training on "Plant Quarantine Procedure for Import and Export" conducted at National Institute of Plant Health Management, Hyderabad from 6th May to 10th May 2024. • Participated and Exhibited ICAR-DCR technologies at Jackfruit mela conducted during 24th to 26th May 2024 at Jain Bhavan Puttur. • Participated and given oral presentation on 'carbon sequestration potential in cashew (Anacardium occidentale) plantation' in 3rd International conference on "Climate-smart Nutri-sensitive Integrated Farming System for Gender-equitable Sustainable Agriculture: Prospects and Challenges (ICNSFS-2024) during November 06-08, 2024 at ICARICAR-CIWA, Bhubaneswar, Orissa, India.
Dr. Jyoti Nishad	• Attended 112th Foundation Course for Agricultural Research Service (FOCARS) at ICAR National Academy of Agricultural Research Management (NAARM), Rajendra Nagar, Hyderabad Training • Attended one-week online training programme on "Digital Competency, New Tools and Softwarefor Efficient Computer Applications" which is organized by ICAR-Indian Agricultural Statistics Research Institute (IASRI) • Attended short course training programme on "Advances in Applications of Nanotechnology in Agriculture" organized by ICAR- Central Institute for Research on Cotton Technology (ICAR-CIRCOT), Mumbai, India. • Attended ADP on "Cultivation and harvesting of Spirulina biomass towards developing value-added product", Division of Microbiology, ICAR- Indian Agricultural Research Institute (ICAR-IARI), New Delhi • Attended Capacity Building Program on "Building Successful Incubation Ecosystem" at ICAR-National Academy of Agricultural Research Management (NAARM), Rajendra Nagar, Hyderabad • Attended 3rd International Conference on "Climate-Smart Nutri-Sensitive Integrated Farming System for Gender-equitable Sustainable Agriculture: Prospects and Challenges (ICNSFS-2024)" at ICAR-CIWA, Bhubaneswar Orissa, India

Name of the Scientist	Title
Dr. Manjunatha K	• Attended the SRIJAN: Orientation programme for ICAR- ZTMCs/ITMUs held on 17-19th January 2024 at Lecture Hall, 02nd Floor, NASC Complex, New Delhi. • Attend the Board of Studies meeting of Dept. of Agricultural Engineering, Alvas Institute of Engineering & Technology, Moodabidri on 19th September 2024 as a member for crafting the curriculum and syllabus and to give insights into the latest technological advancements in the field of Agricultural Engineering (FMP).
Dr. Manjesh G N	• Participated in 21-day -CAFT program entitled "Advanced Forecasting Techniques in Agriculture Science Research" organised by ICAR-IASRI, New Delhi. • Participated in training on "Grafting plants and other perennial crops" held at Yashasrvi Nursery, Puttur. D.K. Karnataka • Participated and presented an oral presentation on "Major Elemental Composition of Cashew Nut in relation to modified Biologische Bundesantalt. Bundessortenamt" and Chemische Industrie (BBCH) at the International Conference on 'Precision Horticulture (ICPH- 2024) held at HCRI, Periyakulam, Tamil Nadu. • Participated and displayed the exhibits at the Horticulture Fair held at ICAR-CPCRI, Kidu, DK, Karnataka.
Dr. Mohana G S	• Participated in the online workshop on Cultivating Tomorrow: Advancing digital agriculture through IoT and AI, March 18-19, 2024, organized by the Horticulture Science Division, ICAR, New Delhi. • Attended the webinar on Dynamic Digital Presence on 07th October 2024 organized by ICAR- NAARM, Hyderabad • Participated in the workshop on Geospatial Applications in Plantation Crops on 01-08-2024 at CPCRI, Kasaragod jointly organized by CPCRI, Kasaragod, and Regional Remote Sensing Center – South (RRSC-S), NRSC, ISRO, Bangalore • Attended online the Editor's workshop -Enabling a Research Ecosystem conducted by the ICAR, New Delhi on 24th September 2024 • Participated as a resource person in Krishimela at KSNUAHS, Shimoga on 20th October 2024 and presented a talk on Cashew cultivation and other opportunities
Dr. Siddanna Savadi	• Attended the 2l days CAFT training on "Statistical and Computational Advances for Bioinformatics Data Analysis in Agriculture: Practical Aspects" being organized by ICAR- Indian Agricultural Statistics Research Institute, New Delhi during 2nd -22nd January,2024. • Attended 5-day Intellectual property (IP) awareness week programme from 3–9 September 2024 organized by IPTM new Delhi in collaboration with IIVR, Varanasi • Participated and presented in the International Conference on Advances and Applications of Biotechnology (ICAAB 2024) organized by School of Life Sciences, B.S. Abdur Rahman Crescent Institute of Science and Technology, Chennai in association with University of East London, UK., Tamil Nadu State Council for Science and Technology, National Council for Science & Technology Communication, Department of Science and Technology, Govt. of India held on 30th 31st July, 2024.
Dr. Vanitha K	• Workshop on Preparation of Expenditure Finance Committee/ Standing Finance Committee conducted by Institute of Secretariat Training and Management, New Delhi during 24th to 25th June, 2024. • Participated as an invited speaker in 'International Conference on Bees and other arthropods: Influence sustainable crop yield' on 16th October, 2024 organized by the School of Agriculture, Bharath Institute of Higher Education and Research, Selaiyur, Tambaram, Chennai -73. • Participated in '7th International Conference on Advances in Agriculture Technology and Allied sciences - (ICAATAS-2024)' at the Neotia University (ICAR Accredited), West Bengal • Participated in 'International Conference on plant protection in Horticulture (ICPPH – 2024): Advances and challenges' held at ICAR-Indian Institute of Horticultural Research, Bengaluru • Participated in 'International Conference on Bees and other arthropods: Influence sustainable crop yield' organized by the School of Agriculture, Bharath Institute of Higher Education and Research, Selaiyur, Tambaram, Chennai -73. • Online training programme on "Statistical Applications in plantation Crops' conducted by ICAR-CPCRI, Kasaragod, Kerala from 11th to -15th November, 2024

Name of the Scientist	Title
Dr. Veena G L	• Participated and delivered and oral presentation on Cashew Sprouts Nutri bars, in 3rd International Conference on Climate smart Nutri sensitive integrated farming system for gender equitable sustainable Agriculture: Prospects and Challengers (ICNSFS-2024) at ICAR-CIWA, Bhubaneswar, Orissa, India during November 6th to 8th 2024. • Participated and presented an oral presentation on "Conservation of Nuclear Genetic Diversity in Cashew and related wild species at the International Conference on 'Precision Horticulture (ICPH-2024) held at HCRI, Periyakulam, Tamil Nadu • Participated and displayed the ICAR-DCR developed technologies in National Technology Day at NITTE University Mangalore. • Online training programme on "Statistical Applications in plantation Crops' conducted by ICAR-CPCRI, Kasaragod, Kerala from 11th to -15th November, 2024 • Attend the Board of examiners meeting on as a member for BOE in Food science and Nutrition scheduled on 04.06.2024 and 30th December 2024 to scrutinize the question papers for MSc food science and nutrition examination.
Prakash G Bhat	• Participated in "South Zone Hindi Workshop" organized by NAARM, Hyderabad during 28-29, May 2024
Dr. Raghuram Kukkude	• Attended One day training cum awareness programme on J-Gate @CeRA for Southern Region organized by Kerala Agricultural University, Thrissur on 16-10-2024. Two days State level workshop on KOHA – Library Management Software organized by Dept. of Library & Information Science, Mangalore University, Konaje during 28-10-2024 to 29-10-2024 • International conference of Agricultural Librarians andUser's Community- ICALUC 2024 on the theme "TechnologicalTransformations in Agricultural Library and Information Systems and Services in the Artificial Intelligence (AI) Era". Organised by University Library, Karnataka Veterinary, Animal and FisheriesSciences University, Bidar (Karnataka) & Association of Agricultural Librarians and Documentalists of India (AALDI) from 22nd -23rd November 2024 Also presented paper entitled "ICT infrastructure facility in agriculture libraries: A study of the ICAR institute libraries of South India".

8.8 Radio & TV Talk

Name of the Scientist	Title and Venue	Date
Dr. Jyoti Nishad	Delivered a radio talk on "Food Licensing". at Community Radio Station, Sahakar Radio, Gadag, Karnataka	13th February, 2024
Dr. Manjesh G N	Delivered a radio talk on "Nutrient Management in Cashew" at Community Radio Station, Sahakar Radio, Gadag, Karnataka.	17th February, 2024
Dr Veena G L	Delivered a radio talk on "Technologies developed at ICAR-DCR Puttur for Commercialization" at Community Radio Station, Sahakar Radio, Gadag, Karnataka	17th February, 2024
Dr Veena G L	Delivered a radio talk on "Entrepreneurship opportunities in Cashew Value addition" at Community Radio Station, Sahakar Radio, Gadag, Karnataka.	8th November, 2024

9 LINKAGES/ COLLABORATION

Name of the Scientist	Details
Dr. D. Balasubramanian	Directorate of Horticulture, Govt of Meghalaya
Dr. Manjunath, K	ICAR-Central Institute of Agricultural engineering (Regional Centre), Coimbatore, Tamil Nadu.
Dr. Jyoti Nishad	ICAR-Indian Institute of Horticultural Research, Bengaluru, Karnataka ICAR- Central Plantation Crop Research Institute, Kerala ICAR-Central Coastal Agricultural Research Institute, Goa.
Dr Siddanna Savadi	Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences (KSNUAHS), Shivamogga

10. HUMAN RESOURCE DEVELOPMENT / TRAINING AND CAPACITY BUILDING

Name of the Scientist	Title
Dr. Bhagya H.P.	• Participated in the training on "Plant Quarantine Procedure for Import and Export" conducted at National Institute of Plant Health Management, Hyderabad from 6th to 10th May 2024
Dr. Jyoti Nishad	• Attended one-week online training programme on "Digital Competency, New Tools and Software for Efficient Computer Applications" which is organized by ICAR-Indian Agricultural Statistics Research Institute (IASRI) held form 03rd to 09th January 2024. • Attended short course training programme on "Advances in Applications of Nanotechnology in Agriculture" organized by ICAR- Central Institute for Research on Cotton Technology (ICAR-CIRCOT), Mumbai, India held from 29th January to 08thFebruary 2024. • Attended Capacity Building Program on "Building Successful Incubation Ecosystem" at ICAR-National Academy of Agricultural Research Management (NAARM), Rajendra Nagar, Hyderabad held from 03rd to 05th July2024. • Attended ADP on "Cultivation and harvesting of Spirulina biomass towards developing value-added product", Division of Microbiology, ICAR- Indian Agricultural Research Institute (ICAR-IARI), New Delhi held from 12th to 14th August 2024.
Dr. Manjunatha K	• Attended the SRIJAN: Orientation programme for ICAR- ZTMCs/ITMUs held on 17-19th January 2024 at Lecture Hall, 02nd Floor, NASC Complex, New Delhi
Dr. Siddanna Savadi	• Attended the 2l days CAFT training on "Statistical and Computational Advances for Bioinformatics Data Analysis in Agriculture: Practical Aspects" being organized by ICAR- Indian Agricultural Statistics Research Institute, New Delhi during 2nd to 22nd January, 2024. • Attended 5-day Intellectual property (IP) awareness week programme from 3rd to 9th September 2024 organized by IPTM new Delhi in collaboration with IIVR, Varanasi.
Dr. Balasubramanian, D.	• Attended the Quarterly Review Meeting (QRM) of National Agricultural Innovation Fund (NAIF) conducted for ABI in association with Division of Intellectual Property and Technology Management, Indian Council of Agricultural Research, New Delhi on 30th January, 2024. • Attended training on "Agri IP: A Specialized Online Short Course on Patents in Agriculture" jointly organized by the Intellectual Property & Technology Management (IP & TM) Unit, ICAR, New Delhi and the Zonal Technology Management Unit, ICAR-Central Institute of Fisheries technology, Kochi, Kerala from 15th January to 5th February, 2024 • Attended training program on 'Innovation Management' conducted by ICAR-National Academy of Agricultural and Research Management, Hyderabad from 8th to 12th July, 2024.

Dr. Mohan G S	• Attended online the Editor's workshop -Enabling a Research Ecosystem conducted by the ICAR, New Delhi on 24th September 2024
Dr. Manjesh G N	• Participated in 21-day -CAFT program entitled "Advanced Forecasting Techniques in Agriculture Science Research" organized by ICAR-IASRI, New Delhi held from 24th January to 13th February 2024.
Dr. Vanitha K	• Attended Workshop on Preparation of Expenditure Finance Committee/ Standing Finance Committee conducted by Institute of Secretariat Training and Management, New Delhi from 24th to 25th June, 2024. • Attended Online training programme on "Statistical Applications in plantation Crops' conducted by ICAR-CPCRI, Kasaragod, Kerala from 11th to 15thNovember, 2024.
Dr. Veena G. L.	• Attended training programme on grafting plants and other perennial crops held on 17th July 2024 at Yashaswi Nursery Puttur. • Attended 5 days online training programme on Statistical applications in Plantation crops from 11th to 15th November 2024, organized by ICAR-CPCRI and ISPC.

11. TEACHING/TRAINING ORGANIZED/ EXHIBITIONS ORGANIZED/ATTENDED AND STUDENTS GUIDED

Name of the Scientist	Title
Dr. Aswathy Chandrakumar	• Organized a training on cashew-based intercropping in collaboration with the Rotary club Puttur on 20th February 2024. • Organized a two days training programme for the ST farmers of Parvathipuram Manyam district and Vizianagaram district on scientific cashew production technologies from 1st to 2nd February, 2024 under TSP in collaboration with WASSAN NGO from Vizag, Andhra Pradesh. • Co-ordinated the Cashew Day-2024 on 16th March, 2024. • Co-ordinated the Foundation Day-2024 on 18th June, 2024. • Organized the Kisan Diwas, 2024 on 23rd December 2024 • Organized a training programme on "Mechanization in Cashew cultivation and Post Harvest Technology" for the students of St. Joseph's Engineering College, Mangalore in collaboration with Food Chain, a Mangalore based organization on 19th July 2024. • Organised a scientist-farmer interaction to create awareness about the newly released varieties, Nethra Jumbo-1 and Nethra Ganga on 11th August, 2024. • Organised One-day training programme on "Importance of cashew apple and its value addition for nutritional security" in collaboration with Food Chain Foundation for the home science students of Besant Women's college, Mangalore on 6th September, 2024 at the Directorate • Organised Swachhta Hi Seva campaign 2024 on the theme " Swabhav Swachhata, Sanskaar Swachhata" from 14th September – 2nd October, 2024. • Organised Student Awareness programme on cashew cultivation and enterprise development through Agri-incubation facility for the students of Vivekananda College of Arts, Science and Commerce on 30th October 2024 • Organised special swachhta campaign 4.0 at the Directorate from 2nd October to 31st October, 2024. • Organized a five days Research institute orientation training programme for final year students of College of Horticulture, Mudigere under Rural Horticulture Work Experience Programme (RHWEP) from 11th – 15th November, 2024. • Organized Swachhta Pakhwada campaign from 16th December, 2024 – 31st December, 2024
Dr Balasubramanian D	• One-day Stakeholder Consultation Workshop on "Unlocking Opportunities of Plantation Crop Sector in Meghalaya" held on 2nd February, 2024 at Shillong, Meghalaya by Officer on Special Duty, Directorate of Food Processing, Government of Meghalaya. • Conducted 3-days training on Entrepreneurship Development Program (EDP) on "Cashew Processing and value Addition" at ICAR-Directorate of Cashew Research, Puttur, Dakshina Kannada, Karnataka for the PG Scholars (30 Nos.), M S Ramaiah University of Applied Sciences, Bangalore during 19th to 21st February, 2024. • Coordinated 1-day training on Entrepreneurship Development Program (EDP) on 'Cashew based value added products formulation' under the NAIF Scheme 'Agri-Business Incubation Centre', at ICAR-Directorate of Cashew Research, Puttur, Dakshina Kannada, Karnataka on 16th March, 2024.
Dr. Bhagya H P	• Coordinated and explained ICAR-DCR technologies on cashew cultivation to 45 farmers from Lingadahalli, Chickmagalore district, Karnataka, on 15th March, 2024 • Coordinated and exhibited ICAR-DCR technology during Cashew Day 2024, celebrated at ICAR-DCR Puttur on 16th March, 2024 • Participated and acted as a resource person in the cashew awareness campaign and area expansion programs organized in collaboration with Assam Agricultural University under the NEH funding of the AICRP on cashew from 27th to 30th March, 2024 at HRS, Kahikuchi. • Participated and Exhibited ICAR-DCR technologies at Jackfruit mela conducted during 24th to 26th May 2024 at Jain Bhavan Puttur. • Coordinated in conducting two days 'training programme on 'Scientific Cashew Cultivation Practices' to be held on 31st July and Ist August, 2024 at Babadam, West Garo Hills, Meghalaya in collaboration with All Garo Hills Multipurpose Cooperative Society Ltd., Meghalaya and to distribute cashew 24,240 grafts to ST farmers of West and South Garo Hills of Meghalaya under the STC/TSP scheme of the Directorate of Cashew Research, Puttur. • Coordinated training programme on "student awareness programme on cashew cultivation and enterprise development through Agri-incubation facility" for the 45 students of Vivekananda College of Arts, Science and Commerce on 30th October, 2024 and explained about cashew cultivation and taken them to field visit.

Name of the Scientist	Title
Dr. Jyoti Nishad	• Organized one day training as co-organizer on "cashew cultivation and processing" at ICAR-DCR, Puttur for Kohlapur, Maharashtra Farmers on 4th January 2024. • Organized 5 days training programme as co-coordinator on Hortipreneurship for livelihood improvement in rural youths under SCSP at ICAR-KH Patil, KVK, Hulkoti held from 16th to 20th January 2024. • Conducted 5 days training programme and orientation as co-coordinator about commercialized technologies (Cashew apple cookies, fruit bar, jam, and jelly) for the 3 SC beneficiaries of Gadag District, Karnataka in collaboration with ICAR-K.H Patil KVK, Gadag under the SCSP Scheme at ICAR-DCR, Puttur from 19th to 23rd February, 2024. • Conducted 3 days training programme as co-coordinator on "Entrepreneurship Development Program on Cashew processing and Value addition" under ABI at ICAR-DCR, Puttur for the 30 students of M.Sc. (Food Technology) from Ramaiah University of Applied Sciences, Bangalore from 19th to 21st February, 2024. • Conducted village level awareness programme as co-coordinator on Agri Business Incubation in Cashew for women self-help group at Bettampady village under NAIF-ABI scheme., Bettampady on 01st March, 2024. • "Cashew Awareness Campaign and Area Expansion Programmes" organized in collaboration with Assam Agricultural University; under NEH funding of the AICRP on Cashew, during the F.Y., 2023–24 as a resource person SMAPRS, Buralikson from 04th to 09th March, 2024. • Acted as co-coordinator in organizing The Cashew Day-2024, an annual event of the ICAR-Directorate of Cashew Research. The theme was "Value addition of Cashew apple" on 16th March 2024. • Conducted Entrepreneurship Development Programme as organizer on "Cashew Based Value Added Products Formulation" at ICAR-DCR, Puttur under NAIF-ABI scheme on Cashew Day on 16th March, 2024. • Organized one day training programme as co-coordinator on 'Mechanization in Cashew Cultivation and Post Harvest Technology' for the 35 Civil Engineering students of St. Jospeh's Engineering College, Mangalore at ICAR- Directorate of Cashew Research, Puttur, Karnataka on 19th July, 2024. • Conducted one-day training on "Value Addition of Cashew Kernels" under ABI at ICAR-DCR, Puttur on 08th August, 2024. • Acted as coordinator in conducting training programme on "Promotion of Nutrition Gardening and CAP in Cashew" collaboratively with Horticulture Research and Extension Centre (HREC), Kanabargi, Belgaum and to provide Kitchen garden tools to the SC beneficiaries under SCSP Scheme of ICAR-DCR, Puttur on 13th September, 2024. • Organized a series of activities on the theme "Swabhav swachhata, Sanskaar Swachhata" under Swachhta Hi Seva campaign 2024 from 14th September to 02nd October, 2024. • Conducted webinar on "Cashew Apple Valorization: A Waste to Wealth Approach" 16th September, 2024. • Conducted one-day training on "Importance of cashew apple and its value addition for nutritional security" for the home science students of Besant Women's college, Mangalore at ICAR-DCR, Puttur on 06th September, 2024. • Organized a Special Swacchata campaign 4.0 at ICAR-DCR, Puttur from 02nd to 31st October, 2024. • Organized Swachhta Pakhwada campaign at ICAR-DCR, Puttur from 16th to 31st December 2024. • Acted as convener in conducting Kisan Diwas-2024 at ICAR- Directorate of Cashew Research, Puttur, Karnataka on 23rd December, 2024.
Dr. Manjesh G N	• Organized training programme on "Hortipreneurship for livelihood improvement in rural youths" at Gadag, Karnataka from 16-20th January 2024. • Organized training Programme on "Cashew Cultivation and Cashew Apple Utilization" at Thrissur, Kerala on 02nd March 2024. • Conducted an awareness programme and training on "Cashew cultivation" in collaboration with AAU-ZRS, Diphu, Assam from 08-09th March 2024. • Coordinated a training programme on "Attracting rural youths towards horticulture" collaboratively with K.S.N. UA and HS- Agricultural and Horticultural Research station Sringeri, Chikkamagalur, Karnataka on 22nd June 2024.

Name of the Scientist	Title
	● Coordinated a training programme on "Entrepreneurship opportunities in Horticulture" for farm women of Dakshina Kannada, Karnataka on 25th June 2024. ● Participated in training on "Grafting plants and other perennial crops" held at Yashasvi Nursery, Puttur. D.K. Karnataka on 17th July 2024. ● Organized training program on "Cashew production technology and awareness program on promotion of Kitchen gardening. Parappa Block, Kerala on 13th Aug 2024. ● Organized Training on Cashew Production Technologies in collaboration with the cashew progeny orchard, Gallimukha, Kerala on 20th Aug 2024. ● Organized Training Programme on "Nutrition Gardening and Distribution of Vegetable Seed Kits to SC beneficiaries under SCSP scheme at Andasura, Sagara Taluk Shivamogga, Karnataka on 10th Sep 2024. ● Organized "Good Agricultural Practices in Cashew Cultivation" & Provided inputs under the SCSP scheme at Kanabargi, Belgaum, Karnataka on 13th Sep 2024. ● Organized Entrepreneurship opportunities for Rural Youth in the Horticulture sector" at ICAR-K H Patil KVK, Gadag, Karnataka from 7-9th Nov 2024. ● Organized training programme on "Development of Horticulture – Based Entrepreneurship for Livelihood Improvement at ICAR-K.H. Patil KVK, Hulkoti Gadag, Karnataka from 28th to 29th November, 2024. ● Organized training program on "Cashew Cultivation, Plant Protection, and Value Addition and Distribution of Cashew Grafts under SCSP Scheme at Sagara Taluk, Shivamogga, Karnataka from 29th November to 1st December, 2024. ● Organized World Soil Day at ICAR-DCR, Puttur on 5th Dec 2024 ● Organized a Training program on 'Scientific Cashew cultivation" at Kanker District, Chhattisgarh on 10th Dec 2024 ● Organized Training program on "Scientific Cashew Cultivation" at Jagdalpur, Chhattisgarh on 12th December 2024.
Dr. Manjunatha K	● Acted as a Co-organizer for conducting one day training on "cashew cultivation and processing" at ICAR-DCR, Puttur on 04th January, 2024 for l4l farmers from Kolhapur, Maharashtra. ● Conducted 5-day tentative training program on "Cashew Production and Processing Technologies" for Andhra Pradesh's ST farmers held from 12th to 16th February 2024 at ICAR-DCR, Puttur. (Organizers: Dr. Manjunatha K. and Dr. Aswathy C.; Co-Organizers: Dr. Siddanna Savadi, Dr. Bhagya H. P. and Dr. Eradasappa E.) ● Conducted a 3 days training programme entitled Capacity building of farmers on scientific cashew production technologies under TSP for 25 ST farmers from WASSAN NGO held at ICAR-DCR, Puttur from 31st January to 2nd February, 2024. ● Conducted two days training programme (4 No's) on 'Scientific Cashew Cultivation Practices held on 31st July and 1st August 2024 at Babadam, West Garo Hills. Meghalaya in collaboration with All Garo Hills Multipurpose Cooperative Society Ltd., Meghalaya. (Organizers: Dr. Manjunatha K. and Dr. Siddanna Savadi; Co-Organizers: Dr. Bhagya H. P., Dr. V. Thondaiman and Dr. Aswathy C.) ● Acted as a co-coordinator for conducting 5 days training programme on "ICAR-Research Institute Orientation training of students" for final year RHWEP students from College of Horticulture, Mudigere during 11th to 15th November, 2024. (Co-Ordinator: Dr. Aswathy C.; Co-coordinators: Dr. Babli Mog, Dr. Manjesh G.N. and Dr. Manjunatha K.) ● Acted as co-coordinator for conducting Kisan Diwas-2024 on 23th December, 2024 organized by ICAR-DCR, Puttur.
Dr. Mohan G S	● Resource person for Cashew awareness campaign and area expansion programs organized in association with Assam Agricultural University under NEH program of AICRP; in SMAPRS Buralikson, Jorhat, Assam. 04th to 09th March, 2024 ● Recognized as the guide for carrying out the group mini project by three B.Sc. students of St. Philomena College, Puttur on Basic Cashew Breeding Techniques from 1st April 2024 to 15th May 2024 ● Participated as a resource person in Krishimela at KSNUAHS, Shimoga on 20th October, 2024 and presented a talk on Cashew cultivation and other opportunities ● Recognized as a member of the Doctoral Advisory Committee of Mr. Kedar Sawant, Ph.D. Scholar at the Dept. of Information and Communication Technology, MIT, Manipal.

Name of the Scientist	Title
Dr. Rajashekara H	● Conducted training programme on Improved cashew production technologies: Scientists-Farmers Interactions on 21st February, 2024 at AICRP on Cashew center, Kanabargi, Belagavi. ● Conducted training programme on Improved cashew production technologies: Scientists-Farmers Interactions on 26th July, 2024 at Thippenahalli- Village, Shidlaghatta, Chikaballapura.
Dr. Siddanna Savadi	● Internship programme of four B. Tech (Biotechnology) students of College of Agriculture, Hassan, GKVK, UAS, Bengaluru was facilitated at CoE for Biotechnology. ● Thesis works of six M.Sc. (Biotechnology) students of St. Berchamans college, Chenganassery, Kerala and one M.Sc. (Biotechnology) student of Chinmaya Arts and Science College for Women, Govindagiri, Kannur, Kerala were guided at CoE for Biotechnology.
Dr. Veena G. L	● Acted as Co-Organizer for five days training programme on Hortiprunership for livelihood improvement in rural youths under SCSP during 16th January to 20th Jauary 2024. ● Co-Organized training programme on Cashew cultivation and processing on 04.01.2024 for 141 farmers from Kolhapur Maharashtra 04th January 2024 ● Course coordinator for 3 days training programme on Entrepreneurship development programme on Cashew processing and value addition under ABI from 16th to 21st February, 2024. ● Organized village level awareness programme on EDP-Agri-business Incubation in cashew for women self-help group at Bettampady village under NAIF-ABI during 01st March, 2024 ● Co-organized an entrepreneurship development programme on Cashew Based Value added products formulation under NAIF-ABI during 16th March, 2024 ● Organized and Exhibited DCR technologies on Cashew Day 16th March, 2024 at ICAR-DCR Puttur ● Coordinated a training programme on Attracting rural youths towards horticulture collaboratively with K.S.N. UA and HS- Agricultural and Horticultural Research station Sringeri to SC beneficiaries (50 nos) and provided them vegetable seed kit and garden tools on 21st June, 2024 ● Coordinated a training programme on Entrepreneurship opportunities in Cashew and promotion of Nutrition gardening for farm women under SCSP scheme to SC beneficiaries (35 Nos.) on 25th June, 2024 at ICAR-DCR, Puttur. ● Coordinated one day training programme on Attracting Rural Youths towards Horticulture collaboratively with K.S.N.UA and HS- Agricultural and Horticultural Research Station Anegunda Sringeri to SC beneficiaries on 21st June, 2024. ● Involved in preparation of ICAR-DCR technologies, value added products and videos of technologies for display and arrangements on occasion of 96th foundation and technology day held at NASC complex New Delhi on 16th July, 2024. ● Organized an awareness programme on Entrepreneurship opportunities and value addition in cashew apple on 2nd August, 2024 under NAIF fund of ABI in collaboration with ICAR-KVK, Kankanady, Dakshina Kannada ● Acted as Co-coordinator for conducting a plantation drive organized in cashew progeny orchard, Gallimukha on 20th August, 2024 to create awareness about cashew production technologies among the farmers. ● Acted as coordinator for training programme on "Promotion of Nutrition Gardening and CAP in Cashew" collaboratively with Horticulture Research and Extension Centre (HREC), Kanabargi, Belgaum and to provide Kitchen Garden tools to the SC beneficiaries on I3th September, 2024, under SCSP Scheme. ● Organized a training programme on Cultivation, Plant Protection, and Value Addition in Cashew' and Distribution of Cashew Grafts to SC Beneficiaries in collaboration with MAHRS, KSN UAHS, Shivamogga from 29th November to 1st December, 2024. ● Organized a training programme on Development of Horticulture based entrepreneurship for livelihood improvement and distribution of inputs to SC beneficiaries in collaboration with ICAR-K.H. Patil Krishi Vigyan Kendra Gadag, 28th to 29thNovember, 2024. ● Coordinated an awareness programme on Importance of soil health and distribution of Kitchen Garden kits to the farmers on occasion of World soil day during 5th December, 2024 at ICAR-DCR Puttur. ● Participated and displayed the ICAR-DCR developed technologies in National Technology Day at NITTE University Mangalore.

12. Consultancy, Patents and Commercialization of Technology

12.1 Commercialization of Technology:

12.2 Copyrights/ Patent/ Trademark/ Design Registration:

ITMU facilitated the following Copyrights/ Patent/ Design Registration processes.

- D Balasubramanian, and Ravindra Nayak, 2024. Multi blade rotary system for slicing cashew apples. Indian Patent application: E-1/59124/2024-CHE) dated 04th June, 2024.
- D Balasubramanian, and Sreejith, 2024. A Three in One Moisture meter for quantifying the moisture for agricultural products, Indian Patent application: E-1/1646/2024-CHE dated 09th January, 2024.
- Manjunath K, D Balasubramanian, Ravindra Naik and J Dinakara Adiga, 2024. Portable semi-automatic cashew apple and nut separation system and method thereof. Indian Patent application No. 202441087671 dated 13th November, 2024.
- Manjunath K, D Balasubramanian, Ravindra Naik and J Dinakara Adiga, 2024. Portable pedal operated separator. Indian Patent application No. 202441087671 dated 13th November, 2024.
- Manjunath K, D. Balasubramanian, Ravindra Naik and J Dinakara Adiga,.2024. Cashew apple and nut separator with twisting mechanism. Design registration application: 437177-001 dated 13th November, 2024.
- Manjunath K, D. Balasubramanian, Ravindra Naik and J Dinakara Adiga. Shear type cashew apple and nut separator. Design registration application: 437178-001 dated 13th November, 2024.

A total of 10 copyrights were granted by Copyrights office, Govt. of India

1. Cashew Nutrient Deficiency Management [SW-18091/2024] granted on 12th January, 2024.
2. Cashew pest management [SW-18092/2024] granted on 12th January, 2024.
3. Cashew Single Nucleotide Polymorphisms Database (CSNPDB) [SW-18179/2024] granted on 29th January, 2024.
4. Cashew Microsatellites Database (CMDB) [SW-18333/2024] granted on 23rd February, 2024.
5. Geru maragalige aakara needuvike matthu savaruvike (Kannada) [CF-5636/2024] granted on 13th March, 2024.
6. Gerinalli Sandra besaya hagu athisandra besaya (Kannada) [CF-5656/2024] granted on 12th April, 2024.
7. Training and pruning in cashew (English) [CF-5741/2024] granted on 20th August, 2024.
8. High density and ultra-high-density planting in cashew (English) [CF-5742/2024] granted on 20th August, 2024.
9. ITMU ICAR-DCR website [SW-19568/2024] granted on 15th October, 2024.
10. Technology Inventory: DCR 2024/3, ICAR-DCR technologies for commercialization [L-155725/2024] granted on 23rd October, 2024.

A total of 6 copyrights including three computer applications, one Literature were filed with Copyrights office, Govt. of India.

1. Technology Inventory: DCR 2024/3, ICAR-DCR technologies for commercialization [27072/2024-CO/L] on 27th August, 2024.
2. ITMU ICAR-DCR website [27309/2024-CO/SW] on 30th August, 2024.
3. Cashew Farmers Tracking System (CFTS) [34341/2024-CO/SW] on 04th November, 2024.
4. AICRP-cashew website [34340/2024-CO/SW] on 04th November, 2024.
5. Beneficial Arthropods in Cashew Plantation website [40725/2024-CO/SW] on 23rd December, 2024.
6. Cashew Pest database System [40729/2024-CO/SW] on 23rd December, 2024.

·A trademark entitled "NETHRA" was issued by Trademark Registry, Govt. of India in class 99 under trademark no. 5366651 on 27th July, 2024.

Video Copyrights

Title	Copyright Number	Date obtained
Copyright under Cinematography film work video "Geru Maragalige Akara Needuvike Matthu Savaruvike" (Kannada Language)	CF-5636/2024	13th March, 2024
Copyright under Cinematography film work video "Gerinalli Sandra Besaya haagu athi saandra besaya" (Kannada Language)	CF-5656/2024	12th April, 2024
Copyright under Cinematography film work video High density and ultra-density planting in cashew (English language)	CF-5742/2024	20th August, 2024
Copyright under Cinematography film work video Training and Pruning in Cashew (English language)	CF-5742/2024	20th August, 2024

12.3 Consultancy

- D Balasubramanian, and V Thondaiman, 2024. Members of Expert Committee for Cashew Unit Assessment with the objective to assess the actual / Expected yield per year and recommend for feasible tariff to hire forestry cashew plantations under TAFCORN.
- Cashew kernels sample testing for Dr. Nithin Krishna Shenoy P. Deputy Director, Directorate of Revenue Intelligence, Ministry of Finance. Department of Revenue. Bengaluru Zonal Unit, Kalyan Nagar Post, Bengaluru. Govt. of India on 24th June, 2024. (Balasubramanian, D Rajashekhara H and Veena G L)
- "Checking the Quality of Raw Cashewnuts and issuing Quality Assessment Certificate and Valuation Report"- Mr. Vijaya Kumar, Branch Manager, Central Bank of India dated 08th July, 2024. (Balasubramanian, D)
- Assessment of physical, microbial and quality of samples of cashew kernels – Mr Rahul, Pro Foodiot, Bangalore on 13.08.2024 (F.No. 16/2023-PME(PSF-TTC) dated 13th August, 2024). (Balasubramanian, D, Rajashekhara H and Veena G L)
- Field survey has been taken up to identify suitability of cashew cultivation as apart of consultancy project of MBMA for area expansion of cashew in Garo hills of Meghalaya during 23rd to 25th June, 2024. (Balasubramanian, D, Bhagya H P and Eradasappa E)
- Provided consultancy service to government of Meghalaya for ' Scaling up of Cashew supply chain in Meghalaya through area expansion and improving value addition processes' during 14th to 18th, October 2024 by post care planting and nursery management training to the farmers and officials of Meghalaya. (Balasubramanian, D., D, Bhagya H P and Eradasappa E)

12.4 Professional Services

- DNA fingerprinting of CARS-3 from AICRP centre Jagadalpur and six genotypes viz., Goa 5, Goa 6, Goa 7, Goa 8, Goa 9, and Goa 10 of AICRP centre, Goa were done at CoE Biotechnology, ICAR-DCR, Puttur using the robust SSR markers. (Dr Siddanna Savadi)
- Biochemical characterization of CARS-3 from from AICRP centre Jagadalpur were done at COE for profiling of bioactive components laboratory of ICAR-DCR Puttur (Dr. Veena G L)

13. LIST OF ONGOING PROJECTS

INSTITUTE RESEARCH PROJECTS

Priority area 01: Genetic improvement of cashew for productivity, quality and resistance to biotic and abiotic stresses through conventional and biotechnological approaches

Code	Title	Investigators	Date of start
01 (1)	Collection, conservation, characterisation and evaluation of cashew genetic resources [1986 – Long term] **PIMS Number: IXX19622**	Mohana. G.S. (PI)	From 30-07-21 as PI (06/2012 to 29-07-2021 as Co-PI)
		Vanitha. K	10/2015 onwards
		Eradasappa. E	06/2012 to 2013-14 06/2018 onwards
		Veena. G.L.	09/2021
		Rajashekara. H	09/2021
01 (2)	Genetic improvement of cashew through hybridisation and seedling selection approaches [1986 -Long Term] **PIMS Number: IXX00393**	J.D. Adiga (PI)	PI: 2007-08 to 2014-15; PI: 2017-18 onwards Co-PI from 10-08-2023
		Mohana, G.S.	2015-16 and 2016-17 as PI; 2012-13 to 2014-15 & 2017-18 onwards as Co-PI
		Eradasappa, E.	Co-PI from 10/2014 to 10/2015 &November/2017 onwards
		Veena. G.L.	12-10-20
		Siddanna Savadi	09/2017 onwards
		Manjesh G.N.	27-09-2022
		Bhagya. H.P.	27-09-2022
01 (3)	Breeding in cashew for special traits [06/2012-05/2027] **PIMS Number: IXX09323**	Eradasappa, E. (PI)	06/2012 to 2014-15; (till 15th Aug 2015) and November/2017 onwards
		Mohana, G.S.onwards	PI; 2015-16 to November/2017; Co-PI; November/2017
		Veena. G.L.	09/2021 onwards
		Vanitha. Konwards	10-08-2023
		Raviprasad. T.N.	10-08-2023 onwards
		Rajashekara. H	10-08-2023 onwards
01 (4)	Breeding approaches for developing TMB tolerance [09/2017-08/2030] **PIMS Number: IXX13687**	Mohana, G.S. (PI)	09/2017
		Eradasappa, E.	06/2018
		K. Vanitha	09/2017
01 (5)	Genetics of traits in cashew [05/2019 – 04/2025] **PIMS Number: IXX15237**	Eradasappa, E. (PI)	05/2019
		Mohana, G.S.	05/2019
		Siddanna Savadi	27-09-2022

01 (6)	Polyploidy breeding in cashew [10/2020-09/2030] **PIMS Number: IXX17064**	Mohana, G.S. (PI)	10/2020
		Eradasappa, E.	10/2020
01 (7)	Evaluation of dwarf and semi dwarf accessions and their seedling progenies for high density planting system [09/2021-08/2032] **PIMS Number: IXX17065**	Mohana G.S (PI)	09/2021
		Eradasappa, E	09/2021
01 (8)	Genetic dissection of QTLs governing nut yield and cashew nut shell liquid (CNSL) content in cashew [06/2018-05/2025] **PIMS Number: IXX14347**	Siddanna Savadi (PI)	06/2018
		Eradasappa, E	06/2018
		Mohana, G.S.	06/2018
		Manjunatha. K	27-09-2022
		Manjesh. G.N	27-09-2022
		Veena. G.L.	10-08-2023
01 (9)	Deciphering the molecular basis of Cashew-Tea Mosquito Bug (TMB) interactions to understand host response and TMB effectors (09/2022-09/2026) **PIMS Number: IXX17066**	Siddanna Savadi (PI)	09/2022
		T.N. Raviprasad	09/2022
		K. Vanitha	09/2022
		Rajashekahara H	10-08-2023
01 (10)	In-vitro pollen germination and pollen tube growth of cashew varieties in response to high temperature stress [05/2019 – 04/2024] **PIMS Number: IXX15130**	Babli Mog (PI)	05/2019
		Eradasappa, E.	05/2019
		Veena. G.L.	12-10-2020
		V. Thondaiman	27-09-2022
		Manjesh. G. N	27-09-2022
01 (11)	Physiological and biochemical basis of salinity tolerance in cashew accessions [09/2021-08/2026] **PIMS Number: IXX16223**	Babli Mog (PI)	09/2021
		Shamsudheen M	09/2021
		Manjesh. G.N.	09/2021
		Veena. G.L.	27-09-22
		V. Thondaiman	27-09-22
		Bhagya. H.P.	27-09-22

01 (12)	Physiological, biochemical and molecular characterization of cashew accessions for drought stress [10/2024-10/2027]	Babli Mog (PI)	08/10/2024
		Mohana G.S.	08/10/2024
		Veena G.L.	08/10/2024
		Bhagya H.P.	08/10/2024
		Manjesh G.N.	08/10/2024
		Thondaiman V	08/10/2024
		Siddanna Savadi	08/10/2024
Priority area 02: Development of Refinement of Production Technologies in Cashew			
Sub-Projects			
02 (1)	Effect of growth regulator in combination with flower and fruit-set enhancing chemicals on cashew (Anacardium occidentale L.) [10/2020-09/2024] [10/2024-9/2025] **PIMS Number: IXX16215**	V. Thondaiman (PI)	10/2020
		K. Vanitha	10/2020
		Babli Mog	Co PI from 10.10. 2020 to 25.10.2023 PI from 26.10.2023 to 15.08.2024
		Veena. G.L.	10/2020
		Bhagya. H.P.	27-09-2022
02 (2)	Development of cashew (*Anacardium occidentale* L.) based cropping system for west coastal region [10/2020-09/2025] **PIMS Number: IXX16363**	V. Thondaiman (PI)	10/2020
		Shamsudheen Mangalassery	10/2020
		K. Vanitha	10/2020
		Babli Mog	10/2020
		H. Rajashekahara	09/2021
		Bhagya H. P	14.11.2022 to 26.07.2024 as PI
02 (3)	Influence of weather parameters on growth dynamics of apple and nut in selected varieties of Cashew [09/2021-08/2024] [09/2024-04/2025] **PIMS Number: IXX16942**	Manjesh, G.N. (PI)	09/2021
		Babli Mog	09/2021
		K. Vanitha	09/2021
		Siddanna Savadi	27-09-2022
		Bhagya. H.P.	27-09-2022
02 (4)	Effect of inter-stocks in Cashew (*Anacardium occidentale*) [09/2022-08/2024] [09/2024-08/2030] **PIMS Number: IXX16474**	H.P. Bhagya (PI)	09/2022
		V. Thondaiman	09/2022
		J.D. Adiga	09/2022
		Veena. G.L.	09/2022
		Manjesh G.N.	09/2022
		Babli Mog	09/2022

02 (5)	Canopy management in Cashew under ultra-high density planting system [08/2023 – 08/2029] **PIMS Number: IXX20151**	Bhagya. H.P. (PI)	08/2023
		J.D. Adiga	08/2023
		Shamsudheen M	08/2023
		Thondaiman, V	08/2023
		Veena, G.L.	08/2023
		Manjesh, G.N.	08/2023
		Babli Mog	08/2023
02 (6)	Developing nutrient management strategies for cashew based on soil and leaf status [10/2020-09/2024] **PIMS Number: IXX16218**	Veena G.L.	PI since 11.12.2023
		V. Thondaiman	10/2020
		Babli Mog	09/2021
		Manjesh. G. N	09/2021
		Aswathy Chandrakumar	09/2021
02 (7)	Carbon cycling, sequestration and nutrient dynamics in cashew orchards [10/2020-09/2025] [10/2025-09/2026] **PIMS Number: IXX16199**	Babli Mog	Co PI from 10.10. 2020 to 25.10.2023 and PI since 26.10.2023
		Bhagya. H.P.	27-09-2022
02 (8)	Comparative Studies on Effect of Different Farming system in Sustainable Cashew cultivation. [08/2023-long term]	Veena G.L. (PI)	08/10/2024
		Babli Mog	08/10/2024
		Thondaiman V	08/10/2024
		Manjesh G.N.	08/10/2024
		Vanitha K	08/10/2024
		Rajashekara H	08/10/2024
Priority area 03: Integrated insect pest and disease management in cashew			
Sub-Projects			
03 (1)	Characterization and synthesis of female sex pheromone of Tea Mosquito Bug; (*Helopeltis antonii*) and its bioassay [10/2020-09/2025] **PIMS Number: IXX16224**	T N Raviprasad (PI)	10/2020
		K. Vanitha	10/2020
		K. Subaharan	14-09-2021 Approved by Director, NBAIR

03 (2)	Assessing the field effectiveness of entomopathogenic nematodes (EPN) and indigenous strain of entomopathogenic fungus (EPF) in management of cashew stem and root borers (*Plocaederus ferrugineus* and *Plocaederus obesus*) [09/2021-08/2026] **PIMS Number: IXX16225**	T.N. Raviprasad, (PI)	09/2021
		Vanitha K	09/2021
		Rajkumar CPCRI, Kasaragod	Permitted vide CPCRI-PME F.N. 50.15/DCR/T dated 25-11-2022.
03 (3)	Species complex of thrips infesting cashew, their role and management measures (3 years, 09/2022-09/2025) **PIMS Number: IXX17067**	K. Vanitha (PI)	09/2022
		T.N. Raviprasad	09/2022
		Rachana, R. (ICAR-NBAIR)	Permitted the inclusion of Dr. R.R. Rachana vide communication dated 22-11-2022 from ICAR-NBAIR, Bengaluru by e-mail
		Rajashekara, H	09/2022
		Mohana, G.S.	09/2022
03 (4)	Development of an eco-friendly and cost-effective pest management strategy for cashew using plant and microbial-based pesticides [09/2024-10/2027]	Vanitha K (PI)	09.10.2024
		T. N. Raviprasad	09.10.2024
		K.Velmourougane ICAR-Central Institute of Cotton Research, Nagpur	09.10.2024
		A. Kandan ICAR-NBAIR, Bengaluru	09.10.2024
		H. Rajashekara	09.10.2024
03 (5)	Survey and diagnosis of diseases occurring in cashew through morphological and molecular characterization and their management [09/2021-08/2024] [09/2024-08/2026] **PIMS Number: IXX17045**	H. Rajashekara (PI)	09/2021
		T N Raviprasad	09/2021
		Siddanna Savadi	09/2021
		RTP Pandian, ICAR-CPCRI, RS, Vittal	CPCRI-PME F. No. 50.15/DCR/T dated 11-11-2 in response to DCR request F.No. DCR-PME(IRC)/2020 dated 03-11-2022.
03 (6)	Deciphering the role of core floral microbiome in enhancing productivity in cashew [09/2024-08/2027]	Rajasekhara H (PI)	9.10.2024
		Vanitha K	9.10.2024
		Veena G.L.	9.10.2024

Priority area 04: Developoment of Food Products and Machinery for Pre and Post Harvest Management and Processing			
Sub-Projects			
04 (1)	Optimizing processing parameters in cashew for enhancing whole kernel recovery [09/2022-09/2025] **PIMS Number: IXX17068**	D. Balasubramanian (PI)	10/2020
04 (2)	Development of ready to eat alternate snack food using cashew apple - extrusion and vacuum frying approach [09/2022-08/2025] [09/2025-08/2026] **PIMS Number: IXX17069**	D. Balasubramanian (PI)	09/2022
		M R Manikandan	Approved vide Letter CPCRI F.No. 50.15/DCR/T dated 06-10-2022 in response to DCR letter F.No. DCR-PME(IRC)/2020 dt 22-09-2022
04 (3)	Design and development of gadgets for cashew fruit harvesting and collection [10/2020-09/2025] [10/2025-09/2026] **PIMS Number: IXX15635**	Manjunatha. K (PI)	10/2020
		D. Balasubramanian	10/2020
		Ravindra Naik	10/2020
		J.D. Adiga	10/2020
04 (4)	Development of value-added products from cashew apple and sprouts [06/2018-long term] **PIMS Number: IXX20034**	Veena. G.L. (PI)	Co-PI from 09/2021 to 03-03-2022 PI from 03-03-2022
		Shamsudheen Mangalassery	Co-PI from 06/2018 to 08/2020 & 09/2021 onwards; PI from 10-08-2020 to 09/2021
		Jyoti Nishad	Co-PI from 25-07-2023 (F.No. 2/2023-PME (IRC-Inst-Proj dt 26-07-23)
		Dr. Rajashekara H	Co-PI from 9/2024
		Dr. Manjesh G.N	Co-PI from 9/2024

04 (5)	Development of probiotic food products from cashew apple [09/2021-08/2024] [09/2021-08/2026] **PIMS Number: IXX20035**	Jyoti Nishad (PI)	Co-PI from 08/2023 to 09/2024
		Veena. G.L	Co-PI from 09/2021 to 03-03-2022. PI from 03-03-2022 [Ref: DCR-PME(IRC)/2020 dt 07-03-2022)] to 09/2024. Co-PI from 09/2024.
		H. Rajashekara	09/2021
		Manjesh. G.N.	09/2021
		Renjitha. K; IIHR, Bengaluru	F.No. IIHR/PMEC/1.2.5 & 44 (a)/2022 dated 13-09-2022 & F.No. IIHR/PME Cell/44.0(a)/2022 dated 28 November 2022 in response to F.No. DCR-PME(Res.Collabn)/2020 dt 06-08-2022
		Mathala Juliet Gupta, ICAR-CCARI, Goa	F.No. 10(2)/2020 dated 02-01-2025 in response to F.No. 02/2023-PME(IRC-Inst-Proj) dated 26-12-2024
04 (6)	Phytochemical characterization of cashew (leaf and apple) nutraceuticals for its utilization in development of functional foods [09/2021-08/2025] **PIMS Number: IXX16286**	Manjesh. G.N (PI)	Co-PI from 09/2021 to 03-03-2022 PI from 03-03-2022 [Ref: DCR-PME(IRC)/2020 dt 07-03-2022)
		Veena. G.L.	09/2021
		Bhagya. H. P	27-09-2022
		Jyoti Nishad	10-08-2023
		Shabbir A	NRC Grapes F.No. 2(3)/TC/2022-23 dated 21-11-2022 in response to F.N. DCR-PME (Research collaboration)/2020 dt 11-10-2021
		Rajkumar. A.D, DOGR, Pune	DOGR, permission Letter F. No. PME/General/2020/2616 dt 20-02-2023
		Babli Mog	09/2024
04 (7)	Enhancing the shelf life of cashew apple to increase the market potential [08/2023-08/2026] **PIMS Number: IXX20122**	Jyoti Nishad (PI)	08/2023
		D. Balasubramanian	08/2023
		Veena GL	08/2023
		Rajashekara, H	08/2023
		Vijay Rakesh Reddy S., ICAR-IIHR, Bengaluru	F.No. 02/2023-PME (IRC-Inst-Proj) dated 29-10-2024

Priority area 05: Developing Methodologies and ICT Tools for Capacity Building and Transfer of Technologies in Cashew			
Sub-Projects			
05 (1)	Knowledge management and technology transfer in cashew [09/2021-Long term] **PIMS Number: IXX17070**	Aswathy Chandrakumar (PI)	09/2021
		T N Raviprasad	09/2021
		Mohan G S	09/2021
		Manjesh. G. N	09/2021
		Bhagya. H. P	27-09-2022
05 (2)	Socio-economic and innovation system analysis in Cashew sector [09/2021-Long term] **PIMS Number: IXX17071**	Aswathy Chandrakumar (PI)	09/2021
		D Balasubramanian	09/2021
		Eradasappa E	09/2021
		V Thondaiman	09/2021
		C Thamban, CPCRI	Permission letter received from CPCRI vide F.No. 50.15/NRCC/T dt 16-03-2022 [Ref: DCR-PME(IRC)/2020 dated 16-03-2022]
		Jayasekhar S, CPCRI	Permission letter received from CPCRI vide /NRCC/T dt 16-03-2022 [Ref: DCR-PME(IRC)/2020 dated 16-03-2022]
05 (3)	Cashew Farmer's Tracking System [04/2024- 08/2027]	Mohana G.S. (PI)	04/2024

List of concluded Projects

Institute Research Projects

Sub-Projects

Code	Title	Investigators	Date of start
Priority area 02: Development of Refinement of Production Technologies in Cashew			
02 (1)	Biochemical and mineral composition studies in relation to phenology of fruit development and maturity in cashew **[09/2021-08/2023] PIMS Number: IXX16364**	Veena. G.L. (PI)	09/2021 (PI from 24-01-2022)
		V. Thondaiman	PI from 06-10-2021 to 24-01-2022 (He was not co-PI while proposing the project) [Ref: DCR-PME(IRC)/2020 dt 24-01-2022] Co-PI from 24-01-2022
		Shamsudheen M	09/2021
		Manjesh. G.N	09/2021
		Bhagya. H.P.	27-09-2022
		Previous workers	Manjunatha. K [Co-PI from 09/2021 to 25-07-2023 (F.No. 2/2023-PME (IRC-Inst-Proj dt 26-07-23)] B.M. Muralidhara [PI from 09/2021 till 06-10-2021] J.D. Adiga, Co-PI from 09/2021 to 08/2023
Priority area 03: Integrated insect pest and disease management in cashew			
03 (1)	Influence of *Apis cerana indica* and *Braunsapis* spp. on pollination and fruit set of cashew [05/2019 – 10/2023] **PIMS Number: IXX14974**	K. Vanitha (PI)	05/2019
		Veena. G.L	12-10-2020
03 (2)	Cashew tea mosquito bug interactions and the defensive responses [05/2019 – 04/2024] **PIMS Number: IXX14975**	K. Vanitha (PI)	05/2019
		T.N. Raviprasad	05/2019
		V. Thondaiman	12-10-2020
		Shamsudheen Mangalassery	12-10-2020
		Veena. G.L.	09/2021
Priority area 04: Developoment of Food Products and Machinery for Pre and Post Harvest Management and Processing			
04 (1)	Studying comparative performance of cashewnut processing systems in India [10/2017-09/2023] **PIMS Number:IXX13902**, IXX13683	D. Balasubramanian	10/2017

04 (2)	Design, development and performance evaluation of Cashew fruit and nut separator [10/2020-09/2024] **PIMS Number: IXX15634**	Manjunatha. K (PI)	10/2020
		D. Balasubramanian	10/2020
		Ravindra Naik	Inclusion of the Co-PI approved by Director CIAE, Bhopal

List of Ongoing Externally Funded Projects

Sl. No	Title	Investigators	Date of start
1.	Development of morphological descriptors and DUS test guidelines for cashew Funded by: Protection of Plant Varieties and Farmers' Rights Authority (PPV&FRA), New Delhi Budget: Rs. 10 Lakhs [04/2015-03/2024] **PIMS Number: OXX03473**	Mohana, G.S. (PI)	30/07/2021
2.	**External funded project:** Demonstration of Drone Technology [24-06-2022 to 31-03-2024] [01-04-2024 to 31-03-2025] **PIMS Number: OXX5457**	Manjunatha. K (PI)	06/2022
		T.N. Raviprasad	08/2022
		J.D. Adiga	08/2022
		Shamsudheen M	08/2022
		Siddanna Savadi	08/2022
		Aswathy Chandrakumar	08/2022
		Manjesh. G.N.	From 16-05-2023
3.	Mechanization of pesticide and nutrient sprays in cashew orchards through drones, Funded by: RKVY-RAFTAAR, Budget Rs. 83 lakhs; [2021-22 to 2023-24] [2023-24 to 2024-25] **PIMS Number: OXX5543**	Manjunatha. K (PI)	04/2021
		Vanitha. K	04/2021
		Shamsudheen Mangalassery	04/2021

4.	Establishment of farmer-centric pest diagnostic and bio-control laboratory to achieve sustainable cashew health management, PIMS Number: OXX5545 (KA/RKVY-AGRE/2022/1345) Funded by: RKVY-RAFTAAR, Budget Rs. 100 lakhs; [2022-23 to 2023-24]	H. Rajashekara (PI)	04/2022
		T.N. Raviprasad	04/2022
		K. Vanitha	04/2022
		Siddanna Savadi	04/2022
5.	Front line demonstration of newly developed cashew varieties of ICAR-DCR Puttur, funded by DCCD, Kochi Budget: Rs. 10.0 lakhs [20-06-2023 to 31-03-2024] Ref: F.No. 31/2023-PME(DCCD) dt 20-06-2023 PIMS Number: OXX7285	E. Eradasappa (PI)	20/06/2023
		Aswathy Chanda Kumar	20/06/2023
		Mohana. G.S.	20/06/2023
		J.D. Adiga	20/06/2023
		Bhagya H.P.	13/02/2024
6.	Establishment of state of art facilities for chemical ecology studies targeting eco-friendly pest management and demonstration in cashew. Funded by: RKVY-RAFTAAR, [12/2024-12/2026) **PIMS Number: OXX7287**	Vanitha K (PI)	12/2024
		T.N. Raviprasad	12/2024
		Veena G.L.	12/2024
		H Rajashekara	12/2024
		Babli Mog	12/2024

List of concluded Externally Funded Projects

Sl. No	Title	Investigators	Date of start
1	Establishment of centre of excellence for profiling of bioactive components in cashew apple and nut, Funded by: RKVY-RAFTAAR, Budget Rs. 95 lakhs; [2021-22 to 2023-24], PIMS Number: OXX5544 (KA/RKVY-AGRE/2022/1344	Veena. G.L. (PI)	04/2021
		Shamsudheen Mangalassery	04/2021
		Siddanna Savadi	04/2021

2	Utilization of cashew apple for new products and entrepreneurship development of rural women and youth in Karnataka for mitigating the effect of COVID-19 Funded by: RKVY-FAFTAAR, Government of Karnataka Budget: Rs. 57.0 lakhs [04/2020 to 03/2024] **PIMS Number: OXX5068**	Veena. G.L. (PI)	Co-PI from 21-11-2020 to 20-04-2022 PI from 20-04-2022 [Ref: DCR-PME(IRC)/2020 dt 22-04-2022]
		Shamsudheen Mangalassery	Co-PI from 04/2020 to 10-08-2020 & From 20-04-2022 PI from 10-08-2020 to 20-04-2022 [Ref: DCR-PME(IRC)/2020 dt 22-04-2022]
		Aswathy Chandrakumar	09/2021
3	Improving area, production and productivity of cashew in Shivamogga and Chitradurga districts in Karnataka Funded by: RKVY-FAFTAAR, Government of Karnataka Budget: Rs. 36 lakhs [04/2020 to 03/2024] **PIMS Number: OXX5458**	Mohana, G.S. (PI)	04/2020
		E. Eradasappa	04/2020
4	Development of an AI-based app for identification of pests and diseases in cashew Funded by: RKVY-FAFTAAR, Government of Karnataka Budget: Rs. 16 lakhs [04/2020 to 03/2024] **PIMS Number: OXX5459**	Mohana, G.S. (PI)	04/2020
		K. Vanitha	04/2020
		Shamsudheen Mangalassery	04/2020
		H. Rajashekara	09/2021

14. RAC / IRC / IMC / IJSC MEETINGS

14.1 Research Advisory Committee (RAC)

The first meeting of 10th Research Advisory Committee (28th Meeting of RAC) of ICAR-DCR, Puttur was held during 2 and 3 September, 2024 at the Video Conference Hall of ICAR-DCR, Puttur on hybrid mode. The meeting started on 02.09.2024 at 9.30 am with the field and lab visits by the Chairman and members up to 11.30 am. During the visits, labs of Agriculture Drone Technology, Soil Science, Fruit Science, Food Technology, Biotechnology, Entomology and Post-Harvest Technology and fields of reference varieties and core collection were visited and scientists of respective labs and fields explained about the works being carried out.

At 12 noon the meeting started with the welcome address by Dr. J. Dinakara Adiga, Director, ICAR-DCR Puttur. This was followed by the introductory remarks of the Chairman, Dr. S. B. Dandin, Former VC, UHS Bagalkot. Following this, brief introductory remarks were made by the RAC members, Dr. P.L. Saroj, Principal Scientist, CISH, Lucknow and Former Director, ICAR-DCR and ICAR-CIAH, Dr. G.K. Mukunda, Former Professor of Horticulture and Head, University of Agricultural Sciences, GKVK, Bengaluru, Dr. Sreenath Dixit, Principal Scientist and Strategic Advisor, Office of the DG, ICRISAT, Hyderabad, Dr. Pushpa S. Murthy, Head, Dept. of Plantation Products Spices and Flavored Technology and Senior Principal Scientist, CSIR-CFTRI, Mysuru, Dr N Bakthavatsalam, Former Head, ICAR-NBAIR, Bengaluru, Sri Sanjiv Balaji Kunkalienkar, the Nominated IMC Member of ICAR-DCR, Sri D. Gopalakrishna Kamath, the Nominated IMC Member of ICAR-DCR and Dr. V.B. Patel, ADG (F&PC), ICAR, KAB-II, New Delhi. In the opening remarks the Chairman and Members appreciated the research achievements and progress made by DCR since last meeting.

Thereafter, action taken report on the recommendations of 3rd meeting of 9th RAC was presented by Dr. Eradasappa, E Member Secretary (10th RAC). He informed that all the recommendations of the previous RAC were accepted by the ICAR, and then the action taken on the recommendations was discussed. The Chairman and Members of RAC appreciated the efforts of ICAR - DCR in taking prompt action on the recommendations of the previous RAC meeting. Subsequently, there were presentations by the scientists of ICAR-DCR on their ongoing research projects under Crop Improvement, Crop Management and Farm Machinery, Crop Protection, Post-Harvest Technology and Transfer of Technology sections. On the same day, presentations under Crop Improvement, Crop Management & Crop Protection were completed. The next day presentations under Post-Harvest Technology and Transfer of Technology sections were presented. The research progress and the accomplishments of 48 research projects including 10 external projects were presented during the meeting under nine mega projects. There were critical observations by the RAC on the research outcomes and the suggestions to improve further were discussed in detail. Following the concluding remarks by the RAC Chairman and members, the recommendations were finalized.

14.2 Institute Research Committee (IRC)

The meeting of the 37th Institute Research Committee (IRC) was held during 8th to 9th October, 2024 under the Chairmanship of Dr. J.D. Adiga, Director, ICAR-DCR, Puttur in hybrid mode at Video Conference Hall of Silver Jubilee Building, DCR, Puttur and through Zoom platform. Dr. Babli Mog, Member Secretary, IRC welcomed the Chairman, members of IRC and the resource persons.

In a brief address, the Chairman, IRC, Dr. J.D. Adiga welcomed the scientists and resource persons. He briefed about the ICAR guidelines on project implementation. Dr. Vasudeva, Dean, Forestry College, Sirsi served as resource person for the Crop Improvement section. Dr. Sakthivel, T., Principal Scientist Division of Fruit Crops, Principal Scientist, ICAR-IIHR, Bengalru Bengaluru served as resource person for Crop Managemenbt section. Dr. Sushilendra, Prof. & Head Dept. of Farm Machinery & Power Engineering College of Agricultural Engineering, Raichur, University of Agricultural Sciences, Raichur served as resource person for Farm Machinery section. Dr. J. Srikanth, Principal Scientist ICAR-Sugarcane Breeding Institute,. Coimbatore and Dr. Biju C. N., Principal Scientist (Plant Pathology), ICAR-IISR, Calicut served as resource persons for Crop Protection and Plant Pathology sections respectively. Dr N Venkatachalapathy Dean (Research Consultancy and International Relations) National Institute of Food Technology Entreprenuership and Managment served as resource person for Post harvest technology and Food technology sections. Dr. M V Prasad, Principal scientist (Agril. Extension), Transfer of Technology, ICAR-IIOPR, Pedavegi - 534 435. Eluru Dist. Andhra Pradesh served as resource person for the Transfer of Technology section. The scientists were presented the achievements made under various ongoing projects during the reporting period and presented new project proposals for consideration. The summary of projects presented in IRC and approvals are given below.

Sl. No.	Name	Institute	External	Activity	New projects	New activity	Project getting concluded in 36th IRC	Total institute projects estimated = (a+d)-f	Total External Projects
	Scientist-wise	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**
1.	Dr. J.D. Adiga	1						1	0
2.	Dr. T.N. Raviprasad	2						2	0
3.	Dr. D. Balasubramanian	5		1		1	2	5	0
4.	Dr. Mohana, G.S.	4	1					4	1
5.	Dr. K. Vanitha	1	1		1		1	2	1
6.	Dr. Eradasappa E	2	1					2	1
7.	Dr. V. Thondaiman	2						2	0
8.	Dr. Babli Mog	2			1			3	0
9.	Dr. Rajashekara, H.	1	1		1			2	1
10.	Dr. G.L. Veena	2	2	1	1		1	3	2
11.	Dr. Siddanna Savadi	2						2	0
12.	Dr. Bhagya. H.P.	3		2				3	0
13.	Dr. Manjesh. G.N.	2						2	0
14.	Dr. Manjunatha. K	2	2					2	2
15.	Dr. Aswathy C	2				1		2	0
16.	Dr. Jyoti Nishad	2						2	0
	TOTAL	**35**	**8**	**4**	**4**	**2**	**4**	**39**	**8**

14.3 Institute Joint Staff Council (IJSC)

The XII IJSC meeting was held on 01st February, 2024 under the chairmanship of Dr. J. Dinakara Adiga, Director, ICAR-DCR, Puttur. The following members were present in the meeting

1.	Dr. J. Dinakara Adiga, Director	Chairman
2.	Dr. Eradasappa.E, Senior Scientist	Member, Official side
3.	Dr. Raghurama Kukkude, Assistant Chief Technical Officer	Member, Official side
4.	Finance & Accounts Officer	Member, Official side
5.	Administrative Officer	Secretary, Official side
6.	Mrs. Leela. M, Assistant Administrative Officer	Member, Staff side
7.	Sri. Ravishankar Prasad, Technical Officer	Member, Staff side
8.	Sri. Sundara. V, Skilled Support Staff	Member, Staff side
9.	Sri. Seetharama. B, Skilled Support staff	Member, Staff side
10.	Mr. Umashankar, Assistant	Secretary, Staff side

15. PROGRAMMES, WORKSHOPS, SEMINARS, TRAINING, FARMERS DAYS AND OTHER RELEVANT EVENTS ORGANIZED

15.1Programmes/ Events Organized

Cashew Day 2024

The Directorate celebrated the Cashew Day-on 16th March, 2024. Shri Ramakumar Rajarathnam, progressive cashew farmer, of Chitradurga, was the chief guest of the program and he highlighted the importance of cashew cultivation prospects in rainfed areas especially in plain parts of Karnataka. Dr. M.K. Rajesh, Head CPCRI, Regional Station, Vittal graced the program as guest of honour and appreciated the contribution made by DCR, Puttur on cashew cultivation and production technology. He highlighted the various cashew varieties released by the Institute and the contribution of the biotechnology in respect of whole genome sequencing of cashew variety for the first time and releasing of other value-added products of cashew apple for increasing the farm income.

During the program, Nethra Jumbo-2 (H-125), a new variety developed by this directorate was released and distributed the cashew grafts to farmers and the cashew value added products like cashew fruit bar, Nethra-CAPP cookies were also released on this occasion. The extension leaflet folders on different aspects were also released in the event. An e-book on 25 cashew fruit recipes in 11 languages written by Smt. Soukhya Mohan was also released. Under Schedule Caste Sub Plan, agricultural inputs chain saw and brush cutters were also distributed to selected farmers in the program.

The two special lectures were also delivered on waste to wealth: adding value to cashew apple by Dr. Veena, G.L. Scientist, DCR, Puttur and Value addition in cashew apple by Dr. Jalaja S. Menon, Head, Cashew Research Station, Madakathara, Kerala Agriculture University (KAU), Thrissur. In both presentations, highlighted about the importance of the cashew apple which can be used to prepare various value-added products and increase in income of cashew farmers. An exhibition was also arranged to showcase the technologies of the Directorate. Total 150 participants attended the event.

Foundation Day 2024

Directorate of Cashew Research, Puttur, Dakshina Kannada celebrated its 39th foundation day on 18th June, 2024. Dr. S K Singh, Deputy Dir. General (Horticulture), ICAR, New Delhi was the Chief Guest on the occasion and had joined the program online. In his address, he said that the need of the hour was to equip ourselves with newer and newer technologies to face the challenges of modern-day cashew farmers. The award for Best Research Paper of DCR was given to Dr. Manjunath and his group for their studies on the mechanization of cashew nut separation. Different publications of the institute on Cashew Processing, Agribusiness entrepreneurship, and Transfer of technology were released on the occasion. A folder on a web application “Cashew Farmers Tracking System (CFTS)” was also released on the occasion. This application would help cashew farmers to get details of the purchased varieties and the database would help the institute to track the farmers up to their village level.

Dr. Dinakar Adiga, the Director of DCR, in his introductory remarks, recollected how the directorate has grown to cater to the needs of cashew farmers in the last four decades. He explained the various technologies and varieties developed by DCR for the benefit of cashew farmers. Dr. Nataraj Karaba, Professor and Head of Crop Physiology, University of Agricultural Sciences, GKVK, Bangalore, who delivered the foundation day lecture, emphasized the need to go for genetic engineering techniques to develop superior varieties which in turn can also minimize the time duration to get results. He explained how the Hologenome concept which has helped in other tree crops may help cashew also in exploring better-performing cashew cultivars. Dr. Kempe Gowda, Joint Director, Agriculture, Mangalore, and Dr. Deepaja, Joint Director, Agriculture (RKVY), Bangalore graced the occasion as guests Shri Gopalkrishna Kamath, Member of the Institute Management Committee of DCR and a cashew processor by profession expressed there was a big gap in demand for raw cashew nut by the industry and its production in the country. The industry and research fraternity together need to work to overcome this barrier, he felt. A total of 110 participants attended the programme.

Swachhta Hi Seva campaign 2024

This year marked the 10th year of Swachh Bharat Mission, a nationwide campaign in India to promote hygiene and cleanliness, and eliminate open defecation. The Government of India initiated a three week special campaign to celebrate the 10th year anniversary and ICAR-Directorate of Cashew Research, Puttur organised a series of activities on the theme " Swabhav swachhata, Sanskaar Swachhata" from 14th September – 2nd October, 2024. The activities included webinars and workshops to sensitize the public about the importance of Cashew apple, walkathons, plantation drive, cleanliness drives, health camp for sanitation workers, distribution of PPE kits to farm staff and poster drawing competitions for the school students in Puttur.

Swachhta Special campaign 4.0

A special swachhta campaign 4.0 was organised at the Directorate from 2nd to 31st October, 2024. During the campaign, cleanliness drives and scrap disposal were initiated.

Swachhta Pakhwada 2024

The ICAR-Directorate of Cashew Research, Puttur organized Swachhta Pakhwada campaign from 16th to 31st December, 2024. The activities were planned and implemented according to the tentative activity schedule given from the council ensuring the active participation of ICAR-DCR staff, school students, youths, and residents of nearby villages. Various activities were organized which includes cleanliness drives within and outside the institute, pledge taking by the ICAR-DCR staff, residents of villages and school students, short video contests and tagline competitions, awareness talks by experts and distribution of dustbins to residents of nearby village for creating awareness on the importance of swachhta.

Celebration of World soil day 2024 cum Seed kit distribution at Puttur

ICAR-Directorate of Cashew Research Puttur celebrated World Soil Day 2024. The theme of this year's World Soil Day is "Caring for Soils: Measure, Monitor, Manage." On this occasion, an awareness programme was organized for farmers on the topic Importance of Soil health, on 05th December, 2024. A total of 42 participants attended this programme which included 24 Male and 18 Female participants. On this occasion Dr. J. Dinakara Adiga, Director, ICAR, DCR, Puttur addressed the gathering by mentioning the importance of World Soil Day, and measures to keep the soil in good health. Dr. Veena, G.L. Scientist (Nodal officer Soil Health Programme) addressed the gathering by delivering a lecture on the importance of soil tests in crop cultivation and key points to be followed during soil sampling. She also highlighted the facilities available at ICAR-DCR Puttur for testing of soil.

Dr. Thondaiman, V. Sr. Scientist (SPM&AP) delivered a lecture on the Importance of Kitchen gardening and the importance of balanced nutrition in the daily diet. He also emphasized the benefits of the kitchen garden. Ms. Prajna, (YP-I), briefed about compost preparation by utilizing kitchen waste. As a part of the programme Soil health cards and vegetable seed kits were distributed to the farmers, to create awareness about the importance of soil tests and encourage kitchen gardening.

Kisan Diwas, 2024

Kisan Diwas-2024 was celebrated on 23rd December, 2024. The programme commenced at 10.30 am. Sh. Vishwanath, Superintendent, Social Welfare Department, Puttur, Karnataka was the chief guest for the function. He emphasized the welfare programmes for scheduled caste and scheduled tribes in his address. Dr. J Dinakara Adiga, Director, ICAR-DCR, Puttur presided the function. He appraised the audience about the social status of farming communities, problems associated with achieving the goal of food security, and importance of farmers in this. He also enlightened the farmers to utilize the benefits under Tribal Sub Plan (TSP) offered by the Directorate for improving the livelihood status of farmers. Dr. Manjunatha K, Scientist (Farm Machinery and Power) and nodal officer (TSP), ICAR-DCR briefed the audience about the various activities undertaken as a part of the TSP programme. This was followed by distribution of kitchen garden tools, solar lights and tarpaulins to the ST farmers. There was also a technical session on "prospects of cashew cultivation in Dakshina Kannada" delivered by Dr. Bhagya H P, Scientist (Spices, Plantations, Medicinal and Aromatic Plants), ICAR-DCR. A total of 48 farmers attended the programme.

Sexual Harassment of Women at Workplace Prevention Week

During the occasion of observation of 'Sexual Harassment of Women at Workplace Prevention, Week' - 2024, a programme was organized at ICAR-DCR, Puttur on 12th December, 2024. The programme was organized to sensitize about the POSH act and its role in ensuring a safe and respectful work environment. Dr. Babli Mog, Scientist (Plant Physiology) and member, ICC welcomed the chief guest and the participants to the meeting. Dr. K. Vanitha, Chairperson of ICC, ICAR-DCR, Puttur gave an introduction about the POSH act and the new She-Box portal recently launched by the Union Ministry. Mrs. Chandravathi, T., Advocate, Puttur and the chief guest of the programme delivered a talk on 'Presentation of sexual harassment of women at work place' and spoke about POSH act, the role of the Internal complaints Committee and (LCC) and the Local committees (LC). She stressed that timely investigation and justice is important for the aggrieved women. Dr. J. D. Adiga in his presidential remarks highlighted the importance of providing safe environment to the employees at an institution. The programmed ended with vote of thanks by Dr. Rajashekara, Member Secretary, ICC. A total of 70 participants including ICC, ICAR-Puttur, attended the programme.

15.2 Training / Workshops

Training programme on Cashew based intercropping

ICAR-Directorate of Cashew Research, Puttur organised a training on Cashew based intercropping in collaboration with the Rotary club Puttur on 20th February, 2024 at the Directorate. Dr. N Yadukumar, retired Principal Scientist, ICAR-DCR, Puttur explained the scope of intercropping in cashew and shared his experience abroad. The training was attended by the ICAR-DCR staff and Rotarians. A total of 50 participants were present for the training programme.

Entrepreneurship Development Programme (EDP) on Cashew based Value Added Products Formulation

ICAR-Directorate of Cashew Research (ICAR-DCR), Puttur, under Agri-Business Incubation (ABI) scheme organized an Entrepreneurship Development Programme (EDP) on "Cashew based Value Added Products Formulation" on 16th March 2024 for 26 farmers of different regions of Dakshina Kannada.

Dr. J.D. Adiga, Director, ICAR-DCR inaugurated the programme and emphasized the significance of entrepreneurship in fostering self-reliance and generating income. Dr. D. Balasubramanian, Nodal officer ABI, ICAR-DCR, delved into the current state of entrepreneurship in India and the role of ABI in enhancing agri-entrepreneurship. Discussions also centered around the potential for startups in cashew value addition, aiming to raise awareness and ignite enthusiasm among attendees regarding the opportunities within agribusiness in the cashew sector.

Dr. Veena G L, Scientist (Fruit Science) and Dr. Jyoti Nishad, Scientist (Food Technology) illustrated cashew apple and cashew nut value-added products, presented technologies of ICAR-DCR and the necessary procedures for their adoption. Dr. Manjesh, G.N., Scientist (SPM & AP) aided in facilitating the implementation of EDPs.

The participants were encouraged to share their experiences, pose questions, and provide feedback about the Entrepreneurship Development Programme. The event concluded with the National Anthem and a group photo, marking a successful gathering focused on promoting entrepreneurship and innovation in agriculture. Total 26 farmers attended this programme.




One-day Training on Mechanization in Cashew cultivation and Post-Harvest Technology

A training programme on "Mechanization in Cashew cultivation and Post-Harvest Technology" was organized in collaboration with Food Chain, a Mangalore based organization on 19th July, 2024. The training aimed at imparting awareness about the importance of farm mechanization in pre-harvest and post-harvest technologies in Cashew. Dr. D Balasubramanian, Principal Scientist (AS and PE) delivered a lecture on Entrepreneurial development through engineering approaches in cashew processing and Dr. Manjunatha K, scientist (FM and P) explained about Mechanization in India: Challenges and way forward" During the training, practical oriented sessions were arranged highlighting some of the research institute's initiatives. The training was attended by 35 students of St. Joseph's Engineering College, Mangalore.

One-day training programme on Importance of cashew apple and its value addition for nutritional security

ICAR-Directorate of Cashew Research, Puttur in collaboration with Food chain organisation conducted a training programme for the home science students of Besant Women's college, Mangalore on 6th September, 2024 at the Directorate. The training aimed to impart awareness on the importance of cashew apple and its value addition for nutritional security.

Dr. Jyoti Nishad, Scientist (Food Technology), ICAR-DCR, Puttur in her lecture focussed on the nutritional importance of the cashew apple and the process of value addition. She explained the various steps involved and demonstrated few value added products developed by the Directorate. She also discussed the FSSAI requirements for labelling and packaging and oriented the students about the Agri Business facility. During her interaction, the students were sensitised on the career opportunities available after graduation and post-graduation in food science and home science

The students visited the Cashew Museum and Food technology lab to acquaint them with the various equipment available for food processing. A total of 29 students attended the training programme.

Student Awareness programme on cashew cultivation and enterprise development through Agri-incubation facility

An awareness programme was organised for 45 students of Vivekananda College of Arts, Science and Commerce on 30th October, 2024 at the Directorate. The programme aimed to orient the students about the activities of Agri Business Incubation (ABI) centre and create awareness on business opportunities in cashewnut processing and cashew apple value addition. Dr. D Balasubramanian and Dr. Veena G L were the resource persons. Following the lectures, the students were taken to the cashew museum.

Five days ICAR- Research Institute Orientation Training Programme for students of College of Horticulture, Mudigere

The ICAR-Directorate of Cashew Research in collaboration with College of Horticulture, Mudigere organized a five days Research institute orientation training programme for ten final year students of College of Horticulture, Mudigere under Rural Horticulture Work Experience Programme (RHWEP) from 11th to 15th November, 2024. The students were given orientation about the structure and functioning of the institute which include functioning of PME, AKMU, e-office, HRD cell, ITMU. Students were also attached to the various sections of the institute wherein they were oriented to farm, national gene bank, bee park and the labs. Exposure visits were arranged to the cashewnut processing industry and CAMPCO.

Research-Extension-Farmers interface meeting

The honorable PM Narendra Modi dedicated 109 new varieties of agriculture and horticulture crops from Indian Agricultural Research Institute, New Delhi. The hon'ble PM dedicated two cashew hybrid varieties, Nethra Jumbo-1 and Nethra Ganga developed by ICAR-Directorate of Cashew Research, Puttur on the occasion. Nethra Jumbo-1 and Nethra Ganga are jumbo nut varieties and the nuts weigh 12g – 13g. On the occasion of the release, ICAR-Directorate of Cashew Research, Puttur organized a scientist-farmer interaction to create awareness about the newly released varieties.

The programme commenced with the introductory remarks by Dr. J Dinakara Adiga where he emphasized that it is a proud moment for the institute and congratulated the scientists for their efforts. This was followed by a brief presentation on the newly released varieties. Dr. Eradasappa E, Senior Scientist Genetics and plant breeding, lead developer of Nethra Ubhaya, which is a dual-purpose variety presented about the characteristics of the variety. This was followed by presentation on Nethra Jumbo-1 by the lead developer Dr. J Dinakara Adiga, Director, ICAR-DCR, Puttur and on Nethra Ganga by Associate developer, Dr. Mohana G S, Principal Scientist (Genetics and Cytogenetics).

Dr. N Yadukumar, Retired Principal Scientist of the Directorate shared his experience about the production and sale of the cashew grafts of the newly released varieties Nethra Jumbo-1 and gave positive feedback about the demand. Shri Kadamajalu Subash Rai, progressive farmer, who is associated with ICAR-Directorate of Cashew, Puttur explained his experience with cashew cultivation and the prospects of growing the crop. A total of 37 participants attended the programme including scientists. 24 farmers attended the interaction meeting.

15.3 Frontline Demonstrations

Frontline Demonstration of newly released varieties of ICAR-DCR, Puttur

A frontline demonstration plot showcasing the newly released varieties of cashew were established on one acre in the Cashew Progeny Orchard in Gallimukha, Kasaragod. The newly released varieties of Nethra Jumbo-1, Nethra Ganga, Nethra Ubhaya along with check variety Bhaskara were planted to showcase the performance of the varieties to farmers. A team of scientists comprising of Dr. Aswathy Chandrakumar, Dr. Manjesh G N, Dr. Rajashekara H, visited the demonstration plot and advisories were given to the farm staff regarding the planting and maintenance of the demonstration plot.

16. राजभाषा कार्यान्वयन एवं प्रगति

राजभाषा कार्यान्वयन समिति

1.	डा. जे. दिनक अडिग	अध्यक्ष
2.	डा. राजशेकर	सदस्य
3.	डा. अश्वती चंद्रकुमार	सदस्य
4.	डा.ज्योती निषाध	सदस्य
5.	डा. रघुराम कुक्कडे	सदस्य
6.	श्री अश्विनी कुमार सिंह	सदस्य
7.	श्री राहुल यादव	सदस्य
8.	श्रीमती लीला एम.	सदस्य
9.	श्री विजय आचारी	सदस्य
10.	श्री प्रकाश जी. भट्	सचिव सदस्य

राजभाषा विभाग, गृह मंत्रालय और भारतीय कृषि अनुसंधान परिषद की ओर से जारी किए जा रहे राजभाषा कार्यान्वयन संबंधी दिशानिर्देश और भारत सरकार की राजभाषा नीति के अनुपालन के संबंध में राजभाषा विभाग द्वारा निर्धारित वार्षिक कार्यक्रम में उल्लिखित लक्ष्यों को पूर्ति तथा राजभाषा हिंदी के उत्तरोतर प्रगति हेतु राजभाषा कार्यान्वयन के सभी पहलुओं पर इस निदेशालय में प्रयास किया जा रहा है।राजभाषा विभाग एवं भारतीय कृषि अनुसंधान परिषद के निर्देश एवं आदेशों के अनुपालन एवं राजभाषा कार्यान्वयन की प्रगति की समीक्षा हेतु इस निदेशालय में निदेशक महोदय की अध्यक्षता में गठित राजभाषा कार्यान्वयन समिति की बैठक नियमित रूप से आयोजित की जा रही है। इस बैठक को हर तिमाही में एक बार आयोजन की जा रही है।

इस समिति में राजभाषा विभाग के वार्षिक कार्यक्रम के अनुसार राजभाषा कार्यान्वयन प्रगति तथा भारतीय कृषि अनुसंधान परिषद के आदेशों के अनुपालन पर चर्चा एवं समीक्षा की जाती है। इस निदेशालय के प्रशासनिक अधिकारी, विभिन्न अनुभागों के छः कर्मचारी इस समिति के सदस्य है। प्रत्येक बैठक के कार्यवृत्त की समीक्षा निदेशक (राजभाषा) भारतीय कृषि अनुसंधान परिषद की ओर से की जाती है और तदनुसार अगली बैठक में चर्चा कर निदेशक महोदय की अनुमति से पुष्टि की जाती है।

राजभाषा अधिनियम 1963 धारा 3(3) के अनुपालन का अधिकाधिक प्रयास किया जाता है। तदनुसार निदेशालय की ओर से जारी किए जा रहे प्रपत्रों को द्विभाषीकरण कर नियम का अनुपालन सुनिश्चित किया जाता है। वार्षिक प्रतिवेदनों को पूर्णरूप से हिंदी में भी तैयार कर अधिनियम का अनुपालन किया जा रहा है। राजभाषा के प्रति जागरुकता पैदा कराने हेतु राजभाषा विभाग की ओर से जारी किए गए वार्षिक कार्यक्रम के अनुसार हर साल इस निदेशालय में सितंबर में हिंदी सप्ताह समारोह आयोजन किया जाता है। इस अवसर पर कर्मचारियों के लिए

विभिन्न प्रतियोगिताओं जैसे हिंदी निबंध लेखन, प्रारुप, टिप्पण एवं मसौदा लेखन प्रतियोगिता, क्विझ प्रतियोगिता आदी आयोजित की जाती है।

इस वर्ष भी पुत्तूर नगर राजभाषा कार्यान्वयन समिति की दो अर्ध वार्षिक बैठक और चार तिमाहि बैठकों को आयोजन किया गया। इन बैठकों में निदेशालय की हिन्दी गतिविधियों के बारे में विस्तृत रूप से चर्चा किया गया। राजभाषा में कार्यालय के कामकाज करने के बारे में जरूरी कदम उठाने के बारे में और कर्मचारियों को हिन्दी ज्ञान दिलाने के लिए आवश्यक कदम उठाने के बारे में योजना बनाई गई। सितंबर महिने में दिनांक 14-28 तक हिन्दी पखवाडा मनाया गया। पखवाडा के अवसर पर विध्यार्थियों और कर्मचारियों के लिए भाषण, निबंद लेखन और सामान्य ज्ञान प्रतियोगिता आदी आयोजन किया गया।

हिन्दी में कार्यालयीन काम करने वाले निदेशालय के कर्मचारियों को नकद पुरस्कार से सम्मान किया गया। राजभाषा की कार्यन्वयन को

बढ़ावा देने के लिए पूरी कोशिश किया गया।

राजभाषा नियम 1976 नियम 11 के अनुपालन हेतु आवश्यक सामग्रियों जैसे प्रपत्र, रबड़ की मोहरें, नाम पट्ट आवश्यकतानुसार द्विभाषी में तैयार कर समय समय पर मार्गनिर्देश दिया जाता है। सम्मेलनों का बैनर एवं निमंत्रण पत्र द्विभाषा में ही प्रदर्शित किया जाता है। हिंदी पत्रों की आवति के लिए प्रत्येक रजिस्टर रखकर राजभाषा नियम 1976 नियम 5 का अनुपालन पूर्ण रूप से शत प्रतिशत किया जाता है।

वेबसाइट का प्रदर्शन:

निदेशालय की वेबसाइट द्विभाषा में प्रदर्शित किया गया है। राजभाषा से संबंधित सभी गतिविधियों का विवरण वेबसाइट पर दिया जाता है।

हिंदी कार्यशाला

सरकारी काम काज में हिंदी का प्रयोग बढ़ाने एवं हिंदी कार्य का उपयोगी ज्ञान प्राप्त कराने हेतु निदेशालय में कार्यशालाओं को आयोजन किया जा रहा है। इस वर्ष भी अनुभवी मर्गदर्शकों की मार्गदर्शन में मसौदा लेखन, टिप्पणी लेखन, अनुवाद, राजभाषा नियम एवं अधिनियम पर जनेवरी में हिंदी कार्यशाला आयोजित की गई और उन्हें अभ्यास भी कराया गया है। उपर्युकत कार्यशालाओं में निदेशालय के अधिकारियों तथा नगर राजभाषा कार्यान्वयन समिति के सदस्य कार्यालयों के अधिकारियों एवं कर्मचारियों को भी उपस्थित होने का सुअवसर प्रदान किया गया।

पुत्तूर नगर राजभाषा कार्यान्वयन समिति

पुत्तूर नगर और आस पास के केन्द्र सरकारी कार्यलयों में राजभाषा हिन्दी का कार्यान्वयन सुनिश्चित करने की दृष्टी से पुत्तूर और विट्ल में स्थित केंद्रीय सरकार के कार्यालय, उपक्रम, बैंक सहित 12 सदस्य कार्यालय सम्मिलित नगर राजभाषा कार्यान्वयन समिति (नराकास) का घटन किया गया है। पुत्तूर नराकास की अर्धवार्षिक बैठक दिनांक 23.1.2023 & 26.07.24 को निदेशक महोदय की अध्यक्षता में आयोजित की गई। बैठक में सदस्य कार्यालयों से राजभाषा कार्यान्वयन से संबंधित अर्धवार्षिक प्रगति रिपोर्ट की समीक्षा की गई। काजू अनुसंधान निदेशालय की ओर से आयोजित हिंदी कार्यशाला और प्रशिक्षण में नराकास के सदस्य कार्यालयों को भी आमंत्रित किया गया और संयुक्त रूप से आयोजन किया गया।

निदेशालय में निम्न लिखित रिपोर्ट हिंदी में प्रकाशित किया गया:

1. निदेशालय का वार्षिक प्रतिवेदन का सारांश(वर्ष 2024)
2. अखिल भारतीय समन्वित काजू अनुसंधान परियोजना की वार्षिक प्रतिवेदन सारांश
3. अर्ध वार्षिक, पत्रिका 'काजू समाचार' में हिंदी समिती की गतिविधियों के बारे में प्रतिवेदन।
4. दैनंदिन प्रयोग में आने वाले प्रपत्रों का हिंदी रूपान्तरण।

निदेशालय के सभी वैज्ञानिक, अधिकारी एवं कर्मचारी कार्यालयीन काम में राजभाषा हिंदी के कार्यान्वयन के लिए अपनी प्रतिबद्धता दोहराते हैं।

17. DISTINGUISHED VISITORS

Sl. No.	Name and Designation	Date of Visit
1	Dr. B N S Murthy Former Director, ICAR-IIHR	05th March, 2024
2	Dr. V B Patel ADG (Fruit & Plantation) ICAR headquarters, New Delhi	05th April, 2024
3	Dr. R N Padaria Joint Director (Agricultural Extension), ICAR-IARI, New Delhi	05th April, 2024
4	Deepaja S M Joint Director of Agriculture RKVY Section, Bengaluru	18th June, 2024
5	Dr. Radha Krishna Bhat Retired DRDO Scientist	16th August, 2024
6	Dr. Parveen Kumar Director ICAR – CCARI	28th August, 2024
7	Prof. P. L Saroj Farmer Director DCR Puttur	02nd September, 2024
8	Dr. S B Dandin Farmer VC, UHS, Bagalkot	02nd September, 2024
9	Dr. Sreenath Dixit Pri. Sci & Str Advisor office & DG CRISAT	02nd September, 2024
10	V. B Patel ADG (Fruits & Plantation Crops) ICAR New Delhi	02nd September, 2024
11	Dr. P N Anandh Principal Scientist Head KVK Lakshadweep	02nd September, 2024
12	Dr. Jeena Devasia DDR, Coffee Research Substation Chettalli.	09th October, 2024
13	Dr. V Kumar Principal Scientist ICAR-NRCB Trichy	04th November, 2024
14	Dr. K V Prasad Director ICAR – DFR Pune	05th November, 2024
15	Dr. K Suresh Director ICAR- IIOPR, Pedavegi, Andhra Pradesh	05th November, 2024
16	Dr. B. M. K Reddy ARS Ex Chairman A. P State Biodiversity Board GUNTUR	22nd November, 2024
17	Dr. C Ramachandran Principal Scientist, ICAR-CMFRI, Kochi.	30th December, 2024

18. PERSONNEL

Research Management Position		
1.	Dr. J. Dinakara Adiga	Director
Scientific		
1.	Dr. T. N. Raviprasad	Principal Scientist (Agricultural Entomology)
2.	Dr. D. Balasubramanian	Principal Scientist (Agricultural Structures and Processing Engineering)
3.	Dr. Mohana G.S.	Principal Scientist (Genetics & Cytogenetic)
4.	Dr. Eradasappa E.	Senior Scientist (Plant Breeding)
5.	Dr. K. Vanitha	Senior Scientist (Agricultural Entomology)
6.	Dr. Babli Mog	Senior Scientist (Plant Physiology)
7.	Dr. Rajashekara H.	Senior Scientist (Plant Pathology)
8.	Dr. V. Thondaiman	Senior Scientist (Spices, Plantation, Medicinal & Aromatic Plants)
9.	Dr. Veena G. L.	Scientist (Fruit Science)
10.	Dr. Siddanna Savadi	Scientist (Agricultural Biotechnology)
11.	Dr. H. P. Bhagya	Scientist (Spices, Plantation, Medicinal & Aromatic Plants)
12.	Dr. Manjesh G. N.	Scientist (Spices, Plantation, Medicinal & Aromatic Plants)
13.	Dr. Manjunatha K.	Scientist (Farm Machinery & Power)
14.	Dr. Aswathy Chandrakumar	Scientist (Agricultural Extension)
15.	Dr. Jyoti Nishad	Scientist (Food Technology)
Technical		
1.	Sri. Prakash G Bhat	Chief Technical Officer
2.	Sri. N. Manikandan	Assistant Chief Technical Officer
3.	Dr. Raghurama Kukkude	Assistant Chief Technical Officer
4.	Sri. Ravishankar Prasad	Technical Officer
5.	Sri. Ashvini Kumar Singh	Technician
6.	Sri. Rahul Yadav	Technician
7.	Sri. Lalan Kumar	Technician
Administration		
1.	Sri. Nithianandan K. R.	Administrative Officer
2.	Sri. Ashwin G.	Finance & Account Officer
3.	Smt. M. Leela	Assistant Administrative Officer
4.	Smt. Reshma K	Private Secretary
5.	Sri. Umashankar	Assistant
6.	Sri. Sandeep Joshi	Assistant
7.	Sri. Prateek Tewari	Assistant
8.	Sri. Jayarajan.V.V	UDC

Skilled Supporting Staff

Sl. No.	Name	Sl. No.	Name
1	Sri. N. Narayana Naik	7	Sri. B. Kushalappa
2	Sri. Vijaya Achari	8	Sri. B. Babu Gowda
3	Sri. V. Sundara	9	Sri. S. Monappa
4	Sri. C.H. Hariya Naik	10	Sri. B. Seetharama
5	Sri. K. Narayana	11	Sri. K. Gopalakrishna
6	Sri. B. Narayana Poojari	12	Smt. S. Kasturi

Inter- Institutional Transfers

1. Sri. K. K. Sasi, Assistant Finance & Account Officer transferred to ICAR-CPCRI, Kasaragod on 25th April, 2024.

Inter- Institutional Transfers - Join

1. Dr. V. Thondaiman, Scientist, Rejoined back to ICAR-DCR, Puttur from CUTN –Tamil Nadu on 27th May, 2024.

2. Sri. Jayarajan V. V. Lower Division clerk (Deputation Basis), from ICAR-CPCRI, Kasaragod with promotion to the post of Upper Division clerk has reported for duty to this Directorate on 03rd June, 2024.

Retirement

1. Smt. K. Padminikutty, Assistant retired on superannuation w.e.f. 31st January, 2024(FN).
2. Sri. K. Murlikrishna, CTO / Farm Superintendent retired on superannuation w.e.f. 31st May, 2024 (FN).
3. Sri. K, Annu, SSS retired on superannuation w.e.f. 31st May, 2024 (FN).
4. Sri. Krishnappa Naik, SSS retired on superannuation w.e.f. 31st May, 2024 (FN).
5. Sri. T. Padmanabha, SSS retired on superannuation w.e.f. 31st May, 2024 (FN).

Appointment

1. Sri. Ashwin. G, appointed as Finance & Account Officer w.e.f. 22nd April, 2024.
2. Sri. Ashvini Kumar Singh, appointed as Technician (T-1) w.e.f. 06th May, 2024.
3. Sri. Rahul Yadav, appointed as Technician (T-1) w.e.f. 06th May, 2024.
4. Sri. Lalan Kumar, appointed as Technician (T-1) w.e.f. 24th May, 2024.
5. Sri. Sandeep Joshi, appointed as Assistant w.e.f. 17th September, 2024.
6. Sri. Prateek Tewari, appointed as Assistant w.e.f. 16th October, 2024.

Promotion

1. Dr. Babli Mog, Scientist (Plant Physiology) to the Post of Senior Scientist on 01st January, 2023.
2. Dr. Rajashekara H, Scientist (Plant Pathology) to the Post of Senior Scientist on 01st January, 2023.
3. Dr. V. Thondaiman, Scientist (Spices, Plantation, Médicinal & Aromatic Plants) to the Post of Senior Scientist on 01st January, 2023.

19. PUBLICATIONS FOR SALE

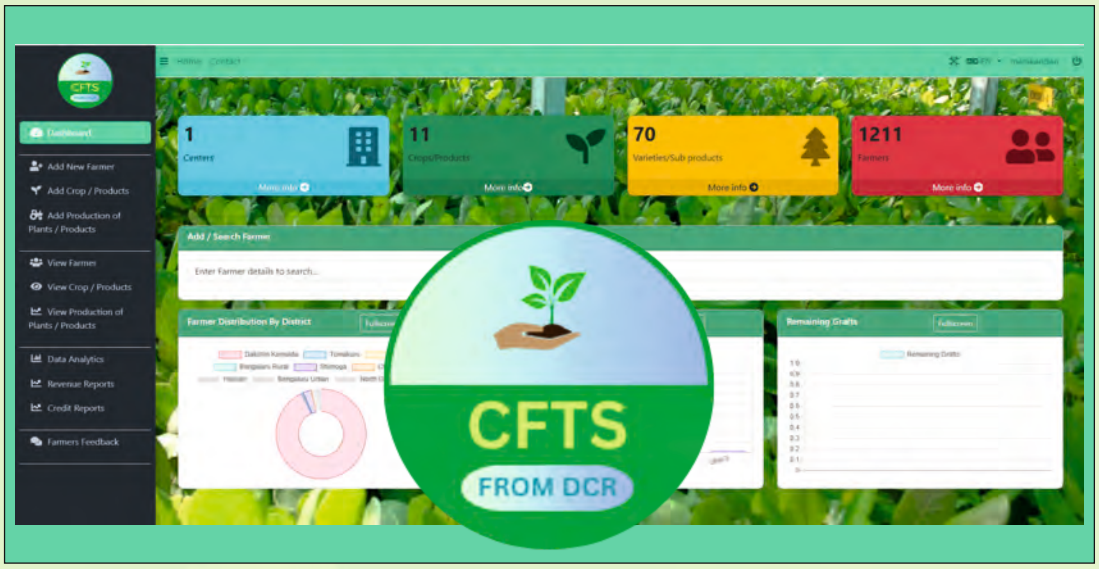
Library and Information Services:

Library and Information Centre of the institute acts as a repository of literature and information in the field of cashew research and development. It continued to collect, store, organize and disseminated much needed information services to scientists, researchers and students from other institutions on all aspects of crop improvement, crop production, crop protection and utilization of cashew crops. An amount of Rs. 1,00,000/- was spent during the period under report to acquire 4 books and for subscribing 16 Indian journals. The library has a total collection of 1991 books and 2255 bound volumes of journals and other reference materials on horticulture, plant breeding, soil sciences, food science and allied subjects. In addition many journals, reports, newsletters were received on gratis/exchange basis. The KOHA Integrated Library Management Software has been in operation in the library. It has a good collection of electronic CD-ROM databases viz., HORT CD ; PLANTgene CD; SOIL CD; CROP CD; CABPEST CD; AGRIS; AGRICOLA, etc. The library is also rendered information and reference services to its users. Access to ICAR-Consortium for e-Resources in Agriculture (CeRA) journals and e-books on agriculture and allied subjects was provided through-Gate Plus Platform. The users of the library extensively used the CeRA to access full text online journals and e-books. In addition to online access to CeRA, library is providing Document Delivery Services to various institutions/SAUs. The unit is also provided active reprography services, newspaper clipping services, Internet services and spiral binding facilities.

Details of Publications for Sale

Sl. No.	Name of the Publication	Qty.	Amount
1	Cashew production technology	8	480-00
2	Process catalogue on development of economically viable on-farm cashewnut processing	4	180-00
3	Pruning and canopy architecturing in cashew	4	160-00
4	Soil and water mgt. in cashew plantations	2	60-00
5	Softwood grafting and nursery mgt. in cashew	5	225-00
6	Annotated bibliography on cashew	1	205-00
7	Development of dual-mode dryer for raw cashewnuts	1	90-00

Price indicated above does not include postage.
Address your enquiries to the Director,
ICAR-Directorate of Cashew Research,
Puttur-574 202, Dakshina Kannada,
Karnataka.



Cashew Farmer Tracking System

Distribution of inputs to beneficiaries under TSP Scheme

Distribution of inputs to beneficiaries under SCSP Scheme

3-in-1 Cashew fruit and nut separator

Cashew Sprouts Cookies

Cashew Apple Muffin

Cashew Prash

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