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ANNUAL REPORT
2022-23

भा.कृ.अनु.प.-केन्द्रीय कृषिवानिकी अनुसंधान संस्थान
झाँसी 284003, उत्तर प्रदेश, भारत

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ICAR-Central Agroforestry Research Institute
Jhansi 284003, Uttar Pradesh, India

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Preface

Agroforestry enables environmentally friendly production while also offering ecosystem services that provide livelihood and safeguard the environment. The practice of agroforestry has a strong conservation agriculture component, which is important since it has the ability to help preserve natural resources in many agro-climatic regions. Moreover, agroforestry is the sole way to increase the nation's forest cover. Only in a scenario of decreasing arable land availability, degraded soil and water resources, rising pollution hazards, and threats to the environment and ecosystem from global warming and climate change can agroforestry interventions meet the growing population's demands for food, fodder, fibre, firewood, and timber. To satisfy these expectations, new farming techniques are necessary. Through coordinated research efforts, CAFRI has been primarily focusing on these issues since its foundation. Four of the more than 80 agroforestry models that the Institute has created and documented for various agroclimatic areas have recently been named by NABARD as bankable agroforestry models.

The Institute has the largest germplasm collection of neem and other agroforestry tree species, including Indian rosewood, cactus, Malabar neem, teak, karanj, leucena, chironji, ber, citrus, mango, aonla, bael, guava, and fig. It also provides opportunities for exploratory research for superior germplasms. Recently, an institute created various vatikas, including the Rashivatika (Zodaic Plantation), Nakshatra Vatika, and Navgarhvatika, to encourage the growth of trees in this period of climate change. These vatikas play important roles in human life in addition to contributing to the growth of the tree canopy. The institute has successfully developed strawberry farming in Jhansi's Babina and Moth blocks with the help of NABARD. The National Mission for Maintaining the Himalayan Environment under the Climate Change Program is a recent initiative that the institute has taken up, and it has a regional centre of the National Afforestation & Eco-Development Board (NAEB). Beside this institute is also documenting the tree number through a USAID project *i.e.* Trees Outside Forests in India (TOFI). The institute has initiated work on drone-based agroforestry in Jhansi and other parts of India.

The Institute Annual Report includes executive summaries, achievements of different research programmes, important meetings/days observed, details on various awards received by Institute scientists and other staff, research publications, participation in trainings, participation in workshops, webinars, meetings, and symposia, as well as a report on the implementation of different externally funded projects, inter-institutional projects and SCSP schemes. The Institute organized farmer events such farmer seminars, training programs, field days, and exhibitions in order to impart agroforestry innovations and promote quick agroforestry adoption. At the selected MGMG villages, scientists from ICAR-CAFRI, Jhansi, took part in a significant plantation campaign.

I express my gratitude to Dr. Himanshu Pathak, Hon'ble Secretary, DARE and Director General, ICAR, New Delhi for his for his unwavering support and encouragement. I am very much pleased to thank Dr. S K Chaudhari, Deputy Director General (NRM), ICAR, New Delhi for his constant direction and motivation. I also thank Dr. Rajbir Singh, ADG (AAF&CC), Dr. Velmurugan, ADG (SWM) and the entire NRM Division for their kind assistance. I thank my predecessors for their assistance in carrying out institutional activities. I appreciate the PME Cell's and the editorial team in preparing and releasing the report on schedule.

(A. Arunachalam)
Director &
Project Coordinator, AICRP (Agroforestry)

कार्यकारी सारांश

भा.कृ.अनु.प.–केन्द्रीय कृषिवानिकी अनुसंधान संस्थान को भारतीय कृषि अनुसंधान परिषद की इकाई के रूप में वर्ष 1988 के दौरान झाँसी में स्थापित किया गया। संस्थान द्वारा पिछले 34 वर्षों में विभिन्न कार्यक्रम के अन्तर्गत अनुसंधान कार्य किये जा रहे है। संस्थान में किये जा रहे अनुसंधान का कार्यकारी सारांश निम्नलिखित हैः

संरक्षित कृषिवानिकी परियोजना में सागौन, बेल और सागौन + बेल आधारित कृषिवानिकी में वृद्धि, उपज और मिट्टी के रासायनिक और जैविक गुणों पर डेटा लिया गया। खरीफ के दौरान, मक्का और ज्वार की फसलों को अलग–अलग जुताई और अवशेष प्रबंधन उपचारों के साथ लिया गया। यह देखा गया कि तीनों कृषिवानिकी प्रणाली में दोनों जुताई उपचार (पारंपरिक और न्यूनतम) सांख्यिकीय रूप से बराबर रहे। हालांकि, फसल अवशेषों के उपयोग से ज्वार और मक्का की फसलों की वृद्धि और उपज काफी अधिक हुई है। फसल अवशेषों के प्रयोग से मक्के के साथ–साथ ज्वार में सूक्ष्मजैविक प्राचलों में भी काफी वृद्धि हुई। तीन प्रणालियों में से सागौन आधारित कृषिवानिकी प्रणाली में उच्च फसल उपज प्राप्त की गई।

आई.आर.सी. की बैठक–2021 में "अर्ध–शुष्क परिस्थितियों में मालाबार नीम आधारित कृषि वानिकी प्रणाली का आंकलन" नामक परियोजना को मंजूरी दी गई थी। तकनीकी कार्यक्रम के अनुसार वर्ष 2022 में मालाबार नीम का रोपण 7 मी. × 3 मी. की दूरी प्रयोगिक प्रक्षेत्र में किया गया। रोपण के दो महीने बाद, 90 प्रतिशत उत्तरजीविता दर्ज की गई। इसके अतिरिक्त, मालाबार नीम को उनके विकास प्रदर्शन का अध्ययन करने के लिए सड़क के किनारे, खेत की मेड़ पर, तालाब आदि के किनारों पर भी लगाया गया। कुछ किसानों के खेतों में भी मालाबार नीम का रोपण भी किया गया।

अर्ध–शुष्क कटिबंध वाले क्षेत्रों में पोषण सुरक्षा के लिए एक बहु–कार्यात्मक कृषिवानिकी प्रणाली विकसित करने के लिए भारत के विभिन्न भागों में कई सर्वेक्षण किए गए और बहु–कार्यात्मक खाद्य वनों के विकास के लिए अब तक 25 अप्रयुक्त प्रजातियाँ की पहचान की गई है, और 14 प्रजातियाँ मधुमक्खी वन (मधुबन) के लिए पहचान की गई है जिसमें परागण और अमृत क्षमता है। प्राकृतिक (चावल के भूसे पर आधारित) और सिंथेटिक मल्च यानी जूट, ऊन, प्लास्टिक और मल्च के तहत मिट्टी के हाइड्रोथर्मल पर्यावरण पर किए गए अध्ययन से पता चला कि खुले और संरक्षित स्थितियों की तुलना में प्लास्टिक मल्च के बाद जूट, ऊन, और चावल के भूसे में शिमला मिर्च ने बेहतर प्रदर्शन किया। परिणामों से पता चला कि शिमला मिर्च संरक्षित परिस्थितियों में बेहतर प्रदर्शन करती है। कृषिवानिकी प्रणाली (सागौन + फसल, मेलिया + फसल, बेर + फसल, आंवला + फसल) के साथ एक कृषि (एक मात्र) फसल प्रणाली पर 'प्रमुख कृषिवानिकी आधारित भूमि उपयोग प्रणालियों में मृदा जैविक और जैव रासायनिक लक्षणों का आंकलन' परियोजना में मिट्टी के विश्लेषण से महत्वपूर्ण ($P<0.05$) रूप से पता चला सागौन + फसल प्रणाली में उच्चतम माइक्रोबियल श्वसन के रूप में 192.4 और 84.1 माइक्रोग्राम Co_2/ग्राम, माइक्रोबियल बायोमास कार्बन 305.0 और 152.4 मिलीग्राम/किलोग्राम, माइक्रोबियल बायोमास नाइट्रोजन 112.7 और 78.1 मिलीग्राम/किलोग्राम और कॉलोनी बनाने के रूप में फफूंद की इकाई (सीएफयू) क्रमशः 17×104 और 9×104 ग्राम/मृदा शीर्ष मृदा (0–15 सेमी) और उपमृदा (15–30 सेमी.)। जबकि, आंवला + फसल प्रणाली ने उच्चतम डिहाइड्रोजन ने एंजाइम गतिविधि दर्ज की, और दोनों मिट्टी की गहराई पर बैक्टीरिया और एक्टिनो बैक्टीरिया के सीएफयू। एकल फसल प्रणाली ने सबसे कम मिट्टी की सूक्ष्म जैविक गतिविधियों को दिखाया।

उच्च एजाडिरेक्टिन उपज परियोजना के लिए नीम जर्मप्लाज्म के आनुवंशिक लक्षण वर्णन में, हम उच्च एजाडिरेक्टिन उपज के लिए नीम जर्मप्लाज्म के लक्षण वर्णन के लिए एजाडिरेक्टिन आंकलन को अनुकूलित करने की प्रक्रिया में हैं।

मध्यप्रदेश और उत्तर प्रदेश के बुंदेलखंड जिलों से विभिन्न रूपात्मक विशेषताओं वाले कुल तीस मोरिंगा जर्मप्लाज्म एकत्र किए गए हैं जो फील्ड जीन बैंक के रूप में संस्थान में संरक्षित हैं । इनमें से जर्मप्लास्म–6 का कड़वा स्वाद, जर्मप्लास्म–9 साल में दो बार फल वाला, जर्मप्लास्म–10 को बैंगनी रंजकता तथा जर्मप्लास्म–58 और 12 को वार्षिक फूल और फल देने वाला पाया गया। अन्य चार जर्मप्लास्म में तीव्र गति से बढ़ने की क्षमता पायी गयी। आणविक स्तर पर वास्तविक भिन्नता को समझने के लिए रूपात्मक विविधता और आणविक विविधता विश्लेषण प्रगति पर है।

भा.कृ.अनु.प.–सी.ए.एफ.आर.आई., झाँसी में पूर्व में देखे गए एक वर्ष पुराने मालाबार नीम के पौधों में मुरझान और जड़ सड़न की 90 प्रतिशत घटना देखी गई थी, जो वर्तमान परियोजना के लिए एक आधार थी। अलग किए गए कल्चर में इंटरक्लेरी क्लैमाइडोस्पोर्स, 1–2 सेल वाले माइक्रो और 2–4 सेल वाले मैक्रोकोनिडिया के साथ सेप्टेट, हाइलिन, ब्रांच्ड मायसिलियम दिखाया गया है। चुनौती टीकाकरण के साथ पौधों में एक विशिष्ट मुरझाने का लक्षण देखा गया था, जो आगे चलकर कोच के अभिधारणा को साबित करता है। आणविक पहचान के लिए, पीसीआर पर मार्कर जीन को बढ़ाने

के लिए किया गया था, जिसमें आंतरिक लिखित स्पेसर, ITS1 / ITS4 और फ्युजेरियम विशिष्ट आणविक मार्कर जैसे fdRNA पोलीमरेज सबसे बड़ा सब यूनिट, RPB1 दूसरा सबसे बड़ा पोलीमरेज सब यूनिट, निर्दिष्ट थर्मोसायकलर (एपेनडोर्फ, जर्मनी) के साथ शामिल है। प्रत्येक जीन के प्राप्त प्रवर्धित उत्पाद को बायोएडिट सॉफ्टवेयर का उपयोग करके अप्रत्यक्ष रूप से अनुक्रमित, क्यूरेट और असेंबल किया गया था। CLC अनुक्रमदर्शक 8.0 का उपयोग करके NCBI डेटाबेस से प्राप्त संदर्भ अनुक्रमों के साथ कई अनुक्रम संरेखण किए गए थे। क्यूरेटेड तीन जीन अनुक्रमों का विश्लेषण किया गया और उनकी तुलना फ्यूजेरियम–एमएलएसटी (मल्टीलोकस सीक्वेंस टाइप) डेटाबेस से की गई, जो जीन सफ्यूजेरियम की अनुक्रम–आधारित सटीक प्रजातियों की पहचान की सुविधा प्रदान करता है, जैसा कि साथ ही जेनबैंक डेटाबेस।

पादप बाह्य संरचना एवं मृदा गृण परियोजना का मुख्य उद्देश्य कृषिवानिकी प्रजातियों का मृदा के गुणों पर प्रभाव का अध्ययन करना, तथा पत्तियों के विभिन्न संरचनात्मक तत्वों में आपसी सम्बंध स्थापित कर कृषिवानिकी में एग्रो–इकोसिस्टम की कार्यप्रणाली को समझना है। अध्ययन हेतु पाँच कृषिवानिकी, पद्धतियों की वृक्ष प्रजातियों जैसे कि – नीम, शीशम, अंजन, बबूल व कुमट का चुनाव किया गया तथा 100 सेमी. गहराई तक के मृदा नमूने लिए गए। वृक्षों की बढ़वार के आँकड़े जैसे – ऊँचाई, मोटाई तथा आच्छादन, मृदा नमूने एकत्र करने के पहले लिए गए। पत्तियों में क्लोरोफिल सूचकांक तथा पत्रण क्षेत्रफल के आंकड़े भी लिए गए। शुरुआती परिणामों से पता चला है कि औसतन मृदा में गहराई बढ़ने के साथ–साथ, औसतन जैविक कार्बन घटता है तथा पी.एच. मान बढ़ता है जबकि मृदा – ई.सी. में कोई रुझान देखने को नहीं मिला। अधिकतम क्लोरोफिल सूचकांक तथा पत्रण क्षेत्रफल नीम में जबकि कुमट में सबसे कम पाया गया।

पोंगामिया पिनाटा वृक्ष प्रजातियों में एक साथ विकास, फेनोलॉजिकल और इकोफिजियोलॉजिकल डेटा एकत्र किए गए हैं। वृक्षों की आबादी में पारिस्थितिक–शारीरिक लक्षणों में विभेदक प्रतिक्रियाएं देखी गई हैं।

सिल्वीपास्टोरल परियोजना में पारिस्थितिकी तंत्र के सेवाओं के मूल्यांकन में, प्रमुख पारिस्थितिकी तंत्र सेवा जैसे प्रावधानी और विनियमित सेवा का मूल्यांकन किया गया। सागौन + महागोनी + चारा + समोच्च कन्टूर खाइयों वाले उपचार में उच्चतम बायोमास उत्पादकता देखी गई। इसी तरह सागौन + महगोनी + चारा + समोच्च कन्टूर खाइयों वाले उपचार में सबसे कम जल अपवाह, मिट्टी और पोषक तत्वों की हानि और उच्चतम तलछट फंसाने की दक्षता देखी गई। केवल महगोनी में सबसे अधिक जल अपवाह और मिट्टी का नुकसान देखा गया। केवल सागौन या महगोनी की तुलना में, मृदा माइक्रोबियल गतिविधियाँ वृक्ष + चरागाह संयोजन में अधिक देखी गई।

प्रारंभिक समूह चर्चा से, यह पता चला है कि कृषिवानिकी को अपनाने में प्रमुख बाधा आवारा जानवर (13.29%) हैं।

गढ़कुण्डार डाबर जलसमेट क्षेत्र में किये गये कृषिवानिकी एवं जल संरक्षण हस्तक्षेपों से फसल पद्धति में बदलाव आया है, जिससे कुल फसल क्षेत्र, फसल सघनता और फसल चक्र सघनता में वृद्धि हुई। इसके अलावा विशेष रूप से कृषिवानिकी हस्तक्षेप, सूखे के समय सूखारोधी तंत्र एवं सामान्य अवधि के दौरान अतिरिक्त आमदनी का स्रोत साबित हुए।

परसाई–सिंध वाटरशेड क्षेत्र में ग्रामीण परिवारों की खाद्य सुरक्षा और आय परिवर्तनशीलता जैसे दो महत्वपूर्ण सामाजिक–आर्थिक मापदंडों पर पेड़ों के ऑन–फार्म एकीकरण के प्रभाव पर अध्ययन से पता चला है कि सभी चीजों को स्थिर रखते हुए पेड़ घनत्व एवं पेड़ विविधता में इकाई प्रतिशत की वृद्धि, खाद्य उपभोग स्कोर (FCS) को 0–231 प्रतिशत और 0–141 प्रतिशत से बढ़ाता है जबकि आय परिवर्तनशीलता को लगभग 0–38 प्रतिशत और 0–16 प्रतिशत घटाता है।

प्राकृतिक रॉल और गोंद की कटाई, प्रसंस्करण एवं मूल्य संवर्धन परियोजना का समन्वयन आई.सी.ए.आर.–एन.आई.एस.ए., रांची द्वारा किया जाता है। केन्द्रीय कृषिवानिकी अनुसंधान संस्थान, झाँसी को सौंपा गया मुख्य उद्देश्य, "आजीविका सुरक्षा और प्रौद्योगिकियों के क्षैतिज प्रसार के लिए राल और गोंद देने वाले पेड़ों को एकीकृत करते हुए कृषिवानिकी मॉडल विकसित करना है।" इसके अंतर्गत पांच उप–परियोजनाओं – i) गोंद देने वाले वृक्ष आधारित कृषिवानिकी मॉडल की उत्पादकता ii) किसानों के खेतों पर गोंद देने वाले वृक्ष आधारित कृषिवानिकी मॉडल का विकास और प्रदर्शन, iii) गोंद और राल के दोहन, अनुप्रयोगों और कटाई के बाद के मूल्यवर्धन पर स्वदेशी तकनीकी ज्ञान (आई.टी.के.), iv) गोंद दोहन तकनीकों का मानकीकरण और v) जड़ वितरण स्वरूप और *ए. सेनेगल* में जमीन के ऊपर और नीचे के बायोमास पर अध्ययन आदि पर संस्थान में शोध किया जा रहा है। वर्ष के दौरान सभी स्थापित कृषिवानिकी मॉडलों में वृक्षों की वृद्धि, गोंद का रिसाव और अंतःफसलों की उपज की निगरानी की गई। मिश्रित ढेर से अलग–अलग गोंद की पहचान करने का तकनीकी ज्ञान एकत्र किया गया। *ए. सेनेगल* और *ए. निलोटिका* में महीन जड़ों के क्षैतिज और लंबवत वितरण का अध्ययन किया गया, और *ए. सेनेगल* के 4, 5, 6, और 7 साल पुराने पेड़ों की कटाई करके जमीन के ऊपर और नीचे के बायोमास का आंकलन गया ।

ए. सेनेगल आधारित बहु–घटकीय (एग्री–होर्टी–सिल्वीकल्चर) मॉडल में, अधिकतम जी.बी.एच. (57.3 सेमी) और कैनोपी स्प्रेड (36.8 वर्गमीटर) बेल में दर्ज किया गया, तथा उससे कम *ए. सेनेगल* में पाया गया। बारानी कृषिवानिकी मॉडल के, बबूल और *ए. सेनेगल* में 10 मीटर × 10 मीटर की रोपाई में अधिकतम जी.बी.एच. पाया गया। सिल्वी–हर्बल मॉडल–I में, *ए. सेनेगल* (48.2 सेमी)

जबकि *ए. निलोटिका* (101.1 सेमी) ने मॉडल–II में अधिकतम जी. बी.एच. दर्ज किया। बहु–घटकीय (एग्री–होर्टी–सिल्वीकल्चर) मॉडल में गेहूं की उपज पेड़ों की प्रजाति के साथ–साथ पेड़ के तने से दूरी से काफी प्रभावित हुई। गेंहू की अधिकतम उपज क्रमशः बेल व नींबू के साथ पाई गयी और जैसे जैसे दूर से तने के पास गए, उपज में गिरावट पाई गयी। वर्ष के दौरान 71 किग्रा. नींबू, 74 किग्रा. करोंदा तथा 1400 किग्रा. बेल फल का उत्पादन हुआ। बारानी कृषि–वानिकी (एग्री–सिल्वीकल्चर) में, *ए. निलोटिका* और *ए. सेनेगल* द्वारा *ईरूका सटाइवा* (तारामिरा) की उपज को रोपाई के तीनों अंतरालों (10 मी. × 10 मी., 10 मी. × 5 मी. और 5 × 5 मी.) ने प्रभावित किया। अधिकतम उपज 10 × 10 मी. की दूरी पर जबकि सब से कम 5 × 5 मी. की दूरी पर देखी गई। सिल्वी–हर्बल मॉडल में, लेमन घाँस के मुंजों की अधिकतम वृद्धि और बायोमास उत्पादन 100 सेमी. × 100 सेमी. की दूरी पर लगाए गए मुंजों में देखा गया। अधिकतम औसत गोंद का उत्पादन एग्री–होर्टी–सिल्वीकल्चर मॉडल में *ए. सेनेगल* (175.5 ग्राम/वृक्ष) द्वारा जबकि सिल्वी–हर्बल मॉडल में *ए. निलोटिका* (102.3 ग्राम/वृक्ष) द्वारा किया गया। किसान के खेतों की तुलना में *ए. सेनेगल* और *ए. निलोटिका* की तुलनात्मक वृक्ष वृद्धि अनुसंधान फार्म पर बेहतर थी। *ए. निलोटिका* ने अनुसंधान फार्म में *ए. सेनेगल* से बेहतर प्रदर्शन किया, जबकि किसानों के खेतों में इसके विपरीत प्रवृत्ति देखी गई। आदिवासी महिलाओं के आई.टी.के. ने खुलासा किया कि सलई (*बोसवेलिया सेराटा*) का गोंद सफेद रंग का, पारदर्शी और विशिष्ट सुगंध वाला होता है। खैर (कत्था) का गोंद गोल आकार का, भूरे से लाल–भूरे रंग का, समान सतह वाला और स्वाद में मीठा होता हैं। बबूल (*ए. निलोटिका*) का गोंद गोल आकार का, पीले से लाल भूरे रंग का असमान सतह और कशैले स्वाद का होता हैं। पलास में गोंद निकलने पर किए गए अध्ययन से पता चला है कि दिसंबर के महीने में अधिकतम गोंद प्राप्त हुआ इसके बाद घटते क्रम में जनवरी और फरवरी में गोंद प्राप्त हुआ। बरसात के मौसम में निकलने वाली गोंद पानी के साथ बह जाती है। *ए. पेंडुला* में एथेफॉन के प्रयोग से पता चला कि सभी संततियों में एथेफॉन के उपयोग का असर दिखाई दिया और एपी–20 के पेड़ों में गमोसिस के साथ अधिकतम गोंद और जे–62 में सबसे कम गोंद पैदा हुआ। महीन जड़ वितरण पर अध्ययन से पता चला है कि सामान्य रूप से, अधिकतम महीन जड़ें गोंद देने वाले दोनों पेड़ों (*ए. सेनेगल* और *ए. निलोटिका*) में मिट्टी की 60 सेमी. गहराई तक सीमित होती हैं और मिट्टी की गहराई और पेड़ से दूरी बढ़ने के साथ महीन जड़ें कम हो जाती हैं। *ए. सेनेगल* में जमीन के ऊपर और नीचे के बायोमास पर किए गए अध्ययनों से संकेत मिलता है कि 4, 5, 6 और 7 वर्ष पुराने पेड़ों में जड़/प्ररोह अनुपात क्रमशः 0.14, 0.12, 0.17 और 0.17 था।

झाँसी जिले के बबीना और मोठ ब्लॉकों में स्ट्रॉबेरी की खेती के मूल्यांकन पर किए गए शोध से पता चला कि स्ट्रॉबेरी ने उपज और गुणवत्ता के मामले में दोनों ब्लॉकों के तहत अच्छा प्रदर्शन किया है। बाजार में उपलब्ध स्ट्रॉबेरी फल की तुलना में परियोजना के अन्तर्गत उत्पादित फलों का रंग, आकार, सुगंध और स्वाद उत्कृष्ट था। 25 किसानों में से, बबीना ब्लॉक के 10 किसानों और मोठ ब्लॉक के 9 किसानों का उत्पादन बेहतर गुणवत्ता वाला था, जो उन्हें उनकी कृषि फसलों की तुलना में अधिक लाभ देता है। स्ट्रॉबेरी की बाजार में कीमत 100 से लेकर 250 रुपये तक थी।

गिरी और तेल उपज के लिए 170 नीम जननद्रव्य की आनुवंशिक क्षमता के आंकलन के आधार पर VKAF11, VKAF3, VKAF13, VKAF9, VKAF67, VKAF68, VKAF92, VKAF110, VKAF85, VKAF43 और OR05 को उच्च कर्नेल और तेल उत्पादक जर्मप्लाज्म पाया गया। इसके अलावा, इस आबादी में रूपात्मक और आणविक मार्करों द्वारा मूल्यांकन किए गए उपज मापदंडों के लिए आनुवंशिक परिवर्तनशीलता का उच्च परिमाण है।

वास्तविक समय के लिए चिप–आधारित प्रौद्योगिकी के समाधान पर पायलट परियोजना के आधार पर और स्केलिंग अप करने के लिए जीन–बैंक और कृषिवानिकी प्रजातियों की आरएफआईडी – निष्क्रिय निगरानी। निष्क्रिय चिप आधारित प्रौद्योगिकी (RFID) द्वारा नीम, पोंगामिया और बबूल के चयनात्मक परिग्रहण के वृक्ष आनुवंशिक संसाधन का प्रभावी प्रबंधन किया जा रहा है। साथ ही सक्रिय चिप्स द्वारा 50 चयनित नीम जर्मप्लाज्म की सक्रिय रूप से निगरानी की जा रही है। अंत में, इन तकनीकों को वृक्ष आनुवंशिक संसाधन प्रबंधन का एक उन्नत तरीका माना जाता है।

Executive Summary

The executive summary of the research and development activities carried out at ICAR-Central Agroforestry Research Institute during 2022 is presented here:

In conservation agroforestry project, data on growth, yield and soil chemical and biological properties were taken in teak, bael and teak+bael based agroforestry. During kharif season, maize and sorghum crops were taken with different tillage and residue management treatments. It was observed that both the tillage treatments (conventional and minimum) statistically remained at par in all the three agroforestry system. However, application of crop residue significantly increased the growth and yield of sorghum and maize crops. Application of crop residue significantly increased the microbial parameters in maize as well as in sorghum. Among the three systems, higher crop yields were obtained in teak based agroforestry system.

The project entitled "Assessment of *Melia dubia* based agroforestry system under semi-arid conditions" was approved in the IRC meeting – 2021. As per the technical programme the plantation of *Melia dubia* was carried out in the year 2022 at a spacing of 7 m x 3 m in the Experimental Farm of the Institute. After two months of plantation, 90% survival was recorded. Additionally, *Melia dubia* was also planted as road sides, on field bunds/boundaries, on the banks of pond etc. to study their growth performance. *Melia dubia* plantation was also carried out at some farmers' fields.

For developing a multifunctional agroforestry system for nutritional security in semi-arid tropics, several surveys were conducted in different parts of India and for the development of multifunctional food forests, till now 25 underutilized spp. has been identified, and 14 spp. has been identified for bee forest which has polleniferous and nectariferous potential. The study on soil hydrothermal environment under natural (rice straw-based) and synthetic mulches *i.e.* jute, wool, plastic and rice straw mulches revealed that plastic mulches performed better followed by Jute, wool, rice straw, and control. Compared to open and protected conditions, the results revealed that capsicum performs better under protected conditions.

In 'Assessment of soil biological and biochemical characters in predominant agroforestry-based land use systems' project on the experimental agroforestry systems (Teak + cropping, Melia + cropping, Ber + cropping, Amla + cropping) along with an agricultural (sole) cropping system, soil analysis revealed significantly (P<0.05) higher basal microbial respiration as 192.4 and 84.1 µg CO_2 g^{-1}, microbial biomass carbon as 305.0 and 152.4 mg kg^{-1}, microbial biomass nitrogen as 112.7 and 78.1 mg kg^{-1} and colony forming unit (CFU) of fungi as 17×10^4 and 9×10^4 g $soil^{-1}$ at the topsoil (0-15 cm) and subsoil (15-30 cm) of Teak + cropping system, respectively. Whereas, amla + cropping system registered highest dehydrogenase enzyme activity, and CFU of bacteria and actinobacteria at both soil depths. Sole cropping system showed least soil microbial activities.

In Genetic characterization of neem germplasm for high azadirachtin yield project, we are in the process of optimizing azadirachtin estimation for characterizing neem germplasm for high azadirachtin yield.

A total of thirty *Moringa oleifera* germplasm with varied morphological characteristics have been collected from different Bundelkhand districts of Madhya Pradesh and Uttar Pradesh and are preserved as field gene bank at research farm of the institute. CMC-6 had bitter taste, CMC-9 exhibited twice a year fruiting habit and CMC-10 possessed purple pigmentation whereas, CMC-5, CMC-8 and CMC-12 showed annual flowering and fruiting habit. Four germplasm were identified for higher initial seedling growth performance. The morphological diversity and molecular diversity analysis are in progress to understand the actual variation at molecular level.

The mortality of one year old malabar neem plants showing wilt and root rot incidence of 90 per cent observed previously in ICAR – CAFRI, Jhansi formed a basis for the current project. The isolated culture shown septate, hyaline, branched mycelium with intercalary chlamydospores, 1-2 celled micro and 2-4 celled macro conidia. A typical wilting symptom was observed in the plants with challenge inoculation further proved Koch's postulates. For molecular identification, PCR assay was performed to amplify marker genes, including internal transcribed spacer, ITS1/ITS4 and *Fusarium* specific molecular markers such as RNA polymerase largest subunit, *RPB1* second largest RNA polymerase subunit, with specified thermocycler (Eppendorf, Germany) conditions. The obtained amplified product of each gene was sequenced bidirectionally, curated, and assembled using BioEdit software. Multiple sequence alignment was performed with the reference sequences retrieved from the NCBI database using CLC sequence viewer 8.0 (Qiagen, http://www.qiagenbioinformatics.com). Curated three gene sequences were analyzed and compared at the *Fusarium*-MLST (Multilocus Sequence Type) database (http://www.cbs.

knaw.nl/*Fusarium*), which facilitates the sequence-based precise species identification of the genus *Fusarium*, as well as GenBank database.

The objectives of the project on plant morphology versus are i) to study the influence of agroforestry tree species on soil properties, and ii) to establish the relationship among leaf traits to understand agro-ecosystem functioning in agroforestry. Five agroforestry systems, with tree speceis *Azadirachta indica, Dalbergia sissoo, Hardwickia binata, Acacia nilotica* and *Acacia senegal* have been selected and soil samples collected up to 100cm depth. The tree growth data *viz.* height, girth, canopy spread were collected before soil sampling. The observation on chlorophyll content index and leaf area were also recorded. The initial results revealed that on an average, the SOC declined and soil pH increased with increase in soil depth, while EC of soil did not show any trend. Maximum chlorophyll content index (CCI) and leaf area were observed in *A. indica* while the least in *Acacia senegal.*

Simultaneously growth, phenological and ecophysiological data have been collected. Differential responses in ecophysiological traits in the tree populations have been observed.

In assessment of ecosystem services in silvipastoral project, major ecosystem services *viz.*, provisioning and regulating services were assessed. The highest biomass productivity was observed with the treatment having teak + Mahogani + pasture + CST and contour staggered trenches. Similarly teak+Mahogani+pasture resulted in lowest runoff, soil and nutrient loss and highest sediment trapping efficiency. Sole plantation of Mahogani observed with high runoff and soil loss. Compared to sole tree plantation (teak or Mahogani), tree+pasture combination observed with higher soil microbial activities.

From preliminary focused group discussion, it is revealed that the major constraint in adoption of agroforestry is stray animals (13.29%).

The interventions implemented in the Garhkundar-Dabar watershed area witnessed changes in cropping patterns that have increased gross cropped area, cropping intensity and crop rotation intensity as well. Furthermore, agroforestry interventions proved drought-proofing mechanisms during drought periods and worked as additional sources of income during normal periods.

The study on impact of on-farm integration of trees on two important socio-economic parameters namely food security and income variability of the households in Parasai-Sindh watershed area revealed that unit percentage increase in the tree density and tree diversity on farm significantly increases food consumption score (FCS) by 0.231% and 0.141% points and decreases income variability by about 0.38% and 0.16%, holding all things constant.

The ICAR-Network Project on HPVANRG is coordinated by ICAR-NISA Ranchi. The main objective assigned to ICAR-CAFRI, Jhansi is "to develop agroforestry models integrating resin- and gum-yielding trees for livelihood security and horizontal dissemination of technologies". Five sub-projects *viz*., i) productivity of gum yielding tree-based agroforestry models; ii) demonstration and development of gum yielding tree-based agroforestry models on farmer's fields; iii) indigenous technical knowledge (ITK) on gum and resin's tapping, applications and post-harvest value addition; iv) standardization of gum tapping techniques; and v) studies on root distribution pattern and above- & below-ground biomass in *Acacia senegal* are being undertaken at the institute. During the year tree growth, gum exudation and yield of intercrops were monitored in all the established agroforestry models. Technical know-how of identifying different gum-tears from mixed lot was collected. Horizontal and vertical distribution of fine roots was studied in *A. senegal* and *A. nilotica*, and above and below ground biomass was estimated in 4, 5, 6, and 7 years-old trees of *A. senegal* by harvesting the trees.

In *Acacia senegal* based multi-component (agri-horti-silviculture) model, maximum GBH (57.3 cm) and canopy spread (36.8 m^2) was recorded in *Aegle marmelos* followed by *A. senegal.* In rainfed agroforestry (agri-silviculture) model, *Acacia nilotica* and *A. senegal* recorded maximum GBH in 10 m × 10 m spacing. In silvi-herbal models, *A. nilotica* (101.1 cm) recorded maximum GBH in model – II while *A. senegal* (48.2 cm) in model-I. In multi-component agri-hort-silviculture model the yield of wheat was significantly affected by tree component as well as the distance from tree trunk. Maximum yield was observed with *A. marmelos* followed by *C. limon* ,and yield declined with increasing nearness to tree-trunk. During the year 71 kg lemon, 74 kg karonda and 1400 kg of bael fruits were produced. In rainfed agri-silviculture, yield of *Eruca sativa* (taramira) was affected by *A. nilotica* and *A. senegal* planted at three spacing viz. 10 m × 10 m, 10 m × 5 m and 5 m × 5 m. Maximum yield was observed in 10x10m spacing while the least in 5 m x 5 m. In silvi-herbal model, maximum growth of lemon grass tussock and biomass production was observed in tussocks planted at 100 cm × 100 cm spacing. Maximum mean gum yield of *A. senegal* (175.5 g/tree) was produced in agri-horti-silviculture model while *A. nilotica* (102.3 g/tree) in silvi-harbal model. Comparative tree growth of *A. senegal* and *A. nilotica* was better on research farm than on farmer's fields. The *A. nilotica* outperformed *A. senegal* at farm while reverse

trend was seen on farmers fields. The ITK of tribal women revealed that gum of salai (*Boswellia serrata*) is whitish in color, transparent and smells specific aroma. The gum-tears of khair (*Acacia catechu*) is round in shape, brown to reddish brown in color with even surface and sweet in taste. The gum tears of babul (*A. nilotica*) are roundish in shape, yellow to reddish brown in color with uneven surface and pungent taste.

Studies on gum exudation in *B. monosperma* revealed that maximum gum yield was obtained in the month of December followed by January and February. During rainy season the exuded gum washed away with the rain water. Ethephon application in *A. pendula* revealed that all the progenies responded to ethephon and exhibited gummosis with maximum gum yield in trees of AP-20 and the least by J-62 progeny. Studies on fine root distribution revealed that, in general, maximum fine roots confined up to 60 cm soil depth in both gum yielding trees (*A. senegal* and *A. nilotica*) and fine roots decreased with the increase in soil depth and distance from tree-base. Studies on above- and -below ground biomass indicated root: shoot ratio 0.14, 0.12, 0.17 and 0.17 in 4, 5, 6 and 7 years-old trees, respectively.

Based on the assessment of genetic potential of 170 neem germplasm for kernel and oil yield. VKAF11, VKAF3, VKAF13, VKAF9, VKAF67, VKAF68, VKAF92, VKAF110, VKAF85, VKAF43 and OR05 were found to be high kernel and oil yielding germplasms. Further, this population have high magnitude of genetic variability for yield parameters assessed by morphological and molecular markers.

The research on the evaluation of strawberry cultivation in the Babina and Moth blocks of the Jhansi district revealed that the strawberry performed well under both blocks in terms of yield and quality. The plant produces profuse vegetative and reproductive growth. The fruit color, size, aroma, and flavor were excellent compared to the strawberry fruit available in the market. Out of 25 farmers, 10 farmers in Babina block and 9 farmers in Moth block had better quality production, which fetch them higher returns compared to their agronomic crops. The price of strawberry fruit ranged from Rs. 100 to Rs 250 in the market.

Based on the pilot project on the solutions of chip-based technology for real-time and RFID-passive monitoring of gene-bank and agroforestry species for scaling up. The tree genetic resource of selective accessions of Neem, Pongamia and Acacia being effectively management by passive chip-based technology (RFID). Also, 50 selected Neem germplasm are being actively monitored by active chips. In conclusion, these technologies are found to be an advanced way of tree genetic resource management.

1. General

Climate change accompanied by land degradation on account of unabated forest destruction worldwide is a serious threat to the very sustenance of mankind. Increasing population pressure and its associated demands limit expansion of forests which is already insufficient for a healthy ecosystem. These warrants land use change on a wider scale. The problem can be addressed through agroforestry which has proven potential of climate moderation, halting land degradation and increasing biomass production per unit area and time without demanding additional land. Agroforestry land use is the only viable option to avert degradation and bring back the agricultural economy in harmony with nature. In India, research and development programmes on promoting agroforestry over the past five decades have been spread over time and regions but, the speedy transition of tree-based farming in the country is still a challenge. This calls for organized efforts in setting priorities and strategies for the promotion of tree-based farming system through agroforestry research and extension services in India.

ICAR-Central Agroforestry Research Institute (ICAR-CAFRI), formerly the National Research Centre on Agroforestry, located at Jhansi, has successfully served the country for 34 years achieving several milestones in integrating trees, crops and livestock on the same farmland.

The institute in its national agroforestry mandate has conducted basic, strategic, adaptive research to systematize the science of agroforestry and has developed robust agroforestry models for different agro-climatic regions across the country, and handholds different states in the country for implementation of the objectives of agroforestry policy through skilling and human resource development program.

VISION

To improve quality of life of rural people through integration of perennials crops on agricultural landscape for economic, environmental and social benefits.

MISSION

Integration of woody perennials in the farming systems to improve land productivity through conservation of soils, nutrients and biodiversity to augment natural resource conservation, restoration of ecological balance, alleviation of poverty and to mitigate risks of weather vagaries.

MANDATE

- Develop sustainable agroforestry practices for farms, marginal land and wastelands in different agroclimatic zones of India.
- Coordinate network research for identifying agroforestry technologies for inter-region.
- Training in agroforestry research for ecosystem analysis.
- Transfer of agroforestry technology in various agro climatic zones.

INFRASTRUCTURE FACILITIES

Laboratories

ICAR- CAFRI has a main office building with eight well equipped laboratories (Agroforestry; Agronomy; Horticulture, Plant Protection; Plant Physiology; Remote Sensing & GIS, Soil Science; and Tissue Culture & Biotechnology).

Library

Library is an integral part of the institute. The institute's library is well-furnished and equipped with LAN facilities. Library operations are automated using Koha Library Management Software. List of library holdings are as under:

Holding	Total Collection (Numbers)
Books (including Hindi books)	4635
Periodical subscribed (Indian)	13
Bound back volumes of research journals	2335
Dissertation -M.Sc.	120
Thesis-Ph.D.	29
CD- ROM (Forest Science Database, ICAR, & ICFRE)	135
Maps	251
Newspapers	07

Agriculture Knowledge Management Unit

ICAR-CAFRI has 100 Mbps Leased Line Internet Connectivity from National Knowledge Network, Lucknow. Web server-based Ubuntu LINUX has been installed for hosting the Institute's website (https://www.cafri.icar.gov.in). The entire network administration of computers, internet and website management is looked after by the Agriculture Knowledge Management Unit (AKMU).

Organizational Setup

DIRECTOR & PROJECT COORDINATOR

Governance & Guidance

Research Programmes

- Agroforesty System Research
- Tree Improvement Research
- Carbon & Climate Change Research
- Agroforestry Extension Research

Service Sections

- PME Cell
- Agriculture Knowledge Management Unit
- Library & Documentation
- Administration & Finance
- Farm cum Workshop
- ITMU (NAIF)
- Public Information Cell
- ABiC

NRM Division, ICAR HQ

- QRT (2013-2018)
- RAC (2021-2023)
- IMC (2022-2025)

Network Research

- AICRP on Agroforestry

State Agricultural University : Solan, Srinagar, Kahikuchi, Palampur, Ludhiana, Pantnagar, Pusa (Bihar), Ayodhya, Jhargram, Bhubaneshwar, Ranchi, Sardarkrushinagar, Fatehpur-Shekhawati, Hisar, Rahuri, Nagpur, Hyderabad, Jabalpur, Dharwar, Mettupalaym, Thrissur, Dapoli, Kattuapakkam, Bengaluru, Jammu (J&K), Shimoga

ICAR Institute : Dehradun, Umiam, Imphal, Gangtok, Karnal, Agartala, Ranchi, Jodhpur, Hyderabad, Jhansi

ICFRE Institute : IFGTB, Coimbatore

- HPVA of NISA, Ranchi

Research Farm Facilities

The institute research farm spreads over 178.029 acres, possessing dug well (5), submersible (4), jet pump (1) and farm Pond (3). About 85% of its acreage is being utilized for various agroforestry based experiments and general crop cultivation. Crop cultivation at Research Farm is totally dependent on rainfall and the operation of the canal during and *Kharif* and *Rabi* seasons, respectively. During the *Kharif* season about 14.35 ha area was sown with different green manuring. However, during *Rabi* season about 17.25 ha area was utilized for the cultivation of different crops. The area cultivated during both the season includes general cultivation, seed production and research experiments. The institute research farm generated revenue to the tune of Rs. 6.96 lakhs from the sale of various farm produces. The institute research farm also maintains the most improved farm machinery and implements for mechanized farm operations including car washing facility. Moreover, there is a mini-workshop equipped with a welding and drills machine, grinder and other tools which are used for repairing and maintenance of available farm machinery. In addition to the above, one new development in the form of farm pond has been done during the period at the section.

Others

The institute has computer laboratory, committee room, conference hall, canteen, sports complex andagroforestry technology information centre (ATIC) and well-furnished Farmers' Training Hostel.

MIS/FMS

Five management modules *viz.,* financial, project (project and scheme code generation), stores (indent creation), human resource (training information, applying leaves) and payroll (information related to transfer and joining of employees) have been supported through MIS/ FMS.

Research and Academic

The institute conducts M.Sc. and Ph.D. courses as well as research in Agroforestry, Horticulture, Environmental Sciences, Plant Protection, Soil Science, Biotechnology and Soil & Water Conservation from different recognized Universities. During 2022, the institute signed MoUs with following institutions for achieving excellence in teaching & research.

S.No.	Name of the party/ Institute entered MoU with ICAR-CAFRI	Date of Signing
	National/ International Organization	
1.	South Asian Forum for Environment, Kolkata, West Bengal	26 November, 2022
2.	Society for Science of Climate Change and Sustainable Environment, New Delhi	10 December, 2022
	Universities	
1.	Gandhi Institute of Technology and Management, Visakhapatnam, Andhra Pradesh	3 January, 2022
2.	Rani Lakshmi Bai Central Agricultural University, Jhansi, Uttar Pradesh	9 March, 2022
3.	Gautam Buddha University, Greater Noida, Uttar Pradesh	10 March, 2022
4.	Bundelkhand University, Jhansi, Uttar Pradesh	24 April, 2022
5.	Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu	10 May, 2022
6.	Rani Lakshmi Bai Central Agricultural University, Jhansi, Uttar Pradesh	19 September, 2022
7.	RajmataVijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh	22 December, 2022
	Others	
1.	Integrated Resource Management, North Lakhimpur, Assam	08 May, 2022
2.	Lakkarwala Private Limited, Yamunanagar, Haryana	28 May, 2022

Budget (2022-23)

(₹ in Lakhs)

S.No.	Head	Budget	Expenditure
1.	**ICAR-CAFRI, Jhansi**		
	a. Capital (Grant for creation of Capital Assets)	25.00	25.00
	b. Establishment Expenses (Grant in Aid-Salaries)	758.00	757.74
	c. Grant in Aid-General (Pension Benefits)	211.00	195.86
	d. Grant in Aid-General	233.01	233.01
	e. ICAR Non Scheme General 1270	70.00	69.96
	Total	**1297.01**	**1281.57**
2.	**Plan Schemes**		
	All India Coordinated Research Project on Agroforestry (AICRP on Agroforestry)	1094.25	1027.25
	Harvest and post-harvest processing and value addition of natural resins, gums and gum resins (HPVA; ICAR, New Delhi)	12.65	12.62
	National Agriculture Innovation Fund (NAIF) Scheme IP&TM	7.60	7.60
3.	**Externally funded projects**		
	a. Assessment of genetic potential of neem germplasm for higher yield and oil content through molecular markers	4.51	4.51
	b. Trees Outside Forests in India (TOFI)	7.39	2.59
	c. Task Force on Himalayan Agriculture- NMSHE (2nd Phase)	42.51	19.91
	d. Pilot the solutions of chip based technology for realtime and RFID-passive monitoring of field genebank and agroforestry species for scaling up	4.41	3.80
	e. Evaluation the performance of Sea weed Extract, Humid acid, Protein Hydrolysates Biochemical, and Botanical Extracts	41.96	18.34
	f. Agri-Drone Project	19.17	10.71
4.	**Resource Generation**	**Target**	**Achievement**
	2022-23	12.39	17.52
	Swachh Bharat Mission	0.27	0.27
5.	**SCSP Fund**		
	Capital	16.00	16.00
	General	25.00	24.99
	Total	**41.00**	**40.99**

2. Research Achievements

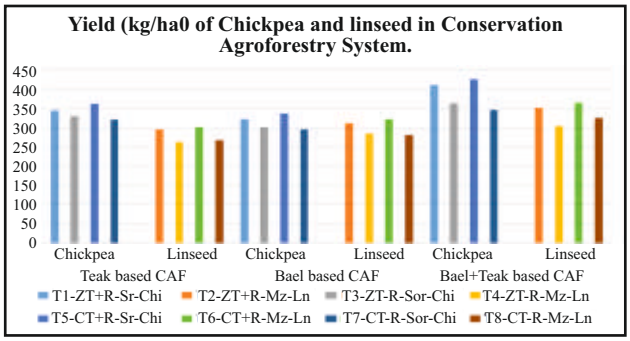
2.1: Agroforestry System Research Programme

NRMA/CAFRI/SIL/2021/003/00127:

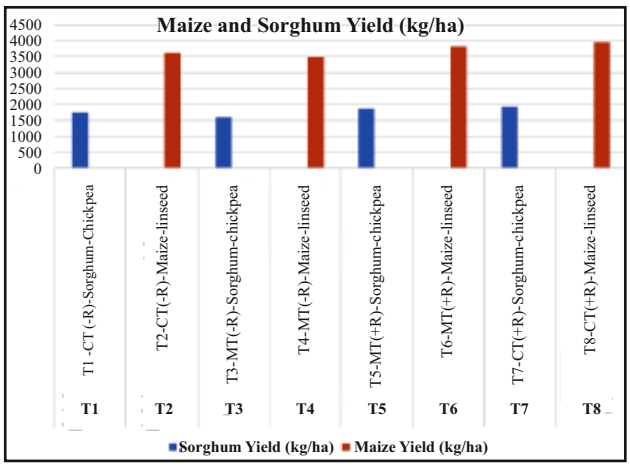
Assessment of conservation agroforestry

(Asha Ram and Inder Dev)

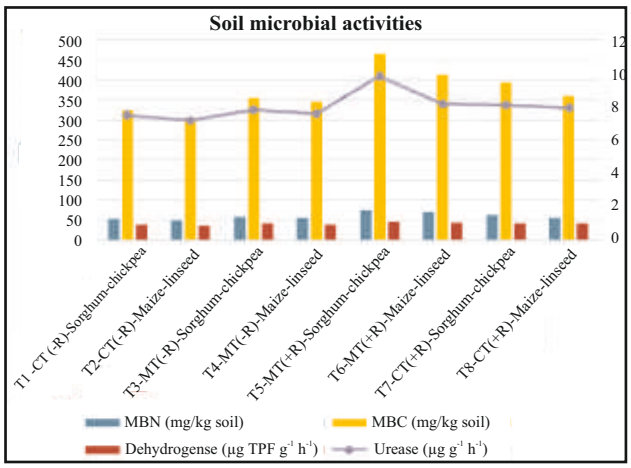
The study was started in the year 2021with three systems *viz.*, Teak based agroforestry system, Bael based agroforestry system and Teak + Bael based agroforestry system (established in year 2014). In all the systems, trees were planted at spacing of 9m x 4m. In Teak + bael based agroforestry system teak and bael was planted in alternate pattern with in row at 4m spacing. Two cropping systems *viz.*, Sorghum-chickpea and Maize-linseed were taken with and without residue and with minimum and conventional tillage. Thus total eight treatments *viz.*, T1-CT (-R)-Sorghum-chickpea; T2-CT (-R)-Maize-linseed; T3-MT(-R)-Sorghum-chickpea; T4-MT (-R)-Maize-linseed; T5-MT(+R)-Sorghum-chickpea; T6-MT(+R)-Maize-linseed; T7-CT(+R)-Sorghum-chickpea and T8-CT(+R)-Maize-linseed were taken with three replications in each agroforestry system. In terms of crop yields, tillage treatments (conventional and minimum tillage) remained at par with each other. However, residue application significantly increased the crop yield irrespective of the tillage treatments. Likewise enhanced soil microbial properties were recorded with residue application with minimum tillage. Compared to linseed residue, higher soil microbial activities were recorded with application of chickpea residue to succeeding sorghum crop.



Chickpea and linseed yield as influenced by conservation agriculture practices in teak, bael and teak + bael based agroforestry system.



Maize and sorghum yield as influenced by conservation agricultural practices in teak based agroforestry system



NRMA/CAFRI/SIL/2021/004/00128:

Assessment of *Melia dubia* based agroforestry system under semi-arid conditions

(Naresh Kumar, Ashok Yadav and Kamini, IGFRI, Jhansi)

The project was approved in the IRC meeting – 2021 with the following objectives:

1. To study the comparative ecological performance of *Melia dubia* based agroforestry system on farmers' fields and research farm
2. To study the farmers' rationale for multifunctional uses of *Melia dubia*
3. To study the economic viability of *Melia dubia* based agroforestry system.

As per the technical programme the plantation of *Melia dubia* was carried out in the year 2022 at a spacing of 7 m x 3 m in the experimental farm of the institute. After two months of plantation, 90% survival was recorded. Additionally, *Melia dubia* was also planted on road sides, field bunds/boundaries, on the banks of pond *etc.* to study their growth performance. *Melia dubia* plantation was also carried out at farmers' field.

Melia dubia **plantation activities at farmers' field**

NRMA/CAFRI/SIL/2021/005/00129:

Developing multifunctional agroforestry system for nutritional security in semi-arid tropics

(Ashok Yadav and Arun Kumar Handa)

Conducted several surveys in different parts of India *i.e.* Uttar Pradesh (Jhansi), Madhya Pradesh (Datia), Rajasthan (Alwar), and Meghalaya (Shillong) for collection of plants suitable for multifunctional agroforestry system (food forest and bee forest). For food forest, till now 25 spp. has been identified and collected their planting material *i.e.* seed and vegetative plant parts. The plants of these species are being raised in the institute and will be transplanted into food forest field when conditions are conducive.

Beside this, 14 spp. has been identified for bee forest which has polleniferous and nectrifereous potential. The planting materials of this species were collected and raised in the nursery of ICAR-CAFRI Jhansi. The list of few species collected are mentioned below:

Collection of different underutilized fruit, vegetables crops for food forest

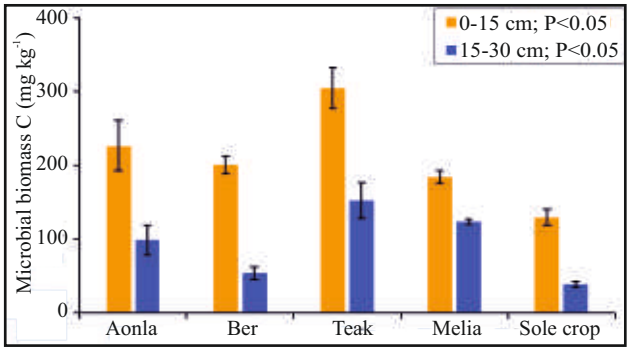
S.No.	Crop	Scientific Name	Important traits
1	Moringa	*Moringa oleifera*	• Bears flowers twice in the year • *Apismellifera* and *Apis cerena* are visiting on the flower • Flowering time: December-Feb & May-June
2	Crepe-myrtle	*Lagerstroemia indica*	• Both pink and white flowering type • Stingless bees are visiting • Flowering time: April-June
3	Dombey	*Dombeya spectabilis*	• Flowers are white and highly visited by *Apis mellifera* and *Apis cerena* • Flowering time: December-Feb
4	Golden Duranta	*Duranta erecta*	• Flowers are purple in color and visited by *Apis mellifera* • Flowering time: May - August
5	Indian Purslane	*Portulaca oleracea*	• Drought-tolerant crop • Flowers are orange, yellow, red, pink and white type and produce enough pollens for honey bees • *Apis cerena* visits the flower • Flowering time: April-September (Flowering is continuous till Mid November also)
6	Cotton rose or cotton rosemallow	*Hibiscus mutabilis*	• Drought resistant and cold-resistant plant • Two sp. *i.e. Apis cerena* and Indian stingless bee activity has been observed • Flowering time: Dec - April (but here in Jhansi flowering it continues up to November also)
7	Lime	*Citrus aurantifolia*	• Flowers are white and highly visited by *Apis mellifera* • Flowering time : March- May
8	Grape fruit	*Citrus x paradisi*	• Flowers are white and highly visited by *Apis mellifera* • Flowering time : March- May
9	Aonla	*Emblica officinalis*	• *Apis mellifera* and *Apis cerena* activity has been observed • Flowering time: March- June
10	Phalsa	*Grewia asiatica*	• Flowers are yellow in color and visited by *Apis cerena* • Flowering time : March- June
11	Karanj	*Pongamia pinnata*	• Flowers are Puple-white in color and are highly visited by *Apis mellifera* and *Apis cerena* • Flowering time: March-May
12	Palash	*Butea monosperma*	• Highly nectariferous and orange color flower • Visited by *Apis mellifera* and *Apis cerena*
13.	Bottlebrush	*Callistemon lanceolatus*	• Drought resistant crop, flowers are red in color and highly visited by*Apis mellifera* • Flowering time: May-August
14.	Sandpaper tree	*Ehretia anacua*	• Drought resistant crop flowers are white in color and highly visited by *Apis mellifera* • Flowering time: April-June

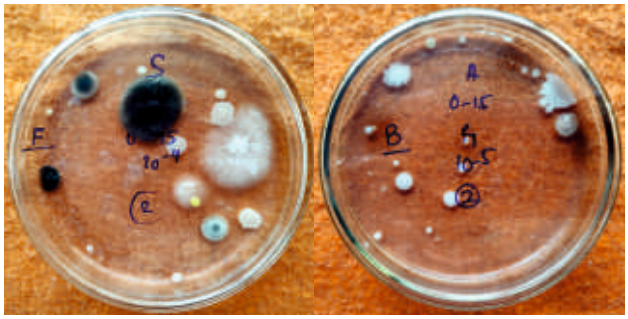
NRMA/CAFRI/SIL/2021/006/00130:

Assessment of soil biological and biochemical characters in predominant agroforestry-based land use systems

(Sovan Debnath and Suresh Ramanan S)

Randomized soil sampling was performed in the field plots of the experimental agroforestry systems (Teak + cropping, *Melia dubia* + cropping, Ber + cropping, Aonla + cropping, and an agricultural (sole) cropping system) and samples were collected in triplicates from topsoil depth (0-15 cm) and subsoil (15-30 cm) of the intercropped areas, with the help of a spade. Analysis of soils revealed significant (P<0.05) variations in the measured soil properties among the agroforestry systems at both soil depths. Teak-based agroforestry registered significantly (P<0.05) higher basal microbial respiration (BMR) quantified as 192.4 and 84.1 µg CO_2 g^{-1}, microbial biomass carbon (MBC) as 305.0 and 152.4 mg kg^{-1}, and microbial biomass nitrogen (MBN) as 112.7 and 78.1 mg kg^{-1} at the topsoil and subsoil, respectively. Metabolic quotient (a ratio of BMR to MBC; qCO_2) was significantly (P<0.05) higher in aonla-based agroforestry (8.9 ug CO_2-C µg biomass C^{-1} h^{-1}) at the topsoil but in sole cropping (11.3 µg CO_2-C µg biomass C^{-1} h^{-1}) at the subsoil. Higher dehydrogenase activity was noticed in aonla-based agroforestry practice at both topsoil (150.2 µg TPF g $soil^{-1}$ h^{-1}) and subsoil (109.7 µg TPF g $soil^{-1}$ h^{-1}). Further, an evaluation of the microbial population revealed significantly (P<0.05) higher colony forming unit (CFU) of bacteria (26×10^5 and 18×10^5 g $soil^{-1}$) and actinobacteria (243×10^3 and 167×10^3 g $soil^{-1}$) under aonla-based agroforestry both at the topsoil and subsoil, respectively. In contrast, teak-based agroforestry registered significantly (P<0.05) higher population of fungi at the topsoil (17×10^4 g $soil^{-1}$) and subsoil (9×10^4 g $soil^{-1}$). It is therefore concluded that Aonla-based agroforestry fosters higher numbers of bacteria and actinobacteria.





Soil microbial biomass carbon and colony forming unit for fungi and bacteria of the experimental agroforestry systems. Vertical bars on columns represent standard error (n = 3).

Agroforestry based Integrated Farming System (Institute activity)

(Asha Ram)

The agroforestry-based integrated farming system (AF-IFS) model is a multifunctional agroforestry model. Various crops, *viz.*, wheat, chickpea, field pea (*rabi* season), dhaincha, sweet corn, hybrid corn, urd bean, paddy (*kharif* season), sweet corn, and bhindi (*Zaid* season) were grown successfully. From the roadside moringa plantation, about 200 kg moringa pods were harvested. The guava production was recorded at 2.2 t. Bunds of the field were utilised for pigeon pea and NB hybrid (grass) production. From bunds, around 7.0 of grass was harvested (on a fresh weight basis). IFS field eggs and other farm produce were sold through the institute sale counter after successful duckery, goatery, and poultry rearing. A large number of farmers visited this IFS model. Now it has become a site of learning and an excellent model for a climate-resilient production system.

NB Hybrid grass on Bunds

Sweet corn in agri-horti system

2. Research Achievements

2.2: Tree Improvement Research Programme

NRMA/CAFRI/SIL/2021/007/00131:

Evaluation of *Melia dubia* clones

(A. K. Handa and Naresh Kumar)

Melia dubia is one of the important short rotation industrial tree species, but the information about superior clones is scarce. The present study has been initiated to understand the growth performance of different clones of *Melia dubia* in semi-arid region central India. The performance of 15 clones of *Melia dubia* developed by ICFRE along with MTP2 clone developed by FCRI, Mattupalayam and one clone of WIMCO have been planted in the research farm of the institute. The initial growth performance of different clones is presented in table below:

Average plant height and collar diameter of different Melia clones

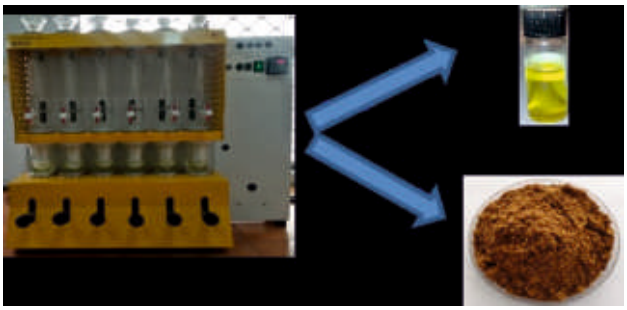
S.No.	Clone	Average Plant height (cm)	Average Collar Diameter (cm)
1.	MTP2	30.75	4.37
2.	2026	78.25	4.61
3.	2087	62.92	3.61
4.	261	55.08	3.47
5.	260	70.00	3.42
6.	75	84.92	4.55
7.	2028	71.42	3.95
8.	2056	65.18	3.58
9.	WIMCO	48.83	4.87
10.	2099	94.25	4.52
11.	2068	60.50	3.76
12.	2059	62.58	3.81
13.	2061	61.42	3.26
14.	2094	74.17	4.05
15.	2035	66.50	3.28
16.	2037	72.42	4.41
17.	2021	88.83	4.71

NRMA/CAFRI/SIL/2021/008/00132:

Genetic characterization of neem germplasm for high azadirachtin yield

(K Rajarajan and H Anuragi)

During the year, 2021-22 neem fruits were harvested from the considered germplasm and processed in to seeds and kernels. Followed by extraction of oil the defatted the samples was collected and considered for comparing different chromatography techniques for optimization of azadirachtin yield.



Overall processing of neem defatted sample preparation for azadirachtin estimation

NRMA/CAFRI/SIL/2021/009/00133:

Collection and evaluation of Moringa germplasm for better adaptability and year fruiting for accelerating agroforestry based nutritional security under semi-arid climate

(Hirdayesh Anuragi and K. Rajarajan)

Moringa oleifera Lam., a member of moringaceae family has been considered as a "Superfood," or "Wonder tree," or "Tree of life" due to its exceptionally high nutritional and therapeutic properties capable of curing above 300 human diseases. Further, the drought tolerance and fast growing nature make moringa a very suitable species for agroforestry for ensuring farmland ecosystem restoration, nutritional and livelihood security under current scenario of climate change. India is leading producer of moringa and own around 80% of global moringa market worth US$ 8 billion. The current study aimed at trapping the available variability in moringa from nearby region and evaluating for year-round fruiting and higher adaptability to suit water scarce and hot Bundelkhand and other semi-arid regions. A total of thirty moringa germplasm with varied morphological characteristics have been collected and preserved at ICAR-CAFRI, Jhansi as field gene bank.

The collected moringa germplasm are under the evaluation

trial. Seedling study identified four germplasm *viz.*, CMC-3, CMC-8, CMC-12, and CMC-24 to be more prominent in terms of initial seedling growth performance mention the parameters. While, field study identified three germplasm *viz.*, CMC-5, CMC-8 and CMC-12 with annual flowering and fruiting behavior as well as higher adaptability indicating its potentiality for further research and utilization. In addition, the molecular diversity analysis using microsatellite /simple sequence repeats (SSRs) markers in order to understand the actual variation at molecular level is in process.

Variations in *Moringa oleifera* pod, seed, leaves and floral characteristics

Field view of moringa germplasm preserved at ICAR-CAFRI, Jhansi

Developing a *Bacillus subtilis* based bioformulation for the management of *Melia dubia* vascular wilt disease incited by *Fusarium solani*

(*M. Ashajyothi and K. Rajarajan*)

The mortality of one year old malabar neem plants showing wilt and root rot incidence of 90 per cent observed previously in ICAR–CAFRI, Jhansi formed a basis for the current project. The infected plants were removed by digging the soil until the roots exposed and carefully collected samples for examining the infected plants root and vascular tissues morphology as well as for pathogen isolation. The vascular tissues of the infected roots were aseptically excised after through washing of adhered soil under running tap water, then cut into 1 mm size pieces, surface sterilized by 1.0% sodium hypochlorite for one minute and then dipped in 70% ethanol for 1 minute. These segments were rinsed in sterile water three times sequentially and blot-dried then aseptically placed on to PDA medium (HiMedia Laboratories, Mumbai, India). Plates were incubated for five days at 26° C. The isolated culture shown septate, hyaline, branched mycelium with intercalary chlamydospores, 1-2 celled micro and 2-4 celled macro conidia. For pathogenicity assay, 3 months old seedlings of malabar neem grown in sterile garden soil in 30 cm dia. plastic pots for 15 days. The representative isolate was multiplied used for challenge inoculation, and to ensure further 10 ml of spore suspension ($1x10^6$ conidia/ml) was poured at the collar region of each seedling without wounding them. Similar inoculation with sterile distilled water served as control. A typical wilting symptom was observed in the plants with challenge inoculation. For molecular identification, the pure culture of the fungus was grown on potato dextrose broth (HiMedia Laboratories, Mumbai, India) and five days after incubation at 26° C with 120 rpm in an orbital shaker incubator, the aseptically harvested mycelium was used for genomic DNA extraction by the CTAB method. PCR assay was performed to amplify

marker genes, including internal transcribed spacer, ITS1/ITS4 and *Fusarium* specific molecular markers such as RNA polymerase largest subunit, *RPB1* second largest RNA polymerase subunit, with specified thermocycler (Eppendorf, Hamburg, Germany) conditions. The obtained amplified product of each gene was sequenced bidirectionally, curated, and assembled using BioEdit software. Multiple sequence alignment was performed with the reference sequences retrieved from the NCBI database using CLC sequence viewer 8.0 (Qiagen, http://www.qiagenbioinformatics.com). Curated three gene sequences were analyzed and compared at the *Fusarium*-MLST (Multilocus Sequence Type) database (http://www.cbs.knaw.nl/*Fusarium*), which facilitates the sequence-based precise species identification of the genus *Fusarium*, as well as GenBank database.

Studies on etiology of malabar neem wilt disease caused by *Fusarium solani*

2. Research Achievements

2.3: Carbon & Climate Change Research Programme

NRMA/CAFRI/SIL/2021/010/00134:

Influence of Plant Morphological Characteristics on Soil Properties in Agroforestry Systems

(Rajendra Prasad and Badre Alam)

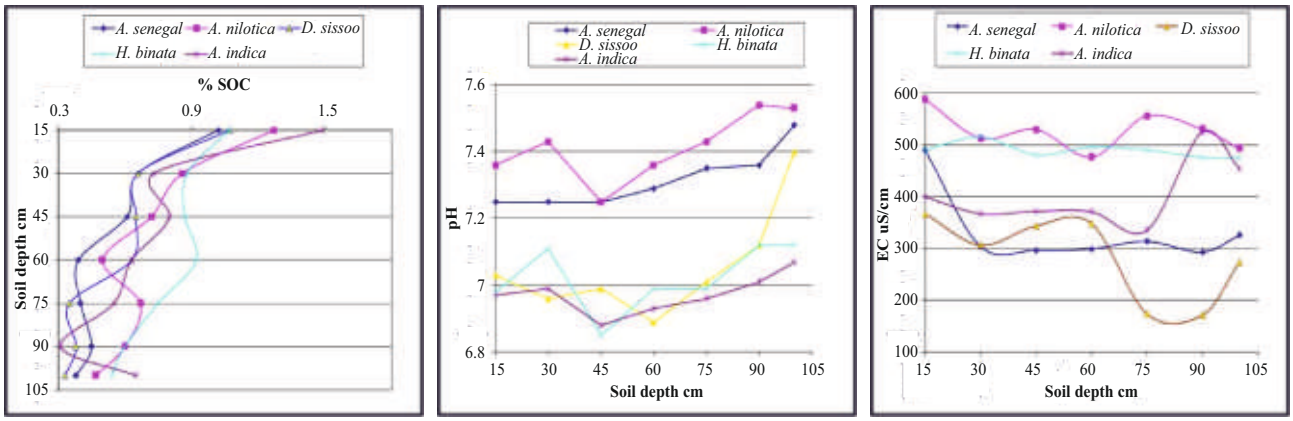
The project was initiated in January 2022. The main outlined objectives of the project are i) to study the influence of agroforestry tree species on soil properties in the tree-rhizosphere , and ii) to establish the relationship among leaf traits to understand agro-ecosystem functioning in agroforestry. Five agroforestry systems, each at two different fields and of varyingage, based on *Azadirachta indica, Dalbergia sissoo, Hardwickia binata, Acacia nilotica* and *Acacia senegal,* weres elected. The tree growth data *viz.* height, girth, canopy spread were collected before soil sampling. The observation on chlorophyll content index and leaf area were also taken.

Tree growth data of selected agroforestry systems

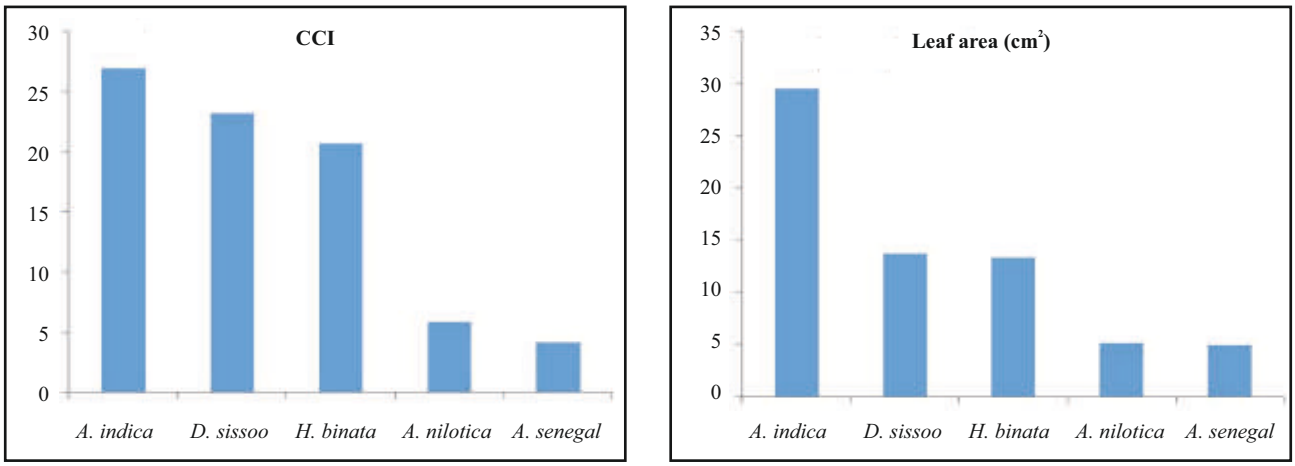
Agroforestry trees	Field	Age (yrs)	GBH (cm)	Height (m)	Canopy spread (m^2)
Azadirachta indica	Old germplasm trial (RFID tagged field no 14/15)	28	140	15.50	62.53
	Plus tree trial (field no 26)	17	71	9.40	17.75
Dalbergia sissoo	Old plantation	28	100	12.80	29.84
	Seed orchard ((PT-2/PT-6)	14	75	12.00	32.15
Hardwickia binata	Density trial (near field no. 25)	26	164	18.00	64.08
	Pruning trial (near field no. 33)	22	123	19.00	64.36
Acacia nilotica	Provenance trial (near field no. 25)	19	52	6.90	38.47
	Rainfed agri-silviculture model (field no 40/41)	10	51	6.60	22.72
Acacia senegal	Agri-horti-silviculture (field no 25)	13	57	7.20	42.12
	Gum garden	7	41	6.00	24.44

Collection of soil samples with the use of power augor

Soil samples were collected from rhizosphere (under tree-canopy) and non-rhizosphere (outside tree canopy) from 0-15, 15-30, 30-45, 45-60, 60-75, 75-90 and 90-100 cm soil depths using power augor. These soil samples were analysed for different soil properties. On an average, in general, the SOC declined and soil pH increased with increase in soil depth in all the studied agroforestry systems. However, the EC of soil did not show any trend. On an average, maximum chlorophyll content index (CCI) and leaf area were observed in *A. indica* followed by *D. sissoo* and *H. binata,* while the least in *Acacia senegal* based agroforestry trees.



Effect of different agroforestry trees on Soil pH, EC, and soil organic carbon



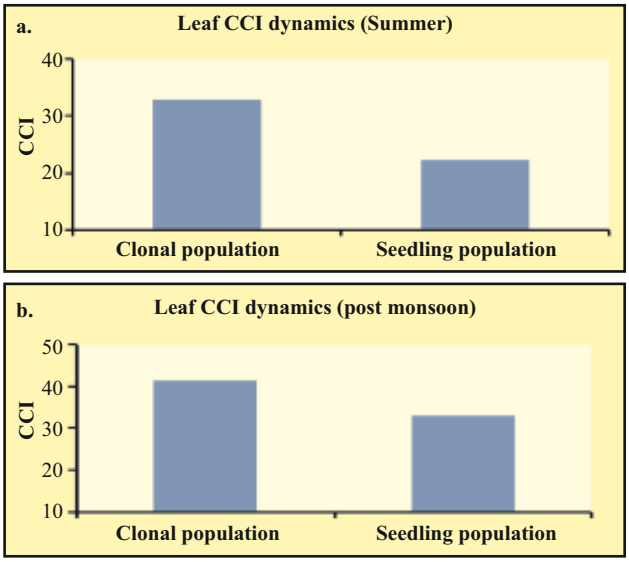
Chlorophyll content index and leaf area of different agroforestry trees

NRMA/CAFRI/SIL/2021/011/00135:

Eco-physiological dynamics for assessing climate change mitigation potential of contrasting tree populations of *Pongamia pinnata*

(Badre Alam and Rajendra Prasad)

Various parameters related to ecophysiological dynamics have been investigated in clonal and seedling populations in temporal and seasonal basis. Required base level data on differential photosynthetic CO_2 capture and photosystem-2 activities in the tree populations have been evaluated. Simultaneously growth and phenological data have been collected. Experiments have been conducted for assessing various ecophysiological traits namely CCI (Chlorophyll content index) dynamics, LAI (Leaf area index) and CTD (Canopy temperature depression analysis) in association with other variables. Differential responses in the CCI dynamics in the tree population were observed. Collection



Dynamics of CCI (Chlorophyll content index) in the contrasting tree population of *Pongamia pinnata*.

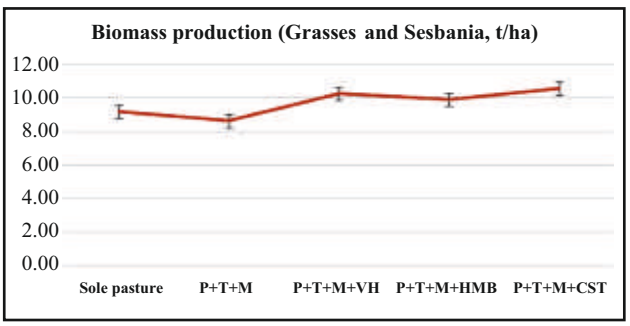
of leaf/ pod samples have been done for further analysis relating to physiological and biochemical observations. Further experiments, data collection and analysis are progressing.

NRMA/CAFRI/SIL/2021/012/00136:

Assessment of ecosystem services in silvipastoral system in semi-arid conditions

(Asha Ram and Inder Dev)

Project on assessment of ecosystem services in silvipastoral system in semi-arid conditions was started in the year 2021. The study was started in the teak and mahogany based silvipastoral system (established in year 2016). Two tree species teak (*Tectona grandis* and *Mahogani*) and two grasses *viz.*, *Cenchrus ciliaris* and *Stylosanthes seabrana* were planted in the silvipastoral system. Both the grasses were sown/transplanted in 1:1 row pattern at 50 cm distance. Trees were planted at 5 m x 5 m distance. Combinations of seven treatments *viz.*, T1- Sole Pasture; T2-Sole Teak (*Tectona grandis*); T3-Sole Mahogani (*Swietenia Mahogani*); T4-Teak+Mahogani+Pasture; T5-Teak+Mahogani+Pasture+halfmoon basin (HMB); T6-Teak+Mahogani+Pasture+Vegetative Hedge (VH); T7-Teak+Mahogani+ Pasture + Contour Staggered Trenches (CST) were taken for the study. Among the tree species, teak observed with good survival and growth parameters. Mahogani survival was poor due to insect attack. In provisioning services, biomass productivity of the grasses including sesbania was recorded which was observed maximum in T7-Teak+Mahogani+ Pasture + Contour Staggered Trenches (CST) followed by in T6-Teak+Mahogani+Pasture+vegetative hedge. Among the regulating services, soil moisture dynamics was observed at every 15 days interval and found that soil and moisture conservation measures resulted in higher soil moisture compared to other treatments. The lowest soil moisture was observed in sole mahagony. In year 2022, total 10 event rainfall was observed in which maximum runoff was generated in sole mahagony whereas lowest in Teak+Mahogani+ Pasture + Contour Staggered Trenches (CST). Likewise, soil and nutrient loss were also recorded in each treatment and observed that lowest were recorded in T7-Teak + Mahogani + Pasture + Contour Staggered Trenches (CST) whereas highest in sole Mahogani. Although soil loss with runoff water reduced considerably due to stabilized soils but contour staggered trenches still having higher sediment trapping efficiency compared to half-moon basin and vegetative hedge.



Biomass production of grasses and sesbania

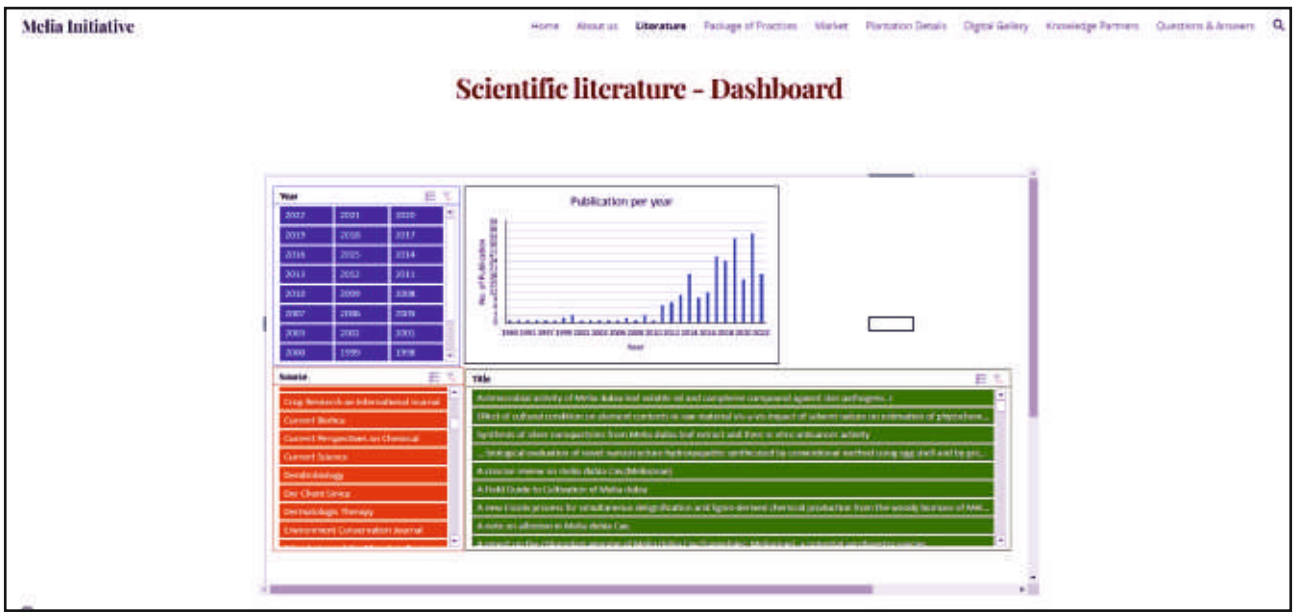
NRMA/CAFRI/SIL/2021/013/00137

Text mining for assessing research trends and gaps of agroforestry perennials: A Big data analysis approach

(Suresh Ramanan S. and A. Arunachalam)

Studies have already begun to take advantage of the computational exploration of large-scale collections of texts *viz.* text mining. Text-mining is one of the powerful tools in big data analysis. Text mining is said to fuel advances in theoretical as well as phenomenological knowledge. The quantum of scientific publications are increasing rapidly; the researchers are finding difficulty in synthesising the developments taking in other disciplines. Moreover, agroforestry is an interdisciplinary science and thus for synthesising information – text mining is a robust method. Open-source software and tools were used to perform four major analyses following PRISMA guidelines. The following analysis was carried out – bibliometric analysis, science mapping, topic analysis and sentiment analysis for one important agroforestry perennial tree species *i.e. Melia dubia.* The

analysis revealed that there is increased trend in the publication as on 01.08.2022 – the total number of scientific publications is about 270 published in > 40 scientific journals. The results of this analysis is presented in the form of dashboard (https://sites.google.com/view/meliadubiaknowledgeforum/home?authuser=0).



2. Research Achievements

2.4: Agroforestry Extension Research Programme

NRMA/CAFRI/SIL/2 021/014/00138

Constraints in Adoption of Agroforestry in Bundelkhand Region of Central India

(R.P. Dwivedi, Sushil Kumar and Priyanka Singh)

Data was collected from Rajapur village of Babina block in Jhansi. Focused group discussion with farmers revealed that the major constraint in adoption of agroforestry is stray animals (13.29%). The data collection is under progress from other identified villages.

NRMA/CAFRI/SIL/2021/015/00139

Impact assessment of agroforestry and water conservation interventions on livelihood of farmers in Garhkundar-Dabar watershed

(Sushil Kumar and Priyanka Singh)

A detailed survey of the villages (Shivrampur, Sakuli, Kundar and Dabar) located in the watershed area was conducted for recording data during the reporting period. Data on demographic details, types of interventions, land and soil characteristics, source of irrigation and drinking water, land holding size, availability of water in ponds or dug wells, migration patterns, cropping systems, input use, crop productivity, market access and livestock information were recorded. Data were collected by following participatory rural appraisal (PRA) techniques, key informants (KI), formal and informal surveys and case studies. The recorded data indicated that interventions enhanced the availability of water in the watershed area, which further influenced agriculture and allied enterprises. The watershed area also witnessed changes in cropping patterns that increased gross cropped area, cropping intensity and crop rotation intensity as well. Thus, it is said that interventions have positive impact on the livelihood of farmers in the Garhkundar-Dabar watershed.

An illustration of a conversation with a farmer in the Garhkundar-Dabar watershed

NRMA/CAFRI/SIL/2021/016/00140

Economic impact of ICAR-CAFRI interventions in Parasai-Sindh Watershed

(Priyanka Singh and R.P. Dwivedi)

The impact of on-farm integration of trees was examined on two important socio-economic parameters namely income variability and food security of the households in Bundelkhand region lying in semi-arid tropics of central India. Agroforestry adoption intensity was measured in terms of tree density (trees/acre) and tree diversity on the farmer's field. The estimated results showed that a 1% increase in the tree density and tree diversity on farm significantly increases food consumption score (FCS) by 0.231% and 0.141% points, respectively, ceteris paribus. The plausible explanation is that tree based farm diversification not only provides fruits for human diet diversity but also generate additional income which improves the purchasing power of the household for allied goods.

The effect of agroforestry in the study area: OLS estimation results

Variables	FCS		Income variability	
	Coefficient	Standard Error	Coefficient	Standard Error
T_Density (Tree density)	0.231*	0.037	-0.388*	0.014
T_Diversity (Tree diversity)	0.141**	0.071	-0.163*	0.003
AHH (Age of household head in years)	0.021	0.141	0.119*	0.017
HHS (Household size)	-0.031	0.103	-0.216*	0.010
HHE (Education status of household head)	0.131	0.102	0.211	0.122

HHEXP (Experience of household head in farming)	0.062**	0.031	0.017	0.111
HHEXP Squared	-0.003	0.003	-----	-----
ALU (Adult livestock unit)	0.113*	0.030	-0.317*	0.007
DPNDR (Dependency ratio)	-0.034*	0.011	0.113**	0.057
Farm_Size	0.319*	0.001	0.017	0.018
Farm_Size Squared	- 0.010*	0.005	------	-------
D_Market (Distance to nearest market)	0.001	0.003	0.000	0.001
EXCONTACT (% of households exposed to extension services, training and demonstration in previous year of the survey)	0.010	0.007	0.121	0.114
Constant	1.529*	0.039	1.317*	0.192
R^2	0.790	0.831		

*and ** indicate statistical significance at 99% and 95% confidence level, respectively.

The results further indicated that integrating trees on farm has a significant negative effect on income variability. Unit percentage increase in the tree density and tree diversity decreases income variability by about 0.38% and 0.16%, holding all things constant. After detailed discussion with farmers, it was discovered that trees on their farm provide a supplemental source of income and food in case of crop raiding by the stray animals. Therefore, the trees seem to have resilience vis-a-vis crop insurance effect in the study area. Various other socio-economic variables also have a significant influence on our outcome variables; FCS (farming experience, adult livestock unit, dependency ratio and farm size), and income variability (age, household size adult livestock unit and dependency ratio).

Mera Gaon–Mera Gaurav (MGMG) 2022

ICAR-CAFRI is implementing MGMG scheme with the main objective to improve the socio-economic conditions of the farmers and other stake holders at village level.

The detailed list of Scientists and technical staff involved is given below:

Name of the University/ Institute/Station	Name of the Village Cluster Nodal Scientist and Team of Scientists/Technical	Designation	Subject/ Specialization
Cluster: Hastinapur Villages	**Dr. Naresh Kumar**	Principal Scientist	Agroforestry
1. Hastinapur	**Nodal Scientist**		
2. Karari	Dr. BadreAlam	Principal Scientist	Plant Physiology
3. RundKarari	Dr. Ashok Yadav	Scientist (SS)	Fruit Science
4. Raunija	Dr. Pradyuman Singh	STO	Agroforestry
Block- Badagaon	Smt. SheljaTamrakar	STA	Library Science
District- Jhansi, U.P.			
Cluster: Parasai Villages	**Dr. Asha Ram**	Senior Scientist	Agronomy
5. Parasai	**Nodal Scientist**		
6. Chhatpur	Dr. Hirdayesh Anuragi	Scientist (SS)	Genetics & Plant Breeding
7. Bachhauni	Dr. Priyanka Singh	Scientist	Agril. Economics
Block- Babina	Shri S.P.S. Yadav	STO	Animal Husbandry
District- Jhansi, U.P.	Shri Prince	TO	Farm Machinery
Cluster: Ganeshgarh Villages	**Dr. A.K. Handa**	Principal Scientist	Agroforestry
8. Ganesh Garh	**Nodal Scientist**		
9. DevGarh	Dr. Sovan Debnath	Scientist (SS)	Soil Science
10. Ramgarh	Dr. M. Ashajyothi	Scientist	Plant Pathology
Block- Babina	Dr. A. Datta	CTO	Plant Breeding
District- Jhansi, U.P.	Shri R.K. Singh	ACTO	Agronomy
Cluster: Domagor Villages	**Dr. Rajendra Prasad**	Principal Scientist	Soil Science
11. Domagor	**Nodal Scientist**		
12. Dhikoli	Dr. Sushil Kumar	Scientist	Agronomy
13. Nayahkera	Dr. K. Rajarajan	Scientist	Genetics & Plant Breeding
Block- Babina	Shri Rajendra Singh	CTO	Agril. Entomology
District- Jhansi, U.P.	Shri Ram Bahadur	ACTO	Physics
Cluster: Garhkundar Villages	**Dr. R.P. Dwivedi**	Principal Scientist	Agril. Extension
14. Garhkundar	**Nodal Scientist**		
15. Dabar	Shri Suresh Ramanan S.	Scientist	Agroforestry
16. Sakuli	Shri Rajesh Srivastava	ACTO	Photo & Art
17. Shivrampur	Dr. Ajay Pandey	STO	Seed Technology
Block- Niwari			
District-Niwari, M.P.			

*Scheduled Visit to Cluster Villages on Every Tuesday & last Thursday

During the year 2022, 60 visits were organized by MGMG team members to 16 adopted villages and around 1560 farmers, farm women and rural youths were benefitted. Various activities were conducted at farmer's field like, distribution of saplings of tree species namely Sandal wood, custard apple, guava, aonla, lemon, jackfruit, karonda, teak and neem; hands-on-training on ber budding and pruning to farmers.

2. Research Achievements

2.5. Externally Funded Projects

ICAR Network Project

NRMACAFRISOP200800100075:

Harvesting, Processing and Value Addition of Natural Resins and Gums

(Rajendra Prasad, A.K. Handa and Badre Alam)

The ICAR-NP on HPVANRG is coordinated by ICAR-NISA Ranchi. The main objective assigned to ICAR-CAFRI, Jhansi is "to develop agroforestry models integrating resin- and gum-yielding trees for livelihood security and horizontal dissemination of technologies". The achievements of different sub-projects are given below.

Sub-Project 1: Productivity of gum yielding tree-based agroforestry models

In all the agroforestry models casualty replacement was done.Annual growth data was recorded in the month of December. Data on tree growth have been tabulated. In *Acacia senegal* based multi-component (agri-horti-silviculture) model (Plate1A), maximum GBH (57.3 cm) and canopy spread (36.8 m^2) was recorded in *Aegle marmelos* followed by *A. senegal.* In rainfed agroforestry (agri-silviculture) model(Plate1B), *Acacia nilotica* and *A. senegal* recorded maximum GBH in 10 m × 10 m spacing. In silvi-herbal models, *A. nilotica* (101.1 cm) recorded maximum GBH in model – II while *A. senegal* (48.2 cm) in model-I (Table 1). *Acacia senegal* attained maximum GBH (29.5 cm) in old gum garden followed by new gum garden (24.7 cm) while survival and growth of *Butea monosperma* was not encouraging in gum garden.

Growth of trees in different agroforestry models

Agroforestry models	Survival (%)	GBH (cm)	Height (m)	Canopy spread (m^2)	Pruned biomass (kg/tree)
***A. senegal* based multi-component model (agri-horti-silviculture)**					
A. senegal	96.4	46.5	6.0	25.3	3.7
C. limon	91.7	24.1	4.3	16.2	5.7
A. marmelos	75.0	57.3	6.1	36.8	4.6
C. carandas	93.5	4.4	2.1	2.3	--
Rainfed agroforestry model (rainfed agri-silviculture)					
A. senegal					
10 m × 10 m	73.7	44.4	5.1	16.0	3.4
10 m × 5 m	77.1	33.6	4.7	12.7	3.0
5 m × 5 m	86.1	37.2	5.5	16.7	2.3
A. nilotica					
10 m × 10 m	80.9	53.5	6.1	17.0	2.7
10 m × 5 m	78.3	41.4	5.2	14.9	2.3
5 m × 5 m	82.9	40.3	5.5	16.5	2.0
Silvi-herbal model-I					
A. nilotica	53.6	56.7	6.8	22.5	18.7
T. arjuna	98.7	35.4	5.2	8.5	28.2
A. senegal (at boundary)	90.0	48.2	6.1	15.9	17.4
Silvi-herbal model-II					
A. nilotica	85.7	101.1	9.5	75.9	36.1
T. arjuna	98.7	32.0	4.5	7.7	29.5
A. senegal (at boundary)	80.0	36.8	5.7	22.1	28.3
Block plantation on rocky hillock					
A. senegal	98.4	28.3	4.9	12.5	--

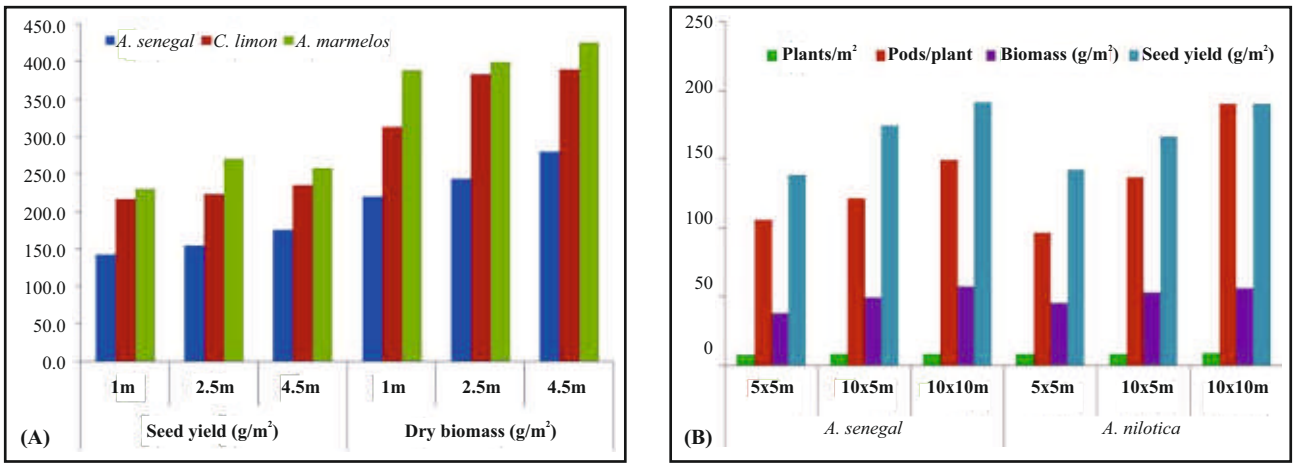
***Acacia senegal* based agri-horti-silviculture (A) rainfed agri-silviculture model (B)**

Tree growth of *Acacia senegal* in gum-gardens

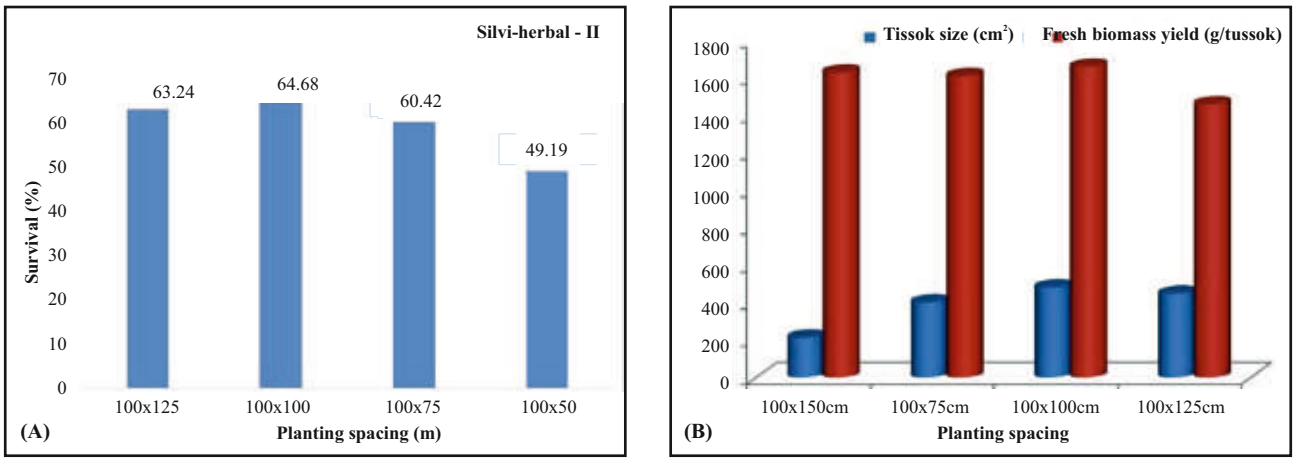
Tree species	Survival (%)	GBH (cm)	Height (cm)	Canopy spread (m^2)	Pruned biomass (kg/tree)
A. senegal					
Old gum garden	58.4	29.5	4.4	12.5	4.0
New gum garden	89.7	24.7	4.2	9.3	3.8
B. monosperma					
Old gum garden	36.7	14.7 (CD)	0.8	0.61	–
New gum garden	58.9	1.6	0.8	0.3	–

In *Acacia senegal* based multi-component model, wheat (var. HD2967) was cultivated as intercrop during *rabi* season of 2021-22 and in summer season of 2022 the field was green manured with dhaincha. The yield of wheat was significantly affected by tree component as well as the distance from tree trunk. On an average, maximum yield was observed with *A. marmelos* followed by *C. limon* and *A. senegal.* There was a declining trend in seed yield of wheat with increasing nearness to tree-trunk. Similar trend was noticed in dry biomass yield. During the year 71 kg lemon, 74 kg karonda and 1400 kg of bael fruits were produced from fruit components of this model. In rainfed agri-silviculture, *Eruca sativa* (taramira) was grown during *rabi* season of 2021-22, and in summer 2022 the field was green manured with dhaincha. The yield of taramira was affected by *A. nilotica* and *A. senegal* planted at three spacing *viz.* 10 m ×10 m, 10 m × 5 m and 5 m × 5 m. Maximum yield was observed in 10 m x 10 m spacing while the least in 5 x 5 m. In silvi-herbal model-I survival of lemongrass is too poor to report due to submergence of field in rainy season. In silvi-herbal model-II, survival, growth of lemongrass tussock and biomass production was affected by the planting spacing of lemongrass. The maximum survival and growth of lemon grass tussock and biomass production was observed in tussocks planted at 100 cm ×100 cm spacing.

During the year 2021-22 natural exudation was observed in all the agroforestry models established at farm. In general, less number of trees exuded gum. Data on gum exudation from different models is given for *A. senegal* and *A. nilotica*. Maximum mean gum yield of *A. senegal* (175.5 g/tree) was produced in agri-horti-silviculture model while *A. nilotica* (102.3 g/tree) in silvi-herbal model.



Effect of trees/ woody components on yield of wheat in *Acacia senegal* based multi-component (A) and *Eruca sativa* in rainfed agri-silviculture (B) models



Survival (A), growth and biomass production (B) of lemongrass in silvi-herbal model

Gum yield from *Acacia senegal* tree (natural exudation)

Parameter	Agri-horti-silviculture		Old Gum Garden	
	No. of tears/ tree	Gum yield (g/tree)	No. of tears/ tree	Gum yield (g/tree)
Mean	8	175.50	1.33	35.00
Minimum	3	120.00	1	10.00
Maximum	13	231.00	2	80.00
SD	5.00	55.50	0.33	22.55

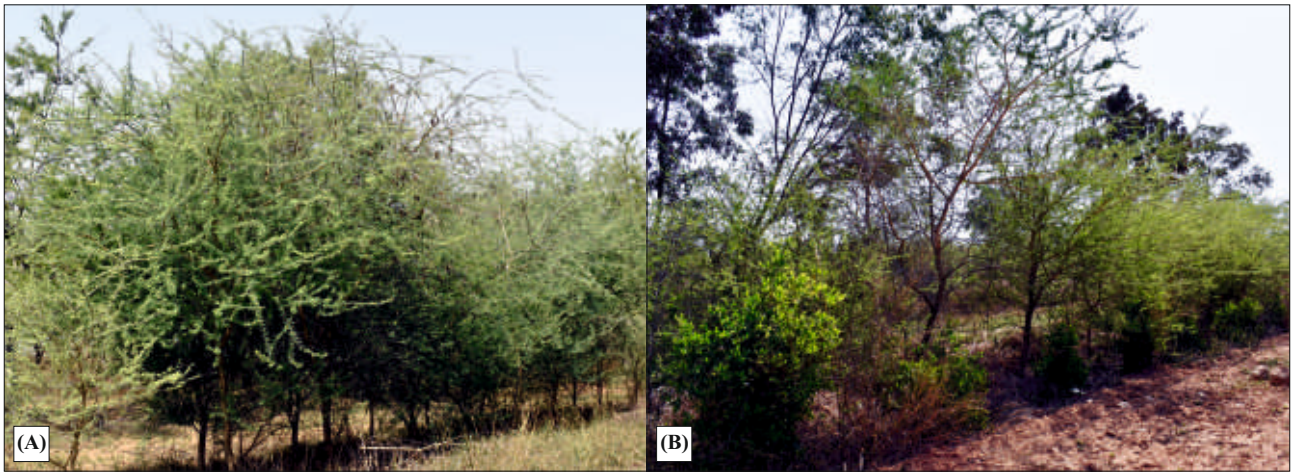
Gum yield from *Acacia nilotica* tree (natural exudation)

Parameter	Silvi-herbal		Rainfed agri-silviculture	
	No. of tears/ tree	Gum yield (g/tree)	No. of tears/ tree	Gum yield (g/tree)
Mean	9.33	102.33	3	63
Minimum	2	25.00	3	63
Maximum	20	212.00	3	63
SD	5.46	56.35	0.0	0.0

Sub-Project 2: Demonstration and development of gum yielding tree based agroforestry models on farmer's fields

Tree growth of agroforestry models on farmer's fields and demonstration of biofence models on research farm was monitored. Data on tree growth on farmer's field and biofence model have been tabulated. On farmers field, maximum GBH of *A. senegal* was recorded in village Garkundar while minimum in Ambabai village. Survival of *A. senegal* in different

biofence model ranged from 33.9 to 100 percent. In general tree growth of double row biofence model appears to be more effective as barriers on field boundary.



Double-row *Acacia senegal* (A) and *A. senegal* + *C. carandas* biofence at farm (B)

Growth of *A. senegal* on farmers fields in Garhkundar and Ambabai villages

Plant species	Survival (%)	GBH (cm)	Height (m)	Canopy spread (m^2)
Shri Himmat's field in Garkundar village (12 years old planting)				
A. senegal	45.5	42.4	4.7	5.9
E. officinalis	51.2	62.7	5.5	22.0
C. carandas	18.0	7.9	1.8	0.6
Shri Ghanshyam (10 year old)				
A. senegal (boundary)*	59.5	23.8	2.6	–
Shri Mani Ram, Village Ambabai (10 year old)				
A. senegal	37.0	20.0	3.1	6.9

Growth of 4 years old *A. senegal* in different Bio-fence model at research farm

Bio-fence models	Survival (%)	CD (mm)	Height (m)	Canopy spread (m^2)	Pruned biomass (kg/tree)
Model-1 (Single row)					
A. senegal	93.2	36.3	1.8	1.5	0.64
C. carandas	61.4	5.0	0.4	0.1	–
Model-2 (Double row)					
A. senegal	83.1	28.1	1.7	1.9	0.69
C. carandas	71.1	5.8	0.4	0.1	–
Model-3 (Double row)					
A. senegal (Outer row) - 1.0 m	95.1	24.4	1.8	0.5	0.93
A. senegal (Outer row) - 1.5 m	86.1	44.4	2.5	1.3	0.71
A. senegal (Outer row) - 2.0 m	72.0	24.9	2.0	0.8	0.86
A. senegal (Inner row) - 1.0 m	100.0	43.7	2.4	1.1	0.98
A. senegal (Inner row) - 1.5 m	86.1	35.7	2.1	1.0	0.87
A. senegal (Inner row) - 2.0 m	88.0	42.7	2.4	1.5	0.88
Model-4 (Double row)					
A. senegal (Outer row)	33.9	21.68	122.4	0.29	0.79
A. senegal (Inner row)	51.9	27.02	144.59	0.72	0.78

Survival of *A. senegal* on farmers' field in village Parasai ranged from 42 to 86.7% after six years of planting. Similarly survival of *A. senegal* varied from 33 to 65% after five years of planting in different villages.

Comparative tree growth of *A. senegal* and *A. nilotica* was better on research farm than farmer's fields. Furthers *A. nilotica* outperformed *A. senegal* at farm while reverse trend was seen on farmers fields.

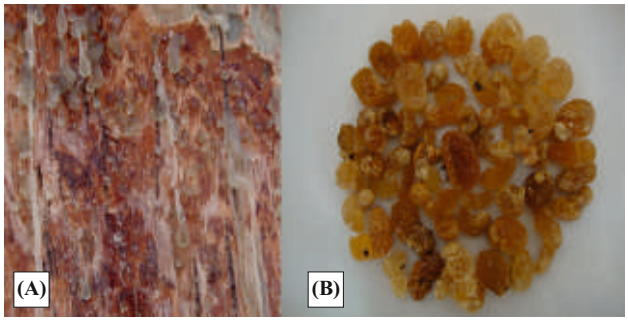
Survival (%) of *A. senegal* after five and six years of planting at farmers fields in villages

Farmer's in Parasai village	2017-18		2018-19		
	Planted	Survival (%)	Villages	Planted	Survival (%)
Sh. Arjun Yadav	400	51.3	Indragarh	300	53.3
Sh. Sukhnandan	350	44.6	Talbehat	1000	65.2
Sh. Rajveer Yadav	300	55.0	Kotkhera	100	44.0
Sh. Bisunnath	250	51.6	Gadhkundar	350	37.1
Sh. Mahendra	150	86.7	Binwara	250	44.0
Sh. Komal Singh	250	62.0	Dhikoli	30	33.3
Sh. Bantoo	100	45.0	Parasai	400	46.3
Sh. Prema	100	50.0			
Sh. Jahar Singh	50	42.0			
Sh. Ashok	150	48.0			
Sh. Vinod	100	50.0			

During 2022 planting season, casualty replacement was done in all bio-fence models at farm. At farmer's field in village Kochhabhawar, 150 *A. senegal*, 25 lemon and 25 karonda were planted on field bund. Besides, 5300 seedlings of *A. senegal* were supplied to NGO for planting on farmers field. As part of extension activity ICAR-CAFRI organized 3-days online training in collaboration with MANAGE, Hyderabad on promotion of gum yielding trees on farmland for livelihood security during 12th-14th July 2022, which was attended by about 150 participants

Sub-Project 3: Indigenous technical knowledge (ITK) on gum and resin's tapping, applications and post-harvest value addition

During the year 2021-22 local traders of gum and resins of Shivpuri district in Madhya Pradesh visited ICAR-CAFRI, Jhansi and interaction was held with women laborers to filter out information on identification and segregation of particular gum from a mixed lot. These skilled tribal women possess knowledge and ability to identify particular gum with specific aroma, shape and luster of gum-tears. These women informed that gum of salai (*Boswellia serrata*) is whitish in color, transparent and smell specific aroma. The gum-tears of khair (*Acacia catechu*) is round in shape, brown to reddish brown in color with even surface and sweet in taste. The gum tears of babul (*A. nilotica*) are roundish in shape, yellow to reddish brown in color with uneven surface and pungent taste.

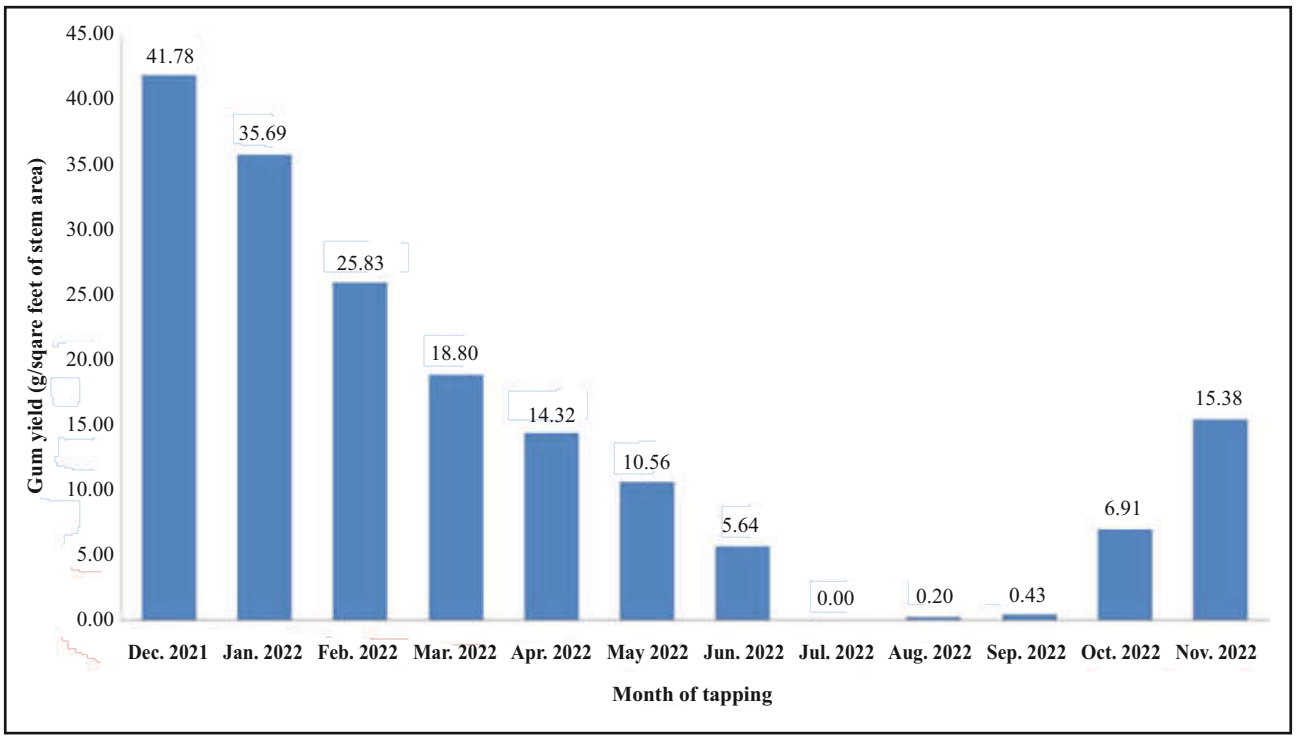


Physical shape and color of Gum-tears of *B. serrata* (A) *and A. nilotica* (B)

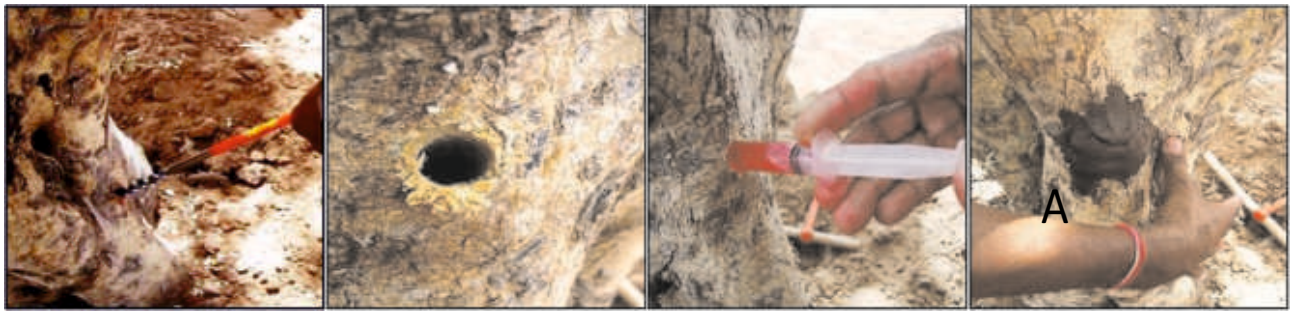
Sub-Project 4. Standardization of gum tapping techniques

To observe gum exudation in *B. monosperma* throughout the year, an experiment was initiated in December 2021. Month wise gum exudation was monitored in *B. monosperma* in response to knotching / incision. Maximum gum yield was obtained in the month of December followed by January and February. From December to June the gum yield declined and during rainy season in the month of July, August and September the exuded gum could not be collected as all the exudates washed away with the rain water.

An experiment was conducted to assess response of different progenies of *A. pendula* to ethephon application on gummosis. Single dose (4 ml/tree) of ethephon (30% concentration) was injected in tree trunk in the month of March 2022 and gummosis was observed in subsequent months. All the progenies responded to ethephon application and exhibited gum exudation. Maximum gum yield was given by trees of AP-20 and the least by J-62 progeny.

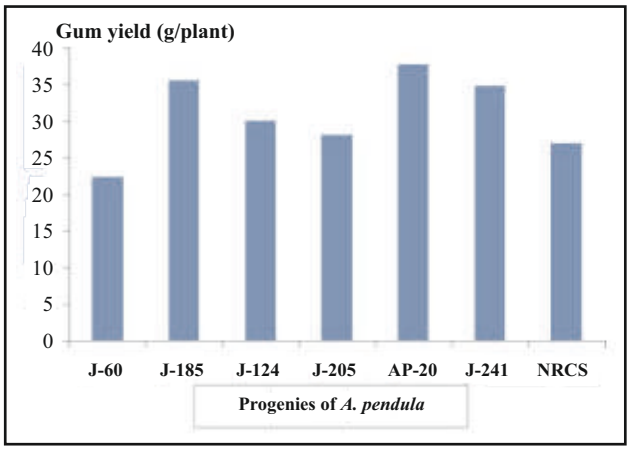


Effect of different months on exudation of gum-butea



Drill for making hole | Injecting ethephon | Plugging of hole

Application of ethephon in *A. pendula* for inducing gummosis

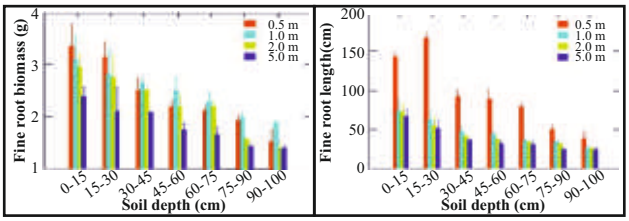


Effect of ethephon on gummosis and gum-yield in progenies of *A. pendula*

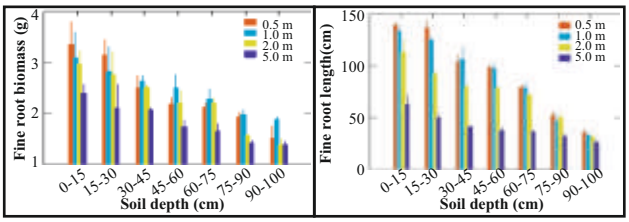
Sub-Project 5.: Studies on root distribution pattern and above- and below-ground biomass in *Acacia senegal*

Horizontal and vertical distribution fine roots in both *A. senegal* and *A. nilotica* was studied. In general maximum fine roots confined up to 60 cm soil depth in both gum yielding trees *viz. A. senegal* and *A. nilotica*. In both the tree species, distribution of fine roots decreased with the increase in soil depth and distance from tree-base.

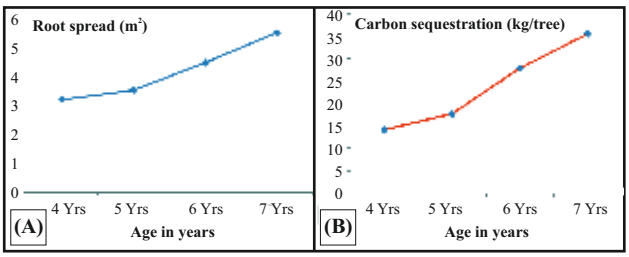
The above and below ground biomass of 4, 5, 6 and 7 years old *A. senegal* was estimated by destructive sampling. The GBH and height of 4, 5, 6 and 7 year-old trees were 19.0, 23.0, 29.0, 33.0 cm and 3.7, 4.8, 6.1 and 6.7 m, respectively. The above ground biomass varied from 26.0 kg in 4 year-old tree to 63.7 kg in 7 year-old tree, while the below ground biomass ranged from 3.75 kg in 4 year-old to 11.1 kg in 7 year-old trees. The root: shoot ratio of 4, 5, 6 and 7 year-old tree was 0.14, 0.12, 0.17 and 0.17 respectively. The root spread ranged from 3.17 m^2 in 4 year-old to 5.45 m^2 in 7 year-old tree. Carbon sequestered in 4, 5, 6 and 7 year-old trees was 14.1, 17.6, 27.9 and 35.5 kg / tree, respectively.



Horizontal and vertical distribution of fine roots of *A. senegal*



Horizontal and vertical distribution of fine roots of *A. nilotica*



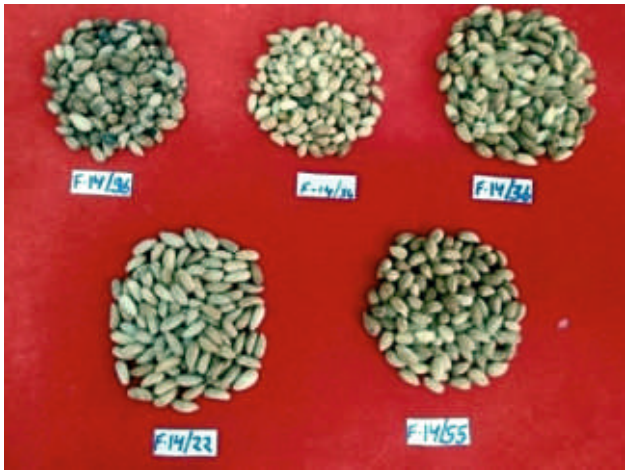
Age of tree v/s root spread (A) and carbon sequestration (B) in *Acacia senegal*

NRMA/CAFRI/SOL/2019/003/00119

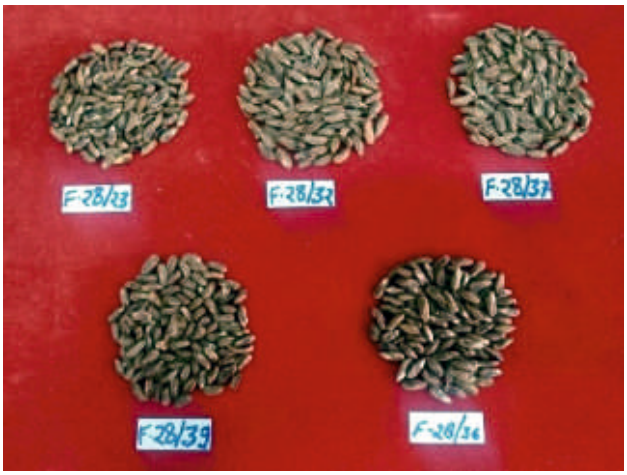
Assessment of genetic potential of neem germplasm for higher yield and oil content through molecular markers

(K. Rajarajan and H. Anuragi)

All the 170 genotypes showed a significant variation for yield traits *viz.* fruit weight, seed weight, kernel weight and oil percentage for both the seasons. The oil yield ranged from 11.40 to 48.25%. The genotype VKAF11, VKAF3, VKAF13, VKAF9, VKAF67, VKAF68, VKAF92, VKAF110, VKAF85, VKAF43 and OR05 had higher oil percentage than other genotypes during both seasons (2020-22). Similarly, the 100 seed weight was ranged from 7.79 to 28.20 g. Also, the kernel weight ranged from 3.56 to 11.25 g. Based on this study, genotypes VKAF11, VKAF3, VKAF13, VKAF9, VKAF67, VKAF68, VKAF92, VKAF110, VKAF85, VKAF43 and OR05 had higher seed and kernel weight for both the seasons. The yield parameters of different neem germplasms are shown in figures below. The genetic variability parameters for all the 170 germplasm was estimated and showed a great magnitude of variation.



Seeds of different Neem genotypes



Kernel weight of Neem genotypes

Neem oil extracted from different genotypes

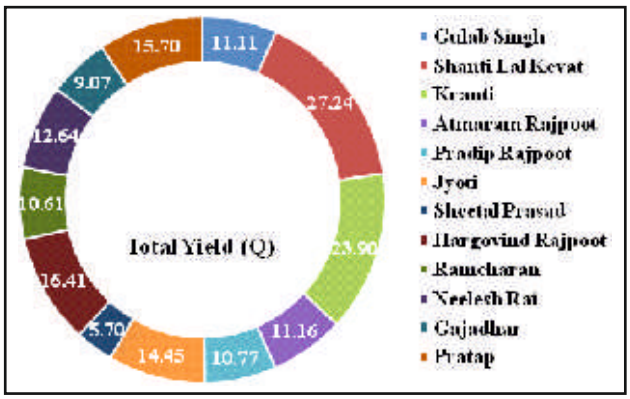
NRMA/CAFRI/SOL/2021/001/00125:

Evaluating the performance of strawberry cultivation in Babina block of Jhansi district for crop diversification, and better economic returns at farmer's field.

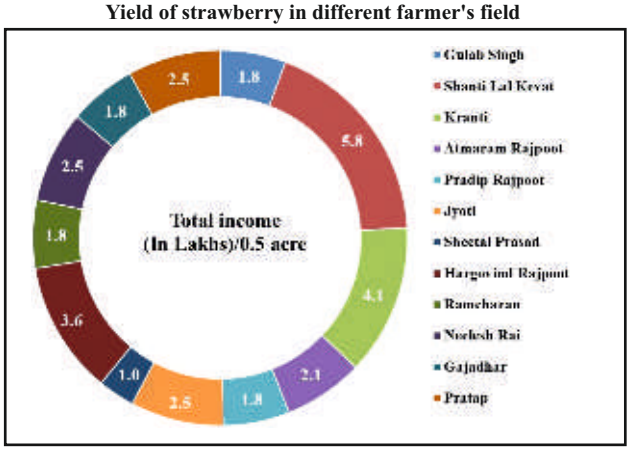
(A. Arunachalam, Ashok Yadav and Sushil Kumar)

The strawberry performed well in Babina block of Jhansi district in terms of yield and quality. The plant produce profuse vegetative and reproductive growth. The fruit color, size, aroma and flavor were excellent compared to the strawberry fruit available in the market. The yield and income from strawberry at different farmers field depicted in below shown diagrams.

Out of 12 farmers, 10 farmers in Babina block resulted in better quality production, which fetch them higher returns compare to their agronomic crops. The price ranged from Rs. 100 to 250 based on different grades of the fruits.



Yield of strawberry in different farmer's field



Income from strawberry at different farmer's field

In this project, a three-days training programme on "Strawberry cultivation for crop diversification and better income in Bundelkhand Region" and three-days programme on "Bundeli Strawberry & Organic Agri-Produce Festival Cum-Exhibition was organized by ICAR-CAFRI during 9th-11th February 2022. The total 13 lectures were scheduled which covered all aspects of strawberry cultivation.

On 27th March 2022, Dr G.R. Chintala (Chairman, NABARD) along with Shri S.K. Dora (CGM, NABARD), Shri Prabhdatta Sahoo (GM, NABARD Lucknow), Shri Raju Kumar Sharma (AGM, NABARD), Shri Bhupesh Pal (AGM, NABARD Jhansi), Captain Saurabh Vikas, (P&SO, NABARD) monitored the performance of strawberry project funded by NABARD. Dr. A. Arunachalam, Director (ICAR-CAFRI) & Dr. Ashok Yadav (Scientist-Fruit Science) briefed about the project activities and result of strawberry project. The chairman appraised the strawberry project success and gave best wishes for future. He told that this cultivation of strawberry needs to be promoted to other farmers for better income and livelihood support. He assured that NABARD will continue its support to the project which meets the aspiration of people and rural development.

Beside above all facts, due to use of drip irrigation technology farmers were able to take third crop which led to increase in the crop index of the farmers. They saved around 70-80% water compared to their previous evaluation and hence they were able to take third crop which led them to earn more income from the third crop of the year because earlier farmers were able to take only two crops per year.

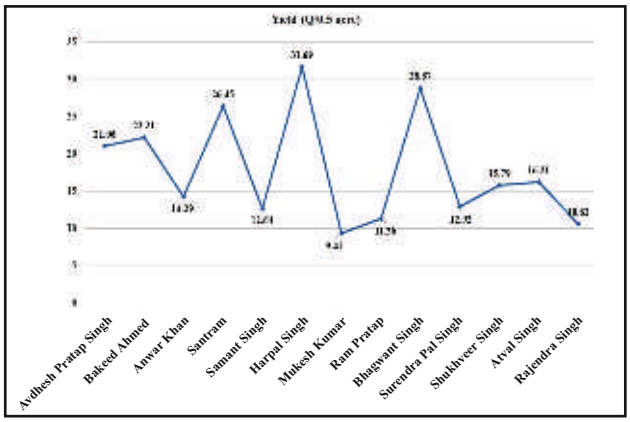
NRMA/CAFRI/SOL/2021/002/00126:

Evaluating the performance of strawberry cultivation in Moth block of Jhansi district for crop diversification, and better economic returns at farmer's field.

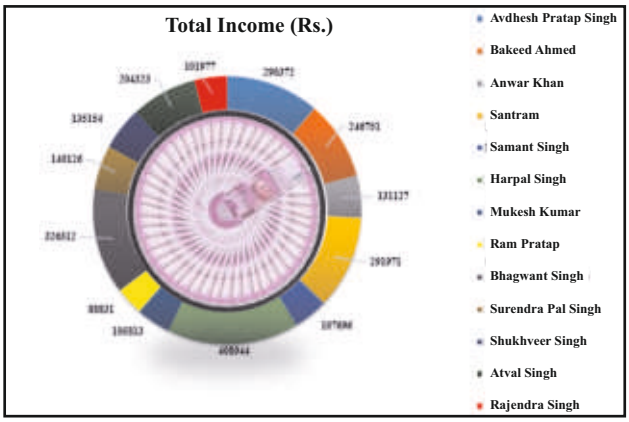
(A. Arunachalam, Ashok Yadav and Sushil Kumar)

The strawberry performed well in Moth block of Jhansi district in terms of yield and quality. The plant produces profuse vegetative and reproductive growth. The fruit color, size, aroma and flavor were excellent compared to the strawberry fruit available in the market.

In this project, to get acquainted with complete information on strawberry a three-days training on "Strawberry cultivation for crop diversification and better income in Bundelkhand Region" and three-days programme on "Bundeli Strawberry & Organic Agri-Produce Festival cum-Exhibition was organized by ICAR-CAFRI during 9th-11th February 2022. The yield of strawberry in different farmer's field is depicted graphically.



Average strawberry fruit yield per plant at different farmer's field



Total income through strawberry cultivation at different farmer's field

Field visit of Dr. G.R. Chintala, Chairman, NABARD at strawberry field of Babina block

Strawberry performance in Moth block of Jhansi

The strawberry produced in the dry climate of Jhansi district had a very unique quality and large sized fruits with excellent aroma and flavor. Therefore, to get good market price and provide better reach in market we gave this strawberry a brand name "Bundeli Strawberry". The success of Bundeli strawberry is documented in the form of a short video film which includes the sequential steps right from the start of the project.

NRMA/CAFRI/SOL/2021/018/00142:

National Mission on Sustaining Himalayan Ecosystems (NMSHE) -Task Force on Himalayan Agriculture

(A. Arunachalam, A.K. Handa and Suresh Ramanan S)

In the Indian Himalayan Region, agriculture is the primary source of income. Still, traditional farming practices and cropping patterns are becoming more and more in danger due to climate instability, increasing erratic precipitation, and rising temperatures. Rural farming communities with limited resources are particularly susceptible to climatic threats. The use of contemporary agricultural technology in the IHR is limited by the physiographic and climatic limits brought on by the considerable diversity in altitude, slope,

and aspect, and the difficulties presented by tiny land holdings.

The Department of Science and Technology (DST) (DST-https://dst.gov.in/climate-change-programme), Government of India, has commissioned the National Mission on Sustaining Himalayan Ecosystems (NMSHE) - Task Force on Himalayan Agriculture to the Indian Council of Agricultural Research (ICAR), with an emphasis on database creation, monitoring for ecological vulnerability, modeling, and simulation, adaptation policy research, pilot studies for revalidation of climate resilient technologies, and capacity building of farmers and other stakeholders. The first phase of the task was successfully concluded from (2015 to 2020, in which 25 ICAR institutes across the IHR worked together to bring climate resilience among the Himalayan farmers. The Task Force created 115 maps, yield trends, and graphs related to the state of agro-ecosystems, climatic trends, and vulnerability in the IHR. To understand the time dependence of precipitation anomalies for seasonal drought occurrence, a regional disparity study was conducted.

The second phase of NMSHE initiated in 2021. A total of 11 institutes, which are geographically evenly dispersed and have expertise in a range of specialist areas of hill agriculture as well as the highly specialized field of climate change effect and adaptation studies, are collaborating to achieve the assigned objectives.

Collaborating Institutions:

- ICAR-Indian Agricultural Research Institute, New Delhi (Lead)
- ICAR-Central Agroforestry Research Institute, Jhansi
- ICAR-Indian Institute of Soil and Water Conservation, Dehradun
- ICAR-Research Complex for North-Eastern Hill Region, Barapani
- High Mountain Arid Agriculture Research Institute, Leh, Leh
- ICAR-Vivekananda Parvatiya Anusandhan Sansthan, Almora
- Sher-E-Kashmir University of Agriculture and Technology, Srinagar
- HP Agricultural University, Palampur
- YS Parmar University of Horticulture and Forestry, Solan
- Toklai Tea Research Institute, Jorhat
- ICAR-National Bureau of Plant Genetic Resources, New Delhi

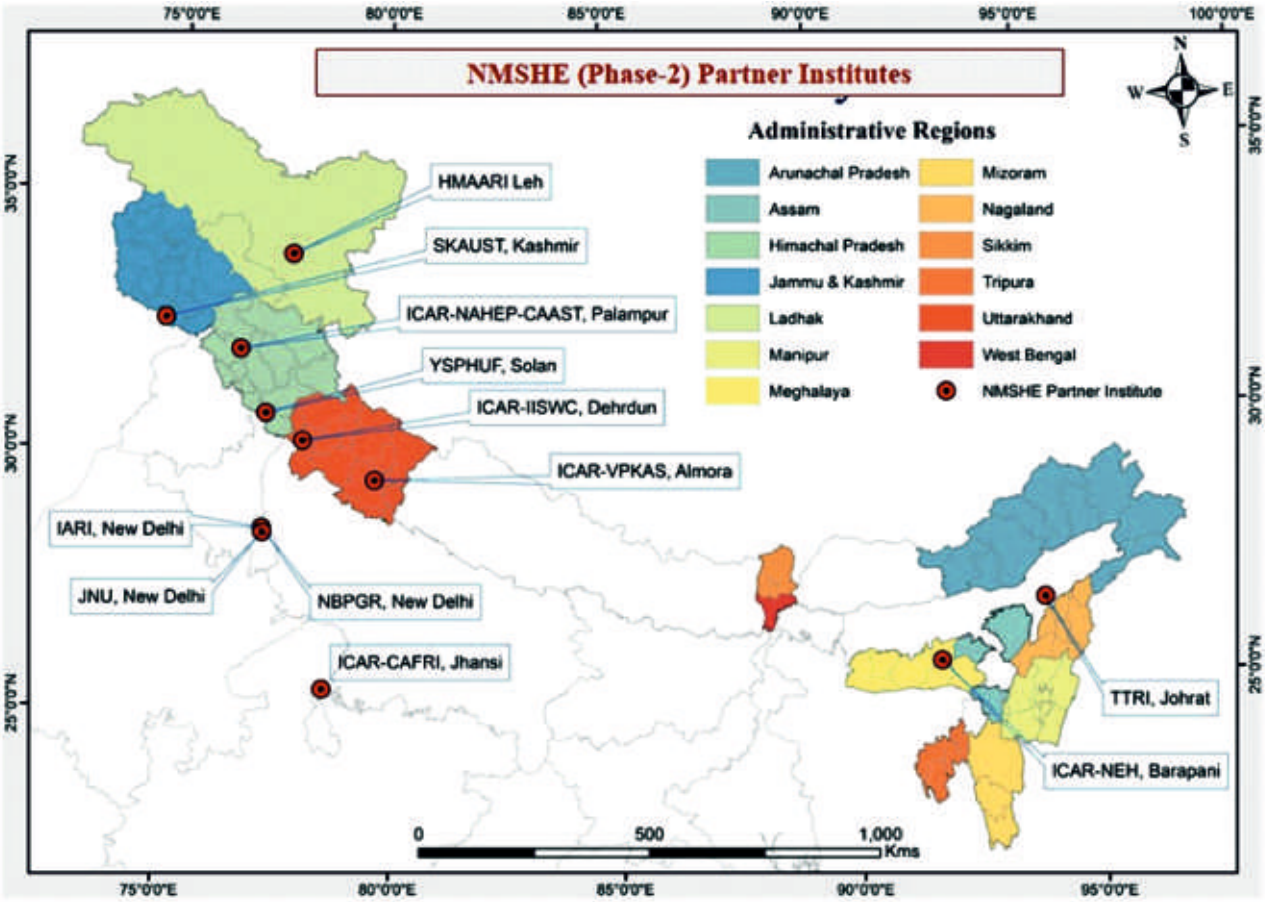
The objectives are

- To develop the bias-corrected high-resolution seasonal ensemble climate scenarios for Indian Himalayan Region (IHR)
- To characterize the agroecosystem changes in the past in relation to extreme weather events and temporal changes
- To develop block-level vulnerability assessment for selected districts/ state/ AEZ
- To project the integrated impacts of climate change on major agri-horticultural crops, livestock, and fisheries in IHR.
- To develop adaptation strategies under climate change scenarios for each state of IHR
- To pilot-test the strategic adaptation technologies for improving resilience and incomes of farmers in different agro-ecological zones of IHR
- To develop ICT tools for adaptation technology dissemination
- To train the stakeholders and develop human resources for climate-resilient agriculture

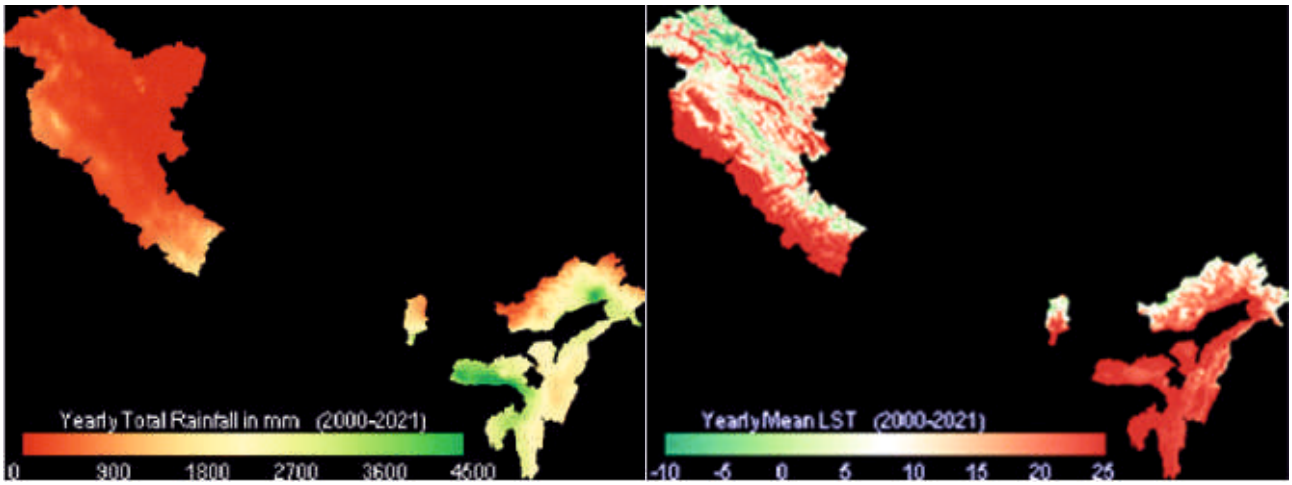
The Indian Himalayan Region is renowned for its biodiversity diversity and ecological fragility, supporting the livelihoods of millions of people and forming a cultural landscape that connects ecology, economics, and ethics. Although biological exploration of the area is not yet complete, human-induced disturbances (deforestation, land conversion) and natural disasters (earthquakes, landslides) have significantly contributed to the degradation of land and bio-resources in the Himalayan watersheds, affecting the entire hydrology. Climate fluctuation eventually has an impact on the crops, cropping system, and cropping pattern in the area.

The National Mission for Sustaining the Himalayan Ecosystem (NMSHE) addresses the concerns raised by climate change in the Indian Himalayan Region under the National Action Plan on Climate Change (NAPCC) (IHR). The Department of Science and Technology of the Government of India established Task Force VI on Himalayan Agriculture under NMSHE in 2021 to address the effects of climate change on Himalayan agriculture and to inform stakeholders about climate-resilient technologies for adaptation and/or mitigation.

India Himalayan Region (IHR) is experiencing serious issues, similar to the rest of the world, as a result of the effects of climate change and global warming. The term "global warming" refers to an increase in the average surface temperature of the planet. Land surface temperature (LST) and Precipitation, which are utilized in a range of hydrological, meteorological, and climatological applications, is crucial in understanding global climate change. Geographic information systems (GIS) and remote sensing (RS) have numerous uses in the study of climate change, including the calculation of LST and rainfall.



NMSHE (Phase-2) Partner institutes and their location



Prepare CHIRPS data based Precipitation map & MODIS data-based time series Land Surface Temperature (LST) map using Google Earth Engine for the entire Indian Himalayan region

ICRAF

NRMA/CAFRI/SOL/2021/021/00145:

Pilot the solutions of chip-based technology for real-time and RFID-passive monitoring of gene-bank and agroforestry species for scaling up

(K. Rajarajan and H. Anuragi)

This is a jointly implemented pilot project by ICAR-NBPGR-ICAR-IIHR & ICAR-CAFRI with ICRAF. In this project, the tree germplasms are being monitored through real-time or active chips. In addition, these tree genetic resources are being managed by RFID tags as passive management by digitally entering the morphological, and other growth-related data from a different time to time. We installed advanced RFID (Radio Frequency Identification) tags in 30 trees of different species as Neem, Pongamia, and Acacia) germplasm in the field gene bank. The data

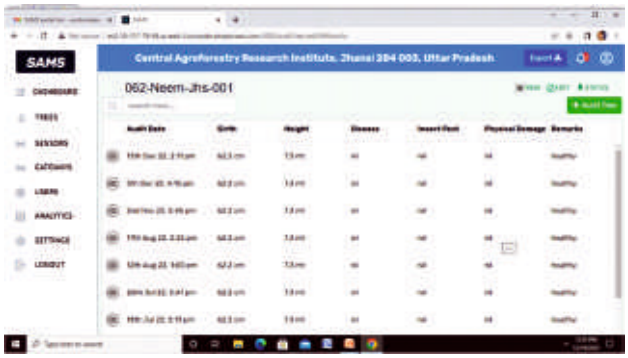


Figure 2. RFID tags installed in neem germplasms at CAFRI, Jhansi

updating on morphological and health status are being updated in SAMS Portal along with its IC number, images, and latitude and longitude. In addition, for real-time monitoring of tree germplasm, we installed chips in 50 neem trees. Optimization of chip signal information by artificial disturbance, we had an alert notification such as severity-critical or tree is at risk. In addition, we optimized the RFID tags scanning at different distances. As a result, it was found that the signal strength was good at 0.25 to 1.5m distance from the trees.

NRMA/CAFRI/SOL/2022/001/00147:

Agri-Drone Project

(Asha Ram)

The project was funded by ICAR-ATARI, Kanpur, under the RKVY Project. This project began in 2022. One drone (model: Agriboat, make: Iotech) was purchased for demonstration purposes as part of this project. To fly a drone, pilot training was taken at PBC's Aero Hub, Pune (MH). Various demonstrations on spraying through drone were organised at farmers' fields and the ICAR-CAFRI Research Farm.

NRMA/CAFRI/SOL/2022/002/00148:

Evaluating the performance of seaweed extract, humic acid, protein hydrolysate, biochemical and botanical extracts.

(Ashok Yadav, A. Arunachalam, Asha Ram, Mahesh Kumar Dhakad and D.R. Bhardwaj)

In this experiment five types of bio-stimulants *i.e.* seaweed extract, humic acid, protein hydrolysate, biochemical and botanical extracts are being evaluated for growth performance of five crops namely strawberry, mustard, tomato, and pea at three locations (ICAR-CAFRI, ICAR-RCER, RS Ranchi, YSPUHF, Solan). During this year, the experiment was laid out in Randomized Block Design and sowing and planting of all crops were done along with first dose of application.

Strawberry **Mustard**

Tomato **Pea**

NRMA/CAFRI/SOL/2022/003/00149:

Development and evaluation of pomegranate-based agroforestry system in Bundelkhand region for higher productivity and economic returns at farmer's field.

(Ashok Yadav and A. Arunachalam)

Different surveys were conducted in the Bangra and Baragoan block for identification of the farmers for implementation of the project. In Bangra block, the farmers were identified whereas in Baragoan block still some farmers need to be identifies. Beside this, the project monitoring committed has been developed.

Inter-Institutional Collaborative Project

ICAR-IGFRI, Jhansi

Farmer FIRST Programme: Scaling up and integration of fodder technologies in existing farming system for sustainable livestock productivity and livelihood security in Bundelkhand region.

(Purshottam Sharma, Sunil Seth, S.K. Mahanta, Harsh Vardhan Singh, Mukesh Choudhary (IGFRI, Jhansi) and R.P. Dwivedi (CAFRI, Jhansi)

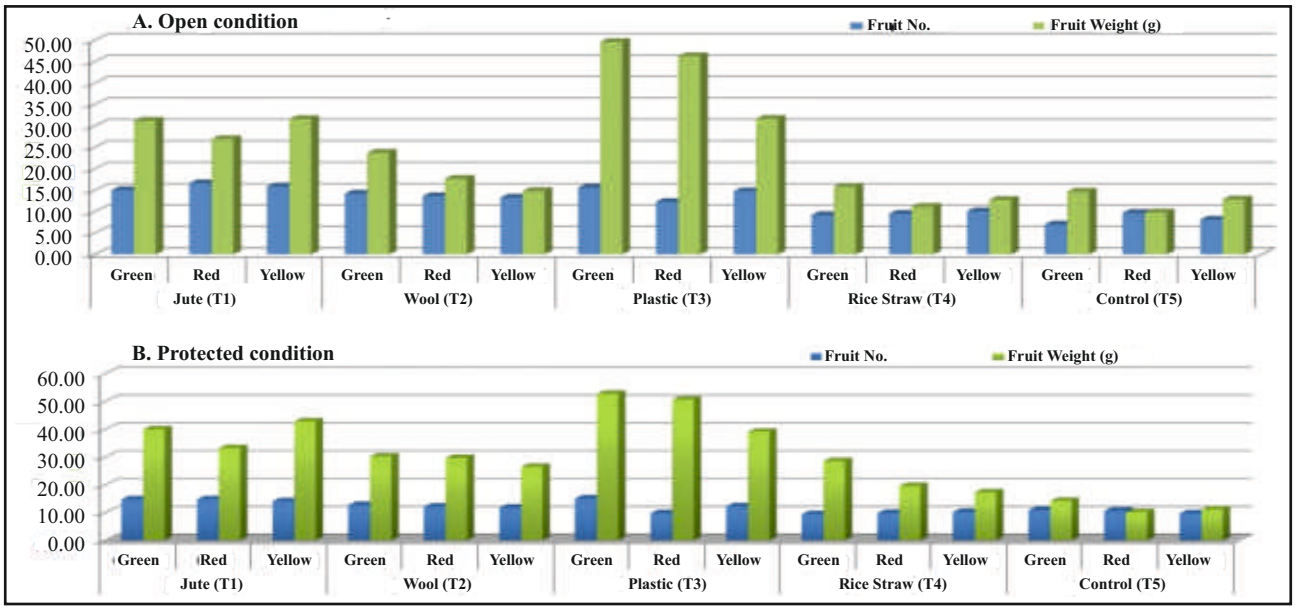
Associated in organizing the livestock health camps to monitor the health status of animals. Motivated the farmers about participatory seed production in fodder crops. Created awareness among farmers towards introduction of improved variety of Tomato, Okra, Bottle gourd, Pumpkin and other cucurbits. Using capacity building module for

capacity building and technology dissemination through trainings, livestock fodder-advisories and weather based agro advisory services. Total 15 training programmes were organized. Demonstrations of improved varieties of fodder crops with standard package of practices including seed treatment were conducted in *Kharif* season. Improved variety of sorghum (CSH 24 MF) produced 579 q/ha green fodder which was 46% higher over local ones was distributed. This variety is multi-cut in nature, so farmers were able to harvest 3-4 cuts. Due to higher yield, improved varieties of fodder crops fetched higher economic returns and benefit to cost ratio.

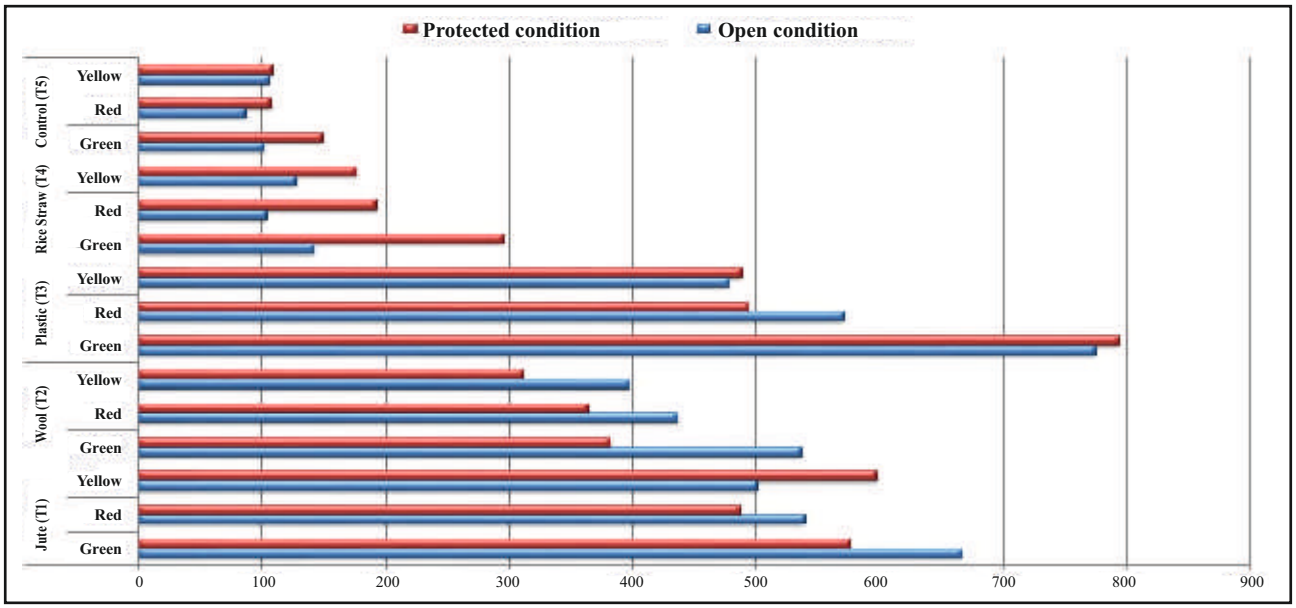
Study on soil hydrothermal environment under natural and synthetic mulch

(Nilimesh Mridha (PI), D.B. Shakyawar, Atul Singha, Manik Bhowmick, Haokhotang Baite, Ashok Yadav (CC-PI), Vinod Kadam and Manoj Kundu)

The study on performance of different coloured capsicum under different types of mulches *i.e.* jute, wool , plastic and rice straw based mulches revealed that, plastic mulches performed better followed by jute, wool, rice straw and control whereas comparing to open and protected conditions, the results revealed that capsicum perform better under protected conditions. The results of fruit parameters and fruit yield are depicted in figure respectively. The minerals profiling of soil analysis indicated that there were no significant improvements in soil chemical properties in mulched treatments over control.



Fruit number and fruit weight of capsicum in different mulches. A: Under open conditions and B: Protected conditions



Yield of capsicum in different mulches under open and protected conditions

2. Research Achievements

2.6: Technologies

The Institute Technology Management Unit convened the Institute Technology Management Committee (ITMC) on 26.12.2022. The ITMC deliberated on the concept, technology, process, methodology, germplasm, and other facets of the IPR, and after elaborate discussion. It was decided to categorize IPR into five major sections: Category I: New Concepts, Category II: New process/methodology, and Unique germplasms Category III: Technologies and Products including Tools and Design, Category IV: Package of practice(s) and Category V: Strategic knowledge. A revised IPR proforma was developed and hosted on the institute's website.

As a part of ITMU, the Institute Plant Germplasm Identification Committee (IGIC) is constituted under the Chairmanship of the Tree Improvement Programme Leader, ICAR-CAFRI. All the plant germplasm and genetic resources related activities of this institute are being handled by the IGIC committee. It has provision for the adoption of need-based tree/crop specialists with reference to the proposal under consideration, with the approval of the Director of the Institute.

As a part of the IP Portfolio management, two trademarks (Appln. No: 5010470, 5010471) and a copyright application (Appln. No:109190) application has been filled to the office of Controller General of Patents, Design & Trade Marks. The applications are being processed.

A sensitization workshop was organized about PPV&FR Act for the promotion of plant nurseries for farmers and rural youths on 27th April 2022. About 25 participants including nursery growers, farmers/students, and rural youths participated in the workshop.

ABiC

The Institute Technology Management Unit (ITMU) of CAFRI facilitates the incubation of new startups/ entrepreneurs and enterprises by providing need-based physical, technical, business and networking support, facilities and services to test and validate their venture before the successful establishment of enterprises, IP/deemed IP and transfer/commercialization of technologies in agroforestry and allied sectors. For this endeavor, on the 35th foundation day (8th May, 2022) of ICAR-CAFRI, ABiC was inaugurated by Hon'ble Dr. S.K. Chaudhari, DDG (NRM), Dr. Arvind Kumar, Vice Chancellor, RLBCAU, Dr. Neelam Patel, Sr. Adviser, NITI Aayog, Dr. Amresh Chandra, Director, ICAR-IGFRI, Jhansi.

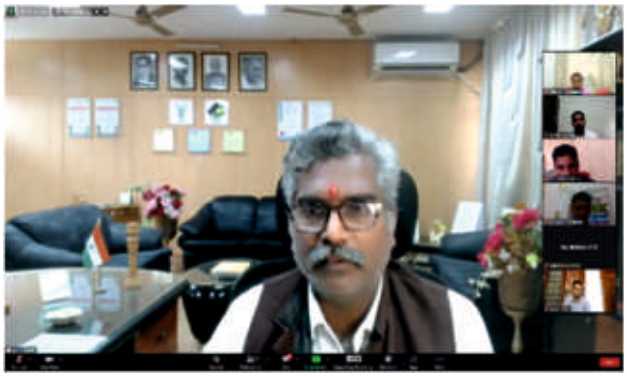
Its mission is to establish a sustainable innovation and entrepreneurship ecosystem through agroforestry business incubation, technology commercialization, capacity building and outreach programmes, for developing original solutions for challenging issues, growth of start-ups and inventions in agricultural inputs, products and managerial practices for the benefit of various stakeholders in agroforestry business.

Activities:

A sensitization workshop on ABiC for the promotion of plant nurseries for farmers and rural youths on 27th April, 2022. 25 Participants including nursery entrepreneurs, farmers/students, and rural youths are participating in the ABiC workshop. The Chief Guest of the program Dr. Vinay Kumar Yadav, Deputy Director Horticulture, Jhansi, Govt.

of Uttar Pradesh appreciated the efforts of ICAR-CAFRI in organizing the sensitization workshop on ABiC in Jhansi.

Sensitization-cum-online training" at ABiC-CAFRI, Sensitization-cum-online training was started to promulgate the activities of ABiC to the incubatee's knowledge. Open remarks by Dr. A. Arunachalam, Director of ICAR-CAFRI, Jhansi. Increase the employability of individual; and increase the individual's employing ability. Then by transforming the youth of the nation from job seekers to job givers. This was followed by a special session on unprocessed (agroforestry-based nursery) by Dr. Ashok Yadav, Scientist (Fruit Science), CAFRI, Jhansi. Semi-Head processed agroforestry by Dr. A.K. Handa, Principal Scientist (Agroforestry), Head of Office, CAFRI, Jhansi. Furthermore, two successful young entrepreneurs—Ms. Shivani Bundela, founder of Abrosaa (Bundelkhand Agro Innovations Pvt. Ltd.) and Mr. Rohit Kansay, founder of Lakkarwala. This programme was organised by ABiC in ICAR-CAFRI led by Mr. Suresh Ramanan S., Incharge-ITMU, CEO-ABiC and Dr. Subin Thomas, Program Manager-ABiC. Overall, the event was held online with participants from various states of India (Chhattisgarh, Karnataka, Kerala, Odisha, Tamil Nadu, Uttar Pradesh *etc.*).



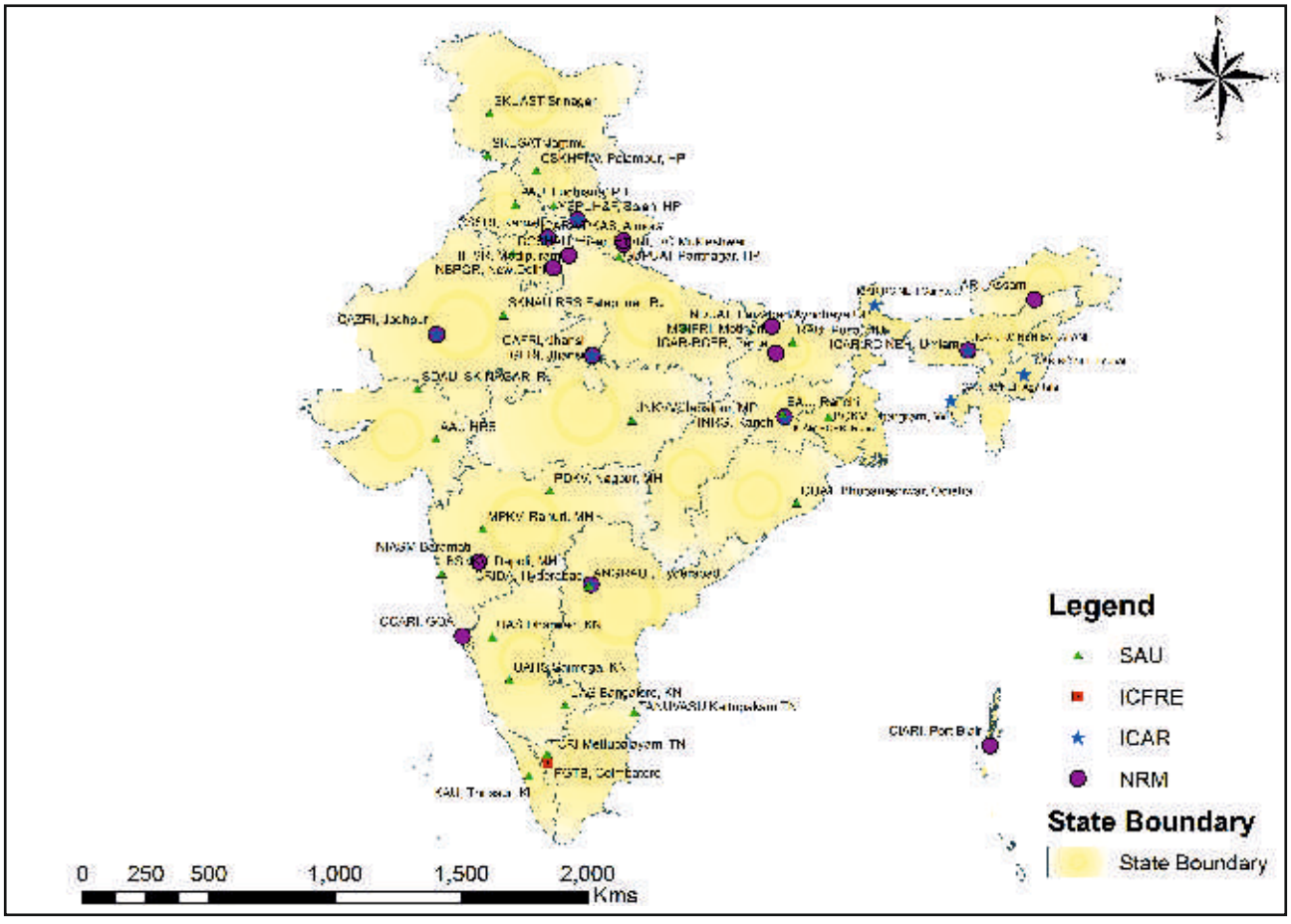
3. All India Coordinated Research Project (AICRP) on Agroforestry

The All India Coordinated Research Project (AICRP) on Agroforestry was started in 1983 with 20 centres and it has now expanded to 37 centres – 26 in SAUs, 10 in ICAR and 01 in ICFRE Institute representing all the agro-climatic zones in the country (Figure 1). The Coordinating unit of AICRP-Agroforestry was shifted from ICAR Headquarters to CAFRI, Jhansi w.e.f. 1st April, 1997 with the following mandates:

- ✓ Screening and genetic upgrading of selected plant species for their compatibility in different agroforestry systems
- ✓ To optimize tree-intercrop combination for different regions
- ✓ Performance enhancement of the pre-dominant agroforestry systems being already practiced by the farmers
- ✓ To upgrade and refine the existing technologies for higher productivity and sustainability.
- Collection and evaluation of promising tree species, cultivars of fuel, fodder and small timber for agroforestry interactions
- Studies on management practices of agroforestry systems such as agri-silviculture, boundary plantation, silvi-pasture, silvi-horticulture, agri-silvihorticulture, multistorey and homestead, *etc.*
- To analyze economical relation of agroforestry systems
- To explore the role of agroforestry in environment protection
- To conduct studies on post-harvest technology, fishery, apiculture and lac, *etc.* in relation to agroforestry systems

Diagnostic and Design survey

The YSPUHF, Solan conducted study on appraisal of existing agroforestry systems in the mid-hill and high-hills of the Himachal Pradesh. Study identified the prominent systems as agri-silviculture, agri-horticulture, agri-silvihorticulture, horti-agriculture, silvi-pastoral, agri-



hortisilviculture, pastoral-silviculture and horti-pastoral. The AAU, HRS, Kahikuchi centre carried out D&D more extensively covering most of the districts of the state. It was reported that the trees such as *Tectona grandis, Dalbergia sissoo, Michelia champaca, Gmelina arborea, Phoebe goalparensis, Terminalia myriocarpa, Shorea assamica, Artocarpus chaplasha* were grown either as block plantation, boundary plantation or in homestead for timber production. Multistoried crops like betel vine and black pepper were grown under shade of *Erythrina indica, Cocos nucifera, Areca catechu* trees. Bamboo spp. namely *Bambusa tulda, Bambusa balcooa* and *Dendrocalamus strictus* reported to be integral part of homestead. Agar as a shade tree within the small tea garden or homestead tea garden. *Tectona grandis, Michelia champaca,* rubber, *Bambusa tulda, Bambusa balcooa, Dalbergia sissoo, Gmelina arborea*, Arecanut, Khasi mandarin, jackfruit, and litchi were commonly grown in block plantation mode. The GBPUAT centre carried out survey in Rangaon village of Thalisain Block in Pauri Garhwal District of Uttarakhand. OUAT conducted D&D in two districts (Khurda & Jagatsinghpur) comprising two blocks and two villages. A total number of 100 farmers were interviewed as per the pre-structured questionnaire. Many heterogeneous species of trees, shrubs, vegetables and herbaceous plants were grown in random arrangement with dense plant population. The home gardens were characterized by high species diversity and usually 3-4 vertical canopy strata. BCKV, Jhargram performed D&D in different villages of Jhargram, Binpur II of Jhargram, Salboni of Paschim Medinipore for extension of agroforestry systems in farmers' plots. They showed on-farm demonstration of gamhar (*Gmelina arborea* Roxb.) and mango (*Mangifera indica* L.) based agroforestry models with pigeon pea (*Cajanus cajan*), boundary plantation of gamhar and bamboo, homestead agroforestry and gamhar-sweetorange-based agroforestry. The SKNAU, Fatehpur- Shekhawati collected seeds of *Capparis decidua* and *P. cineraria* and sown in nursery for evaluation areas of Sikar and Jhunjhunu. Wheat, barley, mustard and gram were grown as irrigated crops in *rabi* season. During the survey *Capparis decidua* pocket have been identified and their biometric observations and GPS location were recorded. D&D survey of Washim district was carried out by PDKV, Akola. AICRP on Agroforestry, UAS, Dharwad undertaken the D&D survey for the perennial components which were most prominent among the farming community and revealed that teak was planted on the bunds/channels, *Melia dubia* cultivated in the recent past on larger scale. In Hilly Zone, the multistoried agroforestry system was noticed in farmer's field where Arecanut, *Erithrina indica*, Jackfruit, Cardamom and Jamun *etc.*, were commonly grown species. The paddy was the main field crop grown in low lands during *kharif* season. *Casuarina equisetifolia* and *Grevillea robusta* were mainly grown as wind breaks in these areas. UAHS, Shivamoga carried out D&D in the remaining parts of the Kodagu district. The farmers in the region were mainly practicing plantation crop-based agroforestry system particularly coffee with some native shade trees. Nearly 25 per cent of the land was being used for paddy. Cultivation by planting some hedge rows and border row planting with silver oak was also common in the region. Small farmers of the region do mix all type of domesticated fruit trees (40%), timber trees (20%), wild edible fruit trees (10%) in their farm out of their interest.

System Research and Tree Germplasm Collection, Evaluation and Improvement work

Name of the centre/State	MPTS working upon	Agroforestry models under trial/ development
Assam Agricultural University - HRS, Kahikuchi	*Gmelina arborea,* Bamboo species evaluation	*Gmelina arborea* based agri-silvicultural system, Jackfruit-based agroforestry system, *Acacia mangium* based agri-silvicultural system
Professor Jayashankar Telangana State Agricultural University, Hyderabad	*Azadirachta indica, Pongamia pinnata, Melia dubia*	*Melia dubia* based agroforestry system, Custard apple based horti-pastoral system, Mango based agri-horticultural system
Birsa Agricultural University, Ranchi	Multipurpose Tree Species (MPTs)	*Melia azedarach* under silvi-pastoral System, Tephrosia alley cropping based agri-silviculture system, *Gmelina arborea* based agri-silvicultural system
Bidhan Chandra Krishi Viswavidyalaya, West Bengal - Jhargram	*Acacia auriculiformis*	*Gmelina arborea*-ber agroforestry system, *Dysoxylum binectaiferum* - mango based agroforestry system, *Anthocephalus cadamba* - mango agroforestry system, *Gmelina arborea* based agri-silvicultural system

Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli	*Melia dubia,* *Gmelina arborea,* Bamboo sp., *Tectona grandis,* *Garcinia indica,* *Pongamia pinnata,* *Madhuca latifolia,* *Acacia mangium,* *Anacardium occidentale*	*Melia dubia* block plantation, Bamboo based plantation agroforestry system, Cashew based plantation agroforestry system
Chaudhary Charan Singh Haryana Agricultural University, Hisar	*Populus deltoides,* *Melia composita,* Eucalyptus	Eucalyptus-Kinnow based agroforestry system, Poplar based agroforestry system, Eucalyptus clone-based agroforestry system
Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur	*Toona ciliate,* *Sapindus mukorossi,* *Leucaena leucocephala,* *Melia dubia*	Harar based silvi-pastoral system, *Leucaena leucocephala* silvi-pastoral agroforestry system, *Toona ciliata* based agroforestry system
Tamil Nadu Agricultural University, Mettupulayam G.B. Pant University of Agriculture and Technology, Pantnagar	*Toona ciliata* 94 indigenous and exotic MPTs including 7 species of bamboos have been maintained at Patharchatta (Old) site and total 54 indigenous and exotic MPTs suitable for agroforestry systems together with 14 species of bamboos have been collected at Haldi (New-AFRC) site. *Dalbergia sissoo* Eucalyptus species	Fodder bank (18 species) Multifunctional Agroforestry Model (Circular) Eucalyptus based agroforestry, Carbon sequestration of Poplar based agroforestry system (Mustard)
Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur	*Dalbergia sissoo*	Mango based agri-horticulture system, *Dalbergia sissoo* based agroforestry system, Gmelina based agroforestry system, *Pongamia pinnata* based agroforestry system
Kerala Agricultural University, Thrissur Mahatma Phule Krishi	*Tectona grandis* 21-tree germplasm under evaluation	Boundary plantation of fast-growing fodder trees; Bamboo-based agroforestry Agri-horticultural system of different fruit tree species, Teak based Agroforestry system
Acharya Narendra Deva University of Agriculture and Technology, Ayodhya	*Dalbergia sissoo* Eucalyptus clones	*Casuarina equsetifolia* and *Psidium guajava* based agri-silvi-horti system, Agri-silviculture system (*Dalbergia sissoo, Casuarina equisetifolia, Eucalyptus*), *Dalbergia sissoo* based silvi-pastoral system
Orissa University of Agriculture and Technology, Bhubaneshwar	*Gmelina arborea*	Fruit based agri-silvihorticultural system (Jackfruit, Mango, Cashew), Silvi-pastoral system (*Acacia mangium, Acacia auriculiformis, Samanea saman*) Mango + Pineapple agri-horticultural system, agri-silvicultural System (*Acacia mangium, Tectona grandis*), *Gmelina arborea* based agri-silvicultural System
Punjab Agricultural University, Ludhiana	*Populus deltoides* *Melia composita* Eucalyptus (Clones) *Dalbergia sissoo*	Poplar based agroforestry, Eucalyptus based agroforestry
Dr. Panjabrao Deshmukh Krishi Vidyapeeth, College of Agriculture Nagpur	*Melia dubia* *Bamboosa balcooa* *Ailanthus excelsa*	Citrus based agroforestry System, Bamboo based agri-silviculture system, *Ailanthus excelsa* based system, Teak based agroforestry system, *Melia dubia* based agroforestry system, *D. stocksii* based agroforestry system

Dr. Rajendra Prasad Central Agricultural University, Pusa	*Populus deltoides* *Dalbergia sissoo*	*Bombax ceiba* based agri-silvicultural system, Bamboo plantations
Sardar krushinagar Dantiwada Agricultural University, SK Nagar	*Ailanthus excelsa* *Azadirachta indica* *Melia* *Moringa oleifera*	Ailanthus-based medicinal plants agroforestry system, *Melia dubia* based agroforestry, *Melia azedarach* agroforestry system, Boundary plantation
Sri Karan Narendra Agriculture University, Regional Research Station, Fatehpur-Shekhawati	*P. cineraria*	*Ailanthus excelsa* based system, *Hardwickia binata* based agroforestry system, Effect of agroforestry systems on soil properties, Irrigation and mulching schedule for budded *P. cineraria*
Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Jammu (J & K)	*Terminalia chebula*	*Terminalia chebula* based Silvi-pastoral system, *Melia composita* based agroforestry system
Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar	*Salix alba* var. Caerulea	Apple based system, Apricot based agroforestry system, Walnut based agroforestry system, Salix based silvi-pastoral system
Tamil Nadu Veterinary and Animal Sciences University, Kattapukkam	-	Horti-pasture in degraded wastelands, *Psidium guajava* based pasture system, Gliricidia based silvi-pastoral system, *Cocus nucifera* based horti-pastoral system
The University of Agricultural and Horticultural Sciences, Shivamoga	Bamboo sp., Mahogany	Litsea based agroforestry, Bamboo based agroforestry *Dendrocalamus stocksii* based agroforestry
University of Agricultural Sciences, Bengaluru	*Tamarindus indica,* *Pongamia pinnata,* *Melia dubia,* *Casuarina*	*Melia dubia* based agroforestry system, Mango based agroforestry system, Teak based agroforestry system, Sandal based agroforestry system, Mahagony based agroforestry system,
University of Agricultural Sciences, Dharwad	*Pongamia pinnata,* *Tamarindus indica,* Thorn less bamboo, *Azadirachta indica,* *Melia dubia,* *Embilica officinalis,* *Carisa carandas*	Neem based agroforestry system, Sapota-timber species-based agroforestry system, TBO based agroforestry, Fodder tree based agroforestry system (7 species), Red sanders block plantation
Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Solan	*Grewia optiva* *Morus alba*	Fruit tree based agroforestry systems, *Grewia optiva* based agroforestry system, *Morus alba* based agroforestry system, *Sapindus mukrosii* based agroforestry system and peach-based agroforestry system

Subsidiary activity

Quality Planting Materials

More than 90000 seedlings of *Populus deltoides*, *Melia dubia*, *Tectona grandis, Gmelina arborea, Dalbergia sissoo, Azadirachta indica, Melia azedarach, Pongamia pinnata, Toona ciliata, Grewia optiva, Celtis australis, Leucaena leucocephala, Robinia pseudocacia, Salix sp., Sapindus mukorossi, Morus alba* and *Artocarpus heterophyllus* were produced in nurseries and sold and/or distributed.

Farmers' Outreach

The AICRP-Agroforestry centres registered various agroforestry technologies to benefit over 15000 farmers during 2021-2022. In addition, our centres also provide agroforestry/tree-centric agro-advisories to the agroforestry practitioners.

STC and SCSP Component

The coordinating centres of the project undertook various activities for the welfare of weaker sections of the society belonging to Schedule Tribe and Schedule Caste categories by providing various inputs in form of seedlings, seeds of intercrops, fertilizers and small equipment for ensuring livelihood opportunities. The centres also conducted capacity building programmes for skill upgradation and knowledge enhancement for practicing agroforestry-based land use system.

Annual Group Meeting of Agroforestry in ICAR-Central Agroforestry Research Instiute, Jhansi

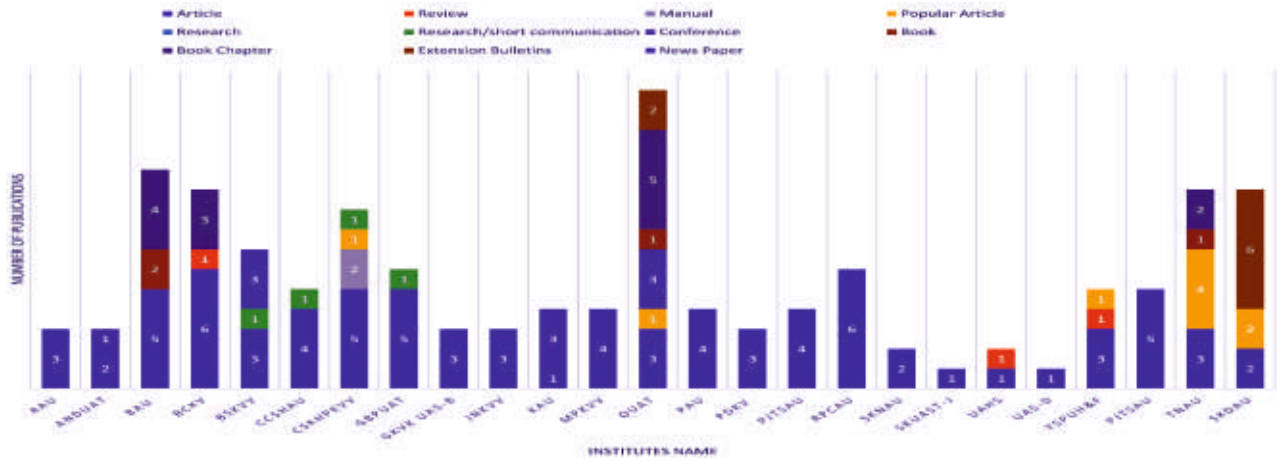
The Annual Group Meeting for 2021-22 held at ICAR-CAFRI, Jhansi to deliberate on the progress of the AICRP on Agroforestry with participation from 26 centres from SAUs and 3 ICAR voluntary centres.

Prof. A. K. Singh, Vice Chancellor, RLBCAU Jhansi was the Chief Guest of the inaugural session. Dr. S. Bhaskar, ADG, ICAR, New Delhi addressed the session virtually as the Guest of Honour and appreciated the efforts of the ICAR-CAFRI as well as the AICRP on Agroforestry. Dr. M. L. Jat, Research Program Director, ICRISAT, Hyderabad also gave his remarks as guest of honour. The program was presided over by Dr. A. Arunachalam, Project Coordinator & Director, CAFRI who presented the overview of the AICRP on Agroforestry with specific emphasis on its salient achievements. The Chief Guest released the Annual Report-2022 of AICRP on Agroforestry and also technical bulletins from the centres. The inaugural session was attended by all ICAR-CAFRI scientists, staff, and employees. The event was coordinated by Dr. A. K. Handa, Principal Scientist, and the vote of thanks was given by Sh. Suresh Ramanan, S., Scientist.

The Officers-in-charge (OICs) of the centre presented their progress reports in the subsequent technical sessions and discoursed on the findings. The Project coordinator commented and provided suggestions for improvement. The project coordinator also insisted that the common experiments in the centres should be presented collectively. It was advised that the OICs should present only the progress of AICRP on agroforestry work and refrain from presenting other scientific achievements to avoid duplicity in reporting. All centres are requested to get in touch with the AICRP secretariat for any assistance regarding data analysis and interpretation. It was recommended that the OICs must explore other thematic areas like Genomics, variety/clone development, hydrology & evapotranspiration carbon and calories, nutrients and nutrition, scoping the entire plant, tree-crop-livestock integration, soil health, value addition, tools and tool kits, *etc.* in the ambit of agroforestry under the AICRP on Agroforestry.

The centre's performance will be ranked based on the information proforma (circulated earlier), state-wise contributions, publications, extension activity, revenue generated and value addition works carried out. This is the first time the Annual Group Meeting of AICRP on Agroforestry conducted at Jhansi.

Publications from AICRP centres



4. Awards and Recognitions

a) Institutional

- ICAR-CAFRI, Jhansi was bestowed with "The Best Annual Report Award" during the 94th Foundation Day celebration of Indian Council of Agricultural Research (ICAR) on 16th July, 2022 in New Delhi.

b) Team

- A team from the ICAR-CAFRI and AICRP on Agroforestry center at CSSHAU, Hisar participated in the blog competition held during the XV WORLD FORESTRY CONGRESS held in Seoul, South Korea (2nd-6th May 2022). The blog titled 'Agroforestry: Can small farm holdings lead a path towards carbon neutrality?' was awarded as one of the top 10 best blogs of the event by Dr. Chhavi Sirohi, Mr. Suresh Ramanan S., Dr. A.K. Handa, and Dr. A. Arunachalam.
- ICAR-CAFRI Team bagged the Dr. S. Chinnamani Award for Excellence in Agroforestry Extension 2021 by the Indian Society of Agroforestry based on teamwork for developing extension mechanism for agroforestry during award function of the society on 18th June 2022. (ICAR-CAFRI Team: Dr. A.K. Handa, Dr. R.P. Dwivedi, Dr. A. Arunachalam, Dr. Ashok Yadav, Dr. Priyanka Singh, Mr. Suresh Ramanan S., Prof. Dr. Atul, Dr. V.V. Sadamate and Dr. B. Lakshmi)
- A team from ICAR-CAFRI, IGFRI, and Upman Mahila Sansthan conferred with the Dr. Ramesh Singh Team Award for Excellence in Natural Resource Management 2020-21 on 18th June 2022. (ICAR-CAFRI Team: Dr. Inder Dev, Dr. Asha Ram, Dr. Naresh Kumar, Dr. A. Arunachalam, Dr. Purushottam Sharma, and Dr. Mamta Jain)
- Sandeep Garg, Ashok Yadav, Satyam Bansal, Sushil Kumar, A. Arunachalam, K. Rajarajan and Rajendra Prasad received the 1st prize in a poster presentation on the topic entitled "Impact of Strawberry cultivation on the socio-economic status of farmers: A case study of Babina block of Jhansi district in Uttar Pradesh.

c) Individual

- Dr. A. Arunachalam received Dr. M.S. Swaminathan Medal for appreciation 2022 conferred by the Agricultural Scientific Tamil Society, New Delhi.
- M. Ashajyothi received best oral presentation award during the 8th International conference on 'Plant Health and Food Security: Challenges and Opportunities' held during March, 23rd-26th, 2022, at Jobner-Jaipur, Rajasthan.
- Dr. Asha Ram notified as NESA Young Scientist Award by National Environment Science Academy, New Delhi at International Conference on "Agriculture Science and Technology: Challenges and Prospects (AST-2022)" organized during 6th-8th May, 2022 at Rani Lakshmi Bai Central Agricultural University Jhansi, U.P.
- Dr. Ashok Yadav was nominated as a member of the Project monitoring committee (PMC) of the NABARD project *i.e.* Demonstration of strengthening Agri-based livelihoods through Climate Resilient Practices" implemented by Sai Jyothi Gramodhyoug Seva Samiti, Gandhi Nagar Lalitpur held on 27th July 2022 at ICAR-IGFRI Jhansi, U.P.
- Dr. A.K. Handa and Dr. Ashok Yadav represented ICAR-CAFRI Jhansi, in the video conferencing meeting on "The Million Farm School (Kissan Pathsala)-6.0 under Master Training Programme held at NIC Jhansi, U.P. on 17th August 2022.

- M. Ashajyothi received best poster award in the '7th Asian PGPR International Conference for Sustainable Agriculture' held by University Putra Malaysisa in Kaula Lumpur, Malaysia during August 23rd-26th, 2022 for the paper titled 'Transcriptional trade-off between plant growth and defense induced by endophyte *Pseudomonas putida* to elicit defense responses in rice against blast disease incited by *Magnaportheoryzae*'.
- Priyanka Singh, B.B. Choudhary, R.P. Dwivedi, A. Arunachalam, Sushil Kumar and Inder Dev received 3rd prize for poster entitled "Madhya Bharat Ke Ardh-sushk Katibandhon Mein Khadya Suraksha Mein Sudhar Aur Aay Parivartanshilta Ko Kam Karne Mein Krishivaniki Ki Bhumika" in poster presentation competition during Hindi Saptah from 14th-20th September, 2022 organized at ICAR-CAFRI, Jhansi
- Dr. K. Rajarajan conferred Best Ph.D. Thesis Award for year 2018 during Foragecon-2022, 8th National symposium of RMSI organized during 1st-3rd November, 2022 at ICAR-IGFRI, Jhansi
- Dr. Asha Ram notified as RMSI Young Scientist Award for year 2020- Award Foragecon-2022, 8th National symposium of RMSI organized during 1st-3rd November, 2022 at ICAR-IGFRI, Jhansi
- Dr Asha Ram awarded Best Oral Presentation Award for the paper titled "Restoration of degraded lands through soil and moisture conservation measures in silvopastoral system in semi-arid conditions" presented in Foragecon-2022, 8th RMSI National symposium during 1st-3rd, November 2022 at IGFRI, Jhansi
- Mr. Y.N. Venkatesh received Best Poster Presentation Award at IVth Technical Session of the VIIth International Conference on GRISAAS-2022 during 21st-23rd November 2022 at Birsa Agricultural University, Ranchi, Jharkhand, India.
- Dr. Nilimesh Mridha, Dipak Nayak, Ashok Yadav, Sourav Paul, Atul Singha, Manjunatha B.S., Manik Bhowmick, H. Baite, Biplab Saha, Surajit Sengupta, D.P. Ray, Sourav Pal, Amit Das, Leena Mishra and D.B. Shakyawar received 3rd prize in the oral presentation in the International conference on "Natural Science and Green Technologies for Sustainable Development (NTSD-2022) organized by National Environmental Science Academy, New Delhi and Goa University, Goa from 30th November - 2nd December 2022.
- Dr. A.K. Handa conferred Award for Outstanding Contribution to Environmental Leadership and Social Responsibility during a Brainstorming session on 'Green technologies for restoration of degraded terrestrial ecosystems' organized by Society for Science of the Climate Change and Sustainable Environment, New Delhi at ICAR-CAFRI, Jhansi on 10th December, 2022.
- Dr. Naresh Kumar, Dr. K. Rajarajan and Dr. Asha Ram conferred Eminent Scientist Award during a Brainstorming session on 'Green technologies for restoration of degraded terrestrial ecosystems' organized by Society for Science of the Climate Change and Sustainable Environment, New Delhi at ICAR-CAFRI, Jhansi on 10th December, 2022.
- Mr. Suresh Ramanan S. conferred Young Scientist Award during a Brainstorming session on 'Green technologies for restoration of degraded terrestrial ecosystems' organized by Society for Science of Climate Change & Sustainable Environment, New Delhi at ICAR-CAFRI, Jhansi on 10th December, 2022.

5. Ongoing Research Projects (2022)

Title of the Project	PI/ CO-PI
(A) Agroforestry System Research (ASR) Programme	
Assessment of conservation agroforestry	**Asha Ram**
Assessment of *Melia dubia* based agroforestry system under semi-arid conditions	**Naresh Kumar,** Ashok Yadav & Kamini, IGFRI-Jhansi
Developing multifunctional agroforestry system for nutritional security in semi-arid tropics	**Ashok Yadav,** A.K. Handa
Assessment of soil biological and biochemical characters in predominant agroforestry based land use systems	**Sovan Dev Nath,** Suresh Ramanan S.
(B) Tree Improvement Research (TIR)Programme	
Evaluation of *Melia dubia* clones	**A.K. Handa,** Naresh Kumar
Genetic characterization of neem germplasm for high azadirachtin yield	**K. Rajarajan,** Hirdayesh Anuragi
Collection and evaluation of Moringa germplasm for better adaptability and year-round fruiting for accelerating agroforestry based nutritional security under semi-arid climate	**Hirdayesh Anuragi,** K. Rajarajan
Developing a *Bacillus subtilis*-based bio-formulation for the management of *Melia dubia* vascular wilt disease incited by Fusarium solani	**M. Ashajyothi** K. Rajarajan
(C) Carbon & Climate Change Research (CCCR) Programme	
Influence of plant morphological characteristics on soil properties in agroforestry systems	**Rajendra Prasad,** Badre Alam
Ecophysiological dynamics for assessing climate change mitigation potential of contrasting tree populations of *Pongamia pinnata*	**BadreAlam,** Rajendra Prasad
Assessment of ecosystem services in silvi-pastoral system in semi-arid conditions	**Asha Ram**
Text mining for assessing research trends and gaps of agroforestry perennials: A Big data analysis approach	**Suresh Ramanan S.,** A. Arunachalam
(D) Agroforestry Extension Research (AER) Programme	
Constraints in adoption of agroforestry in Bundelkhand region of Central India	**R.P. Dwivedi,** Sushil Kumar & Priyanka Singh
Impact assessment of agroforestry and water conservation interventions on livelihood of farmers in Garhkundar-Dabar watershed	**Sushil Kumar,** Priyanka Singh
Economic impact of ICAR-CAFRI interventions in Parasai-Sindh watershed	**Priyanka Singh,** R.P. Dwivedi

All-India Network/Multi-Institutional Projects and Others supported by ICAR

Title of the Project	PI/Co-PIs	Duration	Agency	Budget (Rs. Lakh)
Harvest and post-harvest processing and value addition of natural resins, gums and gum-resins	**Rajendra Prasad** A.K. Handa & Badre Alam	2008- March 2022	ICAR-NISA, Ranchi	179.62
National Agriculture Innovation Fund (NAIF) Scheme	**Inder Dev** (upto August, 2022) **Suresh Ramanan S.** (from September, 2022) Ashok Yadav Priyanka Singh & Sovan Debnath	2017-Ongoing	ICAR-NAIF	7.40 annual

All India Coordinated Research Project on Agroforestry

Title of the Project	PI/Co-PIs	Year of Start	Completion	Agency	Budget (Rs. Lakh)
All India Coordinated Research Project on Agroforestry (AICRP-Agroforestry)*	**Dr. A. Arunachalam** (Project Coordinator) A.K. Handa (Nodal Scientist) & Suresh Ramanan S. (Associate Scientist)	1997	Ongoing	ICAR	1142.00

*AICRP-Agroforestry Secretariat

Externally Funded Projects

Title of the Project	PI/Co-PIs	Duration	Agency	Budget (Rs. Lakh)
Assessment of genetic potential of neem germplasm for higher yield and oil content through molecular markers	**K Rajarajan,** H. Anuragi	2019- March, 2023	NRAA, Govt. of India	21.95
Trees Outside Forests in India (TOFI)	**A. Arunachalam** Project Director A.K. Handa, PI Co-PIs: Naresh Kumar, Suresh Ramanan S. & Priyanka Singh	Oct, 2021-March, 2026	USAID	CAFRI Component: 1.67 Cr.
Task Force on Himalayan Agriculture-NMSHE (2nd Phase)	**A. Arunachalam** Project Coordinator A.K. Handa, PI & Suresh Ramanan S., Co PI	Oct, 2021-March, 2026	DST, New Delhi	952.6 (CAFRI Component: 1.74 Cr.)
Pilot the solutions of chip-based technology for real time and RFID-passive monitoring of field gene bank and agroforestry species for scaling up	**K. Rajarajan,** H. Anuragi	2022-Ongoing	ICRAF-ICAR Work Plan	4.92
Evaluation the performance of Sea weed Extract, Humic acid, Protein Hydrolysates, Biochemical, and Botanical Extracts	**Ashok Yadav,** A. Arunachalam, Asha Ram, Mahesh Kumar Dhakad & D.R. Bhardwaj	Aug, 2022-Aug, 2023	IRM Enterprises Pvt. Ltd. Ahmedabad	41.96
Agri-Drone Project	Asha Ram	Aug, 2022-March, 2023	ICAR, New Delhi	17.50

Inter-Institutional Collaborative Projects

Title of the Project	PI/Co-PIs	Duration	Funding of the Project
Farmer FIRST programme (FFP): Scaling up and integration of fodder technologies in existing farming system for sustainable livestock productivity in Bundelkhand	Purshottam Sharma (PI) Sunil Seth S.K. Mahanta Harsh Vardhan Singh Mukesh Choudhary & **R.P. Dwivedi**	2016-2022	Inter-Institutional (IGFRI Jhansi)
Study of soil-hydrothermal environment under natural vs. synthetic mulch	Nilimesh Mridha (PI), D.B. Shakyawar, Atul Singha, Manik Bhowmick, Haokhotang Baite, **Ashok Yadav (CC-PI),** Manoj Kundu, Dipak Nayak & Vinod Kadam	April 2020-March, 2023	Inter- Institutional (NINFET Kolkata, (W.B.)

Research Projects concluded in 2022

S.No.	Title of the Project	PI/Co-PIs
1.	Transforming rural livelihood through agroforestry based natural resource management in drought prone Bundelkhand region, UP (Sub Project of KISAN MITrA project for Doubling Farmers' Income in Bundelkhand region of Uttar Pradesh)	**Inder Dev,** Naresh Kumar & Asha Ram
2.	Transforming rural livelihood and checking migration through agroforestry in conjunction with natural resource management in Bolangir and Nuapada districts of Odisha	**Inder Dev,** A.K. Handa & Asha Ram
3.	Assessment of area under agroforestry systems/species in agro-climatic zones of India	**A.K. Handa,** Suresh Ramanan S., R.H. Rizvi (ICAR-CSSRI) & A. Verma (ICAR-CAZRI, Jodhpur)
4.	Whole Transcriptome Sequencing of *Pongamia pinnata* for drought stress tolerance	**K. Rajarajan** Alka Bharti, M. Ashajyothi, Suresh Ramanan S., Asha Ram & A.K. Handa
5.	Support implementation of National Agroforestry Policy by enhancing tree cover & production of wood (FAO-NRAA TCP)	**A.K. Handa,** R.P. Dwivedi, Priyanka Singh, Ashok Yadav & Suresh Ramanan S.
6.	Evaluating the performance of strawberry cultivation in Babina block of Jhansi district for crop diversification, and better economic returns at farmer's field	**A. Arunachalam,** Ashok Yadav & Sushil Kumar
7.	Evaluating the performance of strawberry cultivation in Moth block of Jhansi district for crop diversification, and better economic returns at farmer's field	**A. Arunachalam,** Ashok Yadav & Sushil Kumar

6. Important Meetings/Days Observed

Clean Milk: Better Health and Price

As a part of the India@75 Campaign -*Azadi Ka Amrut Mahotsav*, ICAR-CAFRI, Jhansi organized a programme on "Clean Milk: Better Health and Price" on 7th January, 2022. In this event all the staff visited the Dairy and Animal unit of ICAR-IGFRI, Jhansi. The special lecture on the "Clean Milk: Better Health and Price" was delivered by Dr. K.K. Singh, Head, PAR Division, IGFRI, Jhansi. The programme was presided over by Dr. A. Arunachalam, Director, CAFRI, Jhansi.

Republic Day

ICAR-CAFRI celebrated republic day on 26th January, 2022 in the institute premises. The director of the institute unfurled the flag on the occasion. Various cultural activities and sport events were organized for the staff and their family members.

World Wetland Day

ICAR-CAFRI celebrated the world wetland day with the theme: Wetlands Action for People and Nature on 2nd February, 2022. On the occasion, the director of the institute addressed the webinar organized by RLBCAU, Jhansi as the Guest of Honour. The virtual program was attended by 65 delegates from across the country.

World Pulses Day and Freshwater Aquaculture Day

Kisan Gosthi was organized on World Pulses day and Freshwater Aquaculture Day on 10th February, 2022 in Babina and Moth block of Jhansi Districts. Dr. Vinay Kumar Yadav, Deputy Director, Horticulture, Government of Uttar Pradesh reiterated the necessity of soil and water conservation measures like contour bunds and the importance of groundwater recharge in the Bundelkhand region. Director, CAFRI reiterated the theme of this year world pulses day *i.e.* 'Pulses to empower youth in achieving sustainable agri-food systems' and stated that systematic combinations of different components in a single unit of land will be the future of farming. This programme was attended by 107 farmers, staff member and students.

National Science Day

ICAR-CAFRI celebrated the National Science Day on 28th February, 2022 with the theme "Integrated approach in science and technology for a sustainable future". Dr. H.N. Pandey, Professor (Rtd.) & Former Head, Department of Botany, North-Eastern Hill University, Shillong graced the occasion as the chief guest and delivered the National Science Day Lecture. The session was attended by dignitaries from IGFRI, RLBCAU, Central Ayurveda Research Institute and many other distinguished guests and participants.

International Women Day

International Women Day was organized on 8th March, 2022 at the Institute. Dr. Neeti Shastri (Rtd. Principal,

Central School, Jhansi), was the Chief Guest of the function. The chief guest spoke about the women's empowerment. The program was attended by Scientists, Officers, Project Staff and Students of the Institutes.

World Water Day

ICAR-CAFRI celebrated World Water Day and International Day of Forests on 22nd March, 2022. On the occasion, Director of the institute addressed the programme. The chief guest of the programme was Sh. PP Singh, Chief Conservator of Forests accompanied with Forest department officers Shri V.K. Mishra, Shri Gautam and Shri Vinod Kumar.

Vichar Manch

Vichar Manch was organized by ICAR-CAFRI, Jhansi on 19th April, 2022. Dr. V.V. Sadamate, Former Member, Planning Commission, Govt. of India and Dr. K. Wankhede, Former, CEO, IFFDC were the Chief Speakers on the occasion. All the Staff members attended the programme.

Earth Day/ International Mother Earth Day

Earth Day/ International Mother Earth day was celebrated on 22nd April, 2022 to raise awareness about the concerns of loss of biodiversity and depleting the quality of the environment. Dr. Chandrashekhar M. Biradar, Country Director-India of CIFOR-ICRAF was the chief guest of the function and delivered an expert talk on the occasion. All the Staff members attended the programme.

Aatmanirbhar Bharat

On 27thApril, 2022, ICAR-CAFRI organized programme under 'Kisan Bhagidari, Praathmikata Hamari' campaign and for self-reliance in the production of oilseeds and pulses. On the occasion Dr. Sanjeev Gupta, ADG (Oilseed & Pulses), ICAR, New Delhi was the chief guest and Dr. Anil Kumar, Director Education-Rani Lakshmi Bai Central Agricultural University, Jhansi was the guest of honour.

Labour Day

ICAR-CAFRI celebrated International Labour Day on 1st May, 2022. The contractual workers of CAFRI were informed about their rights on the occasion of International Labour Day. During the occasion, various issues and problems of the contractual workers were also discussed and their role in the achievements of the institute were appreciated.

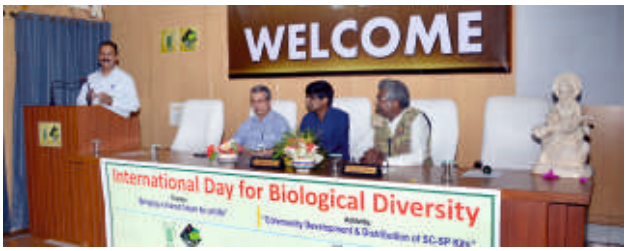
35th Foundation Day

ICAR-CAFRI, Jhansi celebrated its 35th Foundation Day on 8th May, 2022. On this occasion Dr. S.K. Chaudhari, DDG, NRM was the Chief Guest. Dr. Arvind Kumar, Vice Chancellor, RLBCU, Jhansi, Dr. Neelam Patel, Sr. Advisor, NITY Aayog, New Delhi and Dr. Amresh Chandra, Director, IGFRI, Jhansi were the Guests of Honour of the function. All the Staff members attended the programme.

National Technology Day

ICAR-CAFRI celebrated National Technology Day on 10th May, 2022. On the occasion, a documentary film on "Bundeli Strawberry" was released in the presence of Sh. Rabindra Kumar (IAS), District Magistrate, Jhansi. Sh. Shailesh Kumar, CDO-Jhansi was the Guest of Honour.

International Day of Biological Diversity



ICAR-CAFRI, Jhansi organized a program on International Day of Biological Diversity on 21st May, 2022. Dr. K. Ilango, IFS, Chief Conservator of Forests (Projects) was the Chief Guest of the function. All the Staff members attended the programme.

Hindi Workshop

ICAR-CAFRI organized one day quarterly Hindi Workshop on 25th May, 2022. On the Occasion, Chief speaker of the programme, Dr. C.K. Bajpai addressed the importance of positive attitude to lead a successful life. All scientific, administration, technical staff's, RA, SRF, YP, FA and students have participated in the programme.

World Environment Day

ICAR-Central Agroforestry Research Institute, Jhansi and Indian Society of Agroforestry (ISAF), Jhansi in collaboration with Bundelkhand University, Jhansi organized World Environmental Day on 4th June, 2022 at Bundelkhand University, Jhansi. An international seminar was also organized on this day. In this programme saplings of Chandan and other MPTs were planted in the Bundelkhand University campus by the CAFRI, Jhansi.

Silver Jubilee Foundation Day of Indian Society of Agroforestry

ICAR-CAFRI celebrated Silver Jublee Foundation day of Indian Society of Agroforestry on 18 June, 2022. Dr. K.P. Dubey, IFS (PCCF, Govt. of UP) was invited as Chief Guest as well Dr. Syam Viswanath, Director, KFRI and Dr. Amresh Chandra, Director, IGFRI were invited as Guest of Honour. On the occasion, Secretary, ISAF announced various awards and prizes which were given by the President, ISAF and Honourable Guests. Program was attended by ICAR-CAFRI scientists, staff and employees

International Yoga Day

On 21st June, 2022 Institute celebrated the international Yoga Day in the office premises. In this programme scientist, technical, administrative staff, research associates, project associates, SRF, JRF and Security personnel participated.

Annual IRC Meeting

The annual IRC meeting of the institute was conducted on 25th June, 2022. All scientists of the institute participated and new research proposals were approved by the house after thorough discussion

Mega Tree Plantation Drive

ICAR-CAFRI participated in Mega Tree Plantation Drive launched in Uttar Pradesh. More than 500 saplings were planted in ICAR-CAFRI campus as well as in Ronija village (Badagaon block) and 200 saplings were distributed to the farmers on 5th July, 2022 with an objective to increase tree cover in the state.

NABARD Foundation Day

ICAR-CAFRI celebrated 41st foundation day of NABARD on 12th July, 2022 by UPMAN Mahila Sansthan. Chief Guest of the program was Dr. A. Arunachalam, Director, ICAR-CAFRI; Sh. Bhupesh Pal, DDM, NABARD and Dr. R.P. Dwivedi, Principal Scientist, CAFRI were Guest of Honour's. The Program was conducted by Dr. Mamta Jain, Director, UPMAN.

Independence Day

ICAR-CAFRI, Jhansi celebrated the 76th Independence on 15th August, 2022. This day commemorating the 75th years of Indian independence with zest and fervor. The national flag was hoisted by the director of the institute. The institute security staff gave the guards of honor. Dr. Rajendra Prasad, Pr. Scientist, addressed the event and recalled the sacrifices and efforts made by freedom fighters, security personnels and farmers to make India independent and self-sufficient nation. In his speech, he emphasized the achievements made by the ICAR and CAFRI for the social welfare. He also highlighted the role of agroforestry in the current context for achieving the environmental and livelihood sustainability in the country. He wished a wonderful and prosperous future ahead.

Teacher's Day

ICAR-CAFRI celebrated "Teacher's day" on 5th September, 2022. On the occasion, Hon'ble Shri Ravi Sharma, MLA, Jhansi, was invited as the chief guest of the program. He planted sandalwood tree saplings in the Adhyatmik Vatika of ICAR-CAFRI.

Hindi Diwas

ICAR-CAFRI organized Hindi Diwas from 14th-20thSeptember, 2022. Various competitions were held on Hindi during the week in which staff of CAFRI participated. Awards and certificates of appreciation were given at the end day of the programme week.

Special Campaign 2.0 on Swachhta activities

ICAR-CAFRI organized cleanliness drive programmes from 2nd - 31st October, 2022. During this period, awareness campaigns and on-campus as well as off-campus cleanliness activities were conducted involving the staff of the institute.

Women Farmer's Day and World Food Day

Woman farmers' day and world food day were organized by ICAR-CAFRI on 18th October, 2022 along with the live broadcast program of Prime Minister Kisan Samman Sammelan.

Rashtriya Ekta Divas

ICAR-CAFRI celebrated Rashtriya Ekta Diwas and Vigilance Awareness Week on 31stOctober, 2022. On the occasion of Rashtriya Ekta Diwas and Vigilance Awareness Week, the Director and staff of the institute took the integrity pledge to promote integrity, transparency and accountability in public life along with Rashtriya Ekta Diwas pledge to celebrate National Unity Day in remembrance of Shri Sardar Vallabhbhai Patel to uphold the unity and integrity of India.

Children's Day

ICAR-CAFRI celebrated the Children's Day at Primary School in Simardha village, Jhansi on 14th November, 2022.

Celebration of Rani Lakshmi Bai Birth Anniversary

ICAR-CAFRI celebrated Rani Lakshmi Bai birth anniversary on 19th November, 2022 at CAFRI campus. On this occasion, a glow sign board in respect of Rani Lakshmi Bai has been installed in the CAFRI campus. The members of the CAFRI family planted a tree in her name in its premises and lighted the whole campus with `diyas'. Every household in the campus also observed the same.

World Soil Day

ICAR-CAFRI, Jhansi in collaboration with ITM University, Gwalior celebrated World Soil Day on 5th December, 2022 at ITMU Campus, Gwalior. Dr. Rajendra Prasad, Principal Scientist delivered a talk on "Soil health and its role in climate resilient agriculture". Dr. A.K. Handa principal scientist also shared his views. The event was attended by 125 students, and faculty of the university.

Hindi Workshop

ICAR-CAFRI organized a quarterly Hindi workshop on 14th December, 2022. In this programme, Dr. R.P. Dwivedi spoke on the "BHAI-CHARA approach for increasing the Agroforestry productivity".

National Farmer's Day

The 2-days seminar on "Role of women in agriculture: challenges and opportunities" is being organized on the occasion of National Farmer's Day on 23rd December, 2022 at ICAR-CAFRI in collaboration with the Indian Society of Agroforestry (ISAF) and Indo-Global Social Service Society(IGSSS) New Delhi. On this occasion, 15 women farmers from the Mahoba District, Uttar Pradesh, and nearby villages, along with progressive farmers, women scientists, women entrepreneurs, and all the CAFRI staff members participated in the programme.

Swachhta Pakhwara

ICAR-CAFRI organized "Swachhta Pakhwara" programmes from 16th-31st December, 2022. Cleaning work was done in the institute campus as well as in different villages of Jhansi. In this programme, scientists, technical staff and research scholars participated in the programme. The events were widely covered in newspapers.

7. Participation in Workshop/Webinars/Meetings/ Symposia

Duration	Event	Organizer	Participants
13th January, 2022	A civil society dialogue on forestry, land management and biodiversity in India	iForest	Dr. A.K. Handa
22th February, 2022	Ecosystem Service Analysis in Diversified Coconut and Arecanut Gardens	ICAR-CCARI, Goa	Dr. A.K. Handa
23rd February, 2022	'Recent Developments in Agroforestry Dimensions for Managing Salt Affected Ecologies'	ICAR-CSSRI, Karnal	Dr. A.K. Handa
25th February 2022	National Webinar on 'Managing Agro-chemicals for Crop and Environmental Health'	Society for Fertilizers and Environment, Kolkata	Dr. Sovan Debnath
22nd February to 3rd March 2022	Short training course on 'Recent Development in Agroforestry Dimensions for Managing Salt Affected Ecologies'	ICAR-Central Soil Salinity Research Institute, Karnal	Dr. Sovan Debnath
2nd-3rd March, 2022	National Webinar on MPTS Neem entitled "Nurturing the Neem for Nature and Livelihood Security"	RLBCAU, Jhansi	Dr. K. Rajarajan
5th March 2022	Attended IPS platinum jubilee lecture series on Genetic resistance, the ideal weapon to protect wheat from the deadly rust disease	Indian Phytopathological Society, New Delhi	M. Ashajyothi
9th March, 2022	Workshop on Restoration of degraded lands in Sub-Saharan Ecosystems	Center for Forestry International Research (CIFOR), Nairobi	Dr. Ashok Yadav
23rd-26th March, 2022	8th International Conference (hybrid mode) on 'Plant Pathology: Retrospect and Prospects	Sri Karan Narendra Agriculture University, Jobner-Jaipur, Rajasthan	M. Ashajyothi
28th-29th, March, 2022	National Workshop on "Hydroponic Cultivation" under NAHEP-IG ICAR, New Delhi	College of Horticulture and Forestry, Jhalawar, Rajasthan	Dr. Ashok Yadav
5th April, 2022	Sub-Working Group Meeting of NITI Aayog on Resource Estimation, Quality Planting Material and Technologies for Enhancing Bamboo Propagation and Management	NITI Aayog, New Delhi	Dr. A.K. Handa
6-8th May, 2022	International Conference on Agriculture Science and Technology: Challenges and Prospects (AST-2022)	RLBCAU, Jhansi	Dr. Badre Alam Dr. Sushil Kumar Dr. Asha Ram Dr. Sovan Debnath Dr. Ashok Yadav Dr. Hirdayesh Anuragi
26th May, 2022	National Symposium on Horticulture for Sustainable Development, Nutritional & Livelihood Security on Agroforestry for Sustainability and Carbon Neutrality	NHEP, UBKV, Cooch Behar, West Bengal	Dr. A.K. Handa
2nd-4th June, 2022	Online Workshop on "Plant Tissue Culture: Nature in Room	ICAR-IARI, New Delhi	Dr. K. Rajarajan
5th June 2022	International Seminar on World Environment Day-2022	Bundelkhand University, ICAR-CAFRI & Indian Society of Agroforestry, Jhansi	Dr. Priyanka Singh

2nd-4th June, 2022	XXVII Biennial Workshop of All India Coordinated Research Project for Dryland Agriculture, IX Annual Review Workshop of NICRA-AICRPDA and X Annual Review Workshop of NICRA-AICRPAM	ICAR- CRIDA, Hyderabad	Dr. A.K. Handa
10th June, 2022	Online seminar on Agroforestry for Wood production	FRI, Dehradun	Dr. A.K. Handa
14th-16th June, 2022	International Conference on "Recent Advances and Innovations in Biological and Applied Sciences (RAIBAS-2022)"	SGTU, Gurugram, SARRD and ICAR-SSRI, Karnal	Dr. Hirdayesh Anuragi
10th-12th August, 2022	12th TIFAC International Conference on Systems Analysis for Enabling Integrated Policy Making	The International Institute for Applied Systems Analysis (IIASA), New Delhi	Mr. Suresh Ramanan S.
20th August, 2022	IGFRI Diamond Jubilee Lecture Series "Entrepreneurship and agroforestry for timber production"	ICAR-IGFRI, Jhansi	Dr. A.K. Handa
23rd August, 2022	Stakeholders Consultation meet on *Melia dubia*	ICAR-CAFRI, Jhansi	All Scientists
23rd-26th August, 2022	7th Asian PGPR International Conference for Sustainable Agriculture with the theme of 'Regenerating Agriculture through Beneficial Microbes for Improving Crop Productivity and Safety'	Asian PGPR Society, Malaysian PGPR Society & Faculty of Agriculture, University Putra Malaysia	M. Ashajyothi
4th-7th September, 2022	The 3rd Arboricultural Association Conference 2022 at London	Arborical Association, UK	Suresh Ramanan S.
8th September, 2022	Stakeholders' consultation meeting of TAFCORN	Tamil Nadu Forest Plantation Corporation Limited	Suresh Ramanan S.
13th September, 2022	Agroecology TPP's Community of Practice Activation Workshop	CIFOR, Nairobi	Suresh Ramanan S.
17th September 2022	"Entrepreneurship Potential and Opportunities in Natural Resins and Gums for Start-ups"	ICAR-IGFRI, Jhansi in association with Indian Society of Agricultural Engineers & Range Management Society of India	Dr. Rajendra Prasad
19th September, 2022	Workshop on "Policy Dialogues: Inspiring, Innovating, and Designing Solutions for Scaling Landscape Restoration, Especially Agroforestry and Bamboo Cultivation in Madhya Pradesh	World Resources Institute India	Dr. A.K. Handa
26th September, 2022	Online meeting in "Agroforestry for Environment and Rural Livelihood"	Indian Farm Forestry Development Cooperative Ltd (IFFDC)	Dr. A.K. Handa
27th September, 2022	Webinar on "Growth and Yield Modelling of Fast-Grown Intensively Managed Forest Plantations in Chile: A Long Term Collaborative Research Effort"	IUFRO, Vienna, Austria	Suresh Ramanan S.
5th October, 2022	Second meeting of the UNECE Informal Network of Experts Collaboration on Benchmarking, 5 October 2022.	UNECE	Suresh Ramanan S.

7th-9th October, 2022	Annual Group Meeting of AICRP on Agroforestry and "Interactive workshop on Road Map for Agroforestry in different Agro climatic regions in India"	ICAR-CAFRI, Jhansi	All Scientists & Technicals
1st-3rd November, 2022	National symposium during "Innovations in forage and livestock sector for enhancing entrepreneurship and farm productivity"	ICAR-IGFRI, Jhansi	Dr. A. Arunachalam, Dr. Rajendra Prasad, Dr. A.K. Handa, Dr. Badrealam, Dr. R.P. Dwivedi, Dr. Naresh Kumar, Dr. K. Rajarajan, Dr. Asha Ram and Suresh Ramanan S.
4th November, 2022	International Workshop "Unveiling the secret of underground: technologies for visualizing root and rhizosphere"	NARO and CREST, Japan Science and Technology Agency	Suresh Ramanan S.
12th November, 2022	10th Anniversary International Symposium of Japanese Society of Forest Genetics and Tree Breeding (FGTB)	Japanese Society of Forest Genetics and Tree Breeding	Suresh Ramanan S.
14th-15th November, 2022	1st International Conference on ICGETSD 2022	Bundelkhand University, Jhansi	Suresh Ramanan S.
16th November, 2022	Special Symposium on "Achieving Net Zero Emission in Indian Agriculture: Perspective of Soil Management"	Indian Society of Soil Science, New Delhi	Dr. Sovan Debnath
16th November, 2022	History of Agroforestry and role of AICRP on Agroforestry - prospectively in farm diversification to enhance benefits and sustain SDGs.	IISWC Research Centre Kota and MANAGE	Dr. A.K. Handa
15th-17th November, 2022	'National Seminar on 'Developments in Soil Science- 2022'	Indian Society of Soil Science, New Delhi	Dr. Sovan Debnath
15th-18th November, 2022	An Annual Convention of the Indian Society of Soil Science	MPKV, Rahuri	Suresh Ramanan S.
21st-23rd November, 2022	VIIth International Conference on Global Research Initiatives for Sustainable Agriculture & Allied Sciences.	Astha Foundation, Meerut (U.P.) India	Mr. Y.N. Venkatesh
26th November, 2022	"Agroforestry for Livelihood and Environmental Security" during 21 days Faculty Development Programme	ICAR-Indian Grassland and Fodder Research Institute, Himachal Pasturelands, Palampur, H.P. and National Agriculture Development Cooperative Ltd.	Dr. A.K. Handa
10th December, 2022	A Brainstorming session on 'Green technologies for restoration of degraded terrestrial ecosystems'	Society for Science of the Climate Change and Sustainable Environment, New Delhi	Dr. Rajendra Prasad, Dr. AK Handa, Dr. R.P. Diwedi, Dr. Naresh Kumar, Dr. BadreAlam, Dr. K Rajarajan, Dr. Sushil Kumar, Dr. Asha Ram, Dr. Sovan Debnath, Dr. Ashok Yadav, Dr. H Anuragi, Dr. Ashajyothi and Mr. S Suresh Ramanan Dr. Priyanka Singh
22nd December, 2022	Role of Women in Agriculture: Challenges and Opportunities	ICAR-CAFRI, Jhansi	Dr. Sovan Debnath
28th December 2022	National Webinar on Green Budgeting and Launch of Green Budgeting Portal	TERI, New Delhi	Dr. Priyanka Singh

8. Publications

(A) Research Articles

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Inter-Institutional Publications

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- FAO and ICAR-CAFRI (2022) Training Manual Agroforestry Entrepreneurship Building of Rural Youth, Jhansi, India. 60p.

- FAO and ICAR-CAFRI (2022) Workbook for Agroforestry Entrepreneurship Building of Rural Youth, Jhansi, India. 84 p.

(B) Books, Chapters and Technical Bulletins:

Books

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Book Review

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Book Chapters

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9. Trainings and Capacity Building

A. Participation in Trainings

Event	Duration	Organizer	Participants
Annual Group Meeting of ICAR-AICRP on Agroforestry	24th-25th February, 2022	Virtual mode	All Scientists, Technical staff
Short training course on "Recent Development in Agroforestry Dimensions for Managing Salt Affected Ecologies."	22nd February to 3rd March, 2022.	ICAR-CSSRI, Karnal	Dr. Sovan Debnath
Training programme on agroforestry extension for rural youth	3rd-5th March, 2022	KVK Saharanpur, U.P. Forest Department	Dr. R P Dwivedi
Biosafety and biosecurity training workshop	15th March, 2022.	ICAR - IARI, New Delhi	Dr. (Mrs.) M. Ashajyothi
Training on RFID and RTS tags dashboard	5th April, 2022	ICRAF, New Delhi	Dr. K. Rajarajan
Three days training programmePlant Tissue Culture: Nature in Room	2nd-4th June, 2022	ICAR - IARI, New Delhi	Dr. K. Rajarajan
Online training programmes on "Promotion of gum yielding trees on farmland for livelihood security"	12th-14th July, 2022	ICAR-CAFRI Jhansi and MANAGE Hyderabad (Telangana)	Dr. Ashok Yadav
One day Stakeholders consultation on *Melia dubia*	23rd August, 2022	ICAR-CAFRI Jhansi	Mr. Suresh Ramanan S.
The Agroecology TPP's Community of Practice Activation Workshop	13th September, 2022	CIFOR-ICRAF	Mr. Suresh Ramanan S.
International Training on Diversification of Coastal Agroecosystems for Climate Resilience and Livelihood Security	7th-11th November, 2022	ICAR-CCARI, Goa	Suresh Ramanan S.
Seminar on "Empowering women in Agriculture sector"	22nd-23rd December, 2022	ICAR-CAFRI Jhansi	Dr. Priyanka Singh

B. Training organized for employees and other stakeholders

Event	Duration	Venue	Participants
Training program on Agroforestry Extension for Rural Youth of Uttar Pradesh	28th-30th January, 2022	ICAR -CAFRI, Jhansi and UP Forest Department	25
Training Programme on Strawberry cultivation for crop diversification and better income in Bundelkhand Region	9th-11th February, 2022	CAFRI - NABARD joint Training Programme	35
Training-cum-exposure visit on agroforestry and NRM activities for the ICRAF-Odisha key stakeholders	23rd-26th February, 2022	ICAR-CAFRI and ISAF Jhansi	22
Training Program on Agroforestry Extension for Rural Youth	3rd-5th March, 2022	CAFRI, UP Forest Department and Krishi Vigyan Kendra, Saharanpur	25

Training-cum-exposure visit on agroforestry and NRM activities for the ICRAF-Odisha key stakeholders	4th-7th March, 2022	ICAR-CAFRI, Jhansi	22
Training programme on "Application of Biochar and Nano Fertilizers for Quality Planting Stock".	8th-13th March, 2022	CAFRI-TNAU, joint Online Training Programme	25
Training programme for making quality proposal of non-forest land under section-4, section-20 and section-29 of Indian Forest Act-1927.	18th May 2022	ICAR-CAFRI, Jhansi	60
Agroforestry based training program	16th-18th June, 2022	CAFRI, NABARD Hamirpur and Srijan Society, Kanpur.	25
Training programme on "Unnat Krishi Taknikiyan"	11th-13th July, 2022	ICAR-CAFRI, Jhansi and NGO, UPMAN Mahila Sansthan Jhansi, joint Training Programme	25
Training programme on "Promotion of gum-yielding trees on farmland for livelihood security"	12th-14th July, 2022	CAFRI-MANAGE, joint Online Training Programme	150
Training Programme on " Ber Budding"	25th-27th July, 2022	Village- Raunija, District- Jhansi (U.P.)	31
"Stakeholders consultation on *Melia dubia*"	6th August, 2022	ICAR-CAFRI, Jhansi	75
Training programme on "Jalavayu Aadharit Samekit Krishi Taknikiyan"	2nd-3rd September, 2022	ICAR-CAFRI, Jhansi	25
Training programme on "New Analytical Methods in Soil Research"	12th-16th September, 2022	ICAR-CAFRI, Jhansi	5
Sensitizing-cum-online training on Unprocessed and Semi-processed agroforestry-based startups	27th September 2022	ICAR-CAFRI, Jhansi	25
Training programme on "Agroforestry for Increasing Farmer's Income"	17th-19th October, 2022	ICAR-CAFRI, Jhansi	25
Training programme on "Ensuring Soil Health in Scenario of Climate Change"	19th-21th October, 2022	CAFRI-MANAGE, joint Online Training Programme	164
Training programme on "Agroforestry for Increasing Scheduled caste Farmers Income"	22nd-24th November, 2022	ICAR-CAFRI, Jhansi and ICAR-IASRI, New Delhi	25

Training Programme on "Climate Resilient Integrated Farming Practices"	24th-25th November, 2022	ICAR-CAFRI, Jhansi in collaboration with Indian Society of Agroforestry (ISAF) and Indo-Global Social Service Society (IGSSS)	25
Training Programme on "Climate Resilient Integrated Farming Practices"	01st-02nd December, 2022	ICAR-CAFRI, Jhansi in collaboration with Indian Society of Agroforestry (ISAF) and Indo-Global Social Service Society (IGSSS)	25
Training Programme on "Climate Resilient Integrated Farming Practices"	05th-06th December, 2022	ICAR-CAFRI, Jhansi in collaboration with Indian Society of Agroforestry (ISAF) and Indo-Global Social Service Society (IGSSS)	25
Training Programme on "Climate Resilient Integrated Farming Practices"	08th-09th December, 2022	ICAR-CAFRI, Jhansi in collaboration with Indian Society of Agroforestry (ISAF) and Indo-Global Social Service Society (IGSSS)	25
Training Programme on "Climate Resilient Integrated Farming Practices"	14th-15th December, 2022	ICAR-CAFRI, Jhansi in collaboration with Indian Society of Agroforestry (ISAF) and Indo-Global Social Service Society (IGSSS)	29

10. Scheduled Caste Sub Plan (SCSP) Programme

ICAR-CAFRI is implementing SCSP scheme with the main objective to improve the socio-economic conditions of the SC farmers' community. Under this scheme, various training/capacity-buildingprogrammeswere organized for scheduled caste farmers, farm women's, widows and handicapped peoples. The scheme includes the enhancement of the incomes of the target group for the development of assets such as those related to the agricultural sector. During this period, thirty-six (36)programmes were organized in which different SC-SP welfare materials likeequipment/tools were distributed to the farmers/farm women. Two training programmes (03 days each) and Agroforestry Awareness programmes were organized for the benefit of the SC community.

The institute has also organized two training programmes (18th -20th October 2022 and 24th to 26th October2022) of 03 days sponsored by IASRI-SCSP Scheme. In the first training programmes 25 farmers/ farmwomen from village Datar Nagar (Jhansi), district, U.P. have participated. On the occasion, Dr. Rajendra Prasad, Director ICAR-IASRI, New Delhi was the chief guest atthe inaugural function. In the second training programme, 25 farmers/farmwomen from village Shivrampur, Niwari district (M.P.) participated. Shri S. Rajesh IPS, the SSP of Jhansi, was the chief guest at the inaugural function. The ICAR-CAFRI also funded Rs. 7.00 Lakh from SCSP Scheme to RLBCAU, Jhansi.

Table1 Details of the training cum distribution camps organized during 2022 under SCSP at ICAR-CAFRI, Jhansi

S.No.	Total No. of villages	Beneficiaries of SC farmers Male	Female	Distributed items in 2022
1	38	1066	536	1977(Spray Pump, Engine Operated Spray Pump Sewing Machines, Solar light, Search Light, Tirpal, Vermi-bag, Grass cutter Machines, Irrigation Pipe, Plastic Irrigation pipe and Tricycle)

11. Distinguished Visitors

- Hon'ble DG (UPCAR), Dr. Sanjay Singh along with Dr. V.K. Tiwari, ADG, visited ICAR-CAFRI on 13th January, 2022 forfurthering research collaboration.

- CGM, NABARD (Lucknow), Dr. D.S. Chauhan along with AGM, Dr. R.K. Sharma, and DDM, NABARD, Jhansi, Sh. Bhupesh Pal visited ICAR-CAFRI on 9th February, 2022.
- Deputy Director Horticulture (Jhansi), Sh. Vinay Kumar Yadav visited ICAR-CAFRI on 10th February, 2022.

- GM, NABARD, Dr. Prabhudatta Shahoo visited ICAR-CAFRI on 11th February, 2022.
- Dr. S.K. Chaturvedi, Dean, College of Agriculture and Dr. A.K. Pandey, Dean, College of Horticulture & Forestry, RLBCAU visited ICAR-CAFRI on 11th February, 2022.
- GM, NABARD, Dr. Prabhudatta Sahoo along DDM, NABARD, Jhansi, Sh. Bhupesh Pal, and Sh. Govind Chand, Consultant NABCONS visited ICAR-CAFRI on 12thFebruary, 2022.
- Dr. H.N. Pandey, Professor & Former Head, Department of Botany, North-Eastern Hill University, Shillong, visited ICAR-CAFRI on 28th February, 2022.
- Dr. Niti Shastri, Ex Principal, KV, Jhansi, visited ICAR-CAFRI on 8th March, 2022.
- Sh. P.P. Singh, Chief Conservator of Forests, Uttar Pradesh, visited ICAR-CAFRI on 22nd March, 2022.
- Hon'ble Chairman, NABARD, Dr. G.R. Chintala visited ICAR-CAFRI on 27th March, 2022.
- Hon'ble DG, CCRS, AYUSH (GOI), Prof. Rabinarayan Acharya visited ICAR-CAFRI on 3rd April, 2022 to enhance and encourage joint research collaboration with Central Ayurveda Research Institute, Jhansi.
- Hon'ble Former Adviser, Planning Commission (GOI), Dr. V. V. Sadamate along with Former CEO, IFFDC (IFFCO), Dr. Krishna Wankhede visited ICAR-CAFRI on 19th April, 2022.
- Country Director (CIFOR-ICRAF), Dr. Chandrasekhar Biradar visited ICAR-CAFRI on 22nd April, 2022.
- Deputy Director Horticulture (Jhansi), Dr. Vinay Kumar Yadav visited ICAR-CAFRI on 27th April, 2022.
- ADG (Oilseed & Pulses), ICAR, New Delhi, Dr. Sanjeev Gupta visited ICAR-CAFRI on 27th April, 2022.
- Hon'ble DDG (NRM), Dr. S.K. Chaudhari visited ICAR-CAFRI on 8th May, 2022 and guided institute research program.

- Sr. Adviser, NITI Aayog, Dr. Neelam Patel and Sh. Shailesh Kumar, CDO, Jhansi visited ICAR-CAFRI on 8th May, 2022.
- District Magistrate (Jhansi), Sh. Ravindra Kumar along with CDO, Sh. Shailesh Kumar visited ICAR-CAFRI on 10th May, 2022.

- Chief Conservator of Forests (Projects), Govt. of Uttar Pradesh, Dr. K. Ilango visited ICAR-CAFRI on 21st May, 2022.

- PCCF, Govt. of UP, Dr. K.P. Dubey and Dr. Syam Viswanath, Director, KFRI visited ICAR-CAFRI on 18th June, 2022.
- DDM, NABARD, Jhansi, Sh. Bhupesh Pal visited ICAR-CAFRI on 21st July, 2022.
- Hon'ble MLA, Sadar (Jhansi), Sh. Ravi Sharma visited ICAR-CAFRI on 5th September, 2022.
- Additional Commissioner, Ministry of Agriculture and Farmers Welfare (GOI), Dr. O.P. Sharma visited ICAR-CAFRI on 14th September, 2022.
- Hon'ble Vice Chancellor, RLBCAU (Jhansi), Prof. A.K. Singh along with Dr. M.L. Jat, Research Program Director, ICRISAT visited ICAR-CAFRI on 8th October, 2022.

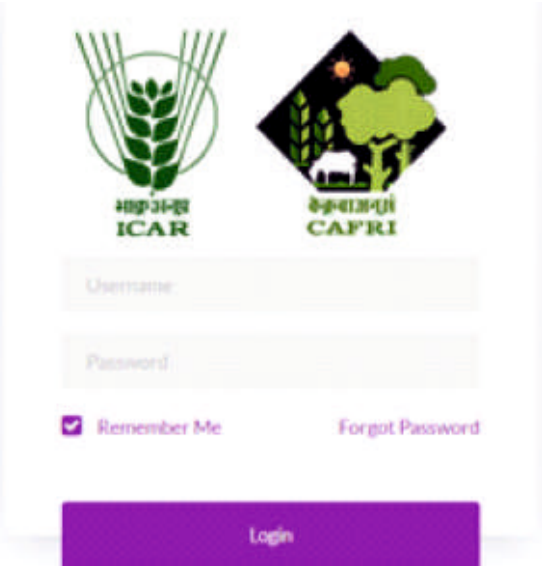
- Director, ICAR-IASRI, New Delhi, Dr. Rajendra Prasad along with Dr. Mukesh Kumar, Nodal Officer (SCSP) visited ICAR-CAFRI on 19th October, 2022.
- Environmentalist and Padma Bhushan awardee, Dr. Anil Prakash Joshi and Hon'ble MLA, Garautha (Jhansi), Shri Jawahar Lal Rajput visited ICAR-CAFRI on 25th October, 2022.

- ADG (Agronomy, agroforestry and climate change), ICAR, New Delhi, Dr. S. Bhaskar visited ICAR-CAFRI on 29th October, 2022 and monitored field experiments.
- CIMMYT, Regional Representative for Asia and Managing Director, Borlaug Institute for South Asia (BISA), Dr. Arun Kumar Joshi visited ICAR-CAFRI on 10th November, 2022CAFRI for furthering research collaboration.
- SSP, Jhansi,Shri S Rajesh (IPS) and Dr. K. Srinivas, ADG (IPTM), ICAR, New Delhi visited ICAR-CAFRI on 18th November, 2022.

- Secretary, Animal Husbandry (GOI), Shri R. K. Singh along with Dr. O.P. Choudhary, CEO (NLM) and Dr. Abhijit Mitra, Commissioner Animal Husbandry visited ICAR-CAFRI on 8th December, 2022.
- Vice Chancellor, RVSKVV, Gwalior, Dr. Arvind Kumar Shukla visited ICAR-CAFRI on 22nd December, 2022.
- CDO, Jhansi, Sh. Junaid Ahmad and Director, CARI (Jhansi), Dr. G. Babu visited ICAR-CAFRI, on 30th December, 2022.

12. Digital Reforms

CAFRI INTERNET Portal



ICAR-CAFRI has successfully transferred its official website domain from local domain https://cafri.res.in/ to ICAR domain https://cafri.icar.gov.in/ and now website is being hosted from ICAR-IASRI server. For easier and central access of the laboratory resources, a digital portal is being created for the institute employees.

Social Media Platform

13. Personnel Information

Dr. A. Arunachalam, Director		
Scientific		
1.	Dr. Rajendra Prasad, Principal Scientist (Soil Science)	
2.	Dr. A K Handa, Principal Scientist (Forestry/ Agroforestry)	
3.	Dr. R P Dwivedi, Principal Scientist (Agriculture Extension)	
4.	Dr. Badre Alam, Principal Scientist (Plant Physiology)	
5.	Dr. Naresh Kumar, Principal Scientist (Agroforestry)	
6.	Dr. K Rajarajan, Senior Scientist (Genetics & Plant Breeding)	
7.	Dr. Sushil Kumar, Senior Scientist (Agronomy)	
8.	Dr. Asha Ram, Senior Scientist (Agronomy)	
9.	Dr. Sovan Debnath, Scientist, Senior Scale (Soil Science)	
10.	Dr. Ashok Yadav, Scientist, Senior Scale (Fruit Science)	
11.	Dr. Hirdayesh Anuragi, Scientist, Senior Scale (Genetics & Plant Breeding)	
12.	Sh. Sukumar Taria, Scientist (Plant Physiology)	(on Study Leave) w.e.f. 26/12/2020
13.	Mrs. Alka Bharati, Scientist (Agricultural Biotechnology)	(on Study Leave) w.e.f. 20/06/2021
14.	Sh. Y N Venkatesh, Scientist (Agricultural Entomology)	(on Study Leave) w.e.f. 04/10/2021
15.	Sh. Suresh Ramanan S, Scientist (Agroforestry)	
16.	Dr. (Mrs.) Priyanka Singh, Scientist (Agricultural Economics)	
17.	Dr. (Mrs.) M Ashajyothi, Scientist (Plant Pathology)	
Technical		
1.	Dr. A Datta, Chief Technical Officer	
2.	Sh. Rajendra Singh, Chief Technical Officer	
3.	Sh. Rajesh Srivastava, Assistant Chief Technical Officer (Art & Photo)	
4.	Sh. R K Singh, Assistant Chief Technical Officer	
5.	Sh. S P Singh, Assistant Chief Technical Officer	
6.	Sh. Ram Bahadur, Assistant Chief Technical Officer	
7.	Dr. Ajay Kumar Pandey, Sr. Technical Officer	
8.	Mrs. Shelja Tamrakar, Sr. Technical Assistant (Library)	
9.	Sh. Prince, Technical Officer, Mechanic	
10.	Sh. Het Ram, Technical Officer (Driver)	
11.	Sh. Kashi Ram, Sr. Technical Officer (Driver)	
Administration		
1.	Sh. Pavan Kumar Panday, F&AO	
2.	Sh. Birendra Singh, AAO	
3.	Sh. Mahendra Kumar, AAO	
4.	Sh. Hoob Lal, Private Secretary	
5.	Sh. Om Prakash, Private Secretary	
6.	Sh. Deepak Vij, Personal Assistant	
7.	Mrs. Kirti Chaturvedi, Personal Assistant	

8.	Sh. Tridev Chaturvedi, Personal Assistant
9.	Sh. Jai Janardan Singh, Assistant
10.	Mrs. Kaushalya Devi, Sr. Clerk
Skilled Supporting Staff	
1.	Sh. Jagdish Singh
2.	Sh. Ram Din
3.	Sh. Pramod Kumar
4.	Sh. Munna Lal
Deputation/Lien	
1.	Dr. Inder Dev, Principal Scientist (Agronomy) has been relieved on 31/08/2022 to Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Solan, H. P.
New Staff	
1.	Dr. Pradyuaman Singh, Sr. Technical Officer joined on 13/06/2022
Promotion	
1.	Dr. K. Rajarajan, promoted to the post of Senior Scientist, w.e.f. 15/09/2021.
2.	Dr. H Anuragi, promoted to the post of Scientist (Senior Scale) w.e.f. 02/07/2022.
3.	Dr. Sushil Kumar, promoted to the post of Senior Scientist w.e.f. 15/09/2021.
4.	Dr. Asha Ram, promoted to the post of Senior Scientist w.e.f. 01/01/2022.
5.	Dr. Ashok Yadav, promoted to the post of Scientist (Senior Scale) w.e.f. 15/07/2021.
6.	Shri Ram Bahadur promoted to Assistant Chief Technical Officer w.e.f 10/12/2020
7.	Shri Shisupal promoted to Assistant Chief Technical Officer w.e.f. 21/03/2020
8.	Shri. Kashi Ram promoted to Technical Officer w.e.f.18/09/2022
9.	Shri Hetram promoted to Technical Officer w.e.f. 27.09.2021
Retirement	
1.	Sh. Sunil Kumar, Chief Technical Officer on 28.02.2022
2.	Dr. Rajeev Tiwari, Chief Technical Officer on 30.06.2022
3.	Dr. C K Bajpai, Chief Technical Officer on 30.06.2022

Annexure-I

Research Advisory Committee (RAC) (2021-23)

Dr. P. Kaushal **Chairman,** Vice Chancellor Uttarakhand university of Horticulture & Forestry, Uttarakhand	**Dr. N.B. Singh** Vice Chancellor, B.N. University, Udaipur, Rajasthan
Dr. K.T. Parthiban Dean, Forest College and Research Institute, TNAU, Mettupalayam	**Dr. K. Sammi Reddy** Director, ICAR-NIASM, Baramati
Dr. A.K. Shukla Vice Chancellor RVSKVV, Gwalior, Madhya Pradesh	**Dr. N. Narasimha** Former Head (Extension), UASB, Bangalore (KA)
Dr. Rajbir Singh Assistant Director General (Agron./AF & CC) NRM Division, ICAR, Krishi Anushandhan Bhawan-II, New Delhi- 110 012	**Dr. A.K. Handa** Pr. Scientist & Member Secretary, ICAR- CAFRI, Jhansi (U.P.)

Annexure-II

Institute Management Committee (IMC)
(2022-2025)

Dr. A. Arunachalam, (Chairman) Director ICAR-CAFRI, Jhansi (U.P.)	**Dr. F. Murli Gopal** Principal Scientist, ICAR-CPCRI, Kasaragod (Kerala)
Dr. V.K. Yadav Principal Scientist, ICAR-IGFRI, Jhansi (U.P.)	**Dr. R.S. Yadav** Principal Scientist, ICAR-IISWC RC, Datia (M.P.)
The Assistant Director General (ADG) (AAF & CC) NRM, Division Indian Council of Agricultural Research, Krishi Anushandhan Bhavan-II, New Delhi-110012	**Dr. A.K. Handa** Principal Scientist, ICAR-CAFRI, Jhansi (U.P.)
Director Agriculture, Govt. of UP, Lucknow (U.P.)	**Dr. Suneel Pandey** ITC Limited, Bhadrachalam (Telangana)
Director Research, JNKVV Jabalpur (M.P.)	**Sh. Ashok Rajput** Village- Nandsiya, Mooth, Post- Kargawa, Jhansi (U.P.)
Director Research, RLBCAU, Jhansi (U.P.)	**Sh. Pradeep Saravgi** House No. 165, Purani Nazai Jhansi (U.P.)
F&AO ICAR-CAFRI, Jhansi (U.P.)	**Sh. Rajesh Dubey** Finance & Acctt. Officer, ICAR-CIAE, Bhopal (M.P.)
	Dr. A. K. Handa HO & Member Secretary ICAR-CAFRI, Jhansi (U.P.)

Annexure-III

Institute Joint Staff Council (IJSC)
(2022-2025)

Chairman : Dr. A. Arunachalam, Director				
Category	**Staff Side**		**Office Side**	
Administration	**Sh. Birendra Singh** AAO	Member, CJSC	**Dr. A.K. Handa** Pr. Scientist	Member
	Sh. Jai Janardan Singh Assistant	Secretary, IJSC	**Dr. K. Rajarajan** Sr. Scientist	Member
Technical	**Smt. Shelja Tamrakar** Sr. Technical Assistant	Member	**Sh. Rajendra Singh** CTO	Member
	Sh. Kashi Ram Sr. Tech. Asstt. (Driver)	Member	**A.O./H.O.**	Member Secretary
Skilled Supporting Staff	**Sh. Pramod Kumar** SSS	Member	**Sh. P.K. Panday** F&AO	Member
	Sh. Munna Lal SSS	Member		

Annexure-IV

Farm Calender-2022

S.No.	Month	Activity
1.	January	1. Need-based cultural operations in rabi season crops/germplasm blocks/seed orchards
		2. Preparation of tentative list of input requirements
		3. Preparation of tentative list of farm produce with periodicity
		4. Price fixation of farm produce (tentative)
		5. Interaction meeting with scientists and stakeholders
2.	February	1. Need-based cultural operations in *rabi* season crops
		2. Auction of farm produces (Ber fruits *etc.*)
		3. Initiation of demo agroforestry model with flower plants/crops
		4. Deepening of existing water resources/excavation of new ponds
		5. Observing open day on the occasion of Basant Panchami
3.	March	1. Need-based work in *rabi* season crops
		2. Initiation of the certification process for model nursery
		3. Initiation of composting pits
4.	April	1. Auction of summer season guava fruits
		2. Harvesting/threshing/winnowing operations of *rabi* season crops
		3. Interaction meeting with scientists and stakeholders
		4. Maintenance of biological units such as organic manure unit/vermicompost/FYM *etc.*
		5. Observing open day on the occasion of Baishakhi
5.	May	1. Storage/price-fixing /sale of *rabi* season crops
		2. Pruning operations in tree plants/ber
		3. Need-based irrigation in established plants/germplasm blocks/seed orchards
		4. Inputs purchasing for kharif season crops
		5. Initiation of field preparation for kharif season crops
		6. Monitoring and maintenance of farm implements for *kharif* sowing
		7. Visit by dignitaries and farmers
		8. Interaction meet with farm incharges of neighbouring institutes
		9. Desiltation of ponds
		10. Sale/auction of lemongrass
		11. Insurance renewal of motorcycle (UP 93 V7891)
		12. Initiation of Annual Rate Contract (ARC) for farm works
6.	June	1. Need-based irrigation in established plants/germplasm blocks/seed orchards
		2. Field preparation for *kharif* season crops
		3. Sowing of *kharif* season crops

		4.	Field day *kharif* season
		5.	Maintenance of drainage channels
		6.	Sale/auction of fuelwood/pruned material
		7.	Finalization of Annual Rate Contract (ARC) for farm works
7.	July	1.	Sowing of *kharif* season crops
		2.	Irrigation schedule
		3.	Interaction meeting with scientists and stakeholder
		4.	Implementation of Annual Rate Contract (ARC) for farm works
8.	August	1.	Need-based cultural operations in *kharif* season crops
		2.	Inputs purchasing for *rabi* season crops
		3.	Monitoring of water source and water bodies for water storage capacity
9.	September	1.	Need-based cultural operations in *kharif* season crops
		2.	Land preparation and sowing of *rabi* season crops (rapeseed & mustard)
		3.	Harvesting/threshing/winnowing of *kharif* season crops
		4.	Monitoring and maintenance of farm implements for *rabi* season sowing
10.	October	1.	Harvesting/threshing/winnowing of *kharif* season crops
		2.	Storage/price fixation/sale of *kharif* season crops
		3.	Land preparation and sowing of *rabi* season crop (gram)
		4.	Field day *rabi* season
		5.	Interaction meeting with scientists and stakeholder
		6.	Sale/auction of lemongrass
		7.	Insurance renewal of Tractors (UP 93 AG0342; UP 93 AG 0227; UP 93 AG 0336)
11.	November	1.	Auction of bael, aonla and guava fruits
		2.	Sowing of *rabi* season crops
		3.	Pruning of MPTs
12.	December	1.	Need-based cultural operations in *rabi* season crops
		2.	Annual store verification

Notes

Swachh Bharat Abhiyan

स्वच्छ भारत

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