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ICAR – ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES

वार्षिक प्रतिवेदन

ANNUAL REPORT 2025

Research with a Global Vision,
for Sustainable
Spice Production





NEWLY IDENTIFIED SPICE VARIETIES



Karan Saunf-1



Gujarat Ajwain-4



Hisar Ajwain-7



Ajmer Ajwain-24



IISR Navya



OUAT Kalinga Ginger-4

ICAR-INDIAN INSTITUTE OF SPICES RESEARCH
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Varieties recommended for release in XXXVI Annual Group Meeting





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कार्यकारी सारांश

भाकृअनुप-अखिल भारतीय समन्वित मसाला अनुसंधान परियोजना (आईसीएआर-एआईसीआरपीएस) भारत का सबसे बड़ा मसाला अनुसंधान प्रणाली है। यह भाकृअनुप-भारतीय मसाला फसल अनुसंधान संस्थान, कोषिक्कोड, केरल में स्थित है। इसके 40 केंद्र (19 नियमित केंद्र, 19 स्वैच्छिक केंद्र और परियोजना मोड के तहत दो केंद्र) है जो उत्तर पूर्वी राज्य और आदिवासी इलाकों सहित 24 राज्यों के 14 कृषि जलवायु क्षेत्रों का प्रतिनिधित्व करते हैं। आईसीएआर-एआईसीआरपीएस अलग-अलग कृषि-जलवायु क्षेत्रों के लिए उपयुक्त किस्मों को विकसित करने में अहम भूमिका निभाता है और प्रतिकूल मौसम में फसल की बीमारियों और फसल प्रबंधन पद्धतियों से जुड़ी किसानों की समस्याओं का समाधान करता है। वर्तमान में, आईसीएआर-एआईसीआरपीएस 18 अधिदेश फसलों जैसे, काली मिर्च, इलायची, बड़ी इलायची, अदरक, हल्दी, जायफल, दालचीनी, लौंग, धनिया, जीरा, सौंफ, मेथी, अजवाइन, निगेल्ला, केसर, काला जीरा, आम अदरक और काली हल्दी पर काम कर रहा है।वर्ष 2024-25 मेंआईसीएआर-एआईसीआरपीएस का वार्षिक बजट 964.5 लाख रुपये (परिषद का हिस्सा) थे।

नई पहल

मसाला के टिकाऊ उत्पादन को मज़बूत करने के लिए आईसीएआर-एआईसीआरपीएस नेटवर्क के तहत कई जगहों पर आनुवंशिक संसाधन, फसल सुधार,फसल प्रबंधन और फसल सुरक्षा से जुड़ी नई अनुसंधान परियोजनाएं शुरू की गईं। फसल सुधार में, हल्दी (उच्च उपज, मोटे प्रकंद और 20% से ज़्यादा उपलब्धी), इलायची (कीट एवं रोग प्रतिरोधकता के साथ उच्च उपज), बीज और पत्ते वाली धनिया, जीरा, मेथी और निगेल्ला की नई सीवीटी शुरू की गईं और साथ ही गुंटूर और कोयंबत्तूर में हल्दी के सोमाक्लोन और बीज संततियों का मूल्यांकन किया गया।फसल प्रबंधन की नई पहलों में काली मिर्च में *राइज़ोफैगस इरेगुलरिस* (एएमएफ), बड़ी इलायची में पॉली सल्फेट (पॉलीहैलाइट), जीरा और धनिया में फसल-विशिष्ट सूक्ष्म पोषकतत्व संयोजन आदि पर कई जगहों पर किए गए परीक्षण और जीरा की अच्छी किस्म CZC-94 के लिए पौधे की सघनता और बुवाई के समय को तय करने का काम भी इसमें शामिल होता है। फसल संरक्षण के तहत, छोटी इलायची में रूट ग्रब्स (*बासिलेप्टा फुलविकोर्नी*) और मूल गांठ सूत्रकृमि (*मेलोयिडोगाइन* स्पी.) के एकीकृत प्रबंधन *हेटरोर्हाबडिटिस इंडिका* और *पैसिलोमाइसेस लिलासिनेस* का इस्तेमाल करते हुए नए परीक्षण शुरू किए गए; अदरक और

हल्दी में जीवाणु कंसोर्टियम आधारित ग्रोथ प्रमोशन और प्रकंद गलन प्रबंधन; और काली मिर्च में पोल्लू बीटल और अदरक और हल्दी में प्ररोह बेधक एवं हल्दी में सूत्रकृमि प्रबंधन के प्रति कवकनाशी और कीटनाशियों के सीआईबीआरसी पंजीकरण के लिए लेबल क्लेम अध्ययन शुरू हुआ। इसके अलावा, *अल्टरनेरिया बर्नसी* से होने वाले जीरे के झुलसा रोग के लिए मौसम-आधारित बीमारी का अनुमान लगाने वाले तीन वर्ष के मॉडल भी शुरू किया गया।

विमोचित करने एवं अधिसूचना के लिए संस्तुत आईसीएआर-एआईसीआरपीएस की किस्में

बागवानी फसलों के लिए फसल मानकों, अधिसूचना और किस्मों को ज़ारी करने पर केंद्रीय उप समिति की 32 वीं बैठक 4 अप्रैल 2025 को संपन्न हुई। इसमें आईसीएआर-एआईसीआरपीएस द्वारा पहचानी गई मसाला फसलों की पांच किस्मों को अधिसूचित किया गया। इनमें अदरक की किस्म, एसएएस-केईवीयु; हल्दी की किस्म, आईआईसआर सूर्या; सौंफ की किस्म गुजरात सौंफ-13 (जीएफ-13); जीरा की किस्म, जोधपुर जीरा-1 (जेजे-1/एमसीयु-105) और आम अदरक की किस्म आईआईसआर अमृत शामिल हैं।राष्ट्रीय स्तर पर ज़ारी किस्मों के अलावा, समिति ने कई जगहों पर आईसीएआर-एआईसीआरपीएस परीक्षण डेटा के आधार पर क्षेत्र विशेष /राज्य स्तर पर किस्म को ज़ारी करने और अधिसूचित करने के लिए आईसीएआर-एआईसीआरपीएस केंद्रों पर भी विचार किया गया।

भाकृअनुप-अखिल भारतीय समन्वित मसाला अनुसंधान परियोजना (आईसीएआर-एआईसीआरपीएस) की XXXVI वीं वार्षिक समूह बैठक में ज़ारी करने के लिए अनुशंसित किस्में

आईसीएआर-एआईसीआरपीएस की XXXVI वीं वार्षिक समूह बैठक के दौरान, तीन फसलों में छह मसाला किस्मों की पहचान की गई:

1. **करण सौंफ-1 (RF 234/UF-231):**यह सौंफ की ज्यादा पैदावार वाली एक किस्म है जिसकी वाणिज्यिक गुणवत्ता बहुत अच्छी है, इसे एसकेएनएयु, जोबनेर, राजस्थान ने विकसित किया है। इसमें औसतन 1742 किलोग्राम/हेक्टर बीज की पैदावार हुई, साथ



ही इसमें ज़्यादा बाष्पशील तेल (3.32%) और तेल की पैदावार (57.83 लिटर/हेक्टर)थीं।इस किस्म में बहुत अच्छी गुणवत्ता की एसेंशियल तेल होती है, जिसमें

18 एरोमैटिक संयुक्तहोते हैं, जिनमें एस्ट्रागोल (52.54%) और एनेथोल (16.67%) मुख्य घटक हैं।इस किस्म को राजस्थान, गुजरात, उत्तराखंड, उत्तर प्रदेश, बिहार, मध्य प्रदेश और हरियाणा के सौंफ उगाने वाले इलाकों में विमोचन के लिए पहचाना गया है।

2. **गुजरात अजवाइन-4 (JA 2019-01):**यह एक उच्च उपुजवाली अजवाइन की किस्म है जिसे बीज मसाला अनुसंधान स्टेशन, एसडीएयु, जगुदान, गुजरात ने विकसित किया है। इसकी औसत बीज उपज 1136 किलोग्राम/हेक्टर है। इसकी विशेषता यह है कि यह पहले फूलती हैं और पक जाती हैं,



बीज मोटे होते हैं, और बाष्पशील तेल की मात्रा ज़्यादा (4.18%) होती है। इस किस्म को राजस्थान, गुजरात, आंध्र प्रदेश, उत्तर प्रदेश और छत्तीसगढ़ के अजवाइन उगाने वाले इलाकों में खेती के लिए पहचान किया गया है।

3. **हिसार अजवाइन -7 (HAJ-7):**इसउच्च उपज वाली किस्म को सीसीएस हरियाणा कृषि विश्वविद्यालय, हिसार ने विकसित की गई है, जिसकी औसत बीज उत्पादन 1193 किलोग्राम/हेक्टर है। यह मध्यम अवदिमें पकने वाली किस्म है इसमें अधिक अम्बल



है और हर अम्बल में अधिक संख्या में बीज होते हैं। इस किस्म में ज़्यादा एसेंशियल तेल (4.96%) होता है और यह जड़ सड़न को सहन कर सकती है, साथ ही इसमें एफिड्स का आपतन भी कम होता है। इसे राजस्थान, गुजरात और हरियाणा में विमोचित करने के लिए पहचाना गया है।

4. **अजमेर अजवाइन-24 (AA-24)** : इस उच्च उपज वाली अजवाइन की किस्म को भाकृअनुप-राष्ट्रीय बीज मसाला अनुसंधान केंद्र, अजमेर द्वारा विकसित किया गया है, जिसकी औसत बीज उत्पादन 1216 किलोग्राम/हेक्टर है। यह किस्म मध्यम अवधि की होती है और इसमें बेहत्तर उत्पादन वाले घटक होते हैं। यह गुणवत्ता में भरपूर



होते हैं और इसमें थाइमोल तत्व (49.47%) और एसेंशियल तेल (4.96%) ज़्यादा होता है, और यह जड़ सड़न को सहन कर सकती है। इस किस्म को राजस्थान के अजवाइन उगाने वाले इलाकों के लिए पहचाना गया है।

5. **आईआईएसआर नव्या (HP 0.5/2):**यह



भाकृअनुप-भारतीय मसाला फसल अनुसंधान संस्थान, कोषिक्कोड़ द्वारा विकसित अदरक की एक टिकाऊ, ज़्यादा पैदावार वाली किस्म है, जिसकी औसत साफ प्रकंद उपज 15.3 टन/हेक्टर और उत्पादन क्षमता 36 टन/हेक्टर तक है। यह प्रकंद गलन के लिए खेत सहनशील है और इसमें अच्छी गुणवत्ता के तत्व है, जिसमें एसेंशियल तेल (2.7%), ओलियोरेसिन (6.65%), और शुष्क उपज (18.78%) शामिल है। इस किस्म को केरल, पश्चिम बंगाल, मेघालय और पूर्वोत्तर क्षेत्रों में विमोचित करने के लिए पहचाना गया है।

6. **ओयुएटी कलिंगा जिंजर-4 (कोरापुट अडा/V1E4-5)**: यह अदरक की एक उच्च उत्पादन वाली किस्म है जिसे एचएआरएस, ओडीशा कृषि एवं तकनोलॉजी विश्वविद्याल (ओयुएटी), पोट्टांगी, ओडीशा ने विकसित किया है। इसकी औसत उत्पादन 15.9 टन/हेक्टर है। यह मध्यम अवधि की होती है, इसके प्रकंद मोटे होते हैं और इसकी गुणवत्ता बेहत्तर होती है, जिसमें फाइबर कम होता है और शुष्क उपज ज़्यादा होती है। यह



किस्म प्रमुख बीमारियों और कीड़ों के प्रति प्रतिरोधकता/सहनशीलता दिखाती है और विभिन्न कृषि पारिस्थितिक स्थितियों में अच्छा प्रदर्शन करती है। इसे ओडीशा और आंध्र प्रदेश में विमोचन के लिए पहचाना गया है।

अनुशंसित मसाला प्रौद्योगिकियाँ

36 वीं वार्षिक समूह बैठक के दौरान, एकीकृत कीट एवं रोग प्रबंधन, वृद्धि नियामन, कृषि अनुकूलरोग नियंत्रण,अंतर फसल प्रणाली और पोषक तत्वों के उपयोग की दक्षता के लिए कई जरूरत-आधारित और क्षेत्र विशिष्ट तकनोलॉजी की सलाह दी गई।

1. **मेथी में उत्पादकता बढ़ाने के लिए पादप वृद्धि नियामक का इस्तेमाल:** मेथी में बुवाई के 30 और 60 दिनों के बाद, दो बार ब्रासिनेस्टेरॉइड (1.0ppm) या बेंजाइल एडेनिन

(20ppm) के पत्तियों पर छिड़काव करने की तकनोलॉजी से बीज की उत्पादकता में 25-30% की बढ़ोत्तरी हुई और प्रति हेक्टर रु 15,000-17,000 का ज़्यादा नेट रिटर्न मिला। इस तकनोलॉजी को राजस्थान, बिहार, हरियाणा और उत्तर प्रदेश के लिए अनुशंसित किया जाता है।

2. धनिया में उत्पादकता और गुणवत्ता बेहत्तर करने के लिए वृद्धि नियामक का इस्तेमाल : बुवाई के 30 और 60 दिनों के बाद सैलिसिलिक एसिड (50 ppm) को पत्तियों पर डालने से उत्पादकता और आमदनी में वृद्धि हुई और इसे राजस्थान, मध्य प्रदेश, छत्तीसगढ़, हरियाणा, तमिलनाडु और आंध्र प्रदेश के लिए अनुशंसित किया गया है।

3. अदरक में अंतर-फसलन प्रणाली:आंध्र प्रदेश, बिहार और पश्चिम बंगाल के लिए अदरक को रत्तालू (2.2) के साथ अंतर-फसलन करने की सलाह दी जाती है; ओडीशा, नागालैंड, हिमाचल प्रदेश और मिज़ोरम के लिए अदरक को मक्के (2:1 या 2:2) के साथ; पश्चिम बंगाल के लिए अदरक को फ्रेंच बीन (2:2) के साथ, और सिक्किम के लिए अदरक को धनिया के साथ तथा उसके बाद पत्तेदार सब्जियां उगाने की सलाह दी जाती है।

4. अदरक में फॉस्फोरस और ज़िंक को घोलने के लिए पौधे की वृद्धि बढ़ाने वाले राइज़ोबैक्टीरिया (*बैसिलस सफ़ेंसिस*) का इस्तेमाल: इस तकनोलॉजी में, अनुशंसित मात्रा के फॉस्फोरस का 75%, ज़िंक का 50%, और बैसिलस सफेंसिस को रोपण करते समय और फिर रोपण के 30, और 60 दिनों के बाद डालना शामिलहै। इसे केरल, आंध्र प्रदेश, पश्चिम बंगाल, उत्तर प्रदेश, अरुणाचल प्रदेश और ओडीशा के लिए इस्तेमाल करने की सलाह दी जाती है।

5. काली मिर्च में पोल्लू बीटल (लंका रामकृष्णई) का प्रबंधन: केरल और कर्नाटक के काली मिर्च उगाने वाले इलाकों में पोलू बीटल के प्रबंधन के लिए जुलाई, अगस्त और सितंबर के दौरान क्लोरेंट्रानिलिप्रोल18.5% एससी या फ्लूबेंडियामाइड 39.35% एससी को 0.3 से 0.5 मिली लिटर/लिटर पानी में मिलाकर तीन बार कीटनाशक छिड़काव करने की सलाह दी जाती है।

6. मेथी में पाउडरी मिल्ड्यू का प्रबंधन : मेथी में पाउडरी मिल्ड्यू के प्रबंधन के लिए बीमारी की शुरूआत में ही कवकनाशक छिड़काव करने की सलाह दी गई, और फिर 15 दिनों के बाद दूसरा छिड़काव किया जाना चाहिए। गुजरात के लिए हेक्साकोनाज़ोल5%एससी (0.1%), राजस्थान के लिए हेक्साकोनाज़ोल या टेबुकोनाज़ोल (0.1%) और मध्य प्रदेश के लिए टेबुकोनाज़ोल 25.9% ईसी (0.1%) इस्तेमाल करने की सलाह दी गई, जिससे बीमारी पर प्रभावी नियंत्रण और पैदावार की सुरक्षा मिली।

7. जीरे ब्लाइट का पर्यावरण अनुकूल प्रबंधन: बीज उपचार के बाद, बुवाई के 40 दिनों के बाद बैसिलस सबटिलिस 1.15 WP (40 ग्राम/10 लिटर) के साथ स्यूडोमोनस फ्लोरसेंस 1.15 WP (50 ग्राम/10 लिटर) के चार बार पत्तियों पर छिड़काव करने से बीमारी काप्रभावी नियंत्रण किया गया। यह तकनोलॉजी राजस्थान और गुजरात के लिए अनुशंसित की जाती है।

ये तकनोलॉजियां मिलकर जलवायु के प्रति लचीलेपन को मज़बूत करती है, रासायनिक इनपुट पर आश्रय को कम करती है, पर्यावरण अनुकूलफसल प्रबंधन को बढ़ावा देती हैं, और देश के विभिन्न मसाला उगाने वाले इलाकों में खेती केलाभ को बढ़ाती हैं।

अनुसंधान उपलब्धियाँ (2024-25)

काली मिर्च

आईसीएआर-एआईसीआरपीएस के छह केंद्रों में कुल 454 काली मिर्च जर्मप्लाज़म एक्सेशनों का संरक्षण किए गए, जिसमें 2024-25 में 43 नए एक्सेशनों को जोड़े गए। दापोली में चरित्रांकन के दौरान, एक्सेशन DBSKKVPN-2 सबसे ज़्यादा स्पाइक नंबर (88.0/बेल) और शुष्क बेरी की उपज (0.542 किलोग्राम/बेल) के साथ एक उम्मीद जगाने वाला दाता बनकर उभरा। पन्नियूर में, अनुरक्षण किए गए 292 एक्सेशनों में से, PRS 116 ने सबसे ज़्यादा उत्पादकता (6.35 किलोग्राम हरी बरी उपज, 2.20 किलोग्रामशुष्क बरी की उपज, 1,545 स्पाइक्स/बेल) दर्ज की, इसके बाद PRS 124 (5.73 किलोग्राम हरे, 2.08 किलोग्रामशुष्क 1,465 स्पाइक्स/बेल)का नंबर आया; PRS 124 ने सबसे ज़्यादा शुष्क उपज (36.30%) भी दर्ज की, जिसके ठीक बाद PRS 137 (36.18%) का नंबर आया। छह जगहों पर जांचे गए CVT 2018 क्रमIX में, पन्नियूर 1 सबसे स्थिर और सबसे ज़्यादा पैदावार देने वाला जीनोटाइप रहा (ताज़ी बेरी का पैदावार 0.62 किलोग्राम/बेल, शुष्क उपुज 0.20 किलोग्राम/बेल)। HP 1117 X तोम्मनकोडी ने बहुत ज़्यादा ताकत और बेहत्तर बेरी सेट (72.03 बेरी/स्पाइक) दिखाया, जो सूखी बेरी की उत्पादकता (0.20 किलोग्राम/बेल) में पन्नियूर 1 जैसा ही था, जबकि कुरीमलाई ने अच्छी स्पाइक लंबाई (19 से. मी. तक) दिखाई और SV 7 ने उच्चतम शुष्क उपज की प्राप्ति (33.3%) अंकित की। जांच की गई सभी डोज़ पर पोलु बीटल (*लंका रामकृष्णई*) के संक्रमणमें 99-100% की कमी की, जो क्विनालफोस 25 ईसी (45-86% कमी) से बेहतर था, और बताई गई डोज़ से दोगुनी डोज़ पर भी पूरी फसल सुरक्षा पक्की हुई। सबसे अच्छी डोज़ (0.625 मिली लिटर/लिटर) ने सबसे ज़्यादा ताज़ी और शुष्क उपज (क्रमश: 3.70 किलोग्राम/बेलऔर 2.07 किलोग्राम/बेल)दर्ज की, जो अनुपचारित नियंत्रण की तुलना में 52.3% और 59.2% की पैदावार में बढ़ेत्तरी दिखाती है।

इलायची

मुडिगरे (93) और पाम्पाडुमपारा (197) केंद्र में कुल 290 एक्सेशनों को रखे गए हैं। पांपाडुमपारा में एक्सेशन 145 में सबसे ज़्यादा 100 कैप्स्यूल वज़न (116.67 ग्रा.) अंकित किया, एक्सेशन 3 में सबसे लंबे कैप्स्यूल (19.56 मिलीमीटर), एक्सेशन 101 में सबसे ज़्यादा ताज़ी उपज (1,625.00 किलोग्राम/हेक्टर) और कैप्स्यूल का आयतन(108.33 मिलीलिटर/100 केप्स्यूल) और एक्सेशन 5 में सबसे ज़्यादा सूखी उपज (277.00 किलोग्राम/हेक्टर) दर्ज की गई; एक्सेशन 1, 3, और 4 ने अषुकल बीमारी के लिए पूरी तरह से प्रतिरोध दिखाया, जबकि एक्सेशन 2, 4 और 11 में बोरर से कोई नुकसान नहीं हुआ। छोटी इलायची संकर पर सीवीटी श्रृंखला IX में, MHC-2 शीर्ष प्रदर्शनकर्ता (केरल में शुष्क उपज 1,324.2 किलोग्राम/हेक्टर, सभी केंद्रों में कुल औसत उपज 753.5 किलोग्राम/हेक्टर) के रूप में उभरा, जबकि GGxNKE19X बोल्ड ने केरल में 892.4 किलोग्राम/हेक्टर हासिल किया और बोल्ड xIC 547219 कर्नाटक (518.0 किलोग्राम/हेक्टर) के लिए असाधारण रूप से अनुकूल साबित हुआ। थ्रिप्स के सहनशील प्रकारों को कई जगहों पर किए गए मूल्यांकन में IC 349606 को सबसे ज़्यादा उम्मीद जगाने वाला पाया गया (अप्पंगला में उच्च कैप्स्यूल उत्पादन 432.7 किलोग्रा/हेक्टर, सकलेशपुर में थ्रिप्स का कम आपतन 9.0, और कैप्स्यूल नुकसान 15.0%), जबकि IC 349364 ने मैलाडुमपारा में सबसे कम थ्रिप्स का आपतन (हर पत्ते शीथ पर 0.56थ्रिप्स) दिखाया। पर्ण ब्लाइट सहनशीलता के परीक्षण में, IC 547156 ने 471.0 किलोग्राम/हेक्टर की शुष्क कैप्स्यूल उपज के साथ सबसे कम औसतPDI (10.5%) अंकित किया, जबकि नेशनल चेक जल्लानी ग्रीन गोल्ड ने सबसे ज़्यादा औसत उपज (580.9 किलोग्राम/हेक्टर) हासिल की। आईआईएसआर इलायची सूक्ष्म पोषकतत्व मिश्रण का पत्तियों पर प्रयोग सभी केंद्रों पर अनुशंसित उर्वरक खुराक से आगे निकल गया, और अधिक पैदावार को लक्षित करने वाली स्थान-विशिष्ट पोषक तत्व सिफारिशों (8 क्विंटल /हेक्टर के लिए टी 3और 10 क्विंटल/हेक्टर के लिए टी 4) ने मानक प्रथाओं (154.7 किलोग्राम/हेक्टर) की तुलना में बेहत्तर सूखी कैप्स्यूल (क्रमश: 261.5 किलोग्राम/हेक्टर और 244.4 किलोग्राम /हेक्टर) का उत्पादन अंकित किया।

बड़ी इलायची

सिक्किम के पांगथांग और कार्बी में खेत जीन बैंक में कुल 61 जर्मप्लाज़्म एक्सेशनों का संरक्षण किए गए हैं। पश्चिम सिक्किम की लैंडरेस उत्तरे वरलांग (SCC-218) ने प्रमुख बीमारियों के प्रति काफी सहनशीलता दिखाई। गांगटोक और कलिम्पोंग में CVT में, SCC-264 (सॉनी) सबसे अच्छा कैंडिडेट बनकर उभरा, जिसकी वृद्धि अच्छी थी, और लीफ

कैटरपिलर, शूट फ्लाई और ब्लाइट का आपतन बहुत कम था, जबकि यह प्ररोह बेधक, ड्राई रॉट और विषाणु बीमारियाँ (चिर्की और फुर्की) से पूरी तरह मुख्त था, इसके बाद SCC-307(वारलांगे) का नंबर आता है। फसल प्रबंधन परीक्षण से पता चला कि अनुशंसित जैविक पैकेज के अलावा 400 किलोग्राम/हेक्टर में पॉलीसल्फेट (पॉलीहैलाइट) ने पौधे की उत्पादकता को काफी बढ़ाया।

अदरक

आनुवंशिक संसाधन प्रबंधन के तहत, सात केंद्रों में 449 देशी अदरक जर्मप्लाज़म एक्सेशनों को संरक्षित किया गया; बारापानी में, आईसी-584361 ने सबसे अधिक ताज़ा प्रकंद उपज (15.28 टन /हेक्टर) दर्ज की, आईसी -584334 ने सबसे अधिक ओलिओरसिन (6.05%), और आई सी -584344 ने सबसे अधिक शुष्क पदार्थ (21.7%) अंकित किया। धोली में, आरजी-57 और आरजी-36 ने सबसे अधिक उपज (22.80 टन/हेक्टर) अंकित की; कुमारगंज में, एनडीजी-23, एनडीजी-28 और एनडीजी-35 ने बेहत्तर उपज (क्रमश: 24,37,22.90 और 21.39 टन/हेक्टर) का उत्पादन किया; पोट्टांगी में एस-62 आशाजनक था (20.40टन/हेक्टर); पुंडिबारी में, जीसीपी-58 और जीसीपी-59 ने प्रकंद गलन और विल्ट (15-16% रोग आपतन) के लिए मध्यम प्रतिरोध दिखाया, जिसमें जीसीपी-58 से 13.50 टन/हेक्टर पैदावार हुई; रायगढ़ में आईजीएस-14, आईजीएस-11, और आईजीएस-16 से क्रम से 21.17, 20.17 और 18.33 टन/हेक्टर पैदावार हुई; और सोलन में, ताज़े प्रकंद की उपज 10.99 से 36.14 टन/हेक्टर (औसत 21.90 टन/हेक्टर) तक रही, जिसमें एसजी19-11 सबसे ज्यादा (36.14 टन/हेक्टर) रहा। मोटे अदरकसीवीटी में, जी 2023-6 सबसे ज़्यादा उत्पादक (23.05 टन/हेक्टर) रहा, जबकि जी 2023-7 ने सबसे ज़्यादा शुष्क उपज (22.77%) और प्रकंद की मोटाई (3.34 से.मी.) अंकित की। उच्च एसनशियल तेल परीक्षण में, जी 2023-16 ने सबसे ज़्यादा औसत उपज (21.15 टन/हेक्टर) और जी 2023-12 ने सबसे ज़्यादा एसेंशियल तेल सामग्री (3.83%) दिया। तीन साल से ज़्यादा के अंतर फसलन प्रणाली में, अदरक +रत्तालू (2:2) ने सबसे ज़्यादा अदरक उत्पादन (15.48 टन/हेक्टर) और बीसीआर (2.46) अंकित किया। *बैसिलस सर्फेसिसस* के साथ 75% अनुशंसित फॉसफोरस उपचार करने पर ताज़े प्रकंद की सबसे ज़्यादाऔसत उपज (14.31 टन/हेक्टर) मिली, जो 100% फॉस्फोरस उपचार (13.25टन/हेक्टर) से 8.0% ज्यादा थी। वहीं अनुशंसित ज़िंक का 50% और *बैसिलस सर्फेसिसस*का इस्तेमाल करने पर सबसे ज्यादा औसत उपज (12.77 टन/हेक्टर) मिली, जो ज़िंक की पूरी डोज़ (12.12टन/हेक्टर) से 5.4% अधिक थी। क्लोरेंट्रानिलिप्रोल 18.5% एस सी और

स्पिनोसाद 45% एस सी ने अनुशंसित मात्रा से दोगुनी मात्रा में भी बिना किसी नुकसान दायक असर (फाइटोटॉक्सिक) के शूट बोरर पर 100% तक नियंत्रण प्रदान किया।

हल्दी

वर्ष 2024-25 के दौरान, ग्यारह केंद्रों में 1,659 जर्मप्लाज़म एक्सेशनों को बनाए रखे गए, जिसमें 19 नए संग्रह जोड़े गए, जिससे राष्ट्रीय भंडार में 1,896 एक्सेशन हो गए। प्रमुख प्रदर्शन करने वालों में बारापानी में आईसी-586755 (16.80 टन/हेक्टर) और आईसी -586759 (5.75% कुरकुमिन); कोयंबत्तूर में सीएल 180 (658 ग्राम पौधा) और सीएल 9 (21.75% सूखी उपज); धोली में राजेंद्र सोनाली (48.00 टन /हेक्टर) को पीछे छोड़ते हुए आरएच-414 (52.80 टन/ हेक्टर); कम्मरपल्ली में जेटीएस-605 (63.25टन/हेक्टर); रायगढ़ में आईटी-59 (46.80 टन/हेक्टर); और सोलन में एसटी 19-04 में सबसे ज़्यादा कुरकुमिन मात्रा (6.65%) था। पुंडिबारी में, 32 जीनोटाइप का उत्पादन 35 टन/हेक्टर से ज्यादा थे, साथ ही, 62 जीनोटाइप पर्ण ब्लॉच के लिए और 65 पर्ण चित्ती के लिए प्रतिरोधी थे। काली हल्दी पर पहली बार किए गए समन्वित प्रजातिपरीक्षण में, बीटी-162 ने सबसे ज़्यादा उपज (17.56 टन/हेक्टर) अंकित की, उसके बाद एक्से. 751 (17.53 टन/हेक्टर) और एनबीटी-2 (16.87 टन/हेक्टर) रहे, जबकि एनबीटी-1 ने सबसे ज़्यादा शुष्क उपज (19.25%) और ओलियोरसिन (4.73%) और एक्से. 292 ने सबसे ज़्यादा एसेंशियल तेल की मात्रा (2.20%) अंकित की। बैसिलस सफेंसिस के साथ 75%अनुशंसित फॉस्फोरस के एकीकरण ने 11 केंद्रों में 100% फॉस्फोरस (25.74 टन/हेक्टर) के मुकाबले सबसे अधिक एकत्रित ताज़ा प्रकंद उपज (28.94 टन /हेक्टर) उत्पन्नकी, और बैसिलस सफेंसिस के साथ 50% अनुशंसित ज़िंक ने तेरह केंद्रों मे पूर्ण ज़िंक खुराक (27.90 टन/हेक्टर) के मुकाबले सबसे अधिक एकत्रित उपज (28.70 टन/हेक्टर) अंकित की। क्लोरेंट्रानिलिप्रोल 18.5% एस सी और स्पिनोसाद 45% एस सी ने शूट बोरर (कोनोगीथस पंक्टिफरालिस) का 95-100% दमन किया, और फ्लुओपिरम 34.48 एससी(0.5 मिलीलिटर) ने जड़ में घाव करने वाले सूत्रकृमि (*प्रोटिलेंचस* स्पी.) को प्रभावी रूप से दबाया, जिसमें कोयंबत्तूर (39.17 टन/हेक्टर), गुंटूर (43.47 टन/हेक्टर). कोषिक्कोड़ (27.90 टन/हेक्टर),काम्मरपल्ली (27.90टन/हेक्टर) और पुंडिबारी (29.40 टन/हेक्टर) में सबसे अधिक उत्पादन अंकित किया।

वृक्ष मसाले

वर्ष 2024-25 के दौरान, 169 जायफल, 26 लौंग, 23 दालचीनी, और छह कैसिया जर्मप्लाज़्म एक्सेशनों का संरक्षण किया गया।जायफल में, पेचिपराई में एमएफ-4 ने

सबसे ज़्यादा फल (744.18/पेड), एक फल का वज़न (64.13 ग्राम.) और जावित्री का उत्पादन (357.19 ग्राम/पेड) अंकित की, जबकि लंबे समय के मूल्यांकन में DBSKKV 9772 को सबसे अच्छा (सूखे नट काउत्पादन 12.62 किलोग्राम/पेड़, सूखी जावित्री का उत्पादन 2.85 किलोग्राम/पेड़) और DBSKKV 65 ने सबसे ज़्यादा नट (842/पेड) पैदा किए।लौंग में, पेचिपराई में एसए-3 ने सूखी कली काउत्पादन (2.09 किलोग्राम/पेड़) अंकित की, जो लोकल चेक (0.56 किलोग्राम/पेड़) से लगभग चार गुना अधिक है।दालचीनी में, सीवी-5 ने सबसे अधिक सूखी छाल की उपज (4.42 किलोग्राम/पेड़) और सूखी पत्ती की उपज (18.08 किलोग्राम) अंकित की। सीवीटीमूल्यांकन ने कोचुकुडी को सबसे आशाजनक जायफल किस्म के रूप में पहचान लिया, जिसमें त्रिश्शूर में स्थानीय चेक (33 नट/पेड़) और 297 नट/पेड़ के मुकाबले सबसे अधिक एकत्रित उपज (152 नट/पेड़) है, जिसमें बेहत्तर पौधे की ऊंचाई (4.89 मीटर), विस्तार (3.85 मीटर) और शाखाएं (69.33) है। त्रिश्शूर में स्वतंत्र मूल्यांकन ने एक्से. 23 को सबसे अधिक उपज देने वाला (463 फल/पेड), एक्से. 1 को अधिकतम पुष्पण (628 फूल/पेड़) वाला, एक्से. 14 को सबसे भारी फलों (105.25 ग्रामफल/पेड) वाला और एक्से. 5 में उच्चतम सूखे नट (9.23 ग्राम) और सूखी जावित्री वज़न (2.58 ग्राम) था, और यह सब राष्ट्रीय चेक आईआईएसआर विश्वश्री से आगे था।

धनिया

कुल 2,097 जर्मप्लाज़्म एक्सेशनों को बचाया गया, जिसमें 29 नए जोड़े गए, 1,085 का मूल्यांकन किया गया, और 70 अच्छी लाइनों की पहचान की गई। बीज उत्पादन के लिए बेहत्तर जर्मप्लाज़्म में कोयंबत्तूर में सीएस-46 (9.20 ग्राम/पौधा), हिसार में डीएच-328 (35.4 ग्राम/पौधा), और रायगढ़ में आईसीएस-4 (2,101 किलोग्राम/हेक्टर) शामिल थे।एलसीसी-69, एलसीसी -79, एलसीसी -150 और एलसीसी -169 को फ्यूज़ेरियम विल्ट के लिए प्रतिरोधक के रूप में पहचाना गया।15 केंद्रों में सीवीटी सीरीज़ XII में, सीओआर -207 ने सबसे अधिकबीज उपज (1,586 किलोग्राम /हेक्टर) अंकित की, जबकि परीक्षण में औसत 1,425 किलोग्राम/हेक्टर था, इसके बाद सीओआर-220 (1,509 किलोग्रा/हेक्टर) और सीओआर-215 (1,503 किलोग्राम/हेक्टर) रहे। 10 केंद्र में पहले साल के पत्तेदार धनिया सीवीटी में, एलसीओआर-15 ने सबसे ज्यादा बायोमास उपज (2,713.02 किलोग्राम/हेक्टर) अंकित की।गुणवत्ता मूल्यांकन से पता चला कि संपूर्ण बाष्पशील तेल की मात्रा 0.26 -0.46% के बीच था, जिसमें सीओआर-221 सबसे ऊपर (0.46%) था।फसल विशिष्ट सूक्ष्मपोषकतत्व संयोजन को दो बार पत्तों पर छिड़काव करने से सबसे ज़्यादा बीज उपज

(1,436.1किलोग्राम/हेक्टर) अंकित की गई, जो नियंत्रण (1,201.4 किलोग्राम/हेक्टर) से 19.5% अधिक थी।तीन साल की पूल्ड अध्ययन से पता चलाकि 100% अनुशंसित फॉस्फोरस से सबसे अधिक बीज उपज (18.69 क्विंटल/हेक्टर) हुई,हालांकि 75% फॉस्फोरस (18.08 क्विंटल/हेक्टर) ने भी उतना ही अच्छा प्रदर्शन किया, जिससे 25% फॉस्फोरस बचाने की क्षमता सूचित होता है।पादप वृद्धि नियामक अध्ययन में बेंज़ाइल एडेनिन @20 पीपीएम को सबसे अधिक उपज देने वाले उपचार (15.4 क्विंटल/हेक्टर) की तुलना में अनुपचारित नियंत्रण (12.8 क्विंटल/हेक्टर) के रूप में पहचाना गया, और धनिया की उत्पादकता बढ़ाने के लिए रोपण के 30 और 60 दिनों के बाद सैलीसिलिक एसिड @50 पीपीएम, जैस्मोनिक एसिड@50 पीपीएम, बेंज़ाइल एडेंनिन@10 पीपीएम, या ब्रासिनोस्टेरॉयड @0.50 पीपीएम का पत्तियों पर अनुप्रयोग की सिफारिश की गई।

जीरा

भाग लेने वाले केंद्रों में कुल 928 जीरा जर्मप्लाज़्म एक्सेशनों (911 देशी, 10 विदेशी, 7 अतिरिक्त विदेशी) का संरक्षण किए गए।जोबनर में, युसी-233 (21.0ग्राम/5 पौधे) ने सबसे अच्छे चेक जी सी-4 (16.0ग्राम/5पौधे) को पीछे छोड़ दिया।पहले साल की सीवीटी में, सीयुएम-66 ने सबसे अधिक पूल्ड बीज उत्पादन (533 किलोग्राम/हेक्टर) अंकित की, उसके बाद सीयुएम-67 (517 किलोग्राम/हेक्टर) और सीयुएम-57 (473 किलोग्राम/हेक्टर) रहे, जबकि कुल परीक्षण का औसत 402 किलोग्राम/हेक्टर था; सीयुएम-67 सबसे अधिक विल्ट सहिष्णु (पीडीआई 41) था और सीयुएम-63 में सबसे कम ब्लाइट आपतन (पीडीआई 26) था।सूक्ष्म पोषकतत्व प्रबंधन में, पत्तों पर दो बार छिडकाव करने से सबसे ज़्यादा औसत बीज उत्पादन (923.3 किलोग्राम/हेक्टर) और बी सी अनुपात (2.89) मिला, जबकि नियंत्रण (777.1 किलोग्राम/हेक्टर, बी:सी 2.47) था।तीन सालके बहुस्थानीय पर्यावरण अनुकूल प्रबंधि परीक्षण में क्रेसोक्सिम-मिथाइल 44.3 एससी@0.044% (पत्तों पर तीन बार छिड़काव करना) को बिना उपचार वाले नियंत्रण (55.64% पीडीआई) के मुकाबले सबसे कम पूल्ड ब्लाइट की गंभीरता (13.51%पीडीआई) अंकित करने वाला पाया गया।*बैसिलस सबटिलिस* और *स्यूडोमोनस फ्लोरेसेंस* का इस्तेमाल करके एकीकृत जैविक प्रबंधन पद्धति नेभी बीमारी को प्रभावी ढ़ंग से कम किया (20.71% पीडीआई) और इसे 36वीं वार्षिक समूह बैठक में राजस्थान और गुजरात के लिए अनुशंसित पर्यावरण अनुकूल तकनोलॉजी के तौर पर मंजूरी दी गई।मौसम आधारित रोग पूर्वानुमान अध्ययनों से पता चला है कि नवंबर की शुरूआत मेंबुवाई में सबसे अधिक झुलसा रोग (>80% पीडीआई) देखा गया, जिसमें रोग की प्रगति उच्च सापेक्ष

आर्द्रता (>75%) और 10-14 डिग्री सेलेश्यस के न्यूनतम तापमान के साथ निकटता से जुड़ी हुई थी।

सौंफ

कुल 1,301 सौंफ जर्मप्लाज़्म एक्सेशनों को 29 नए जोड़ के साथ संरक्षित किया गया और 741 का मूल्यांकन किया गया।उत्कृष्ट उच्च उपज देने वाले जर्मप्लाज्म में धोली में आर एफ-02 (98.83 ग्राम/पौधा), हिसार में एचएफ-178 (37.6 ग्राम/पौधा), कुमारगंज में एनडीएफ-52 (70.12 ग्राम/पौधा और जोबनेर में, युएफ-131 (119.0 ग्राम) और युएफ-80 (107.0 ग्राम) मूल्यांकित 205 एक्सेशनों में सर्वश्रेष्ठ के रूप में उभरे।नौ केंद्रों में 14 प्रविष्टियों के साथ की गी पहले साल की सीवीटी में, बीज की उपज 1,243 से 1,627 किलोग्राम/हेक्टर के बीच थी, जबकि कुल औसत 1,415 किलोग्राम/हेक्टर था; एफएनएल-152 में सबसे ज़्यादा पूल्ड बीज उपज (1,627 किलोग्राम/हेक्टर) अंकित की गई, इसके बाद एफएनएल-145(1,599 किलोग्राम/हेक्टर) और एफएनएल-146 (1,530 किलोग्राम/हेक्टर) आता है।गुणवत्ता मूल्यांकन से पता चला कि बाष्पशील तेल की मात्रा 1.84 से 2.46% (कुल औसत 2.05%) के बीच था, जिसमें एफएनएल-151 में सबसे अधिक (2.46%) और उसके बाद एफएनएल-143 (2.42%) आता है।

मेथी

सात केंद्रों में कुल 1,240 जर्मप्लाज़्म एक्सेशनों का संरक्षण किया गया जिसमें 34-नए जोड़ भी शामिल है।बेहत्तर एक्सेशनों में हिसार में एचएम-525 (35.6 ग्राम/पौधा), जोबनेर में युएम-246 (93.0 ग्राम/पांचपौधा) और रायगढ़ में आईएफजीएस-11 (2,613.7 किलोग्राम/हेक्टर) शामिल थे। पहले साल 11 जगहों में 16 प्रविष्टि के साथ की गई की सीवीटी में, कुल बीज उत्पादन 1,511 से 1,849 किलोग्राम/हेक्टर तक थी;एफजीके-162 सबसे अधिक उपज देने वाला (1,849 किलोग्राम/हेक्टर) निकला, इसके बाद एफजीके -170 (1,846 किलोग्राम/हेक्टर) और एफजीके -160 (1,834 किलोग्राम/हेक्टर) रहे। एएमएफ के साथ 75% अनुशंसित फॉस्फोरस का प्रयोग करने से सबसे अधिक बीज उत्पादन (1,849 किलोग्राम/हेक्टर) और बी सी अनुपात (3.14) मिला, जो 100% फॉस्फोरस के बराबर है, जबकि ब्रासिनोस्टेरॉइड @1.0पीपीएम से सबसे अधिक बीज उत्पादन (1,768 किलोग्राम/हेक्टर) हुई, जो नियंत्रण से लगभग 30.7% अधिक थी।बेंजाइल एडेनिन @20 पीपीएम से सबसे ज़्यादा फायदा (बी:सी अनुपात 2.59) हुआ, जिसका कारण आईसीएआर-एआईसीआरपी की अनुशंसा के अनुसार राजस्थान, हरियाणा, बिहार और उत्तर प्रदेश में दो बार पत्तों पर छिडकाव करने की सलाह थी।फसल संरक्षण में, टेबुकोनाज़ोल 25.9% ईसी@0.1% न सबस कम पाउडरी

मिलड्यू का आपतन (16.77 पीडीआई) अंकित किया, जिससे बीमारी में 56.5-63.0% की कमी आई, जबकि एसएयु की अनुशंसा से सबसे अधिक बीज उपज (15.18 क्विंटल/हेक्टर) हुई, जो अनुपचारित नियंत्रण से 32.5-39.1% अधिक उपज दिखाता है।हेक्साजोनाज़ोल और प्रोपिकोनाज़ोल के बचे हुए हिस्से मात्रीकरण की सीमा($<0.02\ mg\ kg^{-1}$) से कम रहे, जिससे खाने की सुरक्षा पक्की हुई।

अजवाइन

आईसीएआर-एआईसीआरपीएस के आठ कोंद्रों में कुल 540 जर्मप्लाज़्म एक्सेशनों का संरक्षण किया गया, जिसमें पांच नए जोड़े गए और 529 एक्सेशनों का मूल्यांकन किया गया।सीवीटी 2022 क्रम में एचएजे-38 ने सबसे अधिक औसत बीज उपज (1,225 किलोग्राम/हेक्टर) अंकित की, इसके बाद एए-24 (1,215 किलोग्राम/हेक्टर), एचएजे-7 (1,193 किलोग्राम/हेक्टर), जेए-19-05(1,184किलोग्राम/हेक्टर), एए-45 (1,533 किलोग्राम/हेक्टर) और एए-16 (1,141 किलोग्राम/हेक्टर) आता है, इन सभी ने राष्ट्रीय चेक एए-2 (1,026 किलोग्राम/हेक्टर) से 10% से अधिक बेहत्तर दक्षता का प्रदर्शनकिया। तीन अच्छे किस्मों कोविमोचन के लिए पहचान की गई; गुजरात अजवाइन-4 (1,136 किलोग्राम/हेक्टर, एए-2 से 10.72% अधिक; जल्दी पकनेमें 155-166 दिन; परीक्षण वज़न 1.72 ग्राम; बाष्पशील तेल 4.18%) राजस्थान, गुजरात, आंध्र प्रदेश, हरियाणा और छत्तीसगढ़ के लिए; हिसार अजवाइन 7 (1,193 किलोग्राम/हेक्टर, एए -2 से 16.2% अधिक; एसनश्यल तेल 4.96%; जड़ गलन के सहनशील 9.99%) राजस्थान, गुजरात और हरियाणा के लिए; और राजस्थान के लिए अजमेर अजवाइन-24 (1,216 किलोग्राम/हेक्टर, एए -2 से 19.7% अधिक; 323 अम्बेल/पौधा; 380 बीज/अम्बेल; एसेंनश्यल तेल 4.96% ; थाइमोल 49.47%; जड़ गलन के सहनशील 8.86%)।

निगेला

पांच केंद्र में कुल 129 जर्मप्लाज़्म एक्सेशनों का संरक्षण किए गए, जिसमें 27 विशेष संकलन का पंजीकरण किया गया।पहले सालछह जगहों पर किए गए सीवीटी क्रम II-2024 में, कुल औसत उपज में 8.00 से 9.83 क्विंटल/हेक्टर तक का अंतर था; एनजीएल-11 सबसे अधिक उपज देने वाला (9.83 क्विंटल/हेक्टर) निकला, उसके बाद एनजीएल-13 (9.41क्विंटल/हेक्टर) और एनजीएल-14 (9.35 क्विंटल/हेक्टर) रहे। जड़ गलन प्रबंधन के लिए, एज़ोक्सीस्ट्रोबिन (20%) + डिफेनोकोनाज़ोल (12.5%) एससी @0.2% के साथ मिट्टी में लगाने से सबसे कम रोग का आपतन (10.2%) और उच्चतम बीज उपज (8.5 क्विंटल/हेक्टर) अंकित की गई, जबकि ट्राइकोडर्मा विरिडे उपचार ने भी अनुपचारित

नियंत्रण (23.4%) की तुलना में उत्पादकता में सुधार (7.7 बनाम 5.8 क्विंटल /हेक्टर) करते हुए रोग आपतन को कम (13.8%) किया।

केसर

पंपोर केंद्र में, 211 जर्मप्लाज़्म प्रकारों (198 देशी और 13 विदेशी) को बनाए रखा गया और 208 एक्सेशनों को क्रमिक तरीके से जांच किया गया।एक्सेशन एसआरएस-एसएएफ-156 ने कोर्न विकास, अधिक केसर का उत्पादन, ज़्यादा एपोकैरोटेनाइड की मात्रा और कार्न गलन के लिए मध्यम प्रतिरोधकता के साथ बेहत्तर साबित हुआ। एवीटी-II के तहत 11 विशिष्ट एक्सेशनों के साथ, एसआरएस-एसएप-178 ने सबसे अधिक फूलों की सघनता (86 फूल/मी^{2}) और केसर का उत्पादन (590.82 मिली ग्राम/मीटर^2) दिखाय, जबकि एसआरएस-एसएएफ-199 ने अधिकतम स्टिग्मा लंबाई (4.76 से.मी.) अंकित की।

कालाजीरा

पंपोर में कालाजीरा के कार्यक्रम में 98 जर्मप्लाज़्म लाइन बनाए रखी गई, साथ ही हिमाचल प्रदेश के ऊंचे इलाकों से 25 नए एक्सेशनों (17 बीज-आधारित और 8 कंद-आधारित) जोड़े गए, जिससे संग्रहमें 123 एक्सेशनें हो गई।एसआरएस-केज़ेड -120, एसआरएस-केज़ेड-108 औरएसआरएस-केज़ेड -131 को बेहत्तर जीनोटाइप के तौर पर पहचाना गया, जिनमें अधिक एसेंश्यल तेल, हीट स्ट्रेस की सहनशीलता, कंद गलन के लिए मध्य प्रतिरोधकताऔर कंद की लंबी उम्र थी।लाधू, चोटीपोरा और खानसाहिब में बहु-स्थानीय परीक्षण (एमएलटी) से एसआरएस-केज़ेड-177 को बेहत्तर साबित हुआ, जिसमें 366.67 किलोग्राम/हेक्टर औसत बीज उत्पादन अंकित किया, जो स्वाभाविक आबादी (305.67 किलोग्राम/हेक्टर) की तुलना में 19.96% उपज उपलब्धी दिखाती है।

अच्छी गुणवत्ता की रोपण सामग्रियों का उत्पादन और वितरण

आईसीएआर-एआईसीआरपीएस केंद्रों ने काली मिर्च की 3.81 लाख जड़ वाली कतरनों के साथ साथ 5,538 झाडी काली मिर्च पौधे और 10,450 छोटी इलायची के पौधे, 5,263 छोटी छोटी इलायची के सकेर्स का उत्पादन करके वितरित किए।कुल 30.1 टन अदरक और 107.35 टन हल्दी के प्रकंदों का उत्पादन किए, इसके अलावा दोनों फसलों के अच्छी गुणवत्ता के प्रो-ट्रे पौधे का भी उत्पादन किया।साथ ही, केंद्र ने 2.5 क्विंटल आम अदरक के प्रकंद का भी उत्पादन करके वितरण किए। बीजमसालों में, 64.15 टन धनिया के बीज, 4.6 टन जीरा के बीज, 4.7 टन सौंफ के बीज, 6.25 क्विंटल मेथी के बीज, 5.32 क्विंटल अजवाइन के बीज और 5 किलोग्राम कालाजीरा के बीज के साथ 2,000 कालाजीरा कंद भी शामिल थे।इसके अलावा, विभिन्न मसाला फसलों के लिए अच्छी गुणवत्ता की रोपण सामग्रियों के

उत्पादन का समर्थन करने के लिए 19,578 वृक्ष मसाले के पौधे और 4,700 कलम लगाए पौधे का उत्पादन करके वितरण किए गए।

निगरानी

वर्ष 2025 के दौरान, आईसीएआर-एआईसीआरपीएस के तहत अनुसंधान गतिविधियों की प्रगति पर परियोजना समन्वयक और पीसी इकाई के वैज्ञानिकों ने खेत भ्रमण, ऑनलाइन पुनरीक्षण बैठक, समयसमय पर प्रगति रिपोर्ट और नियमितप्रसार कार्यक्रम के ज़रिए बारीकी से निरीक्षण किया, ताकि केंद्र में अनुसंधान कार्यक्रम को असरदार तरीके से लागू किया जा सके। डॉ. डी. प्रसाथ (पीसी) ने नवसारी, सानंद और जगुदान (जनवरी); एचसी &आरआई, टीएनएयु, कोयंबत्तूर (फरवरी); रंजमुंदरी, चिंतापल्ली और पोट्टांगी (जून); और मैलाडुमपारा और पांपाडुमपारा (जुलाई, डॉ. मुकेश शकर के साथ) केंद्र का निरीक्षणदौरा किया, ताकि चल रहे परीक्षण का पुनरीक्षणकरके तकनीकी मार्गदर्शन दिया जा सके।फरवरी-मार्च 2025 के दौरान, श्री नाफिद सी., युवा पेशेवार-I ने सीवीटी परीक्षण, अग्रपंक्ति प्रदर्शनी और प्रशिक्षण कार्यक्रम की निगरानी करने के लिए नागालैंड विश्वविद्यालय, मेडज़िफेमा के एसएएसआरडी में एनईएच केंद्र का दौरा किया।भाकृअनुप-राष्ट्रीय बीज मसाला अनुसंधान केंद्र, अजमेर के निदेशक की अध्यक्षता में एक बीजमसाला निगरानी समिति बनाई गई थी।इसमें आईसीएआर-एआसीआरपीएस और सहयोगी संस्थानों के प्रतिनिधि शामिल थे। समिति ने समय-समय पर चल रहे अनुसंधान परीक्षण, परीक्षणात्मक रिकॉर्ड और केंद्र की गतिविधियों का पुनरीक्षम किया।इसके अलावा, परीक्षण की प्रगति, वित्तीय स्थिति और अनुसंधान योजना का आकलन करने के लिए पूरे साल ऑनलाइन पुनरीक्षण बैठक आयोजित की गई, जिससे समय पर फीडबैक मिल सके और परियोजना के लक्ष्यों का पालन हो सके।निगरानी प्रक्रिया को आईसीएआर-एआसीआरपीएस की XXXVI वीं वार्षिक समूह बैठक के ज़रिए मज़बूत किया गया। यह बैठक 29-31 अक्तूबर 2025 को आईसीएआर रिसर्च काम्प्ल्क्स फॉरएनईएच रीजन, बारापानी, मेघालय में हुई थी।इससे वैज्ञानिक पुनरीक्षण, अंतर-केंद्रीय समन्वय और भविष्य की शोध प्राथमिकता की योजना के लिए एक प्लेटफॉर्म मिला।

प्रमुख कार्यक्रम

वर्ष 2025-26 के दौरान, आईसीएआर-एआईसीआरपीएस ने मसाला उगाने वाले प्रमुख इलाकों में अनुसूचित जाति उप योजना (एससीएसपी) और आदिवासी उप योजना (टीएसपी) कार्यक्रम लागू किए, जिससे क्षमता निर्माण, अग्रपंक्ति प्रदर्शनी, अच्छी गुणवत्ता वाली रोपण सामग्रियों का वितरण और इनपुट सपोर्ट के ज़रिए 1,900 से अधिकअनुसूचित जाति और अनुसूचितजनजाति के किसानों को

फायदा हुआ।30 से अधिक प्रशिक्षण कार्यक्रम ऑनलाइन किए गए, जबकि 49,000 से अधिक अच्छी गुणवत्ता वाली रोपण सामग्रियों का वितरण किए गए, जिसमें 28,000 काली मिर्च के जड़ लगाए कतरन, 2,700 दालचीनी के पौधे, 1,000 वानिला के पौधे, 2,400 किलोग्राम अदरक और हल्दी की बीज सामग्रियां और बेहत्तर बीज वाले मसाले, साथ ही बायो-इनपुट, पौध संरक्षण रासायनिक और खेती के औज़ार शामिल थे, ताकि वैज्ञानिक और टिकाऊ मसालों की खेती को बढ़ावा दिया जा सके।तकनोलॉजी के इस्तेमाल से जोबनेर में सौंफ और मेथी की उत्पादकता में लगभग 10% की बढ़ोत्तरी हुई, पांपाडुमपारा में आदिवासी किसानों की खेती से वार्षिक आमदनी में 29% की बढ़ोत्तरी के साथ मसालों की पैदावार में 18-25% कीबढ़ोत्तरी हुई, और इडुक्की जिले में अनुसूचित जाति के किसानों की वार्षिक आय में लगभग 55% की बढ़ोत्तरी के साथ उत्पादन में 25-35% की बढ़ोत्तरी हुई।किसान उत्पादक संगठन (एफपीओ /एफपीसीएस) हल्दी के मूल्य वर्धन में सक्रिय रूप से शामिल थे, जबकि जैविक खेती, नर्सरी प्रबंधन, फसलोत्तर संभालन और एकीकृत फसल प्रबंधन पर प्रदर्शनीनेबेहत्तर तकनोलॉजी को अपनाने को मज़बूत किया। इन फ्लेगशिप कार्यक्रम ने देश भर में सामाजिक रूप से पिछड़े किसान समुदायों के बीच आजीविका के मौके, उद्यमिता और टिकाऊ मसाला उत्पादन को काफी बढ़ावा दिया।

पूर्वोत्तर और हिमालयी (एनईएच) क्षेत्र में मसाला खेती को बढ़ावा देना

वर्ष 2025-26 के दौरान, आईसीएआर-एआईसीआरपीएस ने प्रशिक्षण, अग्रपंक्ति प्रदर्शनी, अच्छी गुणवत्ता वाली रोपण सामग्रियों का वितरण और इनपुट सपोर्ट के ज़रिए पूरे पूर्वोत्तर और हिमालयन (एनईएच) क्षेत्रों में बेहत्तर मसाला उत्पादन तकनोलॉजी को फैलाने को मज़बूत किया।यह सीधे 250 से अधिक किसानों तक और गांव स्तर के विस्तार कार्यक्रम के ज़रिए कई और किसानों तक पहुंचा दिया। बेहत्तर तकनोलॉजी की प्रदर्शनी में मेघालय में लोकल लाकाडोंग किस्म के मुकाबले मेघा हल्दी 1 से 25-30% ज़्यादा हल्दी का उत्पादन, सिक्किम में 36% तक ज़्यादा अदरक का उत्पादन और 41.1% अधिक हल्दी का उत्पादन दर्ज किया गया, जिससे वैज्ञानिक खेती से मिलने वाली उत्पादकता के फायदे पर ज़ोर दिया गया।बारापानी, मिज़ोरम, नागालैंड, पासीघाट, कहिकुची, सिक्किम और गांगटोक के केंद्र ने जैविक उत्पादन, प्रकंद प्राइमिंग, प्रो-ट्रे में जड़ लगाने की तकनोलॉजी, नर्सरी प्रबंधन, फसलोत्तर संभालन, जैव कीटनाशक, वर्मीकम्पोस्टिंग, उद्यमिता विकास और मूल्य वर्धन पर कार्यक्रम आयोजित किए, साथ ही अच्छी गुणवत्ता की रोपण सामग्री, खेती के औज़ार और ज़रूरी उत्पादन इनपुट का भी वितरण किए थे।इसके अलावा, असम के आकांक्षा रखने वाले जिलों में 1,400 काली

मिर्च की जड़ लगाई कतरनों का वितरण किया गया ताकि मसाले पर आधारित खेती के तरीके को मज़बूत किया जा सके।इन हस्तक्षेप से तकनोलॉजी अपनाने में काफी बढ़ोत्तरी हुई, अच्छी गुणवत्ता की रोपण सामग्रियों तक पहुंच बेहत्तर हुई, किसानों की तकनीकी क्षमता मज़बूत हुई और पूर्वोत्तर क्षेत्र में टिकाऊ आजीविका के मौकों को बढ़ावा मिला।

तकनीक का प्रसार

वर्ष 2025-26 के दौरान, आईसीएआर-एआसीआरपीएस के वैज्ञानिकों ने खेत प्रदर्शनी, किसानों के लिए प्रशिक्षण कार्यक्रम (83 प्रशिक्षण), कृषि मेले और प्रदर्शन (11 कार्यक्रम) के अलावा रेडियो में व्याख्यान, दूरदर्शन कार्यक्रम, ऑनलाइन कार्यक्रम और अन्य विस्तार गतिविधियों के ज़रिए बेहत्तर मसाला उत्पादन तकनोलॉजी को सक्रिय रूप से लोकप्रिय बनाया, जिससे रिसर्च आउटपुट किसान समुदायों तक प्रभावी ढ़ंग से पहुंचे।उच्च उत्पादन वाली किस्मों, बेहत्तर फसल उत्पादन, रोपण सामग्रियों की तेज़ी से बढ़ोत्तरी, एकीकृत रोग और कीट प्रबंधन, जैविक खेती, फसलोत्तर प्रबंधन और मूल्य वर्धन पर प्रदर्शनियां आयोजित करके देश भर के किसानों के खेतों में स्थान-विशिष्ट तकनोलॉजी को अपनाने में मदद की।इन तकनोलॉजियों को 11 कृषि मेलों और प्रदर्शनियों के ज़रिए और अवगत कराया, जिसमें 23,000 से ज़्यादा किसानों, कृषक महिलाओं, उद्यमियों और अन्य संबंधित लोगों ने भाग लिया, जहाँ बेहत्तर किस्मों, उत्पादन तकनोकों और गुणवत्ता रोपण सामग्रियों का प्रदर्शन किया गया। वैज्ञानिकों ने कई क्षमता निर्माण कार्यक्रमों में विशेषज्ञों के तैर पर सेवा की और प्रिंट और इलेक्ट्रॉनिक मीडिया के ज़रिए आउटरीच को मज़बूत किया, जिससे वैज्ञानिक सुझाव बहुत बड़े किसान समुदाय तक पहुंचे। इस तरह के समन्वित विस्तार कार्यक्रमों से किसानों की जागरूकता, तकनोलॉजी अपनाने का कौशल, उद्यमिता कौशल और मसालों के टिकाऊ उत्पादन में काफी बढ़ोत्तरी हुई, जिससे मसालों पर आईसीएआर-एआईसीआरपीएस का प्रभाव और अधिक मज़बूत हुआ।

सफलता की कहानियाँ

आईसीएआर-एआईसीआरपीएस की तकनीकियों ने बेहत्तर किस्मों, एकीकृत फसल प्रबंधन और क्षमता निर्माण के ज़रिए पर्यावरण अनुकूल क्षेत्रों में उत्पादकता, लाभ और आजीविका की सुरक्षा को बढ़ाकर ज़मीनी स्तर पर अहम असर दिखाया है।वैज्ञानिक तरीकों से मेघालय में मेघा हल्दी-1 से हल्दी की उत्पादकता में 25-30% वृद्धि हुई, हिमाचल प्रदेश में बेहत्तर भण्डारण तकनीकी का इस्तेमाल करके अदरक

के बीज प्रकंदों की 90% से अधिक पुन:प्राप्ति हुई, येरकाड में काली मिर्च की उत्पादकता में 23% वृद्धि हुई और कुल आमदनी में 56% की बढ़ोत्तरी हुई, पेचिपराई में वैज्ञानिक काली मिर्च की खेती से वार्षिक आय में 30% की बढ़ोत्तरी हुई, और कोरापुट में काली मिर्च पर आधारित एग्रोफोरस्ट्री से वर्ष में रु.4 लाख से ज़्यादा आमदनी हुई।बेहत्तर तकनीकियों को अपनाने से काली मिर्च में शीघ्र मुरझाने का सफल प्रबंधन, जीएनटी-3, अमरावंती और डॉ. वाईएसआरएचयु-एलएएम वर्षा (लगभग 100 एकड़ में अपनाई गई) जैसी जलवायु अनुकूल और उच्च उत्पादन वाली किस्म का तेज़ी से फैलाव हुआ,इसके अलावा सुपारी -काली मिर्च और आदिवासी खेती के इलाकों में फ़ायदेमंद एकीकृत फसलप्रणाली को बढ़ावा मिला। चिंतापल्ली में आदिवासी आजीविका कार्यक्रम लगभग 10,000 आदिवासी परिवारों तक पहुंचा, जिसमेंलगभग 3,000 किसानों को प्रदर्शनी, अच्छी गुणवत्ता रोपण सामग्रियों के वितरण और खेती के मशीनीकरण के ज़रिए प्रशिक्षण एवं मदद दी गई, जिससे तकनीकी अपनाने और आजीविका की क्षमता में काफ़ी सुधार हुआ।ये सफलता की कहानियां आईसीएआर-एआईसीआरपीएस की बदलाव लाने वाली भूमिका को स्पष्ट रूप से दिखाती है, जो अनुसंधान को मापक खेत स्तर तकनोकी में बदल रही हैं, जिससे पूरे देश में खेती की उत्पादकता, आमदनी और निरंतरता में सुधार होता है।

EXECUTIVE SUMMARY

ICAR-AICRP on Spices (ICAR-AICRPS) is India's largest spices research system, located at ICAR-Indian Institute of Spices Research, Kozhikode, Kerala has 40 centres (19 regular centres, 19 voluntary centres and 2 project mode centres) representing 14 agro-climatic regions in 24 states including North Eastern States and Tribal areas.

ICAR-AICRPS plays an important role in the development of varieties suitable to different agro-climatic regions and addresses the problems faced by the farming community on crop diseases, crop management practices during adverse and aberrant weather conditions. Currently, ICAR-AICRPS is working on 18 mandate crops viz., Black Pepper, Cardamom, Large Cardamom, Ginger, Turmeric, Nutmeg, Cinnamon, Clove, Coriander, Cumin, Fennel, Fenugreek, Ajwain, Nigella, Saffron, Kalazeera, Mango Ginger and Black Turmeric. The annual budget of the ICAR-AICRP on Spices for the year 2024-25 was ₹964.5 lakhs (ICAR share).

New Initiatives

New multi-location research projects were initiated under the ICAR-AICRPS network across genetic resources, crop improvement, crop management and crop protection to strengthen sustainable spice production. In crop improvement, fresh CVTs were launched in turmeric (high yield, bold rhizomes and more than 20% dry recovery), cardamom (high yield with pest and disease resistance), seed and leafy coriander, cumin, fenugreek and nigella, along with evaluation of turmeric somaclones and seedling progenies at Guntur and Coimbatore. Crop management initiatives included multi-location trials on *Rhizophagus irregularis* (AMF) in black pepper, polysulphate (polyhalite) in large cardamom, crop-specific micronutrient formulations in cumin and coriander, and standardization of plant density and sowing time for the promising cumin genotype CZC-94. Under crop protection, new trials were initiated on integrated management of root grubs (*Basilepta fulvicorne*) and root-knot nematodes (*Meloidogyne* sp.) in small cardamom using *Heterorhabditis indica* and *Paecilomyces lilacinus*, bacterial consortium-based growth promotion and rhizome rot management in ginger and turmeric, and label claim studies for CIBRC registration of fungicides and insecticides against pollu beetle in black pepper and shoot borer in ginger and turmeric, nematode management in turmeric.

Additionally, a three-year weather-based disease prediction model for cumin blight caused by *Alternaria burnsii* was initiated.

ICAR-AICRPS Varieties recommended for release and notification

The 32th meeting of the Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Horticultural Crops was held on 4 April, 2025 five ICAR-AICRPS- identified varieties of spice crops were notified. These included ginger variety, SAS-KEVU; turmeric variety, IISR Surya; fennel variety, Gujarat Fennel-13 (GF-13); cumin variety, Jodhpur Jeera-1 (JJ-1 / MCU-105); and mango ginger variety, IISR Amrit.

In addition to the nationally released varieties, the committee also considered ICAR-AICRPS centres to release and notify region specific/state-wide varieties based on multilocation ICAR-AICRPS trial data.

These included one ginger variety (IISR Surasa), one fennel variety (Gujarat Fennel-3), and three turmeric varieties (NDH-98, Pitambari, and Amruta).



Varieties recommended for release in XXXVI Annual Group Meeting of ICAR-All India Coordinated Research Project on Spices (ICAR-AICRPS)

During the XXXVI AGM of ICAR-AICRPS, six spice varieties were identified in three crops for release:

1. Karan Saunf-1 (RF 234 / UF-231): It is a high-yielding fennel variety with superior industrial quality, developed by SKNAU, Jobner, Rajasthan. It recorded a mean seed yield of 1742 kg ha^{-1}, along with high volatile oil content (3.32%) and oil yield (57.83 L ha^{-1}). The variety possesses excellent essential oil quality, characterized by 18



aromatic compounds, with Estragol (52.54%) and Anethole (16.67%) as the major constituents. The variety has been identified for release in fennel-growing regions of Rajasthan, Gujarat, Uttarakhand, Uttar Pradesh, Bihar, Madhya Pradesh, and Haryana.

2. Gujarat Ajwain-4 (JA 2019-01): It is a



high-yielding ajwain variety developed by the Seed Spices Research Station, SDAU, Jagudan, Gujarat, with a mean seed yield of 1136 kg ha^{-1}. It is characterized by early flowering and maturity, bold seeds, and high volatile oil content (4.18%). The variety has been identified for cultivation in ajwain-growing regions of Rajasthan, Gujarat, Andhra Pradesh, Uttar Pradesh, and Chhattisgarh.

3. Hisar Ajwain-7 (HAJ-7): This high yielding variety is developed by CCS Haryana Agricultural University, Hisar, with



an average seed yield of 1193 kg ha^{-1}. It is a medium-duration variety with higher numbers of umbels and seeds per umbel. The variety contains high essential oil (4.96%) and exhibits tolerance to root rot, along with a low incidence of aphids. It has been identified for release in Rajasthan, Gujarat, and Haryana.

4. Ajmer Ajwain-24 (AA-24): This high yielding ajwain variety is developed by ICAR–National Research Centre on Seed Spices, Ajmer, with a mean seed yield of 1216 kg ha^{-1}. The variety is of medium duration and possesses superior yield components. It is rich in quality attributes, with high thymol



content (49.47%) and essential oil (4.96%), and shows tolerance to root rot. The variety has been identified for ajwain-growing regions of Rajasthan.

5. IISR Navya (HP 0.5/2): It is a stable, high



yielding ginger variety developed by ICAR-Indian Institute of Spices Research, Kozhikode, with an average fresh rhizome yield of 15.3 t ha^{-1} and a yield potential of up to 36 t ha^{-1}. It is field- tolerant to rhizome rot and possesses good quality attributes, including essential oil (2.7%), oleoresin (6.65%), and dry recovery (18.78%). The variety has been identified for release in Kerala, West Bengal, Meghalaya, and the NEH region.

6. OUAT Kalinga Ginger-4 (Koraput Ada/V1E4-5): It is a high-yielding ginger variety developed by HARS, Odisha University of Agriculture and Technology (OUAT), Pottangi, Odisha, with an average yield of 15.9 t ha^{-1}. It is of medium duration with bold rhizomes and exhibits superior quality characterized by low fibre content and high dry recovery. The variety shows resistance/tolerance to major diseases and pests and performs well under diverse agroecological conditions. It has been identified for release in Odisha and Andhra Pradesh.

Recommended Spices Technologies

During the 36th AGM, several need-based and region-specific technologies were recommended for integrated pest and disease management, growth regulation, eco-friendly disease control, intercropping systems, and nutrient-use efficiency.

1. Use of plant growth regulators for yield enhancement in fenugreek: The technology of foliar sprays of brassinosteroid (1.0 ppm) or benzyl adenine (20 ppm), twice, at 30 and 60 days after sowing in fenugreek, resulted in a 25–30% increase in seed yield and higher net returns of ₹15,000–17,000 per hectare. The technology is recommended for Rajasthan, Bihar, Haryana, and Uttar Pradesh.

2. Use of growth regulators to improve yield and quality in coriander: Foliar application of salicylic acid (50 ppm) at 30 and 60 days after sowing resulted in higher productivity and profitability and is recommended for Rajasthan, Madhya Pradesh, Chhattisgarh, Haryana, Tamil Nadu, and Andhra Pradesh.

3. Intercropping systems in ginger: Intercropping ginger with elephant foot yam (2:2) is recommended for Andhra Pradesh, Bihar, and West Bengal; ginger with maize (2:1 or 2:2) for Odisha, Nagaland, Himachal Pradesh, and Mizoram; ginger with French

bean (2:2) for West Bengal; and ginger with coriander, followed by leafy vegetables for Sikkim.

4. Application of plant growth-promoting rhizobacteria (*Bacillus safensis*) for phosphorus and zinc solubilization in ginger: The technology involves applying 75% of the recommended phosphorus, 50% zinc, and Bacillus safensis at planting, 30, and 60 days after planting. It is recommended for Kerala, Andhra Pradesh, West Bengal, Uttar Pradesh, Arunachal Pradesh, and Odisha.

5. Management of pollu beetle (Lanka ramkrishnai) in black pepper: Three rounds of insecticidal sprays using chlorantranili prole 18.5 % SC or flubendiamide 39.35% SC at 0.3 to 0.5 ml per litre of water during July, August, and September is recommended as technology for the management of pollu beetle in black pepper-growing regions of Kerala and Karnataka.

6. Management of powdery mildew in fenugreek: Management of powdery mildew in fenugreek was recommended through timely fungicidal sprays at the initial appearance of the disease, followed by a second spray after 15 days. Hexaconazole 5% SC (0.1%) was recommended for Gujarat, hexaconazole or tebuconazole (0.1%) for Rajasthan, and tebuconazole 25.9% EC (0.1%) for Madhya Pradesh, providing effective disease control and yield protection.

7. Eco-friendly management of cumin blight: Seed treatment followed by four foliar sprays of *Bacillus subtilis* 1.15 WP (40 g/10 L) combined with *Pseudomonas fluorescens* 1.15 WP (50 g/10 L), starting from 40 days after sowing, effectively managed the disease. The technology is recommended for Rajasthan and Gujarat.

These technologies collectively strengthen climate resilience, reduce dependency on chemical inputs, promote eco-friendly crop management, and enhance farm profitability across diverse spice-growing regions of the country.

Research Achievements (2024–25)

Black Pepper

A total of 454 black pepper germplasm accessions were conserved across six ICAR-AICRPS centres, with 43 new accessions added in 2024–25. During characterisation at Dapoli, accession DBSKKVPN-2 emerged as a promising donor with the highest spike number (88.0 vine^{-1}) and dry berry yield (0.542 kg vine^{-1}). At Panniyur, among 292 accessions maintained, PRS 116 recorded peak productivity (6.35 kg green berry yield, 2.20 kg dry berry yield, 1,545 spikes vine^{-1}), followed by PRS 124 (5.73 kg green, 2.08 kg dry, 1,465 spikes vine^{-1}); PRS 124 also recorded the highest dry recovery (36.30%), closely followed by PRS 137 (36.18%). In the CVT 2018 Series IX evaluated across six locations, Panniyur 1 remained the most stable and highest-yielding genotype (fresh berry yield 0.62 kg vine^{-1}, dry yield 0.20 kg vine^{-1}). HP 1117 × Thommankodi exhibited exceptional vigour and superior berry set (72.03 berries spike^{-1}) matching Panniyur 1 in dry berry yield (0.20 kg vine^{-1}), while Kurimalai showed desirable spike length (up to 19 cm) and SV 7 recorded the highest dry recovery (33.3%). Under crop protection, Chlorantraniliprole 18.5% SC achieved 99–100% reduction in pollu beetle (*Lanka ramakrishnai*) infestation at all tested doses, outperforming Quinalphos 25 EC (45–86% reduction), with complete crop safety confirmed even at double the recommended dose. The optimal dose (0.625 ml L^{-1}) recorded the highest fresh and dry berry yields (3.70 kg vine^{-1} and 2.07 kg vine^{-1}

respectively), representing yield increases of 52.3% and 59.2% over the untreated control.

Cardamom

A total of 290 accessions are maintained across Mudigere (93) and Pampadumpara (197) centres. At Pampadumpara, Accession 145 recorded the highest 100-capsule weight (116.67 g), Accession 3 the longest capsules (19.56 mm), Accession 101 the highest fresh yield (1,625.00 kg ha^{-1}) and capsule volume (108.33 mL per 100 capsules), and Accession 5 the highest dry yield (277.00 kg ha^{-1}); Accessions 1, 3, and 4 showed total resistance to Azhukal disease while Accessions 2, 4, and 11 demonstrated zero borer damage. In the CVT Series IX on small cardamom hybrids, MHC-2 emerged as the top performer (dry yield 1,324.2 kg ha^{-1} in Kerala, total mean yield 753.5 kg ha^{-1} across all centres), while (GG × NKE 19) × Bold achieved 892.4 kg ha^{-1} in Kerala and Bold × IC 547219 proved exceptionally adapted to Karnataka (518.0 kg ha^{-1}). Multi-location evaluation of thrips-tolerant lines identified IC 349606 as most promising (dry capsule yield 423.7 kg ha^{-1} at Appangala, low thrips infestation of 9.0, and capsule damage of 15.0% at Sakleshpur), while IC 349364 demonstrated the lowest thrips incidence (0.56 thrips per leaf sheath) at Myladumpara. In leaf blight tolerance trials, IC 547156 recorded the lowest mean PDI (10.5%) with dry capsule yield of 471.0 kg ha^{-1}, while national check Njallani Green Gold achieved the highest mean yield (580.9 kg ha^{-1}). Foliar application of the IISR cardamom micronutrient mixture surpassed the recommended fertilizer dose across all centres, and site-specific nutrient recommendations targeting higher yields (T_3 for 8 q ha^{-1} and T_4 for 10 q ha^{-1}) produced superior dry capsule yields (261.5 kg ha^{-1} and 244.4 kg ha^{-1} respectively) compared with standard practices (154.7 kg ha^{-1}).

Large Cardamom

A total of 61 germplasm accessions are conserved in field gene banks at Pangthang and Kabi, Sikkim. The landrace Uttarey Varlang (SCC-218) from West Sikkim showed notable tolerance to major diseases. In the CVT across Gangtok and Kalimpong, SCC-264 (Sawney) emerged as the most promising candidate with superior growth and minimal incidence of leaf caterpillar, shoot fly, and blight while remaining entirely free from shoot borer, dry rot, and viral diseases (chirkey and foorkey), followed by SCC-307 (Varlangey). Crop management experiments revealed that polysulphate (polyhalite) at 400 kg ha^{-1} in addition to the recommended organic package significantly enhanced plant productivity.

Ginger

Under genetic resource management, 449 indigenous ginger germplasm accessions were conserved across seven centres; at Barapani, IC-584361 recorded the highest fresh rhizome yield (15.28 t ha^{-1}), IC-584334 the highest oleoresin (6.05%), and IC-584344 the highest dry matter (21.7%). At Dholi, RG-57 and RG-36 recorded the highest yield (22.80 t ha^{-1}); at Kumarganj, NDG-23, NDG-28, and NDG-35 produced superior yields (24.37, 22.90, and 21.39 t ha^{-1} respectively); at Pottangi, S-62 was promising (20.40 t ha^{-1}); at Pundibari, GCP-58 and GCP-59 showed moderate resistance to rhizome rot and wilt (15–16% disease incidence) with GCP-58 yielding 13.50 t ha^{-1}; at Raigarh, IGS-14, IGS-11, and IGS-16 yielded 21.17, 20.17, and 18.33 t ha^{-1} respectively; and at Solan, fresh rhizome yield ranged from 10.99 to 36.14 t ha^{-1} (mean 21.90 t ha^{-1}), with SG19-11 highest (36.14 t ha^{-1}). In the bold ginger CVT, G2023-6 was the highest yielder (23.05 t ha^{-1}), while G2023-7 recorded the highest dry recovery (22.77%) and rhizome girth (3.34

cm). In the high essential oil trial, G2023-16 produced the highest mean yield (21.15 t ha^{-1}) and G2023-12 the highest essential oil content (3.83%). Among intercropping systems over three years, ginger + elephant foot yam (2:2) recorded the highest pooled ginger yield (15.48 t ha^{-1}) and BCR (2.46). Integration of 75% recommended phosphorus with *Bacillus safensis* recorded the highest pooled fresh rhizome yield (14.31 t ha^{-1}), exceeding 100% phosphorus treatment (13.25 t ha^{-1}) by 8.0%, while 50% recommended zinc with *Bacillus safensis* produced the highest pooled yield (12.77 t ha^{-1}), surpassing the full zinc dose (12.12 t ha^{-1}) by 5.4%. Chlorantraniliprole 18.5% SC and Spinosad 45% SC provided up to 100% shoot borer control without phytotoxic effects even at twice the recommended concentration.

Turmeric

During 2024–25, 1,659 germplasm accessions were maintained across eleven centres with 19 new collections added, increasing the national repository to 1,896 accessions. Key performers included IC-586755 (16.80 t ha^{-1}) and IC-586759 (5.75% curcumin) at Barapani; CL180 (658 g plant^{-1}) and CL9 (21.75% dry recovery) at Coimbatore; RH-414 (52.80 t ha^{-1}) surpassing check Rajendra Sonali (48.00 t ha^{-1}) at Dholi; JTS-605 (63.25 t ha^{-1}) at Kammarpally; IT-59 (46.80 t ha^{-1}) at Raigarh; and ST19-04 with the highest curcumin content (6.65%) at Solan. At Pundibari, 32 genotypes exceeded 35 t ha^{-1} with 62 genotypes resistant to leaf blotch and 65 resistant to leaf spot. In the first coordinated varietal trial on black turmeric, BT-162 recorded the highest yield (17.56 t ha^{-1}), followed by Acc. 751 (17.53 t ha^{-1}) and NBT-2 (16.87 t ha^{-1}), while NBT-1 recorded the highest dry recovery (19.25%) and oleoresin (4.73%) and Acc. 292 the highest essential oil content (2.20%). Integration of 75% recommended phosphorus with *Bacillus safensis* produced the highest pooled fresh rhizome yield (28.94 t ha^{-1}) versus 100% phosphorus (25.74 t ha^{-1}) across eleven centres, and 50% recommended zinc with *Bacillus safensis* recorded the highest pooled yield (28.70 t ha^{-1}) versus full zinc dose (27.90 t ha^{-1}) across 13 centres. Chlorantraniliprole 18.5% SC and Spinosad 45% SC provided 95–100% suppression of shoot borer (*Conogethes punctiferalis*), and Fluopyram 34.48 SC (0.5 ml L^{-1}) effectively suppressed root lesion nematode (*Pratylenchus* spp.) with the highest yields recorded at Coimbatore (39.17 t ha^{-1}), Guntur (43.47 t ha^{-1}), Kozhikode (27.90 t ha^{-1}), Kammarpally (27.90 t ha^{-1}), and Pundibari (29.40 t ha^{-1}).

Tree Spices

During 2024–25, 169 nutmeg, 26 clove, 23 cinnamon, and six cassia germplasm accessions were conserved. In nutmeg, MF-4 at Pechiparai recorded the highest fruit number (744.18 tree^{-1}), single fruit weight (64.13 g), and mace yield (357.19 g tree^{-1}), while long-term evaluation identified DBSKKV 9772 as best (dry nut yield 12.62 kg tree^{-1}, dry mace yield 2.85 kg tree^{-1}) and DBSKKV 65 produced the maximum nuts (842 tree^{-1}). In clove, SA-3 at Pechiparai recorded dry bud yield (2.09 kg tree^{-1}), nearly four times higher than the local check (0.56 kg tree^{-1}). In cinnamon, CV-5 recorded the highest dry bark yield (4.42 kg tree^{-1}) and dry leaf yield (18.08 kg). CVT evaluation identified Kochukudy as the most promising nutmeg variety with the highest pooled yield (152 nuts tree^{-1}) versus local check (33 nuts tree^{-1}) and 297 nuts tree^{-1} at Thrissur, with superior plant height (4.89 m), canopy spread (3.85 m), and branching (69.33). Independent evaluation at Thrissur identified Acc. 23 as the highest yielder (463 fruits tree^{-1}), Acc. 1

with maximum flowering (628 flowers tree^{-1}), Acc. 14 with the heaviest fruits (105.25 g fruit^{-1}), and Acc. 5 with the highest dry nut (9.23 g) and dry mace (2.58 g) weights, all surpassing national check IISR Viswasree.

Coriander

A total of 2,097 germplasm accessions were conserved with 29 new additions, 1,085 evaluated, and 70 promising lines identified. Superior germplasm for seed yield included CS-46 (9.20 g plant^{-1}) at Coimbatore, DH-328 (35.4 g plant^{-1}) at Hisar, and ICS-4 (2,101 kg ha^{-1}) at Raigarh. LCC-69, LCC-79, LCC-150, and LCC-169 were identified as resistant to Fusarium wilt. In the CVT Series XII across 15 centres, COR-207 recorded the highest pooled seed yield (1,586 kg ha^{-1}) against a trial mean of 1,425 kg ha^{-1}, followed by COR-220 (1,509 kg ha^{-1}) and COR-215 (1,503 kg ha^{-1}). In the first-year leafy coriander CVT across 10 centres, LCOR-15 recorded the highest biomass yield (2,713.02 kg ha^{-1}). Quality evaluation showed pooled volatile oil content ranging from 0.26–0.46%, with COR-221 topping (0.46%). Two foliar sprays of the crop-specific micronutrient formulation recorded the highest pooled seed yield (1,436.1 kg ha^{-1}), a 19.5% increase over the control (1,201.4 kg ha^{-1}). Three-year pooled studies confirmed that 100% recommended phosphorus produced the highest seed yield (18.69 q ha^{-1}), though 75% phosphorus (18.08 q ha^{-1}) performed comparably, indicating a 25% phosphorus-saving potential. The plant growth regulator study identified benzyl adenine @ 20 ppm as the highest yielding treatment (15.4 q ha^{-1}) versus untreated control (12.8 q ha^{-1}), and foliar application of salicylic acid @ 50 ppm, jasmonic acid @ 50 ppm, benzyl adenine @ 10 ppm, or brassinosteroid @ 0.50 ppm at 30 and 60 DAS was recommended for enhancing coriander productivity.

Cumin

A total of 928 cumin germplasm accessions (911 indigenous, 10 exotic, seven additional exotic) were conserved across participating centres. At Jobner, UC-233 (21.0 g/5 plants) surpassed the best check GC-4 (16.0 g/5 plants). In the first-year CVT, CUM-66 recorded the highest pooled seed yield (533 kg ha^{-1}), followed by CUM-67 (517 kg ha^{-1}) and CUM-57 (473 kg ha^{-1}) against an overall trial mean of 402 kg ha^{-1}; CUM-67 was the most wilt-tolerant (PDI = 41) and CUM-63 had the lowest blight incidence (PDI = 26). In micronutrient management, two foliar sprays produced the highest mean seed yield (923.3 kg ha^{-1}) and BC ratio (2.89) compared with the control (777.1 kg ha^{-1}; B:C 2.47). The three-year multilocation eco-friendly blight management trial established Kresoxim-methyl 44.3 SC @ 0.044% (three foliar sprays) as recording the lowest pooled blight severity (13.51% PDI) versus untreated control (55.64% PDI). The integrated biological management approach using *Bacillus subtilis* and *Pseudomonas fluorescens* also provided effective disease suppression (20.71% PDI) and was approved at the 36th AGM as the recommended eco-friendly technology for Rajasthan and Gujarat. Weather-based disease prediction studies demonstrated that early November sowing experienced the highest blight severity (>80% PDI), with disease progression closely associated with high relative humidity (>75%) and minimum temperatures of 10–14°C.

Fennel

A total of 1,301 fennel germplasm accessions were conserved with 29 new additions and 741 evaluated. Superior high-yielding germplasm included RF-02 (98.83 g plant^{-1}) at Dholi, HF-178 (37.6 g plant^{-1}) at Hisar, NDF-52 (70.12 g plant^{-1}) at Kumarganj, and at Jobner, UF-131 (119.0 g) and UF-80 (107.0 g) emerged as the best among 205 evaluated accessions. In the first-year CVT across nine centres with 14 entries, seed yield ranged from 1,243 to 1,627 kg ha^{-1} against an overall mean of 1,415 kg ha^{-1}; FNL-152 recorded the highest pooled seed yield (1,627 kg ha^{-1}), followed by FNL-145 (1,599 kg ha^{-1}) and FNL-146 (1,530 kg ha^{-1}). Quality evaluation showed volatile oil content ranging from 1.84 to 2.46% (overall mean 2.05%), with FNL-151 recording the highest (2.46%) followed by FNL-143 (2.42%).

Fenugreek

A total of 1,240 germplasm accessions were conserved across seven centres with 34 new additions. Superior accessions included HM-525 (35.6 g plant^{-1}) at Hisar, UM-246 (93.0 g per five plants) at Jobner, and IFGS-11 (2,613.7 kg ha^{-1}) at Raigarh. In the first-year CVT across 11 locations with 16 entries, pooled seed yield ranged from 1,511 to 1,849 kg ha^{-1}; FGK-162 emerged as the highest yielder (1,849 kg ha^{-1}), followed by FGK-170 (1,846 kg ha^{-1}) and FGK-160 (1,834 kg ha^{-1}). Application of 75% recommended phosphorus with AMF achieved the highest pooled seed yield (1,849 kg ha^{-1}) and BC ratio (3.14), comparable to 100% phosphorus, while Brassinosteroid @ 1.0 ppm produced the highest pooled seed yield (1,768 kg ha^{-1}), approximately 30.7% higher than the control. Benzyl adenine @ 20 ppm recorded the highest profitability (B:C ratio 2.59), leading to the ICAR-AICRP recommendation for two foliar sprays in Rajasthan, Haryana, Bihar, and Uttar Pradesh. In crop protection, Tebuconazole 25.9% EC @ 0.1% recorded the lowest powdery mildew severity (16.77 PDI) with 56.5–63.0% disease reduction, while the SAU recommended practice produced the highest pooled seed yield (15.18 q ha^{-1}), representing 32.5–39.1% higher yield than the untreated control. Hexaconazole and Propiconazole residues remained below the limit of quantification (<0.02 mg kg^{-1}), ensuring food safety.

Ajwain

A total of 540 germplasm accessions were conserved across eight ICAR-AICRPS centres with five new additions and 529 accessions evaluated. In the CVT 2022 Series, HAJ-38 recorded the highest mean seed yield (1,225 kg ha^{-1}), followed by AA-24 (1,215 kg ha^{-1}), HAJ-7 (1,193 kg ha^{-1}), JA-19-05 (1,184 kg ha^{-1}), AA-45 (1,153 kg ha^{-1}), and AA-16 (1,141 kg ha^{-1}), all outperforming national check AA-2 (1,026 kg ha^{-1}) by more than 10%. Three promising varieties were identified for release: Gujarat Ajwain-4 (1,136 kg ha^{-1}, 10.72% higher than AA-2; early maturity 155–166 days; test weight 1.72 g; volatile oil 4.18%) for Rajasthan, Gujarat, Andhra Pradesh, Haryana, and Chhattisgarh; Hisar Ajwain-7 (1,193 kg ha^{-1}, 16.2% higher than AA-2; essential oil 4.96%; root rot tolerance 9.99%) for Rajasthan, Gujarat, and Haryana; and Ajmer Ajwain-24 (1,216 kg ha^{-1}, 19.7% higher than AA-2; 323 umbels plant^{-1}; 380 seeds umbel^{-1}; essential oil 4.96%; thymol 49.47%; root rot tolerance 8.86%) for Rajasthan.

Nigella

A total of 129 germplasm accessions were conserved across five centres with 27 unique collections registered. In the first-year CVT Series II–2024 across six locations, pooled mean yields ranged from 8.00 to 9.83 q ha^{-1}; NGL-11 emerged as the highest yielder (9.83

q ha^{-1}), followed by NGL-13 (9.41 q ha^{-1}) and NGL-14 (9.35 q ha^{-1}). For root rot management, soil drenching with Azoxystrobin (20%) + Difenoconazole (12.5%) SC @ 0.2% recorded the lowest disease incidence (10.2%) and highest seed yield (8.5 q ha^{-1}), while *Trichoderma viride* treatment also reduced disease incidence (13.8%) compared with the untreated control (23.4%) while improving productivity (7.7 vs. 5.8 q ha^{-1}).

Saffron

At the Pampore centre, 211 germplasm lines (198 indigenous and 13 exotic) were maintained and 208 accessions systematically evaluated. Accession SRS-Saf-156 emerged as superior with enhanced corm development, higher saffron yield, elevated apocarotenoid content, and moderate resistance to corm rot. Under AVT-II with 11 elite accessions, SRS-Saf-178 produced the highest flower density (86 flowers m^{-2}) and saffron yield (590.82 mg m^{-2}), while SRS-Saf-199 recorded the maximum stigma length (4.76 cm).

Kalazeera

The Kalazeera programme at Pampore maintained 98 germplasm lines, with the addition of 25 new accessions (17 seed-based and 8 tuber-based) from high-altitude regions of Himachal Pradesh, expanding the repository to 123 accessions. SRS-KZ-120, SRS-KZ-108, and SRS-KZ-131 were identified as superior genotypes with higher essential oil content, heat stress tolerance, moderate resistance to tuber rot, and extended tuber longevity. Multi-location trials (MLT) across Ladhoo, Chotipora, and Khansahib established the superiority of SRS-KZ-177, which recorded a mean seed yield of 366.67 kg ha^{-1}, representing a 19.96% yield advantage over the natural population (305.67 kg ha^{-1}).

Production and distribution of quality planting material

The ICAR-AICRP on Spices centres produced and distributed 3.81 lakhs rooted cuttings of black pepper along with 5,538 bush pepper plants and 10,450 small cardamom seedlings, along with 5,263 small cardamom suckers. A total of 30.1 tonnes of ginger and 107.35 tonnes of turmeric rhizomes were produced, besides quality pro-tray seedlings of both crops. Also, centres produced and distributed 2.5 quintals of mango ginger rhizomes. In seed spices, 64.15 t of coriander seed, 4.6 t of cumin seed, 4.7 t of fennel seed, 6.25 q of fenugreek seed, 5.32 q of ajwain seed, and 5 kg of kalazeera seed along with 2,000 kalazeera tubers. In addition, 19,578 tree spice seedlings and 4,700 grafts were raised and supplied to support quality planting material production across different spice crops.

Monitoring

During the year 2025, the progress of research activities under the ICAR-AICRPS was closely monitored by the Project Coordinator and scientists of the PC Unit through field visits, online review meetings, periodic progress reports, and regular communication to ensure effective implementation of research programmes across centres. Monitoring visits were undertaken by Dr. D. Prasath (PC) to the centres at Navsari, Sanand, and Jagudan (January); HC&RI, TNAU, Coimbatore (February); Rajahmundry, Chintapalli, and Pottangi (June); and Myladumpara and Pampadumpara (July, along with Dr. Mukesh Sankar) to review ongoing trials and provide technical guidance. During February–March 2025, Mr. Nafid C., Young Professional-I, visited the NEH Centre at SASRD, Nagaland University, Medziphema, to monitor CVT trials, frontline demonstrations, and training

programmes. A Seed Spices Monitoring Committee, constituted under the chairmanship of the Director, ICAR-NRC on Seed Spices, Ajmer, with representatives from ICAR-AICRP on Spices and collaborating institutes, periodically reviewed ongoing research trials, experimental records and centre activities. In addition, online review meetings were conducted throughout the year to assess trial progress, financial status, and research planning, facilitating timely feedback and adherence to project objectives. The monitoring process was further strengthened through the XXXVI Annual Group Meeting of ICAR-AICRP on Spices, held during 29–31 October 2025 at the ICAR Research Complex for NEH Region, Barapani, Meghalaya, which provided a platform for scientific review, inter-centre coordination, and planning of future research priorities.

Flagship Programmes

During 2025–26, the ICAR-AICRP on Spices implemented Scheduled Caste Sub Plan (SCSP) and Tribal Sub Plan (TSP) programmes across major spice-growing regions, benefiting over 1,900 SC and ST farmers through capacity building, frontline demonstrations, quality planting material distribution and input support. More than 30 training programmes were organized, while over 49,000 quality planting materials, including 28,000 black pepper rooted cuttings, 2,700 cinnamon seedlings, 1,000 vanilla plants, 2,400 kg of ginger and turmeric seed materials, and improved seed spices, along with bio-inputs, plant protection chemicals and farm implements, were distributed to promote scientific and sustainable spice cultivation. Technology interventions resulted in about 10% yield improvement in fennel and fenugreek at Jobner, 18–25% increase in spice yields with 29% higher annual farm income among tribal farmers at Pampadumpara, and 25–35% yield enhancement with nearly 55% increase in annual income among Scheduled Caste farmers in Idukki district. Farmer Producer Organizations (FPOs/FPCs) were actively involved in turmeric value addition, while demonstrations on organic cultivation, nursery management, post-harvest handling and integrated crop management strengthened adoption of improved technologies. These flagship programmes substantially enhanced livelihood opportunities, entrepreneurship and sustainable spice production among socially disadvantaged farming communities across the country.

Promotion of Spice Cultivation in the North Eastern and Himalayan (NEH) Region

During 2025–26, the ICAR-AICRP on Spices strengthened the dissemination of improved spice production technologies across the North Eastern and Himalayan (NEH) region through training, frontline demonstrations, quality planting material distribution and input support, reaching over 250 farmers directly and many more through village-level extension programmes. Demonstrations of improved technologies recorded 25–30% higher turmeric yield with Megha Turmeric-1 over the local Lakadong variety in Meghalaya, up to 36% higher ginger yield and 41.1% higher turmeric yield in Sikkim, highlighting the productivity gains achievable through scientific cultivation. Centres at Barapani, Mizoram, Nagaland, Pasighat, Kahikuchi, Sikkim and Gangtok organized programmes on organic production, rhizome priming, pro-tray seedling technology, nursery management, post-harvest handling, bio-pesticides, vermicomposting, entrepreneurship development and value addition, while distributing quality planting

materials, agricultural implements and critical production inputs. In addition, 1,400 black pepper cuttings were supplied in aspirational districts of Assam to strengthen spice-based farming systems. These interventions substantially enhanced technology adoption, improved access to quality planting materials, strengthened farmers' technical capacity and promoted sustainable livelihood opportunities in the NEH region.

Technology Popularization

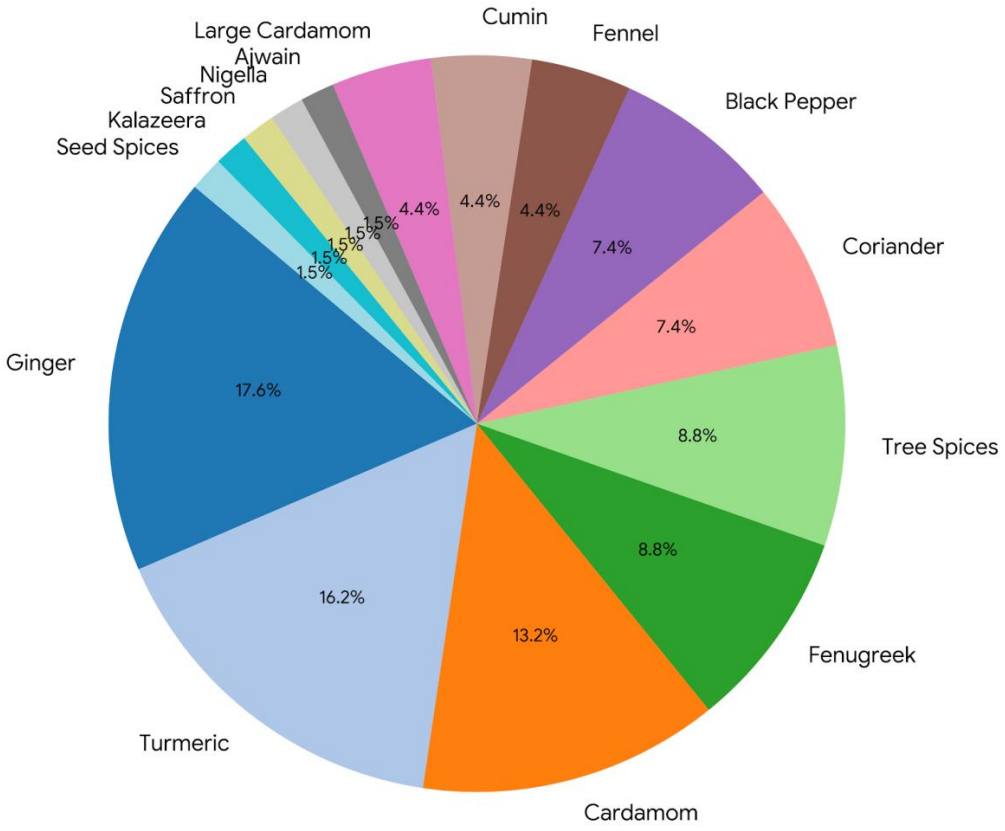
During 2025–26, scientists of the ICAR-AICRP on Spices actively popularized improved spice production technologies through field demonstrations, farmers' trainings (83 programmes), Krishi Melas and exhibitions (11 events), besides radio talks, television programmes, online programmes, and other extension activities, ensuring effective last-mile delivery of research outputs to the farming community. Demonstrations on high-yielding varieties, improved crop production, rapid multiplication of planting materials, integrated disease and pest management, organic cultivation, post-harvest management and value addition facilitated the adoption of location-specific technologies in farmers fields across the country. The technologies were further showcased through 11 Krishi Melas and exhibitions, attracting over 23,000 farmers, farm women, entrepreneurs and other stakeholders, where improved varieties, production technologies and quality planting materials were displayed. Scientists also served as resource persons in numerous capacity-building programmes and strengthened outreach through print and electronic media, extending scientific recommendations to a much wider farming community. These coordinated extension initiatives substantially enhanced farmers' awareness, technology adoption, entrepreneurial skills and sustainable spice production, thereby reinforcing the grassroots impact of the ICAR-AICRP on Spices.

Success Stories

ICAR-AICRP on Spices technologies demonstrated significant on-ground impact by enhancing productivity, profitability and livelihood security across diverse agro-ecological regions through improved varieties, integrated crop management and capacity building. Scientific interventions resulted in 25–30% higher turmeric yield with Megha Turmeric-1 in Meghalaya, more than 90% recovery of ginger seed rhizomes using improved storage technology in Himachal Pradesh, 23% higher black pepper yield and 56% increase in net income at Yercaud, 30% increase in annual income through scientific pepper cultivation at Pechiparai, and over ₹4 lakh annual income from black pepper-based agroforestry in Koraput. Adoption of improved technologies also led to successful management of Quick Wilt in black pepper, rapid dissemination of climate-resilient and high-yielding varieties such as GNT-3, Amravanti, and Dr. YSRHU–LAM Varsha (adopted on about 100 acres), besides promoting profitable integrated cropping systems in arecanut–black pepper and tribal farming landscapes. The Tribal Livelihood Programme at Chintapalli alone reached nearly 10,000 tribal households, with about 3,000 farmers trained and supported through demonstrations, quality planting materials and farm mechanization, substantially improving technology adoption and livelihood resilience. These success stories clearly demonstrate the transformative role of ICAR-AICRP on Spices in translating research into scalable field-level technologies that improve farm productivity, income and sustainability across the country.

PROFILE OF AICRP ON SPICES

ICAR-All India Coordinated Research Project on Spices (ICAR-AICRPS) is the largest spices research network in the country through which a nationwide collaborative and interdisciplinary research is being carried out, linking ICAR system with the State Agricultural Universities and central institutions. ICAR-AICRPS was initiated in 1971 as All India Spices and Cashew nut Improvement Project (AISCIP). In 1986 it has become a full-fledged coordinating unit for spices (major spices and seed spices) with its headquarters at Indian Institute of Spices Research, Kozhikode, Kerala. In VII plan (1986) it was having 12 centres and subsequently grew into 19 regular centres by the end of VIII Plan. ICAR-AICRPS is working on 17 mandate crops viz., black pepper, small cardamom, large cardamom, ginger, turmeric, nutmeg, cinnamon, clove, coriander, cumin, fennel, fenugreek, ajwain, nigella, saffron, kalazeera and mango ginger. Presently the network has 40 centres including 19 Regular centres and 19 voluntary centres and two project mode centres representing the major agro climatic regions of the country. These centres are mostly located in State Agricultural Universities and some centres in ICAR Institutes and also Spices Board. In addition to this, there are two centres functioning under project mode funding.



Number of ongoing AICRP on Spices experiments-crop wise

Mandates of the ICAR-AICRPS are:

- Evolving high yielding, high quality varieties suitable for various agro-ecological situations and that are tolerant/ resistant to biotic and abiotic stresses to mitigate climate change.

- Development of location specific green agro technologies for improved production with water and nutrient management, organic farming, ecologically sound control measures against pests and diseases through mechanisation for production of clean spices and spiceproducts.

- Facilitate faster adoption of proven technologies/varieties developed through technology dissemination, Field Level Demonstrations (FLDs) and attract youth to agriculture and agro enterprise.

- Working as an interface between State Agricultural Universities (SAUs) and Indian Council of Agricultural Research (ICAR).

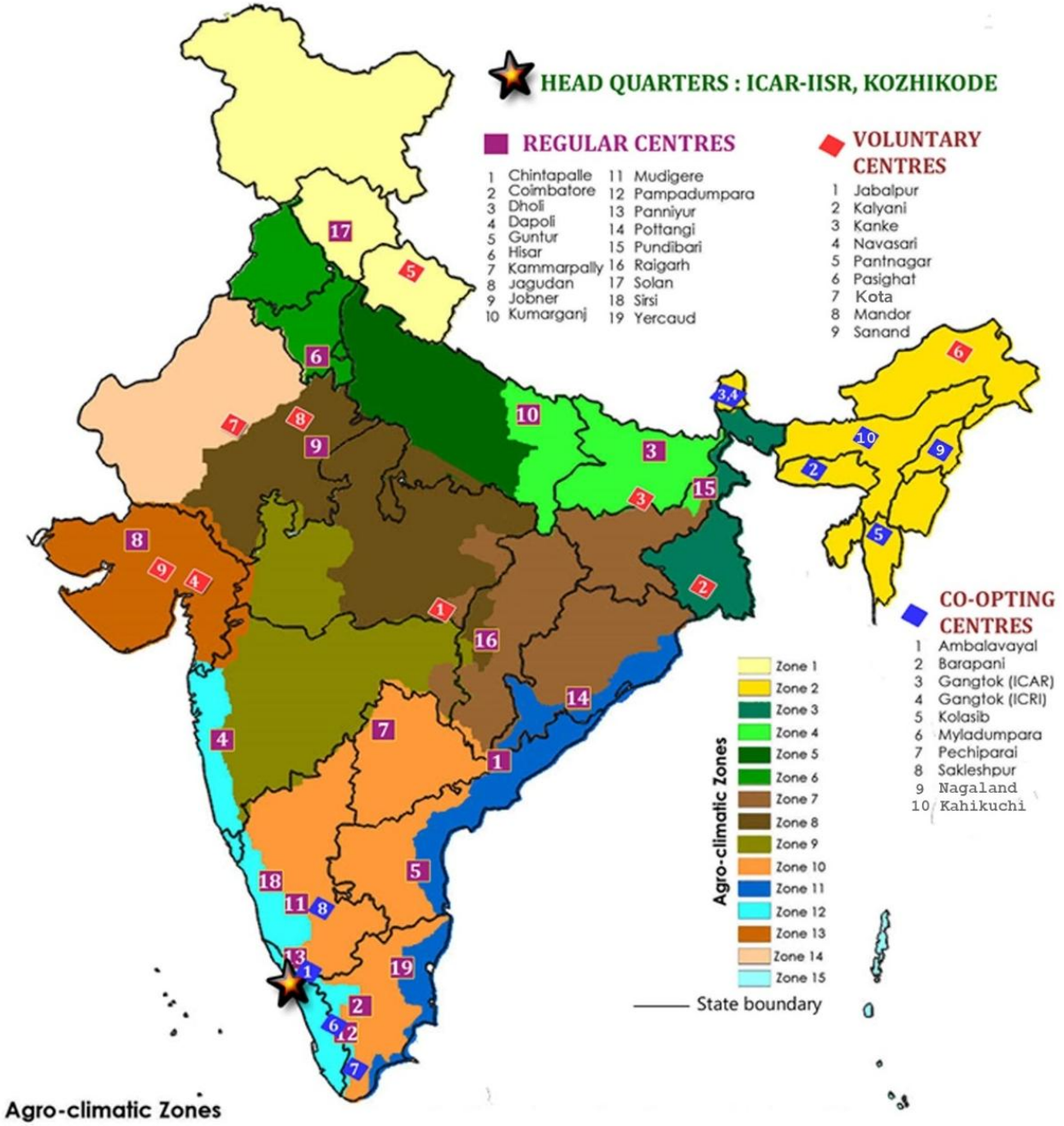
- Spread the cultivation of spices to non-traditional areas, North East and tribal areas for increased production, tribal empowerment and identification of most suitable areas (cropmapping) for each of the crop.

S. No.	State	University / Institution	Centre	Year	Crops handled
Regular Centres					
1	Andhra Pradesh	Dr YSRHU	Chintapalle	1981	Black pepper, Ginger, Turmeric
2	Andhra Pradesh	Dr YSRHU	Guntur	1975	Coriander, Fennel, Fenugreek, Ajwain
3	Bihar	RAU	Dholi	1993	Turmeric, Coriander, Fenugreek
4	Chhattisgarh	IGKV	Raigarh	1996	Coriander, Turmeric, Ginger, Ajwain, Nigella
5	Gujarat	SKDAU	Jagudan	1975	Cumin, Coriander, Fennel, Fenugreek, Ajwain
6	Haryana	CCSHAU	Hisar	1993	Coriander, Fennel, Fenugreek, Ajwain, Nigella
7	Himachal Pradesh	YSPUHF	Solan	1971	Ginger, Turmeric
8	Karnataka	UAHS	Mudigere	1971	Cardamom, Black pepper
9	Karnataka	UHS	Sirsi	1981	Black pepper, Turmeric, Ginger
10	Kerala	KAU	Panniyur	1971	Black pepper
11	Kerala	KAU	Pampadumpara	1971	Black pepper, Cardamom
12	Maharashtra	BSKKV	Dapoli	1995	Black pepper, Nutmeg, Clove, Cinnamon
13	Odisha	OUAT	Pottangi	1975	Turmeric, Ginger
14	Rajasthan	SKNAU	Jobner	1975	Cumin, Coriander, Fennel, Fenugreek, Ajwain
15	Telangana	SKLTSHU	Kamarpally	1986	Turmeric
16	Tamil Nadu	TNAU	Coimbatore	1975	Coriander, Fenugreek, Turmeric

17	Tamil Nadu	TNAU	Yercaud	1981	Clove, Nutmeg, Cinnamon, Black pepper
18	Uttar Pradesh	NDUAT	Kumarganj	1995	Turmeric, Ginger, Fennel, Coriander, Fenugreek, Ajwain, Nigella
19	West Bengal	UBKV	Pundibari	1996	Black pepper, Turmeric, Ginger
Voluntary Centres					
1	Assam	AAU	Kahikuchi	2014	Black pepper, Turmeric
2	Karnataka	ICRI	Sakaleshapura	2008	Cardamom
3	Kerala	KAU	Ambalavayal	2008	Black pepper, Ginger, Turmeric,
4	Kerala	ICRI	Myladumpara	2008	Cardamom
5	Meghalaya	ICAR RC NEHR	Barapani	2008	Ginger, Turmeric
6	Mizoram	ICAR RC NEHR	Mizoram	2008	Ginger, Turmeric
7	Nagaland	SASRD	Medziphema	2014	Black pepper, Ginger, Turmeric
8	Sikkim	ICRI	Gangtok	2008	Large cardamom
9	Sikkim	ICAR RC NEHR	Gangtok	2008	Large cardamom, Ginger, Turmeric
10	Tamil Nadu	TNAU	Pechiparai	2008	Black pepper, Cinnamon, Clove, Nutmeg
11	Arunachal Pradesh	CAU	Pasighat	2008	Large cardamom, Ginger, Turmeric
12	Gujarat	NAU	Navasari	2008	Black pepper, Turmeric, Coriander
13	Gujarat	AAU	Sanand	2014	Cumin
14	Jharkhand	BIRSA AU	Kanke	2008	Ginger, Turmeric
15	Madhya Pradesh	JNKVV	Jabalpur	2008	Coriander, Fennel, Fenugreek
16	Rajasthan	AUK	Kota	2008	Coriander, Cumin, Fennel, Fenugreek, Nigella
17	Rajasthan	AUJ	Mandor	2014	Cumin
18	Uttarakhand	GBPUA&T	Pantnagar	2008	Turmeric, Coriander, Fennel, Fenugreek, Nigella
19	West Bengal	BCKV	Kalyani	2008	Ginger, Turmeric, Nigella
Project Mode Centres					
1	Jammu & Kashmir	SKUAST	Pampore	2019	Saffron, Kalazeera
2	Kerala	KAU	Vellanikkara	2014	Nutmeg

Agro-climatic zones in India

CENTRES OF AICRP ON SPICES



Agro-climatic Zones

Zone 1 – W. Himalayan region
Zone 2- E. Himalayan region
Zone 3- L. Gangetic plain region
Zone 4- M. Gangetic plain region
Zone 5- U. Gangetic plain region
Zone 6- T. Gangetic plain region
Zone7-E.plateau and hills region
Zone8- C. Plateau and hills region
Zone9- W.Plateau hills region
Zone 10- S. plateau and hills region
Zone 11- E. coast plains and hills region
Zone 12- W.coast plains and ghat region
Zone 13- Gujarat plains and hills region
Zone14- Western dry region
Zone15- Island region

TECHNICAL PROGRAM 2025

Project Code	Title	Centres
Black Pepper		
PEP/CI/1	Genetic Resources	
PEP/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Dapoli, Panniyur, Pundibari, Sirsi, Yercaud
PEP/CI/3	Coordinated Varietal Trial (CVT)	
PEP/CI/3.5	CVT 2018 on black pepper - Series IX	Chintapalli, Dapoli, Kozhikode, Panniyur, Sirsi, Yercaud
PEP/CM/4	Nutrient Management Trial	
PEP/CM/3.4	Effect of Arbuscular Mycorrhizal (*Rhizophagus irregularis)* fungi on growth and yield of black pepper	Dapoli, Kahikuchi, Kozhikode, Panniyur, Sirsi, Yercaud
PEP/CP/5	Pest and Disease Management Trial	
PEP/CP/7.2	Evaluation of effective insecticides against against pollu beetle, *Lanka ramakrishnai* infesting black pepper for label claim expansion.	Appangala, Kozhikode, Panniyur
Cardamom		
CAR/CI/1	Genetic Resources	
CAR/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Mudigere, Pampadumpara
CAR/CI/3	Coordinated Varietal Trial	
CAR/CI/3.9	CVT 2018 on hybrids of cardamom-Series IX	Appangala, Mudigere, Myladumpara, Pampadumpara, Sakaleshpura
CAR/CI/2.1	CVT on small cardamom 2024 Series XII	Appangala, Mudigere, Myladumpara, Pampadumpara
CAR/CI/4	Varietal Evaluation Trial (VET)	
CAR/CI/4.4	Multi-location evaluation of thrips-tolerant cardamom lines	Appangala, Mudigere, Myladumpara, Pampadumpara, Sakleshapura
CAR/CI/4.5	MLT on leaf blight tolerant lines of small cardamom 2018 Series	Appangala, Mudigere, Myladumpara, Pampadumpara, Sakleshapura
CAR/CM/5	Nutrient Management Trial	
CAR/CM/5.5	Effect of micronutrients on growth and yield of small cardamom	Appangala, Mudigere, Myladumpara, Pampadumpara, Sakleshpur
CAR/CM/5.6	Site-specific recommendations for varying yield targets of cardamom.	Mudigere, Myladumpara, Pampadumpara, Sakleshpur
CAR/CP/6	Pest and Disease Management Trial	
CAR/CP/2.1	Efficacy of combined application of *Heterorhabditis indica* (EPF) against root grubs (*Basilepta fulvicorne*) and *Meloidogyne* sp. nematodes in small cardamom	Appangala, Myladumpara, Pampadumpara
Large Cardamom		
LCA/CI/1	Genetic resources	
LCA/CI/1.1	Germplasm collection and evaluation of large cardamom	ICAR Regional Station, Gangtok, ICRI Regional Research Station, Gangtok
LCA/CI/2	Coordinated Varietal Trial	

LCA/CI/2.1	CVT on large cardamom 2023 – Series I	ICAR Regional Station, Gangtok, ICRI Regional Research Station, Gangtok, RRS, UBKV, Kalimpong
LCA/CM/5	Nutrient Management Trial	
LCA/CM/2.1	Assessment of effect of Polysulphate Dehydrite Polyhalite) on Yield and Quality Parameters of Large Cardamom (*Amomum subulatum* Roxb.).	ICAR Gangtok, ICRI Gangtok
Ginger		
GIN/CI/1	Genetic Resources	
GIN/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Barapani, Dholi, Kumarganj, Pottangi, Pundibari, Raigarh, Solan
GIN/CI/2	Coordinated Varietal Trial (CVT)	
GIN/CI/2.5	Coordinated Varietal Trial (CVT) on disease tolerance trial in ginger	Barapani,Chintapalle, Kozhikode, Nagaland, Pottangi, Pundibari, Gangtok, Raigarh)
GIN/CI/2.6	CVT on bold ginger trial Series-2023.	Appangala, Kozhikode, Pottangi, Raigarh, Sikkim
GIN/CI/2.7	CVT on high essential oil ginger genotypes	Appangala, Kozhikode, Nagaland, Pottangi, Umiam
GIN/CM/4	Nutrient Management Trial	
GIN/CM/4.1	Evaluation of different ginger-based intercropping systems for higher yield and income	Chintapalle, Dholi, ICAR Gangtok, Kanke, Kalyani, Mizoram, Nagaland, Pottangi, Pundibari, Solan.
GIN/CM/5.1	Evaluation of Plant Growth Promoting Rhizobacteria, *Bacillus safensis* for Phosphorus (P) Solubilization Potential in ginger	Ambalavayal, Chintapalli, Kalyani, Kammarpally, Kumarganj, Pasighat, Pottangi, Pundibari, Raigarh,
GIN/CM/5.2	Evaluation of Plant Growth Promoting Rhizobacteria, *Bacillus safensis* for zinc (Zn) solubilization potential in ginger	Chintapalli, Kalyani, Kammarpally, Kumarganj, Pasighat, Pottangi, Raigarh,
GIN/CP/6	Disease Management Trial	
GIN/CP/4.1	Evaluation of consortia (*B. safensis, B. amyloliquefaciens, Raoultella terrigena, & Acinetobacer sp*.) for growth promotion and rhizome rot suppression in ginger	Kozhikode, Pundibari, Raigarh, Solan
GIN/CP/7.3	Evaluation of effective insecticides against shoot borer, *Conogethes punctiferalis* infesting ginger for label claim expansion	Ambalavayal, Appangala, Kozhikode, Mudigere, Raigarh
Turmeric		
TUR/CI/1	Genetic Resources	
TUR/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Barapani, Coimbatore, Dholi, Guntur, Kammarpally, Kumarganj, Pasighat, Pottangi, Pundibari, Raigarh, Solan
TUR/CI/1.2	Evaluation of turmeric somaclones and seedling progenies for superior agronomic traits & regional adaptation-Series I	Coimbatore, Guntur
TUR/CI/2	Coordinated Varietal Trial (CVT)	

TUR/CI/2.11	CVT on black turmeric *Curcuma caesia*	Barapani, Coimbatore, Kozhikode, Kumarganj, Mizoram, Navsari, Pottangi, Pundibari
TUR/CM/4	Nutrient Management Trial	
TUR/CM/5.1	Evaluation of Plant Growth Promoting Rhizobacteria, *Bacillus safensis* for phosphorus (P) solubilization potential in turmeric	Chintapalle, Coimbatore, Kahikuchi, Kalyani, Kammarpally, Kozhikode, Pasighat, Pottangi, Pundibari, Raigarh, Solan
TUR/CM/5.2	Evaluation of Plant Growth Promoting Rhizobacteria, *Bacillus safensis* for zinc (Zn) solubilization potential in turmeric	Chintapalle, Coimbatore, Dholi, Kahikuchi, Kalyani, Kammarpally, Kanke, Kozhikode, Kumarganj, Pasighat, Pottangi, Pundibari, Raigarh
TUR/CP/7	Disease Management Trial	
TUR/CP/4.1	Evaluation of consortia *(B. safensis, B. amyloliquefaciens, Raoultella terrigena, & Acinetobacer sp.)* for growth promotion and rhizome rot suppression in turmeric	Coimbatore, Guntur, Kammarpally, Kozhikode
TUR/CP/7.1	Evaluation of effective insecticides against shoot borer, *Conogethes punctiferalis* infesting turmeric for label claim expansion	Appangala, Coimbatore, Guntur, Kammarpally, Kozhikode
TUR/CP/7.2	Assessment of nematicide for the management of root lesion nematodes (*Pratylenchus spp.),* infecting turmeric	Coimbatore, Guntur, Kammarapally, Kozhikode, Pundibari
Tree Spices		
TSP/CI/1	Genetic Resources	
TSP/CI/1.1	Germplasm collection, characterization, evaluation and conservation of clove, nutmeg and cinnamon	Dapoli, Pechiparai
TSP/CI/2	Coordinated Varietal Trial (CVT)	
TSP/CI/2.4	Coordinated Varietal Trial on farmer's varieties of nutmeg	Dapoli, Pechiparai, Thrissur
TSP/CI/2.5	Coordinated Varietal Trial on nutmeg-2023 Series	Dapoli, Kozhikode, Pechiparai and Thrissur
TSP/CI/5.1 (Project mode)	Evaluation of nutmeg genotypes	KAU Thrissur
TSP/CM/4	Nutrient Management trial	
TSP/CM/5.1	Site-specific nutrient management in nutmeg (*Myristica fragrans*)	Vellanikkara, Kozhikode, Dapoli and Coimbatore
Coriander		
COR/CI/1	Genetic resources	
COR/CI/1.1	Germplasm collection, description, characterization, evaluation, conservation and screening against diseases	Coimbatore, Dholi, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh
COR/CI/2	Coordinated Varietal Trial (CVT)	
COR/CI/2.1	Coordinated varietal trial on coriander–2024- Series XII	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Navsari, Pantnagar, Kota, Raigarh, Kalyani, Sanand
COR/CI/2.2	Coordinated Varietal Trial on Coriander (leaf purpose) 2024- Series XII (I year)	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jobner, Kumarganj, Navsari, Pantnagar, Sanand
COR/CI/4.1	Quality evaluation in coriander	Ajmer , Coimbatore ,Jobner, Jagudan
COR/CM/4	Nutrient Management Trial	

COR/CM/2.3	Crop specific micronutrient formulation for coriander	Ajmer, Coimbatore, Guntur, Hisar, Jagudan, Jobner
COR/CM/5.1	Growth and yield of coriander as influenced by AMF (Arbuscular Mycorrhizal Fungi)	Ajmer, Coimbatore, Dholi, Guntur, Jabalpur, Kota
COR/CM/6.1	Effect of growth regulators on yield and quality of coriander	Coimbatore, Guntur, Hisar, Jabalpur, Jobner, Kota, Raigarh
Cumin		
CUM/CI/1	Genetic resources	
CUM/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Jagudan, Jobner, Mandor, Sanand
CUM/CI/2	Coordinated Varietal Trial (CVT)	
CUM/CI/2.5	Coordinated Varietal Trial on cumin Series – 2024	Ajmer, Jagudan, Jobner, Mandore, Sanand
CUM/CM/5	Nutrient Management Trial	
CUM/CM/2.1	Standardization of plant density and sowing time for cumin genotype CZC 94	Ajmer, Mandore, Jagudan, Jobner,, Sanand,
CUM/CM/3.4	Crop specific micronutrient formulation for cumin	Ajmer, Mandore, Jagudan, Jobner, Sanand
CUM/CP/6	Disease Management Trial	
CUM/CP/7.1	Eco-friendly management of cumin blight	Jaugdan, Jobner, Mandor
CUM/CP/7.2	Assessment of cumin blight (*Alternaria burnsii)* disease for weather-based prediction model	Ajmer, Mandor, Jagudan, Jobner, Sanand.
Fennel		
FNL/CI/1	Genetic resources	
FNL/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Dholi, Hisar, Jagudan, Jobner, Kumarganj
FNL/CI/2	Coordinated Varietal Trial (CVT)	
FNL/CI/2.8	Coordinated varietal trial on fennel–2024 Series XII	Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Pantnagar, Navsari
Fenugreek		
FGK/CI/1	Genetic resources	
FGK/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Dholi, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh
FGK/CI/2	Coordinated Varietal Trial (CVT)	
FGK/CI/2.5	Coordinated varietal trial on fenugreek–2024 Series XII	Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Navsari, Pantnagar, Kota, Raigarh,
FGK/CM/5	Nutrient Management Trial	
FGK/CM/5.1	Growth and yield of fenugreek as influenced by AMF (Arbuscular Mycorrhizal Fungi)	Dholi, Kota, Mandor, Jabalpur
FGK/CM/6.1	Effect of growth regulators on yield and quality of fenugreek	Ajmer, Dholi, Hisar, Jobner, Kota
FGK/CP/6	Disease Management Trial	
FGK/CP/7.1	Bio-efficacy of fungicides against powdery mildew of fenugreek.	Coimbatore, Hisar, Jabalpur, Jagudan, Jobner, Kota, Raigarh

Ajwain		
AJN/CI/2	Coordinated Varietal Trial (CVT)	
AJN/CI/2.1	Coordinated varietal trial-2022 Series	Ajmer, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh
Nigella		
NGL/CI/2	Coordinated Varietal Trial (CVT)	
NGL/CI/2.1	Coordinated varietal trial on nigella – Series II 2024	Ajmer, Hisar, Kumarganj, Pantnagar, Raigarh, Kota
NGL/CP/6	Disease Management Trial	
NGL/CP/7.1	Management of root rot of nigella	Dholi, Kumarganj, Raigarh
Saffron		
Project mode	Conservation, evaluation and utilization of exotic and indigenous saffron germplasm lines	Pampore
Kalazeera		
Project mode	Exploration, collection and conservation of kalazeera from high altitudes of northern Himalayas	Pampore
Seed Spice		
SS/CP/6	Disease Management Trial	
SS/CP/7.1	Survey and monitoring of diseases and insect pests of seed spices for development of prediction models	Ajmer, Coimbatore, Dholi, Guntur, Jagudan, Jobner, Kammarpally, Kalyani, Kumarganj, Raigarh, Sanand.

01 Black Pepper

Genetic Resources

PEP/CI/1.1: Germplasm collection, characterization, evaluation and conservation

(Centres: Dapoli, Panniyur, Pundibari, Sirsi, Yercaud)

A total of 454 black pepper germplasm accessions, including 447 indigenous, and three exotic, and 43 accesions, got added to the pool during 2024-25 being conserved across six centres, strengthening genetic resource conservation efforts. The details of germplasm collections of black pepper maintained at various ICAR-AICRPS centres are presented in Table 1.

Table 1. Black pepper germplasm collections maintained at various ICAR-AICRPS centres.

Centre	Cultivated types	Wild & related types	Exotic types	Total	New additions 24-25
Dapoli	32	-	-	36	4
Panniyur	289	-	3	292	12
Pundibari	22	-	-	22	-
Sirsi	76	-	-	76	21
Yercaud	28	-	-	28	6
Total	447	-	3	454	43

At Dapoli, characterization of conserved germplasm revealed substantial variability for growth, yield and yield-attributing traits. vine height ranged from 2.86 to 5.46 m, with accession DBSKKVPN-4 recording the maximum vine height (5.46 m). DBSKKVPN-2 produced the highest number of spikes per vine (88.0) and recorded the maximum dry berry yield (0.542 kg vine^{-1}), highlighting its potential as a promising donor for productivity improvement.

At Panniyur, a total of 292 cultivated, wild, related and exotic accessions were maintained and this year twelve new farmer-selected accessions were collected and established for multiplication, enriching the national germplasm repository. Among the evaluated accessions, PRS 116 emerged as the highest yielder with 6.35 kg green berry yield, 2.20 kg dry berry yield and 1,545 spikes per vine, followed closely by PRS 124, which recorded 5.73 kg green berry yield, 2.08 kg dry berry yield and 1,465 spikes per vine. The highest dry recovery was observed in PRS 124 (36.30%), followed by PRS 137 (36.18%).

At Sirsi, considerable diversity was observed for vegetative growth, with plant height ranging from 0.43 to 2.58 m and the number of leaves varying from 6.50 to 96.75 per plant. The check variety Panniyur 1 recorded the highest plant height (2.58 m) and leaf number (96.75), while accession V8 and the local collection Saimane exhibited superior vegetative growth among the germplasm accessions.

At Yercaud, spike length varied from 10.13 to 13.63 cm, with accession PN 58 recording the longest spikes (13.63 cm). Accession PN 11 produced the highest number of berries per spike (72.67) and the maximum green (1.87 kg vine^{-1}) and dry berry yield (0.56 kg vine^{-1}), whereas PN 72 recorded the highest 100-green berry weight (10.26 g) and PN 6 recorded the highest 100-dry berry weight (3.67 g).

At Pundibari, 22 black pepper germplasm lines, including released varieties and region-specific collections from the Sub-Himalayan and Terai regions, were conserved and maintained. Germplasm was successfully put

under rapid multiplication conditions to facilitate future evaluation and dissemination.

Crop Improvement

PEP/CI/3 Coordinated Varietal Trial (CVT)

PEP/CI/3.5: CVT 2018 on Black pepper Series IX

(Centres: Chintapalle, Sirsi, Panniyur, Kozhikode, Dapoli, Yercaud)

Coordinated Varietal Trial (CVT) on black pepper 2018 Series IX, conducted under RBD with 11 genotypes *viz.,* HP 780, HP 1411, OPKM, HP 117 X Thommankodi, IISR Thevam, Kumbukkal, Ponmani, PRS 137, SV 7, Kurimalai along with Panniyur-1 (check) across seven locations. Considerable variability was observed among the entries for vegetative growth, spike characters, berry set and yield, indicating substantial genetic diversity for selection and varietal improvement. Among the entries, HP 1117 × Thommankodi exhibited superior vegetative vigour, recording the maximum plant height at Kozhikode (3.39 m) and the highest number of matured berries at Kozhikode (72.03 berries spike^{-1}). It also produced the highest fresh berry yield across locations with a mean of 0.58 kg vine^{-1}, demonstrating its high yield potential.

Kurimalai recorded the longest spikes at Panniyur (19.00 cm) and Sirsi (16.75 cm), indicating its superiority for spike development, while Panniyur 1 produced the highest spike length at Chinthapalle (12.22 cm) and the maximum number of matured berries at Dapoli (78.00 berries spike^{-1}).

IISR Thevam registered the highest number of spikes per vine at Kozhikode (401.83), whereas SV 7 recorded the maximum number of spikes per vine at Panniyur (221.00). Evaluation of yield parameters revealed that Panniyur 1 (National check) remained the highest yielder with a mean fresh berry yield of 0.62 kg vine^{-1}, closely followed by HP 1117 × Thommankodi (0.58 kg vine^{-1}), Kurimalai (0.44 kg vine^{-1}) and OPKM (0.43 kg vine^{-1}). For dry berry yield, HP 1117 × Thommankodi and Panniyur 1 recorded the highest mean yield (0.20 kg vine^{-1} each), followed by OPKM (0.17 kg vine^{-1}), while Kurimalai, Kumbakkal and IISR Thevam each produced 0.14 kg vine^{-1}. Dry recovery percentage varied from 31.1 to 33.3%, with SV 7 recording the highest mean dry recovery (33.3%), followed by HP 780 and Panniyur 1 (32.7% each), OPKM (32.7%), IISR Thevam (32.4%) and Kurimalai (32.2%).

Overall, Panniyur 1 continued to demonstrate stable and superior yield performance across diverse environments, while HP 1117 × Thommankodi emerged as a promising entry combining vigorous growth, higher berry set and dry berry yield. Kurimalai exhibited desirable spike characteristics, and SV 7 recorded the highest dry recovery, making these genotypes valuable candidates for further evaluation and utilization in black pepper improvement programmes.

Crop Management

PEP/CM/3.4: Effect of Arbuscular Mycorrhizal (*Rhizophagus irregularis*) on growth and yield of black pepper

(Centres: Kahikuchi, Kozhikode, Panniyur, Dapoli, Sirsi, Yercaud)

The trial was initiated during *kharif*, 2025–26 to evaluate the potential of *Rhizophagus irregularis* as a biofertilizer for improving NUE, growth, yield and quality of black pepper, while reducing dependence on chemical fertilizers. The trial was laid out in a RBD with five treatments involving different combinations of recommended fertilizer dose and arbuscular mycorrhizal (AM) inoculation.



The experiment was established using existing black pepper vines (10–15 years old) with ten replications, two vines per standard and fifty standards per centre.

During the reporting period, the experimental plots were successfully established at all participating centres. Initial soil samples were collected before treatment imposition to determine the baseline physicochemical properties and nutrient status. Fertilizer treatments were imposed according to the experimental protocol, followed by application of *Rhizophagus irregularis* one week after fertilizer application. As per the treatment schedule, AM inoculum was applied twice during the first year (May/June and August/September 2025). The AM inoculum required for the experiment was mass multiplied at ICAR-Indian Institute of Spices Research, Kozhikode, and supplied to all participating centres, ensuring uniformity in inoculum quality across locations.

Crop Protection and Food Safety

CP/7 Entomological Trial (ET)

PEP/CP/7.2: Evaluation of effective insecticides against pollu beetle, *Lanka ramakrishnai* infesting black pepper for label claim expansion

(Centres: Chellavoor, Peruvannamuzhi and Panniyur)

The multi-location field evaluation of Chlorantraniliprole 18.5% SC against pollu beetle (*Lanka ramakrishnai*) in black pepper was undertaken during 2024–25 under the AICRP on Spices at Kozhikode (Chelavoor and Peruvannamuzhi), and Panniyur following a RBD with five replications. The study aimed to generate efficacy, phytotoxicity, residue and safety data required for label claim expansion. Chlorantraniliprole 18.5% SC was evaluated at three dosage levels (0.375, 0.50 and 0.625 ml L^{-1}) in comparison with the recommended standard insecticide, Quinalphos 25 EC (2.0 ml L^{-1}), and an untreated control.

The results generated across locations clearly established the superiority of Chlorantraniliprole 18.5% SC over the standard check in suppressing pollu beetle infestation. Complete (100%) or near-complete (99–100%) reduction in pollu beetle damage was achieved with Chlorantraniliprole at 0.50 and 0.625 ml L^{-1} under all test environments, while the lower dose (0.375 ml L^{-1}) also provided excellent control (99–100%). In contrast, Quinalphos recorded only 45–86% reduction over the untreated control, indicating comparatively lower efficacy.

The observations at Panniyur corroborated these findings, where no pest infestation was recorded in vines treated with Chlorantraniliprole, whereas the untreated control registered the highest infestation (15.6%) and Quinalphos-treated plots recorded 8.7% infestation.

Table 2. Performance of entries in Coordinated Varietal Trial (CVT) – 2018 Series IX evaluated across six locations during 2024–25.

Genotype	Plant height (m)						Spike length (cm)						No. of matured berries						No. of spikes per vine					
	KOZ	PAN	SIR	DAP	CPE	YER	KOZ	PAN	SIR	DAP	CPE	YER	KOZ	PAN	SIR	DAP	CPE	YER	KOZ	PAN	SIR	DAP	CPE	YER
HP 780	2.44	3.17	1.53	3.7	1.93	3.06	8.2	7.64	6	12.4	9.31	10.5	36.8	34.8	25.5	74	69.80	46	231.3	53.25	46.0	48	NR	30.12
HP 1411	1.69	3.77	1.98	2.9	2.58	2.84	9.89	8.26	7.6	10.1	9.78	11	46.2	45	28	56	70.22	45.4	80.5	180.7	38.0	30	NR	27.27
OPKM	2.23	5.77	1.53	3.7	1.93	3.25	10.3	12.3	0.0	11.2	9.87	10.6	40.4	29.2	0.0	72	68.99	42.6	254.3	80.25	0.0	40	NR	32.92
HP1117 × Thomm...	3.39	2.17	2.45	3.1	1.69	3.16	12.9	9.5	10.6	10.1	10.2	10.4	72	26.2	41.3	56	70.92	44.9	397.3	30	55.0	30	NR	14.77
Kumbakkal	1.54	4.75	1.43	3.1	2.69	3.36	9.77	12.2	0.0	10.2	11.4	10.7	64.6	37.4	0.0	58	79.33	43.7	97.16	97	0.0	30	NR	60.36
Ponmani	2.02	3.5	1.65	2.4	1.64	2.85	7.94	7.08	6.25	10.6	10.3	11.4	36.9	36.4	22.8	54	68.30	42	151.2	53.25	27.0	36	NR	17.17
PRS 137	2.2	2.83	1.32	2.8	2.00	3.13	6.8	6.06	5.7	10.7	10.1	11.1	42.5	39.2	20	58	69.80	48	197.7	38.5	18.0	36	NR	63.82
SV 7	2.45	5.25	2.43	2.7	2.10	3.3	10.7	11.5	8.25	10.4	10.6	10.3	35.8	15.6	33.5	62	69.18	44.5	74.16	221	26.0	34	NR	16.23
Kurimalai	2.35	5.25	2.05	2.7	2.04	2.97	11.5	19.00	16.8	10.3	9.48	10.7	47.9	40.8	50.3	60	68.99	48.9	207.8	128.5	23.0	34	NR	28.68
IISR Thevam	2.29	3.58	2.78	2.2	2.09	3.24	6.64	7.00	8.0	10.3	10.4	11.5	35.2	11.2	23.8	58	65.46	45.8	401.8	53.25	43.0	30	NR	58.29
Panniyur 1	2.68	4.59	2.8	3.4	2.52	3.11	9.38	13.4	12.0	12.2	12.2	10.8	57.8	27.8	49.3	78	73.27	44.8	176.2	133	69.0	42	NR	65.28
CD (P<0.05)	0.83	1.74	0.87	0.8	0.29	0.31	1.73	1.39	1.77	1.6	1	0.55	14.9	6.07	11	6.9	6.26	1.66	NS	77.58	2.29	8.48	NR	3.46
CV (%)	21.27	25.1	30.2	6.2	8.04	5.88	10.7	10.5	15.0	8.22	5.64	2.99	18.6	15.2	25.3	12	5.18	2.07	38.97	46.56	24.50	10.5	NR	5.34

Table 3. Performance of entries in Coordinated Varietal Trial (CVT) – 2018 Series IX evaluated across six locations during 2024–25.

Genotype	Fresh berry weight (kg vine^{-1})							Dry berry weight (kg vine^{-1})							Dry recovery (%)						
	KOZ	PAN	SIR	DAP	CPE	YER	M	KOZ	PAN	SIR	DAP	CPE	YER	M	KOZ	PAN	SIR	DAP	CPE	YER	M
HP 780	0.55	0.20	0.15	0.64	0.20	0.17	0.32	0.20	0.07	0.03	0.23	0.05	0.05	0.12	36.9	33.1	33.0	36.1	26.3	31.3	32.7
HP 1411	0.24	0.63	0.13	0.49	0.14	0.14	0.30	0.08	0.22	0.03	0.16	0.04	0.04	0.11	35.4	35.0	31.0	32.8	27.5	28.6	31.8
OPKM	1.21	0.36	0.00	0.65	0.16	0.17	0.43	0.42	0.12	--	0.23	0.05	0.05	0.17	34.2	34.9	--	35.7	29.2	29.4	32.7
HP1117 × Thomm..	2.01	0.20	0.58	0.52	0.12	0.06	0.58	0.70	0.06	0.17	0.17	0.03	0.02	0.20	34.7	28.2	34.0	31.5	27.9	33.3	31.1
Kumbakkal	0.35	0.60	0.00	0.54	0.29	0.33	0.35	0.12	0.21	--	0.18	0.08	0.10	0.14	34.6	35.0	--	33.3	29.1	29.4	32.3
Ponmani	0.41	0.20	0.05	0.54	0.17	0.10	0.25	0.13	0.07	0.03	0.19	0.05	0.03	0.09	34.5	32.6	29.0	35.4	28.0	30.0	32.1
PRS 137	0.37	0.34	0.00	0.47	0.15	0.36	0.28	0.13	0.12	0.01	0.16	0.04	0.11	0.11	35.4	34.5	28.0	34.0	26.7	30.6	32.2
SV 7	0.29	0.43	0.25	0.48	0.21	0.09	0.29	0.10	0.14	0.06	0.17	0.06	0.03	0.10	35.3	33.5	31.0	35.2	29.1	33.3	33.3
Kurimalai	0.54	1.04	0.25	0.44	0.19	0.19	0.44	0.10	0.34	0.08	0.15	0.05	0.06	0.14	36.0	33.2	30.0	32.6	27.8	31.6	32.2
IISR Thevam	0.91	0.20	0.08	0.43	0.25	0.33	0.37	0.31	0.07	0.02	0.14	0.08	0.10	0.14	34.6	34.2	35.0	33.2	29.5	30.3	32.4
Panniyur 1	0.71	0.96	0.71	0.54	0.37	0.40	0.62	0.23	0.32	0.22	0.20	0.11	0.12	0.20	33.1	33.5	33.7	36.7	30.4	30.0	32.7
CD (P<0.05)	0.58	0.45	0.18	0.34	0.02	0.02	0.27	0.20	0.15	0.06	0.28	0.01	0.01	0.13	NS	3.4	NS	3.7	2.2	1.2	2.6
CV (%)	38.2	56.2	29.6	4.32	15.3	5.98	28.7	37.3	55.7	59.6	7.54	16.2	7.46	29.2	3.5	5.9	21.1	4.4	4.5	2.32	4.6

Where: KOZ: Kozhikode; PAN: Panniyur; SIR: Sirsi; DAP: Dapoli; CPE: Chinthapalle; YER: Yercaud;

Footnote: Fresh berry weight and dry berry weight are expressed as kg vine^{-1}. Dry recovery is expressed as percentage. NS = Non-significant at P = 0.05.

Phytotoxicity evaluation conducted by applying Chlorantraniliprole at twice the recommended dose (1.0 ml L^{-1}) revealed complete crop safety, as no symptoms of leaf injury, chlorosis, necrosis, wilting, vein clearing, epinasty or stunting were observed during successive observations after spraying. Likewise, assessment of the natural enemy complex demonstrated that Chlorantraniliprole treatments did not adversely affect the abundance of beneficial arthropods associated with the black pepper ecosystem. The populations of predators and parasitoids remained statistically comparable to those in the untreated control, whereas slight reductions were observed under the Quinalphos treatment at some locations.

The superior suppression of pollu beetle by Chlorantraniliprole 18.5% SC was reflected in a marked improvement in black pepper yield across the experimental locations. Among the treatments, Chlorantraniliprole 18.5% SC applied at 0.625 ml L^{-1} (T_3) consistently recorded the highest fresh and dry berry yields at all locations, with fresh yields of 3.70 kg $vine^{-1}$ and dry yields of 1.27, 1.24 and 1.24 kg $vine^{-1}$ at Panniyur, Chelavoor and Peruvannamuzhi, respectively.

Table 4. Bioefficacy of Chlorantraniliprole 18.5% SC against pollu beetle (*Lanka ramakrishnai*) and its effect on natural enemy population in black pepper at different locations

Treatment	Reduction in pollu beetle infestation over untreated control (%)			Natural enemy population (No. $vine^{-1}$)					
				PAN		CHEL		PERU	
	PAN	CHEL	PERU	BS	AS	BS	AS	BS	AS
T1	100.0^{a}	99.0^{a}	99.0^{a}	3.3	3.1^{ab}	3.5	3.4^{a}	3.5	3.4^{a}
T2	100.0^{a}	100.0^{a}	100.0^{a}	3.2	2.9^{b}	2.9	3.1^{ab}	2.9	3.1^{ab}
T3	100.0^{a}	100.0^{a}	100.0^{a}	3.2	2.9^{b}	3.2	2.8^{b}	3.1	2.6^{bc}
T4	45.0^{b}	86.0^{b}	86.0^{b}	3.5	3.3^{ab}	3.5	3.0^{ab}	3.6	2.3^{c}
T5	—	—	—	3.5	3.3^{a}	3.5	3.5^{a}	3.6	3.6^{a}
CD (P = 0.05)	0.82	1.02	1.04	NS	0.22	0.3	0.4	NS	0.4
CV (%)	—	—	—	7	7.6	9.5	13.7	15.7	19.5

Footnotes: T_1 = Chlorantraniliprole 18.5% SC @ 0.375 ml L^{-1}; T_2 = Chlorantraniliprole 18.5% SC @ 0.50 ml L^{-1}; T_3 = Chlorantraniliprole 18.5% SC @ 0.625 ml L^{-1}; T_4 = Quinalphos 25 EC @ 2.0 ml L^{-1}; T_5 = Untreated control. PAN = Panniyur; CHEL = Chelavoor; PERU = Peruvannamuzhi; BS = Before spray; AS = After spray.
Means followed by the same letter(s) within a column are not significantly different at P = 0.05. Natural enemy population data were log-transformed before statistical analysis. NS = Non-significant.

This was followed by T_2 (0.50 ml L^{-1}), while T_1 (0.375 ml L^{-1}) also produced significantly higher yields than the standard check (T4) and the untreated control.

Based on pooled analysis across locations, the highest overall mean fresh and dry berry yields were obtained with T_3 (3.70 and 2.07 kg $vine^{-1}$, respectively), followed by T_2 (3.53 and 1.98 kg $vine^{-1}$) and T_1 (3.37 and 1.88 kg $vine^{-1}$), respectively. Relative to the untreated control, Chlorantraniliprole treatments increased fresh berry yield by 44.6–52.3% and dry berry yield by 52.3–59.2%, whereas the standard check, Quinalphos 25 EC, recorded comparatively lower yield improvements of 34.6% (fresh) and 39.2% (dry).

Table 5. Effect of Chlorantraniliprole 18.5% SC on black pepper yield (kg vine^{-1}) at different locations.

Treatment	Panniyur		Chelavoor		Peruvannamuzhi		Overall Mean	
	Fresh	Dry	Fresh	Fresh	Fresh	Dry	Fresh	Dry
T_1	3.50	1.23	3.30	3.30	3.30	1.12	3.30	1.12
T_2	3.60	1.26	3.50	3.50	3.50	1.18	3.50	1.18
T_3	3.70	1.27	3.70	3.70	3.70	1.24	3.70	1.24
T_4	3.40	1.15	3.20	3.20	3.20	1.07	3.20	1.07
T_5 (Control)	3.10	1.08	2.10	2.10	2.10	0.73	2.10	0.73
CD (P=0.05)	0.22	0.07	0.14	0.14	0.14	0.05	0.14	0.05
CV (%)	3.8	8.8	8.8	8.8	8.8	9.0	8.8	9.0

Footnote: T_1 = Chlorantraniliprole 18.5% SC @ 0.375 ml L^{-1}; T_2 = Chlorantraniliprole 18.5% SC @ 0.50 ml L^{-1}; T_3 = Chlorantraniliprole 18.5% SC @ 0.625 ml L^{-1}; T_4 = Quinalphos 25 EC @ 2.0 ml L^{-1}; T_5 = Untreated control.

02. Small Cardamom

Genetic Resources

CAR/CI/1.1: Germplasm collection, characterization, evaluation and conservation
(Centres: Mudigere, Pampadumpara)

A total of 290 cardamom accessions are presently conserved at the ICAR-AICRPS centres, namely Pampadumpara and Mudigere. The details of cardamom germplasm maintained at the two centres are presented in Table 6.

Table 6. Details of cardamom germplasm maintained at ICAR-AICRPS centres

Centre	Cultivated	Wild and related species	Total
Mudigere	93	-	93
Pampadumpara	193	4	197
Total	286	4	290

At the Pampadumpara centre, conserves considerable variability of 197 cardamom germplasm accessions and were evaluated for morphological, yield and quality traits. Plant height ranged from 56.67 to 314.30 cm, with a mean of 205.5 cm.

The highest number of tillers per plant was recorded in Acc. 148 (260.00), followed by Acc. 157 (79.33) and Acc. 156 (78.67). Accessions 156, 65 and 18 recorded the highest number of panicles per plant (73.67, 66.67 and 61.67, respectively), while the longest panicles (82.67 cm) were observed in accessions Accs. 24, 35 and 78. The maximum number of racemes per panicle was recorded in Acc. 143 (69.00), 142 (68.67) and 58 (60.33).

Among the yield and quality traits, Acc. 145 recorded the highest 100-capsule weight (116.67 g), followed by accessions 105 (113.33 g) and 151 (110.00 g). The longest capsules were recorded in Acc. 3 (19.56 mm), followed by 145 (18.92 mm) and 58 (18.71 mm). The highest fresh yield was recorded in Acc. 101 (1625.00 kg ha^{-1}), followed by 150 (1482.00 kg ha^{-1}) and 5 (1375.00 kg ha^{-1}). Similarly, Acc. 5 registered the highest dry yield (277.00 kg ha^{-1}), followed by 101 (274.50 kg ha^{-1}) and 102 (247.00 kg ha^{-1}). The highest capsule volume was recorded in Acc. 101 (108.33 mL 100 $capsules^{-1}$), 91 (106.67 mL 100 $capsules^{-1}$) and 109 (106.67 mL 100 $capsules^{-1}$).

Further, 133 uniformly bearing cardamom plants were identified and characterized for growth, yield, quality, and pest and disease resistance traits. Several accessions exhibited tolerance to major pests and diseases.

Accessions 1, 3 and 4 showed no incidence of Azhukal disease, while accessions 2, 4 and 11 recorded zero borer damage. Of the 197 cardamom accessions maintained at Pampadumpara, 109 accessions were assigned IC numbers by the ICAR-NBPGR, New Delhi.

At Mudigere, 93 germplasm accessions were replanted in a new germplasm block for maintenance, characterization and evaluation. Among the germplasm evaluated, accession M-2 recorded the maximum plant height (345.15 cm) followed by MCC-309 (309.73 cm), D-163 (300.92 cm), M-3 (297.85 cm) and M-1 (288.27 cm).

The highest number of tillers per clump was recorded in AGP-293 (48.30) followed by SKP-170 (40.63), 26-16-D-11 (37.57), CCS-800 (37.18) and M-1 (35.27).

Crop Improvement

CAR/CI/3 Coordinated Varietal Trial (CVT)

CAR/CI/3.9: CVT 2018 on hybrids of small cardamom – Series IX

(Centres: Appangala, Mudigere, Myladumpara, Pampadumpara and Sakleshpur)

CVT on hybrids of small cardamom – Series IX, conducted in a RBD with 10 genotypes (nine hybrids and one check) across five centres, continued during 2024–25. The trial was initiated in 2018 with the objective of evaluating the yield performance and adaptability of promising F_1 hybrids under diverse cardamom-growing environments.

Among the hybrids evaluated, Bold × IC 547219 recorded the highest pooled dry capsule yield under Karnataka conditions (164.6 kg ha^{-1}), primarily due to its outstanding performance at Appangala (518.0 kg ha, indicating its excellent yield potential and specific adaptation to high-yielding environments. The hybrid (GG × Bold) × Appangala-1 ranked second with a pooled yield of 150.2kg ha^{-1}, followed by MHC-2 (138.5 kg ha^{-1}). The national check, Njallani Green Gold (112.5 kg ha^{-1}). Under Kerala conditions, MHC-2 had an average yield of 1324.2 kg ha^{-1}, followed by (GG × NKE 19) × Bold with a dry yield of 892.4 kg ha^{-1} and Bold × IC 547219 with an average yield of 557.9 kg ha^{-1}.

Table 7. Performance of hybrid cardamom entries for dry capsule yield (kg ha^{-1}) under Coordinated Varietal Trial during 2024–25 across four centres

Entries	APG	SAK	Karnataka Av	MYL	PAMP	Kerala Av.	Mean*	Rank
Bold × IC 547219	518	99.5	164.6	422.2	693.5	557.9	433.3	3
(GG × Bold) × Appangala-1	285	119.8	150.2	396.9	282.6	339.8	271.1	6
(GG × NKE 19) × Bold	97	108.4	141.9	349.5	1435.2	892.4	497.5	2
MHC-1	58	131.9	134.1	494.8	643.7	569.3	332.1	5
MHC-2	248	117.7	138.5	462.3	2186	1324.2	753.5	1
SHC-1	92	137.1	132.9	417.2	214	315.6	215.1	10
SHC-2	277	153.3	135.6	376.4	206	291.2	253.2	9
PH-13	185	100.1	122.3	388.3	713	550.7	346.6	4
PH-14	199	83.3	118.3	399.9	359.3	379.6	260.4	7
Njallani Green Gold (Check)	177	105.8	112.5	485.9	253.7	369.8	255.6	8
Mean	213.6	115.7	135.1	419.3	698.7	559.0	361.8	
CD (0.05)	205.4	32.08	132.14	10.59	120.28	65.4	92.1	
CV (%)	36.08	14.55	130.33	1.47	10.01	5.74	15.51	

Where: Appangala = APG; Sakleshpur = SAK; Myladumpara = MYL; Pampadumpara = PAMP.
*Mean represents the average yield across the four bearing centres during 2024–25. Njallani Green Gold was used as the local check. CD = Critical Difference at 5% level of significance; CV = Coefficient of Variation.

Across individual centres during 2024–25, the yield trend follows similar pattern with Kerala ie. MHC-2 had an average yield of 753.5 kg ha^{-1}, followed by (GG × NKE 19) × Bold with

a dry yield of 497.5 kg ha^{-1} and Bold × IC 547219 with an average yield of 433.3 kg ha^{-1}.

CAR/CI/4.4: Multi-location evaluation of thrips tolerant cardamom lines

(Centres: Appangala, Mudigere, Myladumpara, Pampadumpara, Sakaleshpura)

The experiment on multi locational evaluation of thrips tolerant lines in cardamom was initiated during 2017 to screen the promising cardamom line against cardamom thrips. Trial was undertaken at five centres, with six genotypes (IC 349362, IC 349364, IC 349370, IC 349606, Njallani Green Gold and ICRI 8) in three replications. Observations on thrips population and thrips damaged capsule (%) were recorded at monthly intervals along with other growth parameters.



Table 8. Performance of cardamom genotypes for yield and thrips tolerance under different centres during 2024–25

Genotype	Appangala		Myladumpara	Sakleshpur
	Yield (kg ha^{-1})	Thrips infestation (%)	Thrips incidence (thrips leaf sheath^{-1})	Thrips-damaged capsules (%)
IC 349362	357.6	12.4	1.12	16.4
IC 349606	423.7	9.0	1.02	15.0
IC 349364	256.9	11.3	0.56	16.2
IC 349370	62	11.9	0.85	14.0
Njallani Green Gold*	256.9	30.7	2.57	22.5
Check**	Appangala-1: 323.9	Appangala-1: 22.5	ICRI-5: 1.73	ICRI-8: 29.5
CD (P = 0.05)	108.2	8.32	0.06	6.09
CV (%)	23.38	0.594	2.41	17.46

* National check: Njallani Green Gold.** Local checks differed among centres: Appangala – Appangala-1; Myladumpara – ICRI-5; Sakleshpur – ICRI-8.

At Appangala, significant differences were observed among the genotypes for both dry capsule yield ($CD_{0.05}$ = 108.2 kg ha^{-1}) and thrips infestation ($CD_{0.05}$ = 8.32). IC 349606

recorded the highest dry capsule yield (423.7 kg ha^{-1}), which was significantly superior to the national check Njallani Green Gold (256.9 kg ha^{-1}) and also higher than the local check Appangala-1 (323.9 kg ha^{-1}). The same genotype also exhibited the lowest thrips infestation (9.0) among the high-yielding entries. In contrast, the national check Njallani Green Gold recorded the highest thrips infestation (30.7), while the local check Appangala-1 also showed comparatively higher infestation (22.5). At Myladumpara, significant variation was observed for thrips incidence ($CD_{0.05}$ = 0.06 thrips per leaf sheath). Among the evaluated genotypes, IC 349364 recorded the lowest thrips incidence (0.56 thrips per leaf sheath), followed by IC 349370 (0.85) and IC 349606 (1.02). The national check Njallani Green Gold recorded the highest incidence (2.57 thrips per leaf sheath), whereas the local check ICRI-5 recorded 1.73 thrips per leaf sheath. At Sakleshpur, significant differences were observed for the percentage of thrips-damaged capsules ($CD_{0.05}$ = 6.09). IC 349370 recorded the lowest capsule damage (14.0%), followed closely by IC 349606 (15.0%), IC 349364 (16.2%) and IC 349362 (16.4%). The national check Njallani Green Gold recorded substantially higher capsule damage (22.5%), while the local check ICRI-8 exhibited the highest damage (29.5%). Overall, the multi-location evaluation identified IC 349606 as the most promising genotype owing to its superior combination of high yield and thrips tolerance. The genotype recorded the highest dry capsule yield (423.7 kg ha^{-1}) at Appangala while maintaining comparatively low thrips infestation (9.0), low thrips incidence at Myladumpara (1.02 thrips per leaf sheath), and low capsule damage at Sakleshpur (15.0%), all of which were substantially lower than those of the national check, Njallani Green Gold.

CAR/CI/4.4: MLT of leaf blight tolerant lines of small cardamom 2018

(Centres: Appangala, Mudigere, Pampadumpara, Myladumpara, Sakleshpur)

To screen out the leaf blight tolerant cardamom genotypes, multilocational trial of leaf blight tolerant lines of small cardamom initiated during 2018-19. The trial was laid in RBD design with three replications of six test entries viz., IC-349650, IC-547222, IC-547223, IC-547156, IC-349649 and IC-349648 along with a susceptible check (IISR Vijetha) and two resistant checks (Appangala 1 & Njallani Green Gold).

Table 9. Pooled performance of leaf blight tolerant cardamom lines evaluated across locations under multilocational trial during 2024-25

Genotype	Dry capsule yield (kg ha^{-1})					Leaf blight (PDI)				
	APG	MYL	PAMP	SAK	Mean	APG	MYL	PAMP	SAK	Mean
IC 547156	259.4	36.0	1396.9	191.7	471.0	12.2	7.6	12.3	10.0	10.5
IC 547222	269.8	35.2	1262.6	146.4	428.5	12.8	7.5	24.6	10.0	13.7
IC 349650	287.5	29.9	1135.0	233.5	421.5	12.8	7.6	27.3	15.5	15.8
IC 349648	344.8	38.1	1083.1	173.5	409.9	10.6	6.9	29.0	8.9	13.8
IC 349649	314.8	39.0	650.2	184.4	297.1	12.8	8.4	23.6	17.8	15.6
Appangala 1	264.6	39.2	1020.6	155.7	370.0	13.3	6.8	13.6	20.0	13.4
Njallani Green Gold	310.4	93.8	1726.9	192.3	580.9	11.1	6.1	29.1	22.2	17.1

IISR Vijetha	109.8	41.7	557.1	160.5	217.3	22.8	11.0	20.3	26.7	20.2
CD (0.05)	35.4	6.0	592.5	59.6	173.4	3.2	1.41	NS	5.2	4.2
CV (%)	7.4	8.1	30.6	18.9	16.3	19.9	10.70	32.2	18.1	23.4

Footnote:Njallani Green Gold and Appangala 1 were included as resistant checks, and IISR Vijetha as susceptible. check.APG – Appangala; MYL – Myladumpara; PAMP – Pampadumpara; SAK – Sakleshpur.PDI – Percent Disease Index of leaf blight; CD – Critical Difference at 5% significance; SE(m) – Standard Error of Mean; CV – Coefficient of Variation.

During 2024-25, pooled analysis of multilocational trial for screening leaf blight–tolerant lines in cardamom conducted revealed that IC547156 recorded the lowest leaf blight incidence with mean PDI (10.5%), indicating the best tolerance across locations, followed closely by Appangala 1 (11.1%). In case of dry capsule yield, the highest mean yield was recorded by the national check Njallani Green Gold (580.9 kg ha^{-1}), followed by IC 547156 (471.0 kg ha^{-1}) and IC 547222 (428.5 kg ha^{-1}), both of which combined good yield with tolerance to leaf blight. The susceptible check IISR Vijetha had higher disease incidence (mean PDI 20.2%) and a lower mean yield (217.3 kg ha^{-1}), confirming its utility as a susceptible reference. These results suggest that IC 547222 and IC 547156 are promising entries combining leaf blight tolerance and superior yield performance across diverse environments.

Crop Management

CAR/CM/5.5: Effect of micronutrients on growth and yield of small cardamom (Centres: Appangala, Mudigere, Myladumpara, Pampadumpara, Sakleshpur)

The trial on effect of micronutrient on growth and yield of small cardamom was initiated in the year 2019-20 with two treatments; 1. Recommended dose of fertilizers and 2. Recommended dose of chemical fertilizers + IISR cardamom micro nutrient four sprays at March, April, May, June @ 5 g L^{-1}.

Table 10. Effect of micronutrients on yield in cardamom (g plant^{-1}) across centres

Cultivars	Appangala		Mudigere		Pampadumpara		Myladumpara		Sakleshpur	
	T1	T2	T1	T2	T1	T2	T1	T2	T1	T2
V1	142.1	185.03	172.0	222.4	93.32	184.44	321.43	369.4	122.8	133.2
V2	173.26	265.2	182.9	209.9	144.4	277.39	238.1	254.68	148.6	206.4
V3	143.89	228.19	178.4	200.3	132.7	221.42	600.0	688.29	202.2	212.8
CD 0.05 (V)	NS		3.96		21.63		76.07		4.2	
CD 0.05 (T)	39.43		3.32		26.49		10.97		3.5	
CD 0.05(V×T)	NS		NS		37.46		NS		NS	
CV (%)	20.28		7.19		17.93		17.16		12.8	
V1	Appangala 1		Mudigere -1		Green Gold		Thiruthali		ICRI - 3	
V2	IISR Avinash		Mudigere -2		KAU PV-3		ICRI -5		ICRI - 8	
V3	Green Gold		Mudigere -3		KAU PV-5		MCC 260		Appangala - 1	

The response of cardamom cultivars to foliar application of the IISR micronutrient mixture (T_2) varied across centres during second season of yield (Table 10). In general, T_2 consistently produced higher yields than the control (T_1) across all locations and cultivars, demonstrating the beneficial effect of

micronutrient supplementation on capsule yield.

At Appangala, although varietal differences were non-significant, foliar application of micronutrients significantly increased yield over the control ($CD_{0.05}$ for treatment = 39.43 kg ha^{-1}). The highest yield was recorded in IISR Avinash (V_2) under T_2 (265.20 kg ha^{-1}), followed by Green Gold (V_3) with 228.19 kg ha^{-1}. Appangala-1 (V_1) also responded positively, increasing from 142.10 to 185.03 kg ha^{-1} following micronutrient application.

At Mudigere, significant differences were observed among varieties ($CD_{0.05}$ = 3.96 kg ha^{-1}) and treatments ($CD_{0.05}$ = 3.32 kg ha^{-1}), while the interaction effect was non-significant. The highest yield was recorded in Mudigere-1 (V_1) under T_2 (222.40 kg ha^{-1}), followed closely by Mudigere-2 (209.90 kg ha^{-1}) and Mudigere-3 (200.30 kg ha^{-1}). Across all three cultivars, T_2 produced higher yields than the control.

At Pampadumpara, significant differences were observed among varieties, treatments and their interaction. The highest yield was recorded in KAU PV-3 (V_2) under T_2 (277.39 kg ha^{-1}), followed by KAU PV-5 (221.42 kg ha^{-1}) and GG (184.44 kg ha^{-1}). Micronutrient application substantially improved yield in all three cultivars compared with the untreated control, indicating a strong positive response to foliar nutrition.

At Myladumpara, significant varietal differences ($CD_{0.05}$ = 76.07 kg ha^{-1}) and treatment effects ($CD_{0.05}$ = 10.97 kg ha^{-1}) were observed, whereas the interaction was non-significant. The maximum yield among all centres was recorded in MCC 260 (V_3) under T_2 (688.29 kg ha^{-1}), followed by the same cultivar under T_1 (600.00 kg ha^{-1}). Among the remaining cultivars, Thiruthali (V_1) recorded 369.40 kg ha^{-1}, while ICRI-5 (V_2) produced 254.68 kg ha^{-1} under T_2. All cultivars exhibited improved yield following micronutrient application.

At Sakleshpur, treatment effects were significant ($CD_{0.05}$ = 3.50 kg ha^{-1}), whereas varietal differences and interaction effects were non-significant. The highest yield was recorded in Appangala-1 (V_3) under T_2 (212.80 kg ha^{-1}), closely followed by ICRI-8 (V_2) with 206.40 kg ha^{-1}. ICRI-3 (V_1) also responded positively, with yield increasing from 122.80 to 133.20 kg ha^{-1} following micronutrient application.

Overall, foliar application of the IISR micronutrient mixture (T_2) enhanced cardamom yield across all five experimental locations. The greatest response was observed at Myladumpara, where MCC 260 (V_3) recorded the highest yield of 688.29 kg ha^{-1}. Significant treatment effects at Appangala, Mudigere, Pampadumpara, Myladumpara and Sakleshpur indicate the effectiveness of micronutrient supplementation in improving productivity under diverse agro-climatic conditions. The consistent superiority of T_2 over T_1 across cultivars further demonstrates the potential of foliar micronutrient application as an effective management practice for increasing cardamom yield.

CAR/CM/5.6: Site-specific recommendation for varying yield target of cardamom

(Centres: Mudigere, Myladumpara, Pampadumpara, and Sakleshpura)

The trial on the effect of site-specific nutrient recommendations for varying yield targets on cardamom was initiated in the year 2020-21 with four treatments; T_1- Recommended dose of fertilizer (POP); T_2- Nutrient recommendation for a target yield of 6 q ha^{-1};

T_3 - Nutrient recommendation for a target yield of 8 q ha^{-1} and T_4 - Nutrient recommendation for a target yield of 10 q ha^{-1}. None of the centres achieved the targeted yield mentioned in the treatments. Among the different centres, Mudigere (211.8 kg ha^{-1}) and Pampadumpara (223.4 kg ha^{-1}) reported higher dry capsule yield in T_4, while Myladumpara (487.9 kg ha^{-1}) and Sakleshpur (179.3 kg ha^{-1}) recorded their maximum yields in T_3 and T_4, respectively.

In terms of yield-attributing characters, T_4 recorded the highest number of panicles at all centres except at Myladumpara, where T_4 also performed competitively. Pooled data analysis across all centres confirmed that T_3 and T_4 consistently outperformed the baseline T_1 treatment in both dry capsule yield and number of panicles per clump.

Table 11. Effect of site-specific nutrient recommendations for varying yield targets on cardamom

Treatment	Mudigere		Pampadumpara		Myladumpara		Sakleshpur		Pooled	
	Dry capsule yield (kg/ha)	No. of panicles (cm)	Dry capsule yield (kg/ha)	No. of panicles (cm)	Dry capsule yield (kg/ha)	No. of panicles (cm)	Dry capsule yield (kg/ha)	No. of panicles (cm)	Dry capsule yield (kg/ha)	No. of panicles (cm)
T1 (POP)	136.8	17.8	87.8	22.5	266.2	35.8	128.0	10.1	154.7	21.5
T2 (6 q/ha)	178.4	21.0	139.1	23.4	406.1	40.4	157.2	16.2	220.2	25.3
T3 (8 q/ha)	207.5	22.5	181.8	22.6	487.9	43.3	168.9	17.7	261.5	26.5
T4 (10 q/ha)	211.8	22.9	223.4	26.8	363.1	44.1	179.3	22.9	244.4	29.2
Mean	183.6	21.1	158.0	23.8	380.8	40.9	158.4	16.7	220.2	25.6
CD (0.05)	1.2	0.5	85.5	NS	128.1	6.2	24.2	2.9	4.9	3.2
CV (%)	0.4	1.5	28.5	12.5	18.4	18.9	11.0	12.4	4.7	11.3

Crop Protection and Food safety

CAR/CP/2.1: Efficacy of combined application of *Heterorhabditis indica* (EPN) and *Paecilomyces lilacinus* (EPF) against root grubs (*Basilepta fulvicorne*) and *Meloidogyne* spp. nematodes in small cardamom

(Centres: Appangala, Myladumpara & Pampadumpara)

The experiment was initiated during 2025–26 at the participating centres to evaluate the efficacy of combined application of the entomopathogenic nematode (*Heterorhabditis indica*) and the entomopathogenic fungus (*Paecilomyces lilacinus*) against root grubs (*Basilepta fulvicorne*) and root-knot nematodes (*Meloidogyne* spp.) in small cardamom. The trial comprises four treatments, including three doses of the bioagent combination and a recommended nematicide (Cartap hydrochloride) as the check, laid out in a randomized block design with four replications. Two applications are scheduled annually during June and September.

At the Appangala and Pamapdumpara centre, bioagents were supplied by the Indian Cardamom Research Institute (ICRI), Myladumpara, and the experiment was established successfully at all three locations.

03. Large Cardamom

Genetic Resources

LCA/CI/1.1: Germplasm collection and evaluation of large cardamom

(Centres: ICAR Regional Centre for NEH Region, Gangtok and ICRI Regional Research Station, Gangtok)

A total of 61 germplasm accessions are presently conserved in field gene banks maintained at Pangthang (1952 m ab. msl) and Kabi (1567 m ab. msl). All accessions have been characterized using ICAR-NBPGR passport descriptors and evaluated for key morphological and agronomic traits. During 2025, additional germplasm exploration resulted in the collection of two new accessions, namely SCC-333 (Ramla) from Shagyong village and SCC-334 (Hario Golsey) from Gor village in Dzongu region of Mangan district, Sikkim. Parallelly, the ICAR, Gangtok Centre, in collaboration with ICRI, also documented a unique landrace 'Uttarey Varlang' (SCC-218) collected from farmers' fields in West Sikkim. Preliminary evaluation revealed notable characteristics including tolerance to major diseases in large cardamom.



Figure 1. Newly collected germplasm accessions of large cardamom (A) SCC-333 (Ramla) (B) SCC-334 (Hario Golsey) (C) Uttarey Varlang' (SCC-218)

Crop Improvement

LCA/CI/2.1: Coordinated Varietal Trial (CVT) on large cardamom

(Centres: ICAR Regional Station, Gangtok, ICRI Regional Research Station, Gangtok & RRS for Hill Zone, UBKV, Kalimpong, West Bengal)

Coordinated Varietal Trial (CVT) on large cardamom was initiated during 2023 to evaluate the performance of promising genotypes across locations. The trial was laid

out in RBD with 10 genotypes, including national and zonal checks. Observations on morphological traits as well as pest and disease incidence were recorded at ICRI Gangtok and ICAR Gangtok centres during 2024–25 whereas the planting and plot established at - UBKV, Kalimpong, West Bengal. Evaluation of genotypes at both locations revealed considerable variability in vegetative growth parameters among entries.

Among the entries, SCC 264 (Sawney) consistently performed superior with respect to plant height, tiller production and spike number, indicating its strong growth vigour and yield potential. Genotypes SCC 307 and SCC 242 also exhibited favourable vegetative characteristics, particularly for leaf length and leaf number. Assessment of insect pest and disease incidence indicated differential response among the genotypes. SCC-264 (Sawney) consistently showed minimal incidence of insect pests and diseases, with negligible levels of leaf caterpillar, shoot fly, and blight, and no incidence of shoot borer or dry rot. In contrast, SCC-214 and SCC-213 (Golsey group) exhibited relatively higher susceptibility to rust and blight. Importantly, no incidence of viral diseases such as chirkey and foorkey was observed during the evaluation period. Overall, SCC-264 demonstrated superior performance in terms of vegetative growth and tolerance to pests and diseases.

Table 12. Evaluation of morphological traits of large cardamom under CVT (2024-25) recoded from both centres

Parameters/ Entries	Plant height (cm)			No. of tillers/clump			Nos. of leaves/tiller			Leaf length (cm)			Leaf breadth (cm)			No. of spikes/Clump		
	ICRI	ICAR	M	ICRI	ICAR	M	ICRI	ICAR	M	ICRI	ICAR	M	ICRI	ICAR	M	ICRI	ICAR	M
SCC 216 (Ramla)	86.7	61.8	74.3	6.6	5.9	6.2	8.7	4.6	6.7	42.3	26.8	34.6	8.9	8.4	8.7	4.8	3.5	4.2
SCC 217 (Ramla)	83.3	61.4	72.4	6.2	6.0	6.1	8.3	4.5	6.4	44.2	27.0	35.6	9.0	7.7	8.3	3.4	2.4	2.9
SCC 213 (Golsey)	32.4	37.1	34.8	2.3	5.8	4.0	4.5	1.8	3.1	19.0	14.8	16.9	6.3	5.8	6.0	1.2	0.0	0.6
SCC 214 (Golsey)	30.3	38.9	34.6	2.2	2.1	2.1	3.7	1.5	2.6	22.6	14.9	18.8	6.7	5.3	6.0	1.1	2.3	1.7
SCC 242 (Ramsey)	86.4	56.7	71.6	6	5.3	5.6	10.0	4.4	7.2	45.1	25.6	35.4	8.4	7.9	8.2	3.5	3.5	3.5
SCC 264 (Sawney)	99.1	65.2	82.2	7.1	5.7	6.4	9.5	4.5	7.0	47.8	28.7	38.3	7.9	7.8	7.9	6.5	4.3	5.4
SCC 307 (Varlangey)	98.2	63.8	81.0	5.8	5.7	5.7	8.5	4.0	6.2	51.8	25.8	38.8	8.2	4.9	6.5	4.5	4.5	4.5
ICRI Sikkim-1 (N. check)	96.1	68.8	82.5	6	5.5	5.7	9.8	4.4	7.1	51.1	26.8	39.0	8.0	8.2	8.1	4.6	3.2	3.9
Sawney (Local check)	99.1	60.2	79.7	5.8	5.7	5.8	10.2	3.4	6.8	47.9	25.1	36.5	8.1	7.7	7.9	5.1	3.3	4.2
Seremna (Zo. Check)	87.5	59.1	73.3	6.7	5.4	6.1	9.3	4.1	6.7	48.2	28.5	38.4	9.9	7.6	8.8	6.8	0.0	3.4
Loc. Mean	79.9	57.3	68.6	5.5	5.3	5.4	8.3	3.7	6.0	42.0	24.4	33.2	8.1	7.1	7.6	4.2	2.7	3.4
SEm±	4.4	1.51		0.53	0.14		0.49	0.07		2.0	0.7		0.3	0.1		0.9	0.4	
LSD (p=0.05)	13.2	4.6		1.6	0.4		1.5	0.2		6.0	2.2		0.9	0.4		2.6	1.2	



Figure 2. Glimpses of various CVT on large cardamom trial locations (A) ICRI (B) ICAR

Crop Management

LCA/CM/2.1: Effect of polysulphate (polyhalite) application on growth of large cardamom

(Centres: ICAR Regional Station, Gangtok and ICRI Regional Research Station, Gangtok)

A field experiment was conducted to evaluate the effect of polysulphate (polyhalite) application on vegetative growth and clump vigour of large cardamom. The experiment consisted of four treatments, including recommended organic package of practices and graded levels of polysulphate application. The results recorded at both centres indicated that the application of polysulphate at 400 kg ha^{-1} (T_4) in addition to recommended organic practices significantly improved vegetative growth parameters compared with other treatments. Plants under this treatment exhibited greater plant height, higher number of leaves per tiller, increased number of mature tillers per clump and improved leaf breadth, reflecting enhanced clump vigour.

Table 13. Effect of Polyphosphate on growth parameters of large cardamom

Treatment	Plant height (cm)		No. of leaves		Mature tillers/ clump		Immature tillers/clump		Leaf length (cm)		Leaf breadth (cm)		Girth (cm)	
	ICAR	ICRI	ICAR	ICRI	ICAR	ICRI	ICAR	ICRI	ICAR	ICRI	ICAR	ICRI	ICAR	ICRI
T1	49.7	51.3	4.40	4.44	2.71	2.76	2.34	2.30	30.4	32.3	6.11	6.16	3.40	3.42
T2	45.5	49.3	4.12	4.02	2.27	2.22	2.61	2.64	31.6	31.2	5.59	5.52	5.24	5.14
T3	47.1	49.8	4.21	4.24	2.60	2.66	2.79	2.76	29.7	30.7	6.18	6.08	4.90	4.94
T4	50.7	49.2	4.93	4.96	3.23	3.16	2.88	2.82	32.9	32.6	6.60	6.68	5.31	5.34
C.D.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SE(m)	2.32	2.38	0.35	0.30	0.22	0.25	0.20	0.21	1.50	1.55	0.22	0.26	0.55	0.51
SE(d)	3.30	3.36	0.44	0.42	0.33	0.35	0.33	0.30	2.13	2.19	0.39	0.37	0.75	0.72
C.V.	10.3	10.6	15.7	15.0	20.1	20.3	17.2	17.9	9.70	9.77	9.62	9.57	24.8	24.1

Where, T_1: Recommended organic POP of large cardamom; T_2: T_1 + Polyphosphate @ 100 kg ha^{-1} in three splits; T_3: T1+ Polyphosphate@ 200 kg ha^{-1} in three splits; T_4: T1 + Polyphosphate @ 400 kg ha^{-1}.

04. Ginger

Genetic Resources

GIN/CI/1.1: Germplasm collection, characterization, evaluation and conservation

(Centres: Barapani, Dholi, Kumarganj, Pundibari, Pottangi, Raigarh, Solan)

Collection, characterization, evaluation and conservation activities of ginger germplasm is being carried out at Barapani, Dholi, Kumarganj, Pottangi, Pundibari, Raigarh, and Solan centres, located in the diverse agro-climatic zones. A total of 449 accessions being conserved and maintained by these AICRPS centres jointly (Table 14).

Table 14. Ginger germplasm collections maintained at various AICRPS centres

Centre	Indigenous		Exotic	Total
	Cultivated	Wild & related species		
Barapani	32	-	-	32
Dholi	40	-	-	40
Kumarganj	57	-	-	57
Pottangi	198	-	-	198
Pundibari	40	-	-	40
Raigarh	40	-	-	40
Solan	42	-	-	42
Total	449	-	-	449

At Barapani, thirty-two ginger accessions (IC-584322 to IC-584364) were maintained and evaluated. The highest plant height was recorded in IC-584332 (76.03 cm). The longest leaf was observed in IC-584345 (25.80 cm), while IC-584332 recorded the broadest leaf (2.9 cm). The highest number of tillers was recorded in IC-584327 (6.0). The highest fresh rhizome yield per plant was recorded in IC-584361 (333.75 g) followed by IC-584338 (289.61 g). Biochemical analysis revealed the highest oleoresin content in IC-584334 (6.05%), while IC-584344 recorded the highest dry matter content (21.7%).

At Dholi, forty ginger accessions were evaluated. The genotypes RG-57 and RG-36 recorded the highest yield (22.80 t ha^{-1}), followed by RG-44 (21.66 t ha^{-1}) and RG-30 and RG-71 (18.87 t ha^{-1}), which were superior to the check variety Nadia (17.85 t ha^{-1}). At Kumarganj, fifty-seven (57) germplasm accessions were evaluated. The genotypes NDG-23 (146.23 g $plant^{-1}$), NDG-28 (137.38 g $plant^{-1}$) and NDG-35 (128.35 g $plant^{-1}$) were identified as promising based on rhizome yield.

At Pottangi, a total of 198 ginger germplasm accessions were evaluated. Thirty-two accessions produced more than 5 kg fresh rhizomes per 3 m^2 plot, with a mean yield of 3.9 kg per 3 m^2 during 2025–26. The plot yield ranged from 0.68 kg (PGS-119) to 9.2 kg (S-62) among the evaluated germplasm. At Pundibari, two ginger accessions collected during 2022–23 from Manikchak, Malda (GCP 58) and Suripara, Alipurduar (GCP 59) were evaluated under field conditions. Both genotypes showed moderate resistance to rhizome rot and wilt (15–16% disease incidence). GCP 58 recorded a higher yield of 13.5 t ha^{-1}, while GCP 59 yielded 11.0 t ha^{-1} under local agro-climatic conditions.

At Raigarh, a total of 40 ginger genotypes (38 germplasm lines and two checks, Suprabha and Suruchi) were maintained and evaluated. The genotypes IGS-14 (21.17 t ha^{-1}), IGS-11 (20.17 t ha^{-1}) and IGS-16 (18.33 t ha^{-1}) recorded superior fresh rhizome yield compared to the check varieties Suruchi (12 t ha^{-1}) and Suprabha (13 t ha^{-1}). At Solan,

forty-two (42) ginger accessions were evaluated. The fresh rhizome yield ranged from 10.99 t ha^{-1} to 36.14 t ha^{-1}, with a mean yield of 21.90 t ha^{-1}. The highest yielding genotypes were SG19-11 (216.85 g plant^{-1}) followed by SG19-14 (186.82 g plant^{-1}) and SG19-29 (183.53 g plant^{-1}). Dry matter recovery ranged from 15.43% to 22.82%, with the highest values recorded in SG19-33, followed by SG19-14, SG19-03, SG19-16 and SG19-23, indicating their suitability for dry ginger production and processing. Oleoresin content ranged from 2.65% in SG19-34 to 5.09% in SG19-32.



Figure 3. Germplasm conservation block at (A) Barapani (B) Kumarganj (C) Pottangi (D) Pundibari (E) Raigarh (F) Solan

Table 15. Summary of ginger germplasm evaluation across AICRP Centres (2024-25)

Centre	No. of accessions evaluated	Range (t ha^{-1})	Mean yield (t ha^{-1})	Promising accessions based on key traits
Barapani	32	5.33 -15.28	9.29	Yield: IC-584361 (15.28 t ha^{-1}), IC-584338 (13.03 t ha^{-1}), IC-584346 (11.6 t ha^{-1})
		3.32 - 6.05*	4.42*	Oleoresin content: IC-584334 (6.05%)
Dholi	40	7.2 - 22.8	11.88	RG-57 (22.8 t ha^{-1}), RG-36 (22.8 t ha^{-1})
Kumarganj	57	17 - 24.33	19.69	NDG-23 (24.37 t ha^{-1}), NDG-28 (22.90 t ha^{-1}), NDG-35 (21.39 t ha^{-1})
Pottangi	198	1.51 - 20.4	8.7	S-62 (20.4 t ha^{-1}), Zo-9 (19.76 t ha^{-1}), PGS-150 (19.54 t ha^{-1})
Pundibari	40	3.9 - 13.5	6.2	GCP-58 (13.5 t ha^{-1}), GCP-59 (11.0 t ha^{-1})
Raigarh	40	6.7 - 21.17	11.71	IGS-14 (21.17 t ha^{-1}), IGS-11 (20.17 t ha^{-1}), IGS-16 (18.33 t ha^{-1})
Solan	42	10.99 - 36.14	21.9	SG19-11 (36.14 t ha^{-1}), SG19-14 (31.14 t ha^{-1}), SG19-29 (30.59 t ha^{-1})

*Oleoresin content expressed in percent.

Crop Improvement

GIN/CI/2 Coordinated Varietal Trial (CVT)

GIN/CI/2.5: Coordinated Varietal Trial (CVT) on disease tolerance trial in ginger

(Centres: Barapani, Chintapalle, Kozhikode, Nagaland, Pottangi, Pundibari, Gangtok, Raigarh)

Coordinated Varietal Trial (CVT) on disease tolerance trial in ginger aimed to identify the high yielding ginger genotypes performing well under disease pressure. The trial laid out at 8 AICRPS centres in RBD with nine test genotypes (R 1.25/4, G 1.00/4, HP 05/ 15, HP 0.5/2, V0.5/2, V1E4 1, V1E4 5, V2E5 2 and Indira Ginger) with one national check (IISR Varada) or local check.

Based on multi-location evaluation, the ginger gamma mutant variety 'IISR Navya' (HP 0.5/2), was identified for release by the XXXVI AGM. The variety recorded an average fresh rhizome yield of 15.3 t ha^{-1} across locations with a potential yield of 36.0 t ha^{-1}. It also exhibited desirable quality attributes including 18.78% dry recovery, 2.7% essential oil, 6.65% oleoresin, 6.5% fibre, 20% zingiberene and 10% β-sesquiphellandrene. Under field conditions, IISR Navya showed field tolerance to rhizome rot with PDI of 14.1 and was found suitable for cultivation in Kerala, West Bengal and the North-Eastern region including Meghalaya.

Another promising entry, OUAT Kalinga Ginger 4 (Koraput Ada) / V1E4-5, developed at HARS, OUAT, Pottangi, was also identified during the AGM for release. This genotype recorded an average fresh rhizome yield of 15.9 t ha^{-1} with about 10% yield advantage over the national check IISR Varada and a potential yield of 20.7 t ha^{-1} under Pottangi and Chintapalle trials. It is a medium duration (225 days) variety with medium bold rhizomes and fingers, possessing 21.5% dry recovery, low fibre (3.5%), 4.2% oleoresin and 1.7% essential oil. The genotype also exhibited moderate tolerance to soft rot, tolerance to leaf spot, moderate resistance to shoot borer and scale insects, and high resistance to bacterial wilt, and was recommended for cultivation in Odisha and Andhra Pradesh under irrigated and rainfed conditions in both hill and plain ecosystems.

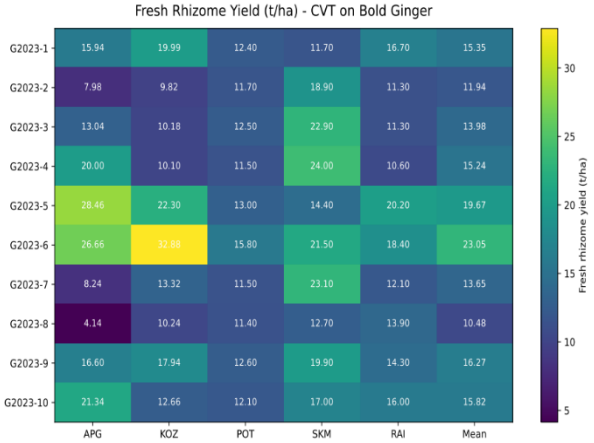


Figure 4. Multi-environment performance of CVT bold ginger entries for fresh rhizome yield across location.

APG: Appangala; KOZ: Kozhikode; POT-Pottangi; SKM: Sikkim; RAI: Raigarh

GIN/CI/2.6: CVT on bold ginger trial Series-2023 (Centres: Appangala, Kozhikode, Pottangi, Raigarh, Sikkim)

During the 2024–25 season, the replicated trial has been established in all five testing centres with three replications and evaluation of growth and yield traits primarly focusing on fresh rhizome yield, dry recovery as well as rhizome girth during *Kharif* 2024 in 3 × 1 m plots. Coordinated Trial (CVT) on Bold Ginger trial conducted across five AICRPS centres during 2024-25 revealed significant variation in fresh rhizome yield, dry recovery

and rhizome girth among the evaluated genotypes, with fresh rhizome yields ranging from about 4.14 to 32.88 t ha^{-1} across locations. Among the entries, G2023-6 recorded the highest mean yield (23.05 t ha^{-1}) followed by G2023-5 (19.67 t ha^{-1}) and G2023-9 (16.27 t ha^{-1}) indicating their superior performance and stability across test environments compared to other entries. For dry recovery (%), the entry G2023-7 recorded the highest mean value of 22.77%, followed by G2023-3 with 22.04% and G2023-10 with 21.13%, indicating these entries possess superior dry matter conversion ability compared to the check variety Rio-de Janero, which recorded a mean dry recovery of only 15.30%. In terms of rhizome girth (cm), entry G2023-7 again performed best with the highest mean girth of 3.34 cm, followed by G2023-10 (2.75 cm) and G2023-3 (2.71 cm), whereas the check variety Rio-de Janero recorded a comparatively lower mean girth of 2.25 cm.

GIN/CI/2.6: CVT on high essential ginger trial Series-2023.
(Centres: Appangala, Kozhikode, Nagaland, Pottangi, Umiam)

During the 2024–25 season, the replicated trial has been established in all five testing centres with three replications and evaluation of growth and yield traits primarily focusing on fresh rhizome yield, as well as essential oil content during *Kharif* 2024 in 3 × 1 m plots.

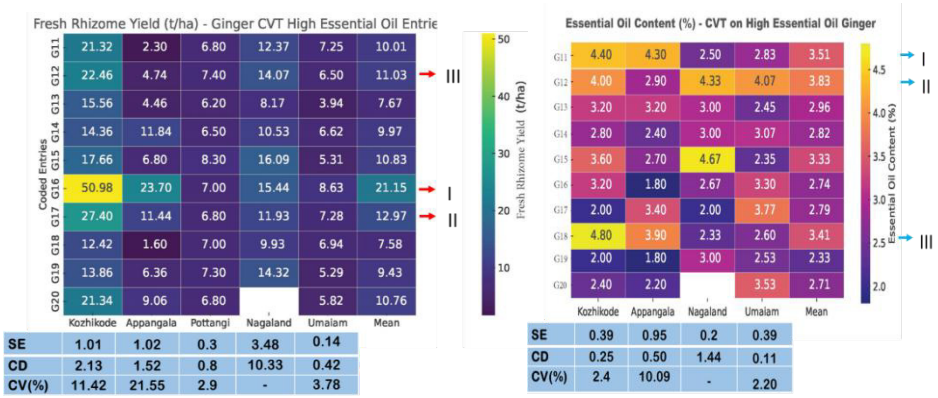


Figure 5. Multi-environment performance of CVT high essential oil ginger entries for fresh rhizome yield and essential oil across location.

CVT for high essential oil ginger entries evaluated for fresh rhizome yield (t ha^{-1}) as well essential oil content (%) revealed considerable variation among the ten coded entries. Entry G2023-16 recorded the highest mean fresh rhizome yield of 21.15 t ha^{-1}, markedly superior to all other entries, followed by G2023-17 with a mean yield of 12.97 t ha^{-1} and G2023-12 with 11.03 t ha^{-1}, positioning these three entries as the top performers in the trial. Entry G2023-12 recorded the highest mean essential oil content of 3.83%, followed closely by G2023-11 with 3.51% and G2023-18 with 3.41%, indicating these three entries as the top performers with superior essential oil accumulation capacity across locations.

Crop Management

GIN/CM/4 Agronomical Trial (AT)
GIN/CM/4.1: Evaluation of different ginger based intercropping systems for higher yield and income (Centres: Chintapalli, Pottangi, Pundibari, ICAR-Gangtok, Solan, Dholi, Nagaland, Mizoram, Kalyani)

The aim of the experiment was to assess the different ginger based intercropping systems

for higher yield and income under organic management condition. This experiment was initiated during 2022-23 (*kharif*/*rabi*) with eight treatments: T_1- sole ginger; T_2- Ginger + Fenugreek (Grow ginger and fenugreek in 2:2 ratio. Grow fenugreek in *Kharif* and *Rabi*); T_3- Ginger + Coriander + leafy vegetables (Grow ginger and coriander in 2:2 ratio. After harvesting of coriander, grow leafy vegetables in place of coriander), T_4- Ginger + Maize (2:1 or 2:2) (Grow sweet corn in *Kharif*, *Rabi* and *Summer*- 3 times); T_5- Ginger + French Bean (2:2) (Grow French bean in *Kharif*, *Rabi* and *Summer*- 3 times); T_6- Ginger + Arhar (3:1) (Grow arhar in *Kharif*) and T_7- Ginger + Elephant foot yam (2:2) (Grow Elephant foot yam in *Kharif*).

Table 16. Pooled mean ginger yield (t ha^{-1}) under different intercropping systems across centres (2022-25)

Treatments	CPE	GTK	NGL	POT	PUN	SLN	DHL	MZM	KAL	Overall Mean	Ranking
T_1	15.07	19.03	11.44	19.30	13.03	18.65	14.05	9.10	15.30	14.18	2
T_2	9.40	17.34	4.69	15.40	1.33	3.87	5.65	6.96	11.50	7.27	6
T_3	11.95	39.90	10.66	16.20	4.52	6.06	5.91	7.83	14.44	9.45	4
T_4	11.15	23.74	13.27	15.40	2.83	22.05	6.36	9.70	14.78	10.43	3
T_5	10.44	22.05	11.00	16.40	5.84	7.17	5.54	6.66	13.62	8.68	5
T_6	11.02	17.01	5.38	14.30	3.47	1.82	9.19	6.16	11.05	7.08	7
T_7	21.59	29.34	12.35	14.30	32.95	9.41	12.32	7.65	17.47	15.48	1
State Average	8.87	5.36	9.05	10.94	11.04	7.14	6.02	7.03	11.04	11.62	–

Footnote: Abbreviations: CPE: Chintapalli (Andhra Pradesh); GTK: Gangtok (Sikkim); NGL: Nagaland; POT: Pottangi (Odisha); PUN: Pundibari (West Bengal); SLN: Solan (Himachal Pradesh); DHL : Dholi (Bihar); MZM: Mizoram; KAL : Kalyani (West Bengal).
Rank = Based on overall mean performance across locations. Values represent the mean of replicated observations. The overall mean was calculated across all nine test locations.

The results of the multi-location evaluation of ginger-based intercropping systems indicated clear advantages of diversified cropping over sole cropping. Among the treatments evaluated, the highest overall ginger yield (15.48 t ha^{-1}) was recorded under ginger + elephant foot yam intercropping, followed by sole ginger (14.18 t ha^{-1}), while ginger + maize recorded the third highest yield (10.43 t ha^{-1}). The yield trend across three years (2022–23 to 2024–25) consistently demonstrated the superiority of the elephant foot yam–based intercropping system, particularly at the Chintapalli and Pundibari centres. In contrast, the treatments ginger + fenugreek and ginger + arhar recorded comparatively lower yields across most locations.

Economic analysis further confirmed the advantage of diversified intercropping systems. The highest benefit–cost ratio (2.46) was obtained with ginger + elephant foot yam, indicating superior profitability compared to other treatments. Intercropping with maize, French bean, and coriander followed by leafy vegetables also proved economically viable and showed promising performance across several centres.

Overall, the study demonstrated that ginger-based intercropping systems significantly improved resource utilization, cropping intensity, and economic returns compared to sole ginger cultivation. The systems were found to be adaptable across diverse agro-climatic regions including the Eastern

Himalayas, North-Eastern states, and Eastern India.

Based on the results obtained from multi-location trials, the 36th Annual Group Meeting (AGM) of AICRP on Spices recommended suitable ginger intercropping systems for different regions under the Transfer of Technology (ToT) programme.

Table 17. Economic analysis (BC ratio) of ginger-based intercropping systems

Treatments	CPE	GTK	NGL	POT	PUN	SLN	DHL	MZM	KAL	Overall mean	Ranking
T1	2.44	1.76	1.66	1.97	2.27	0.93	1.99	2.41	2.06	1.94	
T2	1.69	2.02	1.45	2.9	1.83	0.47	1.16	2.88	1.99	1.82	
T3	1.82	2.68	1.83	2.84	2.47	0.71	1.22	3.35	3.12	2.23	3
T4	1.7	2.07	2.61	3.27	1.97	1.89	1.35	3.47	2.16	2.28	2
T5	1.91	1.92	1.61	2.72	2.65	0.72	1.08	2.95	4.02	2.17	
T6	2.11	1.89	1.77	3.01	2.33	0.92	2.15	2.81	2.34	2.15	
T7	2.95	1.8	1.71	2.41	3.15	0.82	2.28	3.12	3.91	2.46	1

Footnote
Abbreviations: CPE: Chintapalli (Andhra Pradesh); GTK: Gangtok (Sikkim); NGL: Nagaland; POT: Pottangi (Odisha); PUN: Pundibari (West Bengal); SLN: Solan (Himachal Pradesh); DHL : Dholi (Bihar); MZM: Mizoram; KAL : Kalyani (West Bengal).
Rank = Based on overall mean performance across locations. Values represent the mean of replicated observations. The overall mean was calculated across all nine test locations.

Intercropping ginger with elephant foot yam in a 2:2 row ratio, with taro grown during the *Kharif* season, was recommended for the states of Andhra Pradesh, Bihar, and West Bengal. Intercropping ginger with maize in 2:1 or 2:2 row proportions, with sweet corn grown during both *Kharif* and *Rabi* seasons, was recommended for Odisha, Nagaland, Himachal Pradesh, and Mizoram. The system of ginger intercropped with French bean in a 2:2 row ratio, involving cultivation of Dolichos bean during *Kharif* followed by French bean in Rabi, was recommended for West Bengal. Similarly, ginger intercropped with coriander in a 2:2 ratio followed by leafy vegetables after coriander harvest was recommended for Sikkim.

GIN/CM/5 Nutrient Management and Soil Fertility Trials (NM/SF)

GIN/CM/5.1: Evaluation of Plant Growth Promoting Rhizobacteria, *Bacillus safensis* for Phosphorus (P) Solubilization Potential in ginger (Centres: Ambalavayal, Chintapalli, Kalyani, Kammarpally, Kumarganj, Pasighat, Pottangi, Pundibari, Raigarh)

Multilocation trial was conducted during 2022–23 to 2024–25 to evaluate the phosphorus (P) solubilizing efficiency of *Bacillus safensis* in ginger under varying phosphorus fertilizer levels. The experiment tested seven nutrient management treatments comprising different phosphorus doses either alone or in combination with *B. safensis*. T_1-100 % recommended phosphorus (P) fertilizer; T_2- 75 % P fertilizer alone; T_3-75 % P fertilizer and *Bacillus safensis;* T_4-50% phosphorus (P) fertilizer alone; T_5-50 % P fertilizer and *Bacillus safensis;* T_6- *Bacillus safensis* alone; T_7- Control without P.

Pooled analysis for three years clearly demonstrated the beneficial effect of *Bacillus safensis* when integrated with reduced phosphorus fertilization (Table 1). Across the nine participating centres, application of 75% recommended phosphorus along with *Bacillus safensis* (T_3) recorded the highest

pooled fresh rhizome yield of 14.31 t ha^{-1}, surpassing the standard recommendation of 100% recommended phosphorus (13.25 t ha^{-1}) by 1.06 t ha^{-1} (8.0%).

Table 18. Pooled mean of fresh rhizome yield (t ha^{-1}) of ginger under different phosphorus fertilizer levels integrated with *Bacillus safensis* across nine AICRP on Spices centres (2022–23 to 2024–25).

Treatments	ABL	CPE	KAL	KMP	KUM	PASI	POT	PUN	RAI	Overall mean	Rank
T_1-100% P	20.54	11.23	15.30	7.43	8.38	12.17	14.17	15.56	14.51	13.25	2
T_2-75% P	18.25	9.97	14.69	7.60	7.88	10.07	13.40	14.29	12.47	12.07	
T_3-75% P+*Bacillus safensis*	21.47	12.73	17.97	8.67	9.79	13.35	14.80	17.45	12.61	14.31	1
T_4-50% P	17.04	9.88	13.92	5.02	7.55	9.26	13.17	13.36	11.93	11.24	
T_5-50% P+*Bacillus safensis*	18.91	11.59	16.76	7.11	8.93	10.86	14.53	15.76	10.90	12.82	3
T_6-*Bacillus safensis* alone	16.39	10.03	13.39	5.82	7.28	8.55	13.63	12.49	9.73	10.81	
T_7-Control without P	17.37	9.02	12.45	4.93	6.79	8.01	12.67	11.41	8.65	10.14	

Footnote:ABL : Ambalavayal; CPE : Chintapalli; KAL : Kalyani; KMP : Kammarpally; KUM : Kumarganj; PASI : Pasighat; POT : Pottangi; PUN : Pundibari; RAI : Raigarh.
Overall mean represents the average across all participating centres. Rank is based on pooled overall mean fresh rhizome yield.

Table 19. Pooled mean of fresh rhizome yield (t ha^{-1}) of ginger under different zinc fertilizer levels integrated with *Bacillus safensis* across nine AICRP on Spices centres (2022–23 to 2024–25).

Treatments	CPE	KAL	KMP	KUM	PASI	POT	RAI	Overall mean	Rank
T_1-100% Zn	11.36	16.61	8.14	8.51	12.53	14.80	12.87	12.12	2
T_2-50% Zn +Bacillus *safensis.*	12.86	17.94	10.08	9.23	13.37	15.00	10.88	12.77	1
T_3-50% Zn	10.96	15.21	7.44	7.70	11.13	13.90	9.70	10.86	3
T_4- *Bacillus safensis* alone	10.94	14.63	6.92	6.98	10.20	14.60	9.21	10.50	
T_5-control without Zn	8.58	12.24	6.06	6.69	9.12	13.43	8.53	9.24	

Footnote: CPE : Chintapalli; KAL : Kalyani; KMP : Kammarpally; KUM : Kumarganj; PASI : Pasighat; POT : Pottangi; RAI : Raigarh.

The study demonstrates that 25% of the recommended phosphorus fertilizer can be safely substituted through inoculation with *Bacillus safensis* without compromising productivity, resulting in improved phosphorus-use efficiency and reduced fertilizer inputs.

GIN/CM/5.2: Evaluation of Plant Growth Promoting Rhizobacteria, *Bacillus safensis* for zinc (Zn) solubilization potential in ginger (Centres: Chintapalle, Kalyani, Kammarpally, Kumarganj, Pasighat, Pottangi, Raigarh)

The experiment was conducted with the following treatments: T_1-100 % recommended zinc (Zn) fertilizer; T_2-50 % Zn fertilizer and *Bacillus safensis;* T_3-50% zinc (Zn) fertilizer alone; T_4- *Bacillus safensis* alone; T_5- Control without Zn. Multilocation experiment was conducted during 2022–23 to 2024–25 and the pooled analysis over three years demonstrated a consistent positive response to inoculation with *Bacillus safensis* when integrated with 50% of the recommended zinc dose (Table 1). Across the seven participating centres, 50% recommended Zn + *Bacillus safensis* (T_2) recorded the highest pooled fresh rhizome yield of 12.77 t ha^{-1}, followed by 100% recommended Zn (12.12 t ha^{-1}). The combined application resulted in an

additional 0.65 t ha^{-1} (5.4%) yield advantage over the full recommended zinc dose, thereby supporting the inventor's claim that nearly 50% of the zinc fertilizer requirement can be substituted by inoculation with *Bacillus safensis*. The superiority of T_2 was observed across most locations. Chintapalli, Kalyani, Kammarapally, Kumaraganj, Pasighat and Pottangi consistently recorded their highest yields under 50% Zn + *Bacillus safensis*. Although Raigarh registered slightly higher yield under 100% Zn, the overall pooled performance still favoured the integrated treatment because of its consistent superiority across the majority of locations. Application of 50% Zn alone produced an average yield of 10.86 t ha^{-1}, whereas *Bacillus safensis* alone yielded 10.50 t ha^{-1}. The control without zinc recorded the lowest productivity (9.24 t ha^{-1}), indicating the importance of adequate zinc nutrition for maximizing ginger productivity. The bacterial inoculation alone improved yield over the control, suggesting its ability to mobilize native soil zinc reserves even in the absence of external zinc fertilizer.

Overall mean represents the average across all participating centres. Rank is based on pooled overall mean fresh rhizome yield. These trial findings substantiate that 50% of the recommended zinc fertilizer can be safely replaced through inoculation with *Bacillus safensis* without compromising crop productivity. The microbial inoculant enhanced zinc-use efficiency by increasing zinc solubilization and maintaining adequate nutrient availability throughout crop growth.

Crop protection and food safety

GIN/CP/4 Pathological Trial (PT)

GIN/CP/4.1: Evaluation of Consortia (*B. safensis, B. amyloliquefaciens, Raoultella terrigena, & Acinetobacter sp.*) for Growth Promotion and Rhizome Rot Suppression in Ginger (Centres: Kozhikode, Solan, Pundibari, Raigarh)

The trial aims in evaluating the efficacy of bacterial consortia comprising *Bacillus safensis, Bacillus amyloliquefaciens, Raoultella terrigena,* and *Acinetobacter sp.* for growth promotion and rhizome rot suppression in ginger has been successfully initiated during 2025-26 at four participating centres. Since this is the first year of the three-year trial, the crop is currently under progress and quantitative data on yield and disease suppression will be generated and reported in the subsequent years.

CP/7 Entomological Trial (ET)

GIN/CP/7.3: Evaluation of effective insecticides against shoot borer, *Conogethes punctiferalis* infesting ginger for label claim expansion (Centres: Ambalavayal, Appangala, Kozhikode, Mudigere, Raigarh)

Field trials were conducted at five AICRPS centres to evaluate the efficacy of chlorantraniliprole 18.5% SC and spinosad 45% SC at concentrations of 0.0375, 0.05, and 0.0625%, along with a standard check (lambda-cyhalothrin 5% EC), against the shoot borer, *Conogethes punctiferalis*, infesting ginger, for label claim expansion. The tested insecticide treatments were found to be effective in controlling the pest, recording up to 100% reduction in shoot borer damage at the recommended dose. The treatments were also found to be safe to natural enemies, and symptoms of phytotoxicity (leaf tip or surface injury, stunting, necrosis, chlorosis, vein clearing, epinasty, or hyponasty) were not observed even at twice the recommended dose. The treated plots consistently recorded higher yields compared to the untreated control.

05 Turmeric

Genetic Resources

TUR/CI/1.1: Germplasm collectionn, characterization, evaluation and conservation

(Centres: Barapani, Coimbatore, Dholi, Guntur, Kammarpally, Kumarganj, Pasighat, Pottangi, Pundibari, Raigarh, Solan)

During 2024–25, the AICRP on Spices centres working on turmeric collectively maintained 1,659 germplasm accessions of cultivated and wild forms and relatives and enriched the national turmeric genetic resource base by adding 19 new collections, increasing the total holdings to 1,896 accessions. A total of 1,005 IC-numbered accessions were available across centres, reflecting systematic documentation and conservation efforts. (Table 20).

Table 20. Turmeric germplasm conserved, newly collected and evaluated at various AICRP on Spices centres during 2024–25

AICRP Centre	Germplasm Maintained	New Germplasm Collected	Total Germplasm Conserved	Germplasm Evaluated	IC Numbers Obtained*
Barapani	76	6	82	29	32
Coimbatore	277	–	277	57	225
Dholi	68	4	72	68	46
Guntur	252	2	254	72	5
Kamarapally	318	–	318	50	–
Kumaraganj	188	2	190	188	18
Pasighat	84	–	84	12	–
Pottangi	202	2	204	200	–
Pundibari	220	2	220	181	171
Raigarh	108	–	108	108	55
Solan	86	1	87	40	–
Total	1,879	19	1,896	1,005	552

At Barapani, among 29 accessions evaluated, IC-586763 recorded the highest plant height (96.23 cm), leaf length (49.76 cm), leaf breadth (17.00 cm), and number of leaves (14.00), while IC-586755 gave the highest yield (344.65 g plant^{-1}; 16.80 t ha^{-1}) and IC-586759 recorded the highest curcumin content (5.75%). At Coimbatore, among 200 genotypes screened, CL 180 recorded the highest fresh rhizome yield (658 g plant^{-1}) and CL 9 the highest dry recovery (21.75%). At Dholi, accession RH-414 outyielded the check Rajendra Sonali, recording 52.80 t ha^{-1} against 48.00 t ha^{-1}. At Guntur, LTS-68 (603.60 g plant^{-1}) and clone CL-27 (723.20 g plant^{-1}) outperformed the check Lam Swarna (438.97 g plant^{-1}). At Kammarapally, JTS-605 recorded the highest yield (63.25 t ha^{-1}), while CLI-129/6 (28.76%) and KTS-10 (3.50%) excelled in dry recovery and curcumin content, respectively. At Kumarganj, NDG-23 (146.23 g plant^{-1}) was the top performer among 57 accessions. At Pasighat, CHFT-36 recorded the highest yield (270.06 g plant^{-1}; 28.27 t ha^{-1}) among 75 NE collections. At Pottangi, PTS-3 recorded the highest fresh yield (17.6 kg/3m^2; projected 37.3 t ha^{-1}) among 200 accessions. At

Pundibari, 32 of 181 genotypes exceeded 35 t ha^{-1}, with strong resistance to leaf blotch (62 genotypes) and leaf spot (65 genotypes) also recorded. At Raigarh, IT 59 (late group) recorded the highest yield (46.8 t ha^{-1}), while IT 25 topped both mid-early (40.4 t ha^{-1}) and medium (39.3 t ha^{-1}) maturity groups, surpassing checks IISR Prathibha and Roma. At Solan, ST19-27 recorded the highest yield (393.13 g plant^{-1}; 4.08% curcumin), while ST19-04 recorded the highest curcumin content (6.65%).

Table 21. Range, mean performance and superior genotypes identified for rhizome yield, dry recovery and curcumin content in turmeric under germplasm characterisation under various AICRP on Spices centres.

Centres	Rhizome Yield (t ha^{-1})			Dry Recovery (%)			Curcumin (%)		
	Range	Mean	Highest genotype	Range	Mean	Highest genotype	Range	Mean	Highest genotype
Barapani	05.88–16.80	9.30	IC-586755	17.53–22.13	19.57	IC-586765	3.28–6.89	4.97	Lakadong
Coimbatore	10.22–30.00	20.05	CL180	14.67–27.50	20.99	CL.9	1.46–5.79	2.74	CL.258
Dholi	26.40–52.80	37.02	RH-414	–	–	–	–	–	–
Guntur	02.70–33.53	19.74	LTS-68	12.70–27.70	18.09	LTS-12	0.56–5.80	2.69	LTS-55
Kamarapally	20.49–63.24	39.38	JTS-605	15.70–28.78	20.07	CLI-129\6	0.40–3.24	2.13	JTS-203
Kumarganj	17.00–38.00	22.00	NDH-75	18.00–23.00	20.10	NDH-67	2.97–5.50	4.70	NDH-10
Pottangi	05.55–39.10	12.00	PTS-3	15.30–27.20	18.60	PTS-10	1.10–6.47	2.75	PTS-10
Pundibari	25.00–40.00	28.00	TCP-58	–	–	–	–	–	–
Raigarh	11.40–46.80	30.10	IT-59	20.22–25.88	–	IT-59	–	–	–
Pasighat	13.46–18.52	14.93	CHFT-4	–	–	–	3.24–4.85	–	CHFT-82
Solan	25.11–31.91	27.37	ST19-27	21.80–24.10	23.10	ST19-27	2.17–6.65	3.64	ST19-04

Systematic screening of germplasm and breeding lines for disease reaction under natural field epiphytotic conditions carried out at Dholi, Guntur, and Pundibari centres were screened during 2024-25 for their reaction to leaf blotch and leaf spot diseases under field conditions, and genotypes were categorized into Resistant (R), Moderately Resistant (MR), Susceptible (S), Moderately Susceptible (MS), and Highly Susceptible (HS) groups based on standard disease scoring.

At Dholi, screening against leaf blotch (*Taphrina maculans*) identified three genotypes, namely RH-416, RH-427, and RH-441, as resistant (R), while 39 genotypes fell in the moderately resistant (MR) category. The check variety Morangia was recorded as highly susceptible (HS) to leaf blotch.

At Guntur, screening of turmeric germplasm against leaf spot (*Colletotrichum gloeosporioides*) identified seven genotypes as resistant (R), namely LTS-7, LTS-23, LTS-31, LTS-9, LTS-39, LTS-41, and LTS-42. Additionally, 10 genotypes were categorized as moderately resistant (MR), 7 genotypes as susceptible (S), and 48 genotypes as moderately susceptible (MS), reflecting considerable variability in host response and a relatively narrow base of highly resistant genotypes within the germplasm evaluated.

At Pundibari, large-scale screening of the germplasm collection revealed encouraging levels of field resistance, with 62 genotypes recorded as resistant to leaf blotch and 65 genotypes resistant to leaf spot, indicating a broad genetic base for disease resistance available within this germplasm set for further utilization in resistance breeding.

TUR/CI/1.2: Evaluation of Turmeric Somaclones and Seedling Progenies for Superior Agronomic Traits & Regional Adaptation-Series I
(Centres: Coimbatore, Guntur)

The trial evaluation of turmeric somaclones and seedling progenies under Coimbatore and Guntur during 2024–25 revealed substantial genetic variability for growth and yield attributes, indicating considerable scope for selection of superior genotypes. At Coimbatore, 75 somaclones and seedling progenies were evaluated under an ARBD, where genotype 138/74/10 emerged as the best entry with the highest plant height (58.40 cm), mother rhizome weight (30.20 g) and total rhizome weight (75.50 g), followed by 138/74/23 (72.20 g). Nevertheless, none of the experimental entries exceeded the performance of the standard check, Pragati, which recorded the highest rhizome weight (375.00 g), confirming its superior adaptability under Coimbatore conditions. Similarly, at Guntur, 63 turmeric somaclones, seedling progenies and standard checks were evaluated under a RBD.

Significant variation was observed for plant growth and rhizome yield, although the experimental entries remained inferior to the coordinated checks. Among the test entries, SC 10 recorded the highest total rhizome weight (121.20 g plant^{-1}), followed by 69/10/2 (99.80 g), SC 59 (93.40 g), SC 7 (88.00 g) and seedling progeny 138/23/1 (85.80 g).

The tallest plant among experimental entries was Yellow Type (84.60 cm), followed by Prathiba (83.20 cm). The coordinated check varieties, including LTS-2 (417.77 g plant^{-1}), Mydukur (412.65 g plant^{-1}), Prathiba (412.60 g plant^{-1}), PTB (409.32 g plant^{-1}), Co-2 (397.72 g plant^{-1}), Salem (391.07 g plant^{-1}) and BSR-2 (387.25 g plant^{-1}), consistently outperformed all experimental materials.

Crop Improvement

TUR/CI/2 Coordinated Varietal Trial (CVT)

TUR/CI/2.11: CVT on black turmeric (*Curcuma caesia*)
(Centres: Barapani, Kozhikode, Kumarganj, Mizoram, Navsari, Pottangi, Pundibari)

Coordinated Varietal Trial (CVT) on black turmeric (*Curcuma caesia*) aims to identify varieties harbouring high yield tailored for pharmaceutical use. The trial laid out at 8 AICRPS centres in RBD with seven test entries. After confirming the botanic identity of entries to Curcuma caeisa the trial during 2023-24 was initiated during the planting season 2024-25 at all centre.

Considerable variability was observed among the entries for vegetative growth, rhizome yield and quality traits (Table 1). BT-162 recorded the highest mean fresh rhizome yield (17.56 t ha^{-1}), closely followed by Acc. 751 (17.53 t ha^{-1}) and NBT-2 (16.87 t ha^{-1}) whereas NDHCc-1 produced the lowest mean yield (14.36 t ha^{-1}). The highest mean fresh weight per clump was also recorded by Acc. 751 (321.32 g plant^{-1}), followed by BT-162 (311.78 g plant^{-1}). Among the quality parameters, NBT-1 registered the highest mean dry recovery (19.25%), while NBT-1 also recorded the maximum oleoresin content (4.73%). Essential oil content ranged from 1.60 to 2.20%, with Acc. 292 recording the highest value (2.20%). Disease observations indicated comparatively lower leaf spot and leaf blotch incidence in BT-162 and Acc. 292, suggesting better field tolerance.



Figure 6. Comparative rhizome morphology of the superior test entry SC-10 and standard check varieties (Prathibha and Pragati)

Table 22. Mean growth, yield and quality performance of black turmeric entries evaluated under the coordinated varietal trial (2024–25) across locations.

Entry	S (%)	PH (cm)	Tillers clump^{-1}	FWt clump^{-1} (g)	FRY (t ha^{-1})	DRY (t ha^{-1})	DR (%)	Oleo (%)	EO (%)
NBT-1	95.08	108.84	5.04	290.95	16.15	2.35	19.25	4.73	2.00
NBT-2	96.26	110.35	4.82	273.72	16.87	2.54	18.36	4.60	1.80
BT-162	94.94	116.73	5.15	311.78	17.56	3.20	19.04	4.18	2.00
NDHCc-1	93.48	107.95	4.82	226.21	14.36	2.05	17.34	4.37	1.60
Acc. 292	93.64	111.64	4.92	225.64	14.71	2.41	18.67	4.53	2.20
Acc. 751	94.40*	117.20	5.02	321.32	17.52	2.03	17.76	4.17	2.10
PCC-1	94.60	108.23	4.69	259.02	16.45	2.59	18.73	4.17	1.80

Where S: Sprouting (%); PH: Plant Height (cm); Tillers clump^{-1} Number of Tillers per clump; FWt clump^{-1}: Fresh Weight per clump (g); FRY: Fresh Rhizome Yield (t ha^{-1}); DRY: Dry Rhizome Yield (t ha^{-1}); DR: Dry Recovery (%); Oleo: Oleoresin (%); EO: Essential Oil (%)

Table 23. Fresh and dry rhizome yield of black turmeric entries evaluated across AICRP on Spices centres during 2024–25

Entries	Fresh rhizome yield per ha (t)									Dry rhizome yield per ha (t)			
	BPI	KUM	KOZ	MZM	POT	PUN	NAV	Mean	Rank	PUN	POT	BPI	Mean
Acc 292	7.12	8.83	18.38	25.35	8.00	20.51	14.80	14.71	6	3.12	1.70	1.39	2.41
Acc 751	NG	8.72	24.46	25.12	5.90	19.60	21.37	17.53	2	2.75	1.30	NG	2.03
BT-162	8.60	8.22	20.50	29.26	12.80	23.35	20.20	17.56	1	3.69	2.70	1.72	3.20
NBT-1	7.93	6.39	14.68	28.79	6.90	20.78	27.59	16.15	5	3.19	1.50	1.65	2.35
NBT-2	9.00	5.56	20.00	27.59	10.60	19.56	25.75	16.87	3	2.78	2.30	1.7	2.54
NDHCc 1	7.37	9.78	18.80	25.02	7.20	18.91	13.41	14.36	7	2.60	1.50	1.29	2.05
PCC-1	8.22	8.56	20.84	26.11	11.00	19.40	21.02	16.45	4	2.67	2.50	1.63	2.59
Mean	8.04	8.01	19.67	26.75	8.91	20.30	20.59	16.04		2.97	1.93	1.56	2.45
SEM±	0.19	0.47	0.00	1.79	1.20	1.01	1.31	1.08		0.17	0.30	0.12	–
CD (0.05)	0.58	1.48	3.67	NS	3.70	2.07	3.97	NS		0.35	0.80	0.6	–
CV%	4.06	10.29	11.80	11.59	2.80	6.10	10.86	18.08		7.13	2.70	5.63	–

Where, BPI: Barapani; KUM: Kumarganj; KOZ: Kozhikode; MZM: Mizoram; POT: Pottangi; PUN: Pundibari; NAV: Navsari. NG = No germination.

Crop Management

TUR/CM/5.1: Evaluation of Plant Growth Promoting Rhizobacteria, *Bacillus safensis* for phosphorus (P) solubilization potential in turmeric (Centres: Chintapalle, Coimbatore, Kahikuchi, Kalyani, Kammarpally, Kozhikode, Pasighat, Pottangi, Pundibari, Raigarh, Solan)

The experiment was conducted during 2022-25 in 11 centres with the following treatments: T_1- 100 % recommended phosphorus (P) fertilizer; T_2- 75 % phosphorus (P) fertilizer; T_3 - 75 % phosphorus (P) fertilizer and Bacillus safensis; T_4 - 50 % phosphorus (P) fertilizer; T_5 - 50 % phosphorus (P) fertilizer and *Bacillus safensis*; T_6 - *Bacillus safensis* alone; T_7 – Control without Phosphorus application. The multi-location experiment results consistently demonstrated the beneficial effect of integrating *Bacillus safensis* with reduced phosphorus fertilizer levels for enhancing phosphorus availability and sustaining turmeric productivity. Across the centres, application of 75% recommended phosphorus in combination with *Bacillus safensis* (T_3) outperformed the corresponding fertilizer-alone treatments and, in several cases, equalled or exceeded the performance of 100% recommended phosphorus application. At Chintapalli, T_3 recorded the highest fresh rhizome yield (23.25 t ha^{-1}) together with the maximum available soil phosphorus at 150 DAP (46.40 kg ha^{-1}), significantly surpassing the control (16.83 t ha^{-1} and 10.60 kg ha^{-1}, respectively). Similarly, at Coimbatore, T_3 produced significantly higher rhizome yield (24.78 t ha^{-1}) and available phosphorus (34 kg ha^{-1}) compared with 75% phosphorus alone (22.28 t ha^{-1} and 27 kg ha^{-1}). At Kahikuchi, inoculation with *Bacillus safensis* increased fresh rhizome yield to 27.85 t ha^{-1} under 75% phosphorus compared with 20.78 t ha^{-1} under 75% phosphorus alone, while available phosphorus also increased from 22.65 to 25.53 kg ha^{-1}. Comparable responses were recorded at Kammarapally, where T_3 registered the highest rhizome yield (59.25 t ha^{-1}) with increased available phosphorus (47 kg ha^{-1}), and at Pottangi, where T_3 produced the highest yield (19.30 t ha^{-1}) and available phosphorus (62 kg ha^{-1}). At ICAR-IISR, Kozhikode, T_3 recorded the maximum fresh rhizome yield (33.64 t ha^{-1}), highest phosphorus uptake (25.02 kg ha^{-1}) and greatest available phosphorus (30.80 mg kg^{-1}), confirming the enhanced phosphorus solubilization capacity of the bacterial inoculant. Similar superiority of T_3 was observed at Pasighat, Raigarh, Solan and Kalyani, where integrated phosphorus management consistently improved rhizome productivity over fertilizer-alone treatments. At Pundibari, although treatment differences for fresh rhizome yield were not statistically significant owing to high experimental variability, T_3 recorded the highest available phosphorus (53.74 kg ha^{-1}) and dry recovery (6.02%), indicating improved nutrient availability. Across centres, dry recovery remained relatively stable, suggesting that phosphorus management primarily influenced yield and phosphorus nutrition without adversely affecting rhizome quality. The findings clearly indicate that inoculation with *Bacillus safensis* enables a reduction of mineral phosphorus fertilizer by 25% while maintaining or improving turmeric productivity through enhanced phosphorus solubilization, nutrient uptake and soil phosphorus availability. These results demonstrate the potential of *Bacillus safensis* as an eco-friendly biofertilizer component for integrated phosphorus management in turmeric production systems.

Table 24. Fresh rhizome yield (t ha^{-1}) of the centres on evaluation of plant growth promoting Rhizobacteria for phosphorus solubilization potential in turmeric.

Treatment	CPE	COI	KAHI	KPE	POT	KOZ	PASI	PUN	RAI	SOL	KAL	Mean
T_1	22.72	21.18	21.69	50.47	18.7	28.32	21.67	25.8	19.87	25.62	27.08	25.74
T_2	20.74	22.28	20.72	53.9	18.9	25.21	18.68	27.39	22.34	23.83	23.34	25.21
T_3	23.25	24.78	27.85	59.25	19.3	33.64	23.83	23.44	24.41	28.84	29.77	28.94
T_4	20.02	22.1	20.71	45.47	19.1	18.00	17.12	22.47	20.38	22.19	21.14	22.61
T_5	21.38	23.38	26.83	56.25	18.6	27.60	20.71	20.82	19.42	24.5	26.09	25.96
T_6	20.89	22.85	20.85	41.11	18.1	24.41	15.56	0.98	19.54	20.39	21.15	20.53
T_7	16.83	20.55	20.17	44.96	18	14.84	14.33	2.03	19.34	19.84	19.05	19.09
SE(m)±	0.85	0.48	0.97	1.69	0.4	–	0.42	5.01	0	2.25	0.417	1.25
CD @ 5%	2.65	1.05	1.83	50.89	1.2	–	1.25	25.8	0.485	4.95	1.3	9.14
CV (%)	7.06	5.68	–	7.389	3.5	–	4.47	27.39	0	0	3.017	6.5

Footnote: CPE : Chintapalli; COI : Coimbatore; KAHI : Kahikuchi; KPE : Kammarapally; POT : Pottangi; KOZ : Kozhikode; PASI : Pasighat; PUN : Pundibari; RAI : Raigarh; SOL : Solan; KAL : Kalyani. Mean yield values expressed in tonnes per hectare (t ha^{-1}) represents the average fresh rhizome yield of each treatment pooled across eleven participating centres. SE(m)±, CD @ 5%, and CV (%) values in the "Mean" column represent overall pooled statistical parameters across centres.

TUR/CM/5.2: Evaluation of Plant Growth Promoting Rhizobacteria, *Bacillus safensis* for zinc (Zn) solubilization potential in turmeric (Centres: Chintapalle, Coimbatore, Dholi, Kahikuchi, Kalyani, Kammarpally, Kanke, Kozhikode, Kumarganj, Pasighat, Pottangi, Pundibari, Raigarh)

The experiment to evaluate the effect of Plant Growth Promoting Rhizobacteria, *Bacillus safensis* for zinc (Zn) solubilization potential in turmeric was conducted with 13 AICRPS centre with the following treatments: The experiment was conducted with the following treatments: T_1-100 % recommended zinc (Zn) fertilizer; T_2-50 % Zn fertilizer and *Bacillus safensis*; T_3-50% zinc (Zn) fertilizer alone; T_4- Bacillus safensis alone; T_5- Control without Zn. All the doses of bacterial application were done by soil drenching at the time of planting, 30 DAP and 60 DAP as per the treatment schedule.

At Chintapalli, T_2 recorded the highest fresh rhizome yield (23.82 t ha^{-1}), significantly exceeding both the recommended zinc fertilizer (21.90 t ha^{-1}) and the control (19.17 t ha^{-1}). The treatment also enhanced available zinc in soil (1.02 ppm), compared with 0.82 ppm under the recommended fertilizer and only 0.42 ppm in the control. Similar trends were observed at Coimbatore where T_2 produced the highest fresh rhizome yield (22.70 t ha^{-1}) with greater zinc availability (1.82 ppm), while T_1 recorded 21.38 t ha^{-1} and 1.58 ppm available zinc.

At Kamarapally, integration of B. safensis with 50% zinc fertilizer significantly increased rhizome yield to 38.75 t ha^{-1} and raised soil available zinc to 2.20 ppm, compared with 36.25 t ha^{-1} and 1.92 ppm under the recommended zinc dose. Likewise, Kalyani recorded the highest yield under T_2 (34.37 t ha^{-1}), representing a substantial improvement over T_1 (30.36 t ha^{-1}).

At Kahikuchi, T_2 produced the highest rhizome yield (23.76 t ha^{-1}) with increased available zinc (1.79 ppm), while at Pundibari the same treatment recorded the maximum fresh rhizome yield (27.39 t ha^{-1}), highest dry

recovery (21.34%) and improved available zinc (0.37 ppm).

At Pottangi, T_2 marginally outperformed the recommended zinc treatment with fresh rhizome yield of 21.50 t ha^{-1}. At Pasighat, the integrated treatment produced the highest fresh rhizome yield (18.49 t ha^{-1}) compared with 17.62 t ha^{-1} under the recommended zinc dose and only 11.35 t ha^{-1} in the control.Results from ICAR-IISR, Kozhikode further demonstrated the superiority of integrated zinc management. Although differences in fresh rhizome yield between T_1 (26.50 t ha^{-1}) and T_2 (27.89 t ha^{-1}) were statistically comparable, T_2 registered the highest zinc uptake (228.25 g ha^{-1}), indicating improved zinc acquisition by turmeric plants through microbial solubilization. In contrast, the control treatment recorded the lowest zinc uptake (78.0 g ha^{-1}) and rhizome yield (13.10 t ha^{-1}). Interestingly, the treatment receiving only 50% zinc fertilizer without inoculation recorded higher residual soil zinc (4.86 ppm), suggesting comparatively lower crop uptake, whereas inoculated treatments maintained higher zinc uptake and better productivity.

At Dholi and Kumarganj, treatment differences for fresh rhizome yield were relatively small, although T_1 and T_2 maintained superior performance over the control. Raigarh showed only marginal variation among treatments for soil available zinc, indicating site-specific responses to zinc fertilization. Dry recovery remained largely unaffected by treatments across centres, confirming that zinc nutrition primarily influenced productivity and nutrient dynamics rather than rhizome dry matter accumulation. Overall, the coordinated evaluation clearly established that application of 50% recommended zinc fertilizer in combination with Bacillus safensis was comparable or superior to the full recommended zinc dose across diverse production environments.

Table 25. Fresh rhizome yield (t ha^{-1}) of the centres on evaluation of plant growth promoting Rhizobacteria for zinc solubilization potential in turmeric.

Treatment	CPE	COI	DHL	KML	KUM	KAHI	KKE	KOZ	PASI	POT	POT	PUN	RAI	Mean
T1 : 100% Zn fertilizer	21.9	21.4	49.3	36.3	30.4	32.7	21.4	31.3	26.5	17.6	21.1	25.8	25.4	27.9
T2 : 50% Zn + *B. safensis*	23.8	22.7	47.6	38.8	34.4	34.5	23.8	31.2	27.9	18.5	21.5	27.4	28.7	28.7
T3 : 50% Zn alone	20.7	21.3	45.2	31.4	27.8	31.9	19.6	27.2	16.3	15.2	20.2	22.5	21.6	24.7
T4 : *B. safensis* alone	21.1	21.4	44.8	32.3	30.4	31.1	22.8	28.3	22.5	13.8	20.8	23.4	20.2	25.6
T5 : Control (no Zn)	19.2	19.7	44.3	22.3	26.8	29.6	20.6	24.7	13.1	11.4	19.6	20.8	19.6	22.4
SE(m)±	0.7	0.3	1.2	1.6	0.5	7	0.7	3.1	–	0.3	0.3	1	–	1.5
CD @ 5%	2.2	0.7	3.6	4.8	1.7	21.1	1.6	9.3	–	1	2	4	4.1	4.1
CV (%)	7.7	4.9	5	11.5	3	5.4	21.3	6.4	–	8	2.8	5	–	6.8

Footnote: CPE : Chintapalli; COI : Coimbatore; DHL : Dholi; KML : Kammarapally; KUM : Kumarganj; KAHI : Kahikuchi Kumarganj; KKE : Kanke; KOZ : Kozhikode; PASI : Pasighat; POT : Pottangi; PUN : Pundibari; RAI : Raigarh. Mean yield values expressed in tonnes per hectare (t ha^{-1}) represents the average fresh rhizome yield of each treatment pooled across eleven participating centres. SE(m)±, CD @ 5%, and CV (%) values in the "Mean" column represent overall pooled statistical parameters across centres.

Crop Protection and Food Safety

TUR/CP/7.1: Evaluation of effective insecticides against shoot borer, *Conogethes punctiferalis* infesting turmeric for label claim expansion

(Centres: Appangala, Coimbatore, Guntur, Kammarpally, Chelavoor, Peruvannamuzhi)

A comprehensive multi-location trial on turmeric was initiated in 2024 mandatory for label claim expansion of effective insecticides against turmeric shoot borer as per the guidelines of the Central Insecticides Board and Registration Committee (CIB&RC).

The experiment involved four distinct treatment protocols to evaluate their effectiveness in suppression: T_1- Chlorantraniliprole 18.5% SC @ 0.375 ml L^{-1}; T_2: dose @ 0.50 ml L^{-1}; T_3: dose @ 0.625 ml L^{-1}; T_4: Lambda-cyhalothrin 5 EC @ 2.0 ml L^{-1}; T_5: Untreated control.

Each treatment was replicated four times across the trial sites. The trial involves evaluation of insecticide bio-efficacy against shoot borer (*Conogethes punctiferalis*), their phytotoxicity on turmeric, their side effect on natural enemies and its influence on fresh and dry rhizome yield.

The coordinated multi-location evaluation conducted during 2024–25 clearly demonstrated the effectiveness of Chlorantraniliprole 18.5% SC in managing turmeric shoot borer (*Conogethes punctiferalis*). Significant reduction in shoot borer incidence was observed at all six participating centres, indicating consistent performance of the molecule across diverse agro-climatic conditions. Among the three doses evaluated, Chlorantraniliprole 18.5% SC @ 0.625 ml L^{-1} (T_3) consistently recorded the highest reduction over untreated control, achieving 98–100% suppression of shoot borer damage at 7 and 14 days after treatment in almost all locations. The standard check insecticide, Lambda-cyhalothrin 5 EC, was effective but generally inferior to Chlorantraniliprole at medium and higher doses. The superior efficacy of Chlorantraniliprole translated into improved protection of vegetative shoots, thereby minimizing dead-heart formation and promoting healthy crop growth throughout the season.

Following the evaluation of Chlorantraniliprole 18.5% SC, the second insecticide, Spinosad 45% SC, was evaluated under the same coordinated protocol (TUR/CP/7.1) across the six participating AICRPS centres to generate efficacy data required for label claim expansion. The experiment involved four distinct treatment protocols to evaluate their effectiveness in suppression: T_1- Spinosad 45% SC @ 0.375 ml L^{-1}; T_2: dose @ 0.50 ml L^{-1}; T_3: dose @ 0.625 ml L^{-1}; T_4: Lambda-cyhalothrin 5 EC @ 2.0 ml L^{-1}; T_5: Untreated control. Each treatment was replicated four times across the trial sites.

The evaluation of Spinosad 45% SC against turmeric shoot borer during 2024–25 demonstrated its high efficacy in suppressing *Conogethes punctiferalis* under diverse agro-climatic conditions. Considerable reduction in shoot borer infestation was observed following insecticidal application at all six AICRPS centres. Among the doses tested, Spinosad 45% SC @ 0.625 ml L^{-1} (T_3) consistently recorded the highest percentage reduction over untreated control at both 7 and 14 days after treatment (DAT). T_3 achieved 95–100% reduction in shoot borer incidence, and remained significantly superior to the lower doses and the standard check insecticide (Lambda-cyhalothrin 5 EC), whereas T_2 & T_1 was comparatively less effective but still significantly superior to the untreated control.

Evaluation of phytotoxicity indicated that Chlorantraniliprole 18.5% SC as well as

Spinosad 45% SC did not induce any visible phytotoxic symptoms even when applied at twice the recommended dose. No symptoms of chlorosis, necrosis, leaf tip injury, epinasty, hyponasty, vein clearing or stunting were observed throughout the observation period, confirming the safety of the molecule for turmeric cultivation. The effect of treatments on natural enemies revealed that untreated plots consistently harboured significantly higher populations of spiders, dragonflies, beetles, houseflies and crickets than insecticide-treated plots. However, among the insecticidal treatments, both of them maintained comparatively higher natural enemy populations than expected under effective pest suppression, suggesting relatively lower disruption of beneficial arthropods compared with broad-spectrum insecticides. Yield performance also reflected the effectiveness of shoot borer management. The highest fresh and dry rhizome yields were generally recorded under T_3.

TUR/CP/7.2: Assessment of nematicide for the management of root lesion nematode (*Pratylenchus* spp.) infecting turmeric (Centres: Coimbatore, Guntur, Kammarpally, Kozhikode, Pundibari)

Field trial was initiated during the year 2024–25 following a randomized block design (RBD) with six treatments *viz.,* T_1 –Control; T_2 -*T. asperellum* talc formulation; T_3 - Drenching metalaxyl-mancozeb solution; T_4 - Drenching *Pochonia chlamydosporia* liquid formulation; and T_5-Recommended nematicide) and four replications across five different centres.

The results of the trial revealed significant variations in disease incidence among the different treatments and locations. The results clearly demonstrated the superiority of Fluopyram 34.48 SC in suppressing root lesion nematode populations and improving crop performance. The lowest combined soil and root nematode population was recorded with T_5 (Fluopyram 34.48 SC @ 1.0 ml L^{-1}) at Coimbatore, Guntur, Kammarpally and Pundibari, while T_3 (0.5 ml L^{-1}) proved superior at Kozhikode. Enhanced plant vigour was observed under Fluopyram treatments, with T_3 producing the highest plant vigour at Kozhikode, Coimbatore and Kammarpally, whereas T_5 performed best at Guntur and Pundibari. Plant mortality remained negligible throughout the experiment; complete absence of mortality was observed at Coimbatore, Guntur and Pundibari across treatments. Slight mortality was recorded only at Kozhikode and Kammarpally under T_5.

Phytotoxicity studies indicated that Fluopyram at the recommended dose (0.5 ml L^{-1}) did not produce any visible phytotoxic symptoms at any location. Even at the double dose (1.0 ml L^{-1}), no phytotoxic effects were observed at Coimbatore and Guntur, whereas only minor symptoms were recorded at Kozhikode, Kammarpally and Pundibari, indicating a high degree of crop safety under normal field application. Monitoring of beneficial organisms revealed that untreated plots consistently harboured higher populations of predatory nematodes and free-living beneficial nematodes than treated plots, reflecting the reduction in overall nematode activity following nematicide application. The reduction in nematode infestation translated into substantial yield improvement. Fluopyram 34.48 SC @ 0.5 ml L^{-1} (T_3) consistently produced the highest fresh rhizome yield at all five centres, recording 27.90, 39.17, 43.47, 27.90 and 29.40 t ha^{-1} at Kozhikode, Coimbatore, Guntur, Kammarpally and Pundibari, respectively.

06 Tree Spices

Genetic Resources

TSP/CI/1.1: Germplasm collection, characterization, evaluation and conservation of clove, nutmeg and cinnamon. (Centres: Dapoli, Pechiparai)

Nutmeg

Among the 34 accessions conserved and evaluated at Pechiparai, MF- 1 recorded maximum tree height (13.85 m) and stem girth (67.26 cm) while MF 4 recorded maximum leaf length (18.20 cm), leaf breath (7.32 cm), number of fruits (744.18), single fruit weight (64.13 g) and mace yield (357.19 g tree^{-1}). Local check recorded 508.66 fruits per tree, with single fruit weight (52.79 g) and mace yield (171.11 g tree^{-1}).

Among 90 different germplasm collections of nutmeg planted during the year 1996–97, 21 promising genotypes have been identified. Data revealed that, the highest number of nuts per tree (842) was registered by genotype DBSKKVMF 65. The maximum fresh nut weight (12.18 g), dry nut weight (8.16 g), fresh mace weight (7.56 g) and dry mace weight (1.75 g) was recorded in genotype DBSKKVMF 9772.The genotype DBSKKV 9772 recorded maximum dry nut yield per tree (12.62 kg) and dry mace yield (2.85 kg) followed by genotype DBSKKV 65 which recorded dry nut yield per tree (5.79 kg) and dry mace yield (1.01 kg). The minimum dry nut yield per tree (0.540 kg) and dry mace per tree (0.092 kg) was found in DBSKKVMF 27.

Clove

Among the germplasm of clove planted at Dapoli four promising genotypes were selected. The plant height varied from 3.52 m to 4.42 m; girth ranged 72.28 to 94.10 cm and spread varied from 3.10 m to 3.38 m. The highest plant height (4.42 m), girth of plant (94.10 cm) and maximum plant spread (3.38 m) was registered in genotype DBSKKVSA-1. No flowering was observed during the year 2024-25. The new collected germplasm of clove was planted during July, 2024.

Among the 24 accessions at Pechiparai, SA-1 recorded the highest tree height of 14.82 m, followed by SA-3 (12.71 m). The lowest tree height was observed in SA- 23 where the tree height was 5.24 m. The accession SA-3 was significantly superior to other accessions and recorded highest stem girth (55.73 cm) compared to local check (41.98 cm). The accession SA-3 recorded the highest leaf length (12.95 cm), leaf breadth (7.74 cm), number of branches (33.32). Among the 24 accessions, SA-3 has been identified as the best performer as the dry bud yield is 2.09 kg tree^{-1} while the local check recorded 0.56 kg tree^{-1}.

Cinnamon

Among 12 accessions evaluated at Pechiparai, CV-5 recorded maximum tree height (6.35 m), stem girth (17.77 cm), number of rejuvenation shoots (42.03), dry leaf weight (18.08 kg), fresh bark weight (10.68 kg) and dry bark yield (4.42 kg) against local check with plant height (5.29 m), rejuvenation shoots (27.00), dry leaf weight (13.52 kg), fresh bark weight (8.89 kg) and dry bark yield (3.80 kg).

The details of germplasm of tree spices being conserved at the ICAR-AICRPS Centres are presented in Table 26.

Table 26. Tree spices germplasm collections at ICAR-AICRPS Centres

Crop/Centre	Collections	Crop/Centre	Collections
Clove		**Cinnamon**	
Dapoli	02	Dapoli	11
Pechiparai	24	Pechiparai	12
Total	26	Total	23
Nutmeg		**Cassia**	
Dapoli	90	Dapoli	06
Pechiparai	24	Pechiparai	-
Thrissur	55	Total	06
Total	169		

Crop Improvement TSP/CI/2 Coordinated Varietal Trial (CVT) TSP/CI/2.4: Coordinated Varietal Trial (CVT) on farmer's varieties of nutmeg (Centres: Dapoli, Pechiparai, Thrissur)

The CVT on farmer's varieties of nutmeg was initiated during 2016 with four farmer's varieties (Kochukudy, Punnathanam Jathy, Kadukkamakkan Jathy and Cheripuram) provided by NIF/farmer), along with one local check and a national check at Dapoli, Pechiparai and Thrissur (Figure. 23). The trial is being conducted at Dapoli, Pechiparai and Thrissur under coconut-based cropping systems with budded plants established at a spacing of 8 × 8 m.

During 2025–26, pooled analysis of observations recorded from the three centres revealed significant differences among the genotypes for vegetative growth and yield attributes. Among the entries, Kochukudy recorded the highest average plant height (4.89 m), followed by Punnathanam Jathy (4.62 m) and Cheripuram (4.16 m).

Table 27. Comparative performance of farmer-selected nutmeg varieties across Dapoli, Pechiparai, and Thrissur centres (2024-25)

Entries	Plant height (m)				Number of branches				Plant spread (m)			Yield (nuts/tree)			
	DAP	PECH	THR	Mean	DAP	PECH	THR	Mean	DAP	THR	Mean	DAP	PECH	THR	Mean
Punnathanam Jathy	5.80	3.61	4.44	4.62	77	42	63	60.67	3.58	3.44	3.51	82	60	159	100
Kochukudy	6.20	3.26	5.20	4.89	82	56	70	69.33	3.90	3.80	3.85	102	56	297	152
Kadukkamakkan Jathy	4.48	3.74	2.84	3.69	62	48	37	49.00	3.66	2.76	3.21	58	62	105	75
Cheripuram	4.10	4.42	3.96	4.16	58	62	46	55.33	3.72	3.82	3.77	66	80	80	75
Local Check*	3.72	2.52	4.20	3.48	48	42	33	41.00	3.64	3.04	3.34	50	43	6	33
CD @ 5%	0.68	1.194	0.51	–	0.68	2.65	10.16	–	0.10	0.72	–	9.60	22.83	62.49	–
CV (%)	8.60	21.84	10.10	–	8.60	5.06	15.55	–	3.42	16.42	–	12.52	24.31	27.12	–

Where, DAP: Dapoli; PECH: Pechiparai; THR: Thrissur. *Local checks included were Dapoli: konkan Sungandha, Pechiparai: IISR Vishwasree and KAU: KAU Pullan.

The tallest plants were recorded at Dapoli (6.20 m), while at Thrissur Kochukudy also maintained superior plant height (5.20 m). The maximum number of branches was also observed in Kochukudy (69.33), followed by Punnathanam Jathy (60.67) and Cheripuram (55.33), indicating its vigorous canopy development across locations. Plant spread varied significantly among the entries. Kochukudy recorded the maximum average plant spread (3.85 m), followed by Cheripuram (3.77 m) and Punnathanam Jathy (3.51 m), whereas Kadukkamakkan Jathy exhibited comparatively lower canopy spread (3.21 m). Yield performance also differed considerably across centres. Kochukudy emerged as the best-performing genotype with the highest pooled mean yield of 152 nuts tree^{-1}, followed by Punnathanam Jathy (100 nuts tree^{-1}). Kadukkamakkan Jathy and Cheripuram each recorded an average yield of 75 nuts tree^{-1}, while the local check produced only 33 nuts tree^{-1}. The exceptionally high yield of 297 nuts tree^{-1} recorded by Kochukudy at Thrissur demonstrated its excellent adaptability and productivity under favourable agro-climatic conditions.



Figure 7. Farmer-bred nutmeg varieties at KAU, Thrissur

Table 28. Growth and yield parameters of nutmeg genotypes evaluated in Thrissur (2025-26)

Genotypes	Plant height (cm)	No. of branches	Plant spread (cm)		No. of flowers	No. of fruits	Fruit weight (g)	Nut weight (g)	Mace weight (g)	Dry nut weight (g)	Dry Mace weight (g)
			EW	NS							
Acc.1	4.20	48.12	3.64	3.82	628.0	450	64.51	9.78	2.55	7.85	1.24
Acc.5	5.20	70.31	3.82	3.76	454.0	317	72.39	11.83	4.25	9.23	2.58
Acc.12	3.20	41.20	2.30	2.22	36.2	15	89.14	11.18	4.08	8.10	2.12
Acc.13	3.80	45.06	2.48	2.44	252.0	159	72.25	12.44	2.67	8.66	1.41
Acc.14	4.06	59.03	3.74	3.72	208.0	120	105.25	11.57	4.42	8.29	2.35
Acc.17	3.78	45.06	3.60	3.20	368.0	268	69.67	11.41	2.74	8.43	0.91
Acc.20	3.70	51.34	1.94	1.74	76.0	22.4	75.92	7.64	3.55	5.92	1.23
Acc.21	4.52	60.60	2.50	2.58	204.8	130	73.53	9.23	2.45	6.89	1.20
Acc.23	4.94	72.32	4.54	4.40	550.0	463	56.99	8.28	2.64	6.22	1.37
Acc. 28	3.18	40.12	2.80	2.78	-	-	-	-	-	-	-
IISR-Viswasr-ee (Check)	2.24	33.51	2.26	2.14	44.0	6.0	81.31	10.83	3.32	7.46	1.41
CD @ 5%	0.53	10.53	0.29	0.81	94.83	80.22	11.57	1.49	0.57	0.88	0.35
CV (%)	10.56	16.05	21.18	21.19	26.2	32.06	11.85	11.16	13.67	8.93	17.28

TSP/CI/5.1: Evaluation of nutmeg genotypes (Centres: Thrissur)

The budded plants established well under field conditions and exhibited significant variation for vegetative growth and yield-related characters. Among the evaluated genotypes, Acc. 5 recorded the highest plant height (5.20 m), while Acc. 23 produced the highest number of primary branches (72.32), followed closely by Acc. 5 (70.31). The widest canopy spread in both east-west (4.54 m) and north-south (4.40 m) directions was also observed in Acc. 23, indicating superior vegetative vigour compared with the remaining accessions. Significant differences were also observed for flowering, fruiting and quality parameters among the evaluated genotypes. Acc. 1 and Acc. 23 recorded the highest flowering intensity, producing 628 and 550 flowers per tree, respectively. The highest fruit yield was obtained from Acc. 23 (463 fruits tree^{-1}), closely followed by Acc. 1

(450 fruits tree^{-1}), demonstrating their superior reproductive performance. Acc. 14 produced the heaviest fruits (105.25 g fruit^{-1}), whereas Acc. 13 recorded the highest fresh nut weight (12.44 g). Acc. 5 and Acc. 14 were superior for mace yield, recording the highest fresh mace weights (4.25 and 4.42 g, respectively), while Acc. 5 also registered the highest dry nut (9.23 g) and dry mace (2.58 g) weights among all the evaluated genotypes. The national check variety, IISR Viswasree, exhibited comparatively lower vegetative growth and yield performance than most of the evaluated accessions.

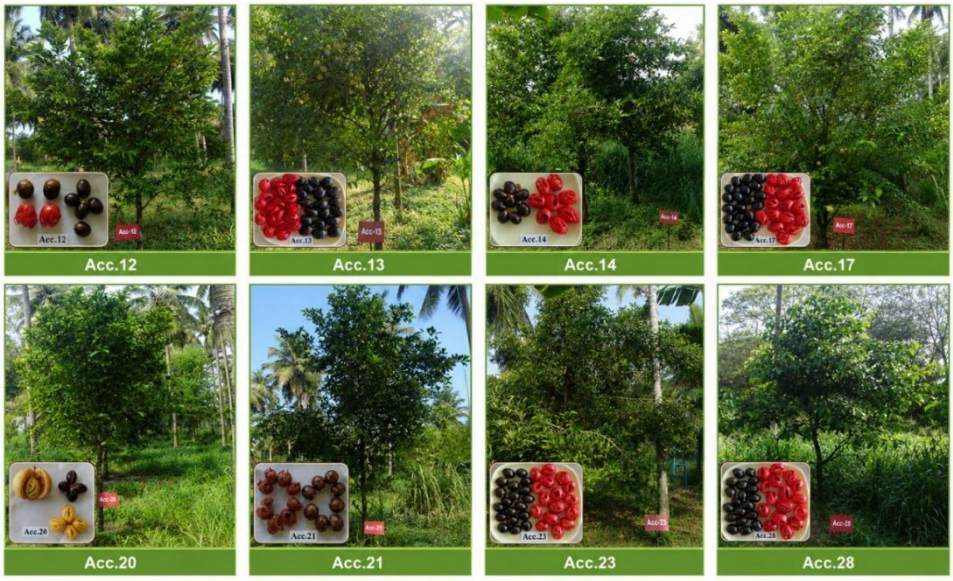


Figure 8. Performance of nutmeg varieties at KAU, Thrissur

TSP/CI/2.5: Coordinated Varietal Trial in Nutmeg – 2023 Series
(Centres: Dapoli, Kozhikode, Pechiparai and Thrissur)

Production of planting materials for the Coordinated Varietal Trial (CVT) in Nutmeg (2023 Series) was initiated during 2023 at the participating centres. The trial comprises 12 genotypes, including promising selections developed by the participating centres and research institutes, along with the nationally accepted check varieties Konkan Sanyukta, IISR Keralashree, and KAU Poothara.

During the reporting period, the project coordinating unit successfully organized five online group meetings involving all participating centres to review and monitor the progress of planting material production, standardize propagation protocols, and finalize the implementation schedule for the coordinated trial. These meetings ensured uniformity in experimental procedures and facilitated effective coordination among the collaborating centres for the timely establishment of the trial. Significant progress was achieved in the multiplication of true-to-type planting materials across the participating centres. Planting material production has been initiated at Dapoli, Kozhikode and Thrissur, and the multiplication programme is progressing satisfactorily. Thrissur has successfully produced the required quantity of planting material and is ready for field establishment, while the remaining centres are continuing multiplication to meet the planting requirements.

Crop Management

TSP/CM/4.1: Site-Specific Nutrient Management in Nutmeg (Myristica fragrans) (Centres: Coimbatore, Dapoli, Kozhikode, Vellanikkara)

The experiment aims to evaluate the efficiency of site-specific, soil test-based nutrient application strategies, including fertigation, for enhancing yieldand profitability of nutmeg cultivation. The trial involves five treatments: full-dose nutrient application based on soil test results (with and without fertigation), and reduced fertigation levels at 75% and 50%, along with a control. All participating centres have finalized the experimental sites, the details of which are presented in Table 29.

Table 29. Detailed location status and relevant information of the multicentric nutmeg management trial.

Centre	Variety	Tree age(Y)	Location of the trial
Coimbatore	Pollachi Local	10	Kottur, Pollachi, Coimbatore, TN
Dapoli	Konkan Swad	20	Burondi, Dapoli, Maharashtra
Kozhikode	Kerala Shree	20	Anackampoil, Kozhikode, Kerala
Thrissur	KAU Kuchukudi	15	Kallorkadu, Angamaly, Kerala

Footnote: The trial is being conducted under farmers' field conditions using commercially established orchards, thereby enhancing the practical relevance and future adoptability of the recommendations.

Table 30: Initial soil fertility status of the experimental sites

Parameter	COI	DAP	KOZ	TCR
pH	6.89	5.91	5.93	5.50
Organic carbon (%)	1.10	1.17	2.95	0.56
Available N (kg ha^{-1})	220.0	275.0	349.5	150.5
Available P (kg ha^{-1})	7.2	24.6	191.8	6.3
Available K (kg ha^{-1})	265.9	358.0	599.0	382.0
Ca (mg kg^{-1})	1918	1642	1147	69
Mg (mg kg^{-1})	425.6	224	168	65
Fe (mg kg^{-1})	46.3	38.0	44.9	22.4
Mn (mg kg^{-1})	26.3	24.5	26.14	1.2
Zn (mg kg^{-1})	0.84	4.60	11.46	0.96
Cu (mg kg^{-1})	2.00	9.20	14.02	7.60
(mg kg^{-1})	—	0.61	—	—

Where, COI: Coimbator, DAP: Dapoli; KOZ: Kozhikode; TCR: Thrissur

Initial characterization of experimental fields revealed substantial variability in soil fertility status among locations. Soil reaction ranged from moderately acidic (pH 5.50) at Thrissur to nearly neutral (pH 6.89) at Coimbatore, while organic carbon content varied from 0.56 to 2.95%. Similarly, available nitrogen, phosphorus and potassium exhibited considerable spatial variation, indicating contrasting nutrient availability among the experimental sites (Table 30). Based on the detailed soil analysis, site-specific nutrient schedules were standardized separately for each experimental location. Both soil application and fertigation schedules were formulated according to the nutrient requirements and existing soil fertility status of each site (Table 31). Fertigation treatments involve weekly application of water-soluble fertilizers from September to May, whereas conventional soil application is carried out in two equal split doses. The participating centres have initiated the trial by applying the prescribed soil test-based fertilizer schedules, and the experiment is currently in progress.

Table 31. Centre-wise soil application and fertigation schedule represent the 100% soil test-based nutrient application

Application method	Fertilizer in g tree^{-1}	COI	DAP	KOZ	TCR
Soil application (T_1)	Urea	1180	1060	900	1330
	DAP	850	–	–	–
	Rock phosphate	–	1490	–	2220
	MOP	1410	1150	450	1080
Fertigation (T_2)	Urea	663	477	900	461
	19:19:19	2058	1412	0	2103
	SOP	1692	844	540	497

Footnotes: T_1: 100% SS soil test-based nutrient application through conventional soil application, applied in two equal split doses. T_2 : 100% site-specific soil test-based nutrient application through fertigation, with fertilizers applied weekly from September to the end of May.

07. Coriander

Genetic Resources

COR/CI/1.1: Germplasm collection, description, characterization, evaluation, conservation and screening against diseases

(Centres: Coimbatore, Dholi, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh)

This is a long-term project aims at collecting, conserving and evaluating the available coriander germplasm towards identifying promising accessions with high yielding potential/resistance to powdery mildew disease. A total of 2097 accessions being conserved and maintained by these AICRPS centres jointly (Table 32). Among the 276 accessions maintained in the germplasm collection at Coimbatore were evaluated along with one check (CO (CR) 4 for growth and yield characters. Among them 49 lines were evaluated during 2024-25 revealed significantly higher seed yield in CS 46 (9.20 g plant^{-1}), CS 95 (8.60 g plant^{-1}) compared to the best check CO(CR) 4 (7.25 g plant^{-1}). At Dholi, Eighty one (81) accessions of coriander along with two checks (Pant Haritma and Rajendra Dhania-1) were evaluated for promising lines with respect to yield. Among them, the yield of best ten accessions ranged from 11.02 to 15.82 g plant^{-1} and only three accessions namely- RD-439 (15.82 g plant^{-1}), RD-121 (15.14 g plant^{-1}) and RD-448 (15.09 g plant^{-1}) gave higher yield than check varieties, Hisar Anand (15.03 g plant^{-1}) and Rajendra Dhania-1 (14.81 g plant^{-1}).

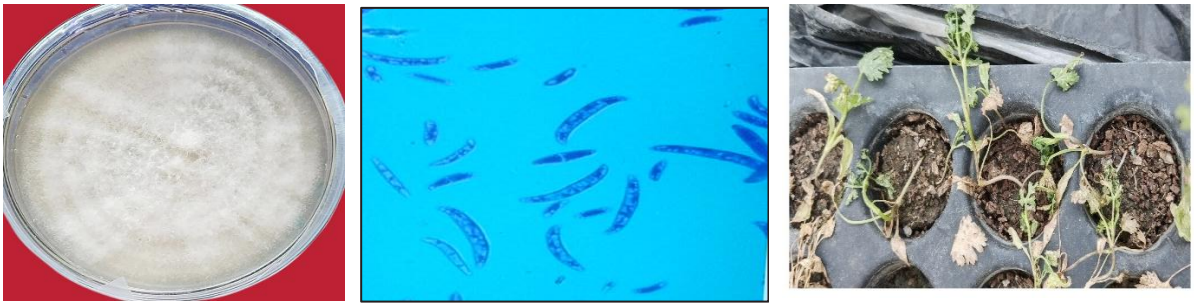
Table 32. Coriander germplasm collections maintained at various AICRPS centres

Centre	New Addition in 2024-25	No. of Accessions Maintained	Germplasm tested in 2024-25	Promising germplasm identified	IC Number Obtained from NBPGR
Coimbatore	-	276	49	05	-
Dholi	02	81	81	09	44
Guntur	25	402	102	05	-
Hisar	02	324	96	10	-
Jagudan	-	152	152	06	04
Jobner	02	664	238	07	28
Kumarganj	8	157	157	05	15
Navsari	22	110	110	11	02
Pantnagar	11	140	140	05	-
Raigarh	03	41	40	03	09
Kota	02	50	10	02	42
Total	29	2097	1085	70	155

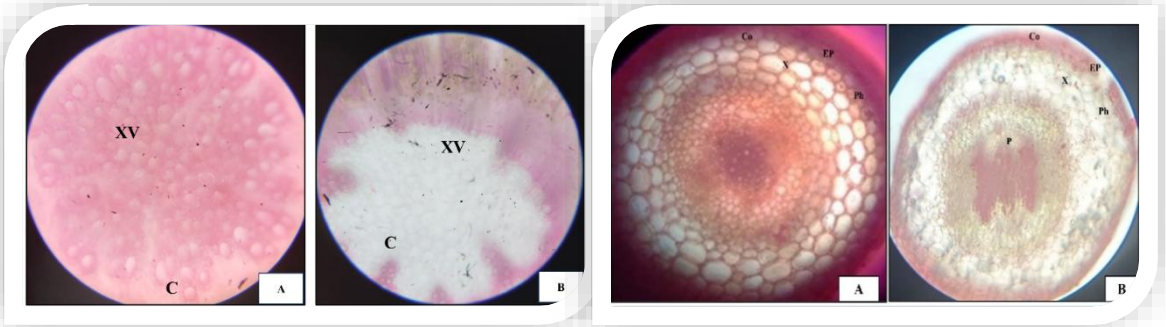
Among the 276 accessions maintained in the germplasm collection at Coimbatore were evaluated along with one check (CO (CR) 4 for growth and yield characters. Among them 49 lines were evaluated during 2024-25 revealed significantly higher seed yield in CS 46 (9.20 g plant^{-1}), CS 95 (8.60 g plant^{-1}) compared to the best check CO(CR) 4 (7.25 g plant^{-1}). At Dholi, Eighty one (81) accessions of coriander along with two checks (Pant Haritma and Rajendra Dhania-1) were evaluated for promising lines with respect to yield. Among them, the yield of best ten accessions ranged from 11.02 to 15.82 g plant^{-1} and only three accessions namely- RD-439 (15.82 g plant^{-1}), RD-121 (15.14 g plant^{-1}) and RD-448 (15.09 g plant^{-1}) gave higher yield than check varieties, Hisar Anand

(15.03 g plant^{-1}) and Rajendra Dhania-1 (14.81 g plant^{-1}).

A total of 350 germplasm accessions suitable for seed purpose and 102 germplasm lines suitable for leaf purpose are maintained in the Guntur centre. Among 350, fifty germplasm lines were evaluated during this year, LCC-316 (5.97 g plant^{-1}), LCC-308 (5.75 g plant^{-1}), LCC-309 (5.61 g plant^{-1}), LCC-198 (5.56 g plant^{-1}) and LCC-127 (4.99 g plant^{-1}) were found superior in yield. Six new germplasm lines under leafy entries were collected. Fifty-six entries of leafy coriander were evaluated. LCC-387, LCC-412, LCC-404 and LCC-403 were found promising and recorded highest fresh herb yield. Among the 350 germplasm lines under natural and artificial screening found four lines viz., LCC-69, LCC-79, LCC-150, LCC-169 were found resistant under both conditions. Among which, LCC-150 in coriander was found to be resistant to *Fusarium* wilt and will be submitted for registration.



Fusarium oxysporum f. sp. *coriandrii*: Pathogen causing Fusarium wilt identified at morphological and molecular level



A: LCC-150 (HR: Highly resistant genotype), B: LCC-1 (HS: Highly susceptible genotype)
Cross section of roots in HR and HS genotypes on challenge inoculation of pathogen
Cross section of stem in HR and HS genotypes on challenge inoculation of pathogen

Ninety six accessions were evaluated at Hisar centre along with Hisar Sugandh and Hisar Anand as checks during 2024-25. The seed yield of the germplasm lines ranged from 13.2 g plant^{-1} (DH-210) to 35.4 g plant^{-1} (DH-328). The most promising lines for seed yield were DH-221, DH-239-1, DH-284, DH-283-1, DH-301, DH-302, DH-318, DH-319, DH-328 and DH-334. During 2024-25, total 152 accessions were evaluated at Jagudan centre along with the checks. The seed yield ranged from 160-360 g plot^{-1}, among which the promising entries were JCr-344, UD-256, Lam-44, J. Cor-2017-29, J. Cor-2017-28, UD -51, and JCr-330. Under natural screening of coriander entries for resistance against powdery mildew disease, a total of forty-five lines were screened at Jagudan during 2024-25. The minimum disease intensity was recorded with COR 207 (10.24%). The

maximum disease intensity was recorded in the entry GCO 4 (90.01 %). At Jobner a total of 238 coriander germplasm accessions were evaluated along with nine checks and data on seed yield per five plants recorded, which ranged from 4.8 g (UD-21) to 29.0 g (UD-81). Out of 238 accessions, 20 outperformed the best check (RCr-446, 19.0 g), with the top ten being UD-81 (29.0 g), UD-75 (28.0 g), UD-357 (28.0 g), UD-20 (27.0 g), UD-806 and UD-824 (25.0 g), UD-849 (24.0 g), UD-409 (22.0 g), and UD-52 and UD-67 (21.0 g). A total of 160 germplasm of coriander were evaluated at Kumarganj. The highest yield was recorded in NDCor-22 (24.20 g plant^{-1}) followed by NDCor-11 (22.13 g plant^{-1}), NDCor-12 (19.16 g plant^{-1}) and NDCor-129 (18.31 g plant^{-1}). At Raigarh, a total 40 accessions were evaluated, revealed that maximum seed yield in ICS 4 (2101 kg ha^{-1}) followed by ICS 6 (2014.2 kg ha^{-1}) and ICS 22 (1873 kg ha^{-1}) over the check Hisar Anand (1795 kg ha^{-1}).



Figure 9. Germplasm conservation blocks maintained at (A) Coimbatore (B) Guntur (C) Kumarganj (D) Jagudan (E) Jobner (F) Pantnagar

Crop Improvement

COR/CI/2 Coordinated Varietal Trial (CVT)

COR/CI/2.1: Coordinated Varietal Trial (CVT) on Coriander 2024-Series XII (Seed spice purpose)

(Centres: Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jabalpur, Jagudan, Jobner, Kalyani, Kota, Kumarganj, Navsari, Pantnagar, Raigarh, Sanand)

Coordinated Varietal Trial (CVT) on coriander 2024 series aims to develop coriander varieties suitable for seed spice purpose laid out at 15 AICRPS centres in RBD with sixteen test genotypes (JCr 21-07, JCr 21-02, RD-434, NDCor-9, NCOR-160, PD-21, DH-362, DH-242, UD-706, UD- 487, ACr-7, ACr-8, SCr-33, LCS 21-6, LCS 21-6, LCS 21-5 and RKD 24-1 with two national check (Hisar Anand and RCr 728). The CVT trial initiated during *rabi*, 2021-22 and concluded during *rabi*, 2024-25.

Results of CVT on Coriander for seed purpose 2024 series revealed considerable variation among most of the traits including seed yield

among the tested genotypes, reflecting differential adaptability across locations. The overall mean seed yield of the entries ranged from 1199 to 1586 kg ha^{-1} across centres. Among the evaluated entries, COR-207 recorded the highest mean seed yield (1586 kg ha^{-1}) and ranked first, followed by COR-220 (1509 kg ha^{-1}) and COR-215 (1503 kg ha^{-1}). Other promising entries included COR-217 (1502 kg ha^{-1}), COR-210 (1467 kg ha^{-1}), COR-222 (1464 kg ha^{-1}) and COR-216 (1461 kg ha^{-1}), which also exhibited relatively higher yields compared to the trial mean (1425 kg ha^{-1}). The location mean yields varied widely, with relatively lower yields were observed at Coimbatore (757 kg ha^{-1}) and the highest mean yield recorded at Hisar (1855 kg ha^{-1}) followed by Dholi (1829 kg ha^{-1}) and Kota (1830 kg ha^{-1}). The overall coefficient of variation (CV) ranged from 5.3 to 14.4% across locations, indicating moderate environmental variability during the crop season.

Table 33. Summary of Seed Yield per Hectare (Q ha^{-1}) data of Coordinated Varietal Trials on Coriander-2024 Series

Entry	AJM	CBE	DHL	GTR	HSR	JBR	JAG	JOB	KAL	KOT	KUM	NAV	PNR	RAI	SAD	MEAN	Rank
COR-207	2408	902	1958	1022	1953	2110	736	1237	711	1908	1993	1612	1742	1841	1653	1586	1
COR-209	901	847	1882	1267	1584	1223	NG	1382	685	NG	NG	1344	1448	629.9	NG	1199	18
COR-210	2097	828	1842	1215	1874	1806	1060	1541	836	1941	1403	1379	1132	1136	1917	1467	5
COR-211	1445	885	1887	977.8	2128	1653	702	1228	924	2173	1563	1502	1674	1110	1455	1420	12
COR-212	878.3	804	1712	1378	1463	1198	627	1001	930	2005	1410	1375	1353	1887	1262	1286	17
COR-213	2238	764	1923	800	2176	2153	627	1108	795	1575	1743	1420	1636	1241	1502	1447	8
COR-214	1445	690	1856	955.6	2259	1884	694	1176	835	2031	1563	1345	1845	1734	1105	1428	10
COR-215	1842	809	1853	1178	1837	1653	1014	1196	1002	2056	1424	1361	2013	1560	1750	1503	3
COR-216	2238	768	1912	911.1	2276	2065	545	1429	1030	1169	1819	1408	1280	1609	1452	1461	7
COR-217	1813	717	1726	1200	1806	1550	960	1472	969	1947	1563	2010	1028	1276	2501	1502	4
COR-218	2040	654	1852	1158	1899	1908	573	1199	729	1981	1424	1505	1124	1457	1590	1406	14
COR-219	1898	705	1902	1044	2190	1722	625	906	1208	1863	1493	1630	1570	968.1	1563	1419	13
COR-220	2423	644	1890	1022	1734	1807	580	1628	996	1618	1424	1636	1749	1775	1712	1509	2
COR-221	1190	715	1804	1244	1552	1505	677	1132	1077	1534	1597	1432	1306	1442	1833	1336	15
COR-222	1983	741	1723	1222	1825	1667	594	1175	874	2004	1806	1628	1449	1593	1670	1464	6
COR-223	2200	688	1709	955.6	2039	1777	823	1164	898	1344	1681	1381	1605	1273	1823	1424	11
COR-225	1473	816	1755	1258	1481	1760	968	1596	942	1933	1667	1393	1349	1431	1760	1439	9
COR-226	869.8	653	1735	1477	1309	1209	901	732.4	986	2025	1514	1715	1368	1272	1566	1289	16
Loc MEAN	1744	757	1829	1127	1855	1703	747	1239	913	1830	1593	1504	1482	1402	1654	1425	
C.D.	179.0	38.4	141.9	254.4	208.9	3.6	172.0	227.3	0.4	254.1	186.4	258.8	153.4	150.9	303.3	169.0	
C.V.	6.2	10.6	5.3	14.1	6.9	12.6	14.4	11.1	-	8.7	7.0	10.4	6.3	13.1	11.7	10.0	

Where, AJM: Ajmer; COI: Coimbatore; DHI: Dholi; GTR: Guntur; HSR: Hisar; JBR: Jabalpur; JAG: Jagudan; JOB: Jobner; KYI: Kalyani; KOT: Kota; KGJ: Kumarganj; NAV: Navsari; PNR: Pantnagar;RAI: Raigarh; and SAD; Sanand.

Screening of coriander entries under the CVT–2024 series against powdery mildew revealed considerable variation in disease incidence among the evaluated entries. The Percent Disease Index (PDI) among the entries ranged from 5 to 63, indicating differential levels of resistance. Among the tested entries, COR-209 recorded the lowest PDI (5) and was categorized as resistant (R). Other entries exhibiting resistant reaction included COR-220 (PDI 17), COR-207 (PDI 18), COR-214 (PDI 19) and COR-221 (PDI

15), indicating good tolerance to powdery mildew infection.

COR/CI/2.2: Coordinated Varietal Trial on Coriander (Leaf Purpose) 2024- Series I (Centres: Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jobner, Kumarganj, Navsari, Pantnagar, Sanand)

Coordinated Varietal Trial (CVT) on coriander 2024 leafy purpose series aims to develop coriander varieties suitable for leafy or herb spice purpose laid out at 10 AICRPS centres in RBD with twelve test genotypes (AGCr-3, AGCr-4, ACoS 22-06, ACoS 22-12, NLC-8, NLC-13, PD-51, DH-228, DH-259, UD-828, UD- 833, and CO-5) with two national check (Arka Isha and Ajmer Coriander 1) along with performance comparison with private sector leafy hybrids (2 nos.). The CVT trial initiated during *rabi*, 2024-25 and completed first season of first year of testing during 2024-25.



Figure 10: Snapshot of promising entries of leafy coriander identified by Guntur centre under CVT trials

Table 34. Summary Table of CVT on Leafy Coriander Series I: *rabi,* 2024-25 (Ist year-Ist Season)

Entry	No. of leaves plant^{-1}	Days to bolting	Essential oil (%)	Total biomass (kg ha^{-1})	Rank
LCOR-1	41.05	56.48	0.59	2150.23	14
LCOR-2	43.12	62.46	0.57	2193.78	13
LCOR-3	44.9	58.54	0.58	2517.33	6
LCOR-4	42.22	47.59	0.6	2237.99	12
LCOR-5	36.29	62.27	0.55	2647.53	3
LCOR-6	29.87	48.34	0.61	1104	16
LCOR-7	33.47	58.81	0.57	2550.1	5
LCOR-8	41.35	47.6	0.53	2434.32	9
LCOR-9	39.05	53	0.52	2560.07	4
LCOR-10	41.11	64.27	0.55	2243.1	10
LCOR-11	43.91	66.34	0.58	2221.18	11
LCOR-12	48.35	55.41	0.41	2438.7	8
LCOR-13	33.82	52.87	0.4	2116.98	15
LCOR-14	35.75	56.74	0.6	2467.61	7
LCOR-15	37.52	45.06	0.54	2713.02	1
LCOR-16	36.37	52.06	0.61	2701.58	2

COR/CI/4.1: Quality evaluation in coriander

(Centres: Ajmer, Coimbatore, Jagudan, Jobner)

The volatile oil content of coriander entries evaluated under the coordinated varietal trial (CVT) varied considerably across the test

locations. The pooled mean volatile oil content across the entries ranged from 0.26% (COR-209 and COR-214) to 0.46% (COR-221), with an overall trial mean of 0.36%. Among the evaluated entries, COR-221 (0.46%) recorded the highest pooled volatile oil content, followed by COR-210 (0.42%) and COR-217 (0.42%), indicating their superior aromatic potential. The performance across locations showed that Jobner generally recorded comparatively higher volatile oil content, where several entries such as COR-221 (0.61%), COR-210 (0.60%) and COR-207/COR-219/COR-223 (0.59%) exhibited higher expression of the trait. The experimental precision across centres was satisfactory, with C.V. values ranging from 7.10% (Jagudan) to 18.57% (Coimbatore). (Table 35)

Table 35. Multi-location quality evaluation of volatile oil content (%) in coriander entries in Coordinated Varietal Trials.

Entry	Ajmer	Coimbatore	Jagudan	Jobner	Mean	Rank
COR-207	0.31	0.47	0.22	0.59	0.4	4
COR-209	0.21	0.42	0.01	0.41	0.26	12
COR-210	0.31	0.47	0.31	0.6	0.42	2
COR-211	0.22	0.48	0.22	0.58	0.38	6
COR-212	0.3	0.36	0.4	0.49	0.39	5
COR-213	0.34	0.33	0.32	0.5	0.37	7
COR-214	0.16	0.29	0.17	0.42	0.26	12
COR-215	0.16	0.33	0.24	0.51	0.31	11
COR-216	0.23	0.3	0.3	0.49	0.33	10
COR-217	0.39	0.34	0.45	0.5	0.42	2
COR-218	0.31	0.36	0.31	0.44	0.36	8
COR-219	0.35	0.38	0.32	0.59	0.41	3
COR-220	0.3	0.47	0.24	0.57	0.4	4
COR-221	0.44	0.37	0.41	0.61	0.46	1
COR-222	0.29	0.29	0.32	0.51	0.35	9
COR-223	0.2	0.37	0.25	0.59	0.35	9
COR-225	0.18	0.47	0.23	0.43	0.33	10
COR-226	0.34	0.29	0.4	0.42	0.36	8
C.D.	0.07	0.01	0.01	0.08	-	
C.V.	14.85	18.57	7.1	8.99	-	

Crop Management

COR/CM/2 Agronomical Trial (AT)

COR/CM/2.3: Crop specific micronutrient formulation of coriander

(Centres: Ajmer, Coimbatore, Guntur, Hisar, Jagudan, Jobner)

The first year of the trial was initiated during *rabi,* 2024–25 with the objective of evaluating the effect of different modes of micronutrient application on the growth and productivity of coriander across diverse agro-climatic conditions. The trial is being conducted at six AICRPS centres in RBD with five replications and four treatment combinations. The treatments include T_1: control (recommended NPK fertilization without micronutrients); T_2: 100% recommended dose of micronutrient fertilizers applied through soil; T_3: two foliar sprays of formulation at 1% concentration applied at 60 and 90 DAS; and T_4: 50% soil application of micronutrients combined with a 1% foliar spray of micronutrient formulation at 60 DAS. A popular improved

variety suitable for the respective is used for the study. The crop is grown in plots measuring 4 m × 2.4 m with spacing of 30 cm × 15 cm. The micronutrient mixture was formulated based on soil test values for Zn, Fe, Mn, Cu and B.

The first-year pooled results demonstrated a significant positive response to micronutrient application across locations (Table 1). Among the treatments, two foliar sprays of micronutrient formulation (T_3) recorded the highest mean seed yield (1436.1 kg ha^{-1}), representing an increase of 19.5% over the control (1201.4 kg ha^{-1}). The integrated treatment comprising 50% soil application of micronutrients combined with one foliar spray (T_4) also performed well, producing a mean yield of 1390.2 kg ha^{-1}, indicating that partial substitution of soil-applied micronutrients with foliar nutrition can sustain high productivity. Essential oil content also revealed a marked improvement following micronutrient application (Table 3). Foliar application recorded the highest pooled essential oil content (0.33%), followed by integrated application (0.32%), compared with only 0.26% under the control. The enhanced oil content indicates the beneficial role of balanced micronutrient nutrition in improving both yield and quality attributes of coriander.

Table 36. Effect of micronutrient formulation on seed yield (kg ha^{-1}) and essential oil (%) content of coriander (2024)

Treatment	Ajmer		Coimbatore		Guntur		Jagudan		Jobner		Mean	
	Y	EO	Y	EO	Y	EO	Y	EO	Y	EO	Y	EO
Control	2252^{c}	0.26	615	0.33	909	0.31	1108^{a}	0.21	1123^{c}	0.19	1201	0.26
Soil Application	2341^{b}	0.33	771	0.39	1096	0.35	1228^{a}	0.24	1236^{b}	0.28	1334	0.31
Foliar Spray	2398^{a}	0.35	688	0.35	1535	0.4	1280^{a}	0.25	1279^{a}	0.32	1436	0.33
Soil Application + Foliar Spray	2408^{a}	0.35	714	0.37	1294	0.38	1289^{a}	0.25	1248^{ab}	0.31	1390	0.32
SEm±	5.7	0.02	5.4	0	52.3	0.02	4.9	0.01	10	0.02	-	-
CD (P=0.05)	18	0.06	12	0.01	9.7	0.07	NS	0.03	31	0.07	-	-

Footnote: Data were recorded during rabi, 2024-25 where Y = Seed yield (kg ha^{-1}); EO = Essential oil content (%). Statistical parameters include means followed by different superscript letters within a column differ significantly at $P = 0.05$. "NS" indicates non-significant treatment differences.

COR/CM/5.1: Growth and yield of Coriander as influenced by AMF (Arbuscular Mycorrhizal Fungi)

(Centres: Ajmer, Coimbatore, Dholi, Guntur, Jabalpur, Kota)

A multilocation experiment was conducted during 2022–23 to 2024–25 at six AICRP on Spices centres (Ajmer, Kota, Coimbatore, Guntur, Dholi and Jabalpur) to evaluate the influence of phosphorus fertilization and Arbuscular Mycorrhizal Fungi (AMF) on growth, productivity and economics in coriander. The trial comprised four phosphorus levels (100, 75, 50 and 0% recommended dose of phosphorus) and three modes of AMF application (seed treatment, soil application and seed treatment + soil application) arranged in a factorial randomized block design (FRBD). Pooled analysis over three years revealed a significant positive response to both phosphorus fertilization and AMF inoculation.

Among phosphorus levels, application of 100% recommended dose of phosphorus (RDP) recorded the highest pooled seed yield (18.69 q ha^{-1}), which was statistically comparable with 75% RDP (18.08 q ha^{-1}),

indicating that a 25% reduction in phosphorus fertilizer could be achieved with only marginal reduction in yield. Yield declined progressively with further reduction in phosphorus, with 50% RDP and no phosphorus recording 16.65 and 15.02 q ha^{-1}, respectively (Table 1). Similar trends were observed for benefit-cost ratio, where both 100% and 75% RDP generated superior economic returns across locations (Tables 37). The mode of AMF application significantly influenced coriander productivity. Combined seed treatment and soil application of AMF produced the highest pooled seed yield (18 q ha^{-1}), followed by soil application alone (17.1 q ha^{-1}), while seed treatment alone recorded the lowest yield (16.3 q ha^{-1}).

The integrated AMF application also realized the highest BCR return 18.0), demonstrating its economic superiority over individual application methods. Although benefit-cost ratio varied among locations, combined seed and soil application consistently produced competitive returns, particularly at Kota and Jabalpur.

Table 37. Pooled seed yield (q ha^{-1}) and profitability (BCR) of coriander as influenced by phosphorus levels and mode of AMF application (2022–23 to 2024–25)

Treatment	Ajmer		Coimbatore		Dholi		Guntur		Kota		Jabalpur		Mean	
	Y	BCR	Y	BCR	Y	BCR	Y	BCR	Y	BCR	Y	BCR	Y	BCR
Phosphorus level														
100% RDP	27	3	13	0	20	20	17	17	21	4.3	15	15	18.7	19
75% RDP	27	3	12	0	19	19	15	15	20	4.1	15	15	18.1	18
50% RDP	26	2.8	11	0	18	18	14	14	19	3.9	12	12	16.7	17
0% RDP	25	2.7	8.6	0	17	17	11	11	17	3.7	12	12	15.0	15
SEm±	42	0.1	0.5	0	0.4	0.4	0.5	0.5	0.5	0.1	0.3	0.3		0
CD (P=0.05)	122	0.2	1.1	0	1	1	1.6	1.6	1.3	0.3	0.9	0.9		0
Mode of application of VAM														
Seed Treatment	25	3.2	11	0	18	18	15	15	18	3.7	12	12	16.3	16
Soil Application	27	2.8	11	0	18	18	13	13	20	4	14	14	17.1	17
Seed Tr + Soil App	28	2.5	12	0	19	19	15	15	21	4.3	14	14	18.0	18
SEm±	36	0.1	0.5	0	0.3	0.3	0.5	0.5	0.4	0.1	0.3	0.3		0
CD (P=0.05)	106	0.2	1.1	0	1	1	1.4	1.4	1.1	0.3	0.8	0.8		0

Footnote: Data pooled over three years (2022-23, 2023-24 & 2024-25) where RDP = Recommended Dose of Phosphorus; AMF = Arbuscular Mycorrhizal Fungi, Y = Seed yield (q ha^{-1}); BCR = Benefit-Cost Ratio. Statistical parameters include Standard Error of Mean (SEm±), Critical Difference (CD) at 5% probability.

Overall, the experiment demonstrated that AMF inoculation substantially enhanced phosphorus-use efficiency and improved coriander productivity. The comparable performance of 75% RDP with 100% RDP suggests that integration of AMF with optimized phosphorus fertilization can reduce fertilizer requirement while maintaining yield and profitability.

COR/CM/6.1: Effect of growth regulators on yield and quality of Coriander

(Centres: Coimbatore, Guntur, Hisar, Jabalpur, Jobner, Kota, Raigarh)

The experiment on effect of growth regulators on yield and quality of Coriander which was initiated in the year 2022-23 got conclude during 2024-25 after three-year multi-locational trial with seven centres with the

following nine treatments: T_1- Salicylic acid @ 50 ppm; T_2 - Salicylic acid @ 100 ppm; T_3-Jasmonic acid @ 50 ppm; T_4-Jasmonic acid @ 100 ppm; T_5-Benzyl adenine @ 10 ppm; T_6-Benzyl adenine @ 20 ppm; T_7-Brassinosteroid @ 0.50 ppm; T_8-Brassinosteroid @ 1.00 ppm; T_9-Control (Water spray).

Among all treatments, benzyl adenine @ 20 ppm (T_6) recorded the highest overall mean seed yield of 15.4 q ha^{-1}, followed by salicylic acid @ 100 ppm (T_2) with 15.1 q ha^{-1}, and benzyl adenine @ 10 ppm (T_5) with 14.5 q ha^{-1}. Notably, T_6 also produced the highest single-centre yield at Raigarh (19.4 q ha^{-1}) and Jabalpur (16.2 q ha^{-1}), along with the best benefit-cost ratio at Jabalpur (3.0) and Raigarh (4.3), indicating its strong yield and economic advantage particularly under these agro-climatic conditions. The untreated control (T_9) recorded the lowest overall mean seed yield of 12.8 q ha^{-1}, confirming the significant positive influence of PGR application on coriander productivity across locations. In terms of benefit-cost ratio, T_2 (salicylic acid @ 100 ppm) and T_7 (brassinosteroid @ 0.5 ppm) also performed consistently well across most centres, reflecting favourable economic returns despite comparatively moderate yield levels. The statistically significant CD values recorded across most centres validate that the differences among treatments are unaffected and reproducible.

Table 38. Effect of growth regulators on seed yield (q ha^{-1}) and benefit-cost ratio (BCR) of coriander — Pooled data across centres

Treatment	Coimbatore		Guntur		Hisar		Kota		Jabalpur		Jobner		Raigarh		Mean	
	Y	BCR	Y	BCR	Y	BCR	Y	BCR	Y	BCR	Y	BCR	Y	BCR	Y	BCR
T_1: SA@50ppm	12.4	1.9	12.5	1.3	19.2	2.3	18.3	3.2	11.9	2.0	14.8	3.4	14.0	3.1	14.7	2.5
T_2: SA@100ppm	12.2	1.9	10.8	0.8	19.2	2.4	20.2	3.1	13.3	2.3	15.0	3.0	15.1	3.6	15.1	2.4
T_3 : JA@50ppm	11.5	1.9	11.1	0.9	19.4	2.5	17.8	3.1	13.5	2.4	14.5	3.3	12.3	3.0	14.3	2.4
T_4: JA@100ppm	11.6	1.8	11.0	0.6	19.2	2.4	19.2	2.9	12.4	2.1	14.5	2.9	13.2	3.1	14.4	2.2
T_5 : BA@10ppm	12.4	1.9	11.7	1.4	19.9	2.5	15.9	3.1	14.4	2.6	14.3	3.7	12.7	2.5	14.5	2.5
T_6: BA@20ppm	11.7	1.9	10.9	1.2	20.1	2.5	14.9	2.8	16.2	3.0	14.4	3.7	19.4	4.3	15.4	2.8
T_7 : BS@0.5ppm	11.2	1.9	11.2	1.0	19.5	2.5	16.7	2.8	14.2	2.2	14.9	3.5	12.7	3.1	14.4	2.4
T_8: BS@1ppm	10.7	1.8	10.5	0.7	19.0	2.4	15.0	2.0	13.0	1.6	15.0	3.2	15.1	3.2	14.1	2.1
T_9 : Control	9.9	1.6	9.6	1.0	18.3	2.3	16.1	3.3	10.5	1.7	12.2	3.3	12.7	2.9	12.8	2.3
SEm±	0.2	1.8	0.3	0.1	27.3	0.0	0.9	0.2	0.5	0.0	0.4	0.1	0.0	0.0		
CD (P=0.05)	0.3	0.1	1.0	0.2	67.7	0.0	2.4	0.6	1.3	0.0	1.0	0.2	113.6	0.0		

Footnote: Data pooled over three years (2022-23, 2023-24 & 2024-25) where Y = Seed yield (q ha^{-1}); BCR = Benefit-Cost Ratio. Statistical parameters include Standard Error of Mean (SEm±), Critical Difference (CD) at 5% probability. Treatments T_1–T_8 involved two foliar sprays at 30 and 60 days after sowing (DAS); T_9 served as untreated water spray control.

Although benzyl adenine @ 20 ppm recorded the highest pooled seed yield (15.4 q ha^{-1}), salicylic acid @ 50 ppm applied twice at 30 and 60 days after sowing consistently produced high and stable seed yield (14.7 q ha^{-1}), superior economic returns across locations. Based on its consistent multi-location performance, profitability, and operational feasibility, spraying salicylic acid @ 50 ppm or jasmonic acid @ 50 ppm or benzyl adenine @ 10 ppm or brassinosteroid @ 0.50 ppm for higher productivity and economics in coriander has been recommended for improving yield and quality of coriander in Rajasthan, Madhya Pradesh, Chhattisgarh, Haryana, Tamil Nadu, and Andhra Pradesh. This technology offers a simple and cost-effective strategy for enhancing coriander productivity under farmers' field conditions.

07. Coriander

Genetic Resources

COR/CI/1.1: Germplasm collection, description, characterization, evaluation, conservation and screening against diseases

(Centres: Coimbatore, Dholi, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh)

This is a long-term project aims at collecting, conserving and evaluating the available coriander germplasm towards identifying promising accessions with high yielding potential/resistance to powdery mildew disease. A total of 2097 accessions being conserved and maintained by these AICRPS centres jointly (Table 32). Among the 276 accessions maintained in the germplasm collection at Coimbatore were evaluated along with one check (CO (CR) 4 for growth and yield characters. Among them 49 lines were evaluated during 2024-25 revealed significantly higher seed yield in CS 46 (9.20 g plant^{-1}), CS 95 (8.60 g plant^{-1}) compared to the best check CO(CR) 4 (7.25 g plant^{-1}). At Dholi, Eighty one (81) accessions of coriander along with two checks (Pant Haritma and Rajendra Dhania-1) were evaluated for promising lines with respect to yield. Among them, the yield of best ten accessions ranged from 11.02 to 15.82 g plant^{-1} and only three accessions namely- RD-439 (15.82 g plant^{-1}), RD-121 (15.14 g plant^{-1}) and RD-448 (15.09 g plant^{-1}) gave higher yield than check varieties, Hisar Anand (15.03 g plant^{-1}) and Rajendra Dhania-1 (14.81 g plant^{-1}).

Table 32. Coriander germplasm collections maintained at various AICRPS centres

Centre	New Addition in 2024-25	No. of Accessions Maintained	Germplasm tested in 2024-25	Promising germplasm identified	IC Number Obtained from NBPGR
Coimbatore	-	276	49	05	-
Dholi	02	81	81	09	44
Guntur	25	402	102	05	-
Hisar	02	324	96	10	-
Jagudan	-	152	152	06	04
Jobner	02	664	238	07	28
Kumarganj	8	157	157	05	15
Navsari	22	110	110	11	02
Pantnagar	11	140	140	05	-
Raigarh	03	41	40	03	09
Kota	02	50	10	02	42
Total	29	2097	1085	70	155

Among the 276 accessions maintained in the germplasm collection at Coimbatore were evaluated along with one check (CO (CR) 4 for growth and yield characters. Among them 49 lines were evaluated during 2024-25 revealed significantly higher seed yield in CS 46 (9.20 g plant^{-1}), CS 95 (8.60 g plant^{-1}) compared to the best check CO(CR) 4 (7.25 g plant^{-1}). At Dholi, Eighty one (81) accessions of coriander along with two checks (Pant Haritma and Rajendra Dhania-1) were evaluated for promising lines with respect to yield. Among them, the yield of best ten accessions ranged from 11.02 to 15.82 g plant^{-1} and only three accessions namely- RD-439 (15.82 g plant^{-1}), RD-121 (15.14 g plant^{-1}) and RD-448 (15.09 g plant^{-1}) gave higher yield than check varieties, Hisar Anand

5 AICRPS centres in RBD with eleven test genotypes (BC-Bold, CZC 83, CZC 104, MCU-502, MCU-504, MCU-507, MCU-511, JC 21-02, JC 21-08, UC 272, and SC-13 along with national check Gujarat Cumin 4. The CVT trial initiated uniformly at five test centres during *rabi*, 2024-25 with plot size of 4.00 m x 2.40 m and completed first year of testing during *rabi*, 2024-25.

Table 40. Summary of Seed Yield per Hectare (Kg ha^{-1}) data of Coordinated Varietal Trials on cumin-2024 Series

Entry	AJM	JAG	JOB	MDR	SAD*	MEAN	Rank
CUM-56	537	444	449	440	102	468	4
CUM-57	597	498	374	424	61	473	3
CUM-58	NG	NG	NG	NG	8	8	12
CUM-59	230	523	357	NG	123	370	9
CUM-60	207	611	447	NG	44	422	8
CUM-61	438	384	462	461	56	436	6
CUM-62	475	347	417	454	60	423	7
CUM-63	639	400	377	448	66	466	5
CUM-64	447	153	521	281	48	351	11
CUM-65	118	491	447	NG	93	352	10
CUM-66	585	435	483	629	66	533	1
CUM-67	457	403	518	689	63	517	2
Loc. MEAN	430	426	441	478	66	402	
S.Em. ±	63.32	30.59	441.19	45.3	7.09		
C .D. at 5%	183.1	90	139.95	126.3	20.81		
C.V %	25.51	14.69	18.62	19.2	77.75		

Where, AJM: Ajmer; JAG: Jagudan; JOB: Jobner; MDR: Mandore; and SAD; Sanand.
*Since Sanand location (SAD) showed high experimental variability (CV% > 77.75%), were excluded from the final grand mean computation to ensure reliability and consistency of the yield estimates.

Results of the CVT on cumin for seed yield (2024 series) revealed considerable variation among the tested entries across different locations, indicating differential performance and adaptability under diverse agro-climatic conditions. The overall mean seed yield of the entries ranged from 8 to 533 kg ha^{-1}, with the trial mean of 402 kg ha^{-1} across centres. Among the evaluated entries, CUM-66 recorded the highest mean seed yield (533 kg ha^{-1}) and ranked first, followed by CUM-67 (517 kg ha^{-1}) and CUM-57 (473 kg ha^{-1}). Other promising entries included CUM-56 (468 kg ha^{-1}), CUM-63 (466 kg ha^{-1}) and CUM-61 (436 kg ha^{-1}), which performed better than the overall trial mean. The location mean yields varied across centres, with Mandore recording the highest mean yield (478 kg ha^{-1}) followed by Jobner (441 kg ha^{-1}), Ajmer (430 kg ha^{-1}) and Jagudan (426 kg ha^{-1}), whereas Sanand recorded comparatively lower yield (66 kg ha^{-1}) due to severe disease incidence during the crop season got omitted for final analysis due to high CV of 78%. The coefficient of variation ranged from 14.69 to 25.51% across qualified locations, indicating moderate environmental variability influencing the performance of the entries during the trial period.

Screening of cumin entries under the CVT – 2024 series against wilt and blight revealed considerable variation in disease incidence among the evaluated genotypes across locations, indicating differential levels of tolerance. Percent Disease Index (PDI) for wilt among the entries ranged from 41 to 86, with overall location mean of 61. Among the tested entries, CUM-67 recorded the lowest wilt incidence (PDI 41) and ranked first,

followed by CUM-62 and CUM-66 (PDI 50) and CUM-56 (PDI 52), indicating relatively better tolerance to wilt compared to other entries. In contrast, CUM-60 (PDI 86) and CUM-65 (PDI 80) exhibited higher wilt incidence, indicating susceptibility. Similarly, for blight incidence, the PDI among entries ranged from 26 to 66 with overall location mean of 48. Among the evaluated genotypes, CUM-63 recorded the lowest blight incidence (PDI 26) followed by CUM-66 (PDI 30) and CUM-62 (PDI 32), indicating relatively better tolerance to blight infection. Conversely, CUM-65 (PDI 66) and CUM-67 (PDI 64) recorded higher disease incidence and were comparatively more susceptible.

Table 41. Reaction of cumin entries under CVT (2024 series) to wilt and blight based on percent disease index (PDI) across locations

Entry	Wilt Incidence (PDI)					Blight Incidence (PDI)					
	JAG	JOB	MDR	MEAN	Rank	AJM	JAG	JOB	MDR	MEAN	Rank
CUM-56	90.36	36.9	30	52	8	40	60.02	69	18	47	7
CUM-57	92.25	42.7	31	55	7	70	50.13	70	23	53	5
CUM-58	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	13
CUM-59	100	43	95	79	3	40	70.24	68	11	47	7
CUM-60	99.27	70.6	88	86	1	40	80.36	63	23	52	6
CUM-61	100	65.1	15	60	5	45	90.44	65	21	55	3
CUM-62	100	29.6	19	50	9	25	40	37	24	32	9
CUM-63	100	52.6	25	59	6	25	5.25	48	25	26	11
CUM-64	100	48.7	40	63	4	60	80.39	49	28	54	4
CUM-65	100	55.9	85	80	2	100	95.98	51	18	66	1
CUM-66	100	41.4	10	50	9	30	38.64	39	14	30	10
CUM-67	100	18.3	6	41	11	100	100	45	9	64	2
Loc. MEAN	98	46	40	61		52	65	55	19	48	

Crop Management

CUM/CM/2 Agronomical Trial (AT)

CUM/CM/2.1: Standardization of plant density and sowing time for cumin genotype CZC 94 (Centres: Ajmer, Mandore, Jagudan, Jobner, Sanand)

The current agronomical trial was initiated during *rabi*, 2024–25 with the objective of standardizing the optimum plant density and sowing time for the cumin genotype CZC 94, and to assess whether this early genotype performs superior to the national check GC-4 in terms of crop duration and seed yield under different planting geometries. The experiment is being conducted for one year across five AICRPS centres to validate the consistency of the claim under diverse agro-climatic conditions. The trial is laid out in a Split Plot Design with six replications, where sowing dates constitute the main treatments [A_1: 15 November and A_2: 5 December]. The sub-treatments include varieties [B_1: CZC 94 and B_2: GC-4] and plant spacing levels [C_1: normal spacing of 30 × 5 cm and C_2: closer spacing of 22.5 × 5 cm]. Accordingly, four subplot treatment combinations were evaluated: CZC 94 + 22.5 × 5 cm, CZC 94 + 30 × 5 cm, GC-4 + 22.5 × 5 cm and GC-4 + 30 × 5 cm. The crop is grown in plots measuring 3.6 m × 3.0 m, enabling the assessment of the influence of sowing time and plant density on growth, yield attributes and productivity of the test genotype in comparison with the standard check.

At Ajmer, the effect of sowing date on seed yield was non-significant, although relatively higher yield was recorded with 05th December sowing (468.52 kg ha^{-1}) compared to 15th

November (402.12 kg ha^{-1}). Varietal effect was significant, wherein GC-4 (616.59 kg ha^{-1}) produced significantly higher seed yield than CZC-94 (254.05 kg ha^{-1}). The effect of spacing was non-significant, though 22.5 cm spacing (446.18 kg ha^{-1}) recorded slightly higher yield compared to 30 cm spacing (424.46 kg ha^{-1}). At Mandore, sowing date had a significant influence on yield, with 15th November sowing (863.28 kg ha^{-1}) producing significantly higher yield than 05th December sowing (398.69 kg ha^{-1}). Among varieties, GC-4 (744.95 kg ha^{-1}) significantly outperformed CZC-94 (517.01 kg ha^{-1}). Spacing treatments did not differ significantly, although relatively higher yield was observed with 22.5 cm spacing (661.61 kg ha^{-1}) compared to 30 cm spacing (600.36 kg ha^{-1}). At Jobner, sowing on 15th November (210.41 kg ha^{-1}) recorded significantly higher yield than 05th December (182.58 kg ha^{-1}). However, varietal and spacing effects were non-significant, with both CZC-94 (197.42 kg ha^{-1}) and GC-4 (195.58 kg ha^{-1}) producing comparable yields. Similarly, 22.5 cm spacing (200.33 kg ha^{-1}) showed marginally higher yield than 30 cm spacing (192.67 kg ha^{-1}), though the difference was not significant.

At Jagudan, the experiment was conducted and the initial plant population was optimum and crop growth was satisfactory up to the flowering stage. The mean days to flowering recorded were 59 DAS for GC-4 and 40 DAS for CZC-94, indicating the earliness of CZC-94. However, during the seed setting stage, the crop was severely affected by blight infestation, resulting in heavy yield loss and rendering the experiment vitiated. Similarly, at Sanand, the trial the trial was vitiated due to severe disease incidence.

Overall, the results suggest that CZC-94 could not demonstrate consistent superiority over GC-4 in yield performance, and timely sowing remains critical for achieving higher productivity in cumin, while spacing variation within the tested range had minimal influence on yield.

Table 42. Effect of sowing date, variety and spacing on seed yield of cumin (kg ha^{-1})

Treatments	Ajmer	Mandore	Jobner	Mean
Main Treatment (A) – Sowing dates				
15-Nov	402.12 ± 45.53	863.28 ± 54.72	210.41 ± 7.98	491.9
05-Dec	468.52 ± 38.43	398.69 ± 24.68	182.58 ± 8.54	349.9
CD at 5%	119.92 (NS)	120.84	12.84	–
Sub Treatments (B) – Varieties				
CZC-94	254.05 ± 22.17	517.01 ± 31.81	197.42 ± 3.51	322.8
GC-4 (Check)	616.59 ± 17.22	744.95 ± 78.45	195.58 ± 3.72	519
CD at 5%	56.5	170.4	20.59 (NS)	–
Sub Treatments (C) – Spacing				
22.5 cm	446.18 ± 34.00	661.61 ± 67.99	200.33 ± 3.56	436
30.0 cm	424.46 ± 49.79	600.36 ± 59.93	192.67 ± 3.51	405.8
CD at 5%	121.36 (NS)	182.44 (NS)	20.11 (NS)	–

Note: Mean values are calculated across Ajmer, Mandore and Jobner centres. NS – Non-significant.

CUM/CM/3 Nutrient Management and Soil Fertility Trials (NM/SF)

CUM/CM/3.4: Crop specific micronutrient formulation for cumin (Centres: Ajmer, Mandore, Jagudan, Jobner and Sanand)

The present trial was initiated during *rabi,* 2024–25 with the objective of evaluating the effect of cumin-specific micronutrient formulations on its growth, yield attributes and productivity of cumin under diverse agro-climatic conditions. The experiment will be

conducted for three years (2024–25 to 2026–27) across five AICRPS centres to generate location-specific recommendations. The trial is laid out in RBD with five replications. Four treatment combinations are being evaluated: T_1 – Control (recommended NPK fertilization without micronutrients); T_2 – 100% recommended dose of micronutrient fertilizers through soil application (Fe @ 10 kg ha^{-1} + Mn @ 10 kg ha^{-1}, Cu @ 5 kg ha^{-1}, Zn @ 5 kg ha^{-1} and B @ 5 kg ha^{-1}); T_3 – two foliar sprays of micronutrient formulation at 1% concentration applied at 60 and 90 days after sowing (DAS); and T_4 – 50% soil application of micronutrients (half of the recommended dose) combined with a 1% foliar spray of micronutrient formulation at 60 DAS. The crop is grown in plots measuring 5.0 m × 3.0 m (gross) with a net plot size of 4.0 m × 2.5 m, maintaining a spacing of 25 cm × 10 cm.

Table 43. Effect of micronutrient management treatments on cumin seed yield, essential oil content and benefit–cost ratio across four locations.

Location	Ajmer			Mandore			Jobner			Jagudan			Mean		
Treatments	SY	EO	B:C	SY	EO	B:C	SY	EO	B:C	SY	EO	B:C	SY	EO	B:C
T1	706.4	3.2	2.5	663	3.46	2.24	1123	0.19	2.05	618	3.638	3.09	777.11	2.62	2.47
T2	834.6	3.5	2.5	840	3.6	2.32	1236	0.28	2.11	652	3.9	2.6	890.64	2.83	2.37
T3	854.1	3.7	3.1	893	3.62	3.1	1279	0.32	2.28	667	3.944	3.1	923.29	2.89	2.89
T4	869.4	3.6	2.8	914	3.59	2.79	1248	0.31	2.17	641	3.864	2.67	918.11	2.85	2.62

Note: SY: Seed yield (kg ha^{-1}), EO: Essential oil (%) and B:C : Benefit-cost ratio as per the location.

The consolidated data across the four locations obtained during *rabi,* 2024-25 clearly indicated that micronutrient management practices had a pronounced influence on seed yield and economic returns, whereas the essential oil content showed relatively non-significant variation among treatments. Seed yield consistently increased with the application of micronutrients compared to the control across most locations. Among the treatments, the application of two foliar sprays of micronutrient formulation at 0.5% concentration at 60 and 90 DAS (T_3) recorded the highest mean seed yield across locations, followed closely by the combined treatment involving 50% soil application along with foliar spray (T_4). The control treatment (T_1) consistently produced the lowest yields, indicating the beneficial role of micronutrient supplementation in improving crop productivity. A similar trend was observed for the benefit–cost ratio, where T_3 recorded the highest economic returns owing to the higher yield advantage with relatively moderate input costs. Although the essential oil content varied slightly among treatments and locations, the differences were statistically non-significant.

Crop Protection and food safety

CUM/CI/7 Pathological Trial (PT)

CUM/CP/7.1: Eco-friendly management of cumin blight (Centres: Jagudan, Jobner, Mandor)

A multilocation trial for ecosafe production of cumin is progressed from *rabi*, 2022-2025, the third year and final year of evaluation of trial with eleven treatments, three replications in RBD were concluded.

During the year 2024–2025 revealed that the lowest blight severity (PDI) was recorded in T_{10} (three foliar sprays of Kresoxim-methyl 44.3 SC @ 0.044% (10 ml 10L^{-1} water); first spray at 35 DAG followed by two sprays at 10-days intervals) at all the experimental centres *viz.,* Jobner, Jagudan and Mandore,

shown 8.29, 23.25 and 9.00% PDI, respectively, with a pooled mean of 13.51%. This treatment was followed by T_9 [seed treatment and four foliar sprays of *Bacillus subtilis* 1.15 WP (1×10^8 cfu g^{-1}) @ 40 g 10 L^{-1} water + *Pseudomonas fluorescens* 1.15 WP (1×10^8 cfu g^{-1}) @ 50 g 10 L^{-1} water], which recorded comparatively lower disease incidence across the locations with 19.35, 26.44 and 16.33% PDI at Jobner, Jagudan and Mandore, respectively, and a mean PDI of 20.71%. In contrast, the highest disease severity was observed in the untreated control (T_{11}) at all locations, registering 51.49, 68.76 and 46.67% PDI at Jobner, Jagudan and Mandore, respectively, with a pooled mean of 55.64%. The remaining treatments showed moderate reduction in blight severity compared with the control but were less effective than T_{10} and T_9. These results clearly indicate that the systemic fungicide-based spray schedule (T_{10}) was the most effective treatment for managing cumin blight across locations, while the integrated biocontrol approach (T_9) also provided substantial disease suppression. The pooled analysis of data from 2022–2025 also exhibited a similar trend across all the centres, confirming that three foliar sprays of Kresoxim-methyl 44.3 SC @ 0.044% (10 ml/10 L water) were most effective in reducing blight incidence and resulted in higher seed yield, test weight and volatile oil content.

This treatment was closely followed by the integrated biocontrol treatment comprising seed treatment and four foliar sprays of *Bacillus subtilis* 1.15 WP (1×10^8 cfu g^{-1}) @ 40 g/10 L water + *Pseudomonas fluorescens* 1.15 WP (1×10^8 cfu g^{-1}) @ 50 g/10 L water, and the trend remained consistent across all the centres viz., Jobner, Jagudan and Mandore.

Table 44. Effect of treatments on blight severity (PDI) in cumin during 2024–25

Treatment	JOB (PDI)	JAG (PDI)	MDR (PDI)	Mean PDI
T_1	30.14 (33.29)	41.97 (40.36)	23.00 (28.64)	31.70
T_2	29.11 (32.65)	42.95 (40.92)	17.67 (24.83)	29.91
T_3	24.31 (29.54)	44.86 (42.04)	18.67 (25.58)	29.28
T_4	35.88 (36.79)	33.37 (35.26)	22.00 (27.94)	30.42
T_5	28.06 (31.98)	39.02 (38.58)	24.67 (29.76)	30.58
T_6	26.89 (31.23)	34.73 (36.09)	16.33 (23.81)	25.98
T_7	32.81 (34.94)	37.29 (37.55)	20.33 (26.77)	30.14
T_8	29.27 (32.75)	41.59 (40.12)	17.67 (24.83)	29.51
T_9	19.35 (26.06)	26.44 (30.85)	16.33 (23.81)	20.71
T_{10}	8.29 (16.72)	23.25 (28.77)	9.00 (17.43)	13.51
T_{11}	51.49 (45.86)	68.76 (56.34)	46.67 (43.07)	55.64
S.Em.±	0.93	1.99	0.80	–
CD (P=0.05)	2.74	5.87	2.38	–
CV (%)	5.03	8.88	6.59	–

Figures in parentheses represent arc-sine transformed values. PDI = Percent Disease Index. JOB = Jobner, JAG = Jagudan, MDR = Mandore.

Based on the consistent performance over multiple years and locations, the 36th Annual Group Meeting of AICRPS recommended the following technology (ToT) for eco-friendly management of cumin blight: seed treatment followed by four foliar sprays of *Bacillus subtilis* 1.15 WP (1×10^8 cfu g^{-1}) @ 40 g per 10 L water + *Pseudomonas fluorescens* 1.15 WP (1×10^8 cfu g^{-1}) @ 50 g per 10 L water, starting from 40 DAS. This technology has been recommended for adoption in the cumin-growing states of Rajasthan and Gujarat for sustainable and environmentally safe management of blight disease.

CUM/CP/7.2: Assessment of cumin blight (*Alternaria burnsii*) disease for weather-based prediction model (Centres: Ajmer, Mandor, Jagudan, Jobner, Sanand)

A multilocation trial was initiated during *rabi* 2024–25 with the objective of assessing the effect of weather parameters in incidence and severity of cumin blight caused by *Alternaria burnsii* and thereby devising a weather-based prediction model for forecasting disease occurrence under different agro-climatic conditions. The experiment will be conducted for three years across five AICRPS centres.The trial is laid out in RBD with three replications using cumin variety GC-4. The experiment consists of four staggered sowing dates, namely 10th November, 20th November, 30th November and 10th December, to expose the crop to varying environmental conditions during the crop growth period. Each plot measures 3 m × 2 m, accommodating eight rows of 3 m length with a spacing of 25 cm × 10 cm, and a total land area of 72 m² is required to accommodate all sowing treatments.

Observations on percent disease severity of cumin blight will be recorded at regular intervals, along with detailed weather parameters, to establish the relationship between disease development and meteorological variables for developing a predictive model for cumin blight management.

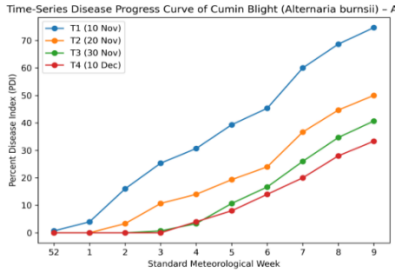


Figure 12. Time-series progression of cumin blight (*Alternaria burnsii*) across meteorological weeks (2024-25)

PDI of blight showed gradual increase over time, reaching their peak during late February to early March, especially for the earlier sowing dates such as T_1 and T_2.

In contrast, the later sowings (T_3 and T_4) experienced a delayed onset of the disease and exhibited a milder incidence, clearly indicating the influence of sowing date on disease progression. Among all treatments, T_1 (sown in early November) encountered the highest disease pressure, with the PDI exceeding 80%, while T_4 (sown in mid-December) remained the least affected.

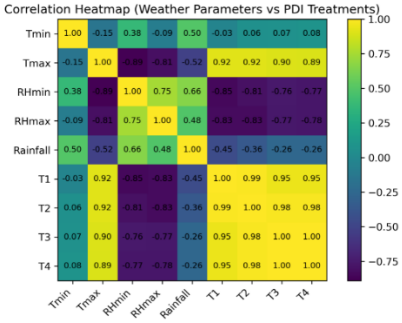


Figure 11: Correlation heatmap of weather parameters with cumin blight severity (PDI) across treatment dates

A strong correlation was observed between high relative humidity (RH) and disease occurrence. There was a sharp rise in PDI between the third and ninth weeks (January to March), which coincided with RH levels above 75% and minimum temperatures ranging between 10°C and 14°C. Particularly, high morning RH (75–78%) and midday RH above 88% during January and February created an environment highly conducive to the development of *Alternaria* blight. This highlights RH as a critical factor driving disease development, especially when accompanied by moderate temperatures and minimal rainfall. Furthermore, a significant increase in PDI was recorded after Week 52 (late December), following a rainfall event of 26.5 mm. Although January and February experienced low rainfall, the combination of high RH and persistent overcast conditions likely simulated a moist environment that favoured the proliferation of the disease.

09. Fennel

Genetic Resources

FNL/CI/1.1: Germplasm collection, description, characterization, evaluation, conservation and screening against diseases (Centres: Dholi, Hisar, Jagudan, Jobner, Kumarganj)

This is a long-term project aims at collecting, conserving and evaluating the available coriander germplasm towards identifying promising accessions with high yielding potential/resistance to powdery mildew disease. A total of 796 accessions being maintained at these AICRPS centres jointly. In total, 1301 fennel germplasm accessions are being conserved and maintained at different AICRPS testing centres, namely Ajmer, Pantnagar, and Navsari, in addition to above mandatory centres, as part of the institute's mandate (Table 45).

Table 45. Fennel germplasm collections maintained at various AICRPS centres

Centres	Total Germplasms	New Addition (2024-25)	Germplasm evaluated (2024-25)	Promising identified	IC Number obtained from NBPGR
Dholi	45	1	45	10	0
Hisar	180	-	96	11	0
Kumarganj	117	7	117	3	0
Jagudan	163	2	163	5	2
Jobner	291	-	205	10	8
Ajmer	385	09	100	7	10
Pantnagar	97	10	-	-	-
Navsari	23	-	15	3	-
Total	1301	29	741	49	20

A total of 45 accessions of fennel, along with two checks (Rajendra Saurabh and RCF-1), were evaluated for their yield potential at Dholi. Among these, only three— RF-02, RF-15 and RF-73—outperformed the both check varieties. The highest yield was recorded in RF-02 (98.83 g plant^{-1}), followed by RF-15 (98.10 g plant^{-1}) and RF-73 (RF-73 (98.10 g plant^{-1}), while the best check variety, RCF-1, yielded 89.91 g plant^{-1}. The top ten highest-yielding germplasms had yields ranging from 58.91 to 98.83 g plant^{-1}. Out of 160, 96 accessions of fennel were evaluated in two row plots of 3.0 m length each using GF-2 and PF-35 as checks as checks during 2024-25 at Hisar. The seed yield of the fennel germplasm evaluated ranged from 13.6 g plant^{-1} (HF-119) to 37.6 g plant^{-1} (HF-178). The most promising lines out of ninety-six accessions with two checks were HF-127, HF-132, HF-145, HF-157, HF-161, HF-164, HF-165, HF-178, HF-187 and HF-194. Among the 117 germplasm collections of fennels evaluated at Kumarganj, maximum yield was recorded in NDF-52 (70.12 g plant^{-1}) followed by NDF-95 (68.30 g plant^{-1}) and NDF -80 (66.30 g plant^{-1}).

During the 2024-25, total 163 accessions of fennel were evaluated at Jagudan along with the two checks. The seed yield ranged ranges from 120-450 g plot^{-1} during trial. JF 332, JF 2016-11, JF 641, JF 600, and JF 514-2 were found as promising for high yielding ability.

Two hundred five (205) germplasm lines of fennel were evaluated along with seven checks in augmented design at Jobner. A wide range of variability was found for all the characters studied. Among 205 accessions evaluated, 50 were better than best check variety RF-143 (58.8 g). Promising accessions identified on the basis of seed yield per 5 plants were UF131(119.0g) UF-80 (107.0g) UF-70 (104.0g), UF 178(97 gm), UF 196 (93.0 g), UF 372 (89.0g), UF 330 (86.0 g), UF402 (85.0), UF 377 (84.0 g) and UF 333 (84.0 g).

Crop Improvement

FNL/CI/2 Coordinated Varietal Trial (CVT) FNL/CI/2.8: Coordinated Varietal Trial on fennel 2024-Series XII (Centres: Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Navsari, Pantnagar)

Coordinated Varietal Trial (CVT) on fennel 2024 series XII trial laid out at nine AICRPS centres in RBD with 13 entries (HF 192, HF 256, JF 18-13, JF 18-03, UF 231, UF 230, AF 87, AF 17, RF 67, NDF 59, and NDF 46, including with two national check RF-101 and RF 205). The CVT trial initiated during *rabi*, 2024-25 and completed the first year of testing under coded multilocational trial.

Table 46. Summary of seed yield (kg ha^{-1}) of Coordinated Varietal Trials on fennel-2024 Series

Entries	AJM	DHL	HSR	JBR	JAG	JOB	KUM	NAV	PNR	Mean	Rank
FNL 143	1406	1686	1813	1546	1432	1367	1432	1336	1129	1461	6
FNL 144	1082	1892	1780	1649	657	1213	657	1089	1317	1260	13
FNL 145	1902	1583	1636	1770	1423	1504	1423	1793	1361	1599	2
FNL 146	1994	1613	1559	1545	1182	1920	1182	1312	1464	1530	3
FNL 147	1765	1868	1862	1654	897	1465	897	1470	1473	1483	4
FNL 148	1047	1511	1629	1579	1073	1704	1073	1886	1684	1465	5
FNL 149	1249	1627	1295	1186	910	1522	910	1181	1307	1243	14
FNL 150	761	1511	835	1465	759	1367	759	3014	1321	1310	11
FNL 151	595	1708	1802	1421	873	1467	873	2714	1076	1392	9
FNL 152	2036	1503	1565	1625	994	1764	994	2598	1562	1627	1
FNL 153	1296	1813	1901	1726	937	1244	937	1585	1321	1418	7
FNL 154	1016	1562	1835	1369	975	1344	975	1956	1645	1409	8
FNL 155	1073	1529	2014	1555	872	1424	872	1123	1369	1315	10
FNL 156	626	1499	980	1560	1029	1766	1029	2115	1063	1296	12
Loc. Mean	1275	1636	1608	1546	1001	1505	1001	1798	1364	1415	
CD (0.05)	112.1	153.2	118.3	262.0	176.0	217.5	176.0	341.7	179.2		
CV %	5.3	5.7	4.4	10.1	10.5	8.6	10.5	11.3	8.0		

Where, AJM: Ajmer; DHL: Dholi; HSR: Hisar; JBR: Jabalpur; JAG: Jagudan; JOB: Jobner; KUM: Kumarganj; NAV: Navsari; PNR: Pantnagar.

The mean volatile oil content in CVT entries across locations varied from 1.84 to 2.46 %, with an overall location mean of 2.05 %. Among the entries, FNL 151 recorded the highest mean volatile oil content (2.46 %) and ranked first, followed by FNL 143 (2.42 %) and FNL 152 (2.15 %). Other entries with comparatively higher oil content included FNL 150 (2.05 %), FNL 145 (2.04 %), and FNL 146 (2.04 %), which performed close to or above the overall mean.

Table 47. Pooled data of Fennel entries for volatile oil (%) in Coordinated Varietal Trial during *Rabi,* 2024-25

Entries	Ajmer	Jagudan	Jobner	Mean	Rank
FNL 143	2.74	2.18	2.33	2.42	2
FNL 144	1.67	1.86	2	1.84	14
FNL 145	2.07	1.8	2.25	2.04	6
FNL 146	2.02	1.91	2.2	2.04	5
FNL 147	1.62	1.95	2.17	1.91	12
FNL 148	1.96	1.91	2.08	1.98	10
FNL 149	2.02	1.88	2.12	2.01	7
FNL 150	1.95	1.81	2.39	2.05	4
FNL 151	3.07	2.15	2.15	2.46	1
FNL 152	2.26	1.86	2.32	2.15	3
FNL 153	2.05	1.84	2.12	2.00	8
FNL 154	2.08	1.82	2.09	2.00	9
FNL 155	1.73	1.81	2.16	1.90	13
FNL 156	2.14	1.6	2.07	1.94	11
Loc. Mean	2.10	1.88	2.18	2.05	
CD (0.05)	0.07	-	0.18	-	
CV %	1.89	-	5.03	-	

10. Fenugreek

Genetic Resources

FGK/CI/1.1: Germplasm collection, characterization, evaluation, conservation and screening against diseases
(Centres: Dholi, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh)

This is a long-term project aims at collecting, conserving and evaluating the available coriander germplasm towards identifying promising accessions with high yielding potential/resistance to powdery mildew disease. A total of 1240 accessions being conserved and maintained by these AICRPS centres jointly (Table 48). At Dholi sixty-two fenugreek germplasm accessions were evaluated along with two check varieties, Rajendra Kranti and Hisar Sonali, for seed yield performance.

Table 48. Fenugreek germplasm collections maintained at various AICRPS centres.

Centres	Indigenous	Exotic	New Additions	Total	Evaluated 2024-25
Dholi	62	-	2	62	62
Guntur	124	-	10	124	124
Hisar	411	-	4	411	132
Jagudan	82	-	-	82	82
Jobner	373	12	12	385	90
Kumarganj	165	-	6	165	165
Raigarh	11	-	-	11	11
Total	1228	12	34	1240	654

Among the evaluated accessions, six genotypes, namely RM-216, RM-202, RM-215, RM-204, RM-210 and RM-206, outperformed both check varieties. The seed yield of the top-performing accessions ranged from 16.03 to 19.82 g plant^{-1}, with RM-216 (19.82 g plant^{-1}) recording the highest yield. A total of 124 fenugreek accessions were evaluated at Guntur for seed and herb yield along with check varieties. Ten accessions produced significantly higher seed yield than the best check, Lam Sonali (3.00 g plant^{-1}). The highest seed yield was recorded by LFC-111 (4.61 g plant^{-1}), followed by LFC-71 (4.57 g plant^{-1}), LFC-171 (4.35 g plant^{-1}), LFC-31 (4.34 g plant^{-1}), and LFC-104, LFC-99 and LFC-162 (3.91 g plant^{-1}). For herb yield, accession LFC-122 was identified as the most promising. Hisar maintains 120 fenugreek accessions which were evaluated along with three check varieties, namely Hisar Sonali, Hisar Suvarna and Hisar Mukta. Seed yield among the accessions varied widely from 11.5 to 35.6 g plant^{-1}. The highest seed yield was recorded by HM-525 (35.6 g plant^{-1}), while HM-488, HM-490, HM-517, HM-522, HM-533, HM-591, HM-595, HM-603 and HM-632 were also identified as promising genotypes for seed yield.

A total of 85 fenugreek germplasm accessions were evaluated at Jagudan along with check varieties, recording seed yield ranging from 170 to 445 g plot^{-1}. Additionally, forty-one accessions were screened against powdery mildew under field conditions. Disease intensity varied considerably from 5.04 to 75.51%, with FGK-173 exhibiting the lowest powdery mildew incidence (5.04%), indicating a high level of field resistance, whereas accession JFg 23-07 recorded the highest disease intensity (75.51%). Ninety fenugreek germplasm accessions were evaluated in an augmented design at Jobner along with seven check varieties. Considerable variability was observed for seed yield among the evaluated material. Sixteen accessions produced higher seed yield than the best check variety RMt-354 (70.0 g per five plants). Among them, UM-246 (93.0 g per five plants) was the highest yielder, followed by UM-285 (88.6 g), UM-141 (86.2 g), UM-379 (85.0 g), UM-355 (83.2

g), UM-151 (80.0 g), UM-145 (79.5 g), UM-136 (75.0 g), UM-118 (74.2 g) and UM-129 (74.0 g). Kumarganj maintains a total of 165 fenugreek germplasm accessions were evaluated during the 2024-25. Seed yield ranged from 8.1 to 14.3 g plant^{-1}. Accession NDM-116 (14.30 g plant^{-1}) recorded the highest seed yield, followed by NDM-9 (12.35 g plant^{-1}) and NDM-124 (12.10 g plant^{-1}), indicating their potential for utilization in future breeding programmes. Eleven fenugreek genotypes were evaluated at Raigarh along with two national check varieties. IFGS-11 recorded the highest seed yield of 2613.7 kg ha^{-1}, followed by IFGS-03 (2440.0 kg ha^{-1}) and IFGS-04 (2002.6 kg ha^{-1}). These genotypes significantly outperformed both national checks, Hisar Sonali (1554.7 kg ha^{-1}) and RMT-305 (1750.9 kg ha^{-1}), as well as the trial mean (1788.3 kg ha^{-1}), demonstrating their potential as valuable breeding materials for high-yielding fenugreek improvement programmes.

Table 49. Summary of evaluation of fenugreek germplasm for yield performance at different AICRP centres during 2024–25

Centre	Genotypes Evaluated*	Yield Range (g plant^{-1})	Best Check (Yield)	No. of Promising Genotypes	Promising Genotypes
Dholi	62 + 2 (C)	16.03–19.82	R. Kranti (17.46 g plant^{-1})	6	RM-216, RM-002, RM-215, RM-204, RM-210 and RM-206
Guntur	134 + 4 (C)	1.80–4.61	Lam Methi-3 (3.60 g plant^{-1})	10	LFC-111, LFC-71, LFC-171, LFC-162, LFC-104, LFC-99, LFC-61, LFC-33, LFC-91 and LFC-95
Hisar	132 + 2 (C)	11.5–35.6	H. Sonali (24.6 g plant^{-1})	11	HM-488, HM-490, HM-491, HM-492, HM-517, HM-522, HM-525, HM-533, HM-591, HM-603 and HM-632
Jagudan	82 + 3 (C)	170–450 g plot^{-1}	GM-2 (365 g plot^{-1})	4	JFg-267, JFg-255, JFg-245 and JFg-239
Jobner	90 + 7 (C)	16.6–93.0	RMt-354 (70.0 g plant^{-1})	10	UM-246 (93.0 g), UM-285 (88.6 g), UM-141 (86.2 g), UM-379 (85.0 g), UM-355 (83.2 g), UM-151 (80.0 g), UM-145 (79.5 g), UM-136 (75.0 g), UM-118 (74.2 g) and UM-129 (74.0 g)
Kumargunj	165 + 2 (C)	8.1–14.3	H. Sonali (10.5 g plant^{-1})	3	NDM-116, NDM-9 and NDM-124
Raigarh	11 + 2 (C)	12.5–17.6	RMt-305 (14.5 g plant^{-1})	4	IFGS-11, IFGS-2, IFGS-7 and IFGS-1

Crop Improvement

FGK/CI/2 Coordinated Varietal Trial (CVT)

FGK/CI/2.5: Coordinated Varietal Trial on fenugreek 2024-Series XI

(Centres: Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kalyani, Kota, Kumarganj, Navsari, Pantnagar, Raigarh)

Coordinated Varietal Trial (CVT) on fenugreek 2024 series trial laid out at 11 AICRPS centres in RBD with fourteen test genotypes (AFg-8, AFg-9, HF-370, HF-464, KFG 24-1, NDM-45, NFG-205, PF-35, RM 205, UM 122, UM 377, IFGS 9, SFg 5 and SFg 7 along with checks RMt-354 and AFg-5. The CVT trial initiated during *rabi*, 2024-25 in all centres in a RBD with three replications, maintaining a plot size of 4.0 × 2.4 m and a crop geometry of 30 × 10 cm. The pooled analysis done for first year revealed

significant variation among the entries for grain yield across test environments, indicating substantial genetic variability and differential adaptation. The mean grain yield ranged from 1511 kg ha^{-1} (FGK-161) to 1849 kg ha^{-1} (FGK-162). Among the evaluated entries, FGK-162 emerged as the highest yielding genotype with a pooled mean grain yield of 1849 kg ha^{-1}, followed closely by FGK-170 (1846 kg ha^{-1}), FGK-160 (1834 kg ha^{-1}), FGK-163 (1833 kg ha^{-1}) and FGK-176 (1820 kg ha^{-1}).These entries consistently performed well across several locations, indicating broad

Table 50. Summary of Seed Yield per Hectare (Q ha^{-1}) data of Coordinated Varietal Trials on fenugreek-2024 Series

Entry	Gujarat		Rajasthan			HR	MP	CG	Bihar	UP	UK	Mean	Rank
	JAG	NAV	AJM	JOB	KOT	HSR	JBR	RAI	DHL	KUM	PNR		
FGK 157	9.7	15.7	23.3	14.4	15.6	20.2	18.8	17.6	20.6	21.8	13.3	17.4	12
FGK 158	12.0	14.8	22.5	13.4	14.7	17.8	19.9	18.4	20.2	20.4	14.2	17.1	14
FGK 159	9.9	15.8	19.9	14.1	13.4	15.8	21.7	23.3	20.4	22.4	17.5	17.7	10
FGK 160	10.3	13.7	23.1	15.8	15.2	20.4	20.1	25.9	18.5	24.0	14.7	18.3	3
FGK 161	11.5	15.9	12.7	10.3	12.6	9.0	19.1	20.3	17.4	20.1	17.2	15.1	16
FGK 162	13.9	17.9	23.1	16.4	17.1	19.4	19.3	20.4	16.1	23.2	16.8	18.5	1
FGK 163	13.1	14.3	24.7	20.1	13.4	19.5	21.4	17.5	20.0	21.7	16.1	18.3	4
FGK 164	15.2	16.0	26.2	15.8	16.7	20.0	19.3	14.9	20.4	18.7	16.4	18.2	7
FGK 167	10.4	13.7	23.0	15.5	11.4	18.6	24.8	12.0	17.1	17.6	15.3	16.3	15
FGK 169	10.7	15.1	20.9	19.3	12.8	22.8	20.4	16.5	19.7	21.8	16.6	17.9	9
FGK 170	12.9	18.3	17.9	17.9	16.1	19.0	20.0	26.8	19.2	20.3	14.6	18.5	2
FGK 171	12.9	15.8	21.6	15.8	15.2	21.1	18.6	17.9	17.0	22.9	17.8	17.9	8
FGK 172	10.5	15.8	23.0	16.4	14.7	19.6	19.7	21.6	17.6	19.9	15.0	17.6	11
FGK 173	11.1	15.5	23.4	19.0	15.7	19.2	17.6	23.6	20.4	21.8	12.5	18.2	6
FGK 175	6.1	12.5	21.3	15.0	10.4	21.4	21.4	23.7	17.6	22.6	18.5	17.3	13
FGK 176	10.1	13.6	23.3	18.4	15.3	19.0	22.7	23.5	16.7	24.2	13.6	18.2	5
Loc. Mean	11.3	15.3	21.9	16.1	14.4	18.9	20.3	20.2	18.7	21.5	15.6	17.6	
S.Em. ±	0.76	0.96	1.04	0.00	0.96	0.00	0.01	1.37	20.41	0.85	0.00	0.00	
C.D.at 5%	2.2	2.8	3.0	0.0	2.8	3.0	0.0	4.0	0.0	2.5	1.8	0.0	
C.V. %	13.17	10.88	8.25		12	9.6	10.26	11.72	57.57	6.836	6.91		

Where, AJM: Ajmer; DHL: Dholi; HSR: Hisar; JBR: Jabalpur; JAG: Jagudan; JOB: Jobner; KOT: Kota; KUM: Kumarganj; NAV: Navsari; PNR: Pantnagar; and RAI: Raigarh.

adaptability and superior yield potential. At the individual location level, considerable environmental influence on yield expression was observed. The highest location yield of 2680 kg ha^{-1} was recorded by FGK-170 at Raigarh, while FGK-160 produced 2589 kg ha^{-1} at the same centre. At Ajmer, FGK-164 recorded the maximum yield (2620 kg ha^{-1}), whereas FGK-163 exhibited superior performance at Jobner (2014 kg ha^{-1}). In Jabalpur, FGK-167 recorded the highest yield (2479 kg ha^{-1}), highlighting the presence of location-specific adaptation among certain entries. Pantnagar recorded comparatively moderate yields, with FGK-175 (1852 kg ha^{-1}) and FGK-171 (1781 kg ha^{-1}) performing better than the remaining entries.

Crop Management

CUM/CM/5 Agronomical Trial (AT)

FGK/CM/5.1: Growth and yield of fenugreek as influenced by AMF (Arbuscular Mycorrhizal Fungi)

(Centres: Dholi, Guntur, Kota, Mandor, Jabalpur)

A multi-location trial conducted to study the effect of Arbuscular Mycorrhizal Fungi (AMF) application and phosphorus levels on the growth and yield of fenugreek across five AICRPS centres. The experiment was laid out in a FRBD involving two factors: phosphorus application level and mode of AMF application. A total of 12 treatment combinations were tested, combining different phosphorus (P) levels and modes of Arbuscular Mycorrhizal Fungi (AMF) application on seed yield, profitability and benefit-cost ratio of fenugreek. The experiment comprised four phosphorus levels (100, 75, 50 and 0% of the recommended dose



Figure 12. Field view of trial undertaken at (a) Mandor, Rajasthan (b) Jabalpur, MP

Table 51. Performance of fenugreek under AMF treatment and different doses of phosphorus application

Treatment	Dholi		Jabalpur		Kota		Mandor		Mean	
	Y	BCR	Y	BCR	Y	BCR	Y	BCR	Y	BCR
Phosphorus level (P)										
P_{100}	19.7	1.2	16.2	3.5	17.5	3.9	17.9	4.5	17.9	3.3
P_{75}	19.0	1.2	15.0	3.2	16.3	3.7	23.7	4.5	18.5	3.1
P_{50}	15.3	1.0	13.5	2.9	14.7	3.4	23.4	3.9	16.7	2.8
P_0	16.4	1.0	11.7	2.5	11.7	2.8	20.2	3.6	15.0	2.5
SEM (±)	1.15	–	0.42	0.07	0.25	0.02	0.21	0.04	–	–
CD (P=0.05)	3.0	–	1.2	0.2	0.7	0.1	0.6	0.1	–	–
Mode of application (S)										
S_1 (AMF Seed)	16.2	1.3	12.9	2.8	12.9	3.0	21.0	4.1	15.8	2.8
S_2 (AMF Soil)	18.1	1.0	13.2	2.7	14.2	3.5	21.2	4.1	16.7	2.8
S_3 (AMF Seed + Soil)	18.5	1.0	16.1	3.5	14.4	3.8	21.7	4.2	17.7	3.1
SEM (±)	0.85	–	0.37	0.06	0.22	0.02	0.18	0.04	–	–
CD (P=0.05)	NS	–	1.1	0.2	0.7	0.1	0.5	0.1	–	–

Footnote:
Factor A -P: Phosphorus levels where as P_{100}: 100% Recommended Dose of Phosphorus (RDP), P_{75}: 75% RDP, P_{50}: 50% RDP, P_0: Control (0 RDP).

Factor B -S: Mode of AMF application whereas S1: Seed treatment (@100g/kg of seed at sowing), S2: Soil application (20 DAS @5 kg/acre), S3: Seed treatment + Soil application (20 DAS @5 kg/acre).
Treatment combinations (T1–T12) represent all possible permutations of phosphorus level and mode of application.

BCR: Benefit-Cost Ratio; SEM: Standard Error of Mean; CD: Critical Difference at p = 0.05; NS: Not Significant; DAS: Days After Sowing.

of phosphorus) as the main factor and three modes of AMF application, viz., seed treatment (S_1), soil application (S_2) and combined seed + soil application (S_3), as the sub-factor.

Pooled analysis across locations clearly demonstrated that phosphorus nutrition and AMF inoculation significantly influenced fenugreek productivity.

Among phosphorus treatments, application of 75% recommended dose of phosphorus (P_{75}) produced the highest pooled mean seed yield of 1849 kg ha^{-1}, followed closely by 100% recommended phosphorus (P_{100}) with 1785 kg ha^{-1} (Table 51). The yield recorded under P_{75} was statistically at par with P_{100} but significantly superior to 50% phosphorus (1671 kg ha^{-1}) and the untreated control (1499 kg ha^{-1}).

The results clearly indicate that 25% reduction in phosphorus fertilizer can be achieved without compromising productivity when integrated with AMF. The mode of AMF application significantly influenced seed yield across locations. Combined seed treatment plus soil application (S_3) consistently outperformed individual methods, recording the highest pooled seed yield of 1768 kg ha^{-1}, followed by soil application alone (1668 kg ha^{-1}) and seed treatment alone (1577 kg ha^{-1}).

The interaction between phosphorus level and AMF application was non-significant at Mandor and Dholi but significant at Jabalpur and Kota.

Economic analysis by benefit-cost ratio substantiated the agronomic observations (Table 2).

Among phosphorus levels, 75% recommended phosphorus (P_{75}) recorded the highest pooled B:C ratio of 3.14, marginally exceeding P_{100} (3.05). This clearly indicates that partial replacement of phosphorus fertilizer improves input-use efficiency and profitability without affecting crop performance. Combined AMF application (S_3) recorded the highest pooled B:C ratio of 3.13, compared with soil application (2.84) and seed treatment (2.78). The superior economic efficiency under S_3 reflects enhanced nutrient uptake, improved biomass production and greater seed yield achieved through continuous mycorrhizal colonization.

FGK/CM/6.1: Effect of growth regulators on yield and quality of fenugreek (Centres: Ajmer, Dholi, Hisar, Jobner, Kota)

The experiment on effect of growth regulators on yield and quality of fenugreek which was initiated in the year 2022-23 got concluded during 2025 with seven centres with the following nine treatments: T_1- Salicylic acid @ 50 ppm; T_2 - Salicylic acid @ 100 ppm; T_3-Jasmonic acid @ 50 ppm; T_4-Jasmonic acid @ 100 ppm; T_5-Benzyl adenine @ 10 ppm; T_6-Benzyl adenine @ 20 ppm; T_7-Brassinosteroid @ 0.50 ppm; T_8-Brassinosteroid @ 1.00 ppm; T_9-Control (Water spray). Pooled analysis across locations and years revealed significant effects of growth regulator treatment coupled with doses, locations, years and their interactions on seed yield, net returns and benefit:cost ratio, indicating differential treatment response across diverse agro-climatic conditions. Foliar application of plant growth regulators consistently enhanced seed productivity over the untreated control.

Among all treatments, Brassinosteroid @ 1.0 ppm recorded the highest pooled seed yield (1,768 kg ha^{-1}), representing an increase of 30.7% over the control (1,353 kg ha^{-1}). This was closely followed by Salicylic acid @ 100 ppm (1,717 kg ha^{-1}), Jasmonic acid @ 100 ppm (1,703 kg ha^{-1}), Benzyl adenine @ 20 ppm (1,670 kg ha^{-1}) and Brassinosteroid @ 0.5 ppm (1,669 kg ha^{-1}). Yield enhancement under growth regulator treatments ranged from approximately 18 to 31% compared with water spray, demonstrating the effectiveness of exogenous plant growth regulators in improving pod setting, assimilate translocation and seed filling. Hisar consistently recorded the highest seed yields across treatments (2,026–2,480 kg ha^{-1}), while Ajmer exhibited remarkable yield improvement during 2024–25, reaching 3,493 kg ha^{-1} under Brassinosteroid @ 0.5 ppm.

The improvement in productivity was reflected in economic returns and profitability in terms of benefit:cost ratio (BCR). Benzyl adenine @ 20 ppm recorded the highest pooled B:C ratio (2.59), followed by Salicylic acid @ 100 ppm (2.43), Brassinosteroid @ 0.5 ppm (2.39), Salicylic acid @ 50 ppm (2.40) and Jasmonic acid @ 50 ppm (2.35). The untreated control registered the lowest B:C ratio (1.98). The higher profitability achieved with benzyl adenine despite slightly lower yield than brassinosteroid indicates its superior economic efficiency.

Table 52. Effect of foliar application of plant growth regulators on seed yield and benefit:cost ratio of fenugreek across five locations (Pooled mean, 2022–23 to 2024–25)

Treatment	Ajmer		Jobner		Kota		Dholi		Hisar		Mean	
	Y	BCR	Y	BCR	Y	BCR	Y	BCR	Y	BCR	Y	BCR
T_1: Salicylic Acid 50 ppm	1635	1.8	1545	3.6	1197	2.6	1762	1.3	2063	NA	1598	2.4
T_2: Salicylic Acid 100 ppm	1703	1.9	1586	3.2	1325	2.9	1808	1.4	2432	NA	1717	2.4
T_3: Jasmonic Acid 50 ppm	1659	1.4	1492	3.4	1334	3.0	1674	1.2	2244	NA	1638	2.4
T_4: Jasmonic Acid 100 ppm	1845	0.9	1516	3.0	1444	3.3	1734	1.2	2125	NA	1703	2.2
T_5: Benzyl Adenine 10 ppm	1699	1.0	1489	3.9	1280	2.7	1713	1.2	2067	NA	1613	2.3
T_6: Benzyl Adenine 20ppm	1752	2.0	1517	3.9	1373	2.8	1795	1.3	2098	NA	1670	2.6
T_7: Brassinosteroid 0.5 ppm	1742	1.7	1600	3.8	1305	2.3	1854	1.4	2025	NA	1669	2.4
T_8: Brassinosteroid 1.0 ppm	1935	1.7	1649	3.6	1398	2.0	1883	1.4	2135	NA	1768	2.2
T_9: Water spray	1278	0.9	1257	3.5	1058	2.2	1537	1.2	1866	NA	1353	2.0

Where table present Y: seed yield (kg ha^{-1}) and BCR: benefit-cost ratio

NA indicates that location-wise B:C ratio was not computed because economic analysis was pooled across locations.

Overall, the three-year pooled results clearly established the beneficial role of foliar application of plant growth regulators in improving fenugreek productivity and profitability. Application of two foliar sprays of Brassinosteroid @ 1.0 ppm at 30–35 and 55–60 DAS to maximize seed yield (25–30% increase over control). Where profitability is the primary objective, apply Benzyl adenine @ 20 ppm at the same growth stages to achieve higher economic returns (B:C ratio up to 2.59) with an additional net income of approximately ₹15,000–17,000 ha^{-1} and the technology was recommended by 36th AGM of ICAR-AICRPS for fenugreek cultivation in Rajasthan, Haryana, Bihar and Uttar Pradesh.

Crop Protection and Food Safety

CUM/CI/7 Pathological Trial (PT)

FGK/CP/7.1: Bio-efficacy of fungicides against powdery mildew of fenugreek (Centres: Coimbatore, Hisar, Jagudan, Jabalpur, Jobner, Kota, Raigarh)

A field trial was initiated in 2022-23 to assess the efficacy fungicides in managing disease incidence across seven centres had come to conclusion during 2025-26**.** The experiment was conducted in a RBD with three replications per treatment. The pooled analysis over locations and years revealed significant differences among fungicidal treatments for powdery mildew reduction, increase in seed yield and economic returns, demonstrating the effectiveness of timely fungicidal intervention. Among the evaluated fungicides, Tebuconazole 25.9% EC @ 0.1% (T_2) recorded the lowest pooled powdery mildew severity (16.77 PDI), followed by the SAU recommended practice (19.00 PDI), Hexaconazole 5% SC @ 0.1% (19.75 PDI) and Propiconazole 25% EC @ 0.1% (20.75 PDI), whereas the untreated control recorded the highest disease incidence (45.36 PDI). These treatments reduced disease severity by 56.46–63.03% over the untreated control.

Disease suppression translated into significant improvement in seed yield across locations. The highest pooled seed yield was recorded with the SAU recommended practice (15.18 q ha^{-1}) followed closely by Hexaconazole (14.97 q ha^{-1}), Tebuconazole (14.91 q ha^{-1}) and Propiconazole (14.46 q ha^{-1}) compared with 10.91 q ha^{-1} in the untreated control. The effective fungicidal treatments resulted in 32.5–39.1% higher seed yield over control, indicating that timely disease management substantially minimized yield losses caused by powdery mildew. Economic analysis further substantiated the superiority of triazole fungicides. Although the SAU practice produced marginally higher yield, Hexaconazole proved more economical owing to its lower application cost and superior cost-benefit ratio. Residue analysis of harvested produce showed that residues of Hexaconazole and Propiconazole were below the limit of quantification (BLQ <0.02 mg kg^{-1}), indicating that these fungicides are safe when applied at the recommended dose and spray schedule.

Based on effectivity of different fungicides against powdery mildew disease at different location AICRPS recommendations is given in table 54.



Figure 13. Field evaluation of fungicidal treatments against powdery mildew of fenugreek under the AICRP on Spices multi-location trial at Jobner, Rajasthan, and Jagudan, Gujarat.

Table 53. Performance of fungicidal treatments against powdery mildew disease of fenugreek under multi-location field trials.

Trts	Jagudan			Jobner			Hisar			Jabalpur			Kota			Coimbatore			Raigarh			Mean		
	PDI	Y	PCBR	PDI	Y	PCBR	PDI	Y	PCBR	PDI	Y	PCBR	PDI	Y	PCBR	PDI	Y	PCBR	PDI	Y	PCBR	PDI	Y	PCBR
T_1	31 (27)	14	6	27 (31)	15	2	21 (27)	21	1	39 (38)	19	0	11 (19)	13	4	16 (24)	5	0	19 (26)	9	1	25 (30)	14	2
T_2	31 (27)	14	11	18 (25)	18	9	27 (31)	19	0	23 (29)	23	10	7 (15)	13	8	17 (24)	5	0	10 (18)	13	10	17 (24)	15	7
T_3	24 (17)	15	29	8 (17)	23	37	24 (29)	20	3	37 (38)	20	7	9 (17)	11	10	17 (24)	5	2	17 (24)	10	12	20 (26)	15	14
T_4	28 (22)	14	15	15 (23)	19	14	23 (28)	20	3	34 (35)	21	6	8 (17)	11	5	7 (16)	6	3	18 (25)	10	6	21 (27)	14	7
T_5	37 (36)	12	10	22 (28)	17	8	21 (27)	21	3	34 (38)	21	5	12 (20)	12	7	21 (27)	5	1	14 (22)	11	9	23 (29)	14	6
T_6	28 (23)	14	22	14 (22)	21	25	29 (33)	20	2	28 (34)	22	13	16 (24)	11	8	10 (18)	5	1	8 (16)	13	21	19 (26)	15	13
T_7	50 (59)	7	–	52 (46)	13	–	58 (49)	19	–	59 (51)	18	–	43 (41)	8	–	32 (34)	4	–	24 (29)	7	–	45 (42)	11	–
SE(m) ±	1	0	–	1	1	–	1	0	–	2	1	–	1	1	–	1	1	–	0	0	–	1	1	–
CD 5%	2	1	–	2	2	–	2	1	–	5	3	–	3	2	–	3	2	–	1	0	–	2	2	–
CV (%)	4	–	–	5	–	–	4	–	–	6	–	–	–	–	–	7	–	–	–	–	–	–	–	–

Footnote:

T_1: Azoxystrobin 23% EC @ 0.1% ; T_2: Tebuconazole 25.9% EC @ 0.1; T_3: Hexaconazole 5% SC @ 0.1% ; T_4: Propiconazole 25% EC @ 0.1% ; T_5: Myclobutanil 10% WP @ 0.05%;T_6: SAU practice; T_7: Untreated control (Water spray only). Two foliar sprays were given at 15-day intervals, commencing from the first appearance of the disease.

SAU packages: For T6: Coimbatore – Carbendazim 0.1%; Jabalpur – Wettable sulphur 0.2%; Jagudan – Wettable sulphur 0.25%; Jobner – Wettable sulphur 0.2%; Kota – Wettable sulphur 0.2%; Hisar – Wettable sulphur 0.2%; Raigarh – Carbendazim 0.1% + Wettable sulphur 0.2%.

Abbreviations:

PDI – Percent Disease Index; Y – Yield (q ha^{-1}); PCBR – Protection Cost–Benefit Ratio; SE(m) – Standard Error of Mean; CD ($P = 0.05$) – Critical Difference at 5% level of significance; CV (%) – Coefficient of Variation.

Table 54. Technology of Transfer recommendations approved during the 36th Annual Group Meeting (AGM) of ICAR-AICRP on Spices for the management of powdery mildew in fenugreek.

Crop	Recommendation	Recommended State(s)
Fenugreek	Apply two foliar sprays of Hexaconazole 5% SC @ 0.1% (1.0 ml L^{-1} water), commencing at the initial appearance of powdery mildew symptoms, followed by a second spray after 15 days for effective disease management and improved seed yield.	Gujarat
Fenugreek	Apply two foliar sprays of Hexaconazole 5% SC @ 0.1% or Tebuconazole 25.9% EC @ 0.1% (1.0 ml L^{-1} water) at the initial appearance of powdery mildew, followed by a second spray after 15 days for effective disease control and higher economic returns.	Rajasthan
Fenugreek	Apply two foliar sprays of Tebuconazole 25.9% EC @ 0.1% (1.0 ml L^{-1} water), beginning at the initial appearance of powdery mildew and repeating after 15 days for efficient disease suppression and enhanced seed yield.	Madhya Pradesh

11. Ajwain

Genetic Resources

Germplasm Collection, Characterization, Evaluation and Conservation

(Centre: Ajmer, Guntur, Hisar, Kumarganj, Jagudan, Jobner, Pantnagar, Raigarh)

The AICRPS centres are voluntarily conserving ajwain accessions as part of their university mandate. These centres play an important role in maintaining the genetic resources of the crop through systematic collection, maintenance, and preliminary evaluation activities. During the year 2024–25, an additional five new germplasm accessions were incorporated into the existing collections. At present, a total of 540 ajwain germplasm accessions are being conserved across different AICRPS centres (Table 55).

Table 55. Ajwain germplasm collections maintained at various AICRPS centres

Centre	Total germplasm collection maintained	New Collection (2024-25)	No. of accession evaluated (2024-25)	IC number obtained
Ajmer	150	-	150	50
Guntur	101	1	101	20
Hisar	59	1	48	-
Kumarganj	46	3	46	5
Jagudan	98	-	98	-
Jobner	44	-	44	-
Pantnagar	35	-	35	-
Raigarh	7	-	7	1
Total	540	5	529	26

Crop Improvement

AJN/CI/2.1:Coordinated varietal trial-2022 Series (Centre: Ajmer, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh)

Coordinated Varietal Trial (CVT) on Ajwain – 2022 Series was laid out at multiple AICRPS centres in randomized block design (RBD) involving nine test genotypes, namely MAS-19-1, LAS-19-2, HAJ-38, HAJ-7, JA-19-05, JA-19-01, AA-16, AA-45, and AA-24, along with one national check, Ajmer Ajwain-2. The trial was initiated in 2022-23 and concluded during *Rabi* 2023-24 with entries to evaluate the genotypes for yield performance and adaptability across diverse agro-climatic zones. Among the tested genotypes, HAJ 38 recorded the highest mean seed yield of 1225 kg ha^{-1} with a weighted IOC of 21.1%, emerging as the top performer across locations. It was followed by AA 24 (1215 kg ha^{-1}, IOC 19.7%), JA 19-05 (1184 kg ha^{-1}, IOC 17.7%), HAJ 7 (1193 kg ha^{-1}, IOC 17.1%), AA 45 (1153 kg ha^{-1}, IOC 13.2%), and AA 16 (1141 kg ha^{-1}, IOC 11.6%). All these six entries recorded more than 10% yield advantage over the national check AA 2 (1026 kg ha^{-1}), demonstrating their superior productivity and wider adaptability across test locations. Based on the consistent superior performance across locations over three years, three promising ajwain varieties were identified and recommended by the Varietal Identification Committee (VIC) for release in major ajwain-growing regions of India.

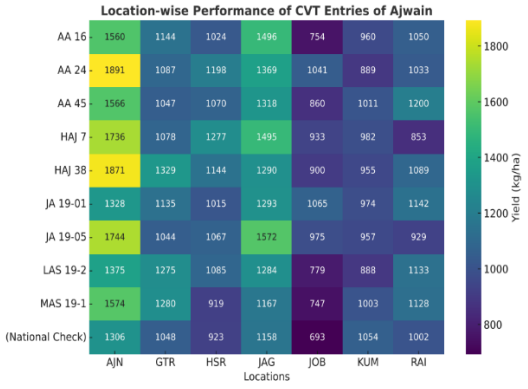


Figure 14. Summary of pooled analysis of seed yield (kg ha^{-1}) of coordinated varietal trials on ajwain-2022 series. Where, AJM: Ajmer; HSR: Hisar; KOT: Kota; KGJ: Kumarganj; PNR: Pantnagar; RAI: Raigarh

Gujarat Ajwain 4 (JA 2019-01): developed by the Seed Spices Research Station, SDAU, Jagudan, recorded an average seed yield of 1136 kg ha^{-1}, representing a 10.72% improvement over the national check AA-2. The variety is characterized by early flowering and early maturity (155–166 days), along with a higher number of seeds per umbel and bold seed size with a test weight of 1.72 g.



It possesses high volatile oil content (4.18%) while maintaining good essential oil quality. Owing to the general consistent and superior performance, the variety was recommended by the VIC for identification in the ajwain-growing regions of Rajasthan, Gujarat, Andhra Pradesh, Uttar Pradesh and Chhattisgarh.

Hisar Ajwain 7 (HAJ-7): Developed by CCS Haryana Agricultural University, Hisar, recorded an average seed yield of 1193 kg ha^{-1}, which is 16.2% higher than the national check AA-2.



It is medium maturing (175–190 days) and is distinguished by good plant architecture with profuse branching, a higher number of umbels and more seeds per umbel. It also recorded a relatively high essential oil content of 4.96%, which is 2.88% higher to AA-2, along with a desirable thymol profile. In addition, the variety showed tolerance to root rot (9.99%) and relatively low incidence of aphids. It performs well under irrigated Rabi conditions on loamy to sandy-loam soils. This variety is identified for the ajwain-growing regions of Rajasthan, Gujarat and Haryana.

Ajmer Ajwain 24 (AA-24): developed by ICAR–National Research Centre on Seed Spices, Ajmer, recorded an average seed yield of 1216 kg ha^{-1}, representing a 19.7% increase over the national check AA-2. The variety is medium maturing (171–176 days) and exhibits improved plant architecture with enhanced branching.



It is characterized by superior yield components, including a higher number of umbels per plant (323) and seeds per umbel (380) on an average. The variety also possesses bold seeds with a test weight of 1.03 g and excellent quality attributes with 49.47 per cent thymol content and 4.96% essential oil, both of which are higher than the national check. It also demonstrated high tolerance to root rot (8.86%) under field conditions and is well adapted to irrigated *rabi* cultivation in major ajwain-growing belts. Based on its consistent performance, the VIC recommended this variety for identification in ajwain growing regions of Rajasthan.

12. Nigella

Genetic Resources

Germplasm collection, characterization, evaluation, and conservation of Nigella (Centre: Ajmer, Hisar, Kumarganj, Pantnagar, Raigarh)

Various AICRPS centre voluntary conserve nigella accessions based on their SAU mandate. A total of 129 accessions of nigella is being maintained by various AICRPS centres (Table 56).

Table 56. Germplasm collection of nigella maintained in various AICRPS centres

Centre	No. of accessions	Unique collections registered	IC numbered
Ajmer	55	25	25
Hisar	11	1	Nil
Kumarganj	37	Nil	5
Raigarh	7	1	1
Pantnagar	19	Nil	Nil
Total	129	27	31

Crop Improvement

NGL/CI/2.1: Coordinated varietal trial on Nigella – Series II 2024 (Centre: Ajmer, Hisar, Kumarganj, Pantnagar, Raigarh, Kota)

The CVT of nigella was started during the *rabi* season of 2024-25 for evaluating promising nigella accessions across the coordinating centres in the country for yield and its components. The experiment was laid out in RBD design with a total of nine genotypes including two checks, with three replications. During its first year of evaluation, NGL-11 was found to be the best-performing genotype in terms of seed yield, yielding an average of 9.83 q ha^{-1}, across test locations, followed by NGL-13 (9.41 q ha^{-1}) and NGL-14 (9.35 q ha^{-1}), The mean performance of the genotypes at various locations during 2024-25 is given in Table 57. The mean location yield ranged from 5.94 (Kota) to 11.76 q ha^{-1} (Pantnagar).

Table 57. Yield performance (q ha^{-1}) of nigella entries in CVT across locations

Entries	AJM	HSR	KOT	KGJ	PNR	RAI	Mean	Rank
NGL-10	9.87	8.12	5.55	7.22	7.96	14.11	8.81	5
NGL-11	12.31	13.05	6.2	8.19	7.66	11.55	9.83	1
NGL-12	9.68	10.3	5.64	6.32	7.38	12.92	8.71	6
NGL-13	10.79	11.64	6.38	7.85	8.53	11.26	9.41	2
NGL-14	11.1	11.15	6.4	7.57	7.07	12.78	9.35	3
NGL-15	NG	NG	NG	NG	NG	8.46	8.46	7
NGL-16	7.93	9.7	5.72	7.08	7.59	10.22	8.04	8
NGL-17	12.7	9.31	5.81	8.68	6.55	12.5	9.26	4
NGL-18	7.44	9.83	5.83	6.74	7.48	10.67	8.00	9
Mean	10.23	10.39	5.94	7.46	7.53	11.76	8.89	
SE	1.5	0.36	0.25	0.29	0.45	0.58	0.57	
CD (5%)	1.09	0.93	0.74	1.06	0.77	1.73	1.05	
CV (%)	6.01	5.1	7.45	8.028	6.05	8.52	6.86	

Where, AJM: Ajmer; HSR: Hisar; KOT: Kota; KGJ: Kumarganj; PNR: Pantnagar; RAI: Raigarh.

Crop Protection and food safety

NGL/CP/7.1: Management of root rot of nigella (Centres: Dholi, Kumarganj, Raigrah)

The experimental trial initiated to study the effect of different soil treatment methods and chemicals on root rot disease incidence (%) and yield (q ha^{-1}) of nigella across three locations. The trial is designed in RBD with three replication and seven treatments *viz.,* T_1: Soil application with Talc-based *Trichoderma viride* @2.5kg multiplied in minimum 250kg FYM per ha; T_2: Soil application with Mustard oil cake @1 ton per ha; T_3: Soil application with Neem cake @1 ton per ha; T_4: Soil application with Castor oil cake @1 ton per ha; T_5: Soil drenching with Boscalid (25.2%) + Pyraclostrobin (12.8%) WG

@0.2%; T_6: Soil drenching with Azoxystrobin (20%) + Difenoconazole (12.5%) SC @ 0.2%; T_7: Control.

Table 58. Summary of crop protection trial on root rot management in nigella conducted at different loction during 2024-25

Treatment	Disease Incidence (PDI)				Yield (q ha^{-1})			
	DHL	KUM	RAI	Mean	DHL	KUM	RAI	Mean
T_1	20.8	8.7	11.8	13.8	7.8	7.9	7.4	7.7
T_2	22.5	11.7	17.4	17.2	7.5	7.6	6.4	7.2
T_3	18.3	10.0	16.1	14.8	8.1	7.7	6.1	7.3
T_4	25.0	12.3	19.4	18.9	7.2	7.2	5.3	6.6
T_5	13.3	9.0	10.4	10.9	8.9	8.2	7.4	8.2
T_6	15.8	7.3	7.4	10.2	8.7	8.7	8.0	8.5
T_7	29.2	14.7	26.4	23.4	6.7	6.3	4.4	5.8
S.Em (±)	2.2	1.0	0.7	1.3	0.4	0.4	0.1	0.3
CD (5%)	6.9	3.0	2.1	4.0	1.1	1.1	0.5	0.9
CV(%)	18.6	8.8	6.6		7.8	7.9	5.9	

Across three AICRPS locations during 2024–25, disease incidence varied significantly among treatments. The lowest mean disease incidence (10.2%) was recorded with T_6: soil drenching with Azoxystrobin (20%) + Difenoconazole (12.5%) SC @ 0.2%, followed closely by T_5: soil drenching with Boscalid (25.2%) + Pyraclostrobin (12.8%) WG @ 0.2% (10.9%). Biological treatment T_1 (*Trichoderma viride* @2.5 kg mixed with FYM) also reduced disease incidence with a mean value of 13.8%, compared to the control (T_7) which recorded the highest disease incidence of 23.4%. The effect of treatments was also reflected in seed yield. The highest mean seed yield (8.5 q ha^{-1}) was obtained with T_6 (Azoxystrobin + Difenoconazole), followed by T_5 (Boscalid + Pyraclostrobin) with 8.2 q ha^{-1}. Among the organic amendments, T_3 (Neem cake @1 t ha^{-1}) recorded a moderate yield of 7.3 q ha^{-1}, while T_4 (Castor oil cake) resulted in comparatively lower yield (6.6 q ha^{-1}). The control treatment (T_7) produced the lowest mean yield (5.8 q ha^{-1}) across locations.

13. Saffron

Genetic Resources

Conservation, evaluation and utilization of exotic and indigenous saffron germplasm accessions
(Centre: Pampore)

The project mode centre at Pampore maintained a total of 211 germplasm lines, comprising 198 indigenous accessions and 13 exotic collections, as part of its ongoing efforts toward the conservation and maintenance of genetic resources. During the cropping season 2025–26, a total of 208 saffron germplasm lines were systematically evaluated at Pampore centre to assess the extent of genetic variability and identify promising genotypes suitable for yield enhancement, quality improvement and stress tolerance in saffron. The evaluated germplasm exhibited highly significant variation for growth, morpho-floral and quality traits, indicating the presence of substantial genetic diversity within the available germplasm (Table 59).

Table 59. Evaluation of saffron germplasm for morpho-floral traits

Trait	Trait expression range
Corm length (mm)	14 – 36
Corm width (mm)	13 – 43
Plant height (cm)	12.5 – 31.5
Days to 50% flowering (days)	108 – 114
Number of flowers per corm	1 – 3
Number of leaves in main sprout	6 – 12
Outer tepals length (cm)	3.0 – 4.5
Outer tepals width (cm)	1.5 – 2.4
Style length (cm)	0.87 – 4.2
Pistil length (cm)	3.19 – 6.96
Fresh weight of pistil (mg)	21.67 – 43.52
Dry weight of pistil (mg)	3.66 – 9.41
Stigma length (cm)	2.33 – 5.69

Among the evaluated accessions, SRS-Saf-156 emerged as a distinct and superior genotype exhibiting excellent corm development and enhanced saffron yield. This accession also recorded higher apocarotenoid



content, a key determinant of saffron quality. Additionally, SRS-Saf-156 showed moderate resistance to corm rot, making it a promising candidate for corm nursery development and large-scale multiplication programmes.

Figure 15. Field view of unique germplasm, SRS Saf 156 saffron accession at Pampore



Figure 16. Field view of germplasm block of saffron at Pampore

Crop Improvement

Advanced Varietal Trial – II
(Centres: Pampore)

Under Advanced Varietal Trial–II, 11 elite saffron accessions including the check variety

Shalimar Saffron-1 were evaluated to assess their yield potential and floral trait performance. Significant variation was observed among the genotypes for floral morphology and yield attributes. The fresh and dry weights of pistil ranged from 26.96 to 34.74 mg and 5.37 to 6.92 mg, respectively. Stigma length varied from 2.98 to 4.76 cm, with the maximum stigma length recorded in accession SRS-Saf-199, indicating its superior floral characteristics. Flower density ranged from 69 to 86 flowers m^{-2}, with SRS-Saf-178 recording the highest floral intensity and the maximum saffron yield of 590.82 mg m^{-2}, thereby establishing its yield superiority under the trial conditions. Table 60. Yield and yield attributes of Saffron accession under AVT-II. Cluster analysis of the elite genotypes further confirmed the superiority of SRS-Saf-178 and SRS-Saf-199, which formed the top performing cluster for yield-related traits. In contrast, SRS-Saf-128 and SRS-Saf-251 showed comparatively lower performance. The strong clustering of fresh pistil weight, dry pistil weight, saffron yield and flower density indicated their close inter-relationship and importance as key selection criteria in saffron improvement programmes.



Figure 17. Field view of AVT entries

14. Kalazeera

Genetic Resources

Exploration, collection and conservation of Kalazeera from high altitudes of northern Himalayas
(Centre: Pampore)

Project mode centre at Pampore continued efforts on conservation and evaluation of kalazeera germplasm and a total of 98 germplasm lines are currently maintained at the centre. During 2025–26, a total of 25 germplasm lines comprising 17 seed-based and eight tuber-based accessions were collected from the high-altitude regions of Himachal Pradesh. With these additions, the total germplasm repository at Pampore increased to 123 accessions. The collected germplasm lines were evaluated for morphological, yield and yield-attributing traits, revealing substantial variability among the accessions (Table 61) that can be effectively utilized in selection and breeding programmes for developing improved Kalazeera cultivars.

Table 60. Evaluation of Kalazeera germplasm for morphological and yield traits.

Traits	Trait expression range
Plant height (cm)	25.28 – 104.11
Primary branches plant^{-1}	1 – 6
Umbel diameter (c)	1.4 – 12.6
Number of umbels plant^{-1}	2 – 45
Number of seeds umbel^{-1}	4.0 – 33.0
Days to maturity (days)	164 – 177
1000-seed weight (g)	0.94 – 2.94
Biological yield (g m^{-2})	31.19 – 248.52
Seed yield (g plant^{-1})	0.46 – 16.14
Tuber length (cm)	1.2 – 2.7 (3rd year)
Tuber width (cm)	1.2 – 2.9 (3rd year)
Weight of tubers (g)	2.19 – 4.59 (3rd year)

Evaluation of these germplasm lines also enabled the identification of the promising accession SRS-KZ-120 exhibited a higher number of primary branches and umbels per plant, enhanced seed yield potential and elevated essential oil content. It also showed moderate resistance to tuber rot along with tolerance to heat stress, indicating its suitability for cultivation under changing climatic conditions.



Figure 18. Glimpse of kalazerra accessions maintained at pampore centre.

The accession SRS-KZ-108 is a dwarf, high-yielding genotype characterized by extended tuber longevity and strong tolerance to heat stress. Its favourable plant architecture and stress resilience make it a promising candidate for inclusion in breeding programmes aimed at developing climate-resilient varieties.



Figure 19. Unique and elite accessions of kalazerra (a) SRS-KZ-120 (b) SRS-KZ-108 (c) SRS-KZ-131

Another unique accession, SRS-KZ-131, displayed distinct morphological traits including long pedicel, higher number of umbellets per umbel and increased number of seeds per umbellet. Notably, this accession produced 6–10 mature seeds in tertiary umbels and exhibited extended seed viability under ambient storage conditions, highlighting its potential utility for genetic improvement.

Crop Improvement

Multilocational testing of promising entries (Centres: Pampore)

A multilocational evaluation of genotype SRS-KZ-177 was conducted across three agro-ecological locations namely Ladhoo (Pulwama), Chotipora (Shopian) and Khansahib (Budgam) to assess its yield performance, stability and adaptability under diverse environmental conditions.

The results demonstrated the consistent superiority of SRS-KZ-177 over the natural population across all locations. The genotype recorded a mean seed yield of 366.67 kg ha^{-1}, compared with 305.67 kg ha^{-1} in the natural population, representing an average yield advantage of about 20% across test locations.

Further evaluation under field conditions revealed that SRS-KZ-177 exhibited moderate resistance (PDI=11.9%) to tuber rot caused by *Fusarium* sp., whereas the natural population (PDI=30.5%) showed a susceptible reaction. This improved disease tolerance, combined with superior yield potential and adaptability, highlights the promising potential of SRS-KZ-177 for varietal release and commercial cultivation in the Northern Himalayan region.

Table 61. Performance of SRS-KZ-177 and natural population for seed yield (kg ha^{-1}) in multilocational trials.

Location	Seed yield (kg ha^{-1})		% increase
	SRS-KZ-177	Natural population	
Ladhoo, Pulwama	360	295	22.03
Chotipora, Shopian	368	344	6.98
Khansahib, Budgam	372	278	33.81
Average	366.67	305.67	19.96



Figure 20. Multi-location testing of SRS-KZ-177

MONITORING

The progress of research trials under the AICRPS was systematically monitored by the Project Coordinator and scientists of the PC Unit through a combination of field visits, virtual interactions, and regular reporting mechanisms. Visits to AICRPS centres provided opportunities for on-site assessment of experimental trials and enabled constructive discussions with the scientists involved. These interactions facilitated timely identification of centre-specific constraints and helped in providing appropriate technical guidance to ensure the effective conduct of research activities across centres.

During January 2025, Dr. D. Prasath, Project Coordinator (AICRPS) visited the centres at Navsari, Sanand, and Jagudan to review the progress of ongoing trials. Subsequently, monitoring visits were undertaken at HC&RI, TNAU, Coimbatore during February 2025. During February–March 2025, Mr. Nafid C., Young Professional-I, visited the NEH centre at Department of Horticulture, SASRD, Nagaland University, Medziphema, to assess AICRPS activities including CVT plot evaluation, frontline demonstrations, and training programmes.

Further monitoring visits were carried out by Dr. D. Prasath to the centres at Rajamundhry, Chintapalli, and Pottangi during June 2025 to review experimental trials and research activities.

In July 2025, Dr. D. Prasath and Dr. Mukesh Sankar visited the centres at Myladumpara and Pampadumpara for monitoring ongoing experiments and providing technical guidance. Online review meetings were also held during the year to review trial plans and financial progress. Additionally, the XXXVI Annual Group Meeting of ICAR-AICRP on Spices was organized during 29–31 October 2025 at ICAR Research Complex for NEH Region, Barapani, Meghalaya, which served as an important platform to review scientific progress and discuss future research strategies among participating centres.

These monitoring activities and review mechanisms ensured effective implementation of technical programmes, improved coordination among centres, and timely resolution of operational issues, thereby strengthening the overall performance and impact of the AICRPS research programme.



Annual Group Meeting 2025

The **XXXVI Annual Group Meeting (AGM)** of ICAR–All India Coordinated Research Project on Spices (AICRPS) was held during **29–31 October 2025** at ICAR–Research Complex for North Eastern Hill (NEH) Region, Umiam, Meghalaya. The meeting brought together researchers and experts from across the country to review the progress of multi-location trials conducted at various AICRPS centres during 2024–25.

Welcoming the delegates, Dr. Samarendra Hazarika, Director, ICAR–RC for NEH Region, highlighted the rich spice biodiversity of the NEH region and emphasized the need for targeted, climate-resilient research. Dr. G. Kadirvel, Director, ICAR–ATARI Zone VI, underscored the importance of leveraging the region's strengths in spice cultivation, addressing disease and supply chain challenges, and promoting high-value, organic spice production. Dr. R. Dinesh, Director, ICAR–Indian Institute of Spices Research (IISR), Kozhikode, emphasized climate resilience, emerging disease management, food safety, and industry linkages, while Dr. Vinay Bharadwaj, Director, ICAR–National Research Centre on Seed Spices (NRCSS), Ajmer, highlighted the need for value chain strengthening, predictive research approaches, and integration of modern digital technologies within the AICRPS network.

Dr. D. Prasath, Project Coordinator, ICAR–AICRP on Spices, presented a comprehensive overview of the project's achievements during the previous year along with key initiatives undertaken.

The meeting was inaugurated by Dr. B.C. Deka, Hon'ble Vice-Chancellor, Assam Agricultural University, Jorhat, while Dr. Sudhakar Pandey, Assistant Director General (FVS & MP), ICAR, presided over the inaugural session. In his presidential address, Dr. Pandey emphasized aligning spice research with national priorities through the development of climate-resilient, high-quality varieties, fast-track breeding programmes, and robust digital data systems, while addressing global competition and food safety concerns. In his keynote address, Dr. Deka highlighted the importance of genotype × environment interactions, efficient resource utilization, and the promotion of entrepreneurship and institutional support to enhance farmer income through high-value spice cultivation.

The meeting witnessed active participation from leading scientists, directors, and heads of participating centres, fostering meaningful deliberations on emerging challenges and future strategies in spice research.

During the meeting, outstanding contributions to the spice sector were recognized. Padma Shri awardee Mrs. Trinity Saioo was honoured for her pioneering efforts in popularizing Lakadong turmeric, underscoring the vital role of progressive farmers in strengthening the spice economy. The **"Best AICRPS Centre Award"** for the year was conferred on Agricultural Research Station, Mandore, Agricultural University, Jodhpur, in recognition of its exemplary contributions to spice research and development.

A total of **24 new publications** were released, significantly enriching the knowledge base for researchers and stakeholders. The launch of a **new online data management pipeline**

for recording, storage, and analysis of multi-location research data under the AICRPS network marked a major step towards digitalization and efficient data handling.

The workshop was organized into six Technical Sessions, viz., Genetic Resources and Crop Improvement, Crop Management, Crop Protection, Variety Release, Technology Transfer, and Plenary Session, facilitating in-depth scientific discussions and decision-making.



Significant progress was made in varietal development, with several new spice varieties identified. These included **Karan Saunf-1 (RF 234/UF-231),** a high-yielding fennel variety (1742 kg ha^{-1}) with high volatile oil content (3.32%); **Gujarat Ajwain-4 (JA 2019-01),** an early maturing variety (1136 kg ha^{-1}) with high oil content (4.18%); **Hisar Ajwain-7 (HAJ-7),** a high-yielding variety (1193 kg ha^{-1}) with higher umbels, high essential oil content (4.96%), and tolerance to root rot; **Ajmer Ajwain-24 (AA-24),** a medium-duration variety (1216 kg ha^{-1}) with high thymol content (49.47%); **IISR Navya (HP 0.5/2),** a ginger variety with an average yield of 15.3 t ha^{-1} (with potential up to 36 t ha^{-1}), tolerant to rhizome rot and rich in essential oil and oleoresin; and **OUAT Kalinga Ginger-4 (Koraput Ada/V1E4-5),** a high-yielding ginger variety (15.9 t ha^{-1}) with bold rhizomes, low fibre content, and tolerance to major pests and diseases.

In addition to varietal advancements, several technologies were recommended for adoption, including management of pollu beetle in black pepper using chlorantraniliprole or flubendiamide; application of brassinosteroid (1.0 ppm) or benzyl adenine (20 ppm) in fenugreek for achieving 25–30% higher yields; effective management of powdery mildew in fenugreek using hexaconazole or tebuconazole; eco-friendly control of cumin blight using Bacillus subtilis and Pseudomonas fluorescens; development of region-specific intercropping systems in ginger; use of Bacillus safensis for improved nutrient utilization; and foliar application of salicylic acid (50 ppm) in coriander to enhance productivity and profitability.

Overall, the XXXVI AGM of AICRPS served as a vital platform for reviewing research progress, releasing improved varieties and technologies, promoting digital innovations, and charting future strategies aimed at enhancing the productivity, resilience, and sustainability of spice crops in India.

NEH, SCSP, and TSP Activities

PROMOTION OF SPICES CULTIVATION IN NER

During 2025-26, various AICRP on Spices centres under the NEH programme actively promoted spice-based development in the North Eastern and Himalayan regions through targeted training, demonstrations, input supply, quality planting material distribution and value addition programmes.

Barapani

At ICAR Research Complex for NEH Region, Umiam (Barapani), a frontline demonstration on turmeric was conducted at five locations in Laskein Block, Meghalaya, in collaboration with the Meghalaya Basin Development Agency, where Megha Turmeric-1 exhibited superior growth, disease resistance and an expected 25–30% higher yield over the local Lakadong variety.

The centre also organized training programmes on organic production and post-harvest management of ginger and turmeric, along with skill development and input distribution programmes, benefiting farmers, functionaries and master trainers.



Mizoram

In Kolasib, training and demonstration programmes on PGPR application for rhizome development and quality improvement in ginger and turmeric, scientific cultivation practices and entrepreneurship development were conducted at Thingdawl and Meidum villages and at the ICAR Research Complex for NEH Region Mizoram Centre, enhancing farmers' skills and livelihood opportunities.



Kahikuchi

Under NEH activities in aspirational districts, 1400 black pepper cuttings were distributed at Kahikuchi through the Diya Foundation and AGAG programme to strengthen spice-based farming systems.



Nagaland

Training programmes on ginger and turmeric production and processing were conducted at



Bade (Dimapur) and Punglwa (Peren) villages, supported by demonstrations on seed rhizome priming, storage and pro-tray technology for seedling production, improving farmers' knowledge on scientific cultivation practices, plant protection and market linkages.

Pasighat

Training on improved spice production technologies along with input distribution was conducted at Kiyit, Boying and Ayeng/Ngopok villages in East Siang District by the College of Horticulture and Forestry Pasighat.



ICAR Gangtok

ICAR Research Complex for NEH Region, Sikkim Centre conducted training programmes, frontline demonstrations, and input distribution to promote scientific cultivation of ginger, turmeric, and large cardamom across North, South, East, West, Soreng, and Pakyong districts of Sikkim.



Three training programmes benefited 255 farmers, while demonstrations of improved production technologies recorded up to 36% higher ginger yield and 41.1% higher turmeric yield over local cultivars. Farmers were also supplied with agricultural implements, seed tubers, fertilizers, micronutrients, and plant protection inputs to support improved spice production.

ICRI Gangtok

The Indian Cardamom Research Institute Regional Station Gangtok, Sikkim conducted four training-cum-input distribution programmes with demonstrations on large cardamom nursery management, bio-pesticides, biological control and vermicomposting to promote improved spice cultivation practices.

DEVELOPMENTAL ACTIVITIES FOR SC COMMUNITIES

During 2025–26, AICRP on Spices centres empowered Scheduled Caste farmers under the SCSP programme through training, demonstrations, and distribution of quality inputs to promote scientific and sustainable spice cultivation.

Solan

Nine training programmes benefited 345 farmers, enhancing skills in scientific spice cultivation, pest management, nursery techniques, and post-harvest handling.



Exposure to value addition and market linkages encouraged adoption of better practices, improved productivity, and increased profitability, supporting sustainable spice cultivation and livelihoods.

Jobner

During 2024–25, Jobner Centre organized two training programmes for 135 Scheduled Caste farmers on scientific cultivation, seed production, post-harvest management and value addition in fenugreek and fennel across Chomu, Jobner, Renwal and Pachar (Sikar), Rajasthan. The centre also conducted 10 frontline demonstrations of improved production technologies and varieties, which enhanced farmers' knowledge and skills while recording about a 10% yield increase over local/check varieties.

Kammarpally

TRS, Kammarpally conducted SCSP activities to promote value addition in turmeric, enhance the income of SC farmers, and create awareness on the production of unadulterated turmeric powder. The programme was implemented through seven Farmers Producer Companies/Farmer Producer Organizations across Nizamabad, Nirmal and Jagityal districts, benefiting turmeric-growing farming communities.



Guntur

During 2025–26, six training programmes were organized for 100 Scheduled Caste (SC) farmers on improved spice production technologies. 1000 kg of rhizome seed material was distributed to 100 beneficiaries along with inputs such as Trichoderma viride (2 kg), neem cake (40 kg), Azospirillum (500 ml) and PSB (500 ml) per farmer to promote sustainable cultivation practices. In addition, 10 technology demonstrations were conducted, benefiting the same 100 SC farmers.



Yercaud

During 2025–26, three SCSP training programmes were organized for 280 Scheduled Caste (SC) farmers on organic farming, subtropical crops, and improved horticultural technologies aimed at entrepreneurship development and livelihood enhancement. The programmes were conducted at HRS Yercaud and in Salem district, including farmers from Vasantham and Jarugumalai FPOs. As part of input support, 20,000 black pepper rooted cuttings and 40 kg of seed spices were distributed to 150 beneficiaries, along with bio-inoculants and planting materials to promote sustainable cultivation practices.

Kumarganj

Three training programmes were conducted benefiting 150 Scheduled Caste (SC) farmers.



मसाले की खेती में ज्यादा मुनाफा

अयोध्या (एसएनबी)। अखिल भारतीय समन्वित मसाला अनुसंधान परियोजना अनुसूचित जाति उपयोजना अंतर्गत मसाला फसलों की उन्नतशील खेती पर सोमवार तहरीर के मांगलसी ग्राम के किसानों को प्रशिक्षित किया गया। कल्पपति डॉ. विजेंद्र सिंह के दिशा-निर्देशन में यह प्रशिक्षण कृषि वैज्ञानिकों ने आयोजित किया।

कृषि वैज्ञानिकों ने मसाला फसलों की उन्नतशील खेती पर किया प्रशिक्षित

कहा, स्वरोजगार से किसानों में आएगी समृद्धि

अखिल भारतीय मसाला अनुसंधान के परियोजना अधिकारी डॉ. प्रदीप कुमार ने मसाला फसलों हल्दी, धनिया, मेथी आदि के उत्पादन तकनीक की जानकारी दी। उन्होंने कहा कि मसाले की खेती करने में भारत विश्वभर में पहले स्थान पर है। मसाले की खेती के लिए सरकार कई योजनाएं चला रही है। इनका लाभ किसानों को उठाना चाहिए। उन्होंने कहा कि राष्ट्रीय बागवानी मिशन और राष्ट्रीय कृषि योजना के तहत किसान मसाले की खेती करें। इससे किसानों को अधिक मुनाफा होगा। एफपीओ एवं स्वयंसहायता समूह के माध्यम से अपने उत्पादों का विक्रय करने पर किसानों को अधिक से अधिक फायदा होगा।

इस अवसर पर किसानों को मसाला फसलों की खेती से संबंधित साहित्य, धनिया व सौफ का बीज, सब्जी किट का पैकेट तथा अदरक, आंवला, बेल आदि के पौधे निशुल्क वितरित किये गये। सब्जी वैज्ञानिक डॉ. धनंजय कुमार उपाध्याय ने सब्जी की विधि एवं सब्जियों की उन्नतशील बीज उत्पादन के बारे में जानकारी दी। उन्होंने बताया कि मसाला फसलों सब्जियों एवं फलों के मूल्य वर्धित उत्पाद, आचार मुरब्बा, आरहरी का प्रयोग कर किसान स्वरोजगार स्थापित कर आर्थिक रूप से समृद्ध बन सकते हैं। इस मौके पर डॉ. विपिन कुमार, डॉ. मनोज कुमार आर्य, डॉ. प्रवीणकुमार व किसान शोभाराम, विजयप्रताप, जितेंद्रमाले, अमरफौल, रामविकास समेत ढाई दर्जन अनुसूचित जाति के किसान मौजूद रहे।

प्रशिक्षण कार्यक्रम में शामिल वैज्ञानिक व किसान। फोटो : एसएनबी

As part of input support, 144 Kitchen Beej packets, 50 kg fenugreek seed, and 50 kg fennel seed were distributed to 150 beneficiaries. Additionally, 50 kg turmeric rhizomes were provided to 50 farmers.

Agricultural inputs including fungicides (15 kg), insecticides (7.5 L), and micronutrients (75 kg) were also distributed to 150 beneficiaries to support improved crop production practices.

Raigarh

216 kg of seed (27 bags of 8 kg each) was distributed to 60 Scheduled Caste (SC) farmers under the SCSP programme. In addition, 122 units of plant protection chemicals were provided to the beneficiaries to support improved crop production and plant protection practices.



Pampadumpara

CRS, Pampadumpara conducted SCSP activities for 100 Scheduled Caste farmers engaged in spice cultivation in Idukki district through structured training, field demonstrations, and critical input support. The programme enhanced farmers' knowledge, skills, and adoption of scientific cultivation practices, resulting in a 25–35% increase in spice yields and an approximately 55% increase in annual farm income, demonstrating the effectiveness of integrated capacity-building and input support.

Pottangi

KVK, Sonepur conducted a farmers' training programme on organic spice cultivation for 100 Scheduled Caste farmers under SCSP. Beneficiaries received quality planting materials, including cinnamon, vanilla, black pepper, allspice, ginger, and turmeric, to promote diversified spice cultivation. In addition, black pepper rooted cutting nurseries were established through farmer groups in several villages of Lamtaput Block to ensure the sustainable production and availability of quality planting materials.

Pundibari

60 farmers from Topsikhata, Natunpara, and Telipara villages in Alipurduar District received 6,000 black pepper rooted cuttings and 900 kg of turmeric rhizomes, enabling adoption of improved cultivation and processing techniques and strengthening technical skills and crop quality.

Panniyur

PRS, Panniyur conducted SCSP activities in Cherupuzha Panchayath following a baseline survey to assess the livelihood and farming conditions of the target population. Thirty-six Scheduled Caste beneficiaries were supported through the distribution of 2,000 black pepper cuttings, 720 vegetable seedlings, bio-inputs (Trichoderma, Pseudomonas, PGPR II and VAM), and 36 mushroom beds. Technical training programmes were also organized to enhance farmers' skills, promote sustainable homestead farming, and improve livelihood opportunities.

DEVELOPMENTAL ACTIVITIES IN THE TRIBAL VILLAGES

During 2025–26, various centres under the AICRP on Spices promoted spice-based development in the North Eastern and Himalayan regions through training, demonstrations, input support, quality planting material distribution, and value-addition programmes. Under the TSP programme, tribal farmers were empowered to adopt scientific and sustainable cultivation practices, enhance productivity, and improve livelihoods.

Yercaud

Distribution of agricultural inputs such as pesticides, fungicides, fertilizers, micronutrients, traps and small farm implements was undertaken to support improved crop production and sustainable farming. A total of 1,000 small farm implements were distributed benefiting 300 farmers, while 5 kg/litre of pesticides were supplied to 100 farmers. Fertilizers (5 q) were distributed to 8 farmers and micronutrients (2 q) to 2 farmers.



In addition, biofertilizers and biocontrol agents such as *Azospirillum*, Phosphobacteria, VAM and *Trichoderma viride* (1,000 kg) were distributed benefiting 300 farmers. As part of input support, 20,000 black pepper rooted cuttings and 40 kg of seed spices were distributed to 150 beneficiaries, along with bio-inoculants and planting materials to promote sustainable cultivation practices.

Chintapalli

1,140 black pepper rooted cuttings, 2,000 cinnamon seedlings, and 1,000 kg of Suprabha ginger seed were supplied to farmers across Pinapadu, Kinnerla, Ramnagar Colony, Sudimetta, Burisingi, Kothapalem, Regallu, and Genjigedda villages. In addition, 50 kg of *Trichoderma viridi*, 24 battery-operated sprayers, and 19 tarpaulins supported 75 farmer groups, while two trainings on post-harvest management of black pepper and turmeric strengthened technical skills and crop quality.



Pottangi

Farmers were trained on organic spice cultivation at Konnagaon, Lamataput, Koraput, and received 700 cinnamon seedlings, 500 vanilla plants, 500 black pepper vines, 300 seedlings of other spices, and 4 q of ginger and 5 q of turmeric, facilitating adoption of sustainable practices and improved yields.

Raigarh

1,500 kg of quality seeds of improved turmeric varieties were distributed to farmers, accompanied by a training at Lailunga providing essential inputs and practical guidance for sustainable cultivation. These integrated TSP initiatives strengthened cultivation practices, enhanced productivity, promoted sustainable spice production, and contributed significantly to improving livelihoods among tribal communities across all programme locations. **Sirsi** HREC, Sirsi conducted a TSP programme on improved cultivation practices and disease management in black pepper at Mundaganamane village, Sirsi, in collaboration with Mundaganamane Group Gramagala Seva Sahakari Sangh Niyamita.

Farmers were trained on scientific black pepper cultivation, disease management, and Bordeaux mixture preparation through

technical sessions and demonstrations. Quality planting materials and agricultural inputs, including black pepper seedlings, vermicompost, Trichoderma, Pseudomonas, and Pepper Special, were distributed to promote improved productivity and sustainable cultivation practices.

Pampadumpara

CRS, Pampadumpara implemented TSP activities for 75 Scheduled Tribe farmers engaged in black pepper and turmeric cultivation in the tribal belt of Idukki district. The programme included technical training, on-farm demonstrations, and critical input support, leading to improved knowledge, skills, and adoption of scientific cultivation practices. The intervention resulted in an 18–25% increase in spice crop yields and a 29% increase in average annual farm income, demonstrating the effectiveness of integrated capacity-building and input support for tribal spice farmers.

Ambalavayal

RARS, Ambalavayal implemented TSP activities in Sugandhagiri, Pozhuthana Grama Panchayat, to promote spice cultivation among tribal farmers. Thirty beneficiaries were provided with quality planting materials of cardamom, clove, cinnamon, nutmeg, and black pepper. A training programme on scientific cultivation of spices was organized to enhance farmers' knowledge of improved production practices, followed by field visits to monitor crop establishment and provide technical guidance.

POPULARIZATION OF TECHNOLOGIES

Scientists from AICRP on Spices centres actively engaged in the popularization of improved technologies to create awareness among the farming community on scientific cultivation practices and sustainable spice production. Some of the major technologies demonstrated during the year are as follows:

High yielding varieties – boon to farmers

- Demonstration of fenugreek varieties HM-257 and HM-273 and kalonji variety HKL-12, recommended for national release in the recent AICRP on Spices group meetings, in farmers' fields (Hisar)
- Demonstration of high yielding fenugreek variety RMt-305 to promote improved productivity (SKNAU, Jobner).
- Demonstration of high yielding fennel variety RF-125 for enhancing production potential (SKNAU, Jobner).
- Adoption of five improved varieties of black pepper in farmers' fields viz., IISR-Shakti, IISR-Girimunda, Pournami, Panchami and Sreekara (Pottangi).
- Adoption of Appangala-1 and Appangala-2 black pepper varieties in the Lamataput region (Pottangi).
- Popularization of ginger variety Suravi in farmers' fields (Pottangi).
- Popularization of turmeric variety Roma among farmers (Pottangi).
- Quality (organic) seed production of coriander variety Chhattisgarh Shri Chandrahasini Dhaniya-2 for promoting availability of quality seed material among farmers (Raigarh).
- Demonstration on cultivation technology of turmeric variety IISR Pragati to
- oduce quality seed material in a cost-effective and efficient manner (Pottangi).
- Protection technologies – for plant health promote improved production practices (Solan).
- Demonstration on cultivation technology of turmeric variety Solan Giriganga for enhancing productivity (Solan).

Improved production practices – for better yield and quality

- Demonstration on turmeric cultivation and post-harvest management practices (Guntur)
- Demonstration on improved cultivation practices in turmeric and other horticultural crops (Guntur)
- Demonstration on improved harvesting techniques in cinnamon for better bark quality and yield (Dapoli)
- Demonstration of intercropping of coriander and fenugreek for leaf purpose with baby corn/sweet corn (Hisar)
- Demonstration on good agronomic management practices for organic cultivation of ginger, turmeric and large cardamom (ICAR-Sikkim)

Rapid multiplication of planting materials – for minimal expenditure

- Demonstration of pro-tray seedling method for quality planting material production in turmeric and ginger (Dapoli)
- Demonstration of air layering technique in cinnamon for rapid multiplication of planting material (Dapoli)
- Demonstration of single bud technique in ginger for rapid multiplication of planting material (Pottangi).

- Demonstration on application of Trichoderma for effective management of

Phytophthora foot rot in black pepper (Dapoli)

- Demonstration on installation of fish meal traps for effective management of shoot fly in cardamom (ICRI-Sakleshpur)
- Demonstration on management of rhizome rot of ginger and turmeric using talc-based formulation of *Trichoderma* (Solan).
- Demonstration on management of stem gall disease of coriander using foliar spray of Azoxystrobin (11% SC) + Tebuconazole (18.3% SC) @ 0.1% at 45, 60 & 75 DAS (Dholi).



In addition to the field-level demonstrations, scientists actively promoted these technologies through various extension and outreach activities. The technologies were disseminated by organizing virtual training programmes, participating as resource persons in trainings and seminars, and by reaching a wider farming community through different mass media platforms such as newspapers, radio talks and television programmes.





एससीएसपी योजना के तहत किसानों को दिया गया एकदिवसीय प्रशिक्षण

मसाला फसलों में हल्दी लगाने की उत्तम तकनीक की दी गई जानकारी







SUCCESS STORIES

Strengthening Tribal Livelihoods through Improved Spice Cultivation: An Initiative by HRS Chintapalli

Since 2022, the Dr. YSR Horticultural University – Horticultural Research Station (HRS), Chintapalli, under the AICRP on Spices, has been collaborating with the Vijayavahini Charitable Foundation (VCF), supported by Tata Trusts, to implement a Tribal Livelihood Programme in the Chintapalli and Rajavommangi mandals. The programme covers nearly 10,000 tribal households, aiming to improve their livelihoods through sustainable and scientific agricultural practices.

As a technical partner, HRS Chintapalli has been providing guidance on the package of practices for horticultural crops, particularly black pepper and turmeric, and conducting field demonstrations to promote improved cultivation methods. In addition, efforts were made to introduce appropriate technological solutions to reduce drudgery, enhance operational efficiency, and improve post-harvest handling practices among tribal farmers.

With financial support from ICAR–Indian Institute of Spices Research (IISR) and ICAR–AICRP on Spices, Kozhikode, under the Tribal Sub Plan, farmers were supplied with quality planting materials of black pepper and cinnamon, along with battery-operated sprayers and tarpaulin sheets to support crop protection and proper post-harvest drying. Nearly 3,000 tribal farmers were trained through capacity-building programmes, and turmeric demonstrations were conducted following ICAR–IISR recommended practices. These interventions helped farmers adopt scientific farming methods, reduce labor-intensive operations, improve the quality and productivity of spice crops, and strengthen their livelihoods. The initiative highlights the important role of technical support, quality inputs, technological interventions, and farmer training in promoting sustainable spice cultivation and improving tribal livelihoods in the region.

Successful Management of Quick Wilt in Black Pepper: The Experience of Shri Vinayak Bhat

Shri Vinayak Bhat of Tharehalli village, Yellapura taluk, Uttara Kannada district, is a progressive farmer known for adopting improved and innovative agricultural practices on his farm. In the region, black pepper is an important commercial crop, but farmers frequently face serious yield losses due to Quick Wilt disease. To overcome this challenge, Shri Vinayak Bhat conducted a farm trial on Integrated Disease Management (IDM) for Quick Wilt in black pepper on an area of 0.5 hectare.

The IDM approach included timely cultural operations, improved drainage management, application of recommended bio-control agents, and need-based plant protection measures. The adoption of these scientific practices significantly reduced the incidence of Quick Wilt disease in his plantation. The pepper vines exhibited better growth, improved vigor, and enhanced spike formation compared to previous seasons. As a result, the trial recorded a production of 8 quintals of dry black pepper from the trial area, which was considerably higher than the yield obtained earlier under conventional practices.

The success of this trial clearly demonstrated that Integrated Disease Management is an effective and economical strategy for managing Quick Wilt disease in black pepper. Shri Vinayak Bhat's experience has inspired neighboring farmers to adopt IDM practices in their own plantations, promoting healthier crops and sustainable pepper cultivation in the region. His achievement highlights the importance of scientific disease management practices in improving crop productivity and farm income, making his farm a model for other farmers in Uttara Kannada district.

Improving Farm Income through Scientific Pepper Cultivation: The Experience of C. Suriyan Kani

C. Suriyan Kani, a spice farmer, traditionally cultivated black pepper and clove, earning an annual income of about ₹1,20,000. However, his crops often suffered from pest and disease problems and nutrient deficiencies, which affected productivity. With the support of HRS, Pechiparai, he participated in training programmes on Integrated Nutrient Management (INM) and Integrated Pest and Disease Management (IPDM), which improved his knowledge and skills in scientific crop cultivation. Demonstrations on black pepper (Panniyur-1) propagation techniques and other spice crops such as cinnamon and nutmeg were also conducted, encouraging farmers to develop nursery skills. Under the Tribal Sub Plan (TSP) programme, he was provided with a portable hand-operated knapsack sprayer. Using his own sprayer enabled timely plant protection measures, improving the effectiveness of spraying while reducing labour costs. By adopting these improved practices, production costs decreased and the quality and yield of produce improved. As a result, his annual income increased to ₹1,56,000, representing about a 30% rise compared to the base year. Awareness was also created on mixed farming systems for sustainable livelihood improvement. In the future, integrating crops such as banana, pineapple, and cinnamon with existing spice crops is expected to provide additional income opportunities for the farmer.

Scientific Storage Method Revives Ginger Cultivation in Himachal Pradesh

Ginger is an important cash crop in Himachal Pradesh, particularly in the districts of Sirmaur and Solan, where it serves as a major source of livelihood for farmers. However, ginger cultivation in the state was gradually declining due to the lack of proper storage methods for seed rhizomes. Farmers traditionally stored ginger in soil pits or in corners of rooms, which often led to severe rotting caused by fungal infections. In some cases, up to 87% seed loss was reported, forcing many farmers to shift to other short-duration crops.To address this challenge, a scientific storage method for ginger seed rhizomes was developed and demonstrated. The method involves treating healthy rhizomes with fungicide solution, shade drying, and storing them in stone-lined pits with sand layers under controlled temperature and humidity conditions. This technique helps maintain seed health and reduces storage losses significantly. Field demonstrations showed more than 90% recovery of seed rhizomes, ensuring the availability of healthy planting material for the next cropping season. The technology was later included in the Package of Practices for Vegetable Crops of Himachal Pradesh and widely promoted through farmer trainings, demonstrations, and extension programmes. The adoption of this scientific storage method has revived farmers' confidence in ginger cultivation and contributed to a significant increase in area and production, even in non-traditional

ginger-growing districts such as Kangra, Mandi, Hamirpur, Una, Chamba, and Bilaspur. This success story highlights how a simple scientific intervention can reduce crop losses, improve productivity, and strengthen farmers' livelihoods.

Adoption of Dual-Purpose Turmeric Variety GNT-3: A Success Story from Navsari

Rashmikaben Patel, a 48-year-old farmer from Manekpur village, Gandevi taluka, Navsari district (Gujarat), has been engaged in farming for the past 20 years on her 0.3 ha landholding, cultivating turmeric and vegetables. Earlier, she was not aware of the newly released turmeric variety GNT-3 developed by Navsari Agricultural University (NAU) and followed traditional cultivation methods without raised beds. With the guidance of KVK Navsari, she adopted the dual-purpose turmeric variety GNT-3 on an area of 4 guntha (about 0.10 acre) using improved practices such as raised bed planting, recommended spacing (45 × 30 cm), seed rate (3 t ha^{-1}), and integrated nutrient management with 10 t FYM ha^{-1} and 60:60:60 kg NPK ha^{-1}. Regular training, field visits, and technical guidance from KVK helped her successfully implement these practices. As a result, the crop showed better growth, higher yield, and lower disease incidence compared to the local varieties previously grown. Encouraged by the performance of the variety, the farmer expressed satisfaction with GNT-3 for its good yield and healthier crop stand. This success highlights the role of KVK Navsari in promoting improved turmeric varieties and scientific cultivation practices, leading to enhanced productivity and farmer confidence in adopting new technologies.



Adoption of Mango Ginger Variety Amravanti: A Success Story from Navsari

Linaben Patel, a 50-year-old farmer from Manekpur village, Gandevi taluka, Navsari district (Gujarat), has been engaged in farming for the past 22 years on her 0.5 ha landholding, cultivating turmeric and vegetables. Earlier, she was not aware of the mango ginger variety Amravanti released by Navsari Agricultural University (NAU) and the recommended scientific cultivation practices. With the guidance of KVK Navsari, she adopted the high-yielding mango ginger variety Amravanti on an area of 4 guntha (about 0.10 acre). The improved practices included raised bed planting, recommended spacing (45 × 15 cm), seed rate of 1.5 t ha^{-1}, and integrated nutrient management with 10 t FYM ha^{-1} and 60:60:60 kg NPK ha^{-1}. Continuous training, field visits, and technical guidance from KVK helped her implement these practices successfully. The adoption of these scientific methods resulted in better crop growth, higher yield, and lower disease incidence compared to local varieties. The farmer expressed satisfaction with the Amravanti variety for its good yield and healthier crop stand. This success story highlights the role of KVK Navsari in promoting improved varieties and scientific cultivation practices, helping farmers enhance productivity and confidence in adopting new technologies.



Dr. YSRHU–LAM Varsha: A Climate-Resilient Ajwain Variety for Dryland Regions

The ajwain variety Dr. YSRHU–LAM Varsha, developed and released by the Regional Horticultural Research Station (RHRS), Lam, Andhra Pradesh, has emerged as a promising option for farmers in dry and semi-arid regions. The variety was specifically developed to perform well under moisture-stress and rainfed conditions, which are common in the Rayalaseema region. Dr. YSRHU–LAM Varsha is characterized by bold, uniform seeds with strong aroma and good market appeal, helping farmers secure better prices. One of its key advantages is its ability to maintain stable productivity under limited irrigation and drought conditions, where traditional varieties often show significant yield reduction. Farmers in Kurnool district of Andhra Pradesh have reported better crop establishment, uniform growth, and higher seed yield even during dry weather. Due to these advantages, the variety has quickly spread to around 100 acres in the district.

The consistent performance of Dr. YSRHU–LAM Varsha has strengthened farmer confidence and improved profitability. Its success highlights the impact of research and extension efforts of RHRS, Lam, and demonstrates the variety's potential for wider adoption in drought-prone areas, promoting sustainable spice cultivation and better farmer livelihoods.

Improving Farm Productivity through Bio-inputs and Scientific Crop Management: A Success Story from Yercaud

During 2025, HRS, Yercaud supported farmers by distributing important bio-inputs including *Azospirillum* (1556 kg), Phosphobacteria (2167 kg), VAM (4382 kg), Vermicompost (1588 kg), and *Trichoderma* viride (1085 kg). Continuous application of these biofertilizers, VAM, and biocontrol agents improved root growth and plant vigor, helping pepper vines perform better even during dry periods. One of the beneficiaries, Th. Dhasarathan (50 years) from Pelakadu village, Yercaud block, owns 3 acres of land and cultivates pepper and coffee. Earlier, he faced problems such as pests, diseases, and nutrient deficiencies, which limited productivity. In 2024, his total annual income from these crops was about ₹5,95,000. After participating in capacity-building programmes at HRS, Yercaud on Integrated Pest and Disease Management (IPDM) and Integrated Nutrient Management (INM), he adopted scientific crop management practices and timely plant protection measures using his own sprayer. As a result, in 2025, pepper production increased from 350 to 430 kg/acre (23% increase) with net income rising to ₹2,89,000 (56% increase). Similarly, coffee yield increased from 420 to 550 kg/acre (31% increase) with net income reaching ₹3,00,000 (43% increase). Overall, his total farm income increased to ₹11,09,000, showing significant improvement in productivity and profitability. The farmer has also been encouraged to adopt mixed farming with crops such as banana, fig, and cinnamon for sustainable livelihood enhancement. This success highlights the impact of bio-inputs, farmer training, and scientific crop management in improving farm income and resilience.

Shri Laikan Badanayak: Turning Black Pepper into "Black Gold" in Koraput

Koraput district in Odisha, with its hilly terrain, high rainfall, and rich forest cover, is home to predominantly tribal communities. Despite favourable agro-climatic conditions, farmers largely relied on low-return subsistence crops, facing limited income, poor market access, and minimal exposure to high-value farming. Among potential high-value crops, black pepper, often called "Black Gold," stood out for its market demand and suitability for shaded agroforestry systems. Shri Laikan Badanayak, a progressive tribal farmer from Banguripada village, Lamtaput block, traditionally cultivated low-value crops.

Motivated to improve his household income and ensure livelihood sustainability, he embraced innovative farming practices under the guidance of AICRP on Spices, Pottangi, and Asha Kiran Society in 2018. He received high-yielding, location-specific pepper planting material, hands-on training on vine management, planting techniques, and live standards, and guidance on organic nutrient management and integrated pest and disease management (IPDM), along with continuous technical support. Shri Badanayak successfully integrated black pepper into his existing coffee and silver oak-based agroforestry system, using mature trees as live standards. This minimized establishment costs while enhancing soil moisture retention, micro-climate, and farm biodiversity. Today, he manages 640 healthy pepper vines using scientific practices like pruning, mulching, and nutrient management. The vines are vigorous, produce high spike density, and fetch premium prices, providing an annual income of over ₹4 lakh.

This steady income has reduced reliance on low-value crops and allowed reinvestment into farm development. His success has gone beyond personal prosperity. The plantation serves as a live learning site, inspiring fellow farmers, creating employment at the household level, and strengthening farmer–scientist linkages. Shri Badanayak's journey illustrates how scientific guidance, motivation, and innovation can transform livelihoods in tribal regions. "With the continuous guidance and encouragement from AICRP scientists, I realized black pepper is not just a crop but a long-term asset.



Today, I am confident, economically secure, and proud to inspire other farmers in my village," shares Shri Laikan Badanayak. The success of this model demonstrates that black pepper-based agroforestry is highly suitable for the Eastern Ghat High Land Zone, with potential to double farmer incomes, promote sustainable land use, and enhance tribal livelihoods. It is highly replicable across Koraput, Rayagada, Malkangiri, and Kandhamal districts with coordinated research, extension, and development efforts, reinforcing the role of science-led agriculture in driving inclusive growth in tribal Odisha.

Harvesting Success: The Arecanut-Black Pepper Model Farm

Nestled in the scenic landscapes of Gavhe, Taluka Dapoli, Ratnagiri, Mr. Balkrishna Pawar, a BSc Agriculture graduate, is

redefining the possibilities of small-scale farming. On his compact 0.5-acre farm, he has introduced an innovative arecanut-based spice cropping system that seamlessly integrates Arecanut (Shrivardhani) with Black Pepper (Panniyur-1). Through this system, he harvests 10.5 kg of fresh arecanut and 2 kg of black pepper per vine, setting a benchmark for productivity in the region.

Mr. Pawar's success is no accident—it comes from the thoughtful adoption of modern agricultural practices. By applying integrated nutrient management, biofertilizers, and foliar sprays of micronutrients, he has enhanced soil health, improved crop quality, and maximized yields. Beyond the numbers, his farm creates a micro-climate ideally suited for black pepper, ensuring that both crops thrive in harmony while optimizing natural resource use.

What sets Mr. Pawar apart is his vision: turning a small plot of land into a model of sustainable, profitable agriculture. His innovative approach not only provides a steady additional income but also inspires fellow farmers across Ratnagiri to embrace modern techniques, demonstrating that with knowledge, dedication, and innovation, even small farms can achieve extraordinary success. His journey stands as a testament to the power of blending traditional farming wisdom with scientific practices to cultivate both wealth and sustainability.

Fighting Foot Rot: Transforming Black Pepper Cultivation in Ratnagiri

In the lush landscapes of Wakawali, Taluka Dapoli, Ratnagiri, Mr. Rajaram Shigwan, a determined farmer with a 10th-grade education, has turned the challenge of phytophthora foot rot into an opportunity for innovation and success. On his 0.125-acre farm (5 gunthas / 5,445 sq ft), he cultivates Black Pepper (Panniyur-1) alongside tuber crops, aiming for both productivity and sustainability. Facing recurring foot rot problems that threatened his black pepper yield, Mr. Shigwan adopted scientific interventions with support from the local agricultural university. Through the application of *Trichoderma*, use of biofertilizers, and strict adherence to the recommended package of practices, he effectively managed the disease while enriching soil health. This not only controlled phytophthora foot rot but also enhanced the yield and quality of his black pepper. His farm now stands as a model of resilience and innovation, showing that even small-scale farmers can achieve remarkable results by integrating modern technology with hands-on dedication. The success of Mr. Shigwan inspires fellow farmers in Ratnagiri to embrace scientific approaches for sustainable, profitable, and high-quality spice cultivation.

KRISHI MELAS & FARMERS TRAININGS

KRISHI MELAS & EXHIBITIONS

Hisar

CCS Haryana Agricultural University Hisar, organized two Krishi Melas on March 17–18, 2025 and September 21–22, 2025. During these events, various Spices varieties and technologies were showcased for farmers, farm women, entrepreneurs, traders, and other stakeholders.

Jobner

Kishan Mela Agri Expo 2025 was held on March 10–11, 2025 at Sri Karan Narendra Agriculture University (SKNAU), Jobner.

Kumarganj

The University stall showcasing spices, fruits, and vegetables was exhibited during the State Fruits, Vegetables and Flowers Exhibition held from 07–09 February 2025 at the Raj Bhawan Campus, Lucknow.

A stall displaying vegetables, fruits, and spices was organized during the 48th Vice-Chancellor Convention held on 13–14 February 2025 at the University Campus.

An exhibition of vegetables, fruits, and spices was organized during the Rabi Production Gosthi 2025 held on 03 November 2025 at the University Campus.

Mudigere

Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga organized Krishi - Totagarike Mela-2025 from 07/11/2025 to 10/11/2025 at its main campus in Shivamogga.

Zonal Agricultural and Horticultural Research Station (ZAHRS), Mudigere, organized Krishi - Totagarike Mela-2025 from 18/12/2025 to 19/12/2025 at Mudigere.

Pampore

The ICAR-All India Coordinated Research Project on Spices at Pampore organized Kisan Mela, Saffron Day, and Kalazeera Day to promote improved cultivation of saffron and kalazeera among farmers.

Sirsi

University of Agricultural Sciences, Dharwad, along with AICRP (Spices), Sirsi, organized Krishi Mela from 11–13 September 2025, which attracted approximately 7,000 farmers.

Horti & Agri Mela was organized by AICRP (Spices), Sirsi at University of Agricultural and Horticultural Sciences, Shivamogga from 9th–11th September 2025, with participation of 300 farmers.

Thotagarika Mela was organized by AICRP (Spices), Sirsi at University of Horticultural Sciences, Bagalkot from 21st–23rd December 2025, with participation of 16,000 farmers

FARMERS TRAININGS ORGANIZED BY AICRPS CENTRES

S. No.	Date	Details of training program	Centre/Organizer	No.of Participants
1.	12.12.2024	Farmers training on Ginger cultivation under TSP at Myrada, KVK, Arepalayam, Sathyamangalam, Erode	Indian Institute of Spices Research (IISR), Kozhikode, Kerala.	50
2.	21.03.2025	Farmers training on Pepper cultivation under TSP Semmedu, Kollihills, Namakkal district	Indian Institute of Spices Research (IISR), Kozhikode, Kerala.	50
	25.11.2025	**Farmers training on Turmeric cultivation under SCSP, TCRC, Yethapur, Salem district**	**Indian Institute of Spices Research (IISR), Kozhikode, Kerala**	**50**
3.	26.07.2025.	Training programme on Turmeric production technology under SCSP	RHRS, Lam	70
4.	06.08.2025	Training programme on Turmeric production technology under SCSP	RHRS, Lam	100
5.	13-05-2025	Pasupu Nilavalo Teesukovalasina Jagratthalu.”	RHRS Lam	All India Radio (AIR), Vijayawada
6.	10.03.2025.	Mirapa kaayalanu aarabettutalo melaina yajamanya paddathulu	RHRS Lam	TV programme
7.	12.09.2025	Vamu sagulo yajamanya padhatulu	RHRS Lam	TV Programme
8.	19.12.2024	Navigating the path to geographical indication: procedures and processes for horticultural crops by Mr. Subhajith Saha, Head-Legal & IPR	HRS, Dr. YSRHU, Lam, Guntur	100
9.	16.7.2024	Chilli nursery management	Dr. YSRHU-HRS, Lam, Guntur	Online
10.	19.12.2024	Navigating the path to geographical indication: procedures and processes for horticultural crops	Dr. YSRHU-HRS, Lam, Guntur	Online
11.	11-12.03.2025	District level Seminar on“Spices: Challenges and Opportunities”	MIDH & Deptt. of Vegetable Science, CCS HAU, Hisar	82
12.	20.03.2025	Training on Production technology of spices crop	MIDH & Deptt. of Vegetable Science, CCS HAU, Hisar	75
13.	21.03.2025	Training on Production technology of spices crop	MIDH & Deptt. of Vegetable Science, CCS HAU, Hisar	75
14.	25.03.2025	Production and processing techniques of spices under Mission for Integrated Development of Horticulture	Village Majhgawan, Panagar, Jabalpur	99(60 M 39F)
15.	26.03.2025	Production and processing techniques of spices under Mission for Integrated Development of Horticulture	Village Bharda, Panagar, Jabalpur	91(15 M 76F)
16.	27.03.2025	Production and processing techniques of spices under Mission for Integrated Development of Horticulture	Village Tilgawan, Panagar, Jabalpur	80(53 M 27 F)

17.	21.02.2025	Production technologies of seed spices	ICAR-AICRPS, Deptt. GPB, SKNAU, Jobner	125
18.	22.02.2025	Value addition and post harvest management in spices	ICAR-AICRPS, Deptt. GPB, SKNAU, Jobner	75
19.	19.12.2024	Spices seed production technology	ICAR-AICRPS, Jobner	60(46 M 14 F)
20.	22.02.2025	Value addition and post harvest management in spices	ICAR-AICRPS, Jobner	75(38 M 37 F)
21.	06.03.2025	Improved production technologies of seed spices crops	KVK, Alwar	125(80M 45F)
22.	07.03.2025	Scientific cultivation of spices	KVK, Arnia-Sikar II	121(8 M 43F)
23.	05.03.2025	Scientific cultivation of fennel	KVK, Bharatpur	100(75 M 5 F)
24.	11.03.2025	Improved production technologies of seed spices crops	DEE, SKNAU, Jobner	81(56M 35 F)
25.	21.02.2025	Production technologies of seed spices	SKNCOA, Jobner	125(51M 74F)
26.	19.03.2025	Masala Phasalo ki Unnat Kheti	Village–Koncha, Block-Bikapur, Distt. Ayodhya	50
27.	21.03.2025	Masala Phasalo ki Unnat Kheti	Bharhu, Block Manaka Pur, Distt. Gonda,	50
28.	22.03.2025	Masala Phasalo ki Unnat Kheti	Village–Koncha, Block-Bikapur, Distt. Ayodhya	50
29.	28.03.2025	Training on 'Improved production technology on Spices Cum Inputs distribution'	CHF, Pasighat (Villages: Kiyit, Boying), East Siang District, Arunachal Pradesh	30
30.	31.03.2025	Training cum Inputs distribution for the farmers of East Siang, Arunachal Pradesh	Ayeng/Ngopok Village, East Siang District, Arunachal Pradesh	30
31.	16.06.2025 to 18.06.2025	Farmers awareness programme on spices for tribal farmers	HRS, Pechiparai	120
32.	06-01-2025	Organic Farming in Major Crops	RARS ,Chintapalli	22
33.	27-01-2025	training program on Soil Testing Demonstration and Turmeric Quality parameters	Horticulture Department	50
34.	15-02-2025	Cultivation of Indian Long Pepper	AP Medicinal and Aromatic Board, Vijayawada	30
35.	24.02.2025	Post-harvest management in Black Pepper	TSP	30
36.	03.03.2025	Post-harvest management in turmeric	TSP	30
37.	21-03-2025	GAP & GHP for sustainable Production of Turmeric	Spice Board	30
38.	15-04-2025	Post Harvest management of Black pepper	VCF- Tata trust	30

39.	22-05-2025	Improved Cultivation Practices in Turmeric Cultivation	Dr. YSRHU- HRS Chintapalli	30
40.	28-05-2025	Improved cultivation practices, Pest & Disease management in Black Pepper	Dr. YSRHU- HRS Chintapalli	30
41.	17-06-2025	Technologies for sustainable cultivation of turmeric	HRS Chintapalli - AICRPS	100
42.	27-06-2025	Organic Farming in turmeric	HRS Chintapalli	30
43.	16-07-2025	Black Pepper Varieties and Propagation methods	RYSS-APCNF	30
44.	04-09-2025	Quality Improvement training programme on Turmeric	Turmeric Board & Spice Board	30
45.	09-10-2025	Growers training programme on Black Pepper and ginger	Spice Board	30
46.	18-10-2025	Awareness program on Biological Control in Tribal Farming	HRS, Ambajipeta	60
47.	23-10-2025	Regional Seminar on Spices	Spice Board	100
48.	14.3.2025	Turmeric cultivation and post-harvest management	Horticulture Department, AP	30 (30 M)
49.	18.3.2025	Turmeric and other Horticultural crops	Horticulture Department, AP	58 (58 M)
50.	7.8.2025	Latest production technologies in turmeric and banana	Horticulture Department and ATMA Krishna district	70 (70 M)
51.	23.12.2025	Turmeric production technology	Horticulture Department and ATMA, Palnadu district	50 (50 M)
52.	6/2/2025	Field training & inputs distribution	ICRI, RRS, Gngtok	36
53.	25/3/2025	Meeting cum distribution of inputs	ICRI, RRS, Gngtok	45
54.	22/4/2025	Input distribution (biocapsules & micronutrient)	ICRI, RRS, Gngtok	33
55.	23/6/2025	Input distribution programme biocapsules & micronutrient)	ICRI, RRS, Gngtok	49
56.	29/04/2025	Input distribution programme (biocapsules & micronutrient)	ICRI, RRS, Gngtok	17
57.	22/5/2025	Spice clinic cum distribution	ICRI, RRS, Gngtok	20
58.	30/5/2025	Meeting cum distribution of inputs	ICRI, RRS, Gngtok	27
59.	12/6/2025	Meeting cum distribution of inputs	ICRI, RRS, Gngtok	27
60.	15/9/2025	Nursery visits & meeting of inputs	ICRI, RRS, Gngtok	32
61.	19/9/2025	Nursery visits & selection of Farmers	ICRI, RRS, Gngtok	16
62.	28/11/2025	Training cum Input distribution	ICRI, RRS, Gngtok	50
63.	15/12/2025	Training cum Input distribution	ICRI, RRS, Gngtok	34
64.	06/05/2025	Dry land farming of horticulture crops	AICRP (Spices), Mudigeree	AIR , Bhadravathi
65.	29/05/2025	Methods of planting in dry land horticulture	AICRP (Spices), Mudigeree	AIR , Bhadravathi
66.	14/05/2025	Top working in horticulture	AICRP (Spices), Mudigeree	AIR , Bhadravathi
67.	28/02/2025	Production and Quality improvement in black pepper for promoting tribal Entrepreneurship	TSP, AICRP(Spices) Pechiparai	25

68.	28/12/2024	Rapid clonal multiplication in pepper and air layering in cinnamon	TSP, AICRP(Spices) Pechiparai	25
69.	28/02/2025	Serpentine method of multiplication in pepper and air layering in cinnamon	TSP, AICRP(Spices) Pechiparai	50
70.	09.03.2025	Training cum input distribution programme on Spice Cultivation and Processing	SCSP, AICRP(Spices) Pundibari	20(14M 6F)
71.	12.03.2025	Training cum input distribution programme on Spice Cultivation and Processing	SCSP, AICRP(Spices) Pundibari	20(13M 7F)
72.	13.03.2025	Training cum input distribution programme on Spice Cultivation and Processing	SCSP, AICRP(Spices) Pundibari	20(15M 5F)
73.	March 2025	Cultivation technology of IISR Pragati	AICRP (Spices), Solan	7(5M 2F)
74.	March, 2025	Cultivation technology of Solan Giriganga	AICRP (Spices), Solan	7(5M 2F)
75.	March, 2025	Management of rhizome rot of ginger and turmeric with talc-based formulation of *Trichoderma*	AICRP (Spices), Solan	7(5M 2F)
76.	21.03.2025	Creating awareness on sub-tropical horticultural crops with organic farming techniques	HRS Yercaud	30
77.	12.02.2025	Horticultural entrepreneurship opportunities to disabled persons	HRS Yercaud	20
78.	18.11.2025	Training cum input distribution programme under TSP programme of AICRP on Spices	Tamnar, Raigarh	60
79.	20.11.2025	Training cum input distribution programme under TSP programme of AICRP on Spices	Gharghoda, Raigarh	60
80.	11-13 March 2025	Training on Spices Production	CSS on Spices Development Dholi	49 (42M 7F)
81.	18-20 march 2025	Training under SCSP Plan on Spices Production:	Dholi	50 (32M 18F)
82.	26.03.2025-04.06.2025	Domain Training on Spices	BSDM, BAMETI, Patna	23 (16M 7 F)

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AICRPS Headquarters

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Vijayasanthi, K. V., Anees, K., Krishnamurthy, K. S., & Praveena, R. (2025). Root colonization studies to elucidate the endophytic association of moisture stress tolerant *Trichoderma* isolates in black pepper (*Piper nigrum* L.). *Journal of Spices and Aromatic Crops*, *34*, 15–29.

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Guntur

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Kumarganj

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Nagaland

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Pampadumpara

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Thrissur

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AWARDS & RECOGNITIONS

Best AICRP Centre Award

The Dr. B.R. Choudhary Agricultural Research Station, Mandor was conferred the Best AICRP Centre (Spices) Award (2024–25) by ICAR – All India Coordinated Research Project on Spices during the 36th Annual Group Meeting, held from 29–31 October 2025 at ICAR Complex for NEH Region, Meghalaya. The award recognized the centre's outstanding contributions in research, varietal development, and extension activities in spices.



Major Individual Awards from National/International Societies Individual Performance

Dr. Amit Kumar (ICAR, Gangtok)
Received the "FSRDA Young Scientist Award" in 1st International Farming Systems Conference-2025 during 7-9 march, 2025, at IIFSR, Modipuram, Meerut, Uttar.

Dr. B. Mahendar (SKLTGHU , Kammarpally)
Received Best Scientist Award on Occasion of 11thFoundation Day of SKLTGHU Dr. G. Vidya was conferred the Best Teacher Award at the 6th Global Agriculture Conference, Harvest – 2025, organized by AgriMeet Foundation Bharat & UGC – MMTIC, Jodhpur, in collaboration as a knowledge partner with ICAR – New Delhi and ICARDA.

Dr. Preethy T. T. (CRS, Pampadumpara)
Honour of presenting the topic: "Genetic diversity analysis of F_6 hybrids through ISSR markers indicates the heterozygous nature of parents in small cardamom (Elettaria cardamomum (L.) Maton)" at the National Symposium on Spices and Aromatic Crops (SYMSAC-XI) held on 7–9 January 2025.

Dr. B. Tanuja Priya (RHRS Lam ,Guntur)
Received Best scientist (Horticulture) in Annual Awards of Excellence in Agriculture-2024, at Kisan Mahotsav 2025, Andhra Pradesh conducted by Eruvaka Foundation on 05-09-2025.

Dr. B. Tanuja Priya, Principal Scientist (Horticulture), HRS, Lam, Guntur, received the SADHNA All India Best Publication Award 2024 from SADHNA, Dr. YS Parmar University of Horticulture & Forestry, Nauni, Solan, HP, on 10 February 2025.

Lokesh G., guided by Dr. B. Tanuja Priya, received the Best Ph.D. Thesis Award from Society for Ecological Sustainability, Odisha at the National Seminar on Agriculture and Farmers Empowerment (20–21 July 2024).

Lokesh G., guided by Dr. B. Tanuja Priya, received the Best Ph.D. Thesis Award from SAAST, Odisha, School of Agriculture, Warangal, and Meadow Agriculture Pvt. Ltd., UP at the First International Conference on Emerging Technologies in Agriculture & Allied Science (10–11 August 2024).

Mr. Botta Srinu, guided by Dr. B. Tanuja Priya, received the Er. J.P. Gupta Memorial

All India Best Thesis Award (Master's 2024) for "Curcumin in leaf as a biomarker for early detection in turmeric rhizomes" from SADHNA, Dr. YS Parmar University, Solan, HP on 25 Feb 2025.

Lokesh G., guided by Dr. B. Tanuja Priya, received the Best Ph.D. Thesis Award from Society for Ecological Sustainability, Odisha at the National Seminar on Agriculture and Farmers Empowerment (20–21 July 2024).

Lokesh G., guided by Dr. B. Tanuja Priya, received the Best Ph.D. Thesis Award from SAAST, Odisha, School of Agriculture, Warangal, and Meadow Agriculture Pvt. Ltd., UP at the First International Conference on Emerging Technologies in Agriculture & Allied Science (10–11 August 2024).

Dr. Giridhar Kalidasu, Principal Scientist (Horticulture), Dr. YSRHU, Venkataramannagudem, was honored as Fellow of the Indian Society for Spices at SYMSAC-XI (7–9 January 2025, ICAR-IISR, Kozhikode, Kerala) for his outstanding research contributions to spice crops.

Ms. Pallavi Sri Padma, guided by Dr. B. Tanuja Priya, received the Smt. Vijaya V. Korikanthimath Award for Best M.Sc. Thesis for "Nutrient Profiling and Design of Ready-to-Mix Curry Powder in Turmeric" (submitted to Dr. YSRHU, Venkataramannagudem, 2023) at SYMSAC-XI (7–9 January 2025, ICAR-IISR, Kozhikode, Kerala).

Dr. R. Naga Lakshmi(RHRS Lam, Guntur)
Received the Meritorious Award from the District Collector of Guntur on 26th January 2025 for her outstanding contributions as the Best Scientist in 2024.

Dr. Sanju Balan (PRS Panniyur)
Awarded Second Best Oral Presentation on Smart Technologies & Natural Resource Management for Healthy Cities at the National Seminar on Soil Health, 5th Dec, College of Agriculture, Padannakkad

Dr Shrikant sawargaonkar (Raigarh)
Dr. Shrikant Sawargaonkar won the Best Paper Oral Presentation at GRIAST-2025, IGKV, Raipur (20–22 Jan 2025), organized with National Agriculture Development Cooperative Ltd., Baramulla, J&K.

Felicitated with the Best Spices Breeder Certificate of Appreciation for release and notification of 7 spices and 2 groundnut varieties by Professor & Head, Nodal Officer, PPV & FRA/Coordinator, BARC-IGKV MoU/PI, UN_GEF, Biodiversity Int. Project on 16/10/2024.

Team Performance

AICRPS Kumarganj (ANDUAT Kumarganj)
Honoured with a Certificate of Appreciation (2024–25) by the Hon'ble Vice Chancellor and Surya Pratap Sahi, Hon'ble Minister of Agriculture, during the Golden Jubilee Foundation Day of Narendra Deva University of Agriculture and Technology.

AICRPS Sirsi (UHS Sirsi) Awarded 3rd prize for best AICRP Spices stall at Thotagarika mela held during 21-23rd Dec.,2025 at University of Horticultural Sciences, Bagalkot.

AICRPS Pampadumpara (CRS Pampadumpara)
Best Poster Presentation: Nafeesa, M., Murugan, M. and Nimisha, M. (2025). Bio-efficacy evaluation of bio-pesticides, botanicals and newer molecules for

management of shoot and capsule borers and thrips in small cardamom. SYMSAC-XI, ICAR – Indian Institute of Spices Research, Kozhikode (7–9 Jan 2025).

AICRPS Solan (Dr. YSPUHF Solan)

First Prize – Oral Presentation: Endophytic Probiotics: Advancing Sustainable Horticulture for Enhanced Productivity and Stress Resilience, National Conference on Indigenous Knowledge System for Sustainable Future – A Roadmap to Viksit Bharat 2047, College of Horticulture and Forestry Thunag, Thunag, Mandi, Himachal Pradesh, India, 13–14 Feb 2025.

AICRPS Pantnagar (GBPUAT Pantnagar)

Excellence Award 2025: In recognition of noteworthy research contributions during 2024–25 by Govind Ballabh Pant University of Agriculture and Technology, Pantnagar.

AICRPS Pampore (SRS Pampore)

Achiever of the Year – 2025: Awarded for contribution to the conduct of the International Training on "Saffron Cultivation, Production, Best Practices and Capacity Building in Traceability and Authenticity Analysis" organized by Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir in collaboration with International Crops Research Institute for the Semi-Arid Tropics and the Ministry of Iran (SKUAST-K/2025-26/Award/176/F/25).

AICRPS Yercaud (HRS Yercaud)

First Prize – Garden Competition: Horticultural Research Station Yercaud secured first prize in the Public Institutional Garden category at the 48th Yercaud Flower Show and Summer Festival, organized by the Salem District Administration, 23–29 May 2025.

AICRPS Pottangi (OUAT Pottangi)

Outstanding Research Output Award (2025): 1st International Conference on Sustainable Agriculture and Biodiversity in Changing Climate, Valmiki Tiger Reserve, 20–22 Apr 2025.

Best Seed & QPM Production Unit Award (2025): Odisha University of Agriculture and Technology, Bhubaneswar, 24 Aug 2025; presented by the Governor of Odisha in the presence of Kanak Vardhan Singh Deo.

Distinguished Scientist Award (2025): International Biodiversity, Conservation and Climate Action Conference, Valmiki Tiger Reserve, 12–14 Dec 2025.

STAFF POSITION

PROJECT COORDINATORS OFFICE			
1.	Project Co-ordinator	:	Dr. D. Prasath
2.	Scientist (Plant Genetics)	:	Dr. Mukesh Sankar. S
3.	Chief Technical Officer	:	Mr. R. Bharathan
4.	Personal Assistant	:	Vacant
5.	Skilled Supporting Staff	:	Vacant
REGULAR/COORDINATING CENTRES			
1.	**Horticultural Research Station (Dr. YSR Horticultural University), Chintapalli**		
	1 Horticulturist	:	Mrs. Chetti Bindhu, Senior Scientist (Horticulture)
	2 Technical Assistant	:	Vacant
2.	**Department of Spices & Plantation Crops (TNAU), Coimbatore**		
	1 Breeder (Horticulture)	:	Dr. M. Mohanalakshmi, Associate Professor (Horticulture)
	2 Jr. Pathologist	:	Dr. S. Sundravadana, Associate Professor (Plant Pathology)
	3 Technical Assistant	:	Th. D. Gopalakrishnan, Assistant Agriculture Officer
3.	**Department of Horticulture (Dr. BSKKV), Dapoli**		
	1. Horticulturist	:	Dr. R. C. Gaibhiye, Professor (Horticulture)
	2. Jr. Breeder	:	Dr. A.V. Bhuwad, Assistant Professor (Horticulture)
	3. Technical Assistant	:	Shri. R. G. Nachare, Agricultural Assistant
4.	**Department of Horticulture, Tirhut College of Agriculture (RAU), Dholi**		
	1. Jr. Horticulturist	:	Vacant
	2. Jr. Pathologist	:	Dr. A. K. Mishra, Associate Professor (Plant Pathology)
	3. Jr. Technical Assistant	:	Sh. A. N. Mishra, Technical Assistant
5.	**Horticultural Research Station (Dr. YSR Horticultural University), Guntur**		
	1. Horticulturist	:	Dr. Ramireddy Nagalakshmi, Senior Scientist (Horticulture)
	2. Jr. Breeder (Horticulture)	:	Dr. Tanuja Priya, Senior Scientist (Horticulture)
	3. Technical Assistant	:	Vacant
6.	**Department of Vegetable Crops, (CCS HAU), Hisar**		
	1. Assistant Scientist (Vegetable Science)	:	Dr. Suresh K. Tehlan, Principal Scientist (Horticulture)
	2. Horticulturist / Olericulturist	:	Dr. Makhan Lal, Senior Scientist (Horticulture)
7.	**Centre for Research on Seed Spices (SDAU), Jagudan**		
	1. Plant Pathologist	:	Dr. N. R. Patel, Associate Professor (Plant Pathology) (up to 05.12.2025)
		:	Dr. Jignesh K. Patel, Associate Professor (Plant Pathology) (from 06.12.2025)
	2. Jr. Breeder	:	Dr. Surabhi S. Chauhan, Associate Professor (Genetics & Plant Breeding) (up to 05.12.2025)
		:	Dr. Hiren S. Patel, Assistant Professor (Genetics & Plant Breeding) (from 06.12.2025)
	3. Technical Assistant	:	Mrs. Rekha Chaudhari, Agricultural Assistant
8.	**Department of Genetics and Plant Breeding (SKNAU), Jobner**		
	1. Sr. Breeder	:	Dr. Shailesh Marker, Professor (Plant Breeding and Genetics)
	2. Jr. Pathologist	:	Sh. G. L. Kumawat, Assistant Professor (Plant Pathology)

	3.	Jr. Agronomist	:	Dr. A. C. Shivran, Professor (Agronomy)
	4.	Jr. Technical Assistant	:	Suman Jat, Technical Assistant
9.	**Turmeric Research Station (SKLTSHU), Kammarpally**			
	1.	Jr. Pathologist	:	Dr. B. Mahender, Scientist (Plant Pathology)
	2.	Jr. Horticulturist	:	Dr. P. Srinivas, Scientist (Horticulture) (up to 16.11.2025)
			:	Dr. G. Vidya, Scientist (Horticulture) (from 17.11.2025)
	3.	Technical Assistant	:	Vacant
10.	**Department of Vegetable Science (NDUAT), Kumarganj**			
	1.	Jr. Pathologist	:	Dr. Pradip Kumar, Associate Professor (Plant Pathology)
	2.	Horticulturist	:	Vacant (up to 24.07.2025)
			:	Dr. D.K Upadhyay, Assistant Professor (Plant Breeding) (from 25.07.2025)
	3.	Technical Assistant	:	Sh. R. K. Gupta, Technical Assistant
11.	**Horticultural Research Station (UAHS), ZAHRS, Mudigere**			
	1.	Horticulturist (Agronomy)	:	Smt. Sandhya G. C., Associate Professor (Agronomy) (up to 18.09.2025)
			:	Dr. Kiran Kumar R, Assistant Professor (Horticulture) (from 19.09.2025)
	2.	Jr. Technical Assistant	:	Vacant
12.	**Cardamom Research Station, KAU, Pampadumpara**			
	1.	Horticulturist (Agronomy)	:	Dr. Nimisha Mathews, Assistant Professor (Horticulture)
	2.	Lab Assistant	:	Mr. Anil Kumar, Lab Assistant
13.	**Pepper Research Station, KAU, Panniyur**			
	1.	Jr. Breeder (Horticulture)	:	Dr. Vikram H.C., Assistant Professor (Horticulture)
	2.	Jr. Pathologist	:	Dr. Sanju Balan, Assistant Professor (Plant Pathology)
	3.	Jr. Agronomist	:	Vacant (up to 11.06.2025)
			:	Dr. Stesy S, Assistant Professor (Agronomy) (from 12.06.2025)
	4.	Jr. Technical Assistant	:	Vacant (up to 16.12.2025)
			:	Jintu Varghese, Farm Assistant Grade II (from 17.12.2025)
	5.	Lab Assistant	:	Rajeev K, Lab Assistant Grade III
14.	**High Altitude Research Station (OUAT), Pottangi**			
	1.	Breeder	:	Dr. Parshuram Sial, Professor (Plant Breeding)
	2.	Technical Assistant	:	Vacant
15.	**Department of Horticulture (UBKV), Pundibari**			
	1.	Horticulturist	:	Dr. Ram Krishna Sarkar, Associate Proffessor (Vegetable Science)
	2.	Jr. Pathologist	:	Dr. Anamika Debnath, Assistant Professor (Plant Pathology)
	3.	Technical Assistant	:	Sh. Murari Krishna Roy, Technical Assistant
16.	**College of Agriculture and Research Station (IGKV), Raigarh**			
	1.	Jr. Plant Pathologist	:	Dr. Ajith Kumar Singh, Principal Scientist (Plant Pathology)
	2.	Jr. Breeder	:	Dr. Shrikant Laxmikant Swargaonkar, Scientist (Plant Breeding) (up to 01.07.2025)

				Vacant (from 02.07.2025)
	3.	Technical Assistant	:	Vacant
17.	**Horticultural Research Station (UHS), Sirsi**			
	1.	Jr. Horticulturist	:	Dr. Sudheesh Kulkarni, Assistant Professor (Horticulture)
	2.	Jr. Plant Pathologist	:	Vacant (up to 12.06.2025)
			:	Dr. Prasad P. S, Assistant Professor (Plant Pathology) (from 13.06.2025)
	3.	Jr. Technical Assistant	:	Mr. Laxman A. Padanad, Senior Technical Officer
18.	**Department of Vegetable Crops (Dr. YSPUHF), Solan**			
	1.	Jr. Pathologist / Jr. Biochemist	:	Dr. Meenu Gupta, Associate Professor (Plant Pathology) (up to 29.05.2025)
			:	Dr. Aditi Sharma, Assistant Professor (Plant Pathology) (from 30.05.2025)
	2.	Jr. Technical Assistant	:	Mr. Surat Singh Negi, Technical Assistant
19.	**Horticultural Research Station (TNAU), Yercaud**			
	1.	Jr. Breeder	:	Dr. G. Malathi, Associate Professor (Horticulture)
	2.	Lab Assistant	:	Mrs. K. Leela, Lab Technician

VOLUNTARY CENTRES	
Regional Agricultural Research Station, (KAU), Ambalavayal	
1.	Smt. Sreerekha M.V Assistant Professor (Horticulture)
ICAR Research Complex for NEH Region, Barapani	
1.	Dr. M. Bilshini Devi Scientist (Vegetable Science)
2.	Dr. Veerendra Verma Senior Scientist (Horticulture)
ICAR GANGTOK Res. Complex for NEH Region, Regional Station, Sikkim Centre	
1.	Dr. Amit Kumar Scientist (Agronomy)
ICRI Regional Station (Spices Board), Gangtok	
1.	Dr. Sasanka Sekhar Bora Scientist-C (Agriculture Entomology)
Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur	
1.	Dr. Reena Nair Assistant Professor (Horticulture)
Horticultural Research Station, AAU,Kahikuchi	
1.	Dr. Kusum Kumar Deka Principal Scientist (Horticulture)
Bidhan Chandra Krishi Vishwa Vidhyalay, Directorate of Research, Faculty of Horticulture, Kalyani	
1.	Dr. Anupam Pariari Professor (Horticulture)
BIRSA Agricultural University, College of Agriculture, Kanke	
1.	Dr. Arun Kumar Tiwary Assistant Professor (Horticulture)
Agricultural Research Station (Agriculture University Kota), Kota	
1.	Dr. Preeti Verma Professor (Genetics & Plant Breeding)
Agriculture research Station, (Agricultural University Jodhpur), Mandor	
1.	Dr. MotilalMehriya Associate Professor (Agronomy)

ICAR Res. Complex for NEH Region Regional Station, Mizoram
1. Dr. Vanlalruati Scientist (Horticulture)
Indian Cardamom Research Institute, Spices Board, Myladumpara
1. Dr. K.A. Saju Scientist-C (Plant Pathology)
2. Manoj Oommen Scientist –C (Agronomy)
Dr.K.Dhanapal Scientist –C (Plant pathology) (up to 31.10.2025)
Department of Horticulture, SASRD, Nagaland University, Medziphema-797 106, Dimapur, Nagaland
1. Dr. C. S. Maiti Professor (Horticulture)
2. Dr. Graceli I Yepthomi Assistant Professor (Horticulture)
N.M. College of Agriculture, Navsari Agricultural University, Navsari
1. Dr. Ritesh K. Patel Assistant Professor (Plant Breeding)
Govind Ballabh Pant University of Agriculture and Technology, College of Agriculture, Pantnagar
1. Dr. Dhirendra Singh Professor (Plant Breeding)
College of Horticulture & Forestry, Central Agricultural University, Pasighat
1. Dr. Arwankie Shadap Assistant Professor (Horticulture)
Horticultural Research Station, (Tamil Nadu Agricultural University), Pechiparai
1. Dr. G. Samlind Sujin Assistant Professor (Horticulture)
2. Dr. Jaya Jasmine Professor (Horticulture)
ICRI Regional Station, Spices Board, Sakleshpur
1. Dr. K.N. Harsha Scientist-C (Agronomy)
Castor-Seed Spices Research Station, (Anand Agricultural University), Sanand
1. Dr. Dharmendra R. Patidar Assistant Research Scientist (Plant Breeding)
PROJECT MODE CENTRES
Kerala Agricultural University, Vellanikkara, Thrissur
1. Dr. Nair Sunil Appukuttan, Assistant Professor (Horticulture)
SRS Pampore, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Shalimar
1. Dr. Sher Ahamad Dar Professor (Genetics & Plant Breeding)

TRAINING AND CAPACITY BUILDING PROGRAMME

Sl. No.	Name of the staff	Details of programme	Duration	Venue	Organisers
1.	Dr.A.V Bhuwad	International online Conference on Advancement of Science and Technology for Environment, Society and People (ICASTESP-VII)	19.12.2025-20.12.2025	Online mode	STESP Society
2.	Dr. B. Tanuja Priya	Production and protection practices in Spices and seed spices	24.4.2024	HRS, Venkataramannagudem, Dr. YSR Horticultural University	ICAR ATARI and DrYSRHU
3.	Dr. B. Tanuja Priya and Dr. R. Naga Lakshmi	Crop specific verticals in turmeric	07.03.2025	Online meeting	Department of Horticulture, Directorate of Horticulture, Andhra Pradesh
4.	Dr. B. Tanuja Priaya, Principal Scientist (Hort)	Turmeric cultivation and post-harvest management	14.3.2025	Chintalanka and Kiskindapalem villages of Kolluru mandal, Bapatla	Horticulture Department, AP
5.	Dr. R. Naga Lakshmi, Senior Scientist (Hort.),	Turmeric and other Horticultural crops	18.3.2025	Eepuru and Potharlanka villages of Kollur mandal, Bapatla	Horticulture Department, AP
6.	Dr. B. Tanuja Priya and Dr. R. Naga Lakshmi	Viksith krishi sankalpa abhiyan programme, on turmeric and other horticulture crops	29.5.2025	Nutakki village, Guntur	Horticulture Department, AP
7.	Dr. B. Tanuja Priya and Dr. R. Naga Lakshmi	Training programme on turmeric and banana	7.8.2025	Nadakuduru village, Challapalli Mandal, Krishna District	RHRS, Lam and ATMA
8.	Dr. R. Naga Lakshmi	Turmeric production technology	23.12.2025	RHRS, Lam	Horticulture Department, AP
9.	Dr. B. Tanuja Priya	Training programme on DATA ANALYSIS IMPLEMENTING R STUDY	27.12.2025 - 29.12.2025	Online -mode	Technology Enabling Centre (TEC), G.B. Pant University of Agriculture & Technology (GBPUAT), Pantnagar

10.	Dr. B. Tanuja Priya,	Can plantations earn carbon credits?	31.01.2025	On-line meeting	ICAR-Directorate of Cashew Research, Puttur, Karnataka
11.	Dr. B. Tanuja Priya and Dr. R. Naga Lakshmi	Biotechnology Applications for crop improvement: Key developments	28.2.2025	RARS, Lam, Guntur	ANGRAU, Lam, Guntur and BCIL, New Delhi
12.	Dr. B. Tanuja Priya and Dr. R. Naga Lakshmi	Attended International workshop on "Exotic horticultural crops, global trade and sustainable technologies for green future	13.3.2025	On-line meeting	Dr. YSRHU
13.	Dr. B. Tanuja Priya and Dr. R. Naga Lakshmi	Cost of cultivation of chilli, exact post harvest losses and reduction of post harvest losses of major crops	21.04.2025	On-line meeting	Department Horticulture
14.	Dr. K. Giridhar, Dr. B. Tanuja Priya and Dr. R. Naga Lakshmi	Mirapa sagulo kota anantaram yajamanyam	13.11.2025	online mode	Dr. YSRHU-HRS, Lam, Guntur in collaboration with Farmers Advisory Cell of Dr.YSRHU
15.	Dr. B. Tanuja Priya and Dr. R. Naga Lakshmi	AI-based research programme across various departments	7.5.2025	On-line meeting	DIIP, VR Gudem
16.	Dr. B. Tanuja Priya and Dr. R. Naga Lakshmi	XXXVI Annual Meeting of AICRPS	28.10.2025 - 01.11.2025	ICAR Complex for NEH Region, Barapani,	Barapani, Meghalaya.
17.	Dr. B. Tanuja Priya and Dr. R. Naga Lakshmi	Mirapa sagu	13.11.2025	Online mode	Farmers advisory cell, Dr. YSRHU
18.	Dr. B. Tanuja Priya and Dr. R. Naga Lakshmi	Brain storming session on "Horticultural Innovations to enhance Export from India	28.11.2025	Online mode	Dr. Himanshu Pathak, President, NAAS
19.	Dr. B. Tanuja Priya and Dr. R. Naga Lakshmi	Climate change and crop productivity, facilities, tools, challenges and opportunities	21.5.2025	Online meeting	William Giles Distinguished Professor, Mississipi State University, USA in collaboration with Dr.YSRHU
20.	Dr. B. Tanuja Priya and Dr. R. Naga Lakshmi	ZREAC meeting	20.5.2025	KVK	VR Gudem

21.	Dr.Makhan lal	Exploring Agricultural Knowledge and Information	21.4.2025	Online meeting	Nehru Library, CCS Haryana Agricultural University, Hisar
22.	Dr.Makhan lal Dr.S.K Tehlan	Genetic and Genomic approaches for improvement of stress resilience and nutritional quality of crops	28.2.25 – 20.3.25	online	Winter School, Department of Genetics, IARI, New Delhi
23.	Dr.Makhan lal Dr.S.K Tehlan	Startups& Entrepreneurship in Agriculture under Jawahar RKVY RAFTAAR – Agri-Business Incubator (Jawahar R-ABI) programme.	20.5.2024 - 24.5.2024	Online	Institute of Agri-Business Management Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, MP
24.	S. Marker, A.C. Shivran, G.L. Kumawat	XXXVI Annual Workshop of AICRP on Spices	October, 28-31, 2025	Barapani	ICAR-Research Complex for NEH Region, Umiam (Barapani), Meghalaya
25.	S. Marker, A.C. Shivran, G.L. Kumawat	Pre-ZREAC (Rabi, 2025), Zone IIIa of Rajasthan	September 18-19, 2025	Durgapur ,jaipur	RARI, Durgapur, Jaipur, Rajasthan
26.	S. Marker, A.C. Shivran, G.L. Kumawat	ZREAC (Rabi, 2025), Zone IIIa of Rajasthan	October 07-08, 2025	Durgapur, jaipur	RARI, Durgapur, Jaipur, Rajasthan
27.	Dr. Kusum Kr. Deka	training programme on the topic “Skill Upgradation and Deepening of Spice Activities”	15th. November,2024	Kamrup	DIYA Foundation,(NGO)
28.	Dr. Kusum Kr. Deka	“Production Technology and Post harvest Management of Ginger, Turmeric and Black Pepper	28th.and 29th, November,2024	Kahikuchi	AICRP(Spices)
29.	Dr. Kusum Kr. Deka	Chandubi Festiva,2025 on “Prospect of Horticulture in Rabha Hasong Area,	02.01.2025	Kahikuchi	Rabha Hasong Council
30.	Dr. Kusum Kr. Deka	Horticulture Show	08.03. 2025	Guwahati	Oil India Limited
31.	Dr.B.Mahendar Dr. G.Vidya	Hands on training programme on Organic	17th - 21st March 2025	Hyderabad	Agri biotech foundation, Prof. Jayashankar

		Horticulture: Application of Microbial Techniques, Opportunities' and Constraints			Telangana State Agricultural University campus, Rajendranagar, Hyderabad.
32.	Dr.B.Mahendar Dr. G.Vidya	MOOC on introduction to bioinformatics	1st October – 30th November	Rajendranagar, Hyderabad	ICAR – National Academy of Agricultural Research Management
33.	Dr.B.Mahendar Dr. G.Vidya	National conference on Climate change and Horticulture, impact adaption and mitigation strategies (CLIMHorti-2025)	18th and 19thSeptembe r 2025	Sri Konda Laxman Telangana Horticultural University in Hyderabad, Telangana	SKLTGHU, Mulugu
34.	Dr. Nimisha Mathew	Digital Agriculture	20.1.2025 to 22.1.2025	Hyderabad	NIPHM, Hyderabad
35.	Dr. Nimisha Mathew	MOOC on Generative AI	16.01.2025 to 08.02.2025	Thrissur	Centre for e-learning, KAU
36.	Dr. Nimisha Mathew	MOOC on Artificial Intelligence in Agriculture	01.02.2025 to 28.02.2025	Hyderabad	NAARM Hyderabad
37.	Dr. M. H. Khan	potential of induced mutagenesis in saffron for generating genetic variability aimed at developing high-yielding, improved-quality cultivars with enhanced resilience to biotic and abiotic stresses.	January, 2025	Mumbai	BRNS, DAE,
38.	Dr. M. H. Khan	the feasibility of different irrigation systems for saffron cultivation and to discuss tissue culture approaches for in vitro corm production.	January, 2025	Jalgaon	Jain Irrigation Pvt. Ltd
39.	Dr. N. A. Dar	the application of robotic technologies for saffron harvesting and stigma separation	August, 2025	Durgapur	CDAC, MEITY, Durgapur

		and mechanization for corm planting and harvesting.			
40.	Dr.M.H.Khan	DUS characterization of Kalazeera and saffron farmer varieties and to facilitate their registration for protection under the PPV&FRA Act.	March 2025	New delhi	PPV&FRA, New Delhi
41.	Dr. Sanju Balan	Comprehensive Hands-On Training in Primer Design for Diverse Applications	27.01.25 to 31.01.25	Panniyur	Gen space
42.	Dr. Stesi	Foundation course on Research, Education and Extension Management	04.08.2025 -08.08.2025	Thrissur	KAU
43.	Dr. Stesi	(Faculty development Training programme) on Innovative teaching, Digital Pedagogy and research education	01.12.2025–05.12.2025	Vellayani	CAITT ,Vellayani
44.	Dr.G.Samlind Sujin	XXXVI Workshop of ACIRP on Spices, Megalaya	27.10.2025 to 02.11.2025	Umiam Meghalaya	ACIRP on Spices
45.	Dr.Parashuram Sial	International Workshop on "Research Paper Writing and Publication Ethics: A Comprehensive Workshop for Researchers"	01.04.25-15.04.25	Hybrid mode	AMF (Bharat) in collab. with UGC-MMTTC (JNVU, Jodhpur), SFU (Russia), EDUHK (China), UT (Iran), ABRII (Iran), ICAR-DCR (Puttur), RSA & BGGI (Sangrur), IKGPTU.
46.	Dr.Parashuram Sial	Training on Agriculture-Related Statistical Data Analysis and Skills Development Program	21.07.25-30.07.25	Online	The Sustainable Agriculture and Learning Foundation (SALF)
47.	Dr. Parashuram Sial	Biometrical Tools in Crop Improvement 45 Days National	07.09.25 to 22.10.25	Online	School of Agriculture, SR University

		Training Program Theory, Application, & Interpretation			Warangal, Telangana-506371
48.	Dr.Parashuram Sial	30-Day International Agriculture Training-cum-Summer School on Natural Farming and Emerging Technologies (AI, Drones, IoT): Advancing Sustainable Agriculture through Initiatives of the Ministry of Agriculture & Farmers Welfare, Government of India	16th August to 16th September 2025	Hybrid mode	GNFSU (Guj), ICAR (Ag Extn., ND), ICAR-RCER (Patna), CRIDA (Hyd), IIMR (Hyd), IIMR-Maize (Pb), ISGPB (ND), ISA (ND), HARWS (Agra), KAU (Kerala), AU (Noida), MU (Aligarh), SPU (Balaghat), DoA&FW (Pb & Raj), CIAO (India), CIMMYT, ICARDA.
49.	Dr.Parashuram Sial	International Agriculture Winter School cum Training programme on Novel Approaches in Agricultural System	01.03.25-30.03.25	Online	ICAR-ATARI (11 Z) & KVKs, CSAUAT (Kanpur), ISGPB (ND), SKRAU (Bikaner), DYPAU&T (Talsande), HARWS (Agra).
50.	Dr.G. Malathi	National Symposium on Spices and Aromatic Crops (SYMSAC-XI)	07.01.2025 to 09.01.2025	Kozhikode	IISR, Calicut, Kerala
51.	Dr.G. Malathi	AICRP – Spices XXXVI Annual Group Meet held at ICAR Research Complex for NEH Region, Barapani, Meghalaya.	29-31 October 2025	Umiam Meghalaya	ICAR – AICRP Spices
52.	Surbhi S. Chauhan	Winter School on: Novel approaches in agricultural systems	01.03.2025 to 30.03.2025	Online Mode	ICAR-ATARI, Krishi Vigyan Kendras, CS Azad University, ISGPB, and D.Y. Patil Agriculture University.

53.	N. R. Patel, Surbhi S. Chauhan, S. M. Patel, and P. J. Patel	XXXVI Annual Group Meeting of AICRP on Spices	29–31 October 2025	ICAR Research Complex for NEH Region, Barapani, Meghalaya	ICAR
54.	P. J. Patel and N. R. Patel	Mission for Integrated Development of Horticulture/National Horticulture Mission Programmes	26–27 June 2025	Vanamati, College of Agriculture, Nagpur Campus, Dr. PDKV, Akola	Directorate of Arecanut and Spices Development, Calicut, Kerala
55.	Dr. John Jo Varghese, Scientist – C & In charge and Dr. S.S. Bora, Scientist-C & AICRPS in charge	Training programme on Virus indexing of large cardamom attended	02-06, January,25	ICAR IISR	ICAR- IISR, Kozhikode
56.	Dr.A.K Mishara	National conference Value Chain Management in Spices & Aromatic Plants for Profit Optimization and Resilience	18-19 January 2025	JISL, Jalgaon, Maharastra	CHAI & JISL (Jalgaon)
57.	Dr. A.K Mishra	Annual Review Meeting of CSS on spices development	26-27 June 2025	VANAMATI, College of Agriculture, Nagpur Campus,	Calicut, Kerala (DASD)

METEOROLOGICAL DATA

AMBALAVAYAL

Month	Temperature (°C)		RH (%)		Rainfall
	Max.	Min.	I	II	(mm)
Jan-25	28.2	13.2	92	64	0
Feb-25	29.9	15.3	92	62	0
Mar-25	31.1	18.1	88	53	160.8
Apr-25	30.1	17.9	90	61	158.3
May25	28.9	18.2	92	71	524.9
Jun-25	26.2	18.3	93	80	411.2
Jul-25	24.6	16.2	95	87	646
Aug-25	26.1	16.5	97	85	354.5
Sep-25	26.5	17.5	94	82	204.3
Oct-25	26.4	18.7	94	84	237.2
Nov-25	27	17	92	78	11.2
Dec-25	26.7	14.9	96	76	1.3

BARAPANI

Month	Temperature(°C)		RH (%)		Rainfall
	Max.	Min	I	II	(mm)
Jan-25	21.5	8.9	91	67	9.6
Feb-25	22.2	8.8	85	59	5
Mar-25	26.8	12.8	81	54	34.4
Apr-25	27.7	17.3	84	68	154.6
May-25	26.4	18.4	89	87	507.3
Jun-25	28.6	20.7	89	84	188.1
Jul-25	28.9	21.2	92	82	343.2
Aug-25	28.0	20.9	93	86	325.6
Sep-25	28.5	20.3	91	82	385.2
Oct-25	27.1	17.3	91	80	362.2
Nov-25	24.3	13.0	89	70	64.9
Dec-25	22.1	7.9	90	62	0

CHINTAPALLI

Month	Temperature(°C)		RH (%)		Rainfall
	Max.	Min.	I	II	(mm)
Jan-25	27.8	10.1	99.1	46.3	0.0
Feb-25	30.5	13.4	97.1	45.5	12.6
Mar-25	33.5	14.5	95.0	40.9	21.9
Apr-25	32.6	18.8	93.8	52.0	118.5
May-25	31.0	20.9	95.6	59.4	206.0
Jun-25	30.8	21.3	93.3	70.7	117.2
Jul-25	27.5	20.4	91.5	81.1	217.3
Aug-25	28.4	21.5	93.2	80.0	298.4
Sep-25	28.6	20.8	95.8	76.9	299.0
Oct-25	27.6	19.6	96.3	75.2	187.6
Nov-25	27.9	14.6	99.0	56.7	3.8
Dec-25	26.8	9.8	99.3	52.8	10.5

COIMBATORE

Month	Temperature(°C)		RH (%)		Rainfall	Rainy
	Max.	Min.	I	II	(mm)	days
Jan-25	29.58	19.84	87.94	48.87	0.08	0.00
Feb-25	32.95	18.98	83.89	34.18	0.00	0.00
Mar-25	34.57	22.16	83.81	39.13	0.92	0.06
Apr-25	25.59	23.67	84.30	45.57	2.53	0.07
May-25	32.67	28.20	89.00	66.00	4.40	12.00
Jun-25	31.18	22.91	84.07	58.07	1.39	0.17
Jul-25	30.98	22.81	81.77	57.03	4.20	0.61
Aug-25	28.10	21.15	85.14	57.06	3.45	0.52
Sep-25	33.00	23.27	78.23	65.20	0.61	0.07
Oct-25	32.32	22.90	77.97	67.84	3.64	0.26
Nov-25	31.03	21.73	79.93	62.63	1.40	0.07
Dec-25	29.94	29.94	29.94	29.94	29.94	29.94

DAPOLI

Month	Temperature(°C)		RH (%)		Rainfall	Rainy
	Max.	Min.	I	II	(mm)	days
Jan -25	32.9	12.4	91.7	50.2	0.0	0.0
Feb-25	35.0	12.9	91.3	48.8	0.0	0.0
Mar-25	34.2	12.6	91.1	47.7	0.0	0.0
Apr-25	33.6	12.3	90.4	46.4	0.0	0.0
May-25	31.8	12.7	90.2	45.6	646.4	11.0
Jun-25	29.8	12.6	89.1	43.5	762.4	22.0
Jul-25	28.4	13.1	88.9	44.2	960.2	28.0
Aug-25	27.6	13.5	88.9	46.2	1575.7	34.0
Sep-25	28.0	14.7	88.8	49.3	450.8	18.0
Oct-25	32.1	15.5	87.4	53.9	116.6	8.0
Nov-25	30.9	16.9	88.1	57.9	161.0	5.0
Dec-25	31.5	17.4	87.1	61.1	0.0	0.0

DHOLI

Month	Temperature(°C)		RH (%)		Rainfall
	Max.	Min.	I	II	(mm)
Jan-25	20.5	9.1	97	70	0.0
Feb-25	26.8	10.8	95	62	0.0
Mar-25	31.7	15.1	90	57	0.0
Apr-25	34.8	19.9	86	57	30.0
May-25	34.7	23.8	86	64	85.3
Jun-25	36.2	25.8	85	64	47.8
Jul-25	34.2	26.0	91	73	235.5
Aug-25	32.6	25.4	95	81	304.0
Sep-25	33.3	25.3	92	77	128.9
Oct-25	32.0	21.0	95	68	182.9
Nov-25	28.1	14.1	94	58	25.0
Dec-25	21.5	9.5	96	69	0.0

ICAR SIKKIM

Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	I	II	
Jan-25	15.5	6.68	86	53	40.7
Feb-25	18.1	9.19	86	51	21.9
Mar-25	21.5	11.90	84	50	160.0
Apr-25	23.3	14.10	87	53	198.2
May-25	25.0	16.53	89	61	252.2
Jun-25	26.1	20.43	92	71	444.4
Jul-25	25.7	20.91	92	77	814.4
Aug-25	27.6	21.12	93	91	415.6
Sep-25	25.4	20.20	92	78	553.6
Oct-25	27.3	17.88	87	55	60.8
Nov-25	21.9	11.16	87	50	0.2
Dec-25	17.1	9.57	87	54	22.0

ICRI GANGTOK

Month	Temperature (°C)		Rainfall (mm)	Rainy days
	Max.	Min.		
Jan-25	12.0	4.0	19.0	4
Feb-25	12.0	5.0	112.0	13
Mar-25	18.0	5.0	139.0	15
Apr-25	20.0	10.0	384.0	16
May-25	22.0	12.0	798.0	22
Jun-25	25.0	13.0	663.0	21
Jul-25	23.0	14.0	814.0	27
Aug-25	22.0	15.0	529.0	28
Sep-25	22.0	15.0	535.0	16
Oct-25	20.0	16.0	185.0	7
Nov-25	16.0	6.0	100.0	5
Dec-25	11.0	4.0	0.0	0

GUNTUR

Month	Temperature (°C)		RH (%)		Rainfall (mm)	Rainy days
	Max.	Min.	I	II		
Jan-25	31.20	19.10	98.80	67.60	0.00	0.00
Feb-25	34.90	20.60	98.10	64.30	0.00	0.00
Mar-25	37.10	24.90	98.20	61.80	0.00	0.00
Apr-25	37.90	27.10	97.40	49.10	16.60	3.00
May-25	36.60	27.70	97.40	60.10	303.80	11.00
Jun-25	36.60	28.10	80.40	54.50	38.50	5.00
Jul-25	34.30	26.30	79.50	56.60	167.70	9.00
Aug-25	33.02	26.60	85.09	64.10	364.50	8.00
Sep-25	33.20	26.70	86.70	66.30	271.30	14.00
Oct-25	31.60	25.60	90.50	74.80	230.80	13.00
Nov-25	31.10	23.90	68.70	63.10	24.20	2.00
Dec-25	29.40	19.80	62.40	55.00	0.00	0.00

HISAR

Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	I	II	
Jan-25	18.7	6.4	97.2	64.4	12.8
Feb-25	24.1	8.7	93.9	47.1	2.9
Mar-25	29.5	11.5	83	34	11
Apr-25	38.7	19.3	54.1	17.4	6.4
May-25	38.3	25.1	66.1	37.4	83
Jun-25	38.3	27	71.8	48.2	63.2
Jul-25	33.9	26.8	90.1	70.1	322.5
Aug-25	32.2	26.4	90.5	72.1	186.9
Sep-25	33.5	25.6	86.5	62.9	127.4
Oct-25	31	19.1	91.1	48.9	78.2
Nov-25	26.7	9.3	88.8	33.5	2.8
Dec-25	22.3	6.5	95.1	50.5	0

JABALPUR

Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	I	II	
Jan -25	24.54	8.10	83.40	47.80	0.0
Feb -25	29.43	11.35	82.75	37.75	0.0
Mar -25	34.20	13.65	72.00	24.75	1.0
Apr -25	38.38	19.95	58.75	24.75	7.2
May -25	37.62	25.22	67.00	41.20	16.2
Jun -25	34.65	25.98	78.00	60.75	171.6
Jul -25	28.84	24.44	93.80	84.00	535.8
Aug -25	31.25	24.93	90.75	72.75	212.2
Sep -25	31.30	24.38	93.25	73.50	164.7
Oct -25	29.80	20.96	90.60	64.40	174.3
Nov-25	26.85	9.58	84.75	38.50	0.0
Dec -25	24.70	5.35	79.50	38.75	0.0

JAGUDAN

Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	I	II	
Jan -25	28.16	13.52	82.76	86.51	0.00
Feb -25	30.11	17.12	77.42	81.74	0.00
Mar -25	35.36	22.23	79.15	83.47	0.00
Apr -25	38.69	25.97	84.93	84.01	36.6
May -25	41.34	27.49	79.73	86.14	252.40
Jun -25	35.87	24.19	83.16	85.11	218.60
Jul -25	40.03	27.11	77.29	81.83	201.80
Aug -25	41.25	27.50	83.58	83.06	192.60
Sep -25	40.64	25.15	82.35	80.52	90.80
Oct -25	40.01	24.73	85.25	82.91	40.00
Nov-25	37.34	20.18	85.95	79.68	0.00
Dec -25	34.23	14.14	82.37	85.87	0.00

JOBNER

Month	Temperature (°C)		RH (%)		Rainfall (mm)	Rainy days
	Max.	Min.	I	II		
Jan -25	30.7	15.4	90.6	47.3	0.0	0
Feb -25	34.4	17.9	86.6	41.6	1.8	0
Mar -25	36.2	19.7	83.0	41.0	39.1	1
Apr -25	39.5	23.3	74.7	38.4	1.5	0
May-25	37.6	24.0	76.2	47.0	246.1	10
Jun -25	34.8	24.2	76.5	56.3	169.5	10
Jul -25	30.9	23.6	85.7	74.6	201.9	16
Aug -25	31.2	23.3	89.0	75.6	285.3	14
Sep -25	31.6	22.6	90.2	72.2	299.4	15
Oct -25	31.5	21.9	77.3	68.5	80.6	6
Nov -25	30.9	14.8	89.8	47.8	0.5	0
Dec -25	29.8	10.8	8.57	30.7	0.0	0

KAMMARPALLI

Month	Temperature (°C)		RH (%)		Rainfall (mm)	Rainy days
	Max.	Min.	I	II		
Jan-25	30.7	15.4	90.6	47.3	0.0	0
Feb -25	34.4	17.9	86.6	41.6	1.8	0
Mar -25	36.2	19.7	83.0	41.0	39.1	1
Apr -25	39.5	23.3	74.7	38.4	1.5	0
May-25	37.6	24.0	76.2	47.0	246.1	10
Jun -25	34.8	24.2	76.5	56.3	169.5	10
Jul -25	30.9	23.6	85.7	74.6	201.9	16
Aug -25	31.2	23.3	89.0	75.6	285.3	14
Sep -25	31.6	22.6	90.2	72.2	299.4	15
Oct -25	31.5	21.9	77.3	68.5	80.6	6
Nov -25	30.9	14.8	89.8	47.8	0.5	0
Dec -25	29.8	10.8	8.57	30.7	0.0	0

KAHIKUCHI

Month	Temperature (°C)		Rainfall (mm)	Humidity (%)
	Max.	Min.		
Jan -25	23.4	12.6	67.2	96.8
Feb-25	25.6	13.7	52.3	94.0
Mar -25	29.6	17.5	96.2	90.3
Apr -25	32.5	22.1	124.8	89.8
May -25	32.5	23.6	301.5	92.5
Jun -25	31.2	26.0	439.0	96.0
Jul -25	33.3	27.4	310.8	95.6
Aug -25	32.7	25.6	332.8	95.7
Sep -25	33.8	25.6	149.6	94.9
Oct -25	29.5	23.1	215.2	96.6
Nov -25	28.8	19.0	62.6	96.5
Dec-25	25.2	13.4	54.8	96.7

KOTA

Month	Temperature (°C)		RH (%)		Rainfall (mm)	Rainy days
	Max.	Min.	I	II		
Jan -25	21.45	8.89	93.87	79.48	4.10	1.00
Feb -25	27.78	13.20	82.00	54.43	0.00	0.00
Mar -25	34.45	16.31	65.42	23.71	0.00	0.00
Apr -25	41.84	24.78	46.33	17.13	0.00	0.00
May-25	41.11	29.47	55.15	30.73	1.09	3.00
Jun -25	37.65	28.55	71.93	53.50	10.39	13.00
Jul -25	31.24	25.62	89.74	78.84	15.30	21.00
Aug -25	32.19	25.89	90.71	75.74	14.04	17.00
Sep -25	32.99	24.60	86.30	65.43	2.80	8.00
Oct -25	31.70	20.65	85.03	51.06	4.71	4.00
Nov -25	27.92	13.31	90.03	41.83	0.33	1.00
Dec -25	26.41	9.29	94.16	45.13	0.00	0.00

KALYANI

Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	I	II	
Jan -25	24.73	11.08	98.41	60.70	0.00
Feb -25	29.05	15.02	96.67	52.42	1.88
Mar -25	33.77	19.27	94.23	38.83	0.09
Apr -25	34.91	23.22	92.43	57.73	2.13
May -25	35.12	24.59	93.81	65.90	6.37
Jun -25	33.74	25.35	95.25	74.28	9.45
Jul -25	31.98	25.10	98.39	86.55	14.02
Aug -25	32.50	24.62	96.48	82.19	10.02
Sep -25	34.05	24.88	95.7	75.93	3.75
Oct -25	32.65	22.40	96.39	73.06	4.59
Nov -25	28.90	14.94	96.67	59.50	0.03
Dec -25	24.18	11.24	97.35	65.77	0.00

KUMARGANJ

Month	Temperature (°C)		RH (%)		Rainfall (mm)	Rainy days
	Max.	Min.	I	II		
Jan -25	19.5	7.2	86.6	59.3	0	0
Feb -25	26.4	9.5	79.1	34.5	0	0
Mar -25	32.8	13.9	86.5	42.5	0	0
Apr -25	35.7	24.4	86.1	49.4	0	0
May-25	37.3	25.2	85.8	47.1	92.8	4
Jun -25	36.8	26.8	87.9	52.3	90.8	6
Jul -25	34.3	26.1	85.6	62.4	279.4	18
Aug -25	32.7	25.8	87.6	66.4	452.0	22
Sep -25	32.5	25.9	84.3	69.9	14.0	9
Oct -25	30.4	20.5	86.8	69.8	30	6
Nov -25	27.7	12.7	86.0	57.1	0	0
Dec -25	20.5	8.1	85.8	64.7	0	0

MANDOR

Month	Temperature(°C)		Rainfall (mm)	Relative Humidity
	Max.	Min.		
Jan -25	23.50	9.70	0.09	30.01
Feb -25	28.39	14.13	0.03	19.47
Mar -25	33.19	17.93	0.02	13.64
Apr -25	40.09	23.94	0.05	10.18
May -25	41.70	27.97	1.20	34.44
Jun -25	39.82	28.39	2.14	47.18
Jul -25	34.05	26.23	6.75	73.33
Aug -25	33.84	25.40	4.14	73.79
Sep -25	33.51	23.52	1.74	74.30
Oct -25	32.36	19.35	0.75	60.65
Nov -25	29.63	13.57	0.14	47.64
Dec-25	27.66	12.68	0.04	34.20

MYLADUMPARA

Month	Temperature(°C)		Rainfall (mm)	Humidity (%)
	Max.	Min.		
Jan -25	23.97	9.90	22.00	91.42
Feb -25	27.04	13.41	1.70	86.63
Mar -25	28.34	12.12	37.60	89.00
Apr -25	29.04	13.07	177.30	89.07
May -25	27.17	12.93	463.30	91.43
Jun -25	23.38	12.08	539.80	95.33
Jul -25	23.26	11.81	491.40	95.83
Aug -25	24.40	12.21	330.90	94.12
Sep -25	25.84	12.46	182.90	93.03
Oct -25	25.99	12.31	363.00	92.35
Nov -25	25.31	11.78	252.50	92.22
Dec-25	25.59	11.11	19.98	92.16

MIZORAM

Month	Temperature(°C)		RH (%)		Rainfall (mm)
	Max.	Min.	I	II	
Jan -25	22.9	12.7	90	62	0.0
Feb -25	25.1	15.1	84	61	0.0
Mar -25	28.8	18.4	80	68	12.0
Apr -25	30.1	20.5	84	63	115.2
May -25	29.3	21.1	87	71	624.1
Jun -25	29.3	22.6	91	76	521.0
Jul -25	29.2	22.8	94	81	551.1
Aug -25	29.0	22.4	95	80	449.4
Sep -25	29.5	22.7	94	78	314.8
Oct -25	29.0	21.5	94	77	134.1
Nov-25	26.4	17.5	94	66	41.2
Dec -25	23.8	14.6	88	62	0.0

NAGALAND

Month	Temperature(°C)		RH (%)		Rainfall (mm)
	Max.	Min.	I	II	
Jan -25	24.8	10.4	95	50	1.1
Feb -25	26.3	10.7	92	45	6
Mar -25	31.5	14.7	86	37	34.1
Apr -25	33.5	19.9	84	52	20.5
May-25	31	22.3	91	68	26.1
Jun -25	33.1	24.5	89	73	80.3
Jul -25	33.9	25.4	91	70	48.2
Aug -25	33.4	24.7	91	71	54.1
Sep -25	33.2	24.2	90	73	395.3
Oct -25	32.4	22.4	90	69	139.7
Nov-25	27.9	16.5	95	63	0
Dec -25	25.6	10.3	94	58	0

MUDIGERE

Month	Temperature (°C)		Rainfall (mm)	Rainy days
	Max.	Min.		
Jan -25	12.0	4.0	18.3	0
Feb -25	12.0	5.0	0	0
Mar -25	18.0	5.0	180	3
Apr -25	20.0	10.0	110.5	8
May-25	22.0	12.0	402	13
Jun -25	25.0	13.0	399.4	18
Jul -25	23.0	14.0	1485.3	30
Aug-25	22.0	15.0	500.5	23
Sep-25	22.0	15.0	188.4	13
Oct -25	20.0	16.0	403.2	17
Nov-25	16.0	6.0	55.5	3
Dec-25	11.0	4.0	52.0	3

NAVSARI

Month	Temperature (°C)		RH (%)		Rainfall (mm)	Rainy days
	Max.	Min.	I	II		
Jan -25	31.73	14.50	83.13	38.92	0.00	0
Feb -25	34.09	14.34	78.44	30.36	0.00	0
Mar -25	36.41	17.39	81.23	29.41	0.00	0
Apr -25	36.06	22.12	91.11	47.30	0.00	0
May -25	33.53	24.13	88.04	65.39	72.00	7
Jun -25	32.01	24.30	91.47	76.71	305.00	16
Jul -25	30.26	23.96	94.87	85.99	546.00	21
Aug -25	30.58	23.57	92.35	82.37	402.00	18
Sep -25	31.05	23.17	94.04	81.04	293.00	14
Oct -25	33.35	23.35	90.65	60.19	220.00	6
Nov-25	32.04	18.82	93.27	52.16	11.00	1
Dec -25	31.82	16.85	92.10	32.93	0.00	0

PAMPADUMPARA

Month	Temperature(°C)		Rainfall (mm)	Rainy days
	Max.	Min.		
Jan -25	20.54	17.38	19.4	4
Feb -25	22.14	18.98	-	0
Mar -25	24.29	21.09	65.2	8
Apr -25	25.84	21.86	104.6	12
May -25	23.69	20.49	381.8	15
Jun -25	21.61	18.41	473.9	23
Jul -25	20.90	17.73	338.2	29
Aug -25	21.54	18.4	233.4	19
Sep -25	21.98	18.87	187.4	18
Oct -25	23.31	20.05	309.2	21
Nov -25	21.6	18.51	125.2	11
Dec-25	19.2	16.27	58.6	5

PAMPORE

Month	Temperature(°C)		RH (%)	Rainfall (mm)
	Max.	Min.		
Apr -25	22.97	5.73	79.17	41.30
May -25	28.96	10.66	75.61	62.50
Jun -25	30.49	15.57	69.03	35.40
Jul -25	31.91	18.73	78.32	62.70
Aug -25	30.66	16.95	82.32	81.50
Sep -25	28.79	12.63	87.43	117.90
Oct -25	24.27	5.08	85.87	34.00
Nov-25	16.57	-2.76	88.77	11.0
Dec -25	11.49	-1.84	89.26	3.00
Jan -25	10.13	-1.87	90.32	46.50
Feb -25	14.36	0.89	82.68	2.00
Mar -25	19.13	3.79	73.90	10.50

PANNNIYUR

Month	Temperature (°C)		Rainfall (mm)	Humidity (%)	Rainy days
	Max.	Min.			
Jan -25	34.8	21.9	0.0	97.3	0
Feb -25	36.5	23.6	95.0	98.0	0
Mar -25	37.2	25.6	0.0	98.0	0
Apr -25	36.7	25.8	44.0	97.8	5
May -25	33.8	25.8	933.3	96.6	18
Jun -25	32.6	25.2	1113.3	97.6	27
Jul -25	29.6	24.8	1049.5	98.0	31
Aug -25	30.3	25.2	509.4	98.5	25
Sep -25	31.2	25.1	230.8	99.0	19
Oct -25	32.5	25.1	213.6	98.3	21
Nov -25	33.7	23.8	25.6	96.9	3
Dec-25	34.1	21.8	4.3	95.8	2

PANTNAGAR

Month	Temperature(°C)		Rainfall (mm)	Humidity (%)	Rainy days
	Max.	Min.			
Jan -25	19.0	6.6	22	80–83	4
Feb -25	22.3	9.0	20	65–70	5
Mar -25	27.7	14.0	25	55–60	6–7
Apr -25	33.1	19.0	24	28–35	8
May -25	35.9	23.5	32	60–65	10
Jun -25	35.9	26.0	102	40–60	15
Jul -25	30.8	25.5	314	70–80	28
Aug -25	29.6	25.0	283	75–80	30
Sep -25	28.9	24.0	158	75–78	22
Oct -25	27.6	18.5	26	65–70	5
Nov -25	24.4	12.0	1	45–50	<1
Dec-25	20.5	8.0	~0–13	70–78	0–1

PASIGHAT

Month	Temperature(°C)		Rainfall (mm)	Humidity (%)	Rainy days
	Max.	Min.			
Jan -25	21.31	13.00	49.10	54.94	3.0
Feb -25	18.24	13.00	33.40	71.29	8.0
Mar -25	22.08	13.90	76.05	69.70	11.0
Apr -25	27.13	20.00	207.00	69.42	8.0
May -25	28.79	22.39	326.70	71.28	11.0
Jun -25	30.68	25.00	284.00	77.15	13.0
Jul -25	32.89	26.36	225.40	71.34	12.0
Aug -25	29.15	26.00	112.80	75.57	18.0
Sep -25	32.44	25.00	325.20	67.30	10.0
Oct -25	23.44	21.00	391.00	63.34	10.0
Nov -25	26.27	17.07	0.00	51.78	0.0
Dec-25	21.85	14.30	4.50	52.70	1.0

PECHIPARAI

Month	Temperature (°C)		Rainfall (mm)	Humidity (%)	Rainy days
	Max.	Min.			
Jan -25	34.0	24.0	22.00	91.42	3
Feb -25	34.0	24.5	1.70	86.63	2
Mar -25	33.5	24.5	37.60	89.00	0
Apr -25	34.0	24.0	177.30	89.07	10
May -25	35.0	24.5	463.30	91.43	19
Jun -25	34.0	24.0	539.80	95.33	19
Jul -25	34.0	24.0	491.40	95.83	14
Aug -25	33.8	24.2	330.90	94.12	11
Sep -25	33.0	24.0	182.90	93.03	10
Oct -25	32.0	24.0	363.00	92.35	12
Nov -25	32.0	24.0	252.50	92.22	13
Dec-25	31.0	24.0	19.98	92.16	6

SANAND

Month	Temperature(°C)		Rainfall (mm)	Rainy days
	Max.	Min.		
Jan -25	12.0	4.0	18.3	0
Feb -25	12.0	5.0	0	0
Mar -25	18.0	5.0	180	3
Apr -25	20.0	10.0	110.5	8
May-25	22.0	12.0	402	13
Jun -25	25.0	13.0	399.4	18
Jul -25	23.0	14.0	1485.3	30
Aug -25	22.0	15.0	500.5	23
Sep -25	22.0	15.0	188.4	13
Oct -25	20.0	16.0	403.2	17
Nov -25	16.0	6.0	55.5	3
Dec-25	11.0	4.0	52.0	3

RAIGARH

Month	Temperature(°C)		RH (%)		Rainfall (mm)
	Max.	Min.	I	II	
Jan -25	30.0	12.3	82.5	38.9	1.1
Feb -25	33.6	14.7	81.7	29.7	0.0
Mar -25	34.8	19.0	81.3	37.4	2.1
Apr -25	38.0	24.4	79.3	38.3	5.6
May -25	37.4	26.0	73.2	48.0	26.5
Jun -25	32.9	24.5	80.8	64.1	38.8
Jul -25	30.7	24.0	86.5	74.2	119.6
Aug -25	31.1	23.6	85.2	72.4	79.7
Sep -25	31.4	23.7	86.5	71.4	72.0
Oct -25	31.4	21.1	86.7	62.0	7.4
Nov-25	27.8	9.4	82.6	43.5	0.0
Dec -25	26.6	8.0	82.3	45.7	0.0

POTANGI

Month	Temperature(°C)		RH (%)		Rainfall (mm)	Rainy days
	Max.	Min.	I	II		
Jan -25	28.7	13.0	76	35	0.0	0
Feb -25	33.4	17.1	77	24	0.0	0
Mar -25	36.0	20.0	66	17	4.0	0
Apr -25	37.0	22.3	76	28	80.9	9
May-25	35.9	23.3	81	44	157.4	12
Jun -25	35.0	23.1	80	57	185.8	9
Jul -25	30.8	22.3	87	66	375.8	20
Aug -25	31.8	22.2	91	69	377.2	18
Sep -25	31.8	21.7	94	70	189.8	14
Oct -25	32.1	20.5	94	66	368.6	14
Nov-25	30.0	15.7	86	51	0.0	0
Dec -25	27.4	10.9	78	39	0.0	0

SAKLESHPUR

Month	Rainfall (mm)	No. of rainy days
Jan, 2025	0	0
Feb. 2025	0	0
Mar, 2025	76	3
April,2025	165	8
May, 2025	594	9
Jun, 2025	1170	23
Jul,2025	932	31
Aug,2025	771	24
Sep,2025	343	18
Oct,2025	399	15
Nov,2025	18	2
Dec,2025	0	0

PUNDIBARI

Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	I	II	
Jan -25	24.1	11.4	88.9	60.8	0.0
Feb -25	26.4	12.6	80.8	54.2	0.0
Mar -25	30.5	16.4	72.9	47.9	5.0
Apr -25	31.8	20.8	80.5	59.4	290.8
May -25	31.4	23.3	84.7	70.4	481.2
Jun -25	33.6	26.0	83.7	70.1	440.4
Jul -25	33.8	26.2	87.8	72.7	357.3
Aug -25	31.9	26.1	91.2	79.0	592.7
Sep -25	33.1	25.6	87.2	73.6	767.5
Oct -25	31.2	22.6	81.9	69.7	292.4
Nov-25	29.6	16.8	76.8	55.8	83.4
Dec -25	25.0	11.9	91.0	58.7	0.4

SIRSI

Month	Temperature (°C)		RH (%)		Rainfall (mm)	Rainy days
	Max.	Min.	I	II		
Jan -25	31	15	74	54	0.0	0
Feb -25	34	18	69	57	0.0	0
Mar -25	37	21	69	56	13.8	1
Apr -25	37	22	77	70	65.4	4
May -25	33	22	90	81	296.6	13
Jun -25	30	21	94	89	839.0	24
Jul -25	29	21	97	91	1084.4	30
Aug -25	28	21	93	89	690.4	25
Sep -25	29	20	90	89	186.0	15
Oct -25	30	20	90	89	63.8	7
Nov -25	30	17	86	73	0.0	0
Dec -25	29	13	71	44	0.0	0

THIRISSUR				
Month	Temperature(°C)		Rainfall (mm)	Humidity (%)
	Max.	Min.		
Jan -25	33.0	23.8	0.0	57
Feb -25	36.0	23.4	0.0	53
Mar -25	36.4	25.4	34.8	70
Apr -25	34.9	25.2	90.1	77
May -25	32.7	24.6	620.4	84
Jun -25	30.6	24.2	850.5	88
Jul -25	29.4	23.1	728.4	91
Aug -25	29.8	23.6	712.5	89
Sep -25	31.6	24.1	206.5	81
Oct -25	32.2	23.8	369.6	80
Nov -25	32.3	23.4	012.0	81
Dec-25	32.0	22.3	046.9	63

YERCAUD		
Month	Rainfall (mm)	No. of rainy days
Jan, 2025	19.4	19.4
Feb. 2025	-	-
Mar, 2025	26.2	26.2
April,2025	35.6	35.6
May, 2025	142.0	142.0
Jun, 2025	44.8	44.8
Jul,2025	99.8	99.8
Aug,2025	105.8	105.8
Sep,2025	234.6	234.6
Oct,2025	137.0	137.0
Nov,2025	53.0	53.0
Dec,2025	13.4	13.4

SOLAN				
Month	Temperature (°C)		Rainfall (mm)	Relative Humidity
	Max.	Min.		
Jan -25	21.3	2.9	4.8	48
Feb -25	21.0	4.7	74.8	48
Mar -25	25.4	7.6	42.0	42
Apr -25	30.2	12.4	2.6	41
May -25	29.2	16.1	148.7	60
Jun -25	30.0	18.9	170.4	68
Jul -25	27.6	20.8	233.3	82
Aug -25	27.4	20.5	399.0	83
Sep -25	28.4	18.8	302.6	77
Oct -25	26.4	12.3	165.6	66
Nov -25	24.0	5.4	0.0	55
Dec-25	23.1	3.5	0.0	51

AICRPS BUDGET

Centres	Salary		RC		TSP	SCSP	NEH		Capital		Total		Grand Total
	ICAR	State	ICAR	State	100%	100%	ICAR	State	ICAR	State	ICAR	State	
Regular Centres													
Chintapalle (Dr. YSRHU)	13	4.33	4.4	1.47	3	-	-	-	-	-	20.4	5.8	26.2
Coimbatore (TNAU)	50.17	16.72	8.4	2.8	-	-	-	-	-	-	58.57	19.52	78.09
Dapoli (BSKKV)	38	12.67	4.85	1.62		-	-	-	-	-	42.85	14.29	57.14
Dholi (RAU)	0	0	4.95	1.65	-	3	-	-	-	-	7.95	1.65	9.6
Guntur (Dr. YSRHU)	58	19.33	7.55	2.52	-	3	-	-	-	-	71.42	22.81	94.23
Hisar (HAU)	55	18.33	6.5	2.17	-	3	-	-	-	-	64.5	20.5	85
Jagudan (SDAU)	34.37	11.46	5.55	1.85	-	-	-	-	-	-	39.92	13.31	53.23
Jobner (SKNAU)	90	30	8.3	2.77	-	4.25	-	-	-	-	102.55	32.77	135.32
Kammarpally (SKLTSHU)	25	8.33	4.934	1.64	-	4	-	-	2.87	0.96	33.934	9.97	43.904
Kumarganj (NDUAT)	11	3.67	4.75	1.58	-	3	-	-	-	-	18.75	5.25	24
Mudigere (UAHS)	32	10.67	3.75	1.25	-	-	-	-	-	-	35.75	11.92	47.67
Pampadumpara (KAU)	16	5.33	6.85	2.283	-	10	-	-	1.25	0.42	32.85	7.613	40.463
Panniyur (KAU)	27.06	9.02	5.95	1.98	-	-	-	-	-	-	34.26	11.42	45.68
Pottangi (OUAT)	23.8	7.93	4.6	1.5	2	3	-	-	-	-	33.4	9.43	42.83
Pundibari (UBKVV)	0	0	5	1.67	-	3	-	-	-	-	8	1.67	9.67
Raigarh (IGKV)	58	19.33	7.3	2.43	1	3	-	-		-	69.3	21.76	91.063
Sirsi (UHS)	41.1	13.7	6.3	2.1	-	-	-	-	-	-	47.4	15.8	63.2
Solan (YSPUHF)	24	8	3.55	1.18	-	3	-	-	-	-	30.55	9.18	39.73
Yercaud (TNAU)	42	14	4.1	1.37	2	0.75	-	-	-	-	48.85	15.37	64.22
Total	**638.5**	**212.82**	**107.58**	**35.83**	**8**	**43**	**-**	**-**	**4.12**	**1.38**	**801.20**	**248.6**	**1049.86**
Voluntary Centres													
Ambalavayal (KAU)	-	-	2.8	0.93					-	-	2.8	0.93	3.73
Gangtok (ICRI)-NEH	-	-	0.4	0.013			15	5	-	-	15.4	5.013	20.413
ICAR RC, Barapani-NEH	-	-	0.4	0.013			8	2.667	-	-	8.4	2.680	11.0805
ICAR RC, Gangtok-NEH	-	-	0.4	0.013			8	2.667	-	-	8.4	2.680	11.0805
ICAR RC, Mizoram-NEH	-	-	0.4	0.013			8	2.667	-	-	8.4	2.680	11.0805
Jabalpur (JNKV)	-	-	3.25	1.08					-	-	3.25	1.08	4.33
Kahikuchi (AAU)	-	-	0.3	0.01			16	5.332	-	-	16.3	5.34	21.6425
Kalyani (BCKVV)	-	-	3	1.1		3			-	-	6	1.1	7.1
Kanke (BIRSAAU)	-	-	1.75	0.583					-	-	1.75	0.583	2.333
Kota (AUK)	-	-	3.3	1.07					-	-	3.3	1.07	4.37
Mandor (AUJ)	-	-	3.35	1.12		5			-	-	8.35	1.12	9.47
Myladumpara (ICRI)	-	-	3.15	1.05				0	-	-	3.15	1.05	4.2
Nagaland (AU)	-	-	0.5	0.017			16.33	5.425	-	-	16.83	5.442	22.272
Navsari (NAU)	-	-	3.2	1.08					-	-	3.2	1.08	4.28
Pantnagar (GBPUAT)	-	-	2.7	0.9					-	-	2.7	0.9	3.6
Pasighat (CAU)-NEH	-	-	0.4	0.013			10	3.33	-	-	10.4	3.34	13.7455
Pechiparai (TNAU)	-	-	2.3	0.77	2				-	-	4.3	0.77	5.07
Sakleshpur (ICRI)	-	-	2.75	0.92				0	-	-	2.75	0.92	3.67
Sanand (AAU)	-	-	2.75	0.92					-	-	2.75	0.92	3.67
Total	-	-	**37.1**	**11.61**	**2**	**8**	**81.33**	**27.09**	**-**	**-**	**128.43**	**38.708**	**167.14**
Project Mode centres													
SRS Pampore	-	-	2.9	0.97	-	-	-	-	-	-	2.9	0.97	3.87
Thrissur	-	-	2.8	0.93	-	-	-	-	-	-	2.8	0.93	3.73
Total	-	-	**5.7**	**1.9**	**-**	**-**	**-**	**-**	**-**	**-**	**5.7**	**1.9**	**7.6**
Annual Group Meeting	-	-	3.83		-	-	-	-	-	-	3.83		3.83
Others	-	-	5.79		-	-	18.67	-	**0.88**	-	25.34		25.34
Total	**638.5**	**212.82**	**160**	**49.35**	**10**	**51**	**100**	**27.09**	**5**	**1.38**	**964.5**	**289.26**	**1253.77**

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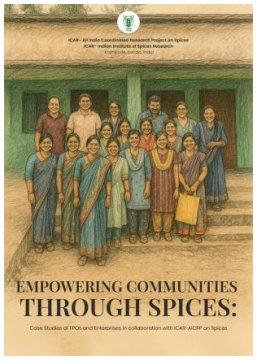



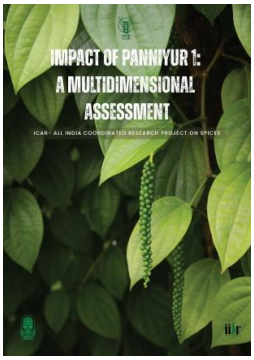

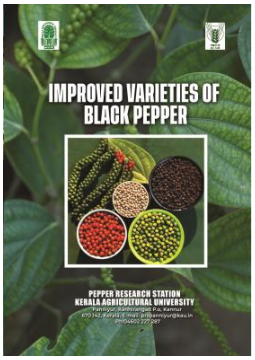

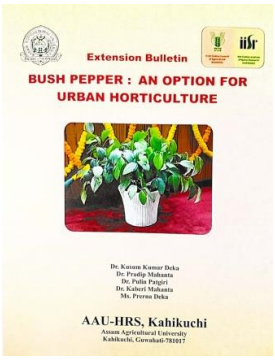

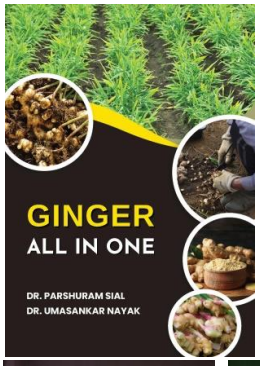

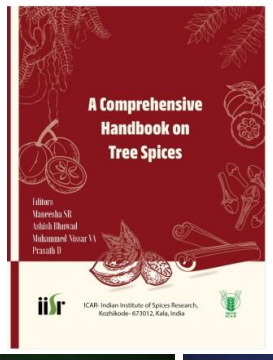

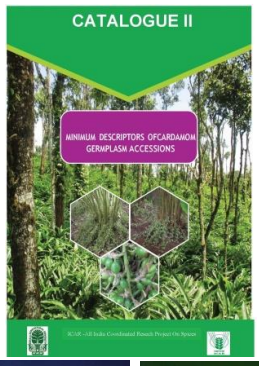



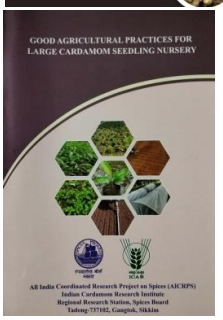

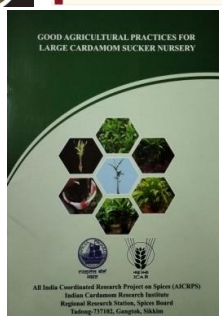

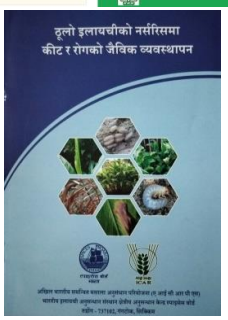

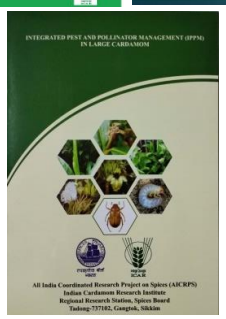

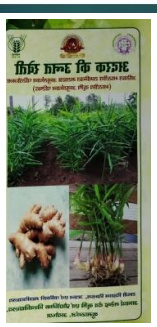

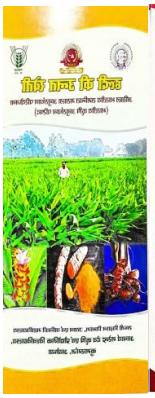







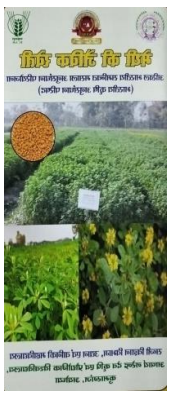

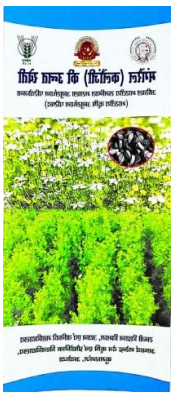

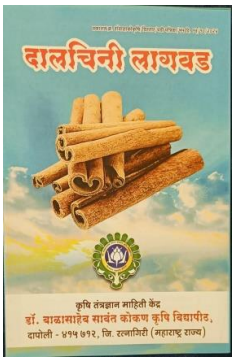

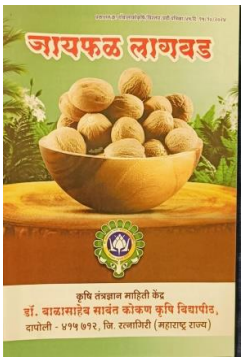

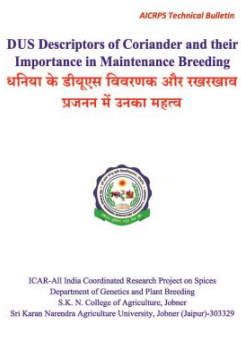



ICAR - AICRPS Publication released during 36th AGM



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