भाकृअनुप
ICAR

भाकृअनुप-अखिल भारतीय समन्वित मसाला अनुसंधान परियोजना की XXXVI वीं वार्षिक समूह बैठक

XXXVI Annual Group Meeting of ICAR-All India Coordinated Research Project on Spices

29-31 अक्टूबर 2025
29-31 October 2025

एजेंडा नोट
AGENDA NOTES

ICAR - RCNEH

भाकृअनुप उत्तर पूर्वी पर्वतीय क्षेत्र अनुसंधान परिसर
उमियम, मेघालय
ICAR-Research Complex for North-Eastern Hills Region,
Umiam, Meghalaya

भाकृअनुप-अखिल भारतीय समन्वित मसाला अनुसंधान परियोजना
ICAR-ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES
ICAR-Indian Institute of Spices Research
Kozhikode-673012, Kerala

XXXVI Annual Group Meeting of
ICAR-All India Coordinated Research Project on Spices

29 - 31 October 2025

ICAR Research Complex for NEH Region, Barapani,
Umiam, Meghalaya

AGENDA NOTES

ICAR-ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES
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KOZHIKODE – 673 012, KERALA

Agenda Notes:
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CONTENTS

TECHNICAL SESSION I

GENETIC RESOURCES AND CROP IMPROVEMENT

Project code	Title	Centres
Black pepper		
PEP/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Ambalavayal, Dapoli, Panniyur, Pundibari, Sirsi, Yercaud
PEP/CI/3.7	CVT 2018 on black pepper - Series IX	Ambalavayal, Chintapalli, Dapoli, Kozhikode, Panniyur, Sirsi, Yercaud
Cardamom		
CAR/CI/1.1	Germplasm collection, characterization, evaluation, and conservation	Mudigere, Pampadumpara
CAR/CI/3.9	CVT on hybrids of small cardamom-2018 – Series IX	Appangala, Mudigere, Myladumpara, Pampadumpara, Sakleshapura
CAR/CI/2.1	CVT on Small Cardamom 2024 Series XII	Appangala, Mudigere, Myladumpara, Pampadumpara
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
Large cardamom		
LCA/CI/1.1	Germplasm collection and evaluation of large cardamom	ICAR Regional Station, Gangtok, ICRI Regional Research Station, Gangtok
LCA/CI/2.1	CVT on large cardamom	ICAR Regional Station, Gangtok, ICRI Regional Research Station, Gangtok, RRS, UBKV, Kalimpong
Ginger		
GIN/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Barapani, Dholi, Kumarganj, Pottangi, Pundibari, Raigarh, Solan
GIN/CI/2.6	CVT on bold ginger	Appangala, Kozhikode, Pottangi, Raigarh, Sikkim
GIN/CI/2.7	CVT on high essential oil ginger genotypes	Appangala, Kozhikode, Nagaland, Pottangi, Umiam
Turmeric		
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/2.11	CVT on black turmeric *Curcuma caesia*	Barapani, Coimbatore, Kozhikode, Kumarganj, Mizoram, Navsari, Pottangi, Pundibari
Tree spices		
TSP/CI/1.1	Germplasm collection, characterization, evaluation and conservation of clove, nutmeg and cinnamon	Dapoli, Pechiparai
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-Series 2023	Dapoli, Kozhikode, Pechiparai and Thrissur
Project Mode	Evaluation of nutmeg genotypes	Thrissur
Coriander		
COR/CI/1.1	Germplasm collection, description, characterization, evaluation, conservation and screening against diseases	Coimbatore, Dholi, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh
COR/CI/2.1	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	CVT on Leafy Coriander Series 2024	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jobner, Kumarganj, Navsari, Pantnagar, Sanand
COR/CI/4.1	Quality evaluation in coriander	Jobner, Jagudan
Cumin		
CUM/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Jagudan, Jobner, Mandor, Sanand
CUM/CI/2.1	Coordinated varietal trial on cumin–2024	Ajmer, Jagudan, Jobner, Mandore, Sanand
Fennel		
FNL/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Dholi, Hisar, Jagudan, Jobner, Kumarganj
FNL/CI/2.1	Coordinated varietal trial on fennel–2024 Series XII	Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Pantnagar, Navsari
Fenugreek		
FGK/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Dholi, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh
FGK/CI/2.1	Coordinated varietal trial on fenugreek–2024 Series XII	Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Navsari, Pantnagar, Kota, Raigarh,
Ajwain		
AJN/CI/2.1	Coordinated varietal trial-2022 Series	Ajmer, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh

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

PROGRESS REPORT OF THE PROJECTS

GENETIC RESOURCES AND CROP IMPROVEMENT

BLACK PEPPER

Project Code	PEP/CI/1.1	**Project Title**	Germplasm collection, characterization, evaluation and conservation
Centres	Ambalavayal, Dapoli, Panniyur, Pundibari, Sirsi, Yercaud		
Date of start	**1960**	**Date of closure/ duration**	Long term
Work done/achievements during 2024-25 (centre-wise)			
Ambalavayal	Terminated due to lack of sufficient crop varieties.		
Dapoli	Germplasm collected from various locations in the Konkan region is being maintained in the germplasm block of Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. Vine height ranged from 2.86 to 5.46 m. Among the different accessions, maximum vine height was observed in DBSKKVPN-4 (5.46 m), while the minimum height was in DBSKKVPN-6 (2.86 m). DBSKKVPN-2 had the highest number of spikes/vine (88), whereas DBSKKVPN-6 had the fewest (28). Maximum dry berry yield per vine was recorded in accession DBSKKVPN-2 (0.542 kg), while the minimum yield in DBSKKVPN-6 (0.226 kg vine^{-1}).		
Panniyur	At present 292 cultivated types including wild & related types as well as exotic types of black pepper are being maintained at PRS, Panniyur. Twelve new accessions were collected during 2024-25 from farmers' fields and planted in the nursery for multiplication. During the year 2024-2025, the genotypes PRS 116 and PRS 124 were recorded maximum yield. PRS 116 recorded maximum green berry yield (6.35 kg/ vine) and dry yield (2.20 kg/vine) and 1545 spikes/vine followed by PRS 124 with 5.73 kg green berry yield, 2.08 dry yield and 1465 spikes/vine. The dry recovery (%) was more for PRS 124 (36.30 %) followed by PRS 137 (36.18 %).		
Pundibari	Twenty-two black pepper entries were maintained in 2024-25. Eleven improved varieties of black pepper (Panniyur – 1, 2, 3, 4, 5, 6 & 7, Sreekara, Subhakara, Pournami, & Panchami) were collected from IISR, Calicut during the year 2000 and 2015. One genotype (Kottanadan) was collected from CPCRI, Mohitnagar, Jalpaiguri in the year 2002. In earlier years seven new genotypes were collected from Sub-Himalayan region adjoining Bhutan boarder (including Totopara). In 2014 – 2015, one new genotype was collected from Terai region of West Bengal All the germplasm are now being maintained in rapid propagation shade. Cuttings are also being prepared for multiplication, evaluation and distribution. For this conservation, black pepper germplasms were planted in university field.		
Sirsi	A total of 54 accessions and 21 released varieties are currently being maintained and evaluated. Among the different accessions, plant height varied significantly, ranging from 0.43 m to 2.58 m. Similarly, the number of leaves per plant ranged from 6.5 to 96.75. The highest plant height (2.58 m) and leaf count (96.75) were recorded in the check variety P1. This was followed by germplasm V8, which recorded a plant height of 2.45 m, and Saimane, which recorded 81.50 leaves per plant. In contrast, the lowest plant height (0.43 m) and number of leaves per plant (6.50) were observed in Dodiga.		
Yercaud	The spike length of different accessions ranged from 10.13 cm to 13.63 cm. The highest spike length was observed in PN 58 (13.63 cm) and the lowest spike		

	length was observed in PN 84 (10.13 cm). The maximum mean number of berries per spike was recorded PN 11 (72.667 nos.) followed by PN 3 (72.33). The maximum 100 green berry weight was recorded in PN. 72 (10.260 g) and the maximum 100 dry berry weight was recorded in PN. 6 (3.67 g). The green berry yield was maximum in PN.11 (1.87 kg/vine). The same accession recorded the maximum dry berry yield (0.560 kg/vine).

Project Code	PEP/CI/3.7	**Project Title**	CVT on black pepper 2018-Series IX
Centres	Ambalavayal, Chintapalli, Dapoli, Kozhikode, Panniyur, Sirsi, Yercaud		
Date of start	2018	**Date of closure/ duration**	TBD
Experimental details	Entries: 11 1. HP 780 (IISR) 2. HP 1411 (IISR) 3. OPKM (IISR) 4. HP 2173/ HP 117 x Thommankodi (IISR) 5. kumbakal (IISR) 6. Ponmani (IISR) 7. PRS 137 (Panniyur) 8. SV 7 (Sirsi) 9. Kurimalai (Sirsi) 10. IISR Thevam (check) 11. Panniyur 1 (check) Design: RBD; Replications:3; Plot size/spacing: 6 standards/ plot (3x3 m), 2 plants/ standard		
Observation recorded	1. Plant height (m) 2. Number of branches per vine 3. Average spike length (cm) 4. % of male, female & bisexual flowers 5. Average number of berries per spike (observation to be taken in 50 spikes) 6. Percent fruit set (%) 7. Fresh berry yield (kg $vine^{-1}$) 8. Dry berry yield (kg $vine^{-1}$) 9. Percent Bold berries (%) 10. 1000 berry weight (g) 11. Dry Recovery (%) 12. Bulk density (g L^{-1}) 13. Quality Parameter (Piperine, Oleoresin, Essential oil content) 14. Incidence of pest and diseases		

Work done/achievements during 2024-25 (centre-wise)	
Ambalavayal	Terminated due to lack of sufficient crop varieties
Chintapalle	The trial was initiated during 2020 and was observed that, among the black pepper entries, var. kumbakal recorded highest plant height (2.69m) and a greater number of berries per spike (79.33). Panniyur 1 recorded the longest spike length (12.24 cm), highest fresh berry yield/plant (0.37 kg fresh and 0.11 kg dry berry) and dry recovery percentage (30.42%)
Dapoli	The trial was planted in November 2018 with gap filling and replanting carried out during 2022 and 2023. Plant height ranged from 2.18 to 3.70 m. The maximum plant height was recorded in OPKM (3.70 m), which was at par with Panniyur-1 (3.42 m), while the minimum was observed in IISR Thevam (2.18 m). The highest fresh berry

	weight (0.646 kg) and dry berry weight (0.234 kg) were obtained in OPKM, followed by HP-780. Maximum recovery was noted in Panniyur-1 (36.40%), which was at par with HP-780 (36.25%).
Kozhikode	Among enties evaluated at IISR EF, Peruvannumuzhi, HP 117 x Thommankodi recorded highest yield followed by OPKM. Long spike was observed in Kurimalai followed by HP 117 x Thommankodi. Highest no; of berries per spike was recorded in HP 117 x Thommankodi followed by Kurimalai and Kumbakal.
Panniyur	During 2024-25, there was significant difference among the treatments with respect to growth and yield parameters. OPKM recorded highest vine height of 5.77 m which was on par with Kurimalai and SV7. Panniyur 1 (161.66) recorded maximum number of branches which was on par with kumbakal (133.33). Significantly highest green berry yield and dry yield per vine was recorded in Kuarimalai (1.37 kg and 0.345kg) which was on par with Panniyur 1 (0.963 kg and 0.32 kg). Dry recovery was significantly superior in HP1411 (34.98%) which was on par with Kumbukkal, OPKM and PRS 137.
Sirsi	Among the different accessions, check Panniyur 1 (2.80m) significantly greater mean height followed by IISR Thevam (2.78m) compared to others. Highest green berry yield was recorded in check Panniyur 1 (0.71kg vine^{-1}) followed by HP 117 X Thommanakodi (0.58 kg vine^{-1})
Yercaud	Among the different entries evaluated, the highest vine length of 3.36 m was recorded in kumbakal. IISR - Thevam recorded the highest spike length of 11.52 cm and the highest number of berries per spike was recorded in Kurimalai (48.90 nos.). The highest green berry yield (0.400 kg vine^{-1}) and dry berry yield (0.12 kg vine^{-1}) were recorded in Panniyur 1.

CARDAMOM

Project Code	CAR/CI/1.1	**Project Title**	Germplasm collection, characterization, evaluation and conservation
Centres	Mudigere, Pampadumpara		
Date of start	2010	**Date of closure/ duration**	Long term
Work done/achievements during 2024-25 (centre-wise)			
Mudigere	A total of 93 germplasm accessions were replanted in the germplasm block for further maintenance, characterization, and evaluation.		
Pampadumpara	A total of 109 cardamom accessions received IC numbers from the National Bureau of Plant Genetic Resources (NBPGR), New Delhi. Additionally, 130 cardamom plants exhibiting uniform bearing were identified, and observations were recorded accordingly.		

Project Code	CAR/CI/3.9	**Project Title**	CVT 2018 on hybrids of cardamom-Series IX
Centres	Appangala, Mudigere, Myladumpara, Pampadumpara, Sakaleshpura		
Date of start	2018	**Date of closure/ duration**	TBD
Experimental details	Design: RBD; Replications:3; Plot size/spacing: 3×3m, 12 plants/plot **Genotypes** 1. (GG×NKE19)×Bold (Appangala) 2. Bold × (GG×CCS 1) (Appangala) 3. GG × NKE 19 (Appangala) 4. MH.C-1 (Myladumpara)		

	5.MH.C-2 (Myladumpara) 6. SHC – 1 (Sakleshpura) 7. SHC-2 (Sakleshpura) 8. PH-13 (Pampadumpara) 9. PH-14 (Pampadumpara) 10. Njallani Green Gold (check)
Observation recorded	1. Plant height (m) 2. Number of tillers 3. Number of bearing tillers 4. Number of panicles 5. Panicle length (cm) 6. Number of capsules 7. Yield (kg ha^{-1})
Work done/achievements during 2024-25 (centre-wise)	
Appangala	During 2024-25, significant differences were observed among the entries for different traits. Hybrid Bold × IC 547219 recorded the highest fresh capsule yield of 2784.1 kg ha^{-1} and the highest dry capsule yield of 517.7 kg ha^{-1}, significantly outperforming all other entries. This was followed by (GG × Bold) × Appangala 1 and SHC-2, which recorded fresh yields of 1310.0 kg ha^{-1} and 1301.7 kg ha^{-1}, and dry yields of 285.1 kg ha^{-1} and 277.2 kg ha^{-1}, respectively. The check variety, Njallani Green Gold, yielded 820.2 kg ha^{-1} (fresh) and 176.6 kg ha^{-1} (dry), both below the performance of several hybrids.
Mudigere	Among the 10 Hybrids, (GG × Bold) × Appangala-1 was observed highest plant height followed by (GG × NKE 19) × Bold. More number of suckers were observed in (GG × NKE 19) × Bold.
Myladumpara	A total of nine hybrids evaluated during 2024-25 in Randomized Block Design (RBD) with three replications and 12 plants per plot adopting a spacing of 3 m x 3 m. The trial showed significant variation among genotypes, with hybrid entry, MHC-1 recording the highest fresh capsule yield (1923.9 kg ha^{-1}), followed by check Njallani Green Gold (1889.5 kg ha^{-1}) and MHC-2 test entry (1797.7 kg ha^{-1}); a similar trend was observed in dry capsule yield, where MHC-1 led with 494.8 kg ha^{-1}, ahead of Njallani Green Gold (485.9 kg ha^{-1}) and MHC-2 (462.3 kg ha^{-1}).
Pampadumpara	Significant differences were observed among the entries for different traits, while plant height and total number of tillers did not show significant variation during 2024-25. MHC2 exhibited the highest yield-related parameters, including the greatest fresh weight (9,927.33 g), highest dry weight (2,186.00 g), and the second highest dry recovery percentage (22.58%). SHC1 recorded the highest dry recovery percentage at 24.24%, and HY14 showed the longest panicle length, measuring 50.00 cm. However, MHC2 was the most susceptible to thrips, with the highest incidence recorded at 9.33, whereas Bold (GG × CCS1) demonstrated good resistance with the lowest thrips incidence of 1.00. Incidence of Azhukal disease was generally low across all accessions, with no significant differences observed. The control variety, GG, showed relatively poor performance, with the lowest dry recovery percentage (13.02%) and below-average fresh and dry weights. High coefficient of variation (CV) values for shoot borer incidence (126.33), number of tillers (117.93) and Azhukal disease incidence (147.75) indicate considerable variability in these traits across replications.
Sakaleshapura	During 2024, data on growth and yield character were recorded and analysed. SHC-2 produced significantly more yield (153.3 kg ha^{-1}) followed by SHC-1 (137.1 kg ha^{-1}).

<table>
<tr><td>Project Code</td><td>CAR/CI/2.1</td><td>Project Title</td><td colspan="2">CVT on Small Cardamom 2024 Series XII</td></tr>
<tr><td>Centres</td><td colspan="4">Appangala, Mudigere, Myladumpara, Pampadumpara</td></tr>
<tr><td>Date of start</td><td>2025</td><td colspan="2">Date of closure/ duration</td><td>TBD</td></tr>
<tr><td colspan="2">Experimental details</td><td colspan="3">Design: RBD; Replications:3; Plot size/spacing: 2×2m,12plants/plot
Genotypes
1. IC 547196 (IISR, Appangala)
2. IC 349340 (IISR, Appangala)
3. IC 349627 (IISR, Appangala)
4. IC584090 (IISR, Appangala)
5. HY 6 (CRS, KAU, Pampadumpara)
6. ICRI 10 (ICRI, Myladumpara)
7. Njallini green gold (National Check)
8. IISR Manushree (Check)</td></tr>
<tr><td colspan="2">Observation recorded</td><td colspan="2">1. Plant height (cm)
2. No. of tiilers per plant
3. No. of bearing tillers
4. No. of leaves per plant
5. Leaf length (cm)
6. Leaf breadth (cm)
7. No. of panicles per plants
8. No. of capsules per panicles</td><td>9. No. of cinncini per panicle
10. No. of seeds per capsule
11. Fresh yield per plant (kg)
12. Dry yield per plant (kg)
13. Capsule length (mm)
14. Capsule breadth (mm)
15. Essential oil (%)
16. Oleoresin (%)
17. Disease and Pest incidence (as per SOP)</td></tr>
<tr><td colspan="5">Work done/achievements during 2025-26 (centre-wise)</td></tr>
<tr><td>Appangala</td><td colspan="4" rowspan="4">All the centres multiplied the CVT planting materials and distributed to trial locations. The experimental plot for the trial was prepared and planting was done during Kharif, 2025.</td></tr>
<tr><td>Mudigere</td></tr>
<tr><td>Myladumpara</td></tr>
<tr><td>Pampadumpara</td></tr>
</table>

<table>
<tr><td>Project Code</td><td>CAR/CI/4.4</td><td>Project Title</td><td colspan="2">Multilocation evaluation of thrips-tolerant cardamom lines</td></tr>
<tr><td>Centres</td><td colspan="4">Appangala, Mudigere, Myladumpara, Pampadumpara, Sakaleshpura</td></tr>
<tr><td>Date of start</td><td>2017</td><td colspan="2">Date of closure/ duration</td><td>TBD</td></tr>
<tr><td colspan="2">Experimental details</td><td colspan="3">Genotypes: 6
1. IC 349362
2. IC 349364
3. IC 349370
4. IC 349606
5. Njallani Green Gold
6. Local check from respective centre
Design: RBD; Replications:4; Plot size/spacing: 3×3m, 12 plants/plot</td></tr>
<tr><td colspan="2" rowspan="2">Observation recorded</td><td colspan="2">1. Fresh yield per plant (kg)
2. Dry yield per plant (kg)
3. Thrips damage on Capsules</td><td>FOCUS TRAITS</td></tr>
<tr><td colspan="3">4. Plant height (m)
5. Number of tillers</td></tr>
</table>

	6. Number of bearing tillers 7. Number of panicles 8. Panicle length (cm) 9. Number of capsules
Work done/achievements during 2024-25 (centre-wise)	
Appangala	Morphological parameters recorded in all the thrips tolerant genotypes during 2025. The average number of tillers of all the genotypes ranged between, 18.78 to 36.21. The genotype IC 349362 (T_3) was recorded with maximum plant height (193.5 cm), highest average number of panicles (27.5), and length of panicle (46.2 cm) and no of capsules (46.3). The average number of panicles of all the genotypes ranged between, 13.2 to 33.6.
Mudigere	The plants were not established at the AICRP (S), Mudigere. The trial may be discontinued
Myladumpara	The trial on thrips tolerance in cardamom, conducted at the experimental farm of ICRI, Myladumpara in 2017, revealed notable differences in thrips incidence among the tested genotypes. Infestation of thrips (nymphs) was assessed in the leaf sheaths of all the lines. Observations on thrips population were recorded at monthly intervals on different cardamom accessions. Among the accessions, IC 349370 has low thrips incidence (0.56 thrips per leaf sheath) than other genotypes indicating a high level of tolerance. This was followed by IC 349606 (0.85), IC 349364 (1.02), and IC 349362 (1.12), all showing moderate levels of resistance. In contrast, the national check Njallani Green Gold exhibited the highest thrips infestation with a mean of 2.57 thrips per sheath, while the local check Appangala 1 also showed higher susceptibility (1.73).
Pampadumpara	Plant height showed highly significant differences between accessions, ranging from 80-210 cm, with Green gold and PV2 consistently showing the highest values (188 cm and 167.33 cm respectively). Number of tillers varied significantly, with IC349364, IC349362, and Green gold showing superior performance (around 38-39 tillers).Bearing tillers showed significant variation, with IC349362 standing out with the highest number (17.67). Panicle length showed significant differences, with Green gold having the highest mean (42 cm). Thrips damage showed significant variation, with Green gold being most susceptible (15.67 mean damage score). Borer and Azhukal damage showed high variability (CV > 100%). Plant height and panicle length showed relatively low coefficients of variation (CV of 15.28% and 14.277% respectively), indicating these are more stable traits across observations. Green gold showed highest values for plant height and panicle length but was most susceptible to thrips. IC349362 performed best for bearing tillers. IC349606 and IC349370 showed the best resistance to thrips damage (0.00).
Sakaleshapura	The fifth-year evaluation (2024-25) of thrips damage on capsule yield, conducted at ICRI Spices Board, Sakleshpur, revealed clear differences in tolerance levels among the entries. IC 349364 recorded the lowest mean thrips damage on capsules (33.8%), indicating better tolerance, followed by IC 349606 (37.1%) and IC 349370 (39.2%). In contrast, ICRI 8 showed the highest susceptibility, with a mean damage percentage of 50.9%, while the popular variety Njallani exhibited moderate damage at 40.4%.

Project Code	CAR/CI/4.5	**Project Title**	MLT on leaf blight tolerant lines of small cardamom
Centres	Appangala, Myladumpara, Pampadumpara, Sakleshpur, Mudigere		
Date of start	2017-18	**Date of closure/ duration**	TBD
Experimental details	Leaf blight resistant accessions: IC – 349650 IC – 547222, IC – 547223, IC – 547156, IIC – 349649, IC – 349648 Susceptible check: IISR Vijetha Resistant checks: Appangala 1, Njallani Green Gold 1.		
Observation recorded	1. Fresh yield per plant (kg) 2. Dry yield per plant (kg) 3. Leaf Blight Disease (PDI)	**FOCUS TRAITS**	
	4. Plant height (m) 5. Number of tillers 6. Number of bearing tillers 7. Number of panicles 8. Panicle length (cm) 9. Number of capsules		

Work done/achievements during 2024-25 (centre-wise)	
Appangala	The trial with all the entries has been planted in 2020 and established under field. The PDI of of leaf blight for fourth year have been recorded twice and the mean was calculated. Among the entries, IC547222 and Njallani Green Gold showed lowest disease incidence of 11.67% followed by Appangala 1, IC547156 and IC349649, IISR Vijetha recorded maximum PDI of 23.33%.
Myladumpara	During 2024, data on growth characters such as tillers/clump, tiller height (cm) and percent disease index (PDI) were recorded. Leaf blight incidence, measured as PDI, varied considerably among the evaluated cardamom genotypes. The highest PDI of 10.95was recorded in IISR Vijetha, the susceptible check, confirming its known susceptibility to leaf blight. Among the test genotypes, IC 349649 showed relatively higher susceptibility with a mean PDI of 8.38, while IC 349650, IC 547156, and IC 547222 recorded moderate PDI values ranging from 7.46 to 7.64. In contrast, the lowest PDI was observed in Njallani Green Gold, one of the resistant checks, with a mean PDI of 6.14, followed by IC 349648 (6.51) and Appangala 1 (6.78). These results suggest that Njallani Green Gold and Appangala 1 continue to exhibit stable resistance to leaf blight, while IISR Vijetha remains a reliable susceptible standard.
Pampadumpara	In this experiment, a total of six cardamom accessions, namely IC 349650, IC 547222, IC 547223, IC 547156, IC 349649, and IC 349648, have been evaluated alongside three check varieties: IISR Vijetha (susceptible check), Appangala 1, and Green Gold (resistant check). The entries are giving stabilized yield and observation on blight characters and yield characters are taking regularly. The experiment shows good precision with relatively low CV (Coefficient of Variation) for most traits, particularly plant height (15.3%) and number of panicles (14.28%). However, there was higher variability in bearing tillers (CV = 35.79%) and yield parameters. Plant height showed significant differences at 5% level but not at 1% level, with IC547156 and IC349648 showing superior height (289.67 cm and 276.67 cm respectively). Number of tillers and panicles showed highly significant differences (significant at both 5% and 1% levels). Oil content

	displayed significant variations, with IC547222 showing significantly higher content (6.233%) compared to other accessions. GG accession showed superior performance in yield parameters, with highest fresh capsule yield (6377.33 g) and dry capsule yield (1726.91 kg/ha). IC547222 stood out for oil content (6.233%), IC349648 consistently performed well across multiple traits, showing good plant height, number of tillers (50), and be.
Sakleshpura	Among the accessions, considerable variability found for leaf blight incidence (measured as PDI) among the cardamom entries. The lowest mean PDI (8.9%) was recorded in IC 547222, indicating high resistance, followed closely by IC 349650 and IC 547156 (both at 10.0%). In contrast, the highest incidence (26.7%) was observed in the susceptible check IISR Vijetha, confirming its vulnerability. Resistant checks like Appangala 1 (20.0%) and Njallani Green Gold (22.2%) had moderate PDI values.
Mudigere	The plants were not established at the AICRP (S), Mudigere. The trial may be discontinued.

LARGE CARDAMOM

Project Code	LCA/CI/1.1	**Project Title**	Germplasm collection and evaluation of large cardamom
Centres	ICAR Regional Station, Gangtok, ICRI Regional Research Station, Gangtok		
Date of start	2008-09	**Date of closure/ duration**	Long term
Work done/achievements during 2024-25 (centre-wise)			
ICAR Regional Station, Gangtok	Germplasm exploration survey was carried out in Sikkim and two new accessions were collected in collaboration with ICRI, Tadong. Characterisation and evaluation of existing germplasm has been initiated.		
ICRI Regional Research Station, Gangtok	The germplasm conservation program, initiated during 2009–10, has led to the collection and maintenance of a total of 59 germplasm accessions in the conservatory. In 2024, two new germplasm collections were made from the Sikkim region, namely 'Ramla' from Shagyong, Dzongu of Mangan District, and 'Hario Golsey' from Gor Busty, Dzongu, Mangan District.		

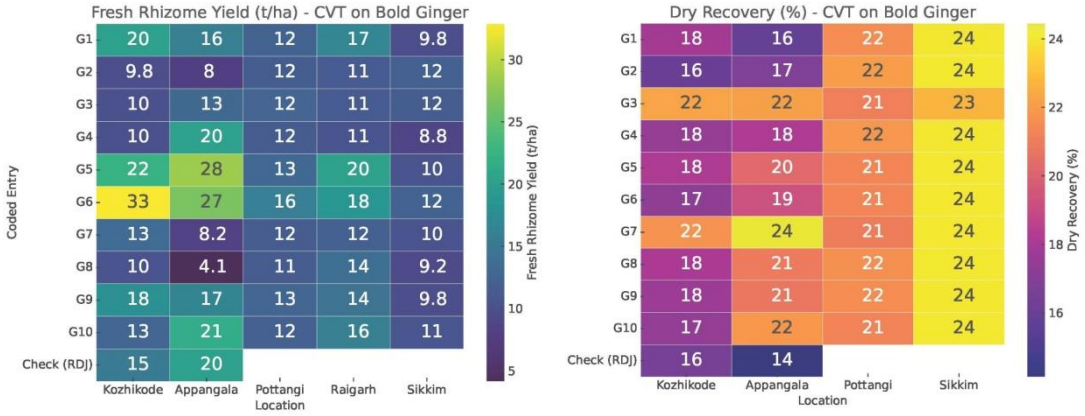
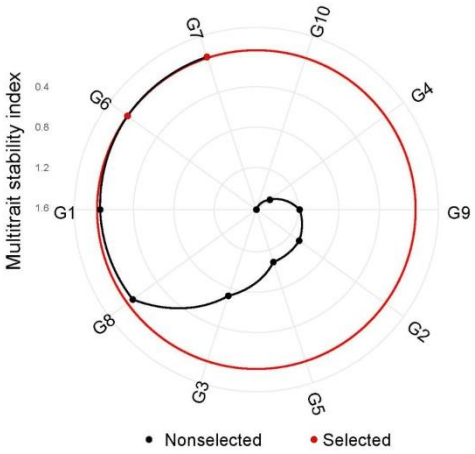
Project Code	LCA/CI/2.1	**Project Title**	CVT on large cardamom 2023 – Series I
Centres	ICAR Regional Station, Gangtok, ICRI Regional Research Station, Gangtok, RRS, UBKV, Kalimpong		
Date of start	2023-24	**Date of closure/ duration**	3 years
Experimental details	Design: RBD; Replications:3; Plot size/spacing: 30 m^2 per entry, spacing- 5 ft x 5 ft **Genotypes (10 nos.)** 1. SCC 216 (Ramla) 2. SCC 217 (Ramla) 3. SCC 213(Golsey) 4. SCC 214 (Golsey) 5. SCC 242 (Ramsey) 6. SCC 264 (Sawney) 7. SCC 307 (Varlangey) 8. ICRI Sikkim 1 (National Check) 9. Local Check//Farmers Traditional cultivar (Sawney) 10. Zonal Check/Farmers Traditional cultivar (Seremna)		

<table>
<tr><td colspan="2">Observation recorded</td><td>Plant Morphological and agronomic data
1. Plant height (cm)
2. Number of leaves/tiller
3. Number of tillers/clump
4. Number of productive tillers
5. Leaf length (cm)
6. Leaf breadth (cm)
7. Number of days to flowering
8. Number of days to maturity
9. Number of spike/clump
10. Number of capsule/spike
11. Number of seed/capsule
12. Fresh yield/ plant (g) and per hectare (kg)
13. Dry yield/plant (g) and per hectare (kg)
14. Diseases and insect pests (if any)
15. Quality aspects such as color and grade of the capsules, oil content etc.
16. Economics. BC ratio
Weather parameters
1. Maximum & minimum temperatures
2. Maximum & minimum humidity
3. Rainfall
4. Rainy days
5. Others
Edaphic factors
1. pH
2. Nutrient status
3. Other physico - chemical parameters of soil
Nutrient applied (N, P, K & others)</td></tr>
<tr><td colspan="3">Work done/achievements during 2024-25 (centre-wise)</td></tr>
<tr><td>ICAR Regional Station, Gangtok</td><td colspan="2">Among the treatments, T_8 (National Check – ICRI Sikkim-1) recorded the tallest plants (65.2 cm). The highest number of tillers per clump (5.3) was observed in T_2 (SCC 217), while T_1 (SCC 216) registered the maximum number of leaves per tiller (4.4) and the widest leaf breadth (8.2 cm). The longest leaves (28.3 cm) were noted in T_6 (SCC 264). Observations on insect pest and disease incidence were also documented as part of the cultivar evaluation trial.</td></tr>
<tr><td>ICRI Regional Research Station, Gangtok</td><td colspan="2">The growth trend of the treatments showed that the highest number of productive tillers per clump was recorded in T_6 (7.1), followed by T_1 (6.6) and T_5 (6.0). Similarly, spike production per clump was highest in T_6 (8.0), with T_1 (6.5) and T_5 (5.1) following. The number of leaves per tiller was maximum in T_5 (10.0), closely followed by T_6 and T_{10}, each with 9.5 leaves per tiller. Regarding disease incidence, leaf blight caused by Colletotrichum spp. was most severe in T_3 (24.2%), followed by T_4 (20.7%) and T_7 (9.2%), while no major insect pest infestations were noted except for leaf caterpillar.</td></tr>
<tr><td>Spice Board alternate location at RRS, UBKV, Kalimpong</td><td colspan="2">Since CAU Pasighat in Arunachal Pradesh was found unsuitable for large cardamom cultivation, the trial was shifted to ICAR-KVK, Anjaw; however, the crop failed due to damage caused by wild animals during 2023-24. Consequently, as per the proceedings of the XXXV Annual Group Meeting held in 2024, an alternative site was identified, and a new CVT on large cardamom was initiated at RRS, UBKV, Kalimpong under spice board and ICRI-Gangtok, where planting has been completed and soil samples collected for physico-chemical analysis.</td></tr>
</table>

GINGER

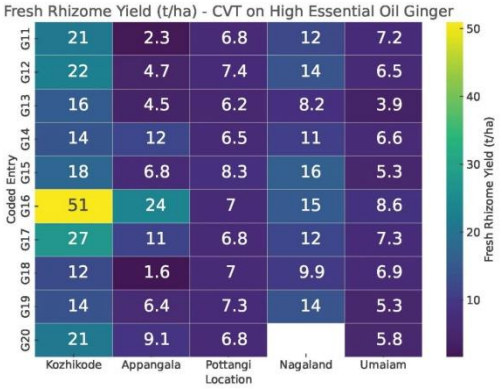
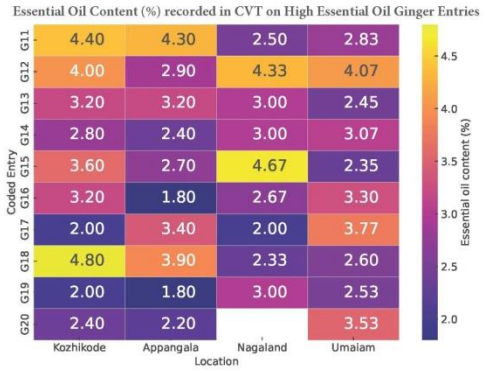
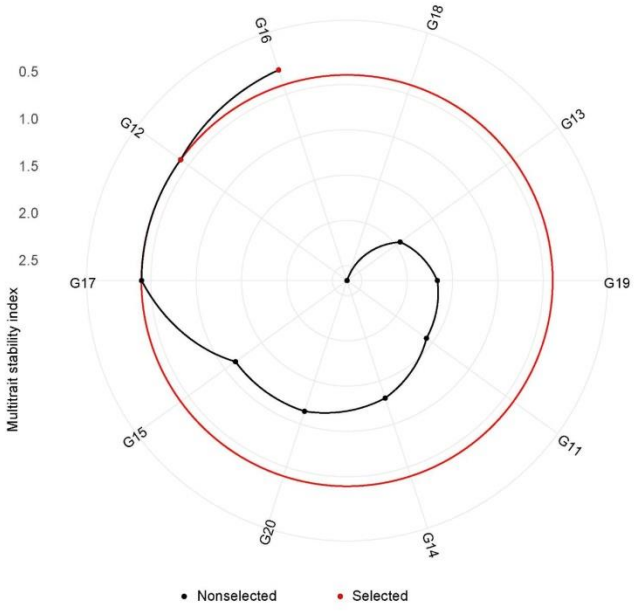
Project Code	GIN/CI/1.1	**Project Title**	Germplasm collection, characterization, evaluation and conservation
Centres	Barapani, Dholi, Kumarganj, Pottangi, Pundibari, Raigarh, Solan		
Date of start	1993	**Date of closure/ duration**	Long term
Work done/achievements during 2024-25 (centre-wise)			
Barapani	Thirty two (32) accessions of ginger having Accession No. from IC-584322 to IC-584364 were maintained and evaluated. Among the accessions wider variability was observed for all the agro morphological traits. The plant height ranged from 57.10cm – 76.03cm, and the highest plant height was recorded in IC-584332 (76.03cm) followed by IC-584327(74.57cm). Likewise, leaf length ranged from 21.53 cm to 25.80cm and the highest length was observed in IC-584345 (25.80cm), followed by IC-584334 (25.70cm), while IC-584332 also recorded the highest leaf breadth (2.9cm). The number of tillers per plant ranged from 3.33-6.00 and the maximum number of tillers was in IC-584327 (6.00) followed by IC-584335 (5.67). Similarly, the highest number of leaves per plant was recorded highest in IC-584332 (52.00) followed by IC-584335 (51.67) and the lowest in IC-584338 (33.67). Further, yield per plant ranged from 120.98-333.75 g and highest yield per plant was recorded from the accession IC-584361 (333.75g) followed by IC-584338 (289.61g). IC-584361 (15.28 t) also recorded the highest yield in terms of t/ha. After biochemical analysis, the highest oleoresin content was recorded in IC-584334 (6.05%) followed by IC-584336 (5.46%), while IC-584344 recorded the highest dry matter content (21.7%). However, the highest essential oil (3.40%) was found highest in IC-584325.		
Dholi	Among 39 + 1 check ginger accessions evaluated, accession RG-57 and RG-36 registered highest yield of (22.80 t ha^{-1}) followed by RG-36 (21.66 tha^{-1}) as compared to check variety, Nadia (17.85 t ha^{-1}).		
Kumarganj	A total of 188 collected germplasm were maintained and evaluated at the station. Out of these NDH-126 (295 g $plant^{-1}$), NDH-53 (287 g $plant^{-1}$) and NDH-147 (278 g $plant^{-1}$) gave higher yield.		
Pottangi	Out of 198 gingers germplasm studied, 32 entries yielded more than 5 kg fresh rhizomes per $3m^2$ plots with the mean yield of 3.9 kg/$3m^2$ during 2024-25. The range of plot yield being 0.68 kg/3 m^2 (PGS-119) to 9.2 kg/3 m^2 (S-62) in tested germplasms		
Pundibari	Forty (38 germplasm + 2 released varieties) germplasm of ginger were maintained during 2024-25 at Pundibari centre, Uttar Banga Krishi Viswavidyalaya. Two new ginger genotypes collected in the year 2022-23 from Manikchak, Malda (GCP 58) and Suripara, Alipuduar (GCP 59) at Pundibari Centre. These lines planted and charaterized from 2023-24. In this year 2024-25 these two lines showed yield of 13.5 t/ha and 11.0 t/ha respecteively and moderartely resistance to rhizome rot and wilt disease		
Raigarh	At present at AICRP on Spices, CARS, Raigarh total 40 (38 germplasms and two checks Suprabha and Suruchi) germplasms of Ginger maintained. For fresh rhizome yield ginger genotypes IG 16 (18 t ha^{-1}); IG 7 (16.5 t ha^{-1}) & IG-15 (16 t ha^{-1}) superior over checks Suruchi (12 t ha^{-1}), Suprabha (13 t ha^{-1})		
Solan	Among a total of 40 ginger genotypes were evaluated at the Solan centre, SG19-11 recorded the highest fresh rhizome yield of 217.55 g/plant, followed by SG19-14 (187.96 g/plant) and SG19-29 (184.65 g/plant). Highest oleoresin content was observed in SG19-32 (5.32%), SG19-05 (5.09%), and SG19-36 (4.88%).		

Project Code	GIN/CI/2.6	**Project Title**	CVT on bold ginger trial Series-2023.
Centres	Appangala, Kozhikode, Pottangi, Raigarh, Sikkim.		
Date of start	2023	**Date of closure/ duration**	3 years
Experimental details	Design: RBD; Replications:3; Plot size/spacing: 3×1m, spacing- 25x 25 cm Genotypes (10) 1. G2023-01 2. G2023-02 3. G2023-03 4. G2023-04 5. G2023-05 6. G2023-06 7. G2023-07 8. G2023-08 9. G2023-09 10. G2023-10		
Observation Recorded	1. Sprouting percentage 2. Plant population at 50 DAS 3. Plant height (cm) 4. Number of tillers per clump 5. Fresh weight of clump (g) 6. Fresh rhizome yield per ha (t) 7. Dry rhizome yield per ha (t) 8. Dry recovery (%) 9. Boldness of rhizome 10. Fiber content 11. Oleoresin (%) 12. Essential oil (%) 13. Disease (bacterial wilt, rhizome rot) and pest (shoot borer) incidence, if any		
Work done/achievements during 2024-25 (centre-wise)			
PC Cell (*kharif*-2024 data analysis)	During 2024-25 trial was taken up with 10 entries and a check variety, *Rio de janerio* at Appangala, Kozhikode, Pottangi, Raigarh, and Sikkim centres with key traits fresh rhizome yield and boldness. **Mean performance of enties for fresh rhizome yield and dry recovery** CVT on bold ginger showed that entry **G2023-6** recorded the highest mean fresh rhizome yield (21.21 t ha^{-1}), followed by **G2023-5** (18.89 t ha^{-1}) and the check variety *Rio de* Janeiro (*RDJ*) (17.72 t ha^{-1}). In terms of dry recovery, **G2023-7** ranked highest (22.78%), closely followed by **G2023-3** (22.04%) and **G2023-8** (21.15%). While **G2023-6** led in fresh rhizome yield, **G2023-7** stood out for its superior dry recovery percent, making it a promising entry for both vegetable ginger yield as fresh rhizome yield and post-harvest quality in terms of dry recovery. **Multi-Triat Selection Index** Multi-Trait Stability Index (MTSI) analysis for CVT on bold ginger trial, considering *Fresh Rhizome Yield (FRY)* and *Dry Recovery % (DR)*, revealed that genotypic effects were non-significant for FRY ($p = 1.0 \times e^{+00}$) and DR ($p = 4.25e^{-01}$), indicating limited genetic variation in submitted entries, while the G×E interaction was highly significant for both traits (FRY: p = $1.2e^{-306}$; DR: p = $1.04e^{-77}$), suggesting differential performance of entries across environments. This justifies the application of MTSI to		

	 identify genotypes with high mean performance and stability. PCA showed that PC1 and PC2 explained 100% of the total variation, with PC1 alone accounting for 64.8%, indicating that FRY and DR are correlated but not redundant. Factor analysis after rotation revealed high factor loadings (|0.805|) for both traits on the same factor (FA1), with opposite signs (FRY: -0.805; DR: 0.805), suggesting a moderate trade-off between yield and dry recovery, where genotypes with very high yield might have slightly lower dry recovery. The communalities were 0.648 for both traits, indicating that approximately 65% of their variance is explained by the common factor. Based on the WAASB (stability-weighted) index, the mean of FRY decreased from 38.5 to 36.4 (selection differential −2.11; −5.47%) and DR decreased from 44.0 to 41.5 (−2.46; −5.60%) among the selected entries, which reflects the trade-off expected when stability is prioritized over extreme performance. When considering the mean of the variables, FRY exhibited moderate heritability (h^2 = 0.636) with a genetic gain of −0.346 (−2.49%), while DR had low heritability (h^2 = 0.333) with a genetic gain of −0.033 (−0.158%), indicating that FRY is under better genetic control whereas DR is more influenced by environmental factors. Overall, based on the MTSI threshold (SI = 20), genotypes **G7** and **G6** were identified as the best-performing and most stable entries, combining desirable performance for both FRY and DR across environments. 
Appangala	During 2024-25 trial was taken up with 10 entries and a check variety, Rio de janerio at Appangala. Morphological and yield parameters were recorded. Among entries evaluated, entry G-2023-5 exhibited highest fresh rhizome yield, (28.46 t ha^{-1}), markedly surpassing local check cultivar RDJ (20.00 t ha^{-1}) followed by G-2023-6 (26.66 t ha^{-1}) and G-2023-10 (21.34 t ha^{-1}). In terms of dry matter recovery, G-2023-7 recorded the maximum recovery percentage (24.45%), closely followed by G-2023-3 (22.13%). Notably, G-2023-5, the highest yielding genotype, also demonstrated a favourable dry recovery of 20.28%, outperforming the check RDJ, which recorded a recovery of 14.13%.
Kozhikode	The results of the CVT on bold ginger genotypes (2024–25) revealed significant variation in morphological and yield parameters. Plant height ranged from 66.23 cm (G-2023-3) to 77.83 cm (G-2023-7). Rhizome thickness varied from 2.12 cm (G-2023-3) to 2.97 cm (G-2023-1) G-2023-6 recorded highest fresh rhizome yield (32.88 t ha^{-1}),

	substantially exceeding both the local check RDJ (15.44 t ha^{-1}) and all other test entries, followed by G-2023-5 (22.30 t ha^{-1}) and G-2023-1 (19.99 t ha^{-1}). In terms of dry recovery percentage, G-2023-3 exhibited highest recovery (22.20%), followed by G-2023-7 (21.67%) and G-2023-10 (17.43%).
Pottangi	First year of trial is initiated during 2024-25 in replication. It was found that G 2023-6 (15.8 t ha^{-1}) was top yielder among test entries followed by G 2023-5 (13.0 t ha^{-1}) during 2024-25.
Raigarh	Evaluation of CVT bold ginger during *Kharif* 2024-25 revelated that all the entries were highly susceptible to rhizome rots disease after 60 days of germination. For yield G-2023-5 (20 t ha^{-1}) recorded highest fresh rhizome yield followed by G-2023-6 (18 t ha^{-1}) and G-2023-1 (16.5 t ha^{-1}).
Gangtok	Maximum fresh rhizome yield (12.3 t/ha) was found in G2023-6 which was statistically at par with G2023-2 and G2023-3 but significantly higher than remaining genotypes, respectively. Ginger genotype G2023-6 followed by G2023-2 and G2023-3 performed better under organic management condition in Sikkim Himalayas

Project Code	GIN/CI/2.7	**Project Title**	CVT on high essential oil ginger genotypes.
Centres	Appangala, Kozhikode, Nagaland, Pottangi, Umiam,		
Date of start	2023	**Date of closure/ duration**	3 years
Experimental details	Design: RBD; Replications:3; Plot size/spacing: 3×1m, spacing- 25x 25 cm Genotypes (10) 1. G2023-11 2. G2023-12 3. G2023-13 4. G2023-14 5. G2023-15 6. G2023-16 7. G2023-17 8. G2023-18 9. G2023-19 10. G2023-20		
Observation Recorded	1. Sprouting percentage 2. Plant population at 50 DAS 3. Plant height (cm) 4. Number of tillers per clump 5. Fresh weight of clump (g) 6. Fresh rhizome yield per ha (t) 7. Dry rhizome yield per ha (t) 8. Dry recovery (%) 9. Boldness of rhizome 10. Fiber content 11. Oleoresin (%) 12. Essential oil (%) Disease (bacterial wilt, rhizome rot) and pest (shoot borer) incidence, if any		
Work done/achievements during 2024-25 (centre-wise)			
PC Cell (*kharif*-2024 data	During 2024-25 trial was taken up with 10 entries including a check variety, *Aswathy* at Appangala, Kozhikode, Pottangi, Nagaland, and Umaiam centres with		

analysis)	key traits fresh rhizome yield and high essential oil content. **Mean performance of enties for fresh rhizome yield and high essential levels** CVT on high essential oil ginger showed that entry **G2023-16** recorded the highest mean fresh rhizome yield (21.15 t ha^{-1}), followed by **G2023-5** (12.97 t ha^{-1}). In terms of essential oil content, **G2023-12** ranked highest (3.83%), closely followed by **G2023-11** (3.51%) and **G2023-18** (3.41%). While **G2023-16** led in fresh rhizome yield, **G2023-12** stood out for its superior oil level and dry recovery percent.   ## Multi-Trait Selection Index (MTSI) Analysis Summary MTSI analysis for the CVT on high essential oil ginger, involving Fresh Rhizome Yield (FRY)**,** Dry Recovery (DR)**,** and Essential Oil content (EO)**,** revealed significant genotype × environment interactions for all three traits (FRY: p = 0.027; DR: p = 0.742; EO: p = 0.467 for genotypic effect; G×E interaction: all p < 2.7e-81), indicating that genotypes responded differently across environments and justifying the use of MTSI for stability-based selection.Principal Component Analysis (PCA) showed that the first two components captured 91.6% of the total variation**,** with PC1 and PC2 explaining 57.6% and 34.0% resp.**,** confirming that most trait variability is well captured in the analysis. Factor analysis after rotation revealed that FRY loaded strongly on Factor 2 (FA2: 0.994)**,** while DR (0.932) and EO (0.919) were highly associated with Factor 1 (FA1)**.** High communalities (mean = 0.916) indicated that the factors reliably represented all traits. The selection differentials based on the WAASB index showed substantial expected genetic gains: FRY increased from 31.3 to 61.2 (+95.8%), EO from 46.7 to 64.2 (+37.4%), and DR from 49.2 to 59.0 (+19.9%). When evaluating selection differential using trait means and heritability, FRY showed the highest heritability (h^2 = 0.654) and selection gain (+28.9%), suggesting strong genetic control, while DR (h^2 = 0.157) and EO (h^2 = 

	0.309) were more influenced by environmental variation. Overall, based on the MTSI cutoff (SI = 20), entries **G16 and G12** were identified as the most promising and stable entries, combining high fresh rhizome yield, better dry recovery, and elevated essential oil content across testing environments.
Appangala	During 2024-25, among ten entries evaluated, G-2023-16 recorded highest fresh rhizome yield of 23.70 t ha^{-1}, followed by G-2023-14 with 11.84 t ha^{-1} and G-2023-17 with 11.44 t ha^{-1}. For essential oil content, highest value was reported in G-2023-11 (4.3%), followed by G-2023-18 (3.9%) and G-2023-17 (3.4%), while entries such as G-2023-16 (1.8%) and G-2023-19 (1.8%) exhibited lowest oil content. In terms of dry recovery percentage, G-2023-13 recorded highest value of 24.04%, followed by G-2023-14 (23.17%) and G-2023-15 (22.34%).
Kozhikode	G-2023-16 was the most productive genotype, with fresh rhizome yield of 50.98 t/ha, followed by G-2023-17 (27.40 t/ha), G-2023-12 (22.46 t/ha) and G-2023-11 (21.32 t/ha). The essential oil content was highest in G-2023-18 (4.8%), followed by G-2023-11 (4.4%) and G-2023-12 (4.0%). Conversely, genotypes such as G-2023-17 (2.0%) and G-2023-19 (2.0%) showed relatively lower oil yields.For dry recovery, G-2023-17 recorded the highest percentage (21.8%), followed closely by G-2023-12 (20.95%) and G-2023-11 (19.75%).
Nagaland	Entry T_5 (G2023–15) recorded the highest sprouting percentage (83.06%) and maintained the highest plant density (19.94 to 19.67 plants m^{-2}) along with the highest tiller count (5.00 at 120 DAP and 8.53 at 150 DAP). T_{10} (G2023–20) exhibited the tallest plants across all stages (79.67 cm at 180 DAP) and also recorded the highest yield at 200.93 g $clump^{-1}$, followed by T_5 with 147.73 g $clump^{-1}$. Fresh ginger oil content ranged from 1.93% to 4.67%, with T_5 again leading at 4.67%, while the highest oleoresin content (7.77%) was also found in T_5, followed by T_1 (6.35%). Dry recovery varied from 18.71% to 24.83%, and maximum fibre accumulation was recorded in T_8 (7.27%) followed by T_3 (6.88%). Genotype T_5 consistently performed well across multiple traits, showing promise for both yield and quality
Pottangi	First year of trial is initiated during 2024-25 in replication. It was found that G 2023-15 (8.3 t ha^{-1}) was top yielder among test entries followed by G 2023-12 (7.4 t ha^{-1}) during 2024-25.
Umiam	Eleven (11) accessions were evaluated for growth, yield and quality parameters. Highest sprouting % (99.17%) was found in G 2023-12, while the highest plant height as well as number of tillers were recorded in G 2023-20 (72.73 cm) and (6.00) respectively. The fresh weight/clump (199.10g) and yield t/ha (8.63 t/ha) were found highest in G 2023 -16.

TURMERIC

Project Code	TUR/CI/1.1	**Project Title**	Germplasm collection, characterization, evaluation and conservation	
Centres	Barapani, Coimbatore, Dholi, Guntur, Kammarpally, Kumarganj, Pasighat, Pottangi, Pundibari, Raigarh, Solan			
Date of start	1999	**Date of closure/ duration**		Long Term
Work done/achievements during 2023-24 (centre-wise)				
Barapani	Twenty nine (29) accessions of turmeric were evaluated at ICAR Research complex for NEH Region Umiam, Meghalaya. Among the accessions, the plant height ranged from 83.67.-96.23 cm. The highest plant height was recorded in IC-586763 (96.23 cm) followed by IC 586777 (95.40cm). Likewise, leaf length (49.76 cm) and breadth (17.00cm) was highest in IC-			

	586763 and lowest in IC-586749 (43.07 cm and 13.30 cm) respectively. Moreover, IC-586763 also recorded the highest no. of leaves (14.00). However, the no. of tillers was found highest in IC-586757 (3.67). As far as yield is concerned, the high yielding accessions were IC-586755 (344.65 g/plant) followed by IC-586764 (335.01). Likewise, yield t/ha was also found highest in IC-586755 (16.80t), while highest curcumin content was recorded in IC-586759 (5.75%). Dry matter content (22.1%) was found to be highest in IC-586765.
Coimbatore	A total of 277 genotypes maintained in the germplasm were raised in the field condition during 2024 - 25. A set of 200 genotypes were evaluated for fresh rhizome yield per plant, dry rhizome yield per plant, dry recovery per cent and total curcuminoid content. Among the 200 genotypes evaluated, CL 180 recorded the highest fresh rhizome yield per clump (658 g plant^{-1}) followed by CL 171 (650 g plant^{-1}). Dry recovery per cent among the 200 genotypes was highly significant. The highest dry recovery was recorded in CL 9 (21.75 %) followed by CL 5 (21.50%).
Dholi	Among 70+2 check turmeric accessions evaluated, accession RH-414 recorded highest yield of (52.80 t ha^{-1}) followed by RH-50 (50.40 t ha^{-1}) as compared to check variety, Rajendra Sonali (48.00 t ha^{-1}).
Guntur	During 2024-25, Seventy two turmeric germplasm lines evaluated LTS-68 (603.60 g clump^{-1}) and LTS-58 (600.00 g clump^{-1}) recorded significantly higher fresh clump weight over the best check Lam Swarna (438.97 g clump^{-1}). Further, Seventy seven clones were evaluated under ABD. Out of which, CL-27 recorded highest fresh clump weight (723.20 g clump^{-1}).
Kammarapally	During 2024–25, a total of 318 germplasm lines were maintained and evaluated for growth and yield using DUS descriptors. From these, 50 high-yielding lines were selected for further assessment of dry recovery and curcumin content. Among them, JTS-605 recorded the highest yield of 63.25 t ha^{-1}, followed by JTS-314 (60.37 t ha^{-1}) and JTS-154 (54.0 t ha^{-1}), outperforming the local check. In terms of quality traits, CLI-129/6 showed the highest dry recovery (28.76%), while KTS-10 recorded the highest curcumin content at 3.50%.
Kumarganj	A total 57 turmeric germplasm accessions collected are maintained and evaluated at the station. Promising germplasm were NDG-23 (146.23 g plant^{-1}) followed by NDG-28 (137.38 g plant^{-1}) and NDG-35 (128.35 g plant^{-1}).
Pasighat	Among the 75 diverse collections from the NE region evaluated, the maximum fresh rhizome yield per plant and estimated rhizome yield per hectare were recorded in genotype CHFT-36 (270.06 g, 28.27 t ha^{-1}) which was statistically at par with CHFT-8 (261.05 g, 28.05 t ha^{-1}) and CHFT-56 (256.02 g, 27.66 t ha^{-1}).
Pottangi	Among 200 turmeric accessions evaluated in 2024-25 at HARS, Pottangi, 62 entries yielded more than 5 kg fresh rhizome yield from 3m^2 plot and 23 entries with more than 10 kg from 3m^2 bed. The range in fresh rhizome yield per plot in *C. longa* was varied from 2.5 kg/3m^2 (TU-4) to 17.6 kg/3m^2 (PTS-3) with the mean of 5.4 kg/3m^{2}among tested germplasms. The projected yield was ranged from 5.6 t/ha (TU-4)-37.3 t ha^{-1} (PTS-3) with the mean of 12.0 t ha^{-1} during 2024-25.
Pundibari	A total 181 (179+2) numbers of turmeric gerplasm were planted and maintained during 2024-25 at Pundibari Centre, Uttar Banga Krishi Viswavidyalaya. Thirty-two (32) genotypes recorded higher rhizome yield above 35 t/ha; 15 genotypes showed rhizome yield between 30 t ha^{-1} to 35 t ha^{-}

	[1] and 17 genotypes recorded rhizome yield between 25 t ha^{-1} to 30 t ha^{-1}. In respect to disease resistance 62 germplasm showed low leaf botch disease incidence (PDI 0.00 to 10) i.e. they are highly resistance to leaf blotch and 65 germplasm showed low leaf spot (PDI 0.00 to 10) disease incidence i.e. they are highly resistance to leaf spot.Two new turmeric genotypes were collected in the year 2023-24 from Malda and Kalimpong districts at Pundibari Centre. These lines were charaterized during 2024-25. The rhizome yield of these two lines recorded 19.57 t ha^{-1} and 23.04 t ha^{-1}, respectively.
Raigarh	The indigenous turmeric germplasm was classified into three maturity groups based on days to maturity and rhizome yield. In the mid-early group (<200 days), IT 15 and IT 99 matured earliest (186 days), while IT 25 recorded the highest yield (40.4 t ha^{-1}), outperforming checks IISR Prathibha (28.3 t ha^{-1}) and Roma (14.1 t ha^{-1}). In the medium group (201–220 days), IT 25 again had the highest yield (39.3 t ha^{-1}), followed by IT 37 and IT 52, all superior to the checks. In the late group (>221 days), IT 59 produced the highest yield (46.8 t ha^{-1}). During *Kharif* 2024, 1000 SPS of three turmeric varieties were maintained, and 2–4 quintals of nucleus seeds were harvested, while breeder seed production of CG Haldi-2 and CG Raigarh Haldi-3 was also initiated with expected yields of 2–2.5 tons for Kharif 2026. Seven germplasm of mango ginger and seven indigenous accessions of black turmeric were also maintained at CARS, Raigarh.
Solan	Among 40 turmeric genotypes were evaluated at the Solan centre, ST19-27 recorded the highest fresh rhizome yield of 393.13 g/plant with 4.08% curcumin content, followed by ST19-22 (375.54 g/plant, 3.92%) and ST19-15 (361.97 g/plant, 3.64%). Notably, genotype ST19-04 exhibited the highest curcumin content (6.65%) with a moderate yield of 212.83 g/plant. Other promising genotypes with high curcumin content included ST19-25 (5.65%), ST19-26 (5.63%), and ST19-33 (5.08%).

Project Code	TUR/CI/1.2	**Project Title**	Evaluation of turmeric somaclones and seedling progenies for superior agronomic traits & regional adaptation Series-I
Centres	Coimbatore, Guntur		
Date of start	2024-25	**Date of closure/ duration**	2025-26
Experimental details	No. of entries & checks: 61+2; Please refer proceedings of 35th AGM page: 47; No of Plots: 75; Design: ARBD; No. of replications: one; Plot size: 1 x 1m^2; spacing of 30 x 30 cm		
Observation Recorded	1. Plant height (cm) 2. Leaf length (cm) 3. Leaf Width (cm) 4. No. of leaves per clump 5. Number of tillers per clump 6. Days to maturity 7. Rhizome core color (Colour value as per RHS) 8. Fresh weight of clump (g) 9. Fresh rhizome yield /ha (t) 10. Dry rhizome yield /ha (t) 11. Dry recovery (%) 12. Curcumin content (%) 13. Oleoresin (%)		

	14. Essential Oil (%) 15. Disease and Pest Incidence: If any against- Rhizome rot/Leaf spot or blotch/Shoot borer as per the screening protocol given by AICRPS (http://14.139.189.27/AICRPS/OP/SC.pdf)
Work done/achievements during 2024-25 (centre-wise)	
Coimbatore	The trial was taken up in Augmented replicated block design with 75 genotypes. The genotype 138/74/10 recorded a plant height of 58.40 cm with a mother rhizome weight of 30.20g with a total weight of 75.50 g followed by 138/74/23 recorded a plant height of 54.40 cm with atotal weight of 72.20g. however the weight of the rhizome was recorded maximum in check varieties 375 g in IISR Pragati.
Guntur	During 2024-25, None of the entries were found superior than the checks

Project Code	TUR/CI/2.11	**Project Title**	CVT on black turmeric *Curcuma caesia*
Centres	Barapani, Coimbatore, Kozhikode, Kumarganj, Mizoram, Navsari, Pottangi, Pundibari		
Date of start	2022	**Date of closure/ duration**	2023-2025 (3years)
Experimental details		Entries: 1. NBT 1 (Navsari) 2. NBT 2 (Navsari) 3. BT 162 (Pundibari) 4. NDHCc1 (Kumarganj) 5. Acc. 292 (IISR) 6. Acc.751 (IISR) 7. PCC-1 (Pottangi)	
Observation recorded		1. Sprouting percentage 2. Plant population at 50 DAS 3. Plant height (cm) 4. Number of tillers per clump 5. Fresh weight of clump (g) 6. Fresh rhizome yield per ha (t) 7. Dry rhizome yield per ha (t) 8. Dry recovery (%) 9. Oleoresin (%) 10. Essential oil (%) 11. Disease (rhizome rot) and pest (shoot borer) incidence, if any	
Work done/achievements during 2024-25 (centre-wise)			
Barapani	Eight (8) accessions were evaluated for growth, yield and quality parameters. Highest sprouting % as well as plant height was found in NBT 1 (98.33 and 98.90 cm). NDH CC1 recorded the highest number of tillers (2.78). Likewise, fresh weight/clump (202.02g) and yield (9 t ha^{-1}) were found highest in NBT 2.		
Coimbatore	The trial was taken up for the first year during 2022 with nine number of genotypes replicated thrice under RBD. These genotypes do not perform well as like that of curcuma longa during the first year itself.		
Kozhikode	Among the seven entries, *Acc. 751* recorded significantly higher yield of 12.23 kg bed^{-1} followed by PCC1 (10.42 kg bed^{-1}), BT 162 (10.25 kg bed^{-1}) and NBT 2 (10.00 kg bed^{-1}) which were on par.		
Kumarganj	Out of seven entries of black turmeric evaluated, the highest yield was recorded from NDHCc-1 (10.83 t ha^{-1}), followed by Acc 751 (10.38 t ha^{-1}) and Acc 292 (10.26 t ha^{-1}).		

Mizoram	Among the seven tested entries, highest plant height was recorded in NBT-2 (137.77 cm) followed by NDHCC-1 (137.29 cm). Maximum number of tillers per clump at maturity was recorded in NBT-1 (6.00) followed by ACC-292 (5.78). BT-162 (450.00 g) attained maximum fresh weight of clump followed by NBT-2 (448.00 g). NBT-1 (9.33) attained maximum number of rhizome per clump followed by ACC-751 (9.00). The highest fresh rhizome yield was recorded in BT-162 (29.26 t ha^{-1}) followed by NBT-1 (28.79 t ha^{-1}). However, all the parameters tested were found to be non-significant.
Navsari	Eight entries were evaluated in RBD during *Kharif*, 2024 at Navsari location. Among evaluated eight genotypes, NBT-1 (27.59 t/ha), NBT-2 (25.75 t ha^{-1}) and CL-277 (22.75 t/ha) were found superior for green rhizome yield. NBT-1 was also found promising for rhizome length (14.57 cm), rhizome width (23.07 cm), number of mother rhizome (10.73) and number of finger rhizome (21.07).
Pottangi	Out of seven entries of black turmeric evaluated, It was found that, BT-162 (12.78 t ha^{-1}) was the top yielder followed by PCC-1(11.0 t ha^{-1}) and NBT-2(10.6 t ha^{-1})
Pundibari	In this trial, seven (7) genotypes of black turmeric were evaluated at Pundibari Centre. It was found that maximum plant height (140.60 cm), number of leaves per plant (8.67), number of tillers (9.27) and highest rhizome yield (23.35 t ha^{-1}) were obtained in case of BT – 162.

TREE SPICES

Project Code	TSP/CI/1.1	**Project Title**	Germplasm collection, characterization, evaluation and conservation of clove, nutmeg and cinnamon
Centres	Dapoli, Pechiparai		
Date of start		**Date of closure/ duration**	Long term
Work done/achievements during 2024-25 (centre-wise)			
Dapoli	**Nutmeg:** Among the different germplasm collections of nutmeg planted during 1996–97, twenty-one promising genotypes have been identified. The highest number of nuts per tree was recorded in DBSKKVMF-65 (842). 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) were observed in DBSKKVMF-9772. The genotype DBSKKVMF-65 registered the highest dry nut yield/tree (5.79 kg), while the maximum dry mace yield/tree (1.01 kg) was found in DBSKKVMF-9772. The lowest dry nut yield/tree (0.540 kg) and dry mace yield/tree (0.092 kg) were recorded in DBSKKVMF-27. **Clove:** Among the different germplasm of clove planted during 2010 and 2015, three promising genotypes were selected. Plant height ranged from 3.52 to 4.42 m, girth from 72.28 to 94.10 cm, and plant spread from 3.10 to 3.38 m. The highest plant height (4.42 m), girth (94.10 cm), and spread (3.38 m) were observed in genotype DBSKKVSA-1, which was found superior over other genotypes. No flowering was recorded during 2024-25. Additionally, newly collected clove germplasm were planted in July 2024.		
Pechiparai	**Nutmeg:** Among 34 accessions are maintained, MF-1 recorded maximum tree height (12.80 m) and stem girth (67.24 cm). The maximum leaf length was recorded in MF-4 the value being 18.34 cm, leaf breath (7.52 cm). Among the 34 accessions, MF-4 recorded maximum number of fruits 716.24 fruits per tree and the single fruit weight was also highest in MF-4 (58.84g), and mace yield recorded per tree was 1442.1 g $tree^{-1}$. Followed by MF-4 more fruit weight per		

	fruit was recorded by MF-6 (52.80 g) Local check recorded 524.28 fruits per tree, single fruit weight (48.38g) and mace yield (917.94 g tree^{-1}). Among the various unique nutmegs, Visvashree recorded maximum plant height (7.34 m) and stem girth (37.74 cm). Among the 10 accessions, visvashree recorded maximum number of fruits 46.02 fruits /tree and the single fruit weight was also highest in visvashree (48.66g) and mace yield recorded per tree was 75.28 g tree^{-1}. **Clove:** During 2024-25, Twenty four accessions maintained in clove are evaluated for morophological characters, yield attributing traits to identify promising accessions. The maximum height was observed in SA-1 and the tree height was 14.12 m followed by SA-3 (13.06m). The lowest tree height was seen in SA-23 where the tree height was 5.70m. The accession SA-3 was significantly superior to other accessions and recorded highest stem girth (52.66 cm) compared with local check (42.40 cm). The accession SA-3 recorded the highest leaf length (12.93 cm), leaf breadth (7.53cm), number of branches (21.54 nos). Among the 24 accessions, SA3 had been identified as the best performer as the dry bud yield is 2.02 kg tree^{-1} while the local check recorded 0.72 kg tree^{-1} **Cinnamon:** Morphological characters and yield attributing traits are being evaluated to identify promising accessions. Among twelve accessions, CV-5 recorded maximum tree height one year after coppicing (6.66m), stem girth (18.54 cm) number of rejuvenation shoots (43.44 nos.) against local check with plant height (5.90 m) and rejuvenation shoots (24.04 nos.). The highest dry bark yield was recorded in CV-5 (712 g tree^{-1}) and lowest in CV-3 with 252 g tree^{-1}.

Project Code	TSP/CI/2.4	**Project Title**	Coordinated Varietal Trial on farmers varieties of nutmeg
Centres	Dapoli, Pechiparai, Thrissur		
Date of start	2016	**Date of closure/ duration**	Long term
Experimental details		Genotypes 1. *Punnathanam Jathy* 2. *Kochukudy* 3. *Kadukkamakkan Jathy* 4. Improved nutmeg variety 5. Local check 6. National check	
Work done/achievements during 2024-25 (centre-wise)			
Dapoli	The trial planted in August 2016 showed significant differences in growth parameters among the genotypes. Plant height ranged from 3.72 (local check, Konkan Sugandha) to 6.20 m (Kochukudy). The highest number of branches was observed in Kochukudy (82.42), which was at par with Punnathanam Jathy (76.22). Plant spread varied from 3.58 m (Punnathanam Jathy) to 3.90 m (Kochukudy). With respect to yield, Kochukudy recorded the highest number of nuts/tree (102), followed by Punnathanam Jathy (82), while the minimum was observed in the local check Konkan Sugandha (50).		
Pechiparai	Among the farmers varieties, Improved Nutmeg variety recorded maximum plant height (4.42m) with maximum stem girth (16.50 cm). Among the farmer's varieties, Improved nutmeg variety recorded maximum number of fruits 80 fruits /tree and the single fruit weight was also highest in Improved nutmeg variety (37.50g), and mace yield recorded per tree was 35.22g/tree. Minimum plant		

	height of 2.52 m and minimum mace yield of 25.21g/tree was recorded by Local check.
Thrissur	Trial has been laid out with four farmer varieties, one local check and one national check. The plants are of seven-year-old and their morphological performance was significant. Trial is under progress. All the accessions have started flowering and fruiting. Their morphological observations were recorded. Among the varieties FV1, FV2 and Local check were recorded significant growth and yield attributes.

Project Code	TSP/CI/5.1	**Project Title**	Evaluation of nutmeg genotypes
Centres	Thrissur		
Date of start	2018	**Date of closure/ duration**	Long term
Experimental details	Genotypes 1. *Acc.1* 2. *Acc.5* 3. *Acc.12* 4. *Acc.13* 5. *Acc.14* 6. *Acc.17* 7. *Acc.20* 8. *Acc.21* 9. *Acc.23* 10. *Acc.28*		
Work done/achievements during 2024-25 (centre-wise)			
Thrissur	Budded plants of all the genotypes were showing significant growth. Plants have established well in the field. All the accessions have started flowering and fruiting (except *Acc.28*) and their morphological observations were recorded. Even though flowering was observed in *Acc.28*, fruit setting was poor. Among the varieties Accession 5 was observed to be significantly superior in growth as well as mace and nut weight. Accession 23 was found to be higher in number of fruits per tree.		

Project Code	TSP/CI/2.5	**Project Title**	Coordinated Varietal Trial on nutmeg-2023 Series
Centres	Dapoli, Kozhikode, Pechiparai, Thrissur		
Year of Start	2025	**Date of closure/ duration**	Long term
Experimental details	Genotypes 1. *DBSKKVMF-65 (Dapoli)* 2. *DBSKKVMF-66 (Dapoli)* 3. *MF-4 (Pechiparai)* 4. *MF-6 (Pechiparai)* 5. *Accession 15 (KAU, Thrissur)* 6. *Accession 43 (KAU, Thrissur)* 7. *Acc 590 (IISR)* 8. *Acc 562 (IISR)* 9. *Acc 530 (IISR)* 10. *Konkan Sanyukta (Check)** 11. *IISR Keralashree (Check)**		

Work done/achievements during 2024-25 (centre-wise)	
PC Unit	Conducted two group meetings to evaluate the progress of planting material production at different centres
Dapoli	Planting materials production is under way
Kozhikode	Planting materials production is under way
Pechiparai	Planting materials production is under way
Thrissur	Thrissur is ready with planting material production

CORIANDER

Project Code	COR/CI/1.1	**Project Title**	Germplasm collection, description, characterization, evaluation, conservation and screening against diseases
Centres	Coimbatore, Dholi, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh		
Date of start	1975	**Date of closure/ duration**	Long term
Work done/achievements during 2024-25 (centre-wise)			
Coimbatore	A total of 276 genotypes maintained in the germplasm at Coimbatore were raised in field condition during the rabi season. Among the 276 genotypes, the best performing genotypes during rabi, 2024-25 in terms of yield were selected and evaluated for various parameters *viz.*, growth & yield parameters and powdery mildew incidence. Significantly higher seed yield was recorded 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}).		
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. Out of eighty-one accessions, only three accessions namely- RD-439, RD-121 and RD-448 gave higher yield than check varieties, Hisar Anand (15.03 g plant^{-1}) and Rajendra Dhania-1 (14.81 g plant^{-1}). The yield of best ten accessions ranged from 11.02 to 15.82 g plant^{-1}. Among the promising accessions, RD-439, RD-121 and RD-448 gave the highest yield of 15.82, 15.14 and 15.09 g plant^{-1} respectively.		
Guntur	During 2024-25, among fifty germplasm lines evaluated, LCC-316 (5.97 g pl^{-1}), LCC-308 (5.75 g pl^{-1}), LCC-309 (5.61 g pl^{-1}), LCC-198 (5.56 g pl^{-1}) and LCC-127 (4.99 g pl^{-1}) were found superior in yield. Six new germplasm lines under leafy entries were collected and fifty-six entries were evaluated. LCC-387, LCC-412, LCC-404 and LCC-403 were found promising and recorded highest fresh herb yield.		
Hisar	Ninety six accessions of coriander were evaluated in two row plots of 3.0 meter length each using Hisar Sugandh and Hisar Anand as checks during 2024-25. The seed yield of the germplasm material 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. Fifty lines were maintained by selfing.		
Jagudan	During 2024-25, total 152 germplasms were evaluated along with the checks. Yield ranges from 160-360 gm/plot. **Screening of coriander entries for resistance against powdery mildew disease** A total of forty-five entries of coriander 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 %). The per cent disease intensity was higher and ranged between 10.24 and 90.01 per cent.		
Jobner	A total of 238 coriander germplasm accessions were evaluated along with nine		

	check varieties in an augmented design with six blocks, sown on 15.11.2024. Each accession was grown in a 3 × 0.3 m² plot, and data on seed yield and morphological traits were recorded from five randomly selected plants. Seed yield per five plants ranged from 4.8 g (UD-21) to 29.0 g (UD-81), showing wide variability. 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).
Kumarganj	A total of 160 germplasm of coriander were evaluated at MES, 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}).
Raigarh	Total 40 germplasm of coriander maintained at CARS, Raigarh during *Rabi*, 2024. Evaluation of PGR 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}). Nucleus seeds of all the three varieties of coriander CG Dhaniya -1 (2 kg); CG Shri Chandrahasini Dhaniya-2 (5 kg) and CG Raigarh Dhaniya-3 (5 kg) maintained at AICRP on Spices, Raigarh.

Project Code	COR/CI/2.1	**Project Title**	Coordinated Varietal Trial on coriander 2024-Series XII
Centres	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jabalpur, Jagudan, Jobner, Kalyani, Kota, Kumarganj, Navsari, Pantnagar, Raigarh, Sanand		
Date of start	2024-25	**Date of closure/ duration**	2026-27
Experimental details	1. JCr 21-07 (Jagudan) 2. JCr 21-02 (Jagudan) 3. RD-434 (Dholi) 4. NDCor-9 (Kumarganj) 5. NCOR-160 (Navsari) 6. PD-21 (Pantnagar) 7. DH-362 (Hisar) 8. DH-242 (Hisar) 9. UD-706 (Jobner) 10. UD- 487 (Jobner) 11. ACr-7 (NRCSS) 12. ACr-8 (NRCSS) 13. Hisar Anand (National Check)* 14. RCr 728 (National Check)* 15. Scr-33 (Sanand) 16. LCS 21-6 (Guntur) 17. LCS 21-5 (Guntur) 18. RKD 24-1 (Kota) Design: RBD; 3 replications; Plot size: 4×2.4m, spacing 30x10 cm		
Observations Recorded	1. Germination % (20DAS) 2. Days to 50% flowering 3. Plant height (cm) 4. Primary Branches per plant 5. Secondary Branches per plant 6. Days to maturity (recorded at 75% of plant in a plot show senescence)		

	7. Umbels per plant 8. Umbellets per umbel 9. Seeds per umbel 10. Test weight (g) 11. Seedyield per plot (g) 12. Seed yield (kg ha^{-1}) 13. Essential Oil (%) 14. Incidence of pests (mites, aphids) 15. Incidence of diseases (wilt, powdery mildew, stem gall, blight)
Work done/achievements during 2024-25 (centre-wise)	
Ajmer	The analysis of variance revealed significant differences among the entries for all the traits including seed yield.
Coimbatore	The plant height of the genotypes ranged from 42.16cm to 62.96 cm. The highest number of umbels per plant was recorded by the genotypes COR 211 (22.46). COR 207 recorded the highest seed yield (901.1 kg ha^{-1}) followed by COR 211 (870.5 kg ha^{-1})
Dholi	Eighteen entries including two check (RCr-728 and Hisar Anand) were tested under coordinated varietal trial during the year 2024-25. Among these eighteen entries, COR-207 (1958.22 kg ha^{-1}) gave the highest yield followed by COR-213 (1923.41 kg ha^{-1}).
Guntur	During 2024-25, among the 18 coded entries evaluated in CVT, COR-226 (1477.40 kg ha^{-1}) and COR-212 (1377.80 kg ha^{-1}) entries were found promising
Hisar	The significant differences were obtained for all the parameters. The plant height ranged from 109.3 to 148.7 cm, number of branches 5.9 to 8.3, umbels per plant 50.8 to 66.6 and seeds per umbel 28.0 to 49.0. Maximum seed yield (2275.7 kg ha^{-1}) was recorded in COR-216 followed by COR-214 (2258.5 kg ha^{-1}) and COR-213 (2176.4 kg ha^{-1}).
Jabalpur	A total of seventeen coriander entries were assessed as part of the CVT conducted during the Rabi season of 2024–2025. Significant variations were noted among the genotypes for all growth, yield, and yield attributing traits. The tallest plants were observed in genotype COR-213 (123.20 cm), followed by COR-214 (121.67 cm). COR-213 also exhibited early flowering (49.67 days) and recorded the highest seed yield (2153 kg ha^{-1}), which was statistically at par with COR-207 (2110 kg ha^{-1}) and COR-221 (2065 kg ha^{-1}).
Jagudan	CVT experiment of coriander was conducted with seventeen entries. The yield differences among the entries were found significant. Entry COR 209 was not germinated. Entries COR 210 (1060 kg ha^{-1}) and COR 215 (1014 kg ha^{-1}) were top performing entries in the experiment.
Jobner	During *rabi*, 2024-25, eighteen (18) entries were evaluated the analysis of variance revealed significant differences among the entries for seed yield and yield attributing characters. The seed yield ranged from 732.40 kg ha^{-1} (COR-226) to 1627.90 kg ha^{-1} (COR-220). Out of the eighteen entries evaluated, COR-220 recorded maximum seed yield (1627.90 kg ha^{-1}) followed by COR-225 (1596.40 kg ha^{-1}), COR-210 (1540.70 kg ha^{-1}), COR-217 (1472.20 kg ha^{-1}) and COR-216 (1429.20 kg ha^{-1}) while lowest seed yield of 732.40 kg $ha^{-1}$was recorded in COR-226.
Kalyani	In the 1st year crop (2024-25) results showed that the maximum projected yield was recorded in CoR-219 followed by CoR-221 and CoR-216 as compared to lowest in CoR-209.
Kota	The CVT Coriander Series 2024 was initated in *rabi*, 2024-25 and during the first

	year of evaluation, COR 211 was found to be the best performing entry in terms of seed yield, yielding 2173 kg ha^{-1} followed by COR 215 (2056 kg ha^{-1}) and COR 226 (2025 kg ha^{-1}). COR 221, COR 226 COR 212 and COR 217 had the highest test weight of 23.00g, 16.4g, 16.3 and 15.2g respectively, while COR 213, COR 209 and COR 216 had the lowest test weight of 8.10g, 9.2g and 9.5g, respectively. COR 207 had highest plant height (116.1cm) while COR 221 and COR 223 were shortest (81.2cm). COR 212 showed earliest flowering (64 days) and maturity (109 days) while COR 207 and COR 213 was the most late in flowering (82 days), whereas COR 209 was most late in maturity (122 days) closely followed by COR 207, COR 216 and COR 224.
Kumarganj	Eighteen entries of coriander were evaluated under CVT Coriander for seed purpose. The highest yield was recorded in COR-207 (1993.06 kg ha^{-1}) followed by COR-216 (1819.44 kg ha^{-1}) and COR-222 (1805.56 kg ha^{-1}). **Entry COR-209 was not germinated.**
Navsari	Out of eighteen entries were evaluated during *Rabi* season of Y-2024 at Navsari. entry COR-217 (2010.37 kg ha^{-1}) followed by COR-226 (1715.25 kg ha^{-1}) and COR-220 (1635.74 kg ha^{-1}) were found superior in seed yield. COR-217 was also found superior in seeds per umbellates (11.73) and umbellates per umbel (8.67) and was also found early in flowering (39 days).
Pantnagar	Among the 18 entries evaluated, COR-215 recorded the highest seed yield (2012.82 kg/ha), tallest plant height (147.88 cm), and longest maturity duration (147.33 days). Other high-yielding genotypes included COR-214, COR-220, and COR-207, all exhibiting good germination and desirable agronomic traits. Early flowering genotypes like COR-219 (47 days) and COR-220 (49.67 days) may be suitable for early cropping, while COR-210 and COR-217 had the shortest maturity durations, though with lower yields.
Raigarh	Evaluation of CVT coriander entries during *Rabi* 2024-25 revealed that COR 212 recorded highest seed yield (1886.8 kg ha^{-1}) followed by COR 207 (1840.7 kg ha^{-1}) and COR 220 (1774.5 kg ha^{-1}) over the national Check CG Raigarh Dhaniya-3 (1505.4 kg ha^{-1}) and local check CG Dhaniya-1 (1486.3 kg ha^{-1}).
Sanand	Eighteen entries were tested under the CVT trial. The yield differences among the entries were found significant. Entry COR 217 was produced significantly highest seed yield of 2605 kg/ha. Entry COR 209 was not germinated in all the replications. Entry COR 226 found earliest among all entries.

Project Code	COR/CI/2.2	**Project Title**	Coordinated Varietal Trial on Coriander (Leaf Purpose) 2024- Series XII (I year)	
Centres	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jobner, Kumarganj, Navsari, Pantnagar, Sanand			
Date of start	2024-25	**Date of closure/ duration**	2026-27	
Experimental details		1. AGCr-3 (NRCSS) 2. AGCr-4 (NRCSS) 3. ACoS 22-06 (Anand) 4. ACoS 22-12 (Anand) 5. NLC-8 (Navsari) 6. NLC-13 (Navsari) 7. PD-51 (Pantnagar) 8. DH-228 (Hisar) 9. DH-259 (Hisar)	10. UD-828 (Jobner) 11. UD- 833 (Jobner) 12. CO-5 (Check) 13. Arka Isha (National Check) 14. Ajmer Coriander 1 (NC) 15. Private Hybrid-1 (Aroma Dhaniya) 16. Private Hybrid-1 (East west seed)	
		Design: RBD; 3 replications; Season: Summer & Rabi;		

	Date of sowing: Rabi :15 Oct - 15 Nov & Summer: 15 Mar - 15 April
	Stages of observation: Stage-I: 40 Days after sowing Stage-II: 55 Days after sowing (15 days after 1st observation)
Observations Recorded	1. Germination % (20 days after sowing) 2. Plant height (cm) 3. Foliage colour (SPAD meter) 4. Leaf lusher (shiny/dull) 5. Number of leaves per plant 6. Days to bolting (days) 7. Leaf area index (LAI) 8. Days to first harvest 9. Total leaf biomass (fresh weight basis) in Kg/ha 10. Total leaf biomass (dry weight basis) in Kg/ha 11. Leaf-to-stem ratio 12. Days to second harvest 13. Essential oil content (%) 14. Diseases if any (record data in PDI) 15. Pest if any 16. Keeping Quality grades (**a) Fresh leaves :** Greenness of leaves (grade) Aroma (Grade) **(b) Three days after storage in polythene bags at Room Temp. (RT):** Greenness of leaves (grade) Aroma (Grade) Keeping quality (days) **(c) Two weeks after storage in polythene bags at Low Temperature (Refrigerator) :** Greenness of leaves (grade) Aroma (Grade) Keeping quality (days) **(d) Three weeks after storage in polythene bags at Low Temperature (Refrigerator) :** Greenness of leaves (grade) Aroma (Grade) Keeping quality (days) **Note:** Grades: 5-Very Good, 4-Good, 3- Average, 2- Bad (unsatisfactory), 1-Very Bad (Unacceptable)

Work done/achievements during 2024-25 (centre-wise)	
Ajmer	The analysis of variance revealed significant differences among the entries for all the traits
Coimbatore	The plant height of the genotypes ranged from 16.65 to 24.24cm. The highest plant height was recorded in LCOR-1(24.24cm) followed by LCOR-2 (23.23cm).the lowest plant height was recorded in LCOR15 (16.65cm). Number of leaves per plant was recorded maximum in LCOR-8 (28.87)
Dholi	Sixteen entries including two checks (Arka Isha and Ajmer Coriander-1) were tested under coordinated varietal trial during the year 2024-25. Among these sixteen entries, LCOR-13 (1675.83 kg ha^{-1} and 1225.92 kg ha^{-1}), LCOR-16

	(1654.26 kg ha^{-1} and 1286.63 kg ha^{-1}), LCOR-06 (1622.94 kg ha^{-1} and 1200.03 kg ha^{-1}) and LCOR-15 (1482.67 kg ha^{-1} and 1205.03 kg ha^{-1}) yielded the highest fresh leaves yield in both the 1st and 2nd pickings respectively.
Guntur	During 2024-25, among the 16 coded entries evaluated in CVT, LCOR-05 (4.85 t ha^{-1}) and LCOR-03 (4.42 t ha^{-1}) entries were found promising
Hisar	The significant differences were obtained for all the parameters. The germination percentage ranged from 41.7 to 90.7%, plant height from 10.5 to 24.0 cm, foliage color light green to dark green, leaf lusher dull to shiny, number of leaves per plant 13.4 to 35.1 and number of stem per plant 4.7 to 10.3 were recorded in different leafy coriander genotypes 45 days after sowing. Among all the entries minimum bolting percentage at 75 days after sowing and maximum total leaf biomass were recorded in LCOR-13(61.8 q/ha), LCOR-15(66.0 q/ha) and LCOR-16 (71.9 q/ha), respectively.
Jobner	During *rabi*, 2024-25, thirteen (12) entries were evaluated in RBD with 3 replications in a plot size of 3 x 2.4 sq. m. accommodating eight rows spaced 30 cm apart with plant to plant distance of 10 cm maintained by thinning. The trial is in the 1st year of its progress. The analysis of variance revealed significant differences among the entries for all the characters studied including leaf yield. The leaf biomass (Ist cutting) ranged from 617.38 (LCOR 3) to 2078.57 kg ha^{-1} (LCOR-8). Out of the sixteen entries evaluated, LCOR 8 recorded maximum seed yield (2078.57 kg ha^{-1}) followed by LCOR-5 (1824.07 kg ha^{-1}), LCOR-15 (1767.43 kg ha^{-1}), LCOR-11 (1650.47 kg ha^{-1}) and LCOR-7 (1625.99 kg ha^{-1}) while lowest seed yield of 617.38 kg $ha^{-1}$was recorded in LCOR-3. Whereas the leaf biomass (IInd cutting) ranged from 230.35 (LCOR 2) to 1202.97 kg ha^{-1} (LCOR-5). Out of the sixteen entries evaluated, LCOR 5 recorded maximum seed yield (1202.97 kg ha^{-1}) followed by LCOR-8 (942.60 kg ha^{-1}), LCOR-7 (852.13 kg ha^{-1}) and LCOR-15 (768.53 kg ha^{-1}). while lowest seed yield of 230.35 kg ha^{-1} was recorded in LCOR-2 in IInd cutting
Kumarganj	Out of sixteen entries tested, the entry LCOR-13, LCOR-16, LCOR-14, and LCOR-15 performed well in respect of foliage, foliage colour, aroma and keeping quality
Navsari	Total of sixteen entries evaluated during *Rabi* season of Y-2024 at Navsari, LCOR-10 (18.27 t ha^{-1}) recorded highest green biomass yield in first and second harvest followed by LCOR-07 (17.27 t ha^{-1}) and LCOR-09 (16.27 t ha^{-1}).
Pantnagar	Among the 16 coriander entries evaluated for leafy purpose traits revealed considerable variation in total leaf biomass (fresh and dry weight), leaf-to-stem ratio, and harvest timing. LCOR-13 recorded the highest fresh biomass (8269.67 kg/ha) and dry biomass (1287.00 kg/ha), along with a high leaf-to-stem ratio (2.80), making it a top performer. Similarly, LCOR-04 also showed high productivity with similar biomass and the same maximum leaf-to-stem ratio. Early first harvests were observed in LCOR-05 (31.67 days) and LCOR-02 (32.00 days), while LCOR-03 had the longest duration to second harvest (55.00 days), potentially allowing for a higher cumulative yield. The leaf-to-stem ratio ranged from 2.33 to 2.80, with most genotypes exceeding 2.4, indicating good leafiness suitable for leaf coriander purposes.
Sanand	Sixteen entries were tested under the CVT trial of leafy coriander. The yield differences among the entries were found significant for fresh and dry weight of leaf. Entry LCOR 03 was produced significantly highest fresh leaf weight of 10698 kg/ha and dry leaf weight of 4060 kg/ha.

CUMIN

Project Code	CUM/CI/1.1	**Project Title**	Germplasm collection, characterization, evaluation, conservation and screening against diseases
Centres	Jagudan, Jobner, Mandor, Sanand		
Date of start	1975	**Date of closure/ duration**	Long term
Work done/achievements during 2024-25 (centre-wise)			
Jagudan	During 2024-25, total 334 germplasms were evaluated along with the checks. Yield ranges from 10-120 gm/plot. **Screening of cumin entries for resistance against wilt disease under wilt sick plot** A total of one hundred and forty-two entries of cumin were sown for the resistance against wilt disease under wilt sick plot conditions during 2024-25. Initially the crop condition was good, but later on the congenial conditions appears for blight disease, it heavily attacked the cumin crop during later stage and crop was severely affected by blight. The minimum wilt per cent (5.01 %) was recorded with the entry JC 24-02. Whereas majority of entries recorded cent per cent wilt infection. **Screening of cumin entries for resistance against blight disease** A total of forty-one entries of cumin were evaluated for the resistance against blight disease at seed Spices Research Station, Jagudan during 2024-25. The minimum disease intensity of blight (5.25%) was recorded with CUM 63, while the maximum disease intensity was recorded with the entry CUM 67 (100.00%). The blight disease intensity was very high and ranged from 5.01 to 100 per cent .**Screening of cumin entries for resistance against powdery mildew disease** A total of forty-one entries of cumin were screened for the resistance against powdery mildew disease at seed Spices Research Station, Jagudan during 2024-25. The minimum disease intensity (7.62%) was observed with CUM 65, while the maximum disease intensity was recorded with the entry JCM 132 (23.85%). The powdery mildew intensity was very low and ranged from 7.62 to 23.85 per cent.		
Jobner	One hundred ninty (190) germplasm accessions were evaluated along with six check varieties in augmented design in eight blocks with one row plots of 3 x 0.3 m^2 size. The trial was sown on 23.11.2024. A wide range of variability was observed for all the characters studied. Based on seed yield per five plants, out of One hundred ninty accessions, five accessions were recorded superior over the best check variety GC-4 (16.0 g). Promising accessions identified based on seed yield per five plants are UC-233 (21.0 g), UC 247 (NC 2022-85 (19.0 g) NC 2022-15 (18.45 g) UC 257 (18.0 g) and NC 2022-4 (17.0 g)		
Mandor	Total 115 germplasm lines available at the centre along with checks GC 4, JJ-1/MCU-105 and MCU-9 were evaluated in augmented design, out of which, 81 survived and yielded seeds. Genotype GP-67-24, GP-29-24, GP-49-24, GP-85-24 and GP-68-24 were the highest seed yielding genotypes		
Sanand	The trial was vitiated in initial stage due to severe effect of wilt.		

Project Code	CUM/CI/2.5	**Project Title**	Coordinated Varietal Trial on cumin Series – 2024
Centres	Ajmer, Jagudan, Jobner, Mandor, Sanand		
Date of start	2024-25	**Date of closure/ duration**	3 years (2026-27)

Experimental details	Genotypes 1. BC-Bold (NRCSS) 2. CZC 83 (CAZRI) 3. CZC 104 (CAZRI) 4. MCU-502 (Mandore) 5. MCU-504 (Mandore) 6. MCU-507 (Mandore) 7. MCU-511 (Mandore) 8. JC 21-02 (Jagudan) 9. JC 21-08 (Jagudan) 10. UC 272 (Jobner) 11. SC-13 (Sanand) 12. Gujarat Cumin 4 (National Check) Design: RBD; Replication: 3; Plot Size: 3 x 2.4 m; spacing : 30 x 5 cm
Observations Recorded	1. Germination % at 20 DAS 2. Days to 50% flowering 3. Plant height (cm) 4. Primary branches per plant 5. Secondary branches per plant 6. Days to maturity (at 75% plants in plot show senescence) 7. Umbels per plant 8. Umbellets per umbel 9. Seeds per umbel 10. Test weight (g) 11. Seedyield per plot (g) 12. Seed yield (kg ha^{-1}) 13. Incidence of pests (mites, aphids) 14. Incidence of diseases (Blight, wilt, powdery mildew etc.) 15. Quality (Essential Oil Content in %)
Work done/achievements during 2024-25 (centre-wise)	
Ajmer	Coordinated varietal trial (CVT) of coriander was carried out under AICRPS at ICAR –NRCSS, Ajmer during 2024-25. 12 entries were evaluated in three replications in RBD with checks in a plot size of 3 x 2.4 sq. m. The analysis of variance revealed significant differences among the entries for all the traits including seed yield.
Jagudan	The CVT experiment of cumin was conducted with eleven entries. The yield differences among the entries were found significant. Entry CUM 58 was not germinated. Entries CUM 60 (611 kg/ha) and CUM 59 (523 kg/ha) were top performing entries in the experiment. The minimum disease intensity of blight (5.25%) was recorded with CUM 63, while the maximum disease intensity was recorded with the entry CUM 67 (100.00%). The minimum disease intensity (7.62%) was observed with CUM 65, while the maximum disease intensity was recorded with the entry JCM 132 (23.85%).

Jobner	Analysis of variance revealed significant differences among the entries for seed yield and yield attributing characters. The seed yield ranged from 356.84 kg ha^{-1} (CUM-59) to 521.59 kg ha^{-1} (CUM-64). Out of twelve entries evaluated, CUM-64 recorded maximum seed yield of 521.59 kg ha^{-1}followed by CUM-67 (518.23 kg ha^{-1}), CUM 66 (482.88 kg ha^{-1}) CUM 61 (461.96 kg ha^{-1}) While lowest seed yield of 356.84 kg $ha^{-1}$was recorded in CUM-59.
Mandor	The CVT general mean was 319 kg ha^{-1} with CD (5%) 68 kg ha^{-1} and CV 12.6%. Seed yield ranged from 281 kg ha^{-1} (CUM-64) to 689 kg ha^{-1} (CUM-67) closely followed by 629 kg/ha (CUM-66). The ancillary data, entry CUM-67 was found earliest in days to 50% flowering (55 days) and days to maturity (117 days). Plant height varied from 33.9 cm (CUM-61) to 42.4 cm (CUM-67), the 1000 seed weight ranged from 4.3 (CUM-67) to 5.5 (CUM-61). In CVT, CUM-66 and CUM-67 had below 10% wilt and below 20% blight incidence and found to be resistant.
Sanand	Twelve entries were tested under the CVT trial. All entries were highly affected by cumin root rot and cumin blight disease. Although, characters including seed yield were recorded. Trial CV was 77.75 %. Although, the entry CUM 59 recorded highest seed yield of 123 kg/ha among all entries.

FENNEL

Project Code	FNL/CI/1.1	**Project Title**	Germplasm collection, characterization, evaluation, conservation and screening against diseases
Centres	Dholi, Hisar, Jagudan, Jobner, Kumarganj		
Date of start	1975	**Date of closure/ duration**	Long term
Work done/achievements during 2024-25 (centre-wise)			
Dholi	Forty five (45) numbers of germplasm along with two checks (Rajendra Saurabh & RCF-1) were evaluated for promising lines with respect to yield. Among the 45germplasm, only threenos. of germplasm, namely- RF-02, RF-15 and RF-73 out yielded both the check variety. The genotype RF-02, RF-15 and RF-73 yielded 98.83 g/plant, 98.10 g $plant^{-1}$ and 97.60 g $plant^{-1}$ respectively. Range of top ten high yielding genotypes was 58.91 to 98.83 g $plant^{-1}$.		
Hisar	Ninety six accessions of Fennel were evaluated in two row plots of 3.0 meter length each using GF-2 and PF-35 as checks. The seed yield of the germplasm material ranged from 13.6 g $plant^{-1}$ (HF-119) to 37.6 g $plant^{-1}$ (HF-178). The most promising lines were HF-127, HF-132, HF-145, HF-157, HF-161, HF-164, HF-165, HF-178, HF-187 and HF-194. Fifty lines were maintained by selfing.		
Jagudan	During the 2024-25, total 161 germplasms were evaluated along with the checks. Yield ranges from 160-400 gm/plot. During 2024-25, a total of thirty-nine entries of fennel were sown under natural conditions at Jagudan. The minimum disease intensity of Ramularia blight (14.25%) was recorded with JF 22-01, while the maximum disease intensity was recorded in the entry JC 21-02 (39.75%). The Ramularia blight intensity was moderate to lower and ranged from 14.25 to 39.75 per cent.		
Jobner	Two hundred five (205) germplasm of fennel were evaluated along with seven checks in augmented design in 7 blocks with one row plot of 3 x 0.5 sq.m. size. A wide range of variability was found for all the characters studied. Seed yield per five plants ranged from 9.0 g (UF-382) to 119.0 g (UF-131). Out of 207 germplasm, 50 germpalsm were better than best check variety RF-143 (58.8 g)		

	on the basis of seed yield per 5 plants. Promising germplasm 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 g), 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)
Kumarganj	Total 117 (115+ 2 checks) germplasm of Fennel was evaluated and recorded maximum yield 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}).

Project Code	FNL/CI/2.8	**Project Title**	Coordinated varietal trial on fennel – 2024 Series XII
Centres	Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Navsari, Pantnagar.		
Date of start	2024-25	**Date of closure/ duration**	3 years (2026-27)
Experimental details		Genotypes 1. AF-5 (NRCSS) 2. AF-6 (NRCSS) 3. HF-122 (Hisar) 4. HF-150 (Hisar) 5. NDF-60 (Kumarganj) 6. NDF-70 (Kumarganj) 7. NFNL-13 (Navsari) 8. JF 21-01(Jagudan) 9. PF-35 (Pant nagar) 10. RF 60 (Dholi) 11. UF 228 (Jobner) 12. UF 229 (Jobner) 13. RF-290 (National Check) 14. Ajmer Fennel-7 (National Check)	
		Design: Randomized Block Design (RBD); No. of replications: Three Plot size/spacing: 3x2.5 m; Spacing: 45x45 cm	
Observations Recorded		1. Germination % at 20 DAS 2. Days to 50% flowering 3. Plant height (cm) 4. Primary branches per plant 5. Secondary branches per plant 6. Days to maturity (measured at 75% of plants in plot show senescence) 7. Umbels per plant 8. Umbellets per umbel 9. Seeds per umbel 10. Test weight (g) 11. Seed yield per plant (g) 12. Seed yield (kg ha^{-1}) 13. Incidence of pests (aphids) 14. Incidence of diseases (leaf blight, wilt, powdery mildew, gall, bacterial soft rot) 15. Quality: Essential oil %	
Work done/achievements during 2024-25 (centre-wise)			
Ajmer	Thirteen entries were evaluated along with checks in three replications in RBD with plot size of 4 x 2.5 sq. m. The trial was sown on 10.10.2024. The analysis		

	of variance revealed significant differences among the entries for all the traits including seed yield.
Dholi	Among the fourteen test entries and one check (Rajendra Saurabh), three entries *viz*., FNL-147 (1868.11 kg ha^{-1}), FNL-144 (1892.31 kg ha^{-1}) and FNL-153 (1812.88 kg ha^{-1}) was found to give significantly higher yield per hectare as compared to check variety, Rajendra Saurabh (1722.21 $kgha^{-1}$).
Hisar	The significant differences were obtained for all the parameters except branches per plant. The plant height ranged from 116.7 to 187.3 cm, number of branches 8.1 to 8.8, umbels per plant 43.5 to 51.5 and seeds per umbel 469.6 to 707.8. Maximum seed yield was recorded as 2014.0 kg ha^{-1} in FNL-155 followed by FNL-153 (1900.7 kg ha^{-1}) and FNL-147 (1861.7 kg ha^{-1}), respectively.
Jabalpur	In fennel, fourteen were evaluated during the *rabi* season, 2024–25 under CVT laid out in RBD with three replications. Significant variation was observed among the genotypes for all morphological and yield attributing traits. The earliest 50% flowering was recorded in genotype FNL-150 (77 days), which was statistically at par with FNL-146 and FNL-148 (79 days). Genotype FNL-151 attained the maximum plant height (142.20 cm), whereas FNL-145 was the shortest (92.87 cm), exhibiting a dwarf growth habit. The highest seed yield was obtained from FNL-145 (1770 kg ha^{-1}), which was on par with FNL-153 (1726 kg ha^{-1}). Notably, FNL-145 also recorded the highest number of umbels per plant and umbellets per umbel (21.67).
Jagudan	The CVT experiment of fennel was conducted with fourteen entries. The yield differences among the entries were found significant. Entries FNL 143 (1432 kg ha^{-1}) and FNL 145 (1423 kg ha^{-1}) were top performing entries in the experiment.
Jobner	Analysis of variance revealed significant differences among the entries for seed yield and yield attributing characters. Mean seed yield of the entries evaluated ranged from 1213.33 kg ha^{-1} (FNL 144) to 1919.89 kg ha^{-1} (FNL 146). Out of the fourteen entries evaluated, entry FNL-146 recorded maximum seed yield of 1919.89 kg ha^{-1} followed by FNL-156 (1766.22 kg ha^{-1}), FNL-152 (1764.22 kg ha^{-1}), FNL-148 (1704.44 kg ha^{-1}) and FNL-151 (1466.56 kg ha^{-1}), while lowest seed yield of 1213.33 kg ha^{-1} was recorded in FNL-144.
Kumarganj	A total of 13entries of fennel were tested in CVT and recorded maximum yield in FNL-143 (17.47 kg ha^{-1}) followed by FNL-155 (1665 kg ha^{-1}) and FNL-148 (1620 kg ha^{-1}).
Navsari	Among the fourteen entries evaluated during *Rabi*- 2024 at Navsari, entries FNL-150 (3013.50 kg ha^{-1}) followed by FNL-151 (2713.58 kg ha^{-1}) and FNL-131 (2597.78 kg ha^{-1}) recorded highest seed yield. The genotype FNL-150 recorded higher umbels per plant (47.13), umbellets per umbel (37.40), primary branches per plant (6.80) and was also found early in flowering (76 days).
Pantnagar	Among the entries tested, at Pantnagar revealed significant differences in seed yield, germination, flowering and maturity duration, and plant height. FNL-148 recorded the highest seed yield (1683.98 kg ha^{-1}), followed by FNL-154 (1645.12 kg ha^{-1}) and FNL-152 (1561.98 kg ha^{-1}), indicating their superior performance under Pantnagar conditions. FNL-152 also flowered earliest (110.33 days), suggesting potential for early harvest. Germination percentages ranged from 75% to 83%, with FNL-144 and FNL-156 showing the highest germination. Plant height varied notably, with FNL-150 (169.78 cm) being the tallest, which could be beneficial for biomass and seed yield. Entries such as FNL-148, FNL-154, and FNL-152 combined high yield with favorable agronomic traits and can be considered promising for cultivation or further breeding.

FENUGREEK

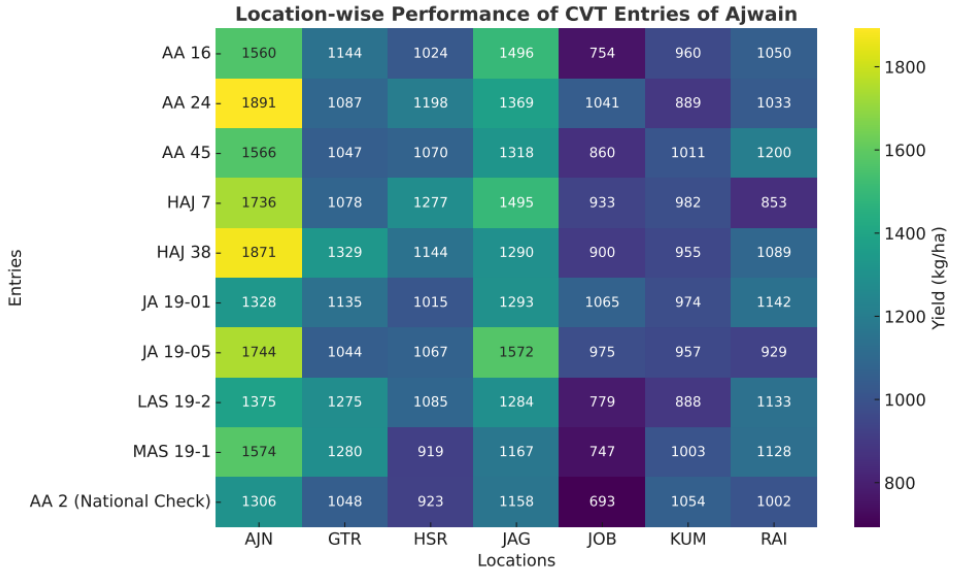
Project Code	FGK/CI/1.1	**Project Title**	Germplasm collection, characterization, evaluation, conservation and screening against diseases
Centres	Dholi, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh		
Date of start	1975	**Date of closure/ duration**	Long term
Work done/achievements during 2024-25 (centre-wise)			
Dholi	Sixty two (62) accessions of fenugreek along with two checks (Rajendra Kanti and Hisar Sonali) were evaluated for promising lines with respect to yield. Among the 62 germplasm, only 6 nos. of germplasm, namely- RM-216, RM-202, RM-215, RM-204, RM-210, and RM-206, gave higher yield than both the check varieties. The performance of top ten promising accessions ranged from 16.03 to 19.82 g plant^{-1}.		
Guntur	Among the 124 entries evaluated, top ten entries that recorded significantly higher yield than the best check Lam Sonali (3.00 g plant^{-1}) are LFC-111 (4.61 g plant^{-1}), 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 & LFC-162 (3.91 g plant^{-1}), LFC-61 (3.89 g plant^{-1}), LFC – 33 (3.86 g plant^{-1}) & LFC-91 (3.83 g plant^{-1}). Further, all the 124 accessions were evaluated for herb yield. Among the entries, LFC-122 performed superior over all the entries.		
Hisar	One hundred twenty accessions of fenugreek were evaluated along with Hisar Sonali, Hisar Suvarna and Hisar Mukta as checks during 2024-25. The seed yield of the germplasm material ranged from 11.5 g plant^{-1} (HM-561) to 35.6 g plant^{-1} (HM-525). The most promising lines for seed yield were HM-488, HM-490, HM-517, HM-522, HM-525, HM-533, HM-591, HM-595, HM-603 and HM-632.		
Jagudan	During the 2024-25, total 85 germplasms were evaluated along with check varieties. Yield ranges from 170-445 gm/plot. A total of forty-one entries of fenugreek were evaluated for the resistance against powdery mildew disease during 2024-25. The minimum disease intensity of powdery mildew (5.04%) was recorded with FGK 173, while the maximum disease intensity was recorded with the entry JFg 23-07 (75.51%). The powdery mildew intensity was moderate to high and ranged from 5.01 to 75.51 per cent		
Jobner	Ninety (90) germplasm accessions of fenugreek were evaluated along with seven check varieties in augmented design. Each accession was sown in plots of 3 x 0.3 m^2 size accommodating single rows spaced 30 cm apart. A wide range of variability was recorded for all the characters studied. Based on seed yield per five plants, out of 90 accessions evaluated, only 16 accessions were found superior than best check variety RMt-354 (70.00 g). Promising top ten accessions identified based on seed yield per five plants are 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)		
Kumarganj	A total of 165 germplasm of fenugreek were maintained and evaluated at the station. The highest yield was found in NDM-116 (14.30 g plant^{-1}) followed by NDM-9 (12.35 g plant^{-1}) and NDM-124 (12.10 g plant^{-1}).		
Raigarh	Maximum seed yield recorded by genotype IFGS-11 (2613.7 kg ha^{-1}) followed by IFGS-03 (2440 kg ha^{-1}) and IFGS -04 (2002.6 kg ha^{-1}) over both national check HisarSonali (1554.7 kg ha^{-1}) and RMT 305 (1750.9 kg ha^{-1}) as well as over grand mean of trial (1788.3 kg ha^{-1}).		

<table>
<tr><td>Project Code</td><td>FGK/CI/2.5</td><td>Project Title</td><td colspan="2">Coordinated Varietal Trial of fenugreek 2024 – Series XII</td></tr>
<tr><td>Centres</td><td colspan="4">Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kota, Kumarganj, Navsari, Pantnagar, Raigarh</td></tr>
<tr><td>Date of start</td><td>2024-25</td><td colspan="2">Date of closure/ duration</td><td>3 years (2026-27)</td></tr>
<tr><td rowspan="2">Experimental details</td><td colspan="4">Genotypes
1. AFg-8 (NRCSS)
2. AFg-9 (NRCSS)
3. HF-370 (Hisar)
4. HF-464 (Hisar)
5. KFG 24-1 (Kota)
6. NDM-45 (Kumarganj)
7. NFG-205 (Navsari)
8. PF-35 (Pant nagar)
9. RM 205 (Dholi)
10. UM 122 (Jobner)
11. UM 377 (Jobner)
12. IFGS 9 (Raigarh)
13. SFg 5 (Sanand)
14. SFg 7 (Sanand)
15. RMt-354 (National Check)
16. AFg-5 (National Check)</td></tr>
<tr><td colspan="4">Design: Randomized Block Design (RBD); No. of replications: Three Plot size/spacing: 4 x 2.4 m; Spacing: 30x10 cm</td></tr>
<tr><td>Observations Recorded</td><td colspan="4">1. Germination % at 20 DAS
2. Days to 50% flowering
3. Plant height (cm)
4. Primary branches per plant
5. Secondary branches per plant
6. Days to maturity (measured at 75% of plants in plot show senescence)
7. No. of pods per plant
8. Seeds per pod
9. Pod length (cm)
10. Test weight (g)
11. Seed yield per plant (g)
12. Seed yield (kg ha^{-1})
13. Incidence of pests (aphids, leaf eating caterpillar, pod borer)
14. Incidence of diseases (Downy mildew, damping off, rust, root rot, leaf spot etc.)
15. Quality: Essential oil %</td></tr>
<tr><td colspan="5">Work done/achievements during 2024-25 (centre-wise)</td></tr>
<tr><td>Ajmer</td><td colspan="4">The trial was sown on 07.11.2024. analysis of variance revealed significant differences among the entries for all the traits including seed yield.</td></tr>
<tr><td>Dholi</td><td colspan="4">Among sixteen entries including two national check varieties (RMt-354 and AFg-5), the entries namely FGK-157(2062.91 kg ha^{-1}), FGK-176 (2041.25 kg ha^{-1}), FGK-173 (2040.28 kg ha^{-1}), FGK-164 (2036.11 kg ha^{-1}) and FGK-158(2018.93 kg ha^{-1}) exhibited highest yield.</td></tr>
<tr><td>Hisar</td><td colspan="4">The significant differences were obtained for all the parameters except branches per plant. Plant height ranged from 90.5 to 106.9 cm, pods per plant 40.0 to 54.8 and seeds per pod 14.6 to 19.7. Maximum seed yield (2283.6 kg ha^{-1}) was recorded in FGK-169 followed by FGK-175 (2138 kg ha^{-1}) and FGK-171 (2113.3 kg ha^{-1}), respectively.</td></tr>
<tr><td>Jabalpur</td><td colspan="4">A total of sixteen fenugreek genotypes were evaluated during the Rabi season of 2024–2025. Among the promising entries and standard checks, enty FGK-171 recorded the tallest plants (92.67 cm) and the highest number of primary branches per plant (8.07), while the shortest plant height was observed in FGK-163 (66.60 cm). Genotype FGK-157 was identified as the earliest maturing entry.</td></tr>
</table>

	The highest seed yield was obtained from FGK-167 (2479 kg ha^{-1}), which was statistically on par with FGK-176 (2273 kg ha^{-1}). Moreover, FGK-167 also exhibited the highest test weight (19.20 g).
Jagudan	CVT experiment of fenugreek was conducted with sixteen entries. The yield differences among the entries were found significant. Entries FGK 164 (1519 kg ha^{-1}), FGK 162 (1387 kg ha^{-1}) and FGK 163 (1310 kg ha^{-1}) were top performing entries in the experiment. The minimum disease intensity of powdery mildew (5.04%) was recorded with FGK 173, while the maximum disease intensity was recorded with the entry JFg 23-07 (75.51%). The powdery mildew intensity was moderate to high and ranged from 5.01 to 75.51 per cent
Jobner	Analysis of variance revealed significant differences among the entries for seed yield and yield attributing characters. Mean seed yield of the entries evaluated ranged from 1030.15 kg ha^{-1} (FGK-161) to 2013.73 kg ha^{-1} (FGK-163). Out of the sixteen entries evaluated, entry FGK-163 recorded maximum seed yield of 2013.73 kg ha^{-1} followed by FGK-169 (1932.22 kg ha^{-1}), FGK-173 (1895.83 kg ha^{-1}), FGK-176 (1843.17 kg ha^{-1}) and FGK-170 (1791.87 kg ha^{-1}).
Kota	CVT on fenugreek 2024 series was initated in *rabi*, 2024-25 and during initial season, the seed yield ranged from 1044-1708 kg ha^{-1}. Among entries evalauted, FGK 162 was found to be the best performing entry in terms of seed yield, yielding 1708 kg ha^{-1} followed by FGK 164 (1673 kg ha^{-1}) and FGK 170 (1606 kg ha^{-1}) while FGK 175 had the lowest yield (1044 kg ha^{-1}). The mean test weight ranged from 7.10g (FGK 159) to 13.00g (FGK 157). FGK 170 and FGK 172 had highest plant height (78.30cm) while FGK 161 was shortest (68.50 cm). FGK 169 and FGK 171 showed earliest flowering (53 days) and maturity (118 days); while FGK 175 was most late in flowering (61.67 days) and maturity (123.5 days).
Kumarganj	A total of 16 entries of fenugreek were tested under CVT and recorded maximum yield in FGK-160 (24.20 q ha^{-1}) followed by FGK-159 (23.75 q ha^{-1}), FGK-161 (23.10 q ha^{-1}) and FGK-175 (22.85 q ha^{-1}).
Navsari	Among the sixteen entries evaluated during *Rabi*- 2024 at Navsari. entries FGK-170 followed by FGK-162 and FGK-164 recorded highest seed yield (1827.87 kg ha^{-1}, 1788.43 kg $ha^{-1}$and 1600.83 kg ha^{-1}, respectively). The entry FGK-170 was also found promising for pods per plant (25.00), seeds per pod (14.00) and pod length (12.97 cm).
Pantnagar	Among the 16 fenugreek entries evaluated at Pantnagar showed substantial variation in seed yield, germination, flowering and maturity duration, and plant height. FGK-175 was the top performer with the highest seed yield (1852.46 kg ha^{-1}) and good germination (81.33%), followed closely by FGK-171 (1780.88 kg ha^{-1}) and FGK-159 (1744.59 kg ha^{-1}). FGK-162 and FGK-171 matured early (126.67 days), making them suitable for short-duration cropping. Germination ranged from 75.33% to 83.33%, with FGK-160 showing the best establishment. FGK-159 was the tallest genotype (93.61 cm), potentially contributing to higher biomass and yield. Genotypes like FGK-175, FGK-171, FGK-159, and FGK-161 demonstrated a desirable combination of high yield, early to mid flowering, and favorable maturity duration.
Raigarh	The results results of CVT of fenugreek revealed that maximum seed yield recorded by genotype FGK 170 (2679.7 kg ha^{-1}) followed by FGK 160 (2589.4 kg ha^{-1}) and FGK 175 (2371.5 kg ha^{-1}) over grand mean of trial (2024.7 kg ha^{-1}).

AJWAIN

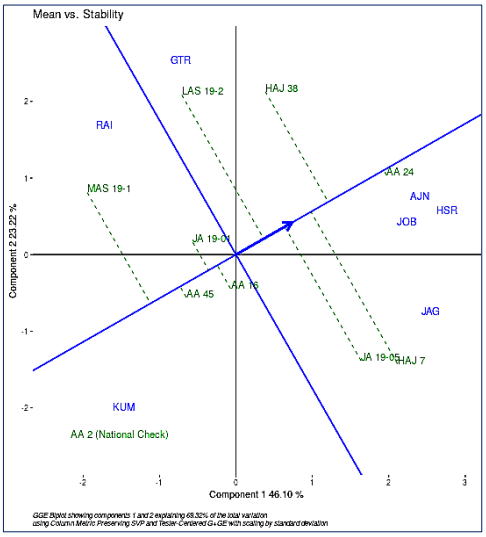
Project Code	AJN/CI/2.1	**Project Title**	Coordinated Varietal Trial–2022 Series
Centres	Ajmer, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh		
Date of start	2022-23	**Date of closure/ duration**	3 years (2024-25)
Experimental details		Treatments/genotypes 1. MAS-19-1 (Jagudan) 2. LAS-19-2 (Jagudan) 3. HAJ-38 (Hisar) 4. HAJ-7 (Hisar) 5. JA-19-05 (Jagudan) 6. JA-19-01 (Jagudan) 7. AA-16 (Ajmer) 8. AA-45 (Ajmer) 9. AA-24 (Ajmer) 10. Ajmer Ajwain-2 (Check) Design: RBD; Replications:3; Plot size/spacing: 4.00x2.5m^2 Spacing- 50x20cm;	
Observations Recorded		1. Germination % 2. Days to 50% flowering (on plot basis) 3. Plant height (cm) 4. Primary branches per plant 5. Secondary branches per plant 16. Days to maturity measured at 75% of plants in plot show senescence) 6. Umbels per plant 7. Umbellets per umbel 8. Seeds per umbel 9. Test weight (g) 10. Seed yield (kg ha^{-1}) 11. Disease and pest incidence, if any 12. Quality (essential oil %)	
Work done/achievements during 2024-25 (centre-wise)			
PC Cell (pooled data)	**Performance in seed yield** Coordinated Varietal Trial (CVT) on ajwain conducted during *rabi*, 2022–25 across seven locations revealed significant variation in seed yield among the test entries. 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%). These six entries showed more than 10 percent increase over the national check AA 2 (1026 kg ha^{-1}), demonstrating their superior yield potential and wide adaptability across locations.		

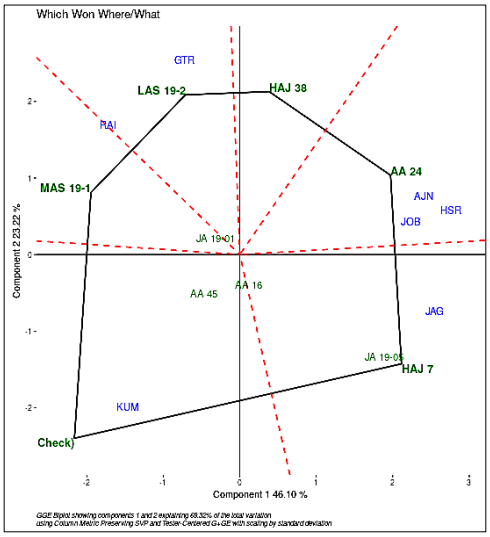


Stability analysis

(a) Mean vs Stability: The biplot analysis reveals that AA 24 is a relative high-performing and stable genotype, making it a strong candidate for varietal identification eventhough HAJ 38 is the highest yielding entry in the current trial. HAJ 7 also show high yields but with slightly lower stability.

(b) Which won where view: This biplot partitions the testing environments





(locations & years) into different 6 sectors, each identifying which genotype performed best (*i.e.*, "won") in that sector. It reveals which genotype performs best under which environment(s) and identifies possible mega-environments. HAJ 38, LAS 19-2, MAS 19-1, AA 2, HAJ 7 and AA 24 lie on the vertices of the polygon, indicating that these genotypes are the **top performers** in specific environment(s). **HAJ 38** have broad adaptability with highest yield whereas **AA 24** is considered as Ideal genotype (high stability & relatively higher yield) performing better in locations forming mega-environment *viz.*, Ajmer, Hisar and Jobner.

Ajmer	Observations on growth parameters, yield attributes and yield were recorded. ANOVA showed significant variability among different traits recorded.
Guntur	Among the entries evaluated, AJN-20 (1306.90 kg ha^{-1}) significantly recorded highest yields followed by the entry AJN-28 (1293.70 kg ha^{-1}).

Hisar	The significant differences were obtained for all the parameters. Plant height ranged from 153.1 to 164.1 cm, umbels per plant 120.2 to 192.9 and seeds per umbel 232.7 to 483.6. Maximum seed yield (1285.3 kg/ha) was recorded in AJN-21 followed by AJN-27 (1266.0 kg ha^{-1}) and AJN-28 (1224.7 kg ha^{-1}), respectively
Jagudan	Total ten entries with local checks GA 1 and GA 2 were evaluated. The yield differences among the entries were found significant. Entries AJN 25 (1560 kg ha^{-1}) and AJN 27 (1449 kg ha^{-1}) were top performing entries in the experiment.
Jobner	Analysis of variance revealed significant differences among the entries for seed yield and yield attributing characters. Mean seed yield of the ten entries evaluated ranged from 466.67 kg ha^{-1} to 977.78 kg ha^{-1}. Entry AJN-27 recorded maximum seed yield of 977.78 kg ha^{-1} followed by AJN-26 (897.78 kg ha^{-1}), AJN-22 (733.30 kg/ha), AJN -29 (726.67 kg ha^{-1}) and AJN-21 (586.27 kg ha^{-1}), while lowest yield of 466.67 kg ha^{-1} was recorded in AJN-24**.**
Kumarganj	Among the entries tested during 2024-25, AJN-29 gave highest yield (1151.39 kg ha^{-1}) followed by AJN-27 (1127.08 kg ha^{-1}) and AJN 20 (1072.22 kg ha^{-1}).
Raigarh	The evaluation of CVT of Ajwain revealed that AJN 25 recorded highest seed yield (847.9 kg ha^{-1}), AJN 26 (826.4 kg ha^{-1}) over local check Chhattisgarh Ajwain-1 (804.2 kg ha^{-1}) CG Ajwain-1 recently notified during 2024 for cultivation in Chhattisgarh State in CVRC meeting of horticulture crops held on 4th May 2023 and notified during 2024.

NIGELLA

Project Code	NGL/CI/2.1	**Project Title**	CVT on Nigella – Series II 2024
Centres	Ajmer, Hisar, Kumarganj, Pantnagar, Raigarh, Kota		
Date of start	2024-25	**Date of closure/ duration**	3 years (2026-27)
Experimental details	Treatments/genotypes 1. AN-10 (NRCSS) 2. AN-32 (NRCSS) 3. AN-37 (NRCSS) 4. NDBC-20 (Kumarganj) 5. NDBC-23 (Kumarganj) 6. PK-12 (Pantnagar) 7. PK-13 (Pantnagar) 8. AN-1 (National Check) 9. Pant Krishna (National Check) Design: RBD; Replications:3; Plot size/spacing: 4.00x2.5m^2/ 30x10 cm		
Observations Recorded	1. Germination % at 20 DAS 2. Days to 50% flowering (on plot basis) 3. Plant height (cm) 4. Primary branches per plant 5. Secondary branches per plant 6. Days to maturity measured at 75% of plants in plot show senescence) 7. Capsules per plant 8. Seeds per capsules 9. Test weight (g)		

	10. Seed yield (kg ha^{-1}) 11. Disease and pest incidence, if any 12. Quality (essential oil % & Thymoquinone (%)$^{\$}$
Work done/achievements during 2024-25 (centre-wise)	
Ajmer	Observations on growth parameters, yield attributes and yield were recorded. Plant height ranged from 66.33 to 74.66 cm, number of capsule/ plants ranged from 53 to 63.66 and number of seeds/capsules ranged from 62 to 67.33
Hisar	The significant differences were obtained for all the parameters except branches per plant. Plant height ranged from 72.8 to 84.3 cm, pods per plant 47.5 to 64.5 and seeds per pod 86.0 to 132.1. Maximum seed yield (1305.3 kg ha^{-1}) was recorded in NGL-11 followed by NGL-13 (1164.0 kg ha^{-1}) and NGL-14 (1114.8 kg ha^{-1}), respectively.
Kota	During the first year of evaluation, the seed yield ranged from 555-640 kg ha^{-1}. Among the entries evaluated, NGL 14 was found to be the best performing entry in terms of seed yield, yielding 640 kg ha^{-1}followed by NGL 13 (638 kg ha^{-1}) and NGL 11 (620 kg ha^{-1}) while NGL 10 had the lowest yield (555 kg ha^{-1}). The mean test weight ranged from 1.10g (NGL 10 and NGL 12) to 2.50g (NGL 14). NGL 10 had highest plant height (69.7 cm) while NGL 17 was shortest (61.10 cm). NGL 13 showed earliest flowering (83 days) while NGL 14 showed late flowering (88.67 days). NGL 18 was earliest to mature (124 days) while NGL 12 was most late in maturity (129.67 days).
Kumarganj	Among the nine entries of black cumin tested under CVT, during 2024-25, entries NGL.17 gave highest yield (868.06 kg ha^{-1}) followed by NGL11 (819.44 kg ha^{-1}) and NGL 13 (784.72 kg ha^{-1}). The entry NGL 15 not germinated.
Pantnagar	Among the nine genotypes of nigella evaluated along with check, revealed significant variability in seed yield and related agronomic traits. NGL-13 recorded the highest seed yield (853.12 kg ha^{-1}) along with the highest number of capsules per plant (37.98) and maximum seeds per capsule (136.91), indicating its superior yield potential. NGL-15 also showed strong performance with high capsule number (38.71) and seed count (134.31), making it another promising genotype. NGL-17 had the earliest flowering (63.33 days) but showed the lowest yield (654.83 kg ha^{-1}) and capsule number, suggesting limited productivity. Plant height ranged from 54.50 cm (NGL-17) to 69.96 cm (NGL-16), with taller plants generally supporting higher capsule load.
Raigarh	It was observed that for seed yield NGL 10 recorded highest seed yield (1411 kg ha^{-1}) over local check CG Karayat-1 (1310 kg ha^{-1}) while NGL 12 (1292 kg ha^{-1}) and NGL 17 (1250 kg ha^{-1}) recorded at par yield with check and significantly superior over mean yield (1175.6 kg ha^{-1}).

SAFFRON

Project Code	Project mode	**Project Title**	Conservation, evaluation and utilization of exotic and indigenous saffron germplasm lines
Centres	Pampore		
Date of start	2019	**Date of closure/ duration**	Project period
Work done/achievements during 2024-25 (centre-wise)			
Pampore	During 2024-25, three germplasm lines per clones were collected making a total of 211 lines, however, germplasm lines per clones with repetitive data expression were culled out and only 182 clones were considered for generating data. Germplasm lines showed significant performance with regard to growth, quality, yield and yield attributing traits.		

	Under the Advanced Varietal Trial-I (AVT-I), the genotype SRS-Saf-178 exhibited superior performance in terms of floral traits. It recorded the highest pistil length (6.28 mm) statistically at par with genotypes SRS-Saf-199, SRS-Saf-195, SRS-Saf-124, Shalimar Saffron-1, and SRS-Saf-128 indicating its potential for enhanced stigma yield. Further, SRSSaf-178 also recorded the highest fresh and dry weight of pistils, emphasizing its superiority in yield-contributing traits. In contrast, genotype SRS-Saf-253 showed the lowest values for these floral attributes suggesting relatively poor stigma development and associated yield potential. In terms of reproductive efficiency, SRS-Saf-178 produced the maximum number of flowers/m^2 (89) which was statistically significant and closely followed by SRS-Saf-199 (85), SRS-Saf-253 (82) and SRS-Saf-251 (79). The lowest floral density was observed in SRS-Saf-124with only 72 flowers/m^2. Overall, SRS-Saf-178 in combination with SRS-Saf199 demonstrated significantly higher saffron yield compared to all other genotypes including the standard check, indicating their promise for future varietal release and commercial cultivation.

KALAZEERA

Project Code	Project mode	**Project Title**	Exploration, collection and conservation of kalazeera from high altitudes of Northern Himalayas
Centres	Pampore		
Date of start	2019	**Date of closure/ duration**	Project period
Work done/achievements during 2024-25 (centre-wise)			
Pampore	During the cropping season of 2024–25, a total of 22 Kalazeera germplasm lines comprising of 17 seed-propagated and 5 tuber-derived accessions were collected from diverse agroclimatic zones of Himachal Pradesh making a total of 124 accessions. These accessions represent a broad spectrum of genetic backgrounds, thereby significantly enriching the existing genetic pool of Kalazeera. Among the seven elite Kalazeera lines identified from the previously evaluated germplasm, the genotype SRS/KZ/177 consistently demonstrated superior agronomic performance across both Initial Varietal Trials (IVT) and Advanced Varietal Trials (AVT) was recommended for minikit testing. During the 2024–25 cropping season, the genotype SRS/KZ/177 was distributed to the line department for minikit evaluation across three locations in Jammu and Kashmir specifically in the districts of Pulwama, Shopian and Budgam. Initial monitoring and field observations indicated that SRS/KZ/177 outperformed the existing check variety in terms of overall growth and productivity.		

TECHNICAL SESSION II

CROP MANAGEMENT

Project code	Title	Centres
	Black Pepper	
PEP/CM/3.4	Effect of Arbuscular Mycorrhizal (*Rhizophagus irregularis*) fungi on growth and yield of black pepper	Dapoli, Kahikuchi, Kozhikode, Panniyur, Sirsi, Yercaud
	Cardamom	
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.	Appangala, Mudigere, Myladumpara, Pampadumpara, Sakleshpur
	Large cardamom	
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/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,
	Turmeric	
TUR/CM/5.1	Evaluation of Plant Growth Promoting *Rhizobacteria*, *Bacillus safensis* for phosphorus (P) solubilization potential in turmeric	Chintapalli, 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	Chintapalli, Coimbatore, Dholi, Kahikuchi, Kalyani, Kammarpally, Kanke, Kumarganj, Kozhikode, Pasighat, Pottangi, Pundibari, Raigarh.
	Tree Spices	
TSP/CM/5.1	Site-Specific Nutrient Management in Nutmeg (*Myristica fragrans*)	Coimbatore, Dapoli, Kozhikode, Thrissur.
	Coriander	
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/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
Fenugreek		
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

PROGRESS REPORT OF THE PROJECTS

CROP MANAGEMENT

BLACK PEPPER

Project Code	PEP/CM/3.4	**Project Title**	Effect of Arbuscular Mycorrhizal (*Rhizophagus irregularis*) fungi ongrowth and yield of black pepper
Centre	Kahikuchi, Kozhikode, Panniyur, Dapoli, Sirsi, Yercaud		
Date of start	**2025**	**Date of closure/ duration**	2027
Experimental details	Design: RBD; Plot size/spacing: 6 standards/ plot (3x3 m), 2 plants/ standard; No. of replications :10 replications/standards (2 vines per standard); Total no. of standards: 50; Plot size/spacing 3 x 3m Treatments T_1:100% NPK (Recommended Dose in POP) T_2:75% NPK (Recommended Dose in POP) T_3:30g AM+T_2 T_4:30g AM T_5: Absolute Control Time of application of Arbuscular Mycorrhizae • May/June and August/September (For the first year) • May/June (IInd year onwards)		
Observation Recorded	1. Number of leaves/50 cm^2 2. Number of laterals/50 cm^2 3. Spike intensity (0.5m^2) 4. Spike length (cm) 5. Fresh berry yield (kg/ vine)	6. Dry berry yield (kg/ vine) 7. Dry Recovery (%) 8. Oleoresin (%) 9. Essential oil (%)	
Work done/achievements during 2025-26			
Panniyur	The experimental trial was initiated during the month of June-25, From the trial plot the intial soil sample was taken for nutrient status analysis. The fertilizer treatments were imposed accordingly. Afterone week of fertilizer application, AMF was applied.		
Dapoli	Trial has been initiated at Dapoli Center during kharif 2025-26. Initial soil sample analysis were conducted ICAR-IISR		
Sirsi	Experiment is laid out in RBD design with 05 treatments. Experiment is under progress during *kharif* 2025-26.		
Yercaud	The trial is initated during kharif, 2025 at famers plot		
Kozhikode	The AMF for all the centres were prepared and delivered at participating centres, the same trial is also initated during kharif, 2025		
Kahikuchi	The trial is initated during kharif, 2025 at famers plot		

CARDAMOM

Project Code	CAR/CM/5.5	**Project Title**	Effect of micronutrients on growth and yield of small cardamom
Centres	Appangala, Mudigere, Myladumpara, Pampadumpara, and Sakleshpur		
Date of start	2020	**Date of closure/ duration**	TBD

Experimental details	Design: FRBD; Replications: four; Variety: Any three varieties; Spacing/plot size:2×2m, 12 plants per plot Treatments T_1: Recommended package of practices (control) T_2: Recommended package of practices + IISR cardamom micronutrient four sprays at March, April, May, June @ 5 g L^{-1}
Observation Recorded	• Physio chemical properties of the soil: pH, nutrient status (major, secondary and micro nutrients) • Growth parameters • Plant height (cm) • Number of tillers per clump • Number of bearing tillers per clump • Number of panicles per clump • Panicle length (cm) • Number of capsules per clump • Fresh capsule yield per panicle (g) • Fresh capsule yield per clump (g) • Fresh capsule yield per hectare (kg) • Dry capsule yield per hectare (g) • Dry recovery (%) • % of bold capsules (8 mm) • Oil content (%) • 1,8 cineole content (%) • Incidence of pests (shoot borer, shoot fly, thrips) • Incidence of diseases (rhizome rot, leaf blight)
Work done/achievements during 2024-25 (centre-wise)	
Appangala	Experiment was laid out with three sub treatments (varieties): V_1-Appangala 1, V_2-IISR Avinash and V_3-Njallani Green Gold, at a spacing of 2mx2m, with 12 plants per treatment. Micronutrients spray (T_2) recorded significantly higher growth and yield parameters. Micronutrient spray recorded 47 per cent increase in yield over control
Mudigere	The experiment, initiated at the Mudigere station during the 2020–21 planting season, involved three cardamom cultivars — Mudigere-1, Mudigere-2, and Mudigere-3. Results revealed that growth and yield attributes were significantly superior in treatments where the IISR Power Mix was applied, compared to the control. However, the differences among the cultivars, as well as the interaction effects between cultivar and micronutrient management, were found to be non-significant.
Myladumpara	The maximum yield was recorded in MCC 260 when supplemented with foliar application of the IISR micronutrient mix under treatment V_3T_2, with a dry capsule yield of 688.28 kg ha^{-1}, followed by Thiruthali under V_1T_2, which yielded 369.42 kg ha^{-1}. The number of racemes per panicle and the number of capsules per raceme were also highest in MCC 260 (V_3), making it significantly superior to the other two varieties in terms of yield-related traits.
Pampadumpara	The experiment was conducted using a FRBD with three varieties—V1: KAU PV-3, V2: KAU PV-5, and V3: Green Gold—planted in plots of 12 plants each, replicated six times. There was significant differences were observed among treatments and varieties for several morphological and yield traits. The tallest plants were recorded in PV3 (299.82 cm), while T_2 showed a maximum average plant height of 272.69 cm. Treatment T_2 also produced the highest number of

	tillers (34.93) and panicles per plant (20.69), whereas PV3 recorded the maximum number of panicles (21.29) and the longest panicle length (75.42 cm). PV3 also recorded the highest fresh weight (416.00 g plant^{-1}) and dry weight (69.21 g plant^{-1}), while T_2 showed even higher fresh weight (483.56 g/plant) and dry weight (80.51 g plant^{-1}), indicating the positive effect of the micronutrient spray on growth and yield.
Sakleshpur	Significant improvements in growth and yield attributes were observed with the application of T_2 compared to the T_1. Among treatments, M_2 recorded the highest plant height (185.2 cm), number of panicles per clump (20.8), and capsule yield per plant (50.3 g), indicating its effectiveness.Among the cardamom cultivars, ICRI-8 and Appangala-1 (APG-1) exhibited superior performance in both growth and yield parameters. The highest dry capsule yield per hectare was also recorded in these two cultivars, at 148.0 kg/ha. Although cultivars showed variation in growth and yield, their differential response to micronutrient application was not statistically significant.

Project Code	CAR/CM/5.6	**Project Title**	Site-specific recommendation for varying yield target of cardamom
Centres	Mudigere, Myladumpara, Pampadumpara, and Sakleshpura.		
Date of start	2021	**Date of closure/ duration**	3 years
Experimental details		Crop variety: Popular improved variety of respective centre/area. Experimental design: RBD; Treatments: 4; Replication: 5 T_1: 20:170:0 kg ha^{-1} (N: P_2O_5: K_2O) for 6 q ha^{-1} yield T_2: 117.9:247.7:103 kg ha^{-1} for 8 q ha^{-1} yield T_3: 227.7:275:244.4 kg ha^{-1} for 10 q ha^{-1} yield T_4: 125:125:250 kg ha^{-1} as per the state POP. Plot Size: 2 x 2m, 12 plants per plot	
Observation Recorded		• Growth parameters • Yield and its attributes • Quality attributes • Soil test analysis before and end of cropping season growth • Economics- BCR, gross returns, net returns	
Work done/achievements during 2024-25 (centre-wise)			
Mudigere	The trial was continued during the reporting period. Treatments were imposed as per the technical programme, and observations on various growth parameters were recorded and analysed. The experiment was initiated at the Mudigere station in 2021 and was laid out in a randomized block design (RBD) with four treatments and five replications. Among the different treatments, significantly higher plant height, number of panicles per clump, and capsule yield were recorded in T_4, which received 202 g urea/clump, 200 g rock phosphate/clump, and 305 g muriate of potash (MoP)/clump.		
Myladumpara	A significant yield improvement in yield was obtained in T_3 which recorded a dry capsule yield of 487.89 kg ha^{-1} followed by T_2 with 406.07 kg ha^{-1}. The yields in T_3 and T_2 were statistically on par, indicating similar levels of effectiveness.		
Pampadumpara	There was significant difference among the treatments in plant height, where T_3 (295.328 cm) recorded maximum. Maximum no. of tillers was registered by T_2 (38.125). No. of panicles was maximum for T_3 (26.813). The maximum fresh weight (155.667 g plant^{-1}) and dry weight (25.800 g plant^{-1}) were registered for		

	T_2.
Sakleshpura	Among different treatments significantly higher plant height (203.8 cm), number of panicles/clump (22.8) and capsule yield (59.77 g/plant) was observed in treatment, T_3.

LARGE CARDAMOM

Project Code	LCA/CM/2.1	**Project Title**	Assessment of effect of Polysulphate Dehydrite Polyhalite) on Yield and Quality Parameters of Large Cardamom (*Amomum subulatum* Roxb.).
Centres	ICAR Gangtok, ICRI Gangtok		
Date of start	2025	**Date of closure/ duration**	3 years
Experimental details	**Treatment details** T_1: Recommended organic POP for large cardamom T_2: T_1 + Polyphosphate @ 100 kg/ha in three splits, T_3: T_1+ Polyphosphate @ 200 kg/ha in three splits, T_4: T_1 + Polyphosphate @ 400 kg/ha in three splits. Place of Experiment: At farmers' fields Design: RBD; replications: 5; Plot size/spacing: 4.5 x 4.5 m and 1.5 x1.5 m		
Observation Recorded	• Plant height (cm) • Number of leaves/tiller • Number of tillers/clump • Number of productive tillers • Leaf length (cm) • Leaf breadth (cm) • Number of days to flowering • Number of days to maturity • Number of spike/clump • Number of capsule/spike • Number of seed/capsule • Fresh yield/ plant (g) and per hectare (kg/ha) • Dry yield/plant (g) and per hectare (kg/ha) • Physico - chemical parameters of soil:pH, nutrient status • Diseases and insect pests (if any) • Economics, BC ratio		
Work done/achievements during 2024-25 (centre-wise)			
ICAR Gangtok	A field experiment was conducted during kharif season of 2025 at Research Farm of ICAR Sikkim Centre for Assessment of effect of Polysulphate (Dehydrite Poly Halite) on Yield and Quality Parameters of Large Cardamom (Amomum subulatum Roxb.). The experiment consisted of five treatments and laid out in randomized block design with five replications. Before the commencement of the field experiment, the soil was sampled up to 0-0.15 m depth for assessment of physicochemical qualities of soil. The Haplumbrept soil of the study site is acidic (pH 5.87), high in SOC (1.51%), available N (330 kg ha-1), P (14.1 kg ha^{-1}), K (212 kg ha-1) Fe (5.93 ppm), Mn (5.03 ppm), Zn (0.82 ppm) and sandy loam in texture. Data of different growth, yield attributes,		

	yield and quality parameters will be taken from March 2026.
ICRI Gangtok	The experiment was laid out at ICRI Research farm Pangthang. The treatments were imposed and initial plant morphological observations were recorded. The mean value of plant height varied between 49.2-51.3cm, nos. of leaves (4.0-4.7), leaf length (30.5-32.0)cm, while, leaf breadth 5.5 -6.7 cm. Soil of the experimental plot was collected for analysing the initial physico-chemical properties..

GINGER

Project Code	GIN/CM/4.1	**Project Title**	Evaluation of different ginger-based intercropping systems for higher yield and income
Centres	Chintapalle, Dholi, ICAR Gangtok, Kalyani, Mizoram, Nagaland, Pottangi, Pundibari, Solan.		
Date of start	2021-22	**Date of closure/ duration**	3 years (2021-22 to 2023-24)
Experimental details	**Treatments:** • T_1- Sole ginger • T_2- Ginger + Papaya + Leafy coriander (Grow papaya with a spacing of 180 x 180 cm. Between two lines of payaya ginger will be sown in a spacing of 30 x 25 cm and leafy coriander will be broadcasted in the border area. After harvesting of leafy coriander, the mulching will be done) • T_3- Ginger + Banana (Grow banana with a spacing of 200 x 200 cm. Between two lines of banana ginger will be sown in a spacing of 30 x 25 cm. Banana may be grown once in two years) • T_4- Ginger + Coriander + leafy vegetables (Grow ginger and coriander in 2:2 ratio. After harvesting of coriander, grow leafy vegetables in place of coriander • T_5- Ginger + Maize (2:1 or 2:2) (Grow sweet corn in Kharif, Rabi and Summer- 3 times) • T_6- Ginger + French bean/soyabean (2:2) (Grow French bean in Kharif, Rabi and Summer- 3 times) • T_7- Ginger + Arhar (3:1) (Grow arhar in Kharif) • T_8- Ginger + Taro/EYF (2:2) (Grow taro in Kharif) Crop variety: Popular improved variety of respective centre/ area. Experimental design: RBD; Treatments: 8; Replications: 3		
Observation Recorded	• Growth parameters • Yield and its attributes • Test weight of seed spices • Essential oil of seed spices • Economics- BCR, Gross returns, net returns		
Work done/achievements during 2024-25 (centre-wise)			
Chintapalle	From the pooled data (2021-22 to 2024-25) it was concluded that among different cropping systems, plant height (63.86 cm) number of tillers per clump (10.93) were more in Ginger + Elephant foot yam (2:2). The highest fresh rhizome yield per plant (213.04g) and yield (14.95 t/ha) was recorded in ginger grown as sole crop followed by Ginger + Arhar (3:1) cropping system (10.62		

	t/ha). The highest benefit cost ratio (9.36:1) was recorded in Ginger + Elephant foot yam followed by Sole Ginger (8.42:1).
Dholi	Among different intercrops *viz*., coriander, fenugreek, french bean, pigeonpea, maize, leafy vegetables and elephant foot yam taken with ginger, highest yield of ginger (8.35 t/ha) was recorded in plot intercropped with pigeonpea. Yield of ginger as sole crop was found 13.14 t/ha.
ICAR Gangtok	The results showed that significantly maximum ginger equivalent yield (28 t ha^{-1}) and system productivity (34 t ha^{-1}) was noticed under Ginger + Maize (2:1 or 2:2) (Grow sweet corn in Kharif, Rabi and Summer- 3 times) ginger fenugreek intercropping system followed by Ginger + Taro (2:2) as compared to other sole and intercropping system.
Kalyani	In the 4th year (2024-25) the best combination was found in T_6 i.e., Ginger + French Bean (2:2) (Grow French bean in *Kharif*, *Rabi* and *Summer*- 3 times), closely followed by T_8 i.e., Ginger + Elephant foot yam (2:2) & T_4 i.e., Ginger + coriander+ Leafy vegetable (Grow ginger and coriander in 2:2 ratio, after harvesting of coriander grow leafy vegetable in place of coriander)
Mizoram	The result indicated that maximum ginger plant height (80.59 cm) was recorded in ginger + taro (2:2) intercropping whereas minimum plant height was recorded in ginger + arhar (72.87 cm). The no. of tillers per plant was highest in sole ginger (6.89) while it was lowest in ginger + taro (5.00 cm). Maximum fresh weight of clump was recorded in ginger + coriander (2:2) intercropping (332.00 g) while the minimum was recorded in ginger + taro intercropping (267.83 g). The number of rhizomes was significantly highest in ginger + maize (8.83) whereas lowest number of rhizomes was recorded in ginger + coriander (5.83). Maximum rhizome yield was obtained in Ginger sole (7.67 t/ha) whereas the minimum was recorded in ginger + taro (4.02 t/ha). Significant highest intercrop fresh yield was recorded in ginger + taro (2.93 t/ha) followed by ginger + taro (7.04 t/ha) while it was lowest in ginger + coriander + leafy vegetables (0.41 t/ha). Maximum crop equivalent yield was obtained in ginger + maize (7.71 t/ha) while minimum was recorded in ginger + coriander + leafy vegetables (5.58 t/ha). The highest B:C ratio was recorded in ginger + maize (3.02) followed by ginger + French bean (2.98) and ginger + fenugreek (2.96).
Nagaland	Out of the seven ginger-based intercropping systems evaluated at Nagaland using variety Nadia, the highest sprouting percentage (80.95%) and number of tillers (12.77) were recorded in T6 (Ginger+Soybean), while T8 (Ginger+Colocasia) showed the tallest plants at 67.55 cm. Fresh yield per clump was highest in T3 (Ginger+Okra+Tomato) at 691.45 g, followed by T5 (Ginger+French bean+Chilli) with 585 g, while T7 recorded the lowest yield (426.67 g). The highest benefit-cost ratio (4.04), ginger equivalent yield (29.04 t/ha), and net returns (Rs. 6,60,384/ha) were achieved in T4 (Ginger+Sweet corn). T3 followed next with a GEY of 16.72 t/ha, net returns of Rs. 4,00,024.97/ha, and B:C ratio of 2.27. All intercropping systems had land equivalent ratios above 1, with the highest in T7 (2.4), followed by T3 (2.13), indicating land-use efficiency in all treatments.
Pottangi	Return from coriander as inter crop in ginger was the highest followed by Maize in ginger.
Pundibari	From the analyzed data it is clear that maximum yield (13.27 t ha^{-1}) of the main crop *i.e.* ginger was obtained in T_1 treatment (sole ginger) and based on the B:C ratio of this trail, the maximum B:C ratio (3.22) was recorded in T_7 treatment (T_7: Ginger + EFY - 2:2), whereas minimum return was recorded in T_2 (Ginger + Fenugreek - 2:2).

Solan	Ginger cv. *Solan Giriganga* intercropped with sweet corn three crops, *Summer*, *Kharif* and *Rabi* with planting ratio 2:2 gave the highest yield of ginger (183.00 q/ha) along with maximum net returns per hectare (₹ 5,24,642) and B:C ratio (1.80) under mid hill conditions of Himachal Pradesh.

Project Code	GIN/CM/5.1	**Project Title**	Evaluation of Plant Growth Promoting Rhizobacteria, *Bacillus safensis* for phosphorus (P) solubilization potential in ginger
Centres	Ambalavayal, Chintapalle, Kalyani, Kammarpally, Kumarganj, Pasighat, Pottangi, Pundibari, Raigarh		
Date of start	2020-21	**Date of closure/ duration**	3 years
Experimental details	Treatments: T_1- 100% recommended phosphorus(P) fertilizer T_2- 75% phosphorus (P) fertilizer T_3- 75% phosphorus (P) fertilizer and Bacillus *safensis* T_3- 50% phosphorus (P) fertilizer T_3- 50% phosphorus (P) fertilizer and Bacillus *safensis* T_3-*Bacillus safensis* alone T_7-Control without P Crop variety: Popular improved variety of respective centre/area. • Experimental design: RBD • Treatments: 7 • Replications: 4 • Bed size: 3 x1m • Spacing: 15x30 cm; Total no. of beds: 28 Bacteria application as soil drench: At the time of planting, 30 days after planting (DAP), 60 days after planting (DAP) • Methodology: Fertilizer application: As per the recommendation except P which may be taken up as per the treatment		
Observation Recorded	• Growth parameters (90 & 120 DAP) • Soil nutrients analysis –Available P & other major &minor nutrients(120DAP) • Nutrient uptake (harvest)- Leaf and rhizome • Yield and quality analysis • Economics		

Work done/achievements during 2024-25 (centre-wise)	
Ambalavayal	Among different treatments in ginger, the treatment T_3 showed maximum fresh and dry rhizome yield. Number of tillers was highest in T_5 and in the treatment T_1, fresh weight of clump was greater. Additionally, the phosphorus (P) levels were found to be the lowest in treatments T_6 and T_7 among all the treatments.
Chintapalli	It was observed that among different treatments in ginger, application of 75% phosphorus (P) fertilizer and *Bacillus safensis* recorded more number of tillers per clump (9.63), highest fresh weight of clump (161.78g) , fresh rhizome yield per hectare (12.92 t/ha) and dry rhizome yield (2.78 t/ha) and maximum available Phosphorus content (46.15 kg/ha) in the soil at 150 DAS.

Kalyani	Result showed that T_3 (75% phosphorus(P) fertilizer and *Bacillus safensis)* is found the best combination followed by T_5 (50% phosphorus(P) fertilizer and *Bacillus safensis)* and T_1 (100% recommended phosphorus(P) fertilizer).
Kammarpally	Among the treatments, T_3 (75% phosphorus (P) fertilizer and *Bacillus safensis)* recored recorded maximum fresh rhizome yield (7.25 t ha^{-1}) followed by T_5 (50% phosphorus (P) fertilizer and *Bacillus safensis*) with yield of 5.75 t ha^{-1} when compare to control (3.0 t ha^{-1})
Kumarganj	Among the 7 different treatments tested in ginger, Treatment T_3 (75% phosphorus fertilizer and *Bacillus safensis*) gave highest yield 82.36 q ha^{-1} followed by in treatment T_1 (100 % recommended phosphorus (P) fertilizer) 72.85 q ha^{-1} and T_5 (50% phosphorus fertilizer and *Bacillus safensis*) 68.40 q ha^{-1}, and T_7 (Control without P) gave lowest yield 63.17 q ha^{-1}.
Pasighat	This experiment was conducted with Nadia variety and treatments were applied as per the technical programme. Among the treatments, the highest plant height (50.15 cm) at 120 days after planting was recorded in T_3 (75% P + *Bacillus safensis*) followed by T_1 (100% P) with a plant height of 45.13 cm at 120 DAP. Number of tillers/clump was maximum in T_3 with 9.05 tillers/clump at 120 DAP. Similarly, number of leaves was also found to be highest in T_3 with 15.20 number of leaves per plant. As far as yield parameters is concerned, highest yield/clump (151.92 g) was found in T_3 and the projected yield per hectare was also found to be highest in T_3 (15.04 t ha^{-1}) and the lowest yield in control (8.99 t ha^{-1}).
Pottangi	Application of P solubilization (14.05t ha^{-1}) gave 11.5% higher yield than control (12.6 t ha^{-1}) in Suravi.
Pundibari	In this trial, effects of plant growth promoting rhizobacteria, *Bacillus safensis* for phosphorus (P) solubilizing potential, seven (7) treatments were evaluated. Analysis of the data revealed that the maximum number of tillers per plant (11.55) and fresh yield (16.58 t ha^{-1}) were recorded in T_3 (75% recommended phosphorus fertilizer and *Bacillus safensis*) followed by T_3 (50% recommended phosphorus fertilizer and *Bacillus safensis*) and T_1 (100% recommended phosphorus fertilizer). Whereas, all the parameters were found to be lowest in T_7 (Control i.e. without P fertilizer).
Raigarh	Maximum plant height 50 DAS (29.53 cm) and 120 DAS (52.53 cm) and maximum yield 15.46 t /ha found in 100 % recommended phosphorus (P) fertilizer (T_1).

Project Code	GIN/CM/5.2	**Project Title**	Evaluation of Plant Growth Promoting Rhizobacteria, *Bacillus safensis* for zinc (Zn) solubilization potential in ginger
Centres	Chintapalle, Kalyani, Kammarpally, Kumarganj, Pasighat, Pottangi, Raigarh		
Date of start	2020-21	**Date of closure/ duration**	3 years
Experimental details	Treatments: T_1- 100% recommended zinc (Zn) fertilizer T_2- 50% zinc (Zn) fertilizer and *Bacillus safensis* T_3- 50% zinc (Zn) fertilizer alone T_3- *Bacillus safensis* alone T_3- control without Zn Crop variety: Popular improved variety of respective centre/area.		

	• Experimental design: RBD • Treatments: 5 • Replication: 5 • Bed size: 3 x1m • Spacing: 15x30 cm; Total no. of beds: 25 • Methodology; Bacteria application as soil drench: At the time of planting, 30 days after planting (DAP), 60 days after planting (DAP) • Fertilizer application: As per the recommendation
Observation Recorded	• Growth parameters (90 & 120 DAP) • Soil nutrients analysis –Available Zn & other major & minor nutrients (120DAP) • Nutrient uptake (harvest)- Leaf and rhizome • Yield and quality analysis • Economics
Work done/achievements during 2024-25 (centre-wise)	
Chintapalli	It was observed that among different treatments in ginger, application of 50% Zinc fertilizer and *Bacillus safensis* recorded more number of tillers per clump (10.24), highest fresh weight of clump (190.96 g), fresh rhizome yield per hectare (13.32 t ha^{-1}) and dry rhizome yield (2.99 t ha^{-1}) and maximum DTPA Extractable Zinc (1.03 ppm) in the soil at 150 DAS.
Kalyani	Result showed that T_2 (50% zinc (Zn) fertilizer and *Bacillus safensis)* is found the best combination followed by T_1 (100% recommended zinc (Zn) fertilizer) and T_3 (50% zinc (Zn) fertilizer alone).
Kammarpally	Among treatments, T_2 (50% Zinc (Zn) fertilizer and *Bacillus safensis*) yielded the highest at 4.6 t ha^{-1}, followed by T_4 (*Bacillus safensis* alone) with a yield of 3.68 t ha^{-1}. Both treatments significantly outperformed the control.
Kumarganj	Out of 5 different tested treatments, treatment T_2 (50 % Zn fertilizer and *Bacillus safensis*) gave highest yield (78.28 q ha^{-1}) followed by T_1 (100 % recommended zinc (Zn) fertilizer) 76.13 q ha^{-1} and T_3 (50% zinc (Zn) fertilizer alone) 64.28 q ha^{-1}, Lowest yield found in treatment T_5 (Control without Zn) 57.43 q ha^{-1}.
Pasighat	This experiment was conducted with Nadia variety and treatments were applied as per the technical programme. Among the treatments, the highest plant height (60.82 cm) at 120 DAP was recorded in T_2 (50% P + *Bacillus safensis*) followed by T_1 (100% Zn) with a plant height of 53.98 cm. Number of tillers/clump was maximum in T_2 with 9.28 tillers/clump at 120 DAP. Similarly, number of leaves was also found to be highest in T_2 with 15.92 number of leaves followed by T_1 (15.40). As far as yield parameters is concerned, highest yield/clump (157.47 g) was found in T_2 and the projected yield per hectare was also found to be highest in T_2 (15.48 t ha^{-1}) and the lowest yield in control (10.89 t ha^{-1}).
Pottangi	Application of Zn solubilization (15.0t ha^{-1}) gave 12.0% higher yield than control (13.4t ha^{-1}) in Suravi.
Raigarh	Maximum plant height 50 DAS (26.56 cm) and 120 DAS (50.47) and maximum yield 14.38 t ha^{-1} in treatment 100% recommended zinc (Zn) fertilizer (T_1) 100 percent recommended zinc fertilizer @ 5 kg ha^{-1}.

TURMERIC

<table>
<tr><td>Project Code</td><td>TUR/CM/5.1</td><td>Project Title</td><td colspan="2">Evaluation of Plant Growth Promoting Rhizobacteria, Bacillus safensis for phosphorus (P) solubilization potential in turmeric</td></tr>
<tr><td>Centres</td><td colspan="4">Chintapalle, Coimbatore, Kahikuchi, Kalyani, Kammarpally, Kozhikode, Pasighat, Pottangi, Pundibari, Raigarh, Solan</td></tr>
<tr><td>Date of start</td><td>2020-21</td><td>Date of closure/ duration</td><td colspan="2">3 years</td></tr>
<tr><td colspan="2">Experimental details</td><td colspan="3">Treatments:
T_1- 100% recommended phosphorus(P) fertilizer
T_2- 75% phosphorus (P) fertilizer
T_3- 75% phosphorus (P) fertilizer and Bacillus safensis
T_3- 50% phosphorus (P) fertilizer
T_3- 50% phosphorus (P) fertilizer and Bacillus safensis
T_3- Bacillus safensis alone
T_7- Control without P
Crop variety: Popular improved variety of respective centre/area.
• Experimental design: RBD
• Treatments: 7
• Replications: 4
• Bed size: 3 x1m
• Spacing: 15x30 cm; Total no. of beds: 28
Methodology: Bacteria application as soil drench: At the time of planting, 30 days after planting (DAP), 60 days after planting (DAP)
• Fertilizer application: As per the recommendation except P which may be taken up as per the treatment</td></tr>
<tr><td colspan="2">Observation Recorded</td><td colspan="3">• Growth parameters (90 & 120 DAP)
• Soil nutrients analysis –Available P & other major &minor nutrients(120DAP)
• Nutrient uptake (harvest)- Leaf and rhizome
• Yield and quality analysis Economics</td></tr>
<tr><td colspan="5">Work done/achievements during 2024-25 (centre-wise)</td></tr>
<tr><td>Chintapalli</td><td colspan="4">It was observed that among different treatments in turmeric, application of 75% phosphorus (P) fertilizer and Bacillus safensis recorded more number of tillers per clump (2.70), highest fresh weight of clump (241.78g), fresh rhizome yield per hectare (23.25 t/ha) and dry rhizome yield (5.82 t/ha) and maximum available Phosphorus (46.40 kg/ha) in the soil at 150 DAS.</td></tr>
<tr><td>Coimbatore</td><td colspan="4">The trial was initiated with seven treatments including Bacillus safensisand Phosporus fertilizer alone and in combination. First dose of bacterial application was done by soil drenching at the time of planting. Among the seven treatments T_3 recorded (75% Phosphorus fertiliser + Bacillius safensis) more fresh weight per clump(299.87 g) and fresh rhizome yield per hectare (24.78 t ha^{-1}) followed by T_5 (50% Phosphorus fertiliser + Bacillius safensis) 287.25 g fresh weight per clump and fresh rhizome yield per hectare (23.38 t ha^{-1})</td></tr>
</table>

Kahikuchi	Treatment T_3 (75% phosphorus (P) fertilizer and *Bacillus safensis*) recorded the highest plant height (179.37 cm), number of shoots per plant (6.29 no.), longest petiole length (39.31 cm), and longest lamina length (80.43 cm). However, the number of leaves in the main shoot (9.47 no.) was recorded highest in T_5 (50% phosphorus (P) fertilizer and *Bacillus safensis*. Fresh rhizome yield was recorded highest in T_3 (27.85 t ha^{-1}) followed by T_5 (26.83 t ha^{-1}). Similarly, Curcumin content was found highest in T_3 (5.62%) followed by T_5. Leaf and soil analysis revealed that phosphorus uptake was highest in T_3 (0.49%) followed by T_5 (0.47%).
Kalyani	Result showed that T_3 (75% phosphorus(P) fertilizer and Bacillus safensis) is found the best combination followed by T_5 (50% phosphorus(P) fertilizer and Bacillus safensis*)* and T_1 (100% recommended phosphorus(P) fertilizer).
Kammarpally	Among different treatments, T_3 (75% phosphorus (P) fertilizer and *Bacillus safensis)* were found effective and recorded maximum yield (59.25 t ha^{-1}) followed by T_5 (50% phosphorus (P) fertilizer and Bacillus *safensis*) with high yield (56.25 t ha^{-1}) when compare to control (51.0 t ha^{-1}). Highest curcumin content recorded in T_2 (2.64 %) followed by T_6 (2.61%)
Kozhikode	Among the treatments, the one with 75% P + *B. safensis* registered significantly ($P < 0.05$) higher rhizome yield and the increase was greater by 36.5% and 47.0 % compared to treated control (100% P) and absolute control. With regard to soil available P, the levels were significantly ($P < 0.05$) higher in all the treatments involving combined application of *B. safensis* with 50% or 75% or 100% P. Higher microbial activity in *B. safensis* treatment was confirmed with the observation on dehydrogenase, which registered greater levels in *B. safensis* + 75% P compared to 100% P .Rhizome rot disease incidence was not observed in turmeric treated with combined application of *B. safensis* with 75% P compared to absolute control.
Pasighat	This experiment was conducted with NDH-98 variety and treatments were applied as per the technical programme. Among the treatments, the highest plant height (104.35 cm) at 120 DAP was recorded in T_3 (75% P + *Bacillus safensis*) followed by T_1 (100% P) with a plant height of 101.12 cm at 120 DAP, respectively. Number of tillers/clump was maximum in T_3 with 4.35 tillers/clump at 120 DAP. Number of leaves was also found to be highest in T_3 with 8.45 numbers of leaves per plant. As far as yield parameters is concerned, highest yield/clump (237.83 g) was found in T_3 and the projected yield per hectare was also found to be highest in T_3 (23.83 t ha^{-1}) and the lowest yield in control (14.33 t ha^{-1}).
Pottangi	Application of P solubilization (20.91 t ha^{-1}) gave 11.8% higher yield than control (18.7 t ha^{-1}) in Roma.
Pundibari	In this trial, effects of plant growth promoting Rhizobacteria, *Bacillus safensis* for phosphorus (P) solubilizing potential, seven (7) treatments were evaluated. Analysis of the data revealed that the highest number of tillers per plant (2.90) and fresh rhizome yield (28.62 t ha^{-1}) were recorded in T_3 (75% recommended phosphorus fertilizer and *Bacillus safensis*) followed by T_5 (50% recommended phosphorus fertilizer and *Bacillus safensis*) and T_1 (100% recommended phosphorus fertilizer). Whereas, all the parameters were found to be lowest in T_7 (Control *i.e.* without phosphorus fertilizer).
Raigarh	Maximum plant height 50 DAS (55.34 cm) and 120 DAS (106.96 cm) and maximum yield 24.413 t /ha found in treatment T_3.
Solan	Turmeric cv. *Palam Lalima* drenched with plant growth promoting rhizobacteria *Bacillus safensis* and application of 37.5 kg $ha^{-1}P_2O_5$ fertilizer

	showed the highest yield (261.67 q ha^{-1}) along with maximum net returns (₹ 3,80,096) and B:C ratio (1.38) under mid hill conditions of Himachal Pradesh.

Project Code	TUR/CM/5.2	**Project Title**	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		
Date of start	2020-21	**Date of closure/ duration**	3 years
Experimental details	Treatments: T_1- 100% recommended zinc (Zn) fertilizer T_2- 50% Zinc (Zn) fertilizer and Bacillus *safensis* T_3- 50% Zinc (Zn) fertilizer alone T_3- *Bacillus safensis* alone T_3- Control without Zn Crop variety: Popular improved variety of respective centre/area. • Experimental design: RBD • Treatments: 5 • Replication: 5 • Bed size: 3 x1m • Spacing: 15x30 cm; Total no. of beds: 25 Methodology: Bacteria application as soil drench: At the time of planting, 30 days after planting (DAP), 60 days after planting (DAP) • Fertilizer application: - As per the recommendation		
Observation Recorded	• Growth parameters (90 & 120 DAP) • Soil nutrients analysis –Available Zn & other major & minor nutrients (120DAP) • Nutrient uptake (harvest)- Leaf and rhizome • Yield and quality analysis • Economics		

Work done/achievements during 2024-25 (centre-wise)	
Chintapalli	It was observed that among different treatments in turmeric, application of 50% Zinc fertilizer and *Bacillus safensis* recorded more number of tillers per clump (2.76), fresh weight of clump in grams (265.05 g), fresh rhizome yield per hectare (23.82 t/ha) and dry rhizome yield (5.98 t/ha) and maximum DTPA Extractable Zinc content (1.02 ppm) in the soil at 150 DAS
Coimbatore	The trial was initiated with seven treatments including *Bacillus safensis* and Zinc fertilizer alone and in combination. 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. Among the treatments ,the treatment T_2 (50% Zinc fertiliser+ *Bacillus safensis*) recorded more fresh weight perclump (216.18g) and fresh rhizome yield per hectare(22.90 t ha^{-1})
Dholi	Among the treatments, highest significant turmeric (Var., Rajendra Sonali) yield of 49.29 t ha^{-1} was recorded in the treatment, T_1- 100%

	recommended dose of Zinc (Zn) fertilizer.
Kahikuchi	Treatment T_1 (100% recommended zinc fertilizer) recorded the highest plant height (175.35 cm), number of leaves at main shoot (8.97), maximum number of shoots (6.29 no.) per clump and longest lamina length (78.37 cm). However, longest petiole length (37.53 cm) was recorded by T_2 (50% zinc (Zn) fertilizer and *Bacillus safensis* treatments). Fresh rhizome yield was recorded highest in T_1 (23.95 t ha^{-1}) followed by T_2 (22.63 t ha^{-1}). Similarly, Curcumin content was found highest in T_1 (5.47%) followed by T_2 (5.23%). Leaf, rhizome and soil analysis were done for available Zn. Zn uptake by leaf was highest in T_2 (40.43 ppm) followed by T_1 (32.21 ppm).
Kalyani	Result showed that T_2 (50% zinc (Zn) fertilizer and *Bacillus safensis*) is found the best combination followed by T_1 (100% recommended zinc (Zn) fertilizer) and T_3 (50% zinc (Zn) fertilizer alone).
Kammarpally	Among the different treatments evaluated, T_2 (50% Zinc fertilizer combined with *Bacillus safensis*) recorded the highest yield of 38.75 t ha^{-1}, followed by T_1 (100% recommended Zinc fertilizer) with 36.25 t ha^{-1}, both significantly outperforming the control. In terms of curcumin content, T_2 also recorded the highest value at 2.75%, followed closely by T_4 with 2.72%.
Kumarganj	During 2024-25 for zinc (Zn) solubilization potential in turmeric, out of 5 treatments, treatment T_2 (50 % Zn fertilizer and *Bacillus safensis*) gave highest yield 312.67 q ha^{-1} followed by in treatment T_1 (100 % recommended zinc (Zn) fertilizer) 296.67 q ha^{-1}, and T_3 (50% zinc (Zn) fertilizer alone) 289.33 q ha^{-1}. The T_5 (Control without Zn) recorded yield 268.67 q ha^{-1}.
Kanke	It was found that effect of 50% Zinc (Zn) fertilizer and *Bacillus safensis* enhanced the yield of turmeric rhizome as 28.34 t ha^{-1} in comparison with control where yield was 21.40 t ha^{-1}. However, 100% recommended zinc (Zn) fertilizer enhanced the yield in similar way as statistically at par which reflects the message that Zn fertilizer alone and 50% Zn fertilizer along with *Bacillus safensis* enhanced the rhizome yield significantly.
Kozhikode	Among the treatments, combined application of *Bacillus safensis* with different levels of $ZnSO_4$ significantly increased the number of tillers, shoot length, number of leaves, dry root weight and shoot weight compared to application of 100% $ZnSO_4$ and absolute control. With regard to soil available Zn, the levels were significantly higher in all the treatments involving combined application of *B. safensis* with 50% or 75% or 100% $ZnSO_4$. The treatment, *B. safensis* + 75% $ZnSO_4$ recorded significantly higher soil available Zn. Among the treatments, application of 75% $ZnSO_4$ + *B. safensis* registered significantly higher fresh rhizome yield and the increase was 58.8% and 63.28 % compared to treated control (100% $ZnSO_4$) and absolute control, respectively. Rhizome rot disease incidence was not observed in turmeric treated with combined application of *B. safensis* with 50% or 75% $ZnSO_4$, compared to absolute control.
Pasighat	This experiment was conducted with NDH-98 variety and treatments were applied as per the technical programme. Among the treatments, the highest plant height (107.84 cm) at 120 DAP was recorded in T_2 (50% P + *Bacillus safensis*) followed by T_1 (100% Zn) with a plant height of

	101.84 cm at 120 DAP. Number of tillers/clump was maximum in T2 with 3.80 tillers/clump at 120 DAP. Similarly, number of leaves was also found to be highest in T_2 with 7.84 number of leaves 120 DAP. As far as yield parameters is concerned, highest yield/clump (213.07 g) was found in T_2 and the projected yield per hectare was also found to be highest in T_2 (20.66 t ha^{-1}) and the lowest yield in control (13.09 t ha^{-1}).
Pottangi	Application of Zn solubilization (21.21t ha^{-1}) gave 12.2% higher yield than control (18.9 t ha^{-1}) in Roma.
Pundibari	In this trial, effects of plant growth promoting rhizobacteria, *Bacillus safensis* for zinc (Zn) solubilizing potential, five (5) treatments were evaluated. Analysis of the data revealed that the maximum number of tillers per plant (3.04) and fresh rhizome yield (27.39 t ha^{-1}) were recorded in T_2 (50% recommended zinc fertilizer and *Bacillus safensis*) followed by T_1 (100% recommended zinc fertilizer). Whereas, all the parameters were found to be lowest in T_7 (Control without zinc fertilizer).
Raigarh	Maximum Plant height 50 DAS (56.80 cm) and 120 DAS (106.93cm) and maximum yield (25.37 t ha^{-1}) found in treatment T_1

TREE SPICES

Project Code	TSP/CM/5.1	**Project Title**	Site-Specific Nutrient Management in Nutmeg (*Myristica fragrans*)
Centres	Vellanikkara, Kozhikode, Dapoli and Coimbatore		
Date of start	2026	**Date of closure/ duration**	Three years
Experimental details	Treatments: 5 1. Site-specific soil test-based nutrient application 2. Site-specific soil test based 100% of their nutrient application through fertigation 3. Site-specific soil test based 75 % of their nutrient application through fertigation 4. Site-specific soil test based 50 % of their nutrient application through fertigation 5. Control		
Observations Recorded	1. Average height (cm) 2. Average girth (cm) 3. Number of branches 4. Average spread (m) 5. Fruit length (cm) 6. Fruit breadth (cm) 7. Fruit weight (fresh) (g) 8. Mace weight (fresh) (g) 9. Mace weight (dry) (g) 10. Nut weight (fresh) (g) 11. Nut weight (dry) (g) 12. Kernel weight (dry) (g) 13. Number of fruits per m^2 14. Number of fruits per tree		

	15. Fresh and dry nut yield per tree (kg) 16. Fresh and dry kernel yield per tree (kg) 17. Fresh and dry mace yield per tree (kg) 18. Kernel analysis: 19. Volatile oil (%) 20. Oleoresin (%) 21. Fixed oil (%) 22. Mace analysis: 23. Volatile oil (%) 24. Oleoresin (%)
Work done/achievements during 2025-26 (centre-wise)	
All Centres	Centres have finallised the site of experiment. Ready to start the experiment
Dapoli	Layout of trial has done and experiment will start in month of September

CORIANDER

Project Code	COR/CM/5.1	**Project Title**	Growth and yield of Coriander as influenced by AMF (Arbuscular Mycorrhizal Fungi)
Centres	Ajmer, Coimbatore, Dholi, Guntur, Jabalpur, Kota		
Date of start	2022-23	**Date of closure/ duration**	Three years
Experimental details	• Experimental design: Factorial RBD; Replication: 3 <u>Treatment combinations: 9 + 1 control (absolute control)</u> T_1: 100% RDP with Seed treatment T_2: 75% RDP with Seed treatment T_3: 50% RDP with Seed treatment T_3: 100% RDP with Soil application (20 DAS @ 5 kg acre^{-1}) T_3: 75% RDP with Soil application (20 DAS @ 5 kg acre^{-1}) T_3: 50% RDP with Soil application (20 DAS @ 5 kg acre^{-1}) T_7: 100% RDP with Seed treatment (@ 100g per kg of seed) at the time of sowing, and Soil application (20 DAS @ 5 kg acre^{-1}) T_8: 75% RDP with Seed treatment with Seed treatment (@ 100g per kg of seed) at the time of sowing, and Soil application (20 DAS @ 5 kg acre^{-1}) T_9: 50% RDP with Seed treatment (@ 100g per kg of seed) at the time of sowing, and Soil application (20 DAS @ 5 kg acre^{-1}) C- Control (water spray) • Crop variety: Popular improved variety of respective centre/area. • Plot size & Crop spacing: 4 x 2.4 m, Spacing- 30 x 10 cm		
Observations Recorded	1. Vigour (Plant height in cm) 2. No. of days to 50% flowering 3. No. of primary branches/plant 4. No. of secondary branches/plant 5. No. of umbels/plant 6. No. of umbellets/umbel 7. No. of seeds/umbel 8. Duration (No. of days to maturity)		

	9. Yield (q ha^{-1}) 10. Essential oil (%) 11. Soil and plant P uptake 12. Economics and B:C ratio.
Work done/achievements during 2024-25 (centre-wise)	
Ajmer	The results show application of 50, 75 and 100 % recommended P gave 2549.3, 2732.0 and 2733.9 kg ha^{-1} seed yield whereas among AMF application methods, seed treatment along with soil application gave 2755.2 kg ha^{-1} seed yield. Maximum seed yield of 2862.3 kg ha^{-1} of coriander was recorded with the application of 75% RDP and seed treatment of coriander with AMF@100g kg^{-1} of seed at the time of sowing and soil application AMF @5 kg $acre^{-1}$ 20 DAS
Coimbatore	The experimental design adopted was FRBD. Among the different phosphorus (P) levels (Factor 1), the treatment with 100% Recommended Dose of Phosphorus (RDP) recorded the highest plant height of 65.23 cm. The number of umbels per plant was statistically similar across all treatments in Factor 1. The maximum seed yield of 12.50 q/ha was also recorded in the 100% RDP treatment. In Factor 2, the highest plant height (60.60 cm) and seed yield (11.53 q ha^{-1}) were observed in T_3, which involved seed treatment combined with soil application of VAM. Regarding interaction effects, the combination of 100% RDP + seed treatment + soil application of VAM resulted in the maximum plant height (63.56 cm). The highest seed yield (12.71 q ha^{-1}) was recorded in the treatment with 100% RDP + seed treatment, followed closely by the treatment with 75% RDP + seed treatment + soil application of VAM (12.63 q ha^{-1}).
Dholi	The results of experiment growth and yield of coriander as influenced by AMF revealed that among all the treatments irrespective of the application method 100 % RDP exhibited the highest seed yield (2,052.82 kg ha^{-1}), while among the application methods, irrespective of the application RDP % level, Seed + Soil application method exhibited the highest yield (1,920.22 kg ha^{-1}) best. However, in terms of benefit cost ratio irrespective of the treatment level AMF seed application method exhibited the highest BC ratio (1.20), while among the treatments, irrespective of the application method, 100 % RDP level exhibited the highest BC ratio (1.61), which shows its economic feasibility compared to other RDP % levels.
Guntur	During 2024-25, among various levels of phosphorus, maximum yield (1675.8 kg ha^{-1}) was recorded in the plots applied with P_1 (100% RDP) followed by P_2 (75% RDP) (1533.3 kg ha^{-1}) over P_4 (absolute control) (1121.0 kg ha^{-1}). Among different mode of application of AMF, seed treatment (ST) and soil treatment (SOT) of AMF recorded highest yield of 1526.3 kg ha^{-1}. However, the interaction effect is not significant.
Jabalpur	Significant differences were observed across all growth and yield parameters, except for 50% flowering, which was found to be non-significant. The maximum plant height (116.69 cm) was recorded in T_3 (100% RDP with both seed treatment and soil application), which was statistically at par with T_6 (75% RDP with combined seed treatment and soil application). Similarly, the highest seed yield (15.20 q ha^{-1}) and harvest index (31.45) were also observed in T_3, followed by T_6, which produced a yield of 14.48 q ha^{-1} and a harvest index of 27.05.
Kota	The experiment was conducted using a Factorial Randomized Block Design with two factors: {4 levels of factor 1 (Phosphorus level), 3 levels of factor 2 (mode of application)}comprising twelve treatments combinations with three

	replications. This trial was sown on 19th November, 2024, among the different fertility treatments, application of 100% RDP (recommended dose of phosphorus) was positively affected the growth parameters, yield attributes and yield of coriander over control. Application of 100% RDP (recommended dose of phosphorus) along with seed + soil treatment with *Arbuscular mycorrhizal* fungi recorded higher yield.

Project Code	COR/CM/6.1	**Project Title**	Effect of growth regulators on yield and quality of Coriander
Centres	Coimbatore, Guntur, Hisar, Jabalpur, Jobner, Kota, Raigarh		
Date of start	2022-23	**Date of closure/ duration**	Three years
Experimental details	• Experimental design: RBD; Replication: 3 Treatment combinations: 8 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 C: Control (water spray) • Crop variety: Popular improved variety of respective centre/area. • Plot size & Crop spacing: 4 x 2.4 m, Spacing- 30 x 10 cm		
Observation Recorded	1. Vigour (Plant height in cm) 2. No. of days to 50% flowering 3. No. of primary branches/plant 4. No. of secondary branches/plant 5. No. of umbels/plant 6. No. of umbellets/umbel 7. No. of seeds/umbel 8. Duration (No. of days to maturity) 9. Yield (q ha^{-1}) 10. Essential oil (%) 11. Economics and B:C ratio		
Work done/achievements during 2024-25 (centre-wise)			
Coimbatore	The highest number of umbel per plant was recorded in T_3 (37.70) and T_5 (36.66) followed by T_6 (36.23). T_1 (*ie.* SA@50 ppm) recorded highest seed yield of 12.40 q ha^{-1}. Lowest seed yield was recorded in control (9.86 q ha^{-1}).		
Hisar	The significant differences were obtained for all the treatments. Maximum umbels per plant (58.4) and seed yield (2022.0 kg ha^{-1}) was recorded with the application of Benzyl adenine @ 20 ppm which is being at par with spray of Benzyl adenine @ 10 ppm (2010.3 kg ha^{-1}).		
Guntur	During 2024-25, among the different growth regulators evaluated, significantly highest yield was obtained in salicylic acid @ 50 ppm (1249.6 kg ha^{-1}) followed by Benzyl Adenine @10 ppm (1114.9 kg ha^{-1}), Brassinosteroids @ 0.5 ppm (1108.7 kg ha^{-1}) over control (901.0 kg ha^{-1}).		
Jabalpur	Using four plant growth regulators viz., Salicylic acid, Jasmonic acid, Benzyl adenine, and Brassinosteroid at different concentrations with water spray as the		

	control, the experiment was laid out in a Randomized Block Design (RBD) with three replications. Spraying was carried out at 30 and 60 days after sowing (DAS). The findings revealed that foliar-applied PGRs had a significant effect on coriander performance. Brassinosteroid @ 0.5 ppm and Jasmonic acid @ 50 ppm recorded the highest values in growth parameters. In terms of yield attributes, BA @ 20 ppm recorded the highest yield and was at par with BA @ 10 ppm and Brassinosteroid @ 0.5 ppm with 16.99 q ha^{-1}, 15.05 q ha^{-1} and 14.63 q ha^{-1} respectively. Quality analysis revealed an increase in volatile oil content with BA @ 20 ppm, while the highest ascorbic acid content was observed with Brassinosteroid @ 0.5 ppm. The maximum benefit-cost (B:C) ratio (2.87) was obtained from the treatment with BA @ 20 ppm followed by BA @ 10 ppm (2.45).
Jobner	Among the different growth regulators, salicylic acid @ 100 ppm recorded the highest yield, growth parameters, quality and economic returns in coriander, followed by jasmonic acid @ 100 ppm and brassinosteroid @ 1.0 ppm. The experiment was conducted for three consecutive rabi seasons (2022–23 to 2024–25) using coriander variety RCr-728 in loamy sand soil with low organic carbon (0.25%), low available N (145.8 kg ha^{-1}), P (8.4 kg ha^{-1}), and medium K (137.6 kg ha^{-1}), alkaline in nature (pH 8.4). Sowing was done on 27.10.2024 with a spacing of 30 × 10 cm in 4.0 × 2.4 m² plots. All treatments significantly enhanced growth, yield attributes, and seed yield over control.
Kota	The field experiment was conducted in RBD comprising nine treatments (two spray of different growth regulators and water spray at 30 & 60 DAS) with replicated trice. The growth, yield attributes and yield of coriander was influenced by different growth regulators as compared to control (water spray). Among the different growth regulators, application of Salicylic acid @ 100 ppm gave the highest growth parameters, yield attributes and seed yield of coriander followed by Jasmonic acid @ 100 ppm.
Raigarh	Among the different growth regulators, earliest flowering (50% & 100% flowering) was recorded at 42 DAS and 54 DAS in treatment of Benzyl adenine @ 20 ppm as well as highest yield (1741.463 kg ha^{-1}) and test weight 13.33g ollowed by T_8 in terms of flowering and yield (1648.39 kg) was recorded.

Project Code	COR/CM/2.3	**Project Title**	Crop specific micronutrient formulation of coriander
Centres	Ajmer, Coimbatore, Guntur, Hisar, Jagudan, and Jobner		
Date of start	2024-25	**Date of closure/ duration**	Three years
Experimental details	• Experimental design: RBD; Replication: 5 Treatment combinations: 4 T_1: Control(Recommended NPK without micronutrients) T_2: 100% recommended dose of Micronutrients fertilisers through soil application T_3:Two foliar sprays of micronurient formulation@ 1% at 60 and 90 DAS T_4: 50% soil application of micronutrients + 1% foliar spray of micronutrient formulation at 60DAS. • Crop variety: Popular improved variety of respective centre/area. • Plot size & Crop spacing: 4 x 2.4 m, Spacing- 30 x 15 cm		
Observation Recorded	1. Weight of fresh shoot and dry shoot at harvesting (g)		

	2. Number of umbels per plant 3. Number of umbellets per umbel 4. Seed yield (Kg/ha) 5. Chemical analysis of micronutrients (Zn, Fe, Mn, Cu and B in mg/kg) present in soil and plant 6. Soil pH, Soil organic carbon (%) etc. before and after crop harvest 7. Essential oil (%) 8. Protein content (%) 9. 9. Economics analysis (Cost of cultivation, Gross return, Net return and B :C Ratio)
Work done/achievements during 2024-25 (centre-wise)	
Ajmer	Treatment T_4 recorded the highest seed yield (2407.76 kg ha^{-1}), which was statistically at par with T_3 (2398.03 kg ha^{-1}), both being significantly superior to T_1 and T_2. The essential oil content was highest in T_4 (0.352%), followed closely by T_3 (0.346%), while T_1 had the lowest (0.258%). Micronutrient content in soil and seed showed notable improvement with treatments T_2–T_4, with T_3 showing the highest levels of seed Zn (42.52 mg kg^{-1}), seed Cu (22.72 mg kg^{-1}), and seed Fe (61.77 mg kg^{-1}). Soil Zn, Cu, Fe, and Mn contents were significantly improved under T_2, confirming the effectiveness of soil micronutrient applications. In terms of protein content, T_4 recorded the highest (3.84%), followed closely by T_3 (3.92%), both significantly higher than T_1 (2.46%). Economic analysis revealed that T_4 and T_3 yielded the highest net returns (₹4.93 and ₹4.83 lakhs/ha, respectively) and benefit-cost ratios of 4.12 and 4.23, indicating superior profitability over the control (T_1), which had the lowest B:C ratio (3.52).
Coimbatore	Trial was initiated with 4 treatments and five replications. The highest number of umbel per plant was recorded in T_2 (33.18) followed by T_4 (28.30). Treatment, T_2 recorded highest seed yield of 768.90 kg ha^{-1}.
Guntur	During the year 2024-25, plants sprayed with two foliar sprays of micronutrient formulation @ 1% at 60 & 90 DAS were found significantly superior with respect to yield (1535.3 kg ha^{-1}) over control (909.1 kg ha^{-1}).
Hisar	The significant differences were obtained for all the treatments. Maximum Umbels per plant (53.2) and seed yield (1993.6 kg ha^{-1}) was recorded with the application of Benzyl adenine @ 20 ppm which is being at par with spray of Benzyl adenine @ 10 ppm (1966.3 kg ha^{-1}).
Jagudan	Total three formulations of micronutrients applied as foliar as well as soil were tested on variety G Co-3 at Seed Spices Research Station, Jagudan in the year *rabi* 2024-25.The yield attributing characters as well as seed yield were not affected significantly due to different micronutrient formulations.
Jobner	The experiment was started in 2024-25 and the four treatments consisted of different micronutrients were evaluated in RBD with 5 replications in a plot size of 4.0 x 2.5 m^2 with crop geometry of 30 x 10 cm. The crop was sown on 16.11.2024. The micronutrient application in soil as well as foliar spray increased the yield attributes and yield of coriander as compare to control.

CUMIN

Project Code	CUM/CM/2.1	**Project Title**	Standardization of plant density and sowing time for cumin genotype CZC 94
Centres	Ajmer, Mandore, Jagudan, Jobner, and Sanand,		
Date of start	2024-25	**Date of closure/ duration**	One year
Experimental details	• Experimental design: Split Plot Design; Replication: 6 **Main Treatment (A) :** Sowing dates (15 Nov and 5 Dec) **Sub Treatments (B)** : Varieties (CZC 94 and GC 4) **Sub Treatments (C) :** Spacing 1. (Normal Spacing) : 30 x 5 cm 2. (Closer Spacing) : 22.5 x 5 cm Subplot Treatments 1. CZC 94 + 22.5 cm 2. CZC 94 + 30 cm 3. GC 4 + 22.5 cm 4. GC 4 + 30 cm • Plot size : 3.6 m x 3.0 m		
Observation Recorded	1. Days of flowering 2. Days of maturity 3. Days to harvest 4. Thousand seed weight 5. Seed Yield (Kg per ha) 6. Incidence of Fusarium wilt (PDI) 7. Incidence of Blight (PDI)		
Work done/achievements during 2024-25 (centre-wise)			
Ajmer	The results revealed that the variety GC 4 significantly outperformed CZC 94 across all treatments, with a critical difference (C.D.) of 67.9 indicating a statistically significant varietal effect. The highest yield (645.6) was recorded with GC 4 sown on 5th December at a row spacing of 30.0 cm. While sowing date and row spacing alone did not show significant differences, the interaction between variety and row spacing was statistically significant (C.D. = 96.1). GC 4 maintained consistently high yields at both spacings, whereas CZC 94 showed a marked reduction in yield at the wider spacing of 30.0 cm, particularly when sown on 15th November. Overall, late sowing (5th December) tended to favor better performance, especially for CZC 94, and the combination of GC 4 with wider spacing and later sowing was the most productive		
Mandore	The date of sowing had a significant impact on crop yield. Late sowing (5th December) resulted in a considerable reduction in yield (399 kg/ha) compared to timely sowing (15th November), which recorded a yield of 863 kg/ha. Among the genotypes, CZC-94 produced a significantly lower yield (517 kg/ha) compared to the check variety GC-4 (745 kg/ha). Plant spacing, in general, did not have a significant effect on overall yield. Interestingly, under late-sown conditions, genotype CZC-94 recorded a numerically higher yield (405 kg/ha) than the check variety GC-4 (393 kg/ha), although both genotypes experienced a significant reduction in yield compared to their performance under timely sowing conditions (CZC-94: 629 kg/ha & GC-4: 1097). Reduction in plant spacing had a positive effect on the yield of the check variety GC-4, with significantly higher yield observed at 22.5 cm spacing (821 kg/ha) compared to the wider spacing of 30 cm (668 kg/ha). However, in genotype CZC-94, variation in plant spacing did not result in any significant difference in yield. Incidence of wilt disease was more in 15th November sown crop as compare to		

	late sowing (5th December) and genotype CZC 94 was more susceptible as compare to GC-4. In later stage, blight disease was also appeared.
Jagudan	A Study on standardization of plant density and time for cumin genotype CZC 94 was carried out at Seed Spices Research Station, Jagudan in the year rabi 2024-25. The treatments consist of two varieties viz, GC 4 and CZC -94 with different plant densities (30 X 5 cm2, 22.5 X 5 cm2) and sowing time (15th November and 5th December).The initial plant population was optimum in all the treatments under study and the crop condition was sustain up to flowering stage. The mean days of flowering for Gujarat cumin-4 and GCZ 94 recorded were 59 and 40 DAS, Respectively. Later at seed setting stage both the varieties were infested with heavy attack of blight, resulted in loss of seed yield. The experiment was vitiated due to heavily infestation of blight.
Jobner	The experiment was conducted during Rabi 2024–25 using four treatments comprising two coriander varieties (CZC-94 and GC-4) and two spacings (30 × 5 cm and 22.5 × 5 cm) in SPD design with six replications. The crop was sown on 15.11.2024 and 05.12.2024 in 3.6 × 3.0 m² plots. Variety CZC-94 flowered and matured 5 days earlier than GC-4, while both varieties recorded statistically similar yields.
Sanand	Two varieties evaluated under two different spacing and date of sowing. Total 8 treatment combinations were tested under split plot design. Variety GC 4 (V2) recorded highest seed yield of 190 kg/ha with 30 x 5 cm spacing (S1) at D2 date of sowing. Treatment S1D2V2, also recorded lowest incidence of wilt and blight.

Project Code	CUM/CM/3.4	**Project Title**	Crop specific micronutrient formulation for cumin
Centres	Ajmer, Mandore, Jagudan, Jobner and Sanand,		
Date of start	2024-25	**Date of closure/ duration**	Three Year (2024-25 to 2026-27)
Experimental details	• Experimental design: RBD; Replication: 5 • T_1 : Control (Recommended NPK without Micronutrients) T_2 : 100% recommended dose of Micronutrient Fertilizers through soil applications (Fe@10Kg/ha+Mn@10kg/ha, Cu@5kg/ha, Zn@5kg, & B@5kg/ha)* T_3 : Two foliar sprays of micronutrient formulation @ 1% at 60 & 90 DAS T_4 : 50% soil application of micronutrients [half of (Fe@10Kg/ha+Mn@10kg/ha, Cu@5kg/ha, Zn@5kg, & B@5kg/ha)]* + 1% foliar spray of Micronutrient formulation* @ 60 DAS Plot size : 5m x 3.0m (Gross) & 4m x 2.5m (Net); Spacing : 25cm x 10 cm		
Observation Recorded	1. Seed yield (Kg/ha) 2. Weight of fresh shoot and dry shoot at harvesting (g) 3. Number of umbels per plant 4. Number of umbellets per umbel 5. Chemical analysis of micronutrients (Zn, Fe, Mn, Cu and B in mg/kg) present in soil and plant 6. Soil pH, Soil organic carbon (%) etc. before and after crop harvest 7. Essential oil (%) 8. Protein content (%) 9. Economics analysis (Cost of cultivation, Gross return, Net		

	return and B :C Ratio)
Work done/achievements during 2024-25 (centre-wise)	
Ajmer	The trial was laid out in a randomized block design with four treatments (T_1–T_4) and observations were recorded Significant differences were observed among treatments for seed yield, economic returns, and B:C ratio, while essential oil content did not vary significantly (p = 0.147). Among the treatments, T_3 (two foliar sprays @ 0.5%) and T_4 (50% soil application + 0.5% foliar spray) recorded significantly higher yields (854.14–869.43 kg ha^{-1}) compared to the control (T_1: 706.43 kg ha^{-1}). These treatments also resulted in higher essential oil content (3.62–3.66%) and maximum net returns (₹761,892 to ₹767,774/ha). Economically, T_3 recorded the highest B:C ratio of 5.02, followed by T_4 (4.88) and T_2 (4.30), while T_1 (control) had the lowest (3.93). The gross returns were also significantly higher in T_3 and T_4 (₹951,533 to ₹965,883/ha), indicating the advantage of integrated nutrient management over conventional practices.
Mandore	The results showed that highest yield was recorded in treatment T_4- 50% Soil application of micronutrients + 1% Foliar sprays micronutrient formulation @ 60 DAS which was at par with treatment T_2-100% Recommended dose of micronutrient fertilizer and T_3- Two foliar sprays of micronutrient formulation @ 1% @ 60 and 90 DAS and significantly higher as compare to control.
Jagudan	Total three formulations of micronutrients as foliar and soil application were tested on variety GC -4 at Seed Spices Research Station, Jagudan in the year *rabi* 2024-25. The results based on one year data indicated that yield attributing characters and seed yield were remained unaffected due to different micronutrient formulations under study
Jobner	Treatments included control (recommended NPK), 100% soil-applied micronutrients, two foliar sprays (1% at 60 & 90 DAS), and a combination of 50% soil + 1% foliar spray. The crop was sown on 16.11.2024 in 4.0 × 2.5 m^2 plots with 30 × 5 cm spacing. However, the cumin crop was vitiated due to a severe blight and wilt infestation.
Sanand	Trial got vitalized due to heavy disease incidence

FENUGREEK

Project Code	FGK/CM/5.1	**Project Title**	Growth and yield of fenugreek as influenced by AMF (Arbuscular Mycorrhizal Fungi)
Centres	Dholi, Guntur, Kota, Mandor, Jabalpur		
Date of start	2022-23	**Date of closure/ duration**	Three years
Experimental details	• Experimental design: Factorial RBD; Replication: 3 <u>Treatment combinations: 9 + 1 control (absolute control)</u> T_1: 100% RDP with Seed treatment T_2: 75% RDP with Seed treatment T_3: 50% RDP with Seed treatment T_3: 100% RDP with Soil application (20 DAS @ 5 kg $acre^{-1}$) T_3: 75% RDP with Soil application (20 DAS @ 5 kg $acre^{-1}$) T_3: 50% RDP with Soil application (20 DAS @ 5 kg $acre^{-1}$) T_7: 100% RDP with Seed treatment (@ 100g per kg of seed) at the time of sowing, and Soil application (20 DAS @ 5 kg $acre^{-1}$) T_8: 75% RDP with Seed treatment with Seed treatment (@ 100g per kg of seed) at the time of sowing, and Soil application		

	(20 DAS @ 5 kg acre^{-1}) T_9: 50% RDP with Seed treatment (@ 100g per kg of seed) at the time of sowing, and Soil application (20 DAS @ 5 kg acre^{-1}) C- Control (water spray) • Crop variety: Popular improved variety of respective centre/area. • Plot size & Crop spacing: 4 x 2.4 m, Spacing- 30 x 10 cm
Observations Recorded	1. Plant height (cm) 2. No. of days to 50% flowering 3. No. of pods/plant 4. Length of pod (cm) 5. No. of seeds/pod 6. Weight of 1000 seeds 7. Duration 8. Yield (q ha^{-1}) 9. Diosgenin content (mg 100-g) 10. Soil and plant P uptake 11. Economics and B:C ratio
Work done/achievements during 2024-25 (centre-wise)	
Dholi	The results of experiment growth and yield of Fenugreek as influenced by AMF revealed that among all the treatments irrespective of the application method 100 % RDP exhibited the highest seed yield (1,974.27 kg ha^{-1}), while among the application methods, irrespective of the application RDP % level, Seed + Soil application method exhibited the highest yield (1,849.32 kg ha^{-1}) best. However, in terms of benefit cost ratio irrespective of the treatment level AMF seed application method exhibited the highest BC ratio (1.26), while among the treatments, irrespective of the application method, 100 % RDP level exhibited the highest BC ratio (1.22), which shows its economical feasibility compared to other RDP % levels.
Kota	During the field experiment, the maximum and significantly higher plant height, pods/plant, seeds/pod and seed yield, net return and B:C ratio of fenugreek was recorded in 100% RDP over 75% RDP and 50% RDP. While in case mode of applications the seed treatment + soil application recorded maximum and significantly higher plant height, pods/plant, seeds/pod and seed yield, net return and B:C ratio of fenugreek.
Mandor	The results of three years pooled analysis showed that 100% RDP significantly increased the pods/plant, plant height, branches/ plant, test weight, net returns and B:C ratio of fenugreek over 50% RDP and control, although, seed and biological yields, gross returns and seeds/pod were also significantly higher over 75% RDP. The different mode of application of mycorrhiza recorded significantly higher pods per plant, test weight, seed yield, biological yield, net returns and B:C ratio over control and were at par with each other.
Jabalpur	The experiment was laid out in a Factorial Randomized Block Design (FRBD) with two factors: phosphorus levels (100% RDP, 75% RDP, 50% RDP, and 0% RDP) and modes of application (seed treatment at 100 g/kg of seed, soil application at 5 kg/acre 20 days after sowing, and a combination of both seed treatment and soil application). The treatment comprising 100% RDP along with both seed treatment and soil application recorded the highest values for plant height (107.87 cm), number of primary branches (8.76), and number of secondary branches at harvest (17.94). However, these treatments had no

	significant influence on phenological traits such as days to flower initiation, days to 50% flowering, and days to maturity. In terms of yield, the highest seed yield (17.78 q/ha) was also recorded under 100% RDP + seed treatment + soil application, which was statistically at par with 75% RDP + seed treatment + soil application (16.64 q/ha).

Project Code	FGK/CM/6.1	**Project Title**	Effect of growth regulators on yield and quality of fenugreek
Centres	Ajmer, Dholi, Hisar, Jobner, Kota		
Date of start	2022-23	**Date of closure/ duration**	Three years
Experimental details		• Experimental design: RBD; Replication: 3 Treatment combinations: 8 T_1: Salicylic acid @ 50 ppm T_2: Salicylic acid @ 100 ppm T_3: Jasmonic acid @ 50 ppm T_3: Jasmonic acid @ 100 ppm T_3: Benzyl adenine @ 10 ppm T_3: Benzyl adenine @ 20 ppm T_7: Brassinosteroid @ 0.50 ppm T_8: Brassinosteroid @ 1.00 ppm C: Control (water spray) • Crop variety: Popular improved variety of respective centre/area. • Plot size & Crop spacing: 4 x 2.4 m, Spacing- 30 x 10 cm	
		1. Plant height (cm) 2. No. of days to 50% flowering 3. No. of pods/plant 4. Length of pod (cm) 5. No. of seeds/pod 6. Weight of 1000 seeds 7. Duration 8. Yield (q ha^{-1}) 9. Diosgenin content (mg 100-g) 10. Soil and plant P uptake 11. Economics and B:C ratio	
Work done/achievements during 2024-25 (centre-wise)			
Ajmer	The results of the experiment indicated that foliar application of different growth regulators significantly influenced the seed yield and economics of the crop. Among the treatments, brassinosteroid @ 0.50 ppm produced the highest seed yield (3,493.3 kg ha^{-1}), closely followed by benzyl adenine @ 10 ppm (3,383.0 kg ha^{-1}) and brassinosteroid @ 1.0 ppm (3,401.7 kg ha^{-1}), whereas the lowest yield was recorded under water spray (2,526.3 kg ha^{-1}). In terms of net returns, benzyl adenine @ 10 ppm gave the maximum value (₹165,609/ha), which was comparable with brassinosteroid @ 0.50 ppm (₹159,611/ha). The highest benefit–cost ratio was observed with salicylic acid @ 50 ppm (4.22), followed by salicylic acid @ 100 ppm (4.20) and brassinosteroid @ 0.50 ppm (4.17), indicating greater profitability. On the other hand, the lowest B:C ratio was noted with jasmonic acid @ 100 ppm (1.64). The statistical analysis (C.D. at 5%) confirmed that the differences among treatments were significant, demonstrating that the application of brassinosteroids, benzyl adenine, and		

	salicylic acid improved productivity and profitability over the control
Dholi	Among nine treatments comprising of application of different growth regulators on fenugreek the second year results revealed that application of Brassinosteroid @ 1.00 ppm exhibited the highest yield (1898.53 kg ha^{-1}) followed by Brassinosteroid @ 0.5 ppm (at par) with yield of 1870.37 kg ha^{-1}. All the treatments were significantly high yielding than that of the control (water spay) which exhibited a yield of 1555.91 kg ha^{-1}. In context to BC ratio the highest BC ratio (1.41) was exhibited by Brassinosteroid @ 1.00 ppm which was significantly higher than all other attempted treatments, showing its cost effectiveness compared to all other treatments.
Hisar	The significant differences were obtained for all the treatment except branches per plant. Maximum number of pods per plant (66.9) and seed yield (2479.6 kg ha^{-1}) was recorded with the application of Salicylic Acid @ 100 ppm followed by spray of Jasmonic Acid @ 50 ppm (2188.9 kg ha^{-1}).
Jobner	The nine treatments consisted of spray of different growth regulators evaluated on fenugreek variety RMt-354 in loamy sand soil, low in organic carbon (0.25%), N (145.8 kg/ha), P (8.4 kg/ha), and medium in K (137.6 kg/ha), with alkaline pH (8.4) in RBD with 3 replications in a plot size of 4.0 x 2.4 m^2 with crop geometry of 30 x 10 cm. The results showed that different modern growth regulators viz., salicylic acid @ 50 ppm, salicylic acid @ 100 ppm, jasmonic acid @ 50 ppm, jasmonic acid @ 100 ppm, benzyl adenine @ 10 ppm, benzyl adenine @ 20 ppm, brassinosteroid @ 0.50 ppm, brassinosteroid @ 1.0 ppm significantly increased growth parameters, yield attributes, yield and economics of fenugreek over control.
Kota	The field experiment was conducted at ARSS, Khanpur in three replications with nine treatments in RBD. The maximum plant height, pods/plant and seed yield of fenugreek was recorded in foliar application of Jasmonic acid @ 100 ppm over control. The higher doses of growth regulators recorded at par results with foliar applications of lower doses.

TECHNICAL SESSION III

CROP PROTECTION & FOOD SAFETY

Project code	Title	Centres
	Black Pepper	
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/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
	Ginger	
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/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
	Cumin	
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
	Fenugreek	
FGK/CP/7.1	Bio-efficacy of fungicides against powdery mildew of fenugreek.	Coimbatore, Hisar, Jabalpur, Jagudan, Jobner, Kota, Raigarh.

Nigella		
NGL/CP/7.1	Management of root rot of nigella	Dholi, Kumarganj, Raigarh
Seed spices		
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.

PROGRESS REPORT OF THE PROJECTS

CROP PROTECTION & FOOD SAFETY

BLACK PEPPER

Project Code	PEP/CP/7.2	**Project Title**	Evaluation of effective insecticides against against pollu beetle, *Lanka ramakrishnai* infesting black pepper for label claim expansion.
Centres	Appangala, Kozhikode, Panniyur		
Date of start	2024-25	**Date of closure/ duration**	2 years (2025-26)
Experimental details		Experimental design: RBD; Replication: 5 Crop variety: Popular variety of respective centre/area. Treatments: T_1- Chlorantraniliprole 18.5% SC @ 0.375 ml L^{-1} (0.0375%) T_2- Chlorantraniliprole 18.5% SC @ 0.5 ml L^{-1} (0.05%) T_3- Chlorantraniliprole 18.5% SC @ 0.625 ml L^{-1} (0.0625 %) T_4- Quinalphos 25%EC @ 2.0 ml L^{-1} (0.2%) T_5- Control T_6- Chlorantraniliprole 18.5% SC@ 0.5 ml L^{-1} (0.1%) Date of first spray: at the start of pest incidence followed by another two sprays at monthly intervals	
Observation Recorded		• Bio efficacy against pest • Phytotoxicity grade (0-10 Scale) • Toxicity against Natural Enemies • Crop Yield • BC ratio	
Work done/achievements during 2024-25 (centre-wise)			
Appangala	The trial commenced in 2025, applications of treatments are in progress, and samples for residue analysis will be collected in the following season.		
Panniyur	Experiment was initiated in July 2024 with the control recorded the highest pest incidence at 15.6%, followed by Treatment T_4 (8.7%), whereas no pest infestation was observed in the remaining treatments. There was no significant reduction in the population of natural enemies in any of the treatments. Importantly, no symptoms of phytotoxicity were observed in the treatment designated for phytotoxicity evaluation. The highest yield was recorded in Treatment T_3 (3.70), which were on par with T_1 and T_2, while the lowest yield was recorded in the control (3.08). To assess any potential residue build-up resulting from the applications, samples of green pepper, black pepper (dried), white pepper, and corresponding soil were collected and submitted for residue analysis.		
Kozhikode	Chlorantraniliprole 18.5% SC treatments (T_1-T_3) significantly reduced pollu beetle infestation compared to the control. The treatment at 0.5 ml L^{-1} (T_2) recorded the lowest mean infestation and was statistically on par with the higher dose (0.625 ml/L). Both effective doses (T_2 and T_3) were superior to the standard check, Quinalphos 25% EC. No phytotoxic symptoms such as leaf burn, chlorosis, necrosis, or stunting were observed even at twice the recommended dose. There was no adverse effect on the population of		

	beneficial arthropods, including predators and parasitoids. The treatments were found to be safe to the natural enemies associated with the black pepper ecosystem. Treated plots, particularly those under T_2 (1.16 kg) and T_3 (1.20 kg), showed a notable increase in dry berry yield, which corresponded with effective pest control (0.73 kg). The yield improvement ranged between 12 and 18 percent over the untreated control.

CARDAMOM

Project Code	CAR/CP/2.1	**Project Title**	Efficacy of combined application of *Heterorhabditis indica* (EPF) against root grubs (*Basilepta fulvicorne*) and *Meloidogyne* sp. nematodes in small cardamom
Centres	Appangala, Myladumpara, Pampadumpara		
Date of start	2025-26	**Date of closure/ duration**	Two years (2026-27)
Experimental details	Crop: existing plants of any variety; Plot size/spacing: 3 x 3 m, 12 plants /plot; Replications:4; Design: RBD **Treatments (4):** T_1-*H. indica* (EPN) cadaver (1,00,000 ijs) + *P. lilacinus* (EPF) talc (25 g) / plant T_2- *H. indica* (EPN) cadaver (1,25,000 ijs) + *P. lilacinus* (EPF) talc (50 g) / plant T_3- *H. indica* (EPN) cadaver (1,50,000 ijs) + *P. lilacinus* (EPF) talc (75 g) / plant T_4- Recommended nematicide (Cartap hydrochloride) **Two applications per year (June and September)**		
Observation Recorded	• Root grub symptoms (yellowing of leaves) • Incidence of root grubs (number per 15 cm^3) • Nematode symptoms (shortened internodes, narrow leaves, root knots, root lesions) • Population of plant parasitic nematodes/EPN in the soil • Yield (dry kg/ha) and BC ratio		
Work done/achievements during 2025-26 (centre-wise)			
Appangala Myladumpara Pampadumpara	Bioagents distributed among centres by ICRI, Myladumpara and trials is in vegetative stage.		

GINGER

Project Code	GIN/CP/4.1	**Project Title**	Evaluation of consortia (*B. safensis, B. amyloliquefaciens, Raoultella terrigena,* & *Acinetobacer* sp.) for growth promotion and rhizome rot suppression in ginger
Centres	Kozhikode, Pundibari, Raigarh, Solan		
Date of start	2025-26	**Date of closure/ duration**	Three years (2027-28)
Experimental details	Variety: Disease free rhizomes of any popular variety; Bed		

	size/spacing: 3 x 1m, Spacing: 15x30 cm Beds: 24; Design: RBD; Replications: 4 **Treatments (5):** T_1-Application of Consortia plus recommended fertilizers (without fungicide) T_2- Application of Consortia plus recommended (N P K, Zn) fertilizers (with fungicide) T_3- Application of Consortia alone (without fertilizers & fungicide) T_4-Normal Package (with fertilizers & fungicide) T_5- Absolute control (without fertilizers & fungicide) **Bacteria application as soil drench:** At the time of planting, 45days after planting (DAP), 90 days after planting (DAP) Fertilizer application: - As per the recommendation PP Chemicals: CIBRC registered fungicide: Metalaxyl-M3.3% + Chlorothalonil 33.1% SC) (1ml L^{-1})
Observation Recorded	• Growth parameters (120 DAP) • Rhizome rot disease index 60 & 90 DAP (as per the screening protocol) • Initial soil nutrients analysis –major nutrients N,P,K & Zn • Nutrient uptake (Harvest)- Rhizome • Yield
Work done/achievements during 2024-25 (centre-wise)	
Kozhikode Pundibari Raigarh Solan	Biocapsules for the trial were dispatched during *Kharif* 2025. Planting and treatment application were carried out as per the technical programme, and the crop is currently in the vegetative stage.

Project Code	GIN/CP/7.1	**Project Title**	Evaluation of effective insecticides against shoot borer *Conogethes punctiferalis* infesting ginger for label claim expansion
Centres	Ambalavayal, Appangala, Kozhikode, Mudigere, Raigarh		
Date of start	2024-25	**Date of closure/ duration**	2 years (2025-26)
Experimental details	**Treatments (9):** T_1- Chlorantraniliprole @ 0.375 ml L^{-1} T_2- Chlorantraniliprole @ 0.5 ml L^{-1} T_3- Chlorantraniliprole 0.625 ml L^{-1} T_4- Chlorantraniliprole 1.0 ml L^{-1} T_5- Spinosad @ 0.375 ml L^{-1} T_6- Spinosad @ 0.5 ml L^{-1} T_7- Spinosad @ 0.625 ml L^{-1} T_8- Spinosad @ 0.5 ml L^{-1} T_9- Untreated Control (water spray) Crop variety: Popular improved variety of respective centre/area. Experimental design: RBD; Treatments: 9; Replication: 4 Spacing: 3 × 1 m, Spray interval – 21 days (limited to 4 sprays only), First spray needs to be initiated 45 days after planting		

Observation Recorded	• Bio efficacy against pest • Phytotoxicity grade (0-10 Scale) • Toxicity against Natural Enemies • Crop Yield • BC Ratio
Work done/achievements during 2024-25 (centre-wise)	
Ambalavayal	At Ambalavayal, in the case of chlorantraniliprole, all treatments recorded a high reduction over control at both 7 and 14 DAT. The maximum reduction (100%) was observed in T_2 and T_3 at both intervals, followed closely by T_1 (99.45% at 7 DAT and 96.14% at 14 DAT). In the case of Spinosad, the maximum reduction was recorded in T_3 (98.61% at 7 DAT and 98.97% at 14 DAT), followed by T_2 (97.92% and 96.88%, respectively). The test chemicals were found to be safe to natural enemies at 14 DAA and did not cause phytotoxicity in plants. The chemical treatments also recorded good yield.
Appangala	In the case of Chlorantraniliprole treatments, maximum reduction was recorded in T_2 and T_3 (100% at 7 DAT, 100% at 14 DAT), followed by T_1 (95.66%). while in Spinosad treatments, maximum reduction was observed in T_3 (100% at both 7 and 14 DAT), followed by T_2. Highest fresh and dry yield was observed in chemical treatments compared to control. Populations of natural enemies were unaffected, and phytotoxicity was absent.
Kozhikode	The tested insecticides were found to be effective in controlling the pest recording up to 100% reduction in shoot borer damage at the recommended dose. Further, even at the 2x dose of insecticides, no phytotoxic symptoms were observed in the treated plants. The tested chemicals were also found to be safe to natural enemies and consistently higher yields were recorded in treated plots compared to the untreated control. Residue analysis in the harvested produce is in progress.
Mudigere	Application of Spinosad 45% SL at 0.5 ml L^{-1} was found to be effective in managing shoot borer. Similarly, Chlorantraniliprole 18.5% SL at 0.5 ml/litre also showed effective control of the pest. The treatments were safe to natural enemies at 14 DAA, with no significant reduction in their populations. Highest yield was recorded in chemical treatments, whereas no phytoxicity was observed.
Raigarh	At the Raigarh centre, the field trial on the evaluation of effective insecticides against the shoot borer (*Conogethes punctiferalis*) infesting ginger revealed that both Chlorantraniliprole 18.5% SC and Spinosad 45% SC performed effectively in reducing pest incidence. Treatments at different doses, including 0.375, 0.5, and 0.625 ml/L, significantly lowered the borer infestation compared to the untreated control and were on par or superior to the standard check, Lambda-cyhalothrin 5% EC. The tested insecticides showed no phytotoxic effects such as leaf injury, chlorosis, or stunting even at double the recommended dose, and they were also safe to natural enemies. The yield data indicated that plots treated with Chlorantraniliprole and Spinosad produced higher rhizome yields than untreated plots, confirming their efficacy and safety under Raigarh conditions during the Season I trials.

TURMERIC

Project Code	TUR/CP/4.1	**Project Title**	Evaluation of consortia (*B. safensis, B. amyloliquefaciens, Raoultella terrigena*, & *Acinetobacer* sp.) for growth promotion and rhizome rot suppression in turmeric
Centres	Coimbatore, Guntur, Kammarpally, Kozhikode		
Date of start	2025-26	**Date of closure/ duration**	Three years (2027-28)
Experimental details		Variety: Disease free rhizomes of any popular variety; Bed size/spacing: 3 x 1m, Spacing: 15x30 cm Beds: 24; Design: RBD; Replications: 4 **Treatments (5):** T_1-Application of Consortia plus recommended fertilizers (without fungicide) T_2- Application of Consortia plus recommended (N P K, Zn) fertilizers (with fungicide) T_3- Application of Consortia alone (without fertilizers & fungicide) T_4-Normal Package (with fertilizers & fungicide) T_5- Absolute control (without fertilizers & fungicide) **Bacteria application as soil drench:** At the time of planting, 45DAP & 90 DAP Fertilizer application: - As per the recommendation PP Chemicals: CIBRC registered fungicide: Azoxystrobin 18.2% + Difenoconazole 11.4% w/w SC (1ml L^{-1})	
Observation Recorded		• Growth parameters (120 DAP) • Rhizome rot disease index 60 & 90 DAP (as per the screening protocol) • Initial soil nutrients analysis –major nutrients N,P,K & Zn • Nutrient uptake (Harvest)- Rhizome • Yield	
Work done/achievements during 2025-26 (centre-wise)			
Coimbatore	Biocapsules for the trial were dispatched during *Kharif* 2025. Planting and treatment application were carried out as per the technical programme, and the crop is currently in the vegetative stage.		
Guntur			
Kammarpally			
Kozhikode			

Project Code	TUR/CP/7.1	**Project Title**	Evaluation of effective insecticides against shoot borer, *Conogethes punctiferalis* infesting turmeric for label claim expansion
Centres	Appangala, Coimbatore, Guntur, Kammarpally, Kozhikode		
Date of start	2024-25	**Date of closure/ duration**	2 years (2025-26)
Experimental details		**Treatments (9):** T_1- Chlorantraniliprole @ 0.375 ml L^{-1} T_2- Chlorantraniliprole @ 0.5 ml L^{-1} T_3- Chlorantraniliprole 0.625 ml L^{-1} T_4- Chlorantraniliprole 1.0 ml L^{-1} T_5- Spinosad @ 0.375 ml L^{-1}	

	T_6- Spinosad @ 0.5 ml L^{-1} T_7- Spinosad @ 0.625 ml L^{-1} T_8- Spinosad @ 0.5 ml L^{-1} T_9- Untreated Control (water spray) Crop variety: Popular improved variety of respective centre/area. Experimental design: RBD; Treatments: 9; Replication: 4 Spacing: 3 × 1 m, Spray interval – 21 days (limited to 4 sprays only), First spray needs to be initiated 45 days after planting
Observation Recorded	• Bio efficacy against pest • Phytotoxicity grade (0-10 Scale) • Toxicity against Natural Enemies • Crop Yield • BC Ratio
Work done/achievements during 2024-25 (centre-wise)	
Appangala	At Appangala, all the treatments of chlorantraniliprole 18.5% SC recorded a high reduction in shoot borer infestation over control at both 7 and 14 DAT. In the case of Spinosad 45% SC also, all treatments were highly effective in reducing shoot borer infestation at both observation intervals. The treatments were safe to natural enemies at 14 DAA, showing no significant adverse effect on their population. No phytotoxic symptoms were noticed in any of the treatments. Highest fresh and dry yield was observed in chemical treatments compared to control.
Coimbatore	The experiment was conducted with turmeric var. CO-2. The treatments were imposed four times viz., (i) 45-days after planting (DAP) followed by 21 days intervals 3 sprays (ii) 66-days after planting (DAP) (iii) 87-days after planting (DAP) and 108 days after planting (DAP). The results showed that the different concentration of Chlorantraniliprole 18.5% SC viz., 0.375 ml L^{-1}; 0.5 ml L^{-1} and 0.625 ml L^{-1} had the lowest mean pseudostem damage *viz.*, 3.86%, 1.94% and 0.12%, respectively and fresh rhizome yield was highest in plots treated with Chlorantraniliprole 18.5% SC (8.1 kg bed^{-1}). The results showed that the different concentration of Spinosad 45% SC *viz.*, 0.375 ml L^{-1}; 0.5 ml L^{-1} and 0.625 ml L^{-1} had the lowest mean pseudostem damage *viz.*, 4.1%, 2.3% and 0.5%, respectively and fresh rhizome yield was highest in plots treated with Chlorantraniliprole 18.5% SC (8.0 kg bed^{-1}).
Guntur	During 2024-25, the final psuedostem damage after four sprays significantly lowered in all the insecticide treatments over control. Among different concentrations of Chlorantraniliprole, Chlorantraniliprole @ 0.5 ml L^{-1} recorded significantly highest yield (34.4 t ha^{-1}) which was on par with Chlorantraniliprole @ 0.625 ml L^{-1} (33.4 t ha^{-1}), Chlorantraniliprole @ 0.375 ml L^{-1} (33.1 t ha^{-1}) and Lambda-cyhalothrin @2.0 ml/L (32.0 t ha^{-1}) over control (26.2 t ha^{-1}). Whereas among different concentrations of Spinosad, Spinosad @ 0.5 ml L^{-1} recorded significantly highest yield (35.0 t ha^{-1}) which was on par with Spinosad @ 0.375 ml L^{-1} (34.6 t ha^{-1}), Spinosad @ 0.625 ml L^{-1} (33.7 t ha^{-1}) and Lambda-cyhalothrin @2.0 ml/L (32.0 t ha^{-1}) compared to the control (26.2 t ha^{-1}).
Kammarpally	To manage shoot borer in turmeric, various treatments were evaluated, among which the highest yield was recorded in T_3 (Chlorantraniliprole @ 0.625 ml L^{-1}) with 42.00 t ha^{-1}, followed by T_2 (Chlorantraniliprole @ 0.5 ml L^{-1}) with 40.26 t ha^{-1}, both significantly higher than the control. The greatest reduction

	in pest infestation was also observed in T_3, followed by T_2, indicating their effectiveness in shoot borer management.
Kozhikode	The tested insecticides were found to be effective in controlling the pest recording up to 100% reduction in shoot borer damage at the recommended dose. Further, even at the 2x dose of insecticides, no phytotoxic symptoms were observed in the treated plants. The tested chemicals were also found to be safe to natural enemies and consistently higher yields were recorded in treated plots compared to the untreated control. Residue analysis in the harvested produce is in progress.

Project Code	TUR/CP/7.2	**Project Title**	Assessment of nematicide for the management of root lesion nematodes (*Pratylenchus spp.*), infecting turmeric.
Centres	Coimbatore, Guntur, Kammarapally, Kozhikode, Pundibari		
Date of start	2024-25	**Date of closure/ duration**	2 years (2025-26)
Experimental details	**Treatments:** T_1- Untreated control T_2- Application of Fluopyram 34.48 SC @ 0.25 ml L^{-1} as a drench 15 DAP. T_3- Application of Fluopyram 34.48 SC @ 0.5 ml L^{-1} as a drench 15 DAP (x dose) T_4 -Application of Fluopyram 34.48 SC @ 0.75 ml L^{-1} as a drench 15 DAP and second application 30 days after first application T_5- Application of Fluopyram 34.48 SC @ 1.0 ml L^{-1} as a drench 15 DAP (2x dose) T_6 -Application of Carbofuran 3%G @ 20g/bed as broadcast 15 days after planting. **Residual analysis** T_3: Application of Fluopyram 34.48 SC @ 0.5ml/L as a drench 15 DAP (x dose) T_5-: Application of Fluopyram 34.48 SC @ 1.0ml/L as a drench 15 DAP (2x dose) Crop variety: Popular improved variety: Design – RBD: Treatments: 6: Replication: 4 (6 x 4 x 1 =32) • Experimental design: RBD • Treatments: 6 • Replication: 4 • Bed size: 3 x2m^2 ; 80 plants/bed • Spacing: 15x30 cm • Time of application: 15 days after planting 30 days after 1st Application of chemicals		
Observation Recorded	• Growth parameters • Yield and its attributes • Pre-treatment nematode count (40, 90, 120, at time of harvest) • Root lesion Index (0-5 scale) • Plant growth parameters • Economics- BCR, gross returns, net returns • Residue analysis		

Work done/achievements during 2024-25 (centre-wise)	
Coimbatore	Application of treatments Fluopyram 34.48 SC @ 0.5ml L^{-1} (T_3); Fluopyram 34.48 SC @ 0.25 ml L^{-1} twice each (T_4) and Fluopyram 34.48 SC @ 1.0 ml L^{-1} (T_5) demonstrated greater effectiveness compared to the positive control (T_6) in terms of percentage reduction of the root lesion index (RLI-0.75, 0.87, and 0.62), soil populations (73%, 71%, and 75%), and root populations (87%, 85%, and 90%), respectively. Treatment T_5 resulted in lower yields compared to T_3 and T_4. Among the treatments, T_3 Fluopyram 34.48 SC @ 0.5 ml L^{-1} (T_3) proved to be highly effective in controlling nematodes in turmeric.
Guntur	Among the flupyram treatments, there were no significant differences observed in the yield. However, significantly highest yield (43.5 t ha^{-1}) was recorded in chemical check *i.e.*, Carbofuran 3%G @ 20g/bed over all other treatments.
Kammarpally	To manage nematodes in turmeric, different nematicides were evaluated. Among the treatments, the highest yield was recorded in T_4 -Application of Fluopyram @ 0.75ml L^{-1} as a drench at 15 and 30 DAP — with 51.50 t ha^{-1}, followed by T_6 -Application of Carbofuran 3%G @ 20g/bed as broadcast 15 DAP with 47.63 t ha^{-1}, both significantly higher than the control. The highest dry recovery was also observed in T_4 (20.35%), followed by T_2 (19.2%).
Kozhikode	Among treatments, drenching turmeric with fluopyrma 34.48 SC (Velume Prime) demonstrated that treatments T_3 (0.5ml/L), T_4 (0.25ml/L twice), and T_5 (1ml/L) were more effective than the positive control (Carbofuran 3% CG 20g/bed) (T_6) in reducing the root lesion index (RLI) to 0.8, 0.8, and 0.7, respectively. Additionally, these treatments achieved reductions in soil populations (*Pratylenchus* spp) of 81%, 80%, and 83%, and in root populations of 85%, 78%, and 86%. Treatment T_5 exhibited phytotoxicity, resulting in lower yields of 24.25 t/ha compared to T_3, which yielded 27.9 t/ha, and T_4, which yielded 26.7 t/ha. Among the treatments, T_3 proved to be particularly effective in controlling nematodes in turmeric. Furthermore, similar kind of observations was recorded included plant vigor, mortality rates, and the presence of free-living beneficial and predatory nematodes.
Pundibari	Data sent to PC Cell

CUMIN

Project Code	CUM/CP/7.1	**Project Title**	Eco-friendly management of cumin blight
Centres	Jaugdan, Jobner, Mandor.		
Date of start	2022-23	**Date of closure/ duration**	3 years (204-25)
Experimental details	• Experimental Design: RBD • Replication: 3 • Variety: Gujarat Cumin 4 (GC 4) • Plot Size and Spacing: 4m x 3.0 m(Gross), 3.0 m x 24 m (Net), 30 cm row spacing, • Seed Rate: 10-12 kg ha^{-1}. • Sowing time: October – November <u>Treatments: 11</u>		

T_1	Seed treatment	*Pseudomonas fluorescens* 1.15 WP ($1x10^8$ cfu g^{-1}) @ 10 g Kg^{-1} seed
	Precautionary sprays (4 sprays)	*Pseudomonas fluorescens* 1.15 WP ($1x10^8$ cfu g^{-1}) @ 50 g $10L^{-1}$ water

	T_2	Seed treatment	*Pseudomonas fluorescens* 1.15 WP ($1x10^8$ cfu g^{-1}) @ 10 g Kg^{-1} seed + *Trichoderma harzianum* 1.15 WP ($2x10^6$ cfu g^{-1}) @ 10 g Kg^{-1} seed
		Precautionary sprays (4 sprays)	*Pseudomonas fluorescens* 1.15 WP ($1x10^8$ cfu g^{-1}) @ 50 g $10L^{-1}$ water + *Trichoderma harzianum* 1.15 WP ($2x10^6$ cfu g^{-1}) @ 50 g $10L^{-1}$ water
	T_3	Seed treatment	*Pseudomonas fluorescens* 1.15 WP ($1x10^8$ cfu g^{-1}) @ 10 g Kg^{-1} seed + *Trichoderma viride* 1.15 WP ($2x10^6$ cfu g^{-1}) @ 10 g Kg^{-1} seed
		Precautionary sprays (4 sprays)	*Pseudomonas fluorescens* 1.15 WP ($1x10^8$ cfu g^{-1}) @ 50 g $10L^{-1}$ water + *Trichoderma viride* 1.15 WP ($2x10^6$ cfu g^{-1}) @ 50 g $10L^{-1}$ water
	T_3	Seed treatment	*Trichoderma harzianum* 1.15 WP ($2x10^6$ cfu g^{-1}) @ 10 g Kg^{-1} seed
		Precautionary sprays (4 sprays)	*Trichoderma harzianum* 1.15 WP ($2x10^6$ cfu g^{-1}) @ 50 g $10L^{-1}$ water
	T_3	Seed treatment	*Trichoderma viride* 1.15 WP ($2x10^6$ cfu g^{-1}) @ 10 g Kg^{-1} seed
		Precautionary sprays (4 sprays)	*Trichoderma viride* 1.15 WP ($2x10^6$ cfu g^{-1}) @ 50 g $10L^{-1}$ water
	T_3	Seed treatment	*Bacillus subtilis* 1.15 WP ($1x10^8$ cfu g^{-1}) @ 10 g Kg^{-1} seed
		Precautionary sprays (4 sprays)	*Bacillus subtilis* 1.15 WP ($1x10^8$ cfu g^{-1}) @ 40 g $10L^{-1}$ water
	T_7	Seed treatment	*Bacillus subtilis* 1.15 WP ($1x10^8$ cfu g^{-1}) @ 10 g Kg^{-1} seed + *Trichoderma harzianum* 1.15 WP ($2x10^6$ cfu g^{-1}) @ 10 g Kg^{-1} seed
		Precautionary sprays (4 sprays)	*Bacillus subtilis* 1.15 WP ($1x10^8$ cfu g^{-1}) @ 40 g $10L^{-1}$ water + *Trichoderma harzianum* 1.15 WP ($2x10^6$ cfu g^{-1}) @ 50 g $10L^{-1}$ water
	T_8	Seed treatment	*Bacillus subtilis* 1.15 WP ($1x10^8$ cfu g^{-1}) @ 10 g Kg^{-1} seed + *Trichoderma viride* 1.15 WP ($2x10^6$ cfu g^{-1}) @ 10 g Kg^{-1} seed
		Precautionary sprays (4 sprays)	*Bacillus subtilis* 1.15 WP ($1x10^8$ cfu g^{-1}) @ 40 g $10L^{-1}$ water + *Trichoderma viride* 1.15 WP ($2x10^6$ cfu g^{-1}) @ 50 g $10L^{-1}$ water
	T_9	Seed treatment	*Bacillus subtilis* 1.15 WP ($1x10^8$ cfu g^{-1}) @ 10 g Kg^{-1} seed + *Pseudomonas fluorescens* 1.15 WP ($1x10^8$ cfu g^{-1}) @ 10 g Kg^{-1} seed
		Precautionary sprays (4 sprays)	*Bacillus subtilis* 1.15 WP ($1x10^8$ cfu g^{-1}) @ 40 g $10L^{-1}$ water + *Pseudomonas fluorescens* 1.15 WP ($1x10^8$ cfu g^{-1}) @ 50 g $10L^{-1}$ water
	T_{10}	Standard chemical Check (3 sprays)	Three sprays of kresoxim- methyl 44.3 SC @ 0.044 % (10 ml $10L^{-1}$ water) (First spray at 35 days after germination and subsequent two spays at 10 days interval after first spray)
	T_{11}	Control	Water spray
	Note: Common furrow application of neem cake @ 1 t ha^{-1} will be made at the time of sowing Standard package of practices should be followed.		
Observation Recorded	• Percent disease intensity (PDI) after last spray • Seed yield (q ha^{-1}) • 1000 seed weight • Volatile oil (%) • Fungicide residue analysis, if requires • Economics and cost benefit ratio		
Work done/achievements during 2024-25 (centre-wise)			
Jaugdan	There was a significant difference in the percent disease intensity of blight and yield of cumin during the experimentation. The minimum blight intensity of 23.25% and the maximum yield (8.10 q ha^{-1}) was observed in T_{10} and it was closely followed by T_9 (26.44 blight PDI and 7.31 q ha^{-1} yield). A similar trend		

	was recorded in the case of 1000 seed weight and volatile oil percent.
Jobner	During rabi 2024-25, the crop was sown on 25.11.2024. The crop variety on nwhich experiment undertaken was GC-4. The results revealed that among the treatments, three sprays of kresoxim- methyl 44.3 SC @ 0.044 % standard chemical check was recorded most effective in controlling cumin blight with lowest disease intensity followed by four sprays of *Bacillus subtilis* 1.15 WP ($1x10^8$cfu/g) @ 40 g/10 L water + *Pseudomonas fluorescens* 1.15 WP ($1x10^8$cfu/g) @ 50 g/10 L water in comparison to untreated check.
Mandor	Data of percent disease severity of blight of cumin showed that lowest percent disease intensity of cumin blight was recorded in three sprays of kresoxim-methyl 44.3 SC @ 0.044 % (10 ml/10 L water) (First spray at 35 days after germination and subsequent two spays at 10 days interval after first spray) (T_{10}) (9.00%) which was followed by Seed treatment of *Bacillus subtilis* 1.15 WP ($1x10^8$ cfu/g) @ 10 g/kg seed + *Pseudomonas fluorescens* 1.15 WP ($1x10^8$ cfu/g) @ 10 g/kg seed + Precautionary sprays (4 sprays) *Bacillus* subtilis 1.15 WP ($1x10^8$ cfu/g) @ 40 g/10 L water + *Pseudomonas fluorescens* 1.15 WP ($1x10^8$ cfu/g) @ 50 g/10 L water (16.33%) (T_9) which was at par with Seed treatment of *Bacillus subtilis* 1.15 WP ($1x10^8$ cfu/g) @ 10 g/kg seed + *Trichoderma viride* 1.15 WP ($2x10^6$ cfu/g) @ 10 g/kg seed + Precautionary sprays (4 sprays) *Bacillus subtilis* 1.15 WP ($1x10^8$ cfu/g) @ 40 g/10 L water + *Trichoderma viride* 1.15 WP ($2x10^6$ cfu/g) @ 50 g/10 L water (17.67%)(T_8). The maximum seed yield was recorded in three sprays of three sprays of kresoxim- methyl 44.3 SC @ 0.044 % (10 ml/10 L water) (First spray at 35 days after germination and subsequent two spays at 10 days interval after first spray) (868 kg/ha) which was followed by Seed treatment of *Bacillus subtilis* 1.15 WP ($1x10^8$ cfu/g) @ 10 g/kg seed + *Pseudomonas* fluorescens 1.15 WP (1x108 cfu/g) @ 10 g/kg seed + Precautionary sprays (4 sprays) *Bacillus subtilis* 1.15 WP ($1x10^8$ cfu/g) @ 40 g/10 L water + Pseudomonas fluorescens 1.15 WP ($1x10^8$ cfu/g) @ 50 g/10 L water (13.33%) (790 kg/ha). However, in control maximum (46.67%) disease intensity of blight and minimum seed yield (333 kg ha-1) were recorded under the control.

Project Code	CUM/CP/7.2	**Project Title**	Assessment of cumin blight (*Alternaria burnsii*) disease for weather-based prediction model
Centres	Ajmer, Mandor, Jagudan, Jobner, Sanand.		
Date of start	2024-25	**Date of closure/ duration**	3 years
Experimental details	• Experimental Design: RBD • Replication: 3 • Total land area needed for four dates of sowing: 72 m^2 • Plot Size and Spacing: 3m × 2m; 8 rows of 3m length each per plot; Spacing: 25 × 10 cm^2 • Variety: GC-4 <u>Treatments: 4</u> Four Sowing dates Staggered sowing of cumin needs to be done at different dates as on 1. 10th November 2. 20th November		

	3. 30th November **4.** 10th December
Observation Recorded	• Percent disease severity • Weather data recordings
Work done/achievements during 2024-25 (centre-wise)	
Ajmer	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. 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 favored the proliferation of the disease.
Mandor	Cumin crop was sown at four different dates of sowing i.e. T_1- 10th November, T_2- 20th November, T_3- 30 November and T_4- 10 December). Early sowing (T_1- 10th November, T_2- 20th November) resulted in higher disease severity, due to favorable environmental conditions (lower temp + higher humidity) during disease incubation and spread. Later sowing (T_3- 30 November, T_4- 10 December) delayed disease onset and had reduced severity, as weather (higher temperature, lower humidity) became less favorable for the pathogen.
Jagudan	Alternaria blight was appeared first on cumin crop from last week of December, 1st week of January, 3rd week of January and 4th week of January in the sowing of 10 November (5.00 PDI), 20 November (10.75 PDI), 30 November (5.31 PDI) and 10 December (1.22 PDI) of sowing, respectively. It was remained progressive during growth stages of crop up to 4th week of February in all the dates of sowing. After appearance, its intensity gradually increased and reached at maximum level 99.21 % (10 November), 70.25% (20 November), 45.87 (30 November) and 28.23% (10 December). The moderate to heavy infection of blight resulted into the black spots on stem, leaves, umbellate and seeds and drying of leaves and poor seed yield of cumin and it also detoriated the seed quality too. The lowest blight disease (28.23 PDI) and slow disease progression was recorded with the sowing of 10 December.
Jobner	The experiment was started in 2024-25 and was conducted during rabi 2024-25. The four treatments consisted of T_1 (10th November), T_2 (20th November), T_3 (30th November) and T_4 (10th December) sowing dates were evaluated in RBD with 3 replications in a plot size of 3.0 x 2.4 m2 with crop geometry of 25 x 10 cm. The crop variety was GC-4. The results revealed that among the treatments, T_1 (10th November) was recorded maximum disease intensity

	(79.33%) in comparison to T_4 (10^{th} December) (36.00%).
Sanand	no Results

FENUGREEK

Project Code	FGK/CP/7.1	**Project Title**	Bio-efficacy of fungicides against powdery mildew of fenugreek.
Centres	Coimbatore, Hisar, Jabalpur, Jagudan, Jobner, Kota.		
Date of start	2022-23	**Date of closure/ duration**	3 years
Experimental details	• Experimental Design: RBD • Replication: 3 • Plot Size and Spacing: 3 x 2.5 m; spacing: 30 x 10 cm • Sowing time: October – November <u>Treatments: 7</u> T_1 = Two foliar spray of Azoxystrobin 23 % EC @ 0.1% T_2 = Two foliar spray of Tebuconazole 25.9 % EC @ 0.1% T_3 = Two foliar spray of Hexaconazole 5% SC @ 0.1% T_3 = Two foliar spray of Propiconazole 25% EC @ 0.1% T_3 = Two foliar spray of Myclobutanil 10% WP @ 0.05% T_3 = Package of respective SAUs (Standard check) T_7 = Control Note: The aforesaid treatments will be applied twice at 15-day intervals starting from the appearance of the disease.		
Observation Recorded	• Percent disease intensity (PDI) (Powdery mildew) • Test weight 1000 seeds(g) • Seed yield (q ha^{-1}) • Residue analysis • Economics (ICBR Ratio)		
Work done/achievements during 2024-25 (centre-wise)			
Coimbatore	The experiment was conducted with fenugreek var. CO2. The treatments were imposed two times viz., (i) at the time of symptom appearance, (ii) 15-days after the first spray. The results showed that the different treatments were able to manage the powdery mildew at different levels when compared to control. Two foliar sprays of propiconazole (0.1%) at 15 days interval was found most effective in controlling the intensity of powdery mildew disease with a mean PDI of 5.12 and a higher seed yield of 5.72 q ha^{-1} as compared to the control which recorded PDI of 35.63 and lowest yield (3.96 q ha^{-1}).		
Hisar	The significant differences were obtained for all the treatments except branches per plant and pod length. Maximum number of pods per plant (46.7) and seed yield (2054.8 kg ha^{-1}) was recorded with the application of two foliar spray of Azoxystrobin 23 % EC @ 0.1%. All the fungicides control the disease ranging from 49.550 to 59.95 per cent. Minimum disease intensity (18.1%) was found where two foliar spray of Azoxystrobin 23 % EC @ 0.1%. and per cent disease control was 59.95 per cent.		
Jabalpur	The experiment was designed using a Randomized Block Design with three replications to identify the most effective chemical control strategies for managing powdery mildew in fenugreek, prioritizing safety and appropriateness. Two foliar sprays of Azoxystrobin (23% EC @ 0.1%),		

	Tebuconazole (25.9% EC @ 0.1%), Hexaconazole (5% SC @ 0.1%), Propiconazole (25% EC @ 0.1%), Myclobutanil (10% WP @ 0.05%), and a control were applied at 15-day intervals starting at the onset of the disease. Percent disease intensity was calculated before spraying and 10 days after each spray using the 0-5 scale as per the scale given by Rathi and Tripathi (1994). Among the treatments, Tebuconazole @ 0.1% (T_2) proved to be the most effective in controlling powdery mildew, followed by Sulphur, Myclobutanil @ 0.05%, and Propiconazole @ 0.1%, with respective PDI values of 23.3, 31.3, 38.7, and 32.7 after the second spray. The highest seed yield of 23.75 q/ha was recorded in the Tebuconazole-treated plot, showing a 30.37% increase over the control.
Jagudan	During the season 2024–25 revealed a significant difference in powdery mildew intensity and seed yield of fenugreek across treatments. All treatments showed lower disease intensity compared to the untreated control, with the lowest intensity (15.02%) and highest seed yield (16.80 q ha^{-1}) recorded in T_3 (two foliar sprays of hexaconazole 5SC). This was closely followed by T_6 (wettable sulphur) and T_4 (propiconazole 25EC). A similar trend was observed for 1000 seed weight.
Jobner	The crop variety on which trial conducted was RMt-1. Result of 2024 revealed that two spray of Hexaconazole 5% SC at 15 days interval was found most effective in controlling powdery mildew disease of fenugreek with lowest disease intensity followed by Wettable Sulphur 80% WP and Propiconazole 25% EC (13.00%) in comparison to untreated check.
Kota	Results revealed that all the treatment significantly reduced powdery mildew intensity as compared to control. The minimum disease intensity (6.3%) with maximum yield (1435 kg ha^{-1}) was recorded with two foliar sprays of Tebuconazole 25.9 % EC @ 0.1% at the initiation of powdery mildew.
Raigarh	Minimum disease intensity (7.43%) and maximum yield (q ha^{-1}) 14.50 found in treatment application of carbendazim 0.1% at the appearance of the disease and followed by 35 DAS after first spray Wettable sulphur 0.2 %. The next best treatment was Treatment T_2.

NIGELLA

Project Code	NGL/CP/7.1	**Project Title**	Management of root rot of nigella.
Centres	Dholi, Kumarganj, Raigarh.		
Date of start	2022-23	**Date of closure/ duration**	3 years
Experimental details	• Experimental Design: RBD • Replication: 3 • Plot Size and Spacing: 3 x 1.0 m; spacing: 30 x 10 cm • Sowing time: October – November <u>Treatments: 7</u> 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_3: Soil application with Castor oil cake @1 ton per ha. T_3: Soil drenching with Boscalid (25.2%) + Pyraclostrobin (12.8%) WG @0.2%.		

	T_3: Soil drenching with Azoxystrobin (20%) + Difenoconazole (12.5%) SC @0.2%. T_7: Control. **Method of soil drenching:** 2.0g or 2.0ml of fungicides should be mixed per lit. of water. 3.0 lit. of thus prepared fungicidal solution should be applied per bed ($3m^2$) for soil drenching. **Schedule of soil drenching (3 times):** I^{st} - One week prior to sowing; 2^{nd} – 45 DAS & 3^{rd} – 60 DAS.
Observation Recorded	• Date of observation of 1^{st} disease incidence • Per cent disease incidence (PDI) • Yield (kg ha^{-1}) • Incremental Cost-Benefit Ratio (ICBR) • Fungicide Residue Analysis in seeds after harvest. Where, $Per\ cent\ disease\ incidence\ (PDI) = \frac{\text{No.of disease plants}}{Total\ no.of\ plants} x100$ • $Incremental\ Cost\ Benefit\ Ratio\ (ICBR) = \frac{\text{Income from yield increased over control/ha}}{Expenditure\ incured\ for\ sparying/ha} x100$

Work done/achievements during 2024-25 (centre-wise)	
Dholi	Among the treatments of soil application with *Trichoderma/* different oil cake/ soil drenching with different fungicide, lowest disease incidence 13.33% was recorded in treatment, Soil drenching with Boscalid (25.2%) + Pyraclotrobin (12.8%) WG @0.2% with highest yield of 17.83 q/ha in treatment, Soil drenching with Azoxystrobin (20%) + Difenconazole (12.5%) SC @0.2%.
Kumarganj	In Management of root rot of nigella, among the seven tested treatments minimum disease incidence (7.33%) and higher yield (8.67 q ha^{-1}) was recorded in the treatment T_6 followed by T_5 with disease incidence (8.67 %) and yield (8.22 q ha^{-1}) and in T_1- Soil application with Talc based *Trichoderma viridae* @ 2.5 kg- disease incidence (9.0 %) and yield (7.89 q ha^{-1}).
Raigarh	Minimum disease incidence (7.43) found in treatment T_6 and yield 8.03 q ha^{-1} followed by treatment T_1 and T_5.

SEED SPICES

Project Code	SS/CP/7.1	Project Title	Survey and monitoring of diseases and insect pests of seed spices for development of prediction models
Centres	Coimbatore, Dholi, Guntur, Jagudan, Jobner, Kalyani, Kumarganj, Mandor, Raigarh, Sanand		
Date of start	Rabi 2020-21	Date of closure/ duration	5 years
Experimental details	A. Field survey of diseases and insect pests of seed spices (cumin, coriander, fenugreek, fennel, ajwain and nigella) Proposed areas of survey: • Cumin- Rajasthan and Gujarat • Coriander- Rajasthan, U.P., Chhattisgarh, Bihar, Tamil Nadu • Fenugreek- Rajasthan, U. P., Chhattisgarh, Bihar, Tamil Nadu		

	• Fennel- Gujarat, Rajasthan, UP • Ajwain- Rajasthan, Gujrat, M.P., Telangana, Andhra Pradesh • Nigella- Rajasthan, M.P., Bihar, Telangana, Andhra Pradesh, Chhattisgarh, West Bengal B. Monitoring diseases and insect pests of seed spices on the Institute farm • Cumin: *Alternaria* blight, powdery mildew, aphids and thrips • Coriander: Stem gall, powdery mildew, aphids, seed wasps • Fenugreek: Powdery mildew, downy mildew, aphids, jassids • Fennel: *Ramularia* blight, powdery mildew, aphids, seed wasps • Ajwain: Root rot, aphids, lygus bug • Nigella: Root rot, termite, capsule borer <u>Methodology to be adopted</u> • Survey will be conducted in farmers' fields of cumin, coriander, fenugreek, fennel, ajwain and nigella for the prevalence of various diseases and insect pests during the cropping season. • The local popular/ susceptible variety of cumin, coriander, fenugreek and fennel crops will be planted in experimental plots. • Plots (5m x 5m) will be kept natural conditions without any plant protection measures for any of the pests/ disease on seed spice crop. Observations for diseases and pests along with meteorological factors will be taken from crop germination to maturity at weekly interval. • Standard package of practices should be followed except plant protection measures.
Observation Recorded	• Disease score of root diseases and DI will be calculated. • Disease score of foliar diseases and PDI will be calculated • Number of insects /umbel/5cm twig/percentage seed /plant damage • Meteorological data & mapping of disease hot spots • Correlation between meteorological parameters and disease/ pest distribution/ incidence
Work done/achievements during 2024-25 (centre-wise)	
Coimbatore	Disease survey was conducted at Tiruppur and Coimbatore district and recorded coriander was infected with powdery mildew disease with 35.65 and 28.6 PDI, respectively
Dholi	During 2024–25, a field survey was conducted in Muzaffarpur district of Bihar to assess diseases and insect pests in seed spices. In coriander, stem gall disease caused by *Protomyces macrosporus* was observed with incidence ranging from 5% to 55%, and a mean incidence of 27%. No disease symptoms were recorded in fenugreek, and nigella was not found under

	cultivation by farmers in the surveyed area. Separately, under natural conditions on the Institute farm during 2023–24, coriander grown without plant protection showed 55% incidence of stem gall, with an average aphid population of 25.20 per 5 twigs during the 4th standard meteorological week (S.M.D). Fenugreek again remained disease-free, though aphid infestation averaged 29.80 per 5 twigs during the 3rd S.M.D.
Guntur	No incidence of root rot was observed. However, South East Asia thrips (*Thrips parvispinus* Karny) was observed at the research station.
Jagudan	**Institute farm:** it was revealed from the data that the incidence of blight was moderate (32.40%) in cumin. The powdery mildew was recorded with lower intensity (19.47%) in cumin. The aphid population was recorded higher as 54.54/ umbel, whereas, thrips population was observed 6.27 per plant. In fennel, the maximum Ramularia blight of 35.54 per cent was recorded. The aphid population was recorded moderate (21.13). The incidence of seed wasp was not observed during the experimentation period. In coriander, the lower intensity of powdery mildew (14.84%) was recorded. The aphid population was observed as 21.13/umbel, whereas no seed wasp infestation was recorded during the experimentation period. In fenugreek, the powdery mildew intensity was recorded moderate (29.37%). The aphid population was recorded as 22.46/umbel, whereas leaf hopper was 2.74 per plant. In ajwain, during the experimentation period the incidence of pest and diseases viz., root rot, aphids, Lygus bugs etc. was not observed. **Field survey:** the incidence of blight and powdery mildew in cumin was moderate to high at different locations. The aphid infestation was ranged from low to moderate in cumin. In fennel, the infestation of Ramularia blight and aphid was recorded lower. In coriander and fenugreek, the powdery mildew incidence was recorded lower to moderate intensity, while the aphid population was very lower. In ajwain, the incidence of any pests and disease was not recorded during the experimentation period.
Jobner	The trial was started in Rabi 2020-21 and is in 5th year of progress. Experiments were conducted during Rabi 2024-25 at Institute Research Farm for cumin, coriander, fenugreek, fennel, ajwian and nigella. Seed spices crops were sown in natural condition without any plant protection measures for any of the pests/disease on seed spices crops. Seed spices crops were evaluated in plot size of 5.0x5.0 sq.m. accommodating with crop geometry maintained by thinning at Institute Research Farm, SKNCOA, Jobner. Experimental site at Institute Research Farm as well as roving survey of different field was done in cumin, coriander, fenugreek, fennel and ajwian during the year 2024-25. **Cumin:** In cumin disease intensity of *Alternaria* blight, wilt and powdery mildew and aphid infestation were recorded in institute research farm and surveyed areas. **Coriander:** Disease intensity of stem gall, powdery mildew and aphid and seed wasps infestation were recorded in research farm and surveyed areas. **Fenugreek:** In fenugreek crop disease intensity of powdery mildew and downy mildew and aphid infestation were recorded in institute research farm and surveyed areas. **Fennel:** In fennel crop disease intensity of *Ramularia* blight and powdery mildew and aphid and seed wasps infestation were recorded and surveyed

	areas. **Ajwain:** In ajwain crop disease incidence of root rot and aphid infestations were recorded in institute farm. **Nigella:** In nigella crop very less pest infestation was recorded in institute farm.
Kalyani	**A. Institute Farm Monitoring (2024-25):** The seed spices are not very common and popular to the farmers of this area, except coriander for leaf purpose and nigella in the northern part of the state. In our BCKV farm coriander, fennel, fenugreek and black cumin were grown in Rabi season for experimental trial and seed purpose. No severe attack of disease/insect pest was noticed in the field. But sowing time is maintained strictly within 15 November. **B. Off Farm Survey of insect pest and disease on seed spices (2024-25)** Since the last year a survey was conducted in 2 districts of West Bengal (North and South Dinajpur) where Nigella or Black cumin is cultivated moderately in the state to identify different diseases and pests occurring in those areas and to assess the severity of different diseases and pests of Nigella, if available. Nine well distributed locations within those 2 districts were selected for the survey. In each location the survey was done at 3 different places. No severe attack of pests was found. Eccept one disease i.e. wilt disease of Nigella caused by *Fusarium oxysporum* f. sp. *cumini* was evident in all the fields of all the places surveyed.
Mandor	Survey and monitoring of diseases (SS/CP/7.1) of cumin was conducted during rabi 2024-25 and found that the disease Alternaria blight was first appeared in the first fortnight of January at Mandor. During survey of major cumin growing area of Jodhpur region, percent disease intensity of Alternaria blight ranged from 15% to 54%, Fusarium wilt from 3% to 22% and powdery mildew from 0% to 4%.
Raigarh	The field survey revealed that among seed spices diseases, powdery mildew was most prevalent in coriander, with a disease intensity of 22.12%, followed by *Alternaria* leaf blight at 17.45% and root rot in fenugreek at 6.3%. At the institute farms, Coriander crops were affected with powdery mildew whereas aphids affected the fennel crop. Ajwain as well as fenugreek were not affected by any diseases or insects.

Research Programmes at a glance (Crop-wise)

Crop Names	GENETIC RESOURCES & CROP IMPROVEMENT		CROP MANAGEMENT		CROP PROTECTION & FOOD SAFETY		Total No. of Projects
	List of Projects	No.	List of Projects	No.	List of Projects	No.	
Black pepper	PEP/CI/1.1, PEP/CI/3.7	2	PEP/CM/3.4	1	PEP/CP/7.2	1	4
Cardamom	CAR/CI/1.1, CAR/CI/2.1, CAR/CI/3.9, CAR/CI/4.4, CAR/CI/4.5	5	CAR/CM/5.5, CAR/CM/5.6	2	CAR/CP/2.1	1	8
Large cardamom	LCA/CI/1.1, LCA/CI/2.1	2	LCA/CM/2.1	1		--	3
Ginger	GIN/CI/1.1, GIN/CI/2.6, GIN/CI/2.7	3	GIN/CM/4.1, GIN/CM/5.1, GIN/CM/5.2	3	GIN/CP/4.1, GIN/CP/7.1	2	7
Turmeric	TUR/CI/1.1, TUR/CI/1.2, TUR/CI/2.11	3	TUR/CM/5.1, TUR/CM/5.2	2	TUR/CP/4.1, TUR/CP/7.1, TUR/CP/7.2	3	7
Tree spices	TSP/CI/1.1, TSP/CI/2.4, TSP/CI/2.5, TSP/CI/5.1	4	TSP/CM/5.1	1		--	5
Coriander	COR/CI/1.1, COR/CI/2.1, COR/CI/2.2, COR/CI/4.1	4	COR/CM/2.3, COR/CM/5.1, COR/CM/6.1	3		--	7
Cumin	CUM/CI/1.1, CUM/CI/2.5	2	CUM/CM/2.1, CUM/CM/3.4	2	CUM/CP/7.1, CUM/CP/7.2	2	6
Fennel	FNL/CI/1.1, FNL/CI/2.8	2		--	FGK/CP/7.1	1	3
Fenugreek	FGK/CI/1.1, FGK/CI/2.5	2	FGK/CM/5.1, FGK/CM/6.1	2		--	2
Ajwain	AJN/CI/2.1	1		--		--	1
Nigella	NGL/CI/2.1	1		--	NGL/CP/7.1	1	2
Seed spices		--		--	SS/CP/7.1	1	1
Saffron	Project mode	1		--			1
Kalazeera	Project mode	1		--			1