

XXXV वीं वार्षिक समूह बैठक का कार्यवृत्त Proceedings of XXXV Annual Group Meeting

भाकृअनुप-अखिल भारतीय समन्वित मसाला अनुसंधान परियोजना ए आई सी आर पी एस
ICAR-All India Coordinated Research Project on Spices

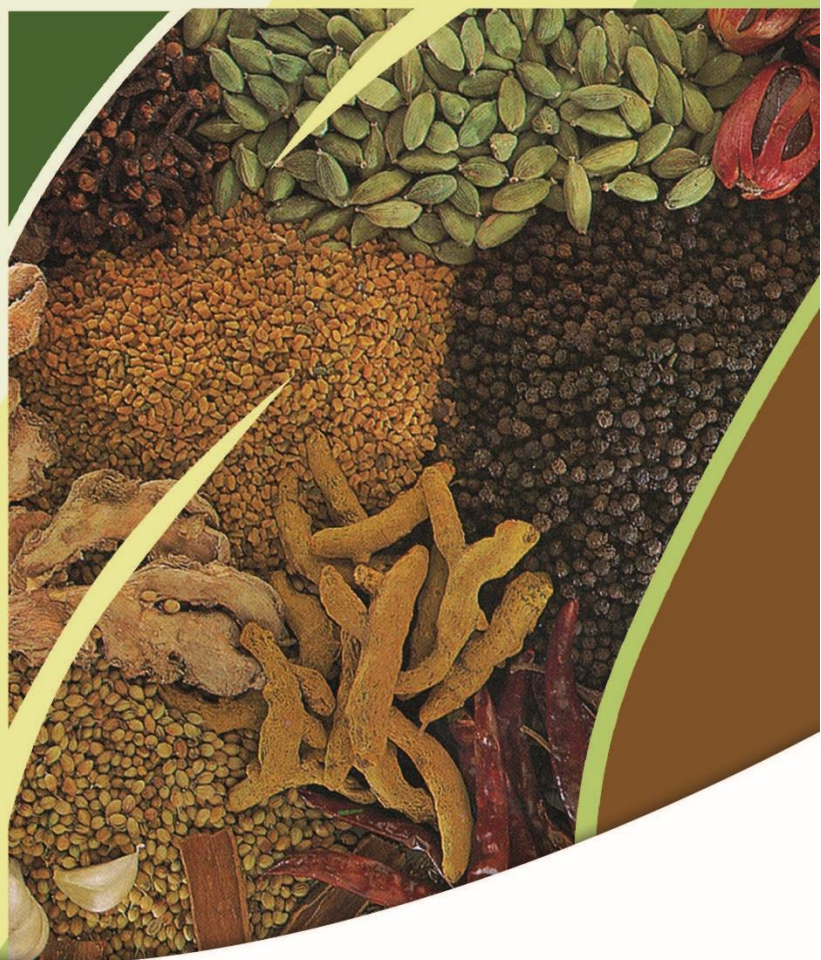


15 अक्टूबर - 17 अक्टूबर 2024

चौधरी चरण सिंह हरियाणा कृषि विश्वविद्यालय
हिसार, हरियाणा

15 October - 17 October 2024

Choudhary Charan Singh
Haryana Agricultural University
Hisar, Haryana



भाकृअनुप-अखिल भारतीय समन्वित मसाला अनुसंधान परियोजना
ICAR- ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES

भाकृअनुप-भारतीय मसाला फसल अनुसंधान संस्थान

ICAR-Indian Institute of Spices Research

कोषिककोड Kozhikode-673 012, केरल Kerala

PROCEEDINGS OF XXXV ANNUAL GROUP MEETING

ICAR- All India Coordinated Research Project on Spices

15 October – 17 October 2024

**Venue: Choudhary Charan Singh Haryana Agricultural University,
Hisar, Haryana**



ICAR- ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES
ICAR-Indian Institute of Spices Research
Kozhikode-673 012, Kerala

2024

December 2024

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XXXV Annual Group Meeting of ICAR-AICRP on Spices

Venue: Choudhary Charan Singh Haryana Agricultural University, Hisar, Haryana

Date: 15 October – 17 October 2024

Organized by: ICAR-AICRPS, ICAR-IISR, Kozhikode

Inaugural Session 15 October 2023 (09.30 AM – 11.00 AM)		
09.30 AM – 09.35 AM	Welcome address	Dr. Rajbir Garg, Director of Research, CCSHAU, Hisar
09.35 AM – 09.40 AM	Project Coordinator's report	Dr. D. Prasath, Project Coordinator (Spices), ICAR-AICRP on Spices, Kozhikode, Kerala.
09.40 AM – 09.50 AM	Director's remarks	Dr. R. Dinesh, Director, ICAR-IISR
09.50 AM - 10.10 AM	Address by Guest of Honour	Dr. N.K. Krishna Kumar Former DDG (HS), ICAR, New Delhi. Dr. V. A. Parthasarathy Former Director & PC (Spices), ICAR-IISR, Kozhikode, Kerala Dr. Sudhakar Pandey, Asst. Director General (FVS&MP) ICAR, New Delhi
10.10 AM - 10.20 AM	Presentations of best centre award/ Release of publications	
10.0 AM - 10.35 AM	Presidential address	Dr. B.R. Kamboj, Vice-Chancellor CCSHAU, Hisar
10.35 AM - 10.50 AM	Address of Chief Guest	Dr. Sanjay Kumar Singh, Deputy Director General (Horticultural Science), ICAR, New Delhi
10.50 AM - 11.00 AM	Vote of Thanks	Dr. S.K. Tehlan, Head, Department of Vegetable Science, CCSHAU, Hisar

Session I	Action taken report/Performance evaluation	11.30 AM – 12.00 PM
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Chair Dr. Sanjay Kumar Singh, Deputy Director General, (Horticultural Science),
ICAR, New Delhi

Co-chair Dr. Sudhakar Pandey, ADG (FVS & MP), ICAR, New Delhi

Presentation of the report - Dr. D. Prasath, Project Coordinator, ICAR-AICRP on Spices

Rapporteurs Dr. H.J. Akshitha, ICAR-IISR
Dr RS Meena, ICAR-NRCSS

Session II	Plant Genetic Resources & Crop Improvement	12.00 PM - 4.00 PM
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Chair Dr. V.A. Parthasarathy, Former Director, ICAR-IISR

Co-Chairs Dr. Vinay Bhardwaj, Director, ICAR-NRCSS
Dr K Nirmal Babu, Former Director, ICAR-IISR

Rapporteurs Dr. M.S. Shivakumar, ICAR-IISR
Dr. Surabi S Chauhan, SDAU

Crop-wise presentations

Coriander	Dr. Shailesh Marker, SKNAU, Jobner
Cumin	Dr. Surabhi S Chauhan, SDAU, Jagudan
Fennel	Dr. R.S. Meena, ICAR-NRC-SS, Ajmer
Fenugreek	Dr. K. Giridhar, Dr YSRHU, Guntur
Ajwain	Dr. S. S. Meena, ICAR-NRC-SS, Ajmer
Nigella	Dr. S. S. Meena, ICAR-NRC-SS, Ajmer
Black Pepper	Dr. Vikram. H. C., KAU, Panniyur
Cardamom	Dr. Nimisha Mathews, KAU, Pampadumpara
Large Cardamom	Dr. Sasanka Sekhar Bora, ICRI, Gangtok
Ginger	Dr. Parshuram Sial, OUAT, Pottangi
Turmeric	Dr. Shrikant Sawargaonkar, IGKV, Raigarh
Tree Spices	Dr. A. V. Bhuwad, Dr BSKKV, Dapoli
Saffron & Kalazeera	Dr. Basheer Ahammed, SKUAST, Pampore

Session III	Crop Management	4.00 PM –6.00 PM
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Chair Dr. R. Dinesh, Director, ICAR-IISR
 Co-Chairs Dr. Rajbir Garg, Director of Research, CCSHAU
 Dr. Prakash Patil, Project Coordinator (AICRP on Fruits)

Rapporteurs Dr. R Shivaranjani, ICAR-IISR
 Dr. Reena Nair, JNKV

Crop-wise presentations

Coriander	Dr. A. C. Shivran, SKNAU, Jobner
Cumin	Dr. A. C. Shivran, SKNAU, Jobner
Fennel	Dr. Ravindra Singh, ICAR-NRC-SS, Ajmer
Fenugreek	Dr. Ravindra Singh, ICAR-NRC-SS, Ajmer
Cardamom	Dr. Manoj Oommen, ICRI, Myladumpara
Large Cardamom	Dr. Amit Kumar, ICAR Res. Complex - NEH Region, Gangtok
Ginger	Dr. P. Srinivas, SKLTSHU, Kammarpalli
Turmeric	Dr. M. Mohanalakshmi, TNAU, Coimbatore

16 October 2024

Session IV	Plant Protection and Food Safety	9.30 AM – 11.30 AM
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Chair Dr. N.K. Krishna Kumar, Former DDG (HS), ICAR
 Co-Chairs Dr. Homey Cheriyan, Director, DASD
 Dr. A.I. Bhat, Head, Division of Crop Protection, ICAR-IISR, Kozhikode

Rapporteurs Dr. Mohammed Faisal Peeran, ICAR-IISR
 Dr. Anamika Debnath, UBKV, Pundibari

Crop-wise presentations

Coriander	Dr. A.K. Mishra, RCAU, Dholi
Cumin	Dr. N.R. Patel, SDAU, Jagudan
Fenugreek	Mr. G. L. Kumawat, SKNAU, Jobner
Nigella	Dr. A.K. Singh, IGKV, Raigarh
Seed spices	Dr. A.K. Mishra, RCAU, Dholi
Black Pepper	Dr. Sanju Balan, KAU, Panniyur
Cardamom	Dr. K. A. Saju, ICRI, Myladumpara
Ginger	Dr. Anamika Debnath, UBKV, Pundibari
Turmeric	Dr. B. Mahender, SKLTSHU, Kammarpally

Session V	Varietal Identification Committee meeting	11.30 AM–01.30 PM
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Chair Dr. Sudhakar Pandey, ADG (FVS & MP), ICAR, New Delhi
Members of the Committee Nominated by DDG
Member Secretary Dr. D. Prasath, Project Coordinator, ICAR - AICRP Spices

Rapporteurs Dr. V. Sivakumar, Dr YSRHU, Chintapalli
Dr. Ramkrishna Sarkar, UBKV

Presentation of variety Identification proposals

S. No.	Crop	Variety	Centre
1	Coriander	RCr-565 (UD 565)	Jobner
2	Cumin	Jodhpur Zeera 1 (MCU-105)	Mandor
3		Jodhpur Zeera 2 (MCU-73)	Mandor
4		CAZRI Cumin 2 (CZC-94)	ICAR-CAZRI, Jodhpur
5		CAZRI Cumin 1 (CZC 135)	ICAR-CAZRI, Jodhpur
6	Fennel	Gujarat Fennel 13 (GF 13)	Jagudan
7		RF-231 (UF 231)	Jobner
8	Fenugreek	RMt-259 (UM 259)	Jobner
9		Chhattisgarh Kelo Methi (IFGS-06)	Raigarh
10	Ginger	SAS-KEVÜ	Nagaland
11		Indira Ginger-1 (IG-1)	Raigarh
12	Turmeric	IISR Surya (Acc. 849)	IISR, Kozhikode

Session VI	Transfer of Technology	2.00 PM – 3.30 PM
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Chair Dr. K.P. Singh, Former Head(i/c), ICAR-IIVR, Varanasi
Co-Chairs Dr Prakash Patil, Project Coordinator (AICRP on Fruits)

Rapporteurs Dr. Muhammed Nissar, ICAR-IISR
Dr. Tanuja Priya, Dr. YSRHU

Presentations of technology proposals

S. No.	Crop	Technology	Centre
1	Large Cardamom	Leaf mould mulch application for sustainable productivity and soil health in large cardamom	ICRI, RS, Gangtok
2	Small Cardamom	Management of leaf blight (<i>Colletotrichum gloeosporioides</i>) with foliar application of azole group of fungicides	ICAR-IISR, RS, Appangala
3	Small Cardamom	Management of rhizome rot (<i>P. vexans</i> , <i>R. solanii</i> , <i>F. oxysporum</i>) with spraying and drenching of azole group of fungicides	ICAR-IISR, RS, Appangala
4	Ginger	Priming of seed rhizomes with Trichoprime @ 5% prior to storage to improve vigour of the buds, enhance sprouting and protect seed rhizomes from	ICAR-IISR

		fungal pathogens during storage	
5	Turmeric	Priming of seed rhizomes with Trichoprime @ 5% prior to storage to improve vigour of the buds, enhance sprouting and protect seed rhizomes from fungal pathogens during storage	ICAR-IISR

Review of TSP, SCSP & NEH activities

S. No.	Center	Program
1.	Horticultural Research Station, (TNAU), YERCAUD	TSP
2.	Horticultural Research Station, Dr. Y.S.R. Horticultural University, CHINTAPALLI	TSP
3.	High Altitude Research Station, (Orissa Univ. of Agrl. & Technology), POTTANGI	TSP, SCSP
4.	Regional Agril. Research Station, (Indira Gandhi KrishiViswavidyalaya), RAIGARH	TSP, SCSP
5.	Horticultural Research Station, (Tamil Nadu Agricultural University), PECHIPARAI	TSP
6.	Department of Horticulture, SASRD, Nagaland University, MEDZIPHEMA	TSP, NEH
7.	Horticultural Research Station, Assam Agricultural University, KAIKUCHI	TSP, NEH
8.	Cardamom Research Station (Kerala Agricultural University), PAMPADUMPARA	SCSP
9.	Faculty of Horticulture, Uttara BangaKrishiVishwavidyalaya, PUNDIBARI	SCSP
10.	Agriculture research Station, (Agricultural University Jodhpur), Mandor, JODHPUR	SCSP
11.	ICRI Regional Station (Spices Board), Yakthung house, Tadong, GANGTOK	NEH
12.	ICAR Res. Complex for NEH Region Regional Station, MIZORAM CENTRE, Kolasib	NEH
13.	ICAR Research Complex for NEH Region, Umroi Road, Ri-Bhoi-79 3 103, BARAPANI	NEH
14.	ICAR Res. Complex for NEH Region, Regional Station, GANGTOK	NEH
15.	College of Horticulture & Forestry, Central Agricultural University, PASIGHAT	NEH

Formulation and discussion on new technical programmes

3.30 PM – 5.30 PM

Chairman Dr. Sudhakar Pandey, Asst. Director General (FVS&MP), ICAR, New Delhi
Co-chair Dr. B. Augustine Jerard, Project Coordinator, AICRP (Palms)
Dr. D. Prasath, Project Coordinator, ICAR - AICRP Spices

Crop	Title	Centre
Crop Improvement		
Turmeric	CVT on Turmeric Series 2024 (TUR/CI/2.1)	PC Cell
	Evaluation of Turmeric Somaclones and Seedling Progenies for Superior Agronomic Traits & Regional Adaptation	PC Cell
Coriander	CVT on Coriander Series 2024 (COR/CI/2.9)	PC Cell
	CVT on Leafy Coriander Series 2024 (COR/CI/2.10)	PC Cell
Nigella	Coordinated Varietal Trial- 2024-25	NRCSS
Cumin	CVT on Cumin Series 2024 (CUM/CI/2.6)	PC Cell
Fennel	CVT on Fennel 2024 Series XII (FNL/CI/2.9)	PC Cell
Fenugreek	CVT on Fenugreek 2024 Series XII (FGK/CI/2.6)	PC Cell
	CVT on Leafy Fenugreek 2024 Series XII (FGK/CI/2.7)	PC Cell
Crop Management		
Black Pepper	Effect of Arbuscular Mycorrhizal (<i>Rhizophagus irregularis</i>) fungi on growth and yield of black pepper	ICAR-IISR
	Efficiency of IoT based pepper harvesting device in reducing the cost of production of quality pepper	Yercaud
	Nutrient management in black pepper (<i>Piper nigrum</i>)	Dapoli
Ginger	Standardization of weed management practices for higher economic yield in Ginger crop	Mudigere

Ajwain	Exploiting the possibilities of transplanting in Ajwain	Jobner
Fennel	Exploiting the possibilities of transplanting in fennel	Jobner
<i>Plant Protection and Food Safety</i>		
Cardamom	Evaluating the bio-efficacy, phytotoxicity of Chlorantraniliprole 18.5% SC against cardamom shoot and capsule borer and its effect on natural enemies.	ICAR-IISR
	Evaluating the bio-efficacy, phytotoxicity of Spinosad 45% SC against cardamom shoot and capsule borer and its effect on natural enemies.	ICAR-IISR
	Evaluating the bio-efficacy, phytotoxicity of Spinosad 45% SC against cardamom thrips and its effect on natural enemies.	ICAR-IISR
Ginger	Effect of Integrated disease management practices against rhizome rot and rhizome yield in ginger	Mudigere
Cumin	Management of <i>Alternaria</i> blight of cumin through newer combi-fungicides	Jobner, Jagudan, Mandor
Fennel	Management of blight of fennel through natural inputs	Jagudan, Jobner

17 October 2024

Plenary Session

10.00 AM – 12.00 AM

Chair	Dr. Sudhakar Pandey, Asst. Director General (FVS&MP), ICAR, New Delhi
Co-Chairs	Dr. Vinay Bhardwaj, Director, ICAR-NRCSS Dr. R. Dinesh, Director, ICAR-IISR Dr. D. Prasath, Project Coordinator, ICAR - AICRP Spices
Rapporteurs	Dr. S. Aarthi, ICAR-IISR Dr. Mukesh Sankar S, ICAR-IISR

Presentation of Rapporteurs Reports and Recommendations

Vote of thanks: Dr. S.K. Tehlan, Head, Department of Vegetable Science, CCSHAU, Hisar

National Anthem

INAUGURAL SESSION

The XXXV Annual Group Meeting (AGM) of the Indian Council of Agricultural Research (ICAR) - All India Coordinated Research Project on Spices (AICRP on Spices) commenced on the 15th of October 2024, at the College of Agriculture, Chaudhary Charan Singh Haryana Agricultural University (CCS HAU), Hisar, Haryana. The event opened with the ceremonial ICAR song and Saraswati Vandana, setting the tone for the subsequent scientific and academic discussions. The event saw the participation of eminent scientists from various spice research centers across the country, including distinguished chairpersons and co-chairs presiding over the technical sessions.

Dr. Rajbir Garg, Director of Research at CCS HAU, Hisar, extended a warm welcome to the distinguished gathering, which included experts and luminaries from the spice research fraternity. Dr. D. Prasath, Project Coordinator of ICAR-AICRP on Spices, provided an overview of the AICRP network and delivered a detailed progress report on the activities and achievements of the AICRP on Spices during the period 2023-24. He underscored the significant advancements made in crop improvement, pest and disease management, and enhancing productivity across major spice-growing regions.

Dr. Sudhakar Pandey, Assistant Director General (ADG), Horticultural Sciences, ICAR, and the guest of honour, extended his congratulations to the entire spices research community on the 50th anniversary of the ICAR-Indian Institute of Spices Research (ICAR-IISR) and the AICRP on Spices. He emphasized the importance of utilizing the rich germplasm collections available for the development of resilient spice varieties tailored to address emerging challenges in the future, including those posed by biotic and abiotic stresses and climate change. Dr. Pandey stressed the need for focused, trait-based breeding programs, enhanced pre-breeding efforts, and the application of modern molecular techniques for mobilizing desirable traits into elite genetic backgrounds.

In his address, Dr. N. Krishna Kumar, during his felicitation, advised the spice research community to prepare a comprehensive roadmap for safer spice production practices, especially to meet the stringent quality standards required in the international market. He urged the scientific community to adopt more sustainable approaches to ensure that Indian spices retain their competitive edge globally.

Dr. Vinay Bhardwaj, Director, ICAR-National Research Centre on Seed Spices (ICAR-NRCSS), and Dr. V. A. Parthasarathy, Former Director of ICAR-IISR, highlighted the need to modernize breeding strategies and embrace cutting-edge genotypic tools to accelerate the development of superior varieties. They also called for the digitalization of research data to ensure better accessibility and transparency, and they recommended strengthening international collaborations to address global challenges in spice production and trade.

Dr. R. Dinesh, Director of ICAR-IISR, Kozhikode, pinpointed key recommendations from the Quinquennial Review Team (QRT) for AICRP on Spices. He urged the centers to align their activities with these recommendations to achieve the desired outcomes. He also mentioned the importance of fostering partnerships with industry to ensure the

commercialization of the research outcomes, particularly in the context of developing new spice varieties and technologies.

The presidential address was delivered by Dr. V.R. Kamboj, Vice-Chancellor of CCS HAU, Hisar. Dr. Kamboj emphasized the need to address critical agricultural challenges, particularly those related to climate change, socioeconomic issues, and the rising costs of inputs. He called for more cost-effective technologies and advocated for cropping system-based research to ensure a more holistic and sustainable approach to agriculture, including spice production.

Dr. S.K. Singh, Deputy Director General (DDG) Horticulture, ICAR, and the chief guest of the event, delivered an insightful address highlighting India's position as the global leader in the spice sector. He pointed out that while India maintains this legacy, it is imperative for the country's research and development efforts to stay aligned with current and future market demands. He emphasized expanding research into the identification and extraction of essential oil compounds, speeding up breeding techniques to enhance genetic gain, and exploring the role of the microbiome in spice production. Dr. Singh also stressed the importance of developing a comprehensive value chain package for farmers, ensuring that they benefit from the innovations being made in the spice sector.

One of the significant highlights of the event was the presentation of the AICRP Best Center Award, which was conferred upon NM College of Agriculture, Navsari, for their exemplary contributions to spice research and development. This recognition is a testament to the hard work and dedication of the scientists and staff at the centre.

During the meeting, a total of 11 new publications were released, showcasing the latest research findings and innovations in the field of spices. These publications are expected to serve as valuable resources for scientists, policymakers, and farmers alike, offering insights into emerging trends and best practices in spice cultivation. An announcement made during the event was the confirmation of the XIth edition of the biennial National Conference of the Symposium on Spices and Aromatic Crops (SYMSAC), which is scheduled to take place in Kozhikode from the 7th to the 9th of January 2024.

The inaugural session was concluded with a vote of thanks by Dr. S.K. Tehlan, Head, Department of Vegetable Science, CCSHAU, Hisar.

ICAR-All India Coordinated Research Project on Spices

Project Coordinators report (2023-24)

The ICAR-AICRP on Spices is the largest spices research system in India, with a network of 40 centres, focusing on 18 spice crops like black pepper, large cardamom, small cardamom, ginger, turmeric, mango ginger, cinnamon, nutmeg, clove, coriander, cumin, fennel, fenugreek, nigella, ajwain, saffron and kalazeera. The AICRP on Spices has contributed substantially, ever since its inception, in developing 187 high yielding varieties with desirable agronomic traits, 190 technologies for increasing the production and productivity, and management strategies for combating pests and pathogens, substantially reducing crop losses in these crops. The group meeting will provide a platform for researchers to come together and share their findings, ideas, and experiences in the field of spice research. The group meeting after three days deliberations will identify high yielding spices varieties and sustainable technologies for different spice growing regions in India.

During 2023-24, 75 research programmes were carried out which includes 43 in Genetic resources and crop improvement, 15 in crop management and 17 in crop protection. The major thrust areas of the AICRPS are as follows,

1. Modern varieties, productivity, sustainability
2. Globally accepted farming practices
3. Promoting biodiversity-friendly production
4. Quality declared planting material
5. Socio-economic relevance

The achievements of the AICRPS during the year are as follows:

1. Modern varieties, productivity, sustainability

- During the year, a remarkable living catalogue of genetic diversity comprising 8613 unique collections of spice crops are conserved under AICRPS.
- During 2023-24, ICAR-AICRP Spices has identified five varieties better suited to Indian growing conditions, with good productivity and desired quality characteristics.
 - Mango ginger: IISR Amrit (plumy rhizomes, desirable flavour)
 - Cardamom: IISR Manushree (tolerant to moisture stress)
 - Ajwain: Gujarat Ajwain 3 (bold seeds, high yield, 1035 kg/ha)
 - Nigella: HKL 12 (tolerant to root rot, medium maturation)
 - Black pepper: Kamakhya 1 (high yield, suitable for NEH)
- AICRP Spices also facilitated the notification of 28 varieties during 2023-24 in the 31st meeting of the Central Sub Committee on Seed Standards and the Variety Release (CSCSS&VR) for horticultural crops.
- ICAR-AICRP Spices facilitated the notification of minimum Seed Certification Standards of 17 spices crops by the Central Seed Certification Board, Department of Agriculture and Farmers Welfare, GoI (Minimum Seed Certification, Part II).

- Eight CVTs are concluded during the year. The data were subjected to pooled analysis which includes stability analysis (GGE biplot) and multi-trait genotype-ideotype distance index (MGIDI). The results are shared with participating centres for making presentation and preparation of varietal release proposals. Received 12 proposals in different spices crops for varietal identification.
- New initiative: During the year, two new CVTs are formulated to evaluate coriander and fenugreek suitable for leaf yield.

These novel and improved crop varieties may usher in a newfound agricultural diversity heralding improved yields that fill farmers' coffers while promoting the local adaptation and innovative cultivation.

2. Globally accepted farming practices

- ICAR-AICRPS has developed four technologies (black pepper-based mixed cropping system; intercropping strategies in seed spices; micronutrient management in fennel; water use efficiency and fertigation in fenugreek) during the year and in total over 190 crop wise technologies have been developed for soil and plant health management in various spice crops.
- Leaf mould mulching found to enhance the yield in large cardamom.
- New initiative: A new trial 'Effect of Arbuscular Mycorrhizal fungi on growth and yield of black pepper' in black pepper has been proposed.
- A trial on 'TSP/CM/5.1. Site-specific nutrient management in nutmeg' is formulated with four participating centres in nutmeg.
- Heavy metal analysis in leafy coriander and fenugreek across major locations revealed that the majority of samples were within the safe limits in respect of the concentration in lead, nickel, chromium and cadmium.

With these innovations in place, our tillers of the land possess the potential to augment their crop yields, curtail the cost on inputs, and diversify the sources of agricultural income from spice-based systems.

3. Promoting biodiversity-friendly production

- ICAR-AICRPS has developed four technologies (biological control of soil-borne pathogens in black pepper and cardamom; integrated pest and disease management in coriander and cumin) during the year for integrated management of pest and diseases of spices.
- Priming of ginger and turmeric rhizomes (trichoPrime) found to enhance sprouting, over all yield and significant reduction in storage rot.
- ICAR-IISR, Kozhikode has developed a rapid assay based on the reverse transcriptase-recombinase polymerase amplification (RT-RPA) for the detection large cardamom chirke virus (LCCV) and cardamom bushy dwarf virus (CBDV).
- New initiative: Four new trials (two in black pepper, one each in ginger and turmeric) for evaluating pesticides (for label claim) are conducted in accordance with CIB & RC guidelines.

Thus, orchestrating a symphony of progress which hold promise for future generations, securing their agricultural heritage and the legacy of ecological resilience, nurturing a network of interconnected lives that endures beyond our time.

4. Quality declared planting material

- ICAR-AICRPS centres during the year produced 3.2 lakh cuttings of black pepper, 12,000 cardamom suckers, 45 tonnes of ginger and turmeric seed rhizomes, 4000 cuttings/grafts of tree spices, 43 tonnes of seed spices.

5. Socio-economic relevance

- Varietal impact studies of coriander varieties in Andhra Pradesh were conducted during the year. Improved coriander varieties of AICRPS (Lam centre, DR YSRHU) occupy ~70% of area in Andhra Pradesh. The productivity in Andhra Pradesh is high (1894 kg/ha) compared to national average 1357 kg/ha. The reasons for improved productivity, is the pragmatic strategy of application of varieties and technologies developed by AICRP on Spices through research and extension activities.
- AICRP Spices centres during 2023-24 have conducted 62 hands-on training programmes for empowering farmers in doubling the income.
- ICAR-AICRPS technologies have also percolated to the remote and inaccessible tribal lands of Andhra Pradesh, Odisha, Chhattisgarh and in six NE states through implementation of SCSP (5 centres), NEH (7 centres) and TSP programmes (7 centres).
- The programmes were structured to provide essential inputs like seeds or planting materials, fertilizers, trainings and FLDs to beneficiaries including rural youth in motivating their involvement in spice-based farming or processing enterprise. These programs have brought positive transformations, promoted inclusive developments, and reduced disparities among marginalized tribal as well as backward communities.
- The successful implementation of NEH programmes and its success were compiled and brought out as technical bulletin.

Monitoring

- The AICRPS activities were monitored by Project Coordinator through 10 visits to different AICRP centres and conducted nine online meetings to monitor and review AICRPS activities.
- The Seeds Spices monitoring committee headed by Director, ICAR-NRCSS visited Seed Spices centres and submitted the report.

QRT

- The QRT constituted by ICAR has reviewed the research programme of ICAR Indian Institute of Spices Research and AICRP on Spices for the years, 2018-2023.
- The review was conducted in four phases at Kozhikode, Jobner, Guntur, Medziphema to review AICRPS centres activities and the report was submitted to ICAR.

Budget and staff position

- The staff position in the AICRPS: 32 scientific staff, 15 technical staff and 3 lab assistants.
- The AICRP on spices has a total budget of Rs. 793.70 lakhs, with a utilization rate of 100%.
- Generated income of Rs. 5.35 lakhs through different AICRP Spices centres.

**Recommendations of XXXV Annual Group Meeting
and
Action taken report**

S. No	Recommendation	Action	Action taken report
Genetic resources and crop improvement			
1.	In large cardamom virus indexing should be done at ICAR-IISR and only virus-free material should be used in trials. All the centers will send samples of mother stock to ICAR-IISR for virus indexing.	ICRI-Sikkim, ICAR-IISR	ICAR-IISR, Kozhikode has developed a rapid assay based on the reverse transcriptase-recombinase polymerase amplification (RT-RPA) for the detection of large cardamom chirke virus (LCCV) causing <i>chirke</i> disease. Method uses total RNA isolated from the leaves of the large cardamom plants as template and the entire assay from isolation of RNA to visualization of results can be completed in about 75 min. The assay was validated using field samples and found suitable for large-scale screening of large cardamom plants against LCCV for the selection of virus-free plants. The finding is published (Malavika et al. 2024; Development of reverse transcriptase-recombinase polymerase amplification (RT-RPA) assay for rapid detection of large cardamom chirke virus. Virus Disease. https://doi.org/10.1007/s13337-024-00861-2). Four samples sent by ICRI-Sikkim was tested for LCCV at ICAR-IISR and results were communicated. Similarly, ICAR-IISR Kozhikode has also developed an RPA based assay for the quick detection of cardamom bushy dwarf virus (CBDV) causing <i>foorkey</i> disease of large cardamom. The assay uses crude extract isolated from the leaves of the large cardamom

			plants as template and the entire assay from isolation of crude extract to visualization of results can be completed in about 60 min.
2.	Data on heavy metals, need to be recorded in fenugreek and coriander used for leaf purposes	Guntur, Coimbatore, Jobner, Jagudan	Random leaf samples of coriander (11) and fenugreek (14) were collected from Rajasthan (Jobner), Kerala (Kozhikode) and Tamil Nadu (Coimbatore) for analysis of the heavy metals. The lead content was within the limits, coriander (0.65 to 4.95 ppm) and fenugreek (2.15 to 5.2 ppm). The nickel content was within the limits except 2 samples of fenugreek (2.9 to 6.9) and 5 samples of coriander (0.4 to 10.9) ppm. The chromium content ranged from 2 to 6.25 ppm for coriander and from 0 to 6.25 ppm in fenugreek. The chromium and cadmium were not detected in some samples. The cadmium content ranged from 0.1 to 2.1 ppm in coriander and from 0 to 0.7 ppm in fenugreek. In general, the majority of samples were within the safe limits in respect of the concentration in lead, nickel, chromium and cadmium. However, systematic studies are required involving a greater number of samples across different markets.
3.	The germplasm collections have been well maintained in the NAGS at ICAR-IISR and ICAR-NRCSS. It was felt that a duplicate set of germplasm could be maintained in the centers with strict control over its exchange (to be done with the consent of PC)	All AICRPS Centers	AICRP Spices centres maintain 8613 germplasm accessions across different crops. The following crop-specific centres have been identified to maintain a duplicate set of germplasm • Black Pepper – Panniyur • Cardamom-Pampadumara • Large cardamom- ICRI, Sikkim • Turmeric – Guntur • Ginger –Pottangi • Tree spices – Dapoli • Coriander, fenugreek –Jobner

			Cumin, fennel: Jagudan The deposition of duplicate entries should be strictly routed through the PC.
4.	The concluded CVT data must be compiled at the PC Unit, systematically analyzed and shared with participating centres.	PC Unit and concern centres	During the year CVT data of eight trials (2 in ginger, 2 in turmeric, one each in coriander, cumin, fennel and fenugreek) have been compiled at AICRPS unit. The data were subjected to pooled analysis which includes stability analysis (GGE biplot) and multi-trait genotype-ideotype distance index (MGIDI). The results are shared with participating centres for making presentation and preparation of varietal release proposals.
Crop management			
5.	The new trials on crop management aspects of tree spices and black pepper should be proposed	Panniyur, Dapoli, Thrissur, Kozhikode	Black pepper: ICAR-IISR has proposed a new trial 'Effect of Arbuscular Mycorrhizal (<i>Rhizophagus irregularis</i>) fungi on growth and yield of black pepper' in black pepper crop management. Tree spices: A trial on 'TSP/CM/5.1. Site-specific nutrient management in nutmeg through fertigation' is formulated with four participating centres in nutmeg.
6.	AICRPS can form a sub-committee to decide the technical programme of FGK/CM/5.1, FGK/CM/6.1 COR/CM/5.1, and COR/CM/6.1 projects.	PC-AICRPS, Guntur	The committee met online (15.11.2023) and finalized the technical programme for the two projects FGK/CM/5.1, FGK/CM/6.1 COR/CM/5.1, and COR/CM/6.1. - The method of application of AMF and growth regulators along with its technical programme were finalized. - Also, it was decided that Guntur centre will procure AMF as well as growth regulators and supply them to the participating centres.

7.	Trials on green leafy coriander may be initiated to identify superior genotypes under AICRPS system.	All coriander centres	During the year, two new CVTs are formulated to evaluate coriander and fenugreek suitable for leaf yield. • CVT on Leafy Coriander Series 2024 (COR/CI/2.10) with 11 entries, 4 checks • CVT on Leafy Fenugreek 2024 Series XII (FGK/CI/2.7) with 10 entries and a check.
8.	Hereafter, ICAR-IISR, Kozhikode centre should participate in any new trials involving ginger, turmeric, black pepper and nutmeg	PC-AICRPS, ICAR-IISR	Implemented. ICAR-IISR and ICAR-NRCSS are now part of all the AICRPS trials to have a better control over experimental results.
Crop Protection			
9.	The session name may be changed as Plant protection and food safety.	PC-AICRPS	Implemented. The session name is changed as 'Plant protection and Food Safety'.
10.	All the pesticide/bioagents evaluation trials should strictly comply with the guidelines of CIBRC	PC Cell and concern Centers	Four new trials (two in black pepper, one each in ginger and turmeric) for evaluating pesticides (for label claim) are conducted in accordance with CIB & RC guidelines. A technical program, including data requirements for bioefficacy, phytotoxicity, and effects on natural enemies (predators and parasites), is prepared by ICAR-IISR and shared with participating centers.
Varietal release			
11.	All the AICRP Spices recommended varieties have to be submitted for notification by CSCSS and VR (Horticultural Crops)	All centers	During the year, seven varieties (national) have been accepted for release and notification during 31 st meeting of CSCSS and VR (Horticultural Crops). • Mango ginger, IISR Amrit • Cardamom, IISR Manushree • Ajwain, Gujarat Ajwain 3 • Fennel, RF 289, RF 290 • Nutmeg, IISR Keralashree & Konkan Konkan Sanyukta • Cassia, IISR Cassia (Konkan cassia)
12.	The varieties that are not part of AICRP on Spices evaluation system and approved by state	All centers	Implemented. The AICRP Spices facilitated the presentation of 21 (state) varieties at the 31 st

	variety release committee should be directly submitted to CVRC for notification and a copy should be submitted to Project coordinator, AICRP on Spices		meeting of the Central Sub-Committee on Crop Standards, Notification, and Release of Varieties for Horticultural Crops, held during 2024. Of these, eight varieties were from AICRP Spices centers.
13.	Facilitate notification of the minimum field and seed certification standards of spices.	AICRPS-PC	Minimum Seed Certification Standards of 17 spices crops have been notified by the Central Seed Certification Board, Department of Agriculture and farmers Welfare, GoI (Minimum Seed Certification, Part II). ICAR-AICRP Spices facilitated the notification.
Transfer of Technology			
14.	The impact of technologies, and varieties, needs to be measured and assessed in the farmers' plots, including the extent of area coverage.	All centres	The AICRPS has undertaken study on varietal spread of spices. In the first stage, varietal spread and impact of GC4 (Gujarat Cumin 4) was studied, and a technical bulletin was published. The salient findings are: • GC4 replaced substantial areas (77%) of other varieties (2005-2023) • Its success is mainly due to the wilt resistance • GC4 led to substantial increases in export earnings (4251 cr) • Estimated cumulative exports earnings (2005-2023) from Gujarat Cumin-4 is Rs 25480 crores, at current (2022-23) prices Impact of seed spices varieties in Andhra Pradesh was studied during the year by the Guntur centre. • Improved coriander varieties of AICRPS (Lam centre, DR YSRHU) occupy ~70% of area in Andhra Pradesh. • The productivity in India is 1357 kg/ha while 1894 kg/ha in Andhra Pradesh The reason for improved productivity, is the pragmatic

			strategy of application of varieties and technologies developed by AICRP on Spices through research and extension activities.
General recommendations			
15.	The research group should extend their efforts from research to commercialization, including the potential for patents, variety registration, and protection under PPVFRA, while also translating research findings into high-quality publications.	All centres	Patent/Commercialization: Requesting ICAR to develop guidelines for patent/commercialization of AICRP varieties and technologies. Publications: During the year, 87 research papers (2.71/scientist) have been published by AICRPS centres.

TECHNICAL SESSION: I

ACTION TAKEN REPORT/PERFORMANCE EVALUATION

Chair	Dr. Sanjay Kumar Singh, Deputy Director General, (Horticultural Science), ICAR, New Delhi
Co-chair	Dr. Sudhakar Pandey, ADG (FVS & MP), ICAR, New Delhi
Rapporteurs	Dr. H.J. Akshitha, ICAR-IISR Dr RS Meena, ICAR-NRCSS

Dr. D. Prasath, Project Coordinator, AICRP on Spices presented the progress report and Action taken report.

Recommendations

- A centre in North East may be identified for taking up nigella trials (Action: PC, AICRPS)
- Director, ICAR-NRCSS may convene a meeting to discuss aflatoxin and artificial colouring agent issues in seed spices (Action: Director, NRCSS)
- A letter may be sent from the PC unit to the centres whose performance is not up to mark to inform the same (Action: PC, AICRPS).

TECHNICAL SESSION: II

GENETIC RESOURCES AND CROP IMPROVEMENT

Chair Dr. V.A. Parthasarathy, Former Director, ICAR-IISR
 Co-Chairs Dr. Vinay Bhardwaj, Director, ICAR-NRCSS
 Dr K Nirmal Babu, Former Director, ICAR-IISR

Rapporteurs Dr. M.S. Shivakumar, ICAR-IISR
 Dr. Surabi S Chauhan, SDAU

Session encompassed a comprehensive evaluation of genetic resources and crop improvement programs in 14 spices crops. Notably, a marked enhancement in the quality of both analysis and presentation was observed compared to previous years. The committee was particularly impressed by the insightful utilization of the robust AMMI model to elucidate genotype-by-environment (GxE) interactions. Furthermore, the committee commended the innovative approach of employing the Multi-trait Genotype-Ideotype Distance Index (MGIDI) for selection. The committee placed on record their appreciations to the PC and his team.

Project wise recommendations

Genetic resources

Crop	Recommendation	Defaulting centres
Black pepper	PEP/CI/1.1. Six centres are maintaining the germplasm. Ensure that all accessions have the IC numbers.	-
Cardamom	CAR/CI/1.1. The Mudigere and Pampadumpara centres conserve total of 197 accessions.	Progress at Pampadumpara may be reviewed.
Large cardamom	LCA/CI/1.1. ICRI collected 57 accessions and two new <i>Amomum</i> spp. while ICAR Complex added two new collections.	-
Ginger	GIN/CI/1.1. Germplasm is being maintained at seven centres. Consolidate the germplasm collections, eliminate duplicates and catalogue them.	-
Turmeric	TUR/CI/1.1. This programme is going on in 11 centres. Eliminate duplicates, get all accessions IC numbers and complete the catalogue. Also mark germplasm along with the desirable traits.	-
Tree Spices	TSP/CI/1.1. Germplasm collection, characterization, evaluation and conservation of clove, nutmeg and cinnamon. • It is a long-term trial as they are all tree crops. Only two centres, Dapoli and	-

	Pechiparai are conserving the germplasm. Sixteen accessions have been collected during the year. TSP/CI/1.2. Collection of unique germplasm in tree spices (nutmeg). • This programme may be merged with TSP/CI/1.1.	
Coriander, cumin, fennel, fenugreek, ajwain	PC and Director, ICAR-NRC seed spices may compile the available data in the form of catalogue.	-
Saffron, kalazeera	It is a single centre project. Explore the possibility of testing them at other suitable places in Arunachal Pradesh and Uttarakhand.	-

Crop improvement

Crop	Status	Recommendation
Black pepper	PEP/CI/3.7. CVT series IX initiated in 2018 with 10 entries.	The trial is in progress well in all centres except Ambalavayal and Chintapalle. PC may find out about the conclusion of the project next year.
Cardamom	1. CAR/CI/3.9. CVT series IX with 10 hybrids is in progress at 5 centres since 2018. 2. CAR/CI/4.4. Multilocation evaluation of thrips-tolerant cardamom line 3. CAR/CI/4.5. MLT on leaf blight tolerant lines of small cardamom	PC may check the progress of Pampadumpara centre. Other centres are doing well. IC 349370 shows promising results except in Sakleshpur. However, results need to be confirmed. The trials show varied results. Need to be carried out for confirmatory results.
Large cardamom	LCA/CI/2.1. CVT series 1 is going on at Gangtok and Pasighat with 10 entries.	The trial under CAU is at Anjaw district of Arunachal Pradesh.
Ginger	1. GIN/CI/2.5. CVT on disease tolerance in ginger 2019 – Series X 2. GIN/CI/4.3. Evaluation of	Entries that perform well under disease pressure, particularly focusing on bacterial wilt and rhizome rot, need to be identified while maintaining good fresh rhizome yield. The trial must be concluded. Although Bold Nadia exhibits

	genotypes of ginger for vegetable purpose (observational trial)	superior fresh rhizome yield, John's Ginger offers a better balance of high yield and stability.
Turmeric	1. TUR/CI/2.8. CVT on high yield and high curcumin with 11 varieties in nine centres since 2020. 2. TUR/CI/2.9. CVT on light yellow colour turmeric for specialty market in 7 centres with 11 varieties (including check).	The trial can be concluded. The genotype with good balance between curcumin content and yield has to be identified using a robust statistical tool. The trial has been concluded with robust statistical tool confirming the superiority of Acc 849.
Tree Spices	1. TSP/CI/2.4. Coordinated Varietal Trial on farmers varieties of nutmeg 2. Evaluation of nutmeg genotypes	May be concluded in 2026. Trial may continue.
Coriander	COR/CI/2.8. Coordinated Varietal Trial on coriander 2021- Series XI with 13 varieties (including 2 checks) at 15 centres.	The trial can be concluded
Cumin	CUM/CI/2.5. Coordinated Varietal Trial – 2021. This trial is going on at five centres with 12 varieties (including one check).	The trial can be concluded.
Fennel	FNL/CI/2.8. Coordinated varietal trial on fennel – 2021 Series XI. The trial with 13 varieties (two checks) in nine centres is going one.	The trial may be concluded.
Fenugreek	FGK/CI/2.5. Coordinated Varietal Trial of fenugreek 2021 – Series XI. This trial with 17 varieties (2 checks) is going on at 12 centres.	The trial may be concluded.
Ajwain	AJN/CI/2.1. Coordinated Varietal Trial–2022 Series	-

General Recommendations

- The germplasm collections in different spice crops have to be consolidated, eliminate duplicates and catalogue them.
- It is recommended that the data analysis on stability analysis and Multi-trait Genotype-Ideotype Distance Index should be published in high rated journals.
- The large cardamom CVT trial under CAU, Pasighat is at Anjaw district (KVK) of Arunachal Pradesh. Conducting a trial remotely from Pasighat may not be easy and hence the centre is recommended for discontinuation. At the same time,

explore the possibility to conduct the experiment at Kalimpong, Darjeeling under UBKV with supervision from ICRI, Gangtok.

- Crop wise SOPs (standard operating procedures) for varietal release has to be prepared, clearly indicating selection indices for promoting genotypes for IET and CVT, and crop wise standards for varietal identification. PC (AICRPS) may submit a proposal to DDG (Hort. Science) to formulate a committee to develop SOPs.
- Pest and disease screening methodologies for seed spices has to be brought out immediately. PC may form a committee to develop these guidelines involving AICRP centres.

TECHNICAL SESSION II

SUMMARY OF THE TECHNICAL SESSION

Project code	Title	Centres	Comments
Black pepper			
PEP/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Ambalavayal, Dapoli, Panniyur, Pundibari, Sirsi, Yercaud	Continued
PEP/CI/3.7	CVT 2018 on black pepper - Series IX	Ambalavayal, Chintapalli, Dapoli, Kozhikode, Panniyur, Sirsi, Yercaud	Continued
Cardamom			
CAR/CI/1.1	Germplasm collection, characterization, evaluation, and conservation	Mudigere, Pampadumpara	Continued
CAR/CI/3.9	CVT on hybrids of small cardamom-2018 – Series IX	Appangala, Mudigere, Myladumpara, Pampadumpara, Sakleshapura	Continued
CAR/CI/4.4	Multi-location evaluation of thrips-tolerant cardamom lines	Appangala, Mudigere, Myladumpara, Pampadumpara, Sakleshapura	Continued
CAR/CI/4.5	MLT on leaf blight tolerant lines of small cardamom 2018	Appangala, Mudigere, Myladumpara, Pampadumpara, Sakleshapura	Continued
Large cardamom			
LCA/CI/1.1	Germplasm collection and evaluation of large cardamom	ICAR Regional Station, Gangtok, ICRI Regional Research Station, Gangtok	Continued
LCA/CI/2.1	CVT on large cardamom	ICAR Regional Station, Gangtok, ICRI Regional Research Station, Gangtok	Continued
Ginger			
GIN/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Barapani, Dholi, Kumarganj, Pottangi, Pundibari, Raigarh, Solan	Continued
GIN/CI/2.5	CVT on disease tolerance in ginger 2019	Barapani, Chintapalli, Gangtok, Kozhikode, Nagaland, Pottangi, Pundibari, Raigarh	Concluded
GIN/CI/2.6	CVT on bold ginger	Appangala, Kozhikode, Pottangi, Raigarh, Sikkim	Continued

GIN/CI/2.7	CVT on high essential oil ginger genotypes	Appangala, Kozhikode, Nagaland, Pottangi, Umiam	Continued
GIN/CI/4.3	Evaluation of genotypes of ginger for vegetable purpose (observational trial)	Chintapalli, Gangtok, Kozhikode, Mizoram, Nagaland, Pottangi, Pundibari	Concluded
Turmeric			
TUR/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Barapani, Coimbatore, Dholi, Guntur, Kammarpally, Kumarganj, Pasighat, Pottangi, Pundibari, Raigarh, Solan	Continued
TUR/CI/2.8	CVT on high yield and high curcumin	Coimbatore, Guntur, Kammarpally, Kanke, Kozhikode, Navsari, Pasighat, Pottangi, Raigarh,	Concluded
TUR/CI/2.9	CVT on light yellow colour turmeric for specialty market	Coimbatore, Guntur, Kammarpally, Kanke, Kozhikode, Pasighat, Pottangi	Concluded
TUR/CI/2.11	CVT on black turmeric <i>Curcuma caesia</i>	Barapani, Coimbatore, Kozhikode, Kumarganj, Mizoram, Navsari, Pottangi, Pundibari	Continued
Tree spices			
TSP/CI/1.1	Germplasm collection, characterization, evaluation and conservation of clove, nutmeg and cinnamon	Dapoli, Pechiparai	Continued
TSP/CI/1.2	Collection of unique germplasm in tree spices	Dapoli, Pechiparai	Merge the project with TSP/CI/1.1 and continue
TSP/CI/2.4	Coordinated Varietal Trial on farmer's varieties of nutmeg	Dapoli, Pechiparai, Thrissur	Concluded with data of 2026
TSP/CI/2.5	Coordinated Varietal Trial on nutmeg- series 2023	Dapoli, Kozhikode, Pechiparai, Thrissur	Continued
Project Mode	Evaluation of nutmeg genotypes	Thrissur	Continued
Coriander			
COR/CI/1.1	Germplasm collection, description, characterization, evaluation, conservation and screening against diseases	Coimbatore, Dholi, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh	Continued

COR/CI/2.8	Coordinated varietal trial on coriander-2021- Series XI	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jabalpur, Jagudan, Jobner, Kalyani, Kota, Kumarganj, Navsari, Pantnagar, Raigarh, Sanand	Concluded
COR/CI/4.1	Quality evaluation in coriander	Jobner	Continued
Cumin			
CUM/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Jagudan, Jobner, Mandor, Sanand	Continued
CUM/CI/2.5	Coordinated varietal trial on cumin-2021	Ajmer, Jagudan, Jobner, Mandor, Sanand	Concluded
Fennel			
FNL/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Dholi, Hisar, Jagudan, Jobner, Kumarganj	Continued
FNL/CI/2.8	Coordinated varietal trial on fennel-2021 Series XI	Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Navsari, Pantnagar	Concluded
Fenugreek			
FGK/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Dholi, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh	Continued
FGK/CI/2.5	Coordinated varietal trial on fenugreek-2021 Series XI	Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kalyani, Kota, Kumarganj, Navsari, Pantnagar, Raigarh	Concluded
FGK/CI/3.7	Chemo-profiling for identification of industrial types among the released varieties of fenugreek	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jobner, Kumarganj	Concluded
Ajwain			
AJN/CI/2.1	Coordinated varietal trial-2022 Series	Ajmer, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh	Concluded with the data of 2024-25
Saffron			
Project mode	Conservation, evaluation and utilization of exotic and indigenous saffron germplasm lines	Pampore	Continued

Kalazeera			
Project mode	Exploration, collection and conservation of kalazeera from high altitudes of northern Himalayas	Pampore	Continued

TECHNICAL SESSION: III

CROP MANAGEMENT

Chair Dr. R. Dinesh, Director, ICAR-IISR
Co-Chairs Dr. Rajbir Garg, Director of Research, CCSHAU
Dr. Prakash Patil, Project Coordinator (AICRP on Fruits)

Rapporteurs Dr. R Shivaranjani, ICAR-IISR
Dr. Reena Nair, JNKV

The session meeting encompassed a total of 12 crop management trial reports, covering crops such as Cardamom, Large Cardamom, Ginger, Turmeric, Coriander, and Fenugreek. Work was conducted across multiple AICRPS centers for each crop, with no non-reporting centers observed.

Brief description of work done and salient achievements reported, where crop-wise and programme-wise recommendations are given below.

Cardamom

CAR/CM/5.5 - Effect of micronutrient on growth and yield of small cardamom

- Most of the centres recorded significant improvement in growth and yield in treatments where IISR Micronutrient formulation for cardamom is used. But the response of cultivars for micronutrients as well as interaction was found to be non-significant.

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

- Mudigere, Myladumpara and Pampadumpara recorded significantly higher yield in T3 (227.7:275:244.4 Kg/ha of NPK) for 10 q/ha yield.

Large cardamom

LCA/CM/5.1 – Effect of mulching on yield of large cardamom

- Leaf mould treatment of soil mulch has given significantly higher dry capsule yield in both the centres

Ginger

GIN/CM/4.1 - Evaluation of different ginger-based intercropping systems for higher yield and income

- No trend was observed among different centres among different intercropping treatments

GIN/CM/5.1 – Evaluation of Plant Growth Promoting Rhizobacteria, *Bacillus safensis* for phosphorus (P) solubilization potential in ginger

- All centres recorded significant increase in Yield in T3 (75% RDP and *Bacillus safensis*)

GIN/CM/5.2 – Evaluation of Plant Growth Promoting Rhizobacteria, *Bacillus safensis* for zinc (zn) solubilization potential in ginger

- In most of the centres, 50% zinc fertilizers and *Bacillus safensis* has given significant higher yield in ginger

Turmeric

TUR/CM/5.1 - Evaluation of Plant Growth Promoting Rhizobacteria, *Bacillus safensis* for phosphorus (P) solubilization potential in turmeric

- In most of the centres, T3 (75% of recommended dose of P and *Bacillus safensis*) has given significant higher yield in turmeric

TUR/CM/5.2 – Evaluation of Plant Growth Promoting Rhizobacteria, *Bacillus safensis* for zinc (zn) solubilization potential in turmeric

- All centres recorded significant higher yield in T2 (50% zinc (zn) fertilizer and *Bacillus safensis*).

Coriander

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

- Most of the centres recorded significantly higher yield in treatments with 100% RDP + seed treatment at 25 g/kg of seeds

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

- No significant trend was observed among treatments among different centres

Fenugreek

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

- Three out of four centres reported significant increase in yield in treatment with 100% RPF+seed treatment @ 25 g/kg.

FGK/CM/6.1 - Effect of growth regulators on yield and quality of fenugreek

- No significant trend was observed among treatments among different centres

Recommendations ready for transfer to extension agency if any:

Effect of mulching by leaf mould in large cardamom for yield increase is ready for technology transfer.

General guidelines for carrying out the work, recording observations and other aspects connected with the implementation of the program

- Trials involving growth regulators across all crops should include specific attributes such as changes in maturity, senescence, and the number of days from flowering to fruit set.
- Qualitative analysis data should be incorporated into the final presentations.
- Factorial analysis and advanced statistical techniques for data visualization should be used to differentiate crop performance across various centers.
- Phosphorus soil status should be analyzed, and data on how VAM enhances phosphorus availability should be included.

- High-quality photographs clearly showing the effects of treatments must be added.
- The presentation should begin with a slide outlining the Inventor's claims regarding the technology.
- When presenting the second-year results, the first-year data should be compared with the second-year data to ensure continuity.
- Benchmarks for fertilizer levels, especially micronutrients, should be developed, as certain micronutrients (Zn) are high in some locations.
- For the large cardamom trial, information on mulch availability should be provided.
- For the ginger-based intercropping system trial, region-specific crop combinations should be included as intercrops, and further studies on insect pests, diseases, and yield effects of intercropping should be conducted. Fertility status should also be included in the presentation.
- In the turmeric trial on PGPR for P solubilization potential, control levels with 0% P may be added.
- In the turmeric trial on PGPR for Zn solubilization potential, uniformity in soil Zn data presentation across centers is required. Pasighat center should resubmit data in consultation with a Soil Scientist, as all centers except Kumarganj presented soil Zn data.
- Micronutrient levels may impact sucking pests, so comprehensive observations should be recorded.
- Previous crops grown in the field should be mentioned in fertilizer trials.
- Crop management trial yields are lower than varietal trials in most centers, and this should be addressed by the concerned scientists.

Recommendations

- New trials should be proposed for black pepper as well as other crops, considering the latest technological needs.
- Since most technologies are developed by ICAR-IISR, participating universities are encouraged to initiate experiments at their own level to develop region-specific technologies. These technologies can then be shared for multi-location trials (MLT) in other zones or regions.
- All observations should align with the objectives of the trial, rather than focusing solely on yield.

TECHNICAL SESSION III

SUMMARY OF THE TECHNICAL SESSION

Project code	Title	Centres	Comments
Cardamom			
CAR/CM/5.5	Effect of micronutrients on growth and yield of small cardamom	Appangala, Mudigere, Myladumpara, Pampadumpara, Sakleshpur	Continued
CAR/CM/5.6	Site-specific recommendations for varying yield targets of cardamom.	Appangala, Mudigere, Myladumpara, Pampadumpara, Sakleshpur	Continued
Large cardamom			
LCA/CM/5.1	Effect of mulching on yield of large cardamom	Pasighat, ICAR Gangtok, ICRI Gangtok	Concluded
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, Sirsi, Solan.	Continued for season 2024-25
GIN/CM/5.1	Evaluation of Plant Growth Promoting Rhizobacteria, <i>Bacillus safensis</i> for Phosphorus (P) Solubilization Potential in ginger	Ambalavayal, Chintapalli, Kalyani, Kammarpally, Kumarganj, Pasighat, Pottangi, Pundibari, Raigarh,	Continued
GIN/CM/5.2	Evaluation of Plant Growth Promoting Rhizobacteria, <i>Bacillus safensis</i> for zinc (Zn) solubilization potential in ginger	Chintapalli, Kalyani, Kammarpally, Kumarganj, Pasighat, Pottangi, Raigarh,	Continued
Turmeric			
TUR/CM/5.1	Evaluation of Plant Growth Promoting Rhizobacteria, <i>Bacillus safensis</i> for phosphorus (P) solubilization potential in turmeric	Chintapalli, Coimbatore, Kahikuchi, Kalyani, Kammarpally, Kozhikode, Pasighat, Pottangi, Pundibari, Raigarh, Solan.	Continued
TUR/CM/5.2	Evaluation of Plant Growth Promoting Rhizobacteria, <i>Bacillus safensis</i> for zinc (Zn) solubilization potential in turmeric	Chintapalli, Coimbatore, Dholi, Kahikuchi, Kalyani, Kammarpally, Kanke, Kumarganj, Kozhikode, Pasighat, Pottangi, Pundibari, Raigarh.	Continued

Tree Spices			
TSP/CM/5.1	Site-Specific Nutrient Management in Nutmeg (<i>Myristica fragrans</i>)	Vellanikkara, Kozhikode, Dapoli, Coimbatore	Continued
Coriander			
COR/CM/5.1	Growth and yield of Coriander as influenced by AMF (Arbuscular Mycorrhizal Fungi)	Ajmer, Coimbatore, Dholi, Guntur, Jabalpur, Kota	Continued
COR/CM/6.1	Effect of modern growth regulators on yield and quality of coriander	Coimbatore, Guntur, Hisar, Jabalpur, Jobner, Kota, Raigarh	Continued
Fenugreek			
FGK/CM/5.1	Growth and yield of fenugreek as influenced by AMF (Arbuscular Mycorrhizal Fungi)	Dholi, Kota, Mandor, Jabalpur	Continued
FGK/CM/6.1	Effect of modern growth regulators on yield and quality of fenugreek	Ajmer, Dholi, Hisar, Jobner, Kota	Continued

Session IV: Crop Protection and Food safety

Chair	Dr. N.K. Krishna Kumar, Former DDG (HS), ICAR
Co-Chairs	Dr. Homey Cheriyan, Director, DASD Dr. A.I. Bhat, Head, Division of Crop Protection, ICAR-IISR, Kozhikode
Rapporteurs	Dr. Mohammed Faisal Peeran, ICAR-IISR Dr. Anamika Debnath, UBKV, Pundibari

Project-wise recommendations

Black pepper

PEP/CP/5.10: Observational trial on efficacy of *Trichoderma asperellum* and *Pochonia* for the management of *Phytophthora* foot rot and nematodes in black pepper (Appangala, Panniyur, Sirsi)

- The project is concluded.

PEP/CP/7.1: Screening of insecticides for pollu beetle, *Lanka ramakrishnai* in black pepper (Appangala, Panniyur)

- The project is concluded.

Cardamom

CAR/CP/6.11: Evaluation of fungicides against rhizome rot in small cardamom (Appangala, Mudigere, Myladumpara, Pampadumpara)

- The project is concluded.

CAR/CP/6.12: Evaluation of fungicides against leaf blight in small cardamom (Appangala, Mudigere, Myladumpara, Pampadumpara)

- The project is concluded.

CAR/CP/6.13: Observational trial on the efficacy of *Trichoderma asperellum* and *Pochonia chlamydosporia* for the management of rhizome rot and nematode in small cardamom (Appangala, Myladumpara, Pampadumpara)

- The project is concluded.

Ginger

GIN/CP/6.15: Priming of rhizomes for enhanced germination, vigour and storage rot suppression in ginger (Ambalavayal, Barapani, Chintapalli, Dholi, Kalyani, Kammarpally, Kanke, Nagaland, Pasighat, Pottangi, Pundibari, Raigarh, Solan)

- The project is concluded.

GIN/CP/7.1: Spray schedule optimization of effective insecticides for shoot borer (*Conogethes punctiferalis*) in ginger (Ambalavayal, Barapani, Kanke, Mizoram, Mudigere, Nagaland, Pasighat, Pottangi, Pundibari, Sirsi)

- The project is concluded.

GIN/CP/7.2: Observational trial on the efficacy of *Trichoderma asperellum* and *Pochonia chlamydosporia* for the management of rhizome rot and nematode in ginger (Barapani, Chintapalli, Kozhikode, Pottangi)

- The project is concluded.

Turmeric

TUR/CP/7.8: Priming of rhizomes for enhanced germination, vigour and storage rot suppression in turmeric (Ambalavayal, Chintapalli, Coimbatore, Dholi, Kammarpally, Kahikuchi, Kanke, Kumarganj, Mizoram, Pasighat, Pottangi, Pundibari, Raigarh, Solan)

- The project is concluded.

TUR/CP/7.9: Spray schedule optimization of effective insecticides for shoot borer (*Conogethes punctiferalis*) in turmeric (Ambalavayal, Barapani, Guntur, Kammarpally, Kanke, Mizoram, Mudigere, Pasighat, Pottangi, Pundibari, Sirsi)

- The project is concluded.

TUR/CP/7.10: Observational trial on the efficacy of *Trichoderma asperellum* and *Pochonia chlamydosporia* for the management of rhizome rot and nematode in turmeric (Barapani, Coimbatore, Guntur, Kozhikode)

- The project is concluded.

Coriander

COR/CP/7.1: Screening of coriander varieties against stem gall disease (Dholi, Hisar, Jabalpur, Kota, Kumarganj)

- Nil.

Cumin

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

- Nil.

Fenugreek

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

- Nil.

Nigella

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

- Nil.

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.)

- Nil.

General Recommendations

- A comprehensive trial for evaluation of technologies of crop protection (entomology, pathology and nematology) for integrated pest and disease management should be initiated in seed spices.
- Programs on plant protection under organic cultivation in selected spices should be initiated
- In all the trials, the effect of fungicides/insecticides on natural enemies and pollinators to be recorded and quantified (Cumin, Coriander and Cardamom etc.).
- Market survey in various crops and recording of aflatoxins in cumin, heavy metal contamination, artificial coloring agents in turmeric, admixtures in Black pepper and other such biosafety issues in market should be reported in AICRP by different centers.
- New pest and diseases in all the spice crops recorded if any during survey should be reported under relevant projects

TECHNICAL SESSION III
SUMMARY OF THE TECHNICAL SESSION

Project code	Title	Centres	Comments
Black pepper			
PEP/CP/5.10	Observational trial on efficacy of <i>Trichoderma asperellum</i> and <i>Pochonia</i> for the management of <i>Phytophthora</i> foot rot and nematodes in black pepper	Appangala, Panniyur, Sirsi	Concluded
PEP/CP/7.1	Screening of insecticides for pollu beetle, <i>Lanka ramakrishnai</i> in black pepper	Appangala, Panniyur	Concluded
PEP/CP/7.2	Evaluation of effective insecticides against pollu beetle, <i>Lanka ramakrishnai</i> infesting black pepper for label claim expansion	Appangala, Kozhikode, Panniyur	Continued
Cardamom			
CAR/CP/6.11	Evaluation of fungicides against rhizome rot in small cardamom	Appangala, Mudigere, Myladumpara, Pampadumpara	Concluded
CAR/CP/6.12	Evaluation of fungicides against leaf blight in small cardamom	Appangala, Mudigere, Myladumpara, Pampadumpara	Concluded
CAR/CP/6.13	Observational trial on the efficacy of <i>Trichoderma asperellum</i> and <i>Pochonia chlamydosporia</i> for the management of rhizome rot and nematode in small cardamom	Appangala, Myladumpara, Pampadumpara	Concluded
Ginger			
GIN/CP/6.15	Priming of rhizomes for enhanced germination, vigour and storage rot suppression in ginger	Ambalavayal, Barapani, Chintapalli, Dholi, Kalyani, Kammarpally, Kanke, Nagaland, Pasighat, Pottangi, Pundibari, Raigarh, Solan.	Concluded
GIN/CP/7.1	Spray schedule optimization of effective insecticides for shoot borer (<i>Conogethes punctiferalis</i>) in ginger	Ambalavayal, Barapani, Kanke, Mizoram, Mudigere, Nagaland, Pasighat, Pottangi, Pundibari, Sirsi	Concluded

GIN/CP/7.2	Observational trial on the efficacy of <i>Trichoderma asperellum</i> and <i>Pochonia chlamydosporia</i> for the management of rhizome rot and nematode in ginger	Barapani, Chintapalli, Kozhikode, Pottangi	Concluded
GIN/CP/7.3	Evaluation of effective insecticides against shoot borer, <i>Conogethes punctiferalis</i> infesting ginger for label claim expansion	Ambalavayal, Appangala, Kozhikode, Mudigere, Raigarh	Continued
Turmeric			
TUR/CP/7.1	Evaluation of effective insecticides against shoot borer, <i>Conogethes punctiferalis</i> infesting turmeric for label claim expansion	Appangala, Coimbatore, Guntur, Kammarpally, Kozhikode	Continued
TUR/CP/7.2	Assessment of nematicide for the management of root lesion nematodes (<i>Pratylenchus</i> spp.), infecting turmeric.	Guntur (AP), Kammarapally (TG), Coimbatore (TN), Pundibari (WB) and Calicut;	Continued
TUR/CP/7.8	Priming of rhizomes for enhanced germination, vigour and storage rot suppression in turmeric	Ambalavayal, Chintapalli, Coimbatore, Dholi, Kammarpally, Kahikuchi, Kanke, Kumarganj, Mizoram, Pasighat, Pottangi, Pundibari, Raigarh, Solan	Concluded
TUR/CP/7.9	Spray schedule optimization of effective insecticides for shoot borer (<i>Conogethes punctiferalis</i>) in turmeric	Ambalavayal, Barapani, Guntur, Kammarpally, Kanke, Mizoram, Mudigere, Pasighat, Pottangi, Pundibari, Sirsi	Concluded
TUR/CP/7.10	Observational trial on the efficacy of <i>Trichoderma asperellum</i> and <i>Pochonia chlamydosporia</i> for the management of rhizome rot and nematode in turmeric	Barapani, Coimbatore, Guntur, Kozhikode.	Concluded
Cumin			
CUM/CP/7.1	Eco-friendly management of cumin blight	Jaugdan, Jobner, Mandor	Continued

Fenugreek			
FGK/CP/7.1	Bio-efficacy of fungicides against powdery mildew of fenugreek.	Coimbatore, Hisar, Jabalpur, Jagudan, Jobner, Kota.	Continued
Nigella			
NGL/CP/7.1	Management of root rot of nigella	Dholi, Kumarganj, Raigarh	Continued
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.	Continued

TECHNICAL SESSION: V

VARIETY IDENTIFICATION COMMITTEE MEETING

Chairman: Dr. Sudhakar Pandey, ADG (FVS & MP), ICAR, New Delhi

Members: Nominated by DDG

Member Secretary: Dr. D. Prasath, Project Coordinator, ICAR-AICRP on Spices

Rapporteurs: Dr. V. Sivakumar, Scientist (Hort.) Dr. YSRHU, Chintapalle

Dr. Ramakrishna Sarkar, UBKV, Pundibari

During the session on variety release, the following varieties were recommended for release

Crop	Variety	Centre	Salient Features	Recommendations
Coriander	Karan Dhaya-1 (RCr 565/UD-565)	Jobner	High yielding with an average seed yield of 1482 kg ha ⁻¹ . mean volatile yield was 5.73 1 ha ⁻¹ . Resistant to stem gall and moderately resistant to powdery mildew, matures in 110-120 days and suitable under irrigated normal sown conditions.	• Identified for release to Rajasthan, Gujarat and other coriander growing areas. • It is recommended to do DNA finger printing and get IC number for this variety.
Cumin	Jodhpur Jeera 1 (MCU-105)	Mandor	High yielding potential with an average seed yield of 566 kg ha ⁻¹ . It possesses a high essential oil content (4.34%), characterized by a high number of branches and umbels. Demonstrates moderate resistance to wilt, blight, and aphid under natural conditions	• Identified for release to Rajasthan. • It is recommended to do DNA finger printing and get IC number for this variety.
Cumin	Jodhpur Jeera 2 (MCU-73)	Mandor	High yielding potential with an average seed yield of 487 kg ha ⁻¹ , enhanced essential oil content (4.54%), increased branching and umbel number, and moderate resistance to key diseases like wilt, blight, and aphids, suitable for irrigated and timely sown conditions.	The proposed variety has been deferred for release.
Cumin	CAZRI Cumin 2 (CZC-94)	CAZRI, Jodhpur	CZC-94 is an early-maturing cumin variety with a shorter maturity period (110days), offering potential for improved	• Variety withheld for identification. • May be considered for release only when demonstrate a significant

			yield with optimized agronomic practices. It exhibits a slightly higher essential oil content (4.34%) and demonstrates resilience to terminal heat stress, making it a suitable option for regions experiencing increasing heat during the growing season	yield advantage under close-spacing experiments, after completing one year of agronomic (spacing) trials across AICRPS cumin centers under high-density planting conditions.
Cumin	CAZRI Cumin 1 (CZC 135)	CAZRI, Jodhpur	High yielding potential with an average seed yield of 522 kg ha ⁻¹ , superior performance in multiple trials, high seed number per umbel, and higher essential oil content (4.25%), demonstrating tolerance to <i>Fusarium</i> wilt.	•Identified for release to Rajasthan. •It is recommended to do DNA finger printing and get IC number for this variety.
Fennel	Gujarat Fennel 13 (JF 2018-03)	SDAU, Jagudan	High yielding potential with av. seed yield of 1814 kg ha ⁻¹ , compact umbel with a greater number of umbels per plant, bold seed (6.52 g) & high volatile oil (2.87 %), and moderately resistant to <i>Ramularia</i> blight.	•Identified for release to Gujarat, Rajasthan, Haryana, Bihar & Uttar Pradesh •It is recommended to do DNA finger printing and get IC number for this variety.
Fennel	RF 231 (UF 231)	Jobner	High yielding potential with av. seed yield of 1742 kg ha ⁻¹ , RF 231 have mean volatile yield of 57.83 l ha ⁻¹ and was found moderately resistant to <i>Ramularia</i> blight disease	•Variety deferred for release, with the suggestion that the volatile oil content be estimated by sending the seed material to the Project Coordinator cell for third-party volatile oil estimation, in order to register the trait.
Fenugreek	Karan Methi-1/ RMt-259 (UM 259)	Jobner	High yielding variety with an average seed yield of 1742 kg/ha. Early maturity of 121 days. Suitable for irrigated normal sown conditions in sandy loam to heavy loamy soils with proper drainage. Moderately resistant to powdery mildew and downy mildew diseases, ensuring better crop protection.	•Identified for release to fennel growing regions of India. •It is recommended to do DNA finger printing and get IC number for this variety. •The pedigree may be corrected.
Fenugreek	Chhattisgarh Kelo Methi	CARS, Raigarh	High yielding potential with av. seed yield of 1693 kg ha ⁻¹ , matures in 108	The proposed variety has been deferred for release.

			days (range: 101 to 113 days), exhibits non-lodging resistance, moderately resistant to powdery mildew, and has field tolerance to aphids	
Ginger	SAS-KEVÜ (Bold Nadia)	Nagaland	Bold variety with a high yield potential of 17.21 t ha ⁻¹ , moderate oil content of 1.4%, and low fiber content of 4.04%. It exhibits high dry recovery at 21.95%, soft texture, and bold rhizome size. Variety matures in 270-280 days, suitable for its uses as vegetable purpose.	Variety has been identified for release to North-Eastern states and Hilly areas of Andhra Pradesh.
Ginger	Indira Ginger 1	CARS, Raigarh	High-yielding variety with an av. fresh rhizome yield of 18.6 t ha ⁻¹ . Non-lodging, moderately resistant to rhizome rot, and possesses high essential oil (1.67%) and oleoresin (4.10%) content.	The proposed variety has been deferred for release.
Turmeric	IISR Surya (Acc 849)	ICAR-IISR	High yield (av. fresh yield 29 t ha ⁻¹ , potential yield 41 t ha ⁻¹) with 5.8 t ha ⁻¹ dry yield. Light yellow colour rhizome with curcumin content of 2-3%. Unique flavour with, significantly high minor volatile compounds zingiberene (21.07%), β -sesquiphellandrene (14.13%), 1,8-cineole (3.42%) and α humelene (6.30%). Best suitable for powdering industry.	Identified for release to Kerala, Telangana, Odisha, Jharkhand and Arunachal Pradesh.

TECHNICAL SESSION: VI

TRANSFER OF TECHNOLOGY

Chairman: Dr. Sudhakar Pandey, ADG (FVS & MP), ICAR, New Delhi
 Co-chairs: Dr. B. Augustine Jerard, Project Coordinator, AICRP (Palms)
 Dr. D. Prasath, Project Coordinator, ICAR-AICRP on Spices

Rapporteurs: Mr. Muhammed Nisar.V.A. ICAR-IISR, Kozhikode
 Dr. Tanuja Priya, Dr.YSRHU, Lam, Guntur

General recommendations

- New technologies should be actively demonstrated through Krishi Vigyan Kendras (KVKs) to ensure practical exposure and hands-on learning for farmers, enabling them to directly witness the benefits and applications.
- New spices technologies identified in the AGMs should be included in the Package of Practices (PoP) for the respective crops, which is published by respective agricultural universities. This ensures that the technologies are officially recognized and accessible to farmers as part of standardized agricultural guidance.
- Technologies should be presented with an appealing and clear title that reflects their value and importance.
- The title along with description should be made easy to remember and understand, making it more likely that farmers will adopt the technology.

Technology proposals

Five technologies were presented in the session. The summary of the technologies and the decisions there of are given below.

Technologies-wise decision taken by chairs were given below: -

S. No.	Crop	Technology	Technology Statement	Decisions
1	Large Cardamom	Leaf mould mulch application for sustainable productivity and soil health in large cardamom	Application of leaf mould mulch @ 10 t ha ⁻¹ enhances dry capsule yield by 41.5%, improves benefit-cost ratio by 56.5%, increases soil moisture content by ~38%, and boosts soil health indicators, including pH (13%), soil organic carbon (SOC, 11.1%), available macronutrients (~21.9%), soil microbial biomass carbon (SMBC, 29%), and acid phosphatase activity (Acid-P, 24.2%), providing a sustainable solution for large	This technology is recommended for large cardamom growing regions of NEH viz., Sikkim, Arunachal Pradesh, Nagaland, Meghalaya, and parts of Manipur and Mizoram.

			cardamom cultivation in the Indian Himalayan region.	
2	Small Cardamom	Management of leaf blight (<i>Colletotrichum gloeosporioides</i>) with foliar application of azole group of fungicides	Two rounds of foliar spray during pre-monsoon (June) and post-monsoon (September) using Hexaconazole (2 ml L ⁻¹) or Tebuconazole (1 ml L ⁻¹) significantly reduce leaf blight incidence by up to 35% above the recommended package of practices, enhance dry yield by up to 18% (339 g clump ⁻¹), and improve the benefit-cost ratio (2.35) under Karnataka and Kerala conditions. This integrated management practice ensures residue-free small cardamom production, sustainable crop protection, and improved farmer profitability with no phytotoxicity risks observed	This technology is recommended for cardamom growing regions of Karnataka, and Kerala
3	Small Cardamom	Management of Rhizome rot (<i>P. vexans</i> , <i>R. solanii</i> , <i>F. oxysporum</i>) with spraying and drenching of azole group of fungicides	Pre- and post-monsoon spraying and drenching of Tebuconazole (1 mL L ⁻¹) or Metalaxyl + Mancozeb (1.25 g L ⁻¹) significantly reduce rhizome rot incidence by up to 30%, enhance yield by 51% (up to 569 kg/ha), and improve the benefit-cost ratio (3.34) in Karnataka.	This technology is recommended for cardamom growing regions of Karnataka.
			Pre and post monsoon spraying and drenching fenamidone + mancozeb@2g L ⁻¹ has reduced the disease incidence in Kerala conditions for managing rhizome rot in region. The technology has shown an effective reduction in disease incidence (PDI=40.83%) and has resulted in increased yield (45.1%), particularly in Myladumpara (446.22 kg ha ⁻¹).	This technology is recommended for cardamom growing regions of Kerala
4	Ginger	Priming of seed rhizomes with Trichoprime @ 5% prior to	Priming of ginger seed rhizomes with Trichoprime @ 5% prior to storage enhances bud vigour, improves	The technology of priming ginger seed rhizomes with Trichoprime @ 5%

		storage to improve vigour of the buds, enhance sprouting and protect seed rhizomes from fungal pathogens during storage	sprouting, and protects rhizomes from fungal pathogens, resulting in a 7.52% yield increase compared to chemical treatments. This technology ensures uniform tiller emergence, protects the emerging crop from rhizome rot disease, and offers a benefit-cost ratio of 2.29, making it a promising solution for ginger cultivation	prior to storage is recommended for the states of Kerala, Meghalaya, Andhra Pradesh, Telangana, Jharkhand, Nagaland, Arunachal Pradesh, Odisha, West Bengal, and Chhattisgarh.
5	Turmeric	Priming of seed rhizomes with Trichoprime @ 5% prior to storage to improve vigour of the buds, enhance sprouting and protect seed rhizomes from fungal pathogens during storage	Technology of priming turmeric seed rhizomes with Trichoprime @ 5% prior to storage is recommended for improving the vigour of rhizome buds, enhancing sprouting, and protecting seed rhizomes from fungal pathogens during storage, resulting in a yield increase of 5.51% compared to chemical treatment, and ensuring uniform tiller emergence while preventing the growth of storage rot pathogens.	The technology of priming turmeric seed rhizomes with Trichoprime @ 5% prior to storage is recommended for the states of Kerala, Tamil Nadu, Telangana, Mizoram, Arunachal Pradesh, Odisha, West Bengal, Himachal Pradesh, and Uttar Pradesh.

Review of Flagship programmes (SCSP/ TSP/ NEH)

- The beneficiary records must be maintained properly for auditing
- Socio economic impact studies of the flagship programmes have to be undertaken

TECHNICAL SESSION: VII

PLENARY SESSION

Chair	Dr. Sudhakar Pandey, Asst. Director General (FVS&MP), ICAR, New Delhi
Co-Chairs	Dr. Vinay Bhardwaj, Director, ICAR-NRCSS Dr. R. Dinesh, Director, ICAR-IISR Dr. D. Prasath, Project Coordinator, ICAR - AICRP Spices
Rapporteurs	Dr. S. Aarthi, ICAR-IISR Dr. Mukesh Sankar S, ICAR-IISR

Day 3 of the annual group meet commenced with a plenary session chaired by Dr. Sudhakar Pandey, (ADG Horticulture, ICAR) with Dr. Vinay Bhardwaj, (Director, NRCSS, Ajmer), Dr. R. Dinesh, (Director, ICAR-IISR, Kerala) and Dr. D. Prasath, (Project coordinator, AICRPS) as co-chairs. Dr. S. Aarthi and Dr. Mukesh Sankar S served as rapporteurs.

During the sessions technical programme for 17 new AICRPS experiment were presented. Following this rapporteur report of Day 1 & Day 2 were presented by Dr. Akshitha (Inaugural session & PC report), Dr. Shivakumar (crop improvement), Dr. Shivaranjani (crop management), Dr. Anamika Debnath (Crop protection and food safety), Dr. V. Sivakumar (Varietal release), and Dr. Muhammed Nissar (Technology release), respectively. The session concluded with a vote of thanks delivered by Dr. S.K. Tehlan, followed by National Anthem.

General Suggestions

- Trait specific evaluation of regional genetic resources and development of pre-breeding materials
- Developing and evaluating high yielding, high quality industrial, climate resilient varieties suitable for various agro-ecological situations.
- Incorporation of modern plant breeding techniques likes MAS, genomic selection towards targeted breeding.
- Evaluation and dissemination agro-techniques, GAPs and machinery (production, protection and management and validation) for different agro-climatic conditions for production of quality and food safe spices.
- Transfer of technologies through FLDs and print and visual media in local languages.

TECHNICAL PROGRAMMES OF APPROVED PROJECTS

Genetic Resources & Crop Improvement

Project Code:	TUR/CI/2.1
Project Title	CVT on Turmeric Series 2025
Crop	Turmeric
Aim of Project	Evaluating high-yielding turmeric varieties that are characterized by long and bold rhizomes with high dry recovery rates (>20%) after boiling and drying.
Centres	Barapani, Coimbatore, Dapoli, Dholi, Guntur, Kammarpally, Kozhikode, Navsari, Pundibari, and Sirsi
Year of start	2025
No. of entries: 14	1. RCLBT-1 (Barapani) 2. NDH-126 (Kumarganj) 3. TCP 90 (Pundibari) 4. KPS 329 (Kammarpally) 5. Acc. 1545 (IISR) 6. Acc. 621 (IISR) 7. RH-411 (Dholi) 8. LTS-19-3 (Guntur) 9. LTS-19-4 (Guntur) 10. Konkan Halad-1 (Dapoli) 11. SK-4 (NIF, Gujarat) 12. IISR Prathiba (Check)* 13. Salem Local (Check)*
Design	Randomized Block Design (RBD)
No. of replications	Three
Plot size/spacing	3 x 1/25 x 25 cm
Observation to be 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 ha⁻¹ (t) 7. Dry rhizome yield ha⁻¹ (t) 8. Dry recovery (%) 9. Boldness of rhizome 10. Curcumin content (%) 11. Essential oil (%) 12. Disease (rhizome rot) & pest (shoot borer) incidence, if any
Weather data	Year wise all parameters

Project Code:	TUR/CI/1.2
Project Title	Evaluation of Turmeric Somaclones and Seedling Progenies for Superior Agronomic Traits & Regional Adaptation
Crop	Turmeric
Centres	Guntur and Coimbatore
Year of start	2024
No. of entries & checks: 61+2	Please refer appendix
No of Plots	75
Design	Augmented Replicated Block Design (ARBD)
No. of replications	one
Plot size/spacing	Plot size: 1 x 1m ² ; spacing of 30 x 30 cm
Observation to be recorded	
Morphological Observations	Plant height (cm) Leaf length (cm) Leaf Width (cm) No. of leaves per clump Number of tillers per clump Days to maturity Rhizome core color (Colour value as per RHS)
Yield & Yield related Parameters	Fresh weight of clump (g) Fresh rhizome yield /ha (t) Dry rhizome yield /ha (t) Dry recovery (%)
Quality Parameters	Curcumin content (%) Oleoresin (%) Essential Oil (%)
Drought Related Indices	If any
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)
Weather data	Year wise all parameters
Soil parameters	Soil pH EC Organic carbon Major nutrients

List of test entries

S.No	Genotype	S.No	Genotype	S.No	Genotype
1	SC-3	22	SC-54	43	138/23/18
2	SC-7	23	SC-56	44	138/23/19
3	SC-8	24	SC-57	45	138/23/24
4	SC-10	25	SC-58	46	138/23/25
5	SC-13	26	SC-59	47	138/23/26
6	SC-18	27	SC-63	48	138/74/3
7	SC-19	28	SC-64	49	138/74/8
8	SC-20	29	SC-65	50	138/74/9
9	SC-22	30	SC-68	51	138/74/10
10	SC-31	31	SC-70	52	138/74/18
11	SC-35	32	SC-71	53	138/74/19
12	SC-36	33	SC-77	54	138/74/20
13	SC-37	34	SC-79	55	138/74/21
14	SC-40	35	69/10/2	56	138/74/23
15	SC-42	36	69/10/3	57	138/74/29
16	SC-44	37	138/23/1	58	138/74/30
17	SC-45	38	138/23/2	59	138/74/34
18	SC-46	39	138/23/3	60	138/76/2
19	SC-50	40	138/23/7	61	415/7/1
20	SC-52	41	138/23/15	62	IISR Pragati (NC)
21	SC-53	42	138/23/16	63	IISR Prathibha (NC)

Advice on Experimental Layout, Number of Test Entries, and Use of Local Checks in Replicated Fashion

1. Experimental Layout:

Design: Use an Augmented Randomized Complete Block Design (Augmented RCBD) or plant as per the design provided along with.

Blocks: Divide the genotypes into a suitable number of blocks. Since you have 63 test entries, dividing them into 5 blocks with 15 plots each (including local checks) can be efficient.

Plot Size: Plot size: 1 x 1m²; spacing of 30 x 30 cm.

2. Number of Test Entries:

Total Entries: 63 test genotypes including two national checks- IISR Pragathi & IISR Prathiba.

3. Use of Local Checks:

Check Varieties: Include local checks in each block to identify top-performing entries over local cultivars/region-specific/drought/disease resistance screens

Distribution: Ensure that each block contains a mixture of test entries and two local check varieties for comparison.

Project Code:	CAR/CI/2.1
Project Title	CVT on Small Cardamom 2024 Series XII
Crop	Cardamom
Centres	Appangala, Mudigere, Pampadumpara, Myladumpara
Year of start	2025-26
No. of entries: 8	1. IC547196 (IISR) 2. IC349340 (IISR) 3. IC349627 (IISR) 4. IC584095 (IISR) 5. IC653022 (IISR) 6. HY 6 (CRS, KAU) 7. ICRI 10 (ICRI, Myladumpara) 7. Njallini green gold (National Check) 8. IISR Manushree (Check)
Design	Randomized Block Design (RBD)
No. of replications	Three
Plot size/spacing	Spacing: 2x2 cm
Observations	
Morphological data	1. Plant height (cm), 2. No. of tillers per plant, 3. No. of bearing tillers, 4. No. of leaves per plant, 5. Leaf length (cm), 6. Leaf breadth (cm)
Yield & yield related parameters	1. No. of panicles per plants, 2. No. of capsules per panicles, 3. No. of cinncini per panicle, 4. No. of seeds per capsule, 5. Fresh yield per plant (kg), 6. Dry yield per plant (kg), 7. Capsule length (mm), 8. Capsule breadth (mm)
Quality parameters	Essential oil (%), oleoresin (%)
Pest & Disease Incidence	As per the SOP published - screening protocol given by AICRPS (http://14.139.189.27/AICRPS/OP/SC.pdf)

Project Code:	COR/CI/2.1
Project Title	CVT on Coriander Series 2024
Crop	Coriander
Aim of Project	The focus of this trial will be on evaluating high-yielding coriander varieties with high seed yield.
Centres (15)	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Navsari, Pantnagar, Kota, Raigarh, Kalyani, Sanand
Year of start	2024-25
No. of entries: (18)	1. JCr 21-07 (Jagudan) 2. JCr 21-02 (Jagudan) 3. RD-434 (Dholi) 4. 5. NDCor-9 (Kumarganj) 5. 7. 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	Randomized Block Design (RBD)
No. of replications	Three
Plot size/spacing	4×2.4m, spacing 30x 10 cm
Observation to be recorded	
Observations	1. Germination % (20 days after sowing) 2. Days to 50% flowering 3. Plant height (cm) 4. Branches per plant 5. 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 per plot (g) 11. Seed yield (kg/ha) 12. Essential oil content (%) 13. Incidence of pests (mites, aphids) 14. Incidence of diseases (wilt, powdery mildew, stem gall, blight)
Weather data	Year wise all parameters
Project Code:	COR/CI/2.2

Project Title	CVT on Leafy Coriander Series 2024	
Crop	Coriander	
Aim of Project	The focus of this trial will be on evaluating high-yielding coriander varieties with high leaf biomass	
Centres (10)	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jobner, Kumarganj, Navsari, Pantnagar, Sanand	
Season	Summer & Rabi	
Year of start	2024-25	
No. of entries: (16)	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	Randomized Block Design (RBD)	
No. of replications	Three	
Plot size/spacing	4 x 2.4 m/30 x 10 cm	
Date of sowing	Rabi :15 Oct - 15 Nov & Summer: 15 March - 15 April	
Stages of observation	Stage-I: 40 Days after sowing Stage-II: 55 Days after sowing (15 days after 1 st observation)	
Observation to be recorded		
Observations	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 Temperature (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)
Weather data	Year wise all parameters

Project Code:	CUM/CI/2.1
Project Title	CVT on Cumin Series 2024
Crop	Cumin
Aim of Project	The focus of this trial will be on evaluating high-yielding Cumin varieties with high seed yield
Centers (5)	Ajmer, Jagudan, Jobner, Mandore, Sanand
Year of start	2024-25
No. of entries: 12	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	Randomized Block Design (RBD)
No. of replications	Three
Plot size/spacing	3 x 2.4 m spacing : 30x5 cm
Observation to be recorded	
Observations	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 plot (g) 12. Seed yield (kg/ha) 13. Incidence of pests & diseases (Blight, wilt, powdery mildew, Cumin aphid, thrips stem gall, blight) as PDI 14. Essential oil %
Weather data	Year wise all parameters
Soil Parameters	Soil types, Available NPK levels, Organic content etc

Project Code:	FNL/CI/2.1
Project Title	CVT on Fennel 2024 Series XII
Crop	Fennel
Aim of Project	The focus of this trial will be on evaluating high-yielding fennel varieties with high seed yield
Centres (9)	Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Pantnagar, Navsari
Year of start	2024-25
No. of entries: 14	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
Observation to be recorded	
Observations	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 plot (g) 12. Seed yield (kg/ha) 13. Incidence of pests & diseases (leaf blight, wilt, powdery mildew, stem gall, bacterial soft rot) 14. Essential oil %
Weather data	Year wise all parameters
Soil Parameters	Soil types, Available NPK levels, Organic content etc

Project Code:	FGK/CI/2.1	
Project Title	CVT on Fenugreek 2024 Series XII	
Crop	Fenugreek	
Aim of Project	The focus of this trial will be on evaluating high-yielding fenugreek varieties with high seed yield	
Centres (11)	Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Navsari, Pantnagar, Kota, Raigarh,	
Year of start	2024-25	
No. of entries: 16	1. AFg-8 (NRCSS) 2. AFg-9 (NRCSS) 3. HF-370 (Hisar) 4. HF-464 (Hisar) 5. KFG 24-1 (Kota) 6. 7. 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. Sanand (SFg 5) 14. Sanand (SFg 7) 15. RMt-354 (National Check) 16. AFg-5 (National Check)
Design	Randomized Block Design (RBD)	
No. of replications	Three	
Plot size/spacing	4 x 2.4 m spacing: 30x10 cm	
Observation to be recorded		
Observations	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 the plot when showing senescence) 7. No. of pods per plant 8. Pod length (cm) 9. Seeds per pod 10. Test weight (g) 11. Seed yield per plot (g) 12. Seed yield (kg/ha) 13. Incidence of pests & diseases (aphids, leaf-eating caterpillar, pod borer, Downy mildew, damping off, rust, root rot, leaf spot etc.) 14. Essential oil %	
Weather data	Year wise all parameters	
Soil Parameters	Soil types, Available NPK levels, Organic content etc	

Project Code:	NGL/CI/2.1
Project Title	CVT on Nigella – Series II 2024
Entries	09
Crop	Nigella
Centres (6)	Ajmer, Hisar, Kumarganj, Pantnagar, Raigarh, Kota
Year of Start	Rabi 2024-25
Duration of the project	Three years (Rabi 2024-25 to Rabi 2026-27)
No. of the entries (9)	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	Randomized Block Design (RBD)
No. of replication	03
Plot size/ Spacing	4.00 x 2.5 m ² / Spacing 30 x 10 cm
Date of sowing/ planting season	Nov (rabi)
Methodology and procedure to be adopted	As per recommended package of practices Fertilizer: 40+20+20 NPK Kg/ha
Observation to be recorded	1. Plant stands at 50% flowering per plot 2. Plant height (cm) 3. Primary branches per plant 4. Secondary branches per plant 5. Capsules per plant 6. Seeds per capsule 7. Days to 75 % maturity 8. Test weight (g) 9. Seed Yield (Kg/ha) 10. Disease and pest incidence, if any 11. Quality (Total oil %)\$ 12. Thymoquinone (%)\$

\$ Sufficient harvested OP seed samples may be sent to Dr. S.S Meena for conducting the concern analysis to NRCSS.

Crop Management

Project Code:	PEP/CM/3.4
Project Title:	Effect of Arbuscular Mycorrhizal (<i>Rhizophagus irregularis</i>) fungi on growth and yield of black pepper
Crop	Black pepper
Centers	Kahikuchi, Kozhikode, Panniyur, Dapoli, Sirsi, Yercaud
Year of start	2024
No. of treatments	T₁:100% NPK (Recommended Dose in POP) T₂:75% NPK (Recommended Dose in POP) T₃:30g AM+T₂ T₄:30g AM T₅: Absolute Control *Existing Plantation to be chosen with the age of 10-15 yrs. *Farm yard manure (FYM), foliar micronutrient application, irrigation, and mulching will be applied for all treatments according to the Package of Practices (POP) Time of application of Arbuscular Mycorrhizae • May/June and August/September (For the first year) • May/June (IInd year onwards)
Design	RBD
No. of replications	10 replications/standards (2 vines per standard) Total no. of standards: 50
Plot size/spacing	3 x 3m
Observation to be recorded	
A. Morphological Observations	✓ Number of leaves/50 cm ² ✓ Number of laterals/50 cm ²
B. Yield & Yield related Parameters	✓ Spike intensity (0.5m ²) ✓ Spike length (cm) ✓ Fresh berry yield (kg/ vine) ✓ Dry berry yield (kg/ vine) ✓ Dry Recovery (%)
C. Quality Parameters	Oleoresin (%) Essential oil (%)
D. Trial-Specific Indices, if any	Analysis of soil population density of arbuscular mycorrhizal fungi (once in year at harvest)
E. Disease and Pest Incidence	Regular monitoring and periodical observation on incidence of disease (once in 6 months)
F. Weather data	-
G. Soil parameters	Soil nutrient status (before imposing treatment and at harvest)
General recommendation	✓ Arbuscular Mycorrhizal fungi should be applied one week after fertilizer application ✓ Maintain adequate soil moisture for mycorrhizal establishment. ✓ Avoid applying fungicides immediately after introducing mycorrhizae (up to two weeks), as they can disrupt the establishment of the mycorrhizal fungi.

Project Code:	LCA/CM/2.1	
Project title:	Assessment of effect of Polysulphate (Dehydrite Poly Halite) on Yield and Quality Parameters of Large Cardamom (<i>Amomum subulatum</i> Roxb.)	
Crop	Large Cardamom	
Centers	ICRI Gangtok and ICAR, Gangtok	
Year of start	<i>Kharif, 2025</i>	
No. of treatments: 4	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	
Design	RBD	
No. of replications	5	
Plot size/spacing	1.5.x1.5 m	
Observations to be recorded		
Morphological Observations	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
Yield & Yield related Parameters	1. Number of capsule/spike 2. Number of seed/capsule 3. Fresh yield/ plant (g) and per hectare (kg)	4. Dry yield/plant (g) and per hectare (kg) 5. Diseases and insect pests (if any)
Quality Parameters	Quality aspects such as color and grade of the capsules, oil content etc.	
Trial-Specific Indices, if any	Changes in soil parameters, Plant biometrics in comparison to the control	
Disease and Pest Incidence	Blight, Dry rot, Leaf streak and rust diseases, Leaf caterpillar, Shoot fly, Stem borer, capsule borer	
Weather data	Rainfall and temperature	
Soil parameters	Physico chemical properties of the soil	

Project Code	:	CUM/CM/2.1
Project Title	:	Standardization of plant density and sowing time for cumin genotype CZC 94
Crop	:	Cumin
Objectives	:	As suggested by Varietal Identification Committee meeting held on 16.10.2024 during XXXV Annual Group Meet of AICRP on spices at HAU, Hisar
Centers	:	Ajmer, Mandore, Jagudan, Jobner, and Sanand,
Year of start	:	2024-25
Duration of the project	:	One Year*
Details of technical programme		
Design	:	Split Plot Design
Main Treatment (A)	:	Sowing dates (15 November and 5 December)
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
No. of Replication	:	6
Plot size	:	3.6 m x 3.0 m
Observation to be 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)

Note: Dr Kakani, CAZRI, Jodhpur is responsible to supply the required seeds of CZC 94 and GC 4 to all the five participating centers, on time. The same trial may also to be laid out at CAZRI.

Discipline Code	:	Crop/Genetic
Project Title	:	COP/GM/T13
Project Title	:	Crop specific micronutrient formulation for cumin
Variety	:	Cumin
Variety	:	Coriander
Variety	:	Amber Masala Variety (Amber, Jobner and Sanand)
Center of start	:	2024-25 Coimbatore, Guntur, Hisar, Jagudan, and Jobner
Year of start	:	2024-25
Duration of the project	:	Three Year (2024-25 to 2026-27)
Details of technical programme		
Design	:	RBD
Plot Size	:	5m x 3.0m (Gross) & 4m x 2.5m (Net)
Spacing	:	30cm x 15 cm
No. of Replication	:	5
Treatments	:	T1 : Control (Recommended NPK without Micronutrients) T2 : 100% recommended dose of Micronutrient Fertilizers through soil applications (Fe@10Kg/ha+Mn@10kg/ha, Cu@5kg/ha, Zn@5kg, & B@5kg/ha)* T3 : Two foliar sprays of micronutrient formulation @ 1% at 60 & 90 DAS T4 : 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
Observation to be 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. Economics analysis (Cost of cultivation, Gross return, Net return and B :C Ratio)

Duration of the project	:	Three Year (2024-25 to 2026-27)
Details of technical programme		
Design	:	RBD
Plot Size	:	5m x 3.0m (Gross) & 4m x 2.5m (Net)
Spacing	:	25cm x 10 cm
No. of Replication	:	5
Treatments	:	T1 : Control (Recommended NPK without Micronutrients) T2 : 100% recommended dose of Micronutrient Fertilizers through soil applications (Fe@10Kg/ha+Mn@10kg/ha, Cu@5kg/ha, Zn@5kg, & B@5kg/ha)* T3 : Two foliar sprays of micronutrient formulation @ 1% at 60 & 90 DAS T4 : 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
Observation to be 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)
Note: All the micronutrient formulations as well as micronutrient fertilizers for soil application will be provided by ICAR-NRCSS, Ajmer (Dr. Chetan Jangir, Scientist, NRCSS). The concerned centers are required to send the samples for analysis listed under Sr. No. 5, 6, 7 and 8 to ICAR-NRCSS (Dr. Chetan Jangir, Scientist, NRCSS) for analysis. For further query please contact, Dr. Chetan Jangir (Email ID: chetanjangir710@gmail.com & Phone: 9352898344)		

Crop Protection and Food Safety

Project Code:	CAR/CP/2.1
Project Title	Efficacy of combined application of <i>Heterorhabditis indica</i> (EPN) and <i>Paecilomyces lilacinus</i> (EPF) against root grubs (<i>Basilepta fulvicorne</i>) and <i>Meloidogyne</i> sp. nematodes in small cardamom
Crop	Small cardamom
Objective	To evaluate <i>H. indica</i> (EPN) and <i>P. lilacinus</i> (EPF) for their combined action against root grubs and root knot nematodes in small cardamom
Centre(s)	Appangala, Myladumpara, and Pampadumapara
Year of start	Kharif, 2025
Duration	Two seasons
Experiment details	Treatments T₁ <i>H. indica</i> (EPN) cadaver (1,00,000 ijs) + <i>P. lilacinus</i> (EPF) talc (25 g) / plant T₂ <i>H. indica</i> (EPN) cadaver (1,25,000 ijs) + <i>P. lilacinus</i> (EPF) talc (50 g) / plant T₃ <i>H. indica</i> (EPN) cadaver (1,50,000 ijs) + <i>P. lilacinus</i> (EPF) talc (75 g) / plant T₄ Recommended nematicide (Cartap hydrochloride) T₅ Control Two applications per year (June and September) No of replications 4 No of plants/replication 12 Design RBD (existing plants of affected plot)
Observations to be recorded	1. Root grub symptoms (yellowing of leaves) 2. Incidence of root grubs (number per 15 cm³) 3. Nematode symptoms (shortened internodes, narrow leaves, root knots, root lesions) 4. Population of plant parasitic nematodes/EPN in the soil 5. Yield (dry kg/ha) and BC ratio

*ICRI, Myladumpara centre should supply the necessary formulation along with chemical as control to all participating centre and need to track all the technical progress and provide support.

Project Code:	GIN/CP/4.1
Project Title:	Evaluation of consortia (<i>B. safensis</i> , <i>B. amyloliquefaciens</i> , <i>Raoultella terrigena</i> , & <i>Acinetobacter</i> sp.) for growth promotion and rhizome rot suppression in ginger
Crop	Ginger
Centers	Kozhikode, Solan, Pundibari, Raigarh
Year of Start	2024-25
Duration	3 years
No. of treatments & Plan of work	Treatments: 5 T₁- Application of Consortia plus recommended fertilizers (without fungicide) T₂- Application of Consortia plus recommended (N P K, Zn) fertilizers (with fungicide) T₃- Application of Consortia alone (without fertilizers & fungicide) T₄-Normal Package (with fertilizers & fungicide) T₅- Absolute control (without fertilizers & fungicide) Fertilizers recommended (N P K, Zn) CIBRC registered fungicide: Metalaxyl-M3.3% + Chlorothalonil 33.1% SC) (1ml /L) Crop variety: Popular improved variety of respective centre/area. • Experimental design: RBD • Treatments : 5 • Replications: 4 • Bed size: 3 x1m • Spacing: 15x30 cm • Total no. of beds: 24
Methodology to be adopted	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
Observations to be 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

Project Code:	TUR/CP/4.1
Project Title:	Evaluation of consortia (<i>B. safensis</i> , <i>B. amyloliquefaciens</i> , <i>Raoultella terrigena</i> , & <i>Acinetobacter</i> sp.) for growth promotion and rhizome rot suppression in Turmeric
Crop	Turmeric
Centers	Kozhikode, Guntur, Coimbatore, Kammarpally
Year of Start	2024-25
Duration	3 years
No. of treatments & Plan of work	Treatments: 5 T₁- Application of Consortia plus recommended fertilizers (without fungicide) T₂- Application of Consortia plus recommended (N P K, Zn) fertilizers (with fungicide) T₃- Application of Consortia alone (without fertilizers & fungicide) T₄-Normal Package (with fertilizers & fungicide) T₅- Absolute control (without fertilizers & fungicide) Fertilizers recommended (N P K, Zn) CIBRC registered fungicide:- Azoxystrobin 18.2% + Difenconazole 11.4% w/w SC (1ml /L) Crop variety: Popular improved variety of respective centre/area. • Experimental design: RBD • Treatments: 5 • Replications: 4 • Bed size: 3 x1m • Spacing: 15x30 cm • Total no. of beds: 24
Methodology to be adopted	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
Observations to be 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

Project Code	:	CUM/CP/7.1
Project Title	:	Assessment of cumin blight (<i>Alternaria burnsii</i>) disease for weather-based prediction model
Crop	:	Cumin
Objectives	:	Under the weather parameter associated with targeted disease and pathogen: Cumin blight disease (<i>Alternaria burnsii</i>)
Centers	:	Ajmer, Mandor, Jagudan, Jobner, and Sanand
Year of start	:	Rabi 2024 to Rabi 2026
Duration of the project	:	Three Years
Details of technical programme		
Design	:	Randomized Block Design
Variety	:	GC-4
No. of Replication	:	3
Plot size & Row No.	:	3m × 2m; 8 rows of 3m length each per plot
Spacing	:	25 × 10 cm ²
Treatments 4		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
Total land area needed		Total land area needed for four dates of sowing: 72 m ²
Package and practices:		Standard crop package and practices may be followed except for foliar spray of fungicide
Observation to be recorded	:	8. Percent disease severity 9. Weather data recording

Details of Observations to be recorded

1. Percent disease severity

- Date of first appearance of the disease symptoms in each experiment to be recorded and further severity progress needs to be recorded at weekly interval
- Disease severity will be recorded on ten randomly selected plants per replication
- Percent disease severity will be recorded as per the standard severity assessment scale (As per attached)

2. Weather data recording

- Daily values of weather parameters from meteorological observatory
- Temperature (maximum and minimum in °C)
- Relative humidity (minimum and maximum in %)
- Wind speeds (minimum and maximum in m/s)

- Sunshine duration (in hours)
- Rainfall (in mm)
- Leaf wetness due to due or rainfall or irrigation (Presence or absence as per visual observation)

Disease Screening Methodology

- The disease assessment is to be done from initiation of the disease till the maturity of the crop.
- Observations on disease reaction should be recorded on five randomly selected plants in each plot.

According to the criteria proposed by Chester (1959) and Wheeler (1969), the severity of the condition was rated on a scale from 0 to 5. Disease severity was documented using the following visual rating system:

Disease rating scale/grade	Per cent leaf area affected
0	No disease symptom
1	A few spots towards tip covering 10 per cent leaf area
2	Several dark brown patches covering upto 20 per cent leaf area
3	Several patches with paler outer zone covering upto 40 per cent leaf area
4	Leaf blight covering upto 75 per cent leaf area or breaking of the leaves from center
5	Complete drying of the leaves or breaking of the leaves from center

Level of resistance/susceptibility of the entries to the disease is determined by Percentage Disease Index (PDI) following the formula of McKinney (1923).

$$\text{PDI} = \frac{\text{Sum of all individual disease rating}}{\text{Total number of plants assessed} \times \text{Maximum possible rating}} \times 100$$

On the basis of the Per cent Disease Index (PDI), the entries can be grouped into the following categories

Classification of the entries based on Per cent Disease Index (PDI) where

Per cent Disease Index (PDI) in %	Disease reaction
0	Highly resistant (HR)
0-10	Resistant (R)
10.1-20	Moderately resistant (MR)
20.1-40	Moderately susceptible (MS)
40.1-75	Susceptible (S)
75.1-100	Highly susceptible (HS)

LIST OF PARTICIPANTS

List of Participants – XXXV Annual Group Meeting of AICRP on Spices	
Indian Council of Agricultural Research, Pusa, KAB-II, New Delhi-110 012	
1.	Dr. Sanjay Kumar Singh, Deputy Director General (Horticultural Science)
2.	Dr. Sudhakar Pandey, Asst. Director General (FVS & MP) ICAR, New Delhi
List of experts	
Session: Genetic resources and crop improvement	
3.	Dr. V. A. Parthasarathy, Former Director, ICAR-IISR, and Chairman, RAC, ICAR-NRCSS, Ajmer
4.	Dr. K. Nirmal Babu, Former Director, ICAR-IISR & former PC, AICRPS, Kozhikode, Kerala
5.	Dr. E.V.D. Sastry, Head, Jaipur National University, Rajasthan
6.	Dr. B. Augustine Jerard, Project Coordinator, AICRP (Palms)
Session: Crop management	
7.	Dr. Homey Cheriyan, Director, Directorate of Arecanut and Spices (DASD), Kozhikode, Kerala
8.	Dr. Prakash Patil, Project Coordinator, AICRP (Fruits)
Session: Crop Protection	
9.	Dr. NK Krishnakumar, formerly DDG (Hort. Science), ICAR, New Delhi
Session: Transfer of technology	
10.	Dr. KP Singh, formerly Principal Scientist, ICAR-IIVR
11.	Dr. Vikramaditya Pandey, Principal Scientist, ICAR, New Delhi
CCSHAU	
12.	Dr. B.R. Kamboj, VC, CCSHAU
13.	Dr. Rajbir Garg, Director of Research, CCSHAU
Project Coordinators Unit, AICRP on Spices	
14.	Dr. D. Prasath, Project Coordinator, AICRP on Spices
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16.	Mr. R. Bharathan, Senior Technical Officer
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20.	Dr. V. Srinivasan, Head & Principal Scientist, Division of Crop Production & PHT
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22.	Dr. C.K. Thankamani, Principal Scientist, Division of Crop Production & PHT
23.	Dr. C.M. Senthil Kumar, Principal Scientist (Entomology)
24.	Dr. R. Praveena, Senior Scientist (Plant Pathology)
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26.	Dr. Aarthi S., Scientist, Division of Crop Improvement
27.	Dr. Muhammed Faisal Peeran, Scientist (Plant Pathology)
28.	Dr. Maneesha, Scientist, Division of Crop Improvement
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35.	Dr. Shyam Sunder Meena, Principal Scientist
36.	Dr. R. S Meena, Principal Scientist (Plant Breeding)
37.	Dr. S. S. Meena, Principal Scientist (Horticulture)
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102.	Dr. Basheer Ahammed Elahi, Associate Professor & Incharge

Research Programmes at a glance (Crop-wise)

Crop Name	GENETIC RESOURCES & CROP IMPROVEMENT		CROP MANAGEMENT		CROP PROTECTION		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	No project	0	PEP/CP/5.10, PEP/CP/7.1, PEP/CP/7.2	3	5
Cardamom	CAR/CI/1.1, CAR/CI/3.9, CAR/CI/4.4, CAR/CI/4.5	4	CAR/CM/5.5, CAR/CM/5.6	2	CAR/CP/6.11, CAR/CP/6.12, CAR/CP/6.13	3	9
Large Cardamom	LCA/CI/1.1, LCA/CI/2.1	2	LCA/CM/5.1	1	No project	0	3
Ginger	GIN/CI/1.1, GIN/CI/2.5, GIN/CI/2.6, GIN/CI/2.7, GIN/CI/4.3	5	GIN/CM/4.1, GIN/CM/5.1, GIN/CM/5.2	3	GIN/CP/6.15, GIN/CP/7.1, GIN/CP/7.2, GIN/CP/7.3	4	9
Turmeric	TUR/CI/1.1, TUR/CI/2.8, TUR/CI/2.9, TUR/CI/2.11	4	TUR/CM/5.1, TUR/CM/5.2	2	TUR/CP/7.1, TUR/CP/7.2, TUR/CP/7.8, TUR/CP/7.9, TUR/CP/7.10	5	11
Tree Spices	TSP/CI/1.1, TSP/CI/1.2, TSP/CI/2.4, TSP/CI/2.5, Project Mode	5	TSP/CM/5.1	1	No project	0	6
Coriander	COR/CI/1.1, COR/CI/2.8, COR/CI/4.1	3	COR/CM/5.1, COR/CM/6.1	2	No project	0	5
Cumin	CUM/CI/1.1, CUM/CI/2.5	2	No project	0	CUM/CP/7.1	1	3
Fennel	FNL/CI/1.1, FNL/CI/2.8	2	FNL/CM/5.1	1	No project	0	3
Fenugreek	FGK/CI/1.1, FGK/CI/2.5, FGK/CI/3.7	3	FGK/CM/5.1, FGK/CM/6.1	2	FGK/CP/7.1	1	6
Ajwain	AJN/CI/2.1	1	No project	0	No project	0	1
Nigella	No project	0	No project	0	NGL/CP/7.1	1	1
Saffron	Project mode	1	No project	0	No project	0	1
Kalazeera	Project mode	1	No project	0	No project	0	1
Seed Spices	No project	0	No project	0	SS/CP/7.1	1	1

Research Programmes at a glance (Centre-wise)

Centre Name	Research Institute Involved	Scientist Involved	Total Programs	List of Programs
ICAR-National Institutes on Spices				
Kozhikode	ICAR-Indian Institute of Spices Research, Kozhikode, Kerala	Dr. S. Arathy Dr. C.K. Thankamani Dr. V. Srinivasan Dr. Praveena R Dr. Sentil Kumar	17	PEP/CI/3.7, GIN/CI/2.5, GIN/CI/2.6, GIN/CI/2.7, GIN/CI/4.3, TUR/CI/2.8, TUR/CI/2.9, TUR/CI/2.11, PEP/CP/7.2, TUR/CM/5.1, TSP/CM/5.1, TUR/CP/7.1, TUR/CP/7.2, TUR/CP/7.10, GIN/CP/7.2, GIN/CP/7.3, TSP/CI/2.5
Appangala	ICAR-Indian Institute of Spices Research, RS, Appangala, Karnataka	Dr. Ankegowda Dr. Shivakumar M.S. Dr. Akshitha HJ Dr. Honnappa Asangi Dr. M. Faisal Peeran Dr. Balaji	16	CAR/CI/3.9, CAR/CI/4.4, CAR/CI/4.5, GIN/CI/2.6, GIN/CI/2.7, CAR/CM/5.5, CAR/CM/5.6, PEP/CP/5.8, PEP/CP/5.10, PEP/CP/7.1, PEP/CP/7.2, CAR/CP/6.11, CAR/CP/6.12, CAR/CP/6.13, GIN/CP/7.3, TUR/CP/7.1
Ajmer	NRC on Spices, Ajmer, Rajasthan	Dr. R.S. Meena Dr. S.S. Meena Dr. Ravinder Singh Dr. Y.S. Sharma Dr. Krishnakant	10	COR/CI/2.8, CUM/CI/2.5, FNL/CI/2.8, FGK/CI/2.5, FGK/CI/3.7, AJN/CI/2.1, NGL/CI/2.2, COR/CM/5.1, FGK/CM/6.1, SS/CP/7.1
Regular Centres				
Pampadumpara	Cardamom Research Station, KAU, Pampadumpara, Kerala	Dr. Muthuswamy Murugan Dr. Nimisha Mathews	9	CAR/CI/1.1, CAR/CI/3.9, CAR/CI/4.4, CAR/CI/4.5, CAR/CM/5.5, CAR/CM/5.6, CAR/CP/6.11, CAR/CP/6.12, CAR/CP/6.13
Panniyur	Pepper Research Station, Panniyur KAU, Kerala	Dr. Vikram H C Dr. Sanju Balan	6	PEP/CI/1.1, PEP/CI/3.7, PEP/CP/5.8, PEP/CP/5.10, PEP/CP/7.1, PEP/CP/7.2
Mudigere	Zonal Agricultural & Horticultural Research Station, Mudigere, Karnataka	Dr. Ullasa M YA	11	CAR/CI/1.1, CAR/CI/3.9, CAR/CI/4.4, CAR/CI/4.5, CAR/CM/5.5, CAR/CM/5.6, CAR/CP/6.11, CAR/CP/6.12, GIN/CP/7.1, GIN/CP/7.3, TUR/CP/7.9
Sirsi	Horticultural Research Station, SIRSI, Karnataka	Dr. Kirankumar K C Dr. Sudheesh Kulkarni	6	PEP/CI/1.1, PEP/CI/3.7, GIN/CM/4.1, PEP/CP/5.10, GIN/CP/7.1, TUR/CP/7.9

Coimbatore	TNAU, Coimbatore, Tamil Nadu	Dr. M. Mohanalakshmi	18	TUR/CI/1.1, TUR/CI/2.9, TUR/CI/2.11, COR/CI/1.1, COR/CI/2.8, FGK/CI/3.7, TUR/CM/5.1, TUR/CM/5.2, FGK/CM/5.9, TSP/CM/5.1, COR/CM/5.1, COR/CM/6.1, TUR/CP/7.1, TUR/CP/7.2, TUR/CP/7.8, TUR/CP/7.10, FGK/CP/7.1, SS/CP/7.1
		Dr. S.Sundravadana		
Yercaud	Horticultural Research Station, (TNAU), Yercaud, Tamil Nadu	Dr. G. Malathi	4	PEP/CI/1.1, PEP/CI/3.7, PEP/CI/3.7, PEP/CP/5.8
Kammarpalli	Turmeric Research Station, SKLTSHU, Kammarpalli, Telangana.	Dr. B. Mahender	13	TUR/CI/1.1, TUR/CI/2.8, TUR/CI/2.9, GIN/CM/5.1, GIN/CM/5.2, TUR/CM/5.1, TUR/CM/5.2, GIN/CP/6.15, TUR/CP/7.1, TUR/CP/7.2, TUR/CP/7.8, TUR/CP/7.9, SS/CP/7.1
		Dr. P. Srinivas		
Chintapalli	Horticultural Research Station, Dr.Y.S.R. Horticultural University, Chintapalli, AP	Chetti Bindhu	12	GIN/CI/2.5, PEP/CI/3.7, GIN/CI/2.5, GIN/CI/4.3, GIN/CM/4.1, GIN/CM/5.1, GIN/CM/5.2, TUR/CM/5.1, TUR/CM/5.2, GIN/CP/6.15, GIN/CP/7.2, TUR/CP/7.8
Guntur	Horticultural Research Station, Dr. Y.S.R. Horticultural University, Guntur, AP	Dr. B. Tanuja Priya	16	TUR/CI/1.1, TUR/CI/2.8, TUR/CI/2.9, COR/CI/1.1, COR/CI/2.8, FGK/CI/1.1, FGK/CI/3.7, AJN/CI/2.1, COR/CM/5.1, COR/CM/6.1, FGK/CM/5.1, TUR/CP/7.1, TUR/CP/7.2, TUR/CP/7.9, TUR/CP/7.10, SS/CP/7.1
		Dr. Ramiredy Nagalakshmi		
Solan	Dept.of Vegetable Science, College of Horticulture (Dr YS Parmar Univ. of Horticulture & Forestry),SOLAN, HP	Dr. Meenu Gupta	6	GIN/CI/1.1, TUR/CI/1.1, GIN/CM/4.1, TUR/CM/5.1, GIN/CP/6.15, TUR/CP/7.8
Pottangi	High Altitude Research Station, (Orissa Univ. of Agri. & Technology), POTTANGI, Odisha	Dr. Parshuram Sial	18	GIN/CI/1.1, GIN/CI/2.5, GIN/CI/2.6, GIN/CI/2.7, GIN/CI/4.3, TUR/CI/1.1, TUR/CI/2.8, TUR/CI/2.9, GIN/CM/4.1, GIN/CM/5.1, GIN/CM/5.2, TUR/CM/5.1, TUR/CM/5.2, GIN/CP/6.15, GIN/CP/7.1, GIN/CP/7.2, TUR/CP/7.8, TUR/CP/7.9
Jobner	SKN College of Agriculture, (Sri Karan Narendra Agriculture University) JOBNER, Rajasthan	Dr. Shailesh Marker	17	COR/CI/1.1, COR/CI/2.8, COR/CI/4.1, CUM/CI/1.1, CUM/CI/2.5, FNL/CI/1.1, FNL/CI/2.8, FGK/CI/1.1, FGK/CI/2.5, FGK/CI/3.7, AJN/CI/2.1, COR/CM/6.1, FGK/CM/6.1, SS/CM/4.1, CUM/CP/7.1, FGK/CP/7.1, SS/CP/7.1
		Dr. A. C. Shivran		
		Sh. G L Kumawat,		
Jagudan	Centre for Research on Seed Spices (CRSS) , Sardarkrushinagar	Dr. N.R. Patel	14	COR/CI/1.1, COR/CI/2.8, CUM/CI/1.1, CUM/CI/2.5, FNL/CI/1.1, FNL/CI/2.8, FGK/CI/1.1, FGK/CI/2.5, AJN/CI/2.1, FNL/CM/5.1, SS/CM/4.1, CUM/CP/7.1,

	Dantiwada Agricultural University (SDAU), JAGUDAN, Gujarat	Dr. Surabhi S. Chauhan		FGK/CP/7.1, SS/CP/7.1
Hisar	Department of Vegetable Science, (Chaudhary Charan Singh Haryana Agril. University), HISAR, Haryana	Dr. Makhan Lal	14	COR/CI/1.1, COR/CI/2.8, FNL/CI/1.1, FNL/CI/2.8, FGK/CI/1.1, FGK/CI/2.5, FGK/CI/3.7, AJN/CI/2.1, NGL/CI/2.2, FNL/CM/5.1, COR/CM/6.1, FGK/CM/6.1, COR/CP/7.1, FGK/CP/7.1
Dholi	Department of Horticulture, Tirhut College of Agriculture (Rajendra Agril. University), DHOLI, Bihar	Dr. A. K. Mishra	19	GIN/CI/1.1, TUR/CI/1.1, COR/CI/1.1, COR/CI/2.8, FNL/CI/1.1, FNL/CI/2.8, FGK/CI/1.1, FGK/CI/2.5, FGK/CI/3.7, TUR/CM/5.2, COR/CM/5.1, FGK/CM/5.1, FGK/CM/6.1, SS/CM/4.1, GIN/CP/6.15, TUR/CP/7.8, OR/CP/7.1, NGL/CP/7.1, SS/CP/7.1
Kumarganj	Department of Vegetable Science, (Narendra Deva University of Agriculture & Technology), KUMARGANJ, Uttar Pradesh	Dr. Pradip Kumar	19	GIN/CI/1.1, TUR/CI/1.1, TUR/CI/2.11, COR/CI/1.1, COR/CI/2.8, FNL/CI/1.1, FNL/CI/2.8, FGK/CI/1.1, FGK/CI/2.5, FGK/CI/3.7, AJN/CI/2.1, GIN/CM/5.1, GIN/CM/5.2, TUR/CM/5.2, SS/CM/4.1, TUR/CP/7.8, COR/CP/7.1, NGL/CP/7.1, SS/CP/7.1
		Dr.D.K.Upadhyay		
Pundibari	Faculty of Horticulture, Uttara Banga Krishi Vishwavidyalaya, PUNDIBARI, West Bengal	Mrs. Anamika Debnath	15	PEP/CI/1.1, GIN/CI/1.1, GIN/CI/2.5, GIN/CI/4.3, TUR/CI/1.1, TUR/CI/2.11, GIN/CM/4.1, GIN/CM/5.1, TUR/CM/5.1, TUR/CM/5.2, GIN/CP/6.15, GIN/CP/7.1, TUR/CP/7.2, TUR/CP/7.8, TUR/CP/7.9
		Dr. Ramkrishna Sarkar		
Dapoli	Department of Horticulture (Dr. BS Konkan Krishi Vidyapeeth), DAPOLI, MH	Dr. R. C. Gajbhiye	8	PEP/CI/1.1, PEP/CI/3.7, TSP/CI/1.1, TSP/CI/1.2, TSP/CI/2.4, TSP/CI/2.5, TSP/CM/5.1, PEP/CP/5.8
		Dr. A. V. Bhuwad		
Raigarh	Regional Agri. Research Station, (Indira Gandhi Krishi Viswavidyalaya), RAIGARH, Chhattisgarh	Dr. Ajit Kumar Singh	22	GIN/CI/1.1, GIN/CI/2.5, GIN/CI/2.6, GIN/CI/4.3, TUR/CI/1.1, TUR/CI/2.8, COR/CI/1.1, COR/CI/2.8, FGK/CI/1.1, FGK/CI/2.5, AJN/CI/2.1, NGL/CI/2.2, GIN/CM/5.1, GIN/CM/5.2, TUR/CM/5.1, TUR/CM/5.2 COR/CM/6.1, GIN/CP/6.15, GIN/CP/7.3, TUR/CP/7.8, NGL/CP/7.1, SS/CP/7.1
		Dr. Shrikant Laxmikant Swargaonkar		

Myladumpara	Indian Cardamom Research Institute, MYLADUMPARA,, Kerala	Dr. K.A. Saju	8	CAR/CI/3.9, CAR/CI/4.4, CAR/CI/4.5, CAR/CM/5.5, CAR/CM/5.6, CAR/CP/6.11, CAR/CP/6.12, CAR/CP/6.13
		Dr. Manoj Oommen		
		Dr.K.Dhanapal		
ICRI GANGTOK, Sikkim	ICRI GANGTOK, Sikkim	Dr. Sasanka Sekhar Bora	5	LCA/CI/1.1, LCA/CI/2.1, LCA/CM/5.1, GIN/CM/4.1, GIN/CM/5.1
Sakleshpur,	ICRI , SAKLESHPUR, Karnataka	Dr. K.N. Harsha	12	CAR/CI/3.9, CAR/CI/4.4, CAR/CI/4.5, COR/CI/2.8, FNL/CI/2.8, AJN/CI/2.2, NGL/CI/2.2, CAR/CM/5.5, CAR/CM/5.6, GIN/CM/5.1, TUR/CM/5.2, PEP/CP/5.8,
Ambalavayal	RARS, KAU, AMBALAVAYAL, Kerala	Ms. Sreerekha M V	9	PEP/CI/1.1, PEP/CI/3.7, TUR/CI/2.7, GIN/CM/5.1, GIN/CP/6.15, GIN/CP/7.1, GIN/CP/7.3, TUR/CP/7.8, TUR/CP/7.9
Pechiparai	Horticultural Research Station, (Tamil Nadu Agricultural University), PECHIPARAI, TN	Dr. G. Samlind Suiin	4	TSP/CI/1.1, TSP/CI/1.2, TSP/CI/2.4, TSP/CI/2.5
		Dr. Jaya Jasmine		
Barapani, Meghalaya	(Umiam) 'ICARNEH'.	Dr. M. Bilshini Devi	9	GIN/CI/1.1, GIN/CI/2.5, TUR/CI/1.1, TUR/CI/2.11, GIN/CP/6.15, GIN/CP/7.1, GIN/CP/7.2, TUR/CP/7.9, TUR/CP/7.10
		Dr. Veerendra Verma		
Mizoram	ICAR Res. Complex for NEH Region Regional Station, Mizoram Centre, Kolasib-796 081, Mizoram	Dr. Vanlalruati	6	GIN/CI/4.3, TUR/CI/2.11, GIN/CM/4.1, GIN/CP/7.1, TUR/CP/7.8, TUR/CP/7.9
ICAR Res. Sikkim Centre, Tadong,	ICAR Res. Complex for NEH Region, Regional Station, Sikkim Centre, Tadong	Dr. Amit Kumar	6	LCA/CI/1.1, LCA/CI/2.1, LCA/CM/5.1, GIN/CM/4.1, GIN/CI/2.5, GIN/CI/2.6
Nagaland	Department of Horticulture, SASRD, Nagaland University, Medziphema-797 106, Dimapur, Nagaland	Dr. C. S. Maiti,	6	GIN/CI/2.5, GIN/CI/2.7, GIN/CI/4.3, GIN/CM/4.1, GIN/CP/6.15, GIN/CP/7.1
		Dr. Graceli I Yephthomi		
Assam AAU	Horticultural Research Station, Assam Agricultural University, Jorhat- 785013, Assam AAU	Dr. Kusum Kr. Deka,	12	GIN/CI/1.1, GIN/CI/2.5, GIN/CI/4.3, TUR/CI/1.1, TUR/CI/2.7, TUR/CI/2.11, TUR/CM/5.1, TUR/CM/5.2, FNL/CM/5.1, FGK/CM/5.9, SS/CM/4.1, TUR/CP/7.8

Pasighat	College of Horticulture & Forestry, Central Agricultural University, PASIGHAT, Arunachal Pradesh	Dr. Arwankie Shadap	11	TUR/CI/1.1, TUR/CI/2.8, TUR/CI/2.9, GIN/CM/5.1, GIN/CM/5.2, TUR/CM/5.1, TUR/CM/5.2, GIN/CP/6.15, GIN/CP/7.1, TUR/CP/7.8, TUR/CP/7.9
Pantnagar	GovindBallabh Pant University of Agriculture and Technology, College of Agriculture, Pantnagar, Uttarakhand	Dr. Dharendra Singh	5	COR/CI/2.8, FNL/CI/2.8, FGK/CI/2.5, NGL/CI/2.2, FGK/CM/5.9
Kanke	BIRSA Agricultural University, College of Agriculture, Kanke, Jharkhand	Dr. Arun Kumar Tiwary	8	TUR/CI/2.8, TUR/CI/2.9, GIN/CM/4.1, TUR/CM/5.2, GIN/CP/6.15, GIN/CP/7.1, TUR/CP/7.8, TUR/CP/7.9
Kalyani	Bidhan Chandra KrishiVishwaVidhyalay, Kalyani, WB	Dr. AnupamPariari,	9	COR/CI/2.8, FGK/CI/2.5, GIN/CM/4.1, GIN/CM/5.1, GIN/CM/5.2, TUR/CM/5.1, TUR/CM/5.2, GIN/CP/6.15, SS/CP/7.1
Navsari	N.M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat	Dr. Ritesh K. Patel	5	TUR/CI/2.8, TUR/CI/2.11, COR/CI/2.8, FNL/CI/2.8, FGK/CI/2.5,
Jabalpur	Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh	Dr. Reena Nair	9	COR/CI/2.8, FNL/CI/2.8, FGK/CI/2.5, COR/CM/5.1, COR/CM/6.1, FGK/CM/5.1, SS/CM/4.1, COR/CP/7.1, FGK/CP/7.1
Kota	Agricultural Research Station, Agriculture University, Kota, Rajasthan	Dr. Preeti Verma	8	COR/CI/2.8, FGK/CI/2.5, NGL/CI/2.2, COR/CM/5.1, COR/CM/6.1, FGK/CM/6.1, COR/CP/7.1, FGK/CP/7.1
Sanand	Castor-Seed Spices Research Station, (Anand Agricultural University), Sanand, Gujarat	Dr. Dharmendra R Patidar	4	COR/CI/2.8, CUM/CI/1.1, CUM/CI/2.5, SS/CP/7.1
Mandor	Agriculture research Station, (Agricultural University Jodhpur), Mandor, Rajasthan	Dr. Motilal Mehriya	4	CUM/CI/1.1, CUM/CI/2.5, FGK/CM/5.1, CUM/CP/7.1
Thrissur	Kerala Agricultural	Dr. Nair Sunil Appukuttan	4	TSP/CI/2.4, TSP/CI/2.5, Project Mode (Nutmeg), TSP/CM/5.1

	University, Vellanikkara, Kerala			
Pampore	SRS, Sher-e-Kashmir Univ of Agricultural Sciences & Technology of Kashmir, Shalimar	Dr. Mudasir H. Khan	2	Project Mode (Saffron), Project Mode (Kalazeera)
		Dr. Basheer Ahammed		



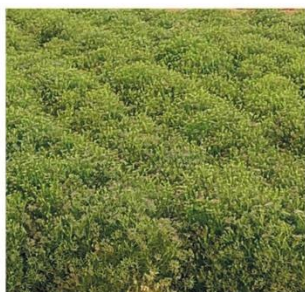
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Karan Dhanya-1



Jodhpur Jeera 1 (MCU 105)



CAZRI Cumin-1 (CZC-135)



Gujarat Fennel-13



IISR Surya (Acc. 849)



Karan Methi -1(RMt 259)



SAS-KEVÜ

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