



Proceedings of XXVIII Workshop
ICAR-All India Coordinated Research Project on Spices

10-12 OCTOBER 2017

**HORTICULTURAL RESEARCH STATION
DR. Y.S.R. HORTICULTURAL UNIVERSITY,
LAM, GUNTUR -534101, ANDHRA PRADESH**



ICAR-ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES
INDIAN INSTITUTE OF SPICES RESEARCH

Kozhikode - 673012, Kerala



New Varieties



ACr-2 (Ajmer Coriander-2)



Fenugreek Variety AFg-5 (Ajmer Fenugreek-5)



Gujarat Coriander 3 (GCo 3)



Turmeric Variety Narendra Saryu (NDH-8)



Turmeric - variety CL 34



CASSIA (D3) as IISR CASSIA

November 2017

Complied & Edited by

Dr. Sharon Aravind
Dr. K. Kandiannan
Dr. E. Radha

Type Setting

Ms. Shyna Deepesh

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10th October 2017

11.30 am – 1.00 pm

Brainstorming on Turmeric

Chairpersons:

1. **Dr. T. Janakiram**, Asst. Director General (HS II), ICAR, New Delhi
2. **Dr. Homey Cheriyan**, Director, DASD, Kozhikode
3. **Dr. K. Nirmal Babu**, Director, ICAR-IISR, Kozhikode

Rapporteurs:

1. Dr. C. Ushamalini, TNAU, Coimbatore
2. Ms. S. Aarthi, ICAR-IISR, Kozhikode

Introduction

Dr. K. Nirmal Babu,
Director, ICAR-IISR, Kozhikode

Crop Improvement

Dr. J. Rema,
Head, Crop Improvement,
ICAR-IISR, Kozhikode

Crop Production

Dr. K. Kandiannan,
Principal Scientist, ICAR-IISR, Kozhikode

Crop Protection

Dr. C. Ushamalini,
Asst. Professor, TNAU, Coimbatore

Value chain development in turmeric through MIDH

Dr. Homey Cheriyan,
Director, DASD, Kozhikode

Turmeric crop situation in India

Sri. Sanjeev Bisht,
Head, ITC, Guntur

E-Spice Bazar & quality evaluation programme

Dr. P. S. Sreekantan Thampi,
Deputy Director, Spices Board, Guntur

Turmeric for tribal empowerment

Mr. N. Sathyanarayana,
Girijana Vikasa, Chintappalli

Turmeric var. IISR Pragati seed production through licensing - A success story

Mr. N. Trivedi,
Ravindrapadu, Guntur

Discussion

11th October 2017

SESSION I : Genetic Resource & Crop Improvement

2.00 - 4.30 pm

Chairpersons: 1. **Dr. Gopal Lal**, Director, ICAR-NRCSS, Ajmer
2. **Dr. James George**, Project Coordinator, ICAR-AICRPTC, Thiruvananthapuram
3. **Dr. J. Rema**, Head, Division of CI&B, ICAR-IISR, Kozhikode

Rapporteurs: 1. Dr. Sreekrishna Bhat, ICRI, Myladumpara
2. Mr. V.A. Muhammed Nissar, ICAR-IISR, Kozhikode

Presentations:

- | | | |
|----|----------------|--|
| 1 | Black pepper | Dr. P. M. Ajith, Pepper Research Station, Panniyur |
| 2 | Large cardamom | Dr. K. Dhanapal, ICRI Regional Station, Gangtok |
| 3 | Cardamom | Dr. K. Pradip Kumar, ICRI Regional Station, Sakleshpura |
| 4 | Ginger | Dr. Parshuram Sial, High Altitude Research Station, Pottangi |
| 5 | Turmeric | Dr. B.Senthamizh Selvi, TNAU, Coimbatore |
| 6 | Tree spices | Dr. R.G. Khandekar, Dr. BSKKV, Dapoli |
| 7 | Coriander | Dr. K. Giridhar, Dr. YSRHU, Guntur |
| 8 | Cumin | Dr. D. K. Gothwal, SKNAU, Jobner |
| 9 | Fennel | Dr. Hiren Patel, SDAU, Jagudan |
| 10 | Fenugreek | Dr. D. K. Gothwal, SKNAU, Jobner |
| 11 | Ajowain | Dr. Shrikant Laxmikant Swargaonkar, IGKV, Raigarh |
| 12 | Nigella | Dr. Shrikant Laxmikant Swargaonkar, IGKV, Raigarh |

Project Mode centres:

- | | | |
|---|-------------------------------|---------------------------------|
| 1 | Nutmeg | Dr. Mini Raj, KAU, Vellanikkara |
| 2 | Coriander, Fenugreek & Fennel | Dr. K. Umesha, COH, Bengaluru |
| 3 | Nutmeg | Dr. P. Paramaguru, TNAU |

Presentation of New Programmes Concerned Scientists

11th October 2017

SESSION II : Crop Management

3.30-5.00 pm

Chairpersons: 1. **Dr. H. P. Maheshwarappa**, Project Coordinator, ICAR-AICRP Palms
2. **Dr. C. K. Thankamani**, Head, Crop Production & PHT, ICAR-IISR, Kozhikode

Rapporteurs: 1. Dr. K. S. Krishnamurthy, ICAR-IISR, Kozhikode
2. Dr. Sarita Sahu, IGKV, Raigarh

Presentations:

- | | | |
|---|--------------|--|
| 1 | Black pepper | Dr. Laxminarayan Hegde, HRS (UHSB), Sirsi |
| 2 | Cardamom | Dr. M. Shivaprasad, ZAHRS (UAHS), Mudigere |
| 3 | Ginger | Dr. Soumendra Chakraborty, UBKV, Pundibari |
| 4 | Turmeric | Dr. B. Mahender, SKLTSHU, Kammarpalli |
| 5 | Coriander | Dr. T. P. Malik, CCSHAU, Hisar |
| 6 | Cumin | Dr. A. C. Shivran, SKNAU, Jobner |
| 7 | Fennel | Dr. Ravinder Singh, ICAR-NRCSS, Ajmer |

Presentation of new programmes Concerned Scientists

11th October 2017

SESSION III : Crop Protection

11.15 am – 1.00 pm

Chairpersons: 1. **Dr. Santhosh J. Eapen**, Head, Crop Protection, ICAR-IISR, Kozhikode
2. **Dr. Y. K. Sharma**, Principal Scientist, ICAR-NRCSS, Ajmer

Rapporteurs: 1. Dr. Meenu Gupta, Dr. YSPUH & F, Solan
2. Dr. C. N. Biju, ICAR-IISR, Kozhikode

Presentations:

- | | | |
|---|----------------|---|
| 1 | Black pepper | Dr. Rajesh RangraoRathod, DrBSKKV, Dapoli |
| 2 | Large cardamom | Dr. K. Dhanpal, ICRI RS, Gangtok |
| 3 | Cardamom | Dr. K. A. Saju, ICRI RS, Sakaleshapura |
| 4 | Ginger | Dr. (Mrs.) Meenu Gupta, Dr. YSPUHF, Solan |
| 5 | Turmeric | Dr. C. Ushamalini, TNAU, Coimbatore |
| 6 | Coriander | Dr. A.K. Singh, IGKV, Raigarh |
| 7 | Cumin | Dr. Y. K. Sharma, ICAR-NRCSS, Ajmer |

Presentation of new programmes **Concerned Scientists**

11th October 2017

SESSION IV : TRANSFER OF TECHNOLOGY

3.45-4.30 pm

Chairpersons: 1. **Dr. Homey Cheriyan**, Director, DASD, Kozhikode
2. **Dr. Dhirendra Singh**, Sr. Breeder, SKNAU, Jobner

Rapporteurs: 1. Dr. P. M. Ajith, PRS, Panniyur
2. Dr. G. Senthamil Selvi, TNAU, Coimbatore

1. Standardization of drip fertigation in black pepper – PRS, Panniyur
2. Effect of organics on yield and quality of cardamom – ZHRES, Mudigere
3. Effect of fertigation on cardamom - ZHRES, Mudigere
4. Liming in cardamom – CRS, Pampadumpara
5. Utilization of herbicides for the effective control of weeds in Ginger – HRS, Chintapalle
6. Micronutrient management in fennel – SDAU, Jagudan
7. Any Other

12th October 2017

SESSION V : VARIETY RELEASE

9.30 –11.00 am

Chairpersons: 1. **Dr. T. Janakiram**, Asst. Director General (HS II.), ICAR, New Delhi
2. **Dr. Gopal Lal**, Director, ICAR-NRCSS, Ajmer

Rapporteurs: 1. Dr. S. S. Meena, ICAR-NRCSS, Ajmer
2. Ms. H. J. Akshitha, ICAR-IISR, Kozhikode

Sl. No.	Crop	Name of the variety	Organization
1.	Turmeric	NDH – 8	NDUAT, Kumarganj
2.	Turmeric	CL - 34	TNAU, Coimbatore
3.	Cassia	IISR Cassia	Pechiparai & Dapoli
4.	Coriander	Gujarat Coriander - 3	SDAU, Jagudan
5.	Coriander	ACr-2	ICAR-NRCSS, Ajmer
6.	Fenugreek	Ajmer Fenugreek 5	ICAR-NRCSS, Ajmer

12th October 2017

SESSION VI: Plenary Session

12.00 – 1.00 pm

Chairpersons: 1. **Dr. T. Janakiram**, Asst. Director General (HS II.), ICAR, New Delhi
2. **Dr. J. Dilip Babu**, Director of Research, Dr. YSRHU

Rapporteurs : 1. Dr. N. K. Leela, ICAR-IISR, Kozhikode
2. Dr. Sharon Aravind, ICAR-IISR, Kozhikode

12.00 noon	Presentation of session reports and recommendation	Chairpersons
12.15 pm	Action Taken Report and New programmes of AICRPS	Dr. K. Nirmal Babu Director, ICAR-IISR & Project Coordinator (AICRPS) Kozhikode
12.30 pm	Address by the Chairpersons	Dr. T. Janakiram , Asst. Director General (HS II.), ICAR, New Delhi Dr. J. Dilip Babu , Director of Research, Dr. YSRHU
12.50 pm	Vote of Thanks	Dr. K. Kandiannan Principal Scientist, ICAR-IISR, Kozhikode
	National Anthem	

INAUGURAL SESSION

The XXVIII Workshop of ICAR-All India Coordinated Research Project on Spices jointly organized by Dr. Y.S.R Horticultural University, Venkataramannagudem, Andhra Pradesh and ICAR-AICRP on Spices, Kozhikode, Kerala was inaugurated by Sri. Chiranjiv Choudhary, IFS, Hon'ble Vice-Chancellor, Dr. Y.S.R Horticultural University, A.P on 10th October 2017.

Dr. T. Janakiram, Assistant Director General (Horticulture Science II), Indian Council of Agricultural Research (ICAR), New Delhi was the chief guest during the occasion.

Dr. J. Dilip Babu, Director of Research, Dr. Y.S.R. HU welcomed the gathering. In the presidential address, the Hon'ble Vice Chancellor indicated that the major challenge encountered by farming community is the authenticity of genetic material and opined that, efforts should be channelized to evolve climate resilient varieties in the regime of global climate change. The Vice Chancellor highlighted the impact of various primary sector missions and other initiatives being implemented in the state under public-private-participatory mode in catering the needs of farming community. The role played by farmer-producer organizations in transforming the age-old marketing systems towards a profit-driven enterprise was also emphasized. The Vice Chancellor concluded by applauding the efforts of enterprising young and educated class of society venturing into the cultivation of high value spice crops.

Dr. T. Janakiram highlighted the relevance of value chain in assuring farmer's income through interventions at various phases of production chain including quality planting material, protected cultivation and value addition. Further, he stressed the need for the establishment of referral laboratories for the analysis of various quality parameters and efforts for adopting value chain system for turmeric production in Mizoram and Sikkim. He also suggested that each AICRP centres should conduct large-scale demonstration of promising technologies aimed to strengthen transfer of technologies and publicize its acceptability among farming community as success stories. He also emphasized on the initiatives like spice parks, e-spice Bazars and establishing centers of excellence of major spices particularly, chilli. Highlighting the emergence of nematodes as major production constraints in spice production, ADG appealed the researchers to evolve management strategies with bio-pesticides as a major component in spice production.

Dr. K. Nirmal Babu, Director and Project Coordinator, ICAR-Indian Institute of Spices Research, Kozhikode outlined the activities undertaken at various AICRP centres representing pan India. In the opening remarks, PC highlighted the importance of purity of seed material and significance of domestic quarantine in disease management, which is ignored many a times during the exchange of planting material and the significance of single-node method in preventing disease spread. The contribution of spices in the growth rate of agricultural economy, the role played by AICRP on Spices in developing as well as popularizing promising spice varieties and developing package of

practices for each spices were also highlighted . Further he focussed on the measures that to be adopted for producing safe food by reducing pesticide inputs substantially through the cultivation of varieties with inherent pest/disease resistance, variety-based spice marketing and demarcating spice hubs for varieties with specific quality traits, farming systems and value addition. He asserted the relevance of varieties with superior qualities like turmeric varieties with high and stable curcumin content to curb blending to meet the standards of various products.

The AICRPS centers at Dholi (Bihar), Guntur and Chintappalli (Andhra Pradesh) bagged the best AICRPS centre award for the period 2016-17. Nine publications on spice cultivation aspects in different languages and a DVD on black pepper production were also released during the occasion for the benefit of farming community.

Dr. L. Naram Naidu, Head, HRS Lam, Guntur proposed the vote of thanks. The representatives of State and Central Research Institutes, industry and farming fraternity participated in the event.

Brainstorming on Turmeric

Dr. K. Nirmal Babu, Director, ICAR-IISR and Project Coordinator, AICRPS briefly explained the importance of brainstorming session. In the introduction, he emphasized on the need of quality turmeric production without any contamination by heavy metals and aflotoxins to benefit farmers, industries and consumers.

Marketing & Value addition in turmeric (Mr. Sanjeet Bisht, ITC)

Speaker gave the glimpses on Turmeric production in international, national and state level. He presented that Andhra Pradesh and Telengana contributes 34% of production in turmeric and also pointed out the need of industry from researchers and farmers. Speaker highlighted the requirement of global market like rhizome colour and curcumin content. Influence of heavy metal contamination and aflotoxin in certain pockets and its influence on produce export value were emphasized.

Farmers' success story

Mr. Goutham Reddy a progressive farmer cum Director, Mangaladhi Agri Produce company Ltd. formed a farmers group with 400 farmers and introduced other varieties released from other states for the benefit of the farmers group.

Mr. Sambhi Reddy, Ex- chairman, Agricultural market committee (AMC), Duggirala explained about the advantage of steam boiling and asked for the research in mechanization in turmeric production.

Turmeric for tribal empowerment (Mr. N. Sathyanarayana, Girijana Vikasa, Chintapalle)

The speaker shared his experience on turmeric in tribal empowerment. He told the cultivation of Roma has increased the production of turmeric in tribal region of Chintapalle.

Value chain development in turmeric through MIDH (Dr. Homey Cheriyan, Director, DASD, Kozhikode)

The speaker emphasized on the need of value chain in turmeric and the need for organized planting material production among the farmers. In Andhra Pradesh Salem Local is more preferred than Duggirala red because of uniform primary fingers which is preferred in market. Under MIDH scheme it is proposed to establish value chain management in turmeric in selected districts of Telengana.

E-Spice Bazar & quality evaluation programme (Dr. P. S. Sreekantan Thampi, Deputy Director, Spices Board, Guntur)

The new initiative of Spice Board on E- Spice Bazar was explained by the speaker. This new initiative connects the producer and consumer directly. It helps in the traceability of the produce and quality assurance to the consumer. The details of practices followed by the producer should be uploaded by the seller and the requirement of buyer can be uploaded and helps in direct marketing.

A way forward in crop improvement in turmeric (Dr. J. Rema, Principal Scientist, ICAR IISR, Kozhikode)

The speaker presented about the turmeric germplasm, varietal wealth of turmeric and the important traits of each varieties and issues to be focused for farmers, market and industries sector. Emphasize was given on disease free planting material and varietal spread.

Production Technology (Dr. K. Kandiannan, Principal Scientist, ICAR IISR, Kozhikode)

The speaker emphasized on the importance of cultural practices on yield and quality of turmeric production. The new technologies on planting system, pre emergence and post emergence weedicide application and importance of need based fertilizer application were well explained. The speaker also explained the suitability of turmeric under several cropping system which helps to increase the income and crop rotation is essential to get sustainable yield in turmeric. Mechanization is feasible and machineries are available for various cultural operations and processing.

Crop Protection (Dr. C. Ushamalini, Asst. Professor, TNAU, Coimbatore)

The importance of pest and diseases in turmeric production and management measures were explained. The components of IPM which includes chemical management, use of biological agents and use of resistant varieties were explained.

General Recommendations from the house:

- Target variety based on market requirement like high curcumin, lemon yellow colour, low oil and good yield.
- There is a huge gap between technologies developed and adaptation and there is need to demonstrate them in effective manner to augment the turmeric production.
- Cultivation of turmeric in specific region for specific purpose should be encouraged.
- The turmeric is used for various purposes from culinary to pharma. Hence, all the possible traits should be observed and considered in the varietal release.
- The ADG (Horti.), ICAR suggested to have MoU with ITC for possible collaborative works.

- Price fixation taking farmer's interest into consideration and government intervention in mechanization of processing is essential.
- Soil mineral may influence the curcumin and other quality parameters, hence, soil mapping of turmeric growing areas for nutrient status and heavy metal contaminations should be initiated
- Promotion of tribal horticulture seminar including spice components should be organized
- Research on safer fungicide with minimal spray for food safety issues may be initiated
- Model for value chain in turmeric should be developed region specific.

TECHNICAL SESSION: I
GENETIC RESOURCES AND CROP IMPROVEMENT

General Comments:

- Germplasm needs to be strengthened in all crops through extensive survey especially unexploited areas and with international collaboration particularly for specific traits and stress tolerance
- Quality parameters/ resistance to stress has to be given more importance
- IC number has to be obtained for all the germplasm accessions and cataloging has to be done.
- High visionary targets to be given to get top performing varieties
- Utmost care should be taken to avoid duplication in germplasm. Record of the original collection number should be maintained when the genetic resources are exchanged among centres.
- DNA finger printing has to be done for all the released varieties and unique germplasm has to be registered
- Selection has to be done in the ginger cultivar Nadia for North East giving special emphasis to boldness, low fibre and high oil.
- In seed spices the germplasm has to be managed scientifically to maintain purity
- In cumin breeding, wilt and blight resistance to be given more thrust
- In fennel *Ramularia* blight is an issue. Breeding programmes to be focused to develop resistance varieties
- Seed spices can be tried in nontraditional areas
- Plant quarantine measures has to be strictly followed while transporting material to different areas
- In CVT for seed spices, the coding will be done during the first year and the same code will be followed for the subsequent years

Black pepper

PEP/CI/3.4 - Evaluation of grafts, orthotropic and runner shoots in black pepper

- This trial may be closed and the closure report submitted to PC Unit.

Large cardamom

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

- Germplasm needs to be strengthened. Extensive survey may be undertaken collaborating ICRI, ICAR Research complex and ICAR-NBPGR. Disease resistance traits has to be given special emphasis during survey.

Small cardamom

CAR/CI/3.6 - Coordinated Varietal Trial 2007/2009-Series VI on Small Cardamom

- This trial may be concluded and the final report has to be submitted.

CAR/CI/4.1 - Initial Evaluation Trial I

- This trial may be concluded and the final report has to be submitted.

CAR/CI/4.2 - Initial Evaluation Trial II

- This trial may be concluded and the final report has to be submitted.

CAR/CI/4.4 - CVT Multi Location Evaluation of thrips tolerant cardamom lines

- The planting materials may be multiplied and the trial may be laid out during next planting season

Ginger

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

- High oil and low fibre genotypes for North east has to be identified

GIN/CI/3.3 Initial Evaluation Trial 2013

- The trial may be concluded and the promising entries may be evaluated in CVT.

GIN/CI/4.1 Evaluation of the germplasm for quality

- The quality evaluation method should be uniform.

Turmeric

TUR/CI/1.1 - Germplasm collection, characterization, evaluation and conservation

- For germplasm evaluation, per clump yield may be considered and the yield may be calculated as per SOP for the other trials.
- The high curcumin line identified at Solan may be confirmed with IISR.

TUR/CI/3.7 – Initial Evaluation Trial 2015

- The trial may be continued and the high yielding entries will be evaluated for quality.

Tree spices

TSP/CI/1.2 Collection of unique germplasm in tree spices

- Programmes on Cinnamon may be initiated in Panniyur centre also

TSP/CI/2.2 – CVT 2001 – Nutmeg

- Promising accessions should be evaluated for quality.

TSP/CI/2.3 – CVT 2001 – Cassia

- The programme may be concluded and the final report has to be submitted.

Coriander

COR/CI/1.1 – Germplasm collection, characterization, evaluation and conservation

- Stem gall resistance has to be given highest priority.

COR/CI/3.7 - Initial Evaluation Trial

- The trial may be concluded and the promising entries may be evaluated in CVT.

Cumin

CUM/CI/1.1 - Germplasm collection, characterization, evaluation and conservation and screening against diseases

- Wilt and blight resistance to be given highest importance. Aphid tolerance also should be exploited.

CUM/CI/2.4 - CVT-2013 on Cumin

- Trial may be concluded and the promising entries will be proposed for varietal release.

CUM/CI/3.4 IET on Cumin 2012

- The trial may be concluded and the final report has to be submitted.

Fennel

FNL/CI/1.1 Germplasm collection, characterization, evaluation and conservation and screening against diseases

- *Ramularia* blight resistant lines has to be identified
- Male sterility has to be exploited for production of hybrids

Project Mode Centres

1. Nutmeg – Evaluation of nutmeg genotypes, KAU, Vellanikkara

- Promising accessions may be registered with PPVFRA

2. Studies on the performance of the Nutmeg (*Myristica fragrans* Houtt) ecotypes in coconut based cropping system in Tamil Nadu – TNAU, Coimbatore

- The project may be concluded and final report has to be submitted.

3. Evaluation of coriander, fenugreek and fennel for growth, yield and quality parameters under Bengaluru conditions – COH, Bengaluru

- The project mode funding will be provided for one more year.
- Popular articles may be published in local languages and English.
- Seed material may be collected from ICAR-NRCSS, Ajmer for distribution to farmers.

Project code	Title	Centres	Comments
Black Pepper			
PEP/CI/1	Genetic Resources		
PEP/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Ambalavayal, Chintapalle, Dapoli, Panniyur, Pundibari, Sirsi, Yercaud	Continued
PEP/CI/2	Hybridization trial		
PEP/CI/2.1	Inter-varietal hybridization to evolve high yielding varieties	Panniyur	Continued
PEP/CI/2.2	Hybridization to evolve varieties tolerant to biotic and abiotic stresses	Panniyur	Continued
PEP/CI/3	Coordinated Varietal Trial (CVT)		
PEP/CI/3.3	CVT 2006 Series VI	Chintapalle, Dapoli, Panniyur, Pampadumpara, Sirsi, Yercaud, Pechiparai	Continued
PEP/CI/3.4	Evaluation of grafts, orthotropic and runner shoots in black pepper	Ambalavayal, Panniyur, Sirsi, Yercaud	Concluded
PEP/CI/3.5	CVT 2015 on Farmers varieties of black pepper – Series VII	Chintapalle, Sirsi, Panniyur, Dapoli, Yercaud	Continued
PEP/CI/3.6	CVT on black pepper 2015-Series VIII	Chintapalle, Sirsi, Panniyur, Dapoli, Yercaud, Kahikuchi	Continued
Small Cardamom			
CAR/CI/1	Genetic Resources		
CAR/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Mudigere, Pampadumpara	Continued
CAR/CI/2	Hybridization		
CAR/CI/2.1	Hybridization and selection in cardamom	Mudigere	Continued
CAR/CI/2.2	Evaluation of promising small cardamom (<i>Elettaria cardamom</i> L. Maton) cultivars / varieties for organic cultivation in the high ranges of Idukki district	Pampadumpara	Continued
CAR/CI/3	Coordinated Varietal Trial		
CAR/CI/3.6	CVT 2007/2009-Series VI	Mudigere, Pampadumpara	Concluded
CAR/CI/3.7	CVT of drought tolerance in Cardamom – Series VII	Appangala, Mudigere, Sakaleshapura, Pampadumpara, Myladumpara	Continued

CAR/CI/3.8	CVT 2015 on Farmers varieties of cardamom-Series VIII	Appangala, Mudigere, Pampadumpara, Myladumpara, Sakleshpur	Continued
CAR/CI/4	Varietal Evaluation Trial (VET)		
CAR/CI/4.1	Initial Evaluation Trial – I	Mudigere	Concluded
CAR/CI/4.2	Initial Evaluation Trial – II	Mudigere	Concluded
CAR/CI/4.3	Initial Evaluation Trial – 2012	Pampadumpara	Continued
CAR/CI/4.4	CVT Multi Location Evaluation of thrips tolerant cardamom lines	Mudigere, Pampadumpara, Myladumpara, Sakleshpura	Continued
Large Cardamom			
LCA/CI/1.1	Germplasm collection and evaluation of large cardamom	ICAR Regional Station, Gangtok, ICRI Regional Research Station, Gangtok	Continued
Ginger			
GIN/CI/1	Genetic Resources		
GIN/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Barapani, Dholi, Kammarpally, Kumarganj, Pundibari, Pottangi, Raigarh, Solan	Continued
GIN/CI/2	Coordinated Varietal Trial (CVT)		
GIN/CI/2.4	CVT 2015-Series IX	IISR, Dholi, Pottangi, Pundibari, Kalyani, Solan, Nagaland	Continued
GIN/CI/3	Varietal Evaluation Trial		
GIN/CI/3.3	Initial Evaluation Trial – 2013	Pottangi, Dholi	Concluded
GIN/CI/3.4	Initial Evaluation Trial of bold / vegetable ginger	Pottangi	Continued
GIN/CI/3.5	Initial Evaluation Trial – 2015	Kumarganj	Continued
GIN/CI/3.6	Initial Evaluation Trial – 2016	Pundibari, Pottangi, Solan	Continued
GIN/CI/4	Quality Evaluation Trial		
GIN/CI/4.1	Evaluation of germplasm for quality	Solan	Continued
GIN/CI/4.2	Evaluation of germplasm from other centres	Solan	Continued

Turmeric			
TUR/CI/1	Genetic Resources		
TUR/CI/1.1	Germplasm collection, characterization, evaluation and conservation	Barapani, Coimbatore, Dholi, Guntur, Kammarpally, Kumarganj, Pasighat, Pottangi, Pundibari, Raigarh, Solan	Continued
TUR/CI/2	Coordinated Varietal Trial		
TUR/CI/2.6	CVT on Turmeric – 2016	Chintapalle, Coimbatore, Dholi, Guntur, Kammarpally, Kumarganj, Pundibari, Pottangi, Raigarh, Navsari	Continued
TUR/CI/3	Varietal Evaluation Trial		
TUR/CI/3.7	Initial Evaluation Trial 2015	Kumarganj	Continued
TUR/CI/3.8	Initial Evaluation Trial 2016	Pundibari, Pottangi, Solan	Continued
Tree Spices			
TSP/CI/1	Genetic Resources		
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, IISR, KAU, Pechiparai	Continued
TSP/CI/2	Coordinated Varietal Trial		
TSP/CI/2.2	CVT 2001-Nutmeg	Dapoli, Pechiparai	Continued
TSP/CI/2.3	CVT-2001-Cassia	Dapoli, Pechiparai	Concluded
TSP/CI/2.4	Coordinated Varietal Trial on farmer's varieties of Nutmeg	Dapoli, Pechiparai, Thrissur	Continued
Project Mode	Evaluation of nutmeg genotypes	KAU	Continued
Coriander			
COR/CI/1	Genetic Resources		
COR/CI/1.1	Germplasm collection, description, characterization, evaluation, conservation and screening against diseases	Coimbatore, Dholi, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh	Continued
COR/CI/1.3	Identification of drought/alkalinity tolerant source in coriander	Jobner	Continued
COR/CI/1.4	Multilocation evaluation of coriander germplasm – 2015	Ajmer, Guntur, Coimbatore, Dholi, Hisar, Jobner, Jagudan, Kota, Kumarganj, Raigarh	Continued

COR/CI/2	Coordinated Varietal Trial		
COR/CI/2.6	Coordinated Varietal Trial on coriander 2015-Series IX	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Navsari, Pantnagar, Kota, Raigarh	Continued
COR/CI/3	Varietal Evaluation Trial		
COR/CI/3.7	Initial Evaluation in coriander 2014	Hisar, Jobner	Concluded
COR/CI/3.8	Initial Evaluation Trial 2015	Guntur, Jagudan, Kumarganj, Dholi, Raigarh	Continued
COR/CI/3.9	Initial Evaluation Trial 2016	Dholi	Continued
COR/CI/4	Quality Evaluation Trial		
COR/CI/4.1	Quality Evaluation in coriander	Jobner	Continued
Cumin			
CUM/CI/1	Genetic Resources		
CUM/ CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Jagudan, Jobner, Mandor, Sanand	Continued
CUM/ CI/1.2	Multi-location evaluation of cumin germplasms	Ajmer	Continued
CUM/CI/1.3	Identification of drought tolerance	Jobner	Continued
CUM/CI/2	Coordinated Varietal Trial		
CUM/CI/2.4	Coordinated Varietal Trial – 2013	Ajmer, Jagudan, Jobner	Concluded
CUM/CI/3	Varietal Evaluation Trial		
CUM/CI/3.4	IET on Cumin 2012	Jobner	Concluded
CUM/CI/3.5	IET on Cumin 2013	Jagudan	Continued
CUM/CI/4	Quality Evaluation Trial		
CUM/CI/4.1	Quality Evaluation in Cumin	Jobner	Continued
Fennel			
FNL/CI/1	Genetic Resources		
FNL/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Dholi, Hisar, Jagudan, Jobner, Kumarganj	Continued
FNL/CI/1.2	Multilocation evaluation of fennel germplasms	Ajmer, Jobner, Kumarganj, Hisar	Continued
FNL/CI/2	Coordinated Varietal Trial		
FNL/CI/2.6	Coordinated Varietal Trial on Fennel 2015 – Series IX	Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Pantnagar	Continued

FNL/CI/3	Varietal Evaluation Trial		
FNL/CI/3.4	Initial Evaluation Trial 2014	Jobner, Pantnagar, Hisar	Continued
FNL/CI/3.5	Initial Evaluation Trial 2015	Jagudan, Kumarganj, Dholi	Continued
FNL/CI/4	Quality Evaluation Trial		
FNL/CI/4.1	Quality Evaluation in Fennel	Jobner	Continued
Fenugreek			
FGK/CI/1	Genetic Resources		
FGK/CI/1.1	Germplasm collection, characterization, evaluation, conservation and screening against diseases	Dholi, Guntur, Hisar, Jagudan, Jobner, Kumarganj, Raigarh	Continued
FGK/CI/1.2	Multi-location evaluation of fenugreek germplasms	Ajmer, Jobner, Hisar, Kumarganj	
FGK/CI/1.3	Identification of drought tolerance source in fenugreek	Jobner	Continued
FGK/CI/2	Coordinated Varietal Trial		
FGK/CI/2.4	Coordinated Varietal Trial of fenugreek 2015 – Series IX	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jagudan, Jabalpur, Jobner, Kumarganj, Pantnagar, Navsari, Raigarh, Kota	Continued
FGK/CI/3	Varietal Evaluation Trial		
FGK/CI/3.6	Initial Evaluation Trial 2014	Dholi, Hisar	Continued
FGK/CI/3.7	Chemo-profiling for identification of industrial types among the released varieties of fenugreek	Ajmer, Coimbatore, Guntur, Dholi, Hisar, Jobner, Kumarganj	Continued
FGK/CI/3.8	Initial Evaluation Trial 2015	Kumarganj, Jagudan, Jobner	Continued
FGK/CI/3.9	Initial Evaluation Trial 2016	Dholi	Continued
Project Mode	Evaluation of Coriander, fenugreek and fennel for growth, yield and quality parameters under Bengaluru conditions.	COH, Bengaluru	Continued
Ajowain			
AJN/CI/2	Coordinated Varietal Trial		
AJN/CI/2.1	Coordinated Varietal Trial-2016	Ajmer, Guntur, Hisar, Jobner, Jagudan, Kumarganj, Raigarh	Continued
Nigella			
NGL/CI/2	Coordinated Varietal Trial		
NGL/CI/2.1	Coordinated Varietal Trial-2016	Ajmer, Hisar, Kota, Kalyani, Kumarganj, Raigarh, Pantnagar	Continued

TECHNICAL SESSION II CROP PRODUCTION

General recommendations

- Data on quality aspects should be included in all the management trials.
- A copy on technology transferred from closed projects may be sent to PC cell.

Specific recommendations

Black Pepper

PEP/CM/4.6 Standardization of drip fertigation in black pepper

- Project may be closed and the final report has to be submitted.
- Data on quality aspects may be included in the final report.

PEP/CM/4.7 Black pepper based mixed cropping system for sustainable productivity and food security

- Observations on growth parameters of the main crop may also be recorded.
- Plot size may be fixed as six pepper vines and the intercrop yield in between six pepper vines may be reported

Small Cardamom

CAR/CM/5.3 Organic farming in cardamom

- Project may be closed and the final report has to be submitted
- Data on quality aspects may be included in the final report.

CAR/CM/5.4 Liming in cardamom

- Project may be closed and the final report has to be submitted
- Technology emanated from the project may be sent to extension cell of KAU for inclusion in the package of practices.

Ginger

GIN/CM/5.6 Organic production of ginger

- Quality analysis data may be included

GIN/CM/5.8 Effect of organic manures and bio-fertilizers on partitioning of dry matter in ginger

- May be continued as an intercrop in orchards.

Turmeric

TUR/CM/5.9 Source sink relationship in turmeric

- Megha Turmeric 1 may be included in all the centres.

TUR/CM/5.13 Comparative performance of turmeric entries under polyhouse and field conditions (Raigarh)

- Project may be closed and the final report has to be submitted

Coriander

COR/CM/5.7 Standardization of drip irrigation and fertigation in coriander

- Data on quality analysis may be included

COR/CM/5.9 Comparative performance of coriander entries under polyhouse, field and selfing net

- Project may be closed and the final report has to be submitted

Cumin

CUM/CM/5.4 Standardization of drip irrigation and fertigation in cumin (Jobner, Jagudan, Mandor)

- Project will be continued in all the centres including Jagudan

Fennel

FNL/CM/5.4 Effect of ferrous and zinc enriched FYM on yield and quality of fennel (Jagudan)

- Project may be closed and the final report has to be submitted

Project code	Title	Centres	Comments
Black Pepper			
PEP/CM/4	Nutrient Management Trial		
PEP/CM/4.6	Standardization of drip fertigation in black pepper	Panniyur	Concluded
PEP/CM/4.7	Black pepper based mixed cropping system for sustainable productivity and food security	Ambalavayal, Sirsi, Panniyur, Dapoli	Continued
PEP/CM/4.8	Management of <i>Phytophthora</i> foot rot by mulching	Sirsi	Continued
Small Cardamom			
CAR/CM/5	Nutrient Management Trial		
CAR/CM/5.3	Organic farming in cardamom	Mudigere, Pampadumpara	Concluded
CAR/CM/5.4	Liming in cardamom	Pampadumpara	Concluded
Ginger			
GIN/CM/5	Nutrient Management Trial		
GIN/CM/5.5	Source sink relationship	IISR, Kanke, Mizoram, Pundibari, Solan, Barapani	Continued
GIN/CM/5.6	Organic production of ginger	Barapani, Mizoram	Continued
GIN/CM/5.7	Effect of micronutrients on growth and yield of ginger (Demonstration trial)	Pottangi, Chintapalle	Continued
GIN/CM/5.8	Effect of organic manures and bio-fertilizers on partitioning of dry matter in ginger	Dholi	Continued
GIN/CM/5.9	Organic production of ginger	Ambalavayal, Pottangi, Chinthapalle, Dholi, Barapani, Kammarpally, Kumarganj, Pundibari, Raigarh, Solan, Kalyani, Mizoram	Continued

GIN/CM/5.10	Effect of micronutrients on growth and yield of ginger	Pottangi, Chinthapalle, Dholi, Barapani, Kammarpally, Kumarganj, Pundibari, Raigarh, Solan, Kalyani, Ambalavayal	Continued
Turmeric			
TUR/CM/5	Nutrient Management Trial		
TUR/CM/5.9	Source sink relationship in turmeric	Coimbatore, IISR, Guntur, Kammarpally, Dholi, Barapani	Continued
TUR/CM/5.10	Organic production of turmeric	Barapani, Mizoram	Continued
TUR/CM/5.13	Comparative performance of turmeric entries under polyhouse and field conditions	Raigarh	Concluded
TUR/CM/5.14	Organic production of turmeric	Barapani, Chinthapalle, Coimbatore, Dholi, Guntur, Kammarpally, Kumarganj, Mizoram, Pantnagar, Pasighat, Pottangi, Pundibari, Raigarh, Solan	Continued
TUR/CM/5.15	Effect of micronutrients on growth and yield of turmeric	Chinthapalle, Coimbatore, Dholi, Kammarpally, Kumarganj, Pantnagar, Pasighat, Pottangi, Pundibari, Raigarh, Solan	Continued
Coriander			
COR/CM/5	Nutrient management trial		
COR/CM/5.5	Response of coriander varieties to various levels of fertility under multi cut management practice	Jagudan	Continued
COR/CM/5.6	Effect of using varying levels of NPK and bio-fertilizers on growth and yield of coriander	Dholi	Continued
COR/CM/5.7	Standardization of drip irrigation and fertigation in coriander	Ajmer, Jobner, Guntur, Kumarganj	Continued

COR/CM/5.9	Comparative performance of coriander entries under polyhouse, field and selfing net	Raigarh	Concluded
Cumin			
CUM/CM/5	Nutrient Management Trial		
CUM/CM/5.2	Organic nutrient and disease management in cumin	Jobner	Continued
CUM/CM/5.4	Standardization of drip irrigation and fertigation in cumin	Jobner, Jagudan, Mandor	Continued
Fennel			
FNL/CM/5	Nutrient Management Trial		
FNL/CM/5.4	Effect of ferrous and zinc enriched FYM on yield and quality of fennel	Jagudan	Concluded
FNL/CM/5.5	Standardization of drip fertigation in fennel	Jobner	Continued

TECHNICAL SESSION III

CROP PROTECTION

General recommendations

- The expertise of ICAR-IISR, Kozhikode and identified institutes may be utilized for the identification of pathogens associated with major spices.
- The observations made from survey programmes need to be confirmed before reporting.
- The new trials aiming at setting MRL levels shall be initiated at all coriander and cumin centers.
- In the trials involving biocontrol agents and chemicals, compatibility shall be ascertained.
- The evaluation of accessions in pipeline with resistant traits against different pests and diseases shall be undertaken in endemic regions.

Black pepper

PEP/CP/5.3 Trial on management of *Phytophthora* foot rot of black pepper in new plantation

- The programme may be continued.
- The planting programme at Mudigere shall be completed.

PEP/CP/5.6 Biological Management of Slow Decline in Black Pepper

- The programme may be continued.
- Association of major pathogens like *Phytophthora* and nematodes associated with yellowing shall be confirmed before drawing conclusions.

PEP/CP/5.8 Management of *Phytophthora* foot rot by mulching

- The programme may be continued and may be included under crop management.

Large cardamom

LCA/CP/1.1 Evolving disease and pest tolerant lines in large cardamom

- The project may be concluded and the promising leaf blight resistant accessions shall be evaluated under multi locational trails in collaboration with ICAR Centre.

LCA/CP/1.2 Integrated pest and disease management in large cardamom

- The expertise of ICAR-IARI and Kallimpong Centre may be utilized for screening against viruses associated with *Chirke* and *Foorkey* diseases.

Small cardamom

CAR/CP/6.8 Comparison of effect of chemical treatments as well as bio-control agents against pseudostem rot of cardamom

- The incidence and field population of nematodes shall be assessed in the trial.

CAR/CP/6.9 Evaluation of new insecticides for thrips control

- Residue analysis in the produce collected during different intervals shall be undertaken. A letter should be addressed to the National Network Coordinator, AINP on Pesticides through DDG for the analysis of samples for pesticide residues.
- A new MLT involving cardamom accessions with leaf blight resistance shall be conducted in collaboration with Appangala, Pampadumpara, Myladumpara, Sakleshpur and Mudigere (two entries from Mudigere shall also be included).

Ginger

GIN/CP/6.1 Disease surveillance and etiology of rhizome rot in ginger

- The programme may be concluded and the results shall be published highlighting the occurrence as well as severity of major diseases in various regions under cultivation.

GIN/CP/6.12 Field screening of different varieties of ginger against leaf spot and rhizome rot

- The programme may be continued for one more year.
- The trial involving bacterial consortium shall be undertaken at Raigarh and Chintapalli centers and other AICRP centers in consultation with ICAR-IISR.

GIN/CP/6.13 Effect of PGPR biocapsule on growth and yield of ginger

- The title may be modified, highlighting biocapsule component and omitting PGPR.

Turmeric

TUR/CP/7.4 Management of foliar diseases in turmeric using tolerant lines

- The promising accession, TCP – 14 shall be multiplied and supplied to other concerned centers.
- Guntur, Kamarapally and Raigarh centers shall include both the accessions, TCP-14 and TCP-129 for evaluation.

TUR/CP/7.7 Effect of PGPR biocapsule on growth and yield of turmeric

- The title may be modified, biocapsule component and omitting PGPR.

Coriander

COR/CP/6.6 Integrated management of stem gall disease of coriander

- The resistant accessions, ACR 1 and ACR 2 shall be included as check in the future programmes.
- A new trial for the management of aphids shall be initiated with promising biocontrol agents identified at ICAR institutes.

Cumin

CUM/CP/6.6 Bio-efficacy of newer molecules of insecticides against cumin aphid

- The programme may be continued with uniformity in recoding the observations

CUM/CP/6.7 Management of powdery mildew in cumin through new chemicals

- The trials on developing crop protection schedule in Cumin at Jagudan centre shall be concluded.
- The trial on chemical management schedule for cumin blight shall be continued.
- The trial on management of wilt and root rot in cumin at Jagudan centre shall be continued as observational trial.

Project code	Title	Centres	Comments
Black Pepper			
PEP/CP/5	Disease Management Trial		
PEP/CP/5.3	Trial on management of <i>Phytophthora</i> foot rot of black pepper in new plantation	Chintapalle, Mudigere, Dapoli	Continued
PEP/CP/5.6	Biological Management of Slow Decline in Black Pepper	Panniyur, Sirsi, Dapoli	Continued
PEP/CP/5.7	Studies on management of <i>Phytophthora</i> causing foot rot in black pepper	Panniyur, Sirsi, Dapoli, Mudigere	Continued
Small Cardamom			
CAR/CP/6	Pest and Disease Management Trial		
CAR/CP/6.8	Comparison of effect of chemical treatments as well as bio-control agents against pseudostem rot of cardamom	Mudigere	Continued
CAR/CP/6.9	Evaluation of new insecticides for thrips control	Mudigere, Myladumpara, Pampadumpara, Sakleshpura	Continued
Large Cardamom			
LCA/CP/1.1	Evolving disease and pest tolerant lines in large cardamom	ICRI Regional Station, Gangtok, ICAR Regional station, Gangtok	Concluded
LCA/CP/1.2	Integrated pest and disease management in large cardamom	ICRI Regional Station, Gangtok, ICAR Regional station, Gangtok	Continued
Ginger			
GIN/CP/6	Disease Management Trial		
GIN/CP/6.1	Disease surveillance and etiology of rhizome rot in ginger	Dholi	Concluded

GIN/CP/6.11	Eco-friendly management of rhizome rot of ginger	Kumarganj	Continued
GIN/CP/6.12	Field screening of different varieties of ginger against leaf spot and rhizome rot	Dapoli	Continued
GIN/CP/6.13	Effect of PGPR biocapsule on growth and yield of ginger	Pottangi, Chintapalle, Dholi, Barapani, Kammarpally, Kumarganj, Pundibari, Raigarh, Solan, Kalyani, Ambalavayal	Continued
Turmeric			
TUR/CP/7	Disease Management Trial		
TUR/CP/7.1	Survey and identification of disease causing organisms in turmeric and screening of turmeric germplasm against diseases (Disease Surveillance)	Coimbatore, Pundibari, Dholi, Raigarh	Continued
TUR/CP/7.3	Assessment of fungicide and biological control agents against foliar disease of turmeric	Raigarh, Coimbatore	Continued
TUR/CP/7.4	Management of foliar diseases in turmeric using tolerant lines	Dholi, Kumarganj, Pundibari, Raigarh, Kammarapally, Solan, Guntur	Continued
TUR/CP/7.5	Eco-friendly management of foliar diseases of turmeric	Kumarganj	Continued
TUR/CP/7.6	Field screening of different varieties of turmeric against leaf spot and rhizome rot	Dapoli	Continued
TUR/CP/7.7	Effect of PGPR biocapsule on growth and yield of turmeric	Chinthapalle, Coimbatore, Dholi, Kumarganj, Pantnagar, Pasighat, Pottangi, Pundibari, Raigarh, Solan	Continued
Coriander			
COR/CP/6	Disease Management Trial		
COR/CP/6.2	Survey to identify the disease incidence, collection and identification of causal organism in coriander	Dholi	Continued

COR/CP/6.4	Studies on the management of coriander powdery mildew using new generation fungicides	Coimbatore, Raigarh, Jobner, Jagudan, Kumarganj	Continued
COR/CP/6.5	Eco-friendly management of stem gall of coriander (Observational trial)	Kumarganj	Continued
COR/CP/6.6	Integrated management of stem gall disease of coriander	Dholi	Continued
Cumin			
CUM/CP/6	Disease Management Trial		
CUM/CP/6.6	Bio-efficacy of newer molecules of insecticides against cumin aphid	Jagudan, Jobner, Ajmer	Continued
CUM/CP/6.7	Management of powdery mildew in cumin through new chemicals	Jobner	Continued

TECHNICAL SESSION: IV

VARIETAL RELEASE

Six varietal release proposals were presented in the session for identification of varieties.

Sl. No.	Crop	Name of the variety	Organization
1.	Turmeric	NDH-8	NDUAT, Kumarganj
2.	Turmeric	CL-34	TNAU, Coimbatore
3.	Cassia	IISR Cassia	HRS, Pechiparai
4.	Coriander	Gujarat Coriander - 3	SDAU, Jagudan
5.	Coriander	Ajmer Coriander-2	ICAR-NRCSS, Ajmer
6.	Fenugreek	Ajmer Fenugreek 5	ICAR-NRCSS, Ajmer

General recommendations:

Following points have to be taken care while recommending variety for release

1. Whether the objective of the trial is fulfilled
2. Specialty of the variety compared to previously released variety
3. If the variety is collected from the farmer/community, prior permission from the farmer has to be taken and due credit has to be given to the farmer.
4. All the variety release proposals should be prepared as per the format of CVRC.

The recommendations of the committee are as follows

1. Crop: **Turmeric**

Variety: **NDH 8 (Narendra Saryu)**

Centre: NDUAT, Kumarganj

The proposal was presented by Dr. V. P. Pandey, NDUAT, Kumarganj.

The variety with curcumin content of 5-6% and with more number of primaries is having yield advantage of 10% over the national check is recommended for national release.

Additional data on following aspects has to be provided.

- Salinity data
- DNA fingerprint has to be included
- Leaf oil data
- Data on performance in farmers field has to be provided.

2. Crop: **Turmeric**

Variety: **CL 34**

Centre: TNAU, Coimbatore

The proposal was presented by Dr. C. Ushamalini, TNAU, Coimbatore

The variety with tolerance to leaf spot and leaf blotch and with higher curcumin content (3.3%) was recommended for state release suitable for turmeric growing regions of Tamil Nadu.

Additional data on following aspects has to be provided.

- Parentage and pedigree has to be given
- DNA fingerprint has to be included

3. Crop: **Cassia**

Variety: **IISR Cassia (D3)**

Centre: HRS, Pechiparai

The proposal was presented by Dr. M. Palani Kumar, HRS (TNAU), Pechiparai

As the accession D1 is having less coumarin content compared to D3, instead of D3 accession D1 may be considered for release. The variety is recommended for release and the data on coumarin content has to be included from all the centres (Pechiparai, Dapoli and IISR). Variety release proposal has to be rewritten in collaboration with IISR and submitted to PC unit.

4. Crop: **Coriander**

Variety: **Gujarat Coriander -3**

Centre: SDAU, Jagudan

The proposal was presented by Dr. Hiren Patel, SDAU, Jagudan

Variety is recommended for Gujarat state.

5. Crop: **Coriander**

Variety: **Ajmer Coriander 2**

Centre: ICAR-NRCSS, Ajmer

The proposal was presented by Dr. R. S. Meena, ICAR-NRCSS, Ajmer

The variety with stem gall resistance, high linalool content (71.7%) and early maturing type recommended for national release.

6. Crop: **Fenugreek**

Variety: **Ajmer Fenugreek 5**

Centre: ICAR-NRCSS, Ajmer

The proposal was presented by Dr. R. S. Meena, ICAR-NRCSS, Ajmer

The variety with average seed yield of 1721.30 kg/ha, higher antioxidant content (66.428 mg/BHTE/ppm) and also suitable for green leaf production under shade net condition in the summer season is recommended for national release.

TECHNICAL SESSION: V
TRANSFER OF TECHNOLOGY

General recommendations:

- The promising technologies may be demonstrated in farmer's field and it has to be included in the Package of Practices of respective states.
1. Standardization of drip fertigation in Black pepper – PRS, **Panniyur**
 - Drip irrigation in black pepper @ 8 litres of water daily and 50 RDF (Half the Recommended Dose of Fertilizer as liquid fertilizer – 19:19:19 mixture) in 3 equal splits at weekly intervals during the months of June, September and February was found to be superior to the conventional method of irrigation and basal fertilizer application with the highest benefit cost ratio (2.07) (Recommended)
 2. Effect of organics on yield and quality of cardamom – ZHRES, **Mudigere**
 - Jeevamrutha (20l/clump) + *Azospirillum* (10g/clump) + PSB (10g/clump) + *Trichoderma* (10g/clump) improved the yield of cardamom
 - BC ratio has to be given
 - Specification of Jeevamrutha should be given
 - Specify when the treatment has to be applied and how to apply
 3. Effect of fertigation on cardamom, ZHRES, **Mudigere**
 - Application of irrigation 9 lt./clump/day along with 100% Rec. dose of fertilizer through drips gives the highest capsule yield in cardamom.
 - BC ratio has to be given
 4. Liming in cardamom- CRS, Pampadumpara
 - In acidic loamy soils of Kerala, application of 2 kg dolomite for 3 years improves the yield in cardamom

(Will be recommended on providing BC ratio)
 5. Utilization of herbicides for the effective control of weeds in Ginger – HRS, **Chintapalle**
 - Under severe shortage of labour for hand weeding, application of Oxyflurofen as Pre-emergent herbicide @500 ml/ha at 2nd day after sowing followed by application of Quazilophop ethyl as Post-emergent herbicide @1 litre/ha at 30 days

of crops stage followed by hand weeding at 90 days of crop stage is recommended for ginger in Chinthapalle condition. (Recommended)

6. Micro nutrient management in fennel – SDAU, **Jagudan**

- Application of fertilizer to fennel with RDF *i.e.* 90 + 30 kg NP/ha along with 200 kg FYM enriched with 3.0 kg Fe + 1.5 kg Zn/ha applied as basal in furrow for light textured soils deficient in iron and zinc. (Recommended)

7. Management of blight and powdery mildew by spacing and potash application in cumin- SDAU, **Jagudan**

- To reduce the incidence of blight and powdery mildew in cumin line sowing @ 30x10 cm and application of Potash @ 20 kg/ha along with recommended dose of fertilizers is recommended. (Recommended)

TECHNICAL SESSION: VI

PLENARY SESSION

Dr. T. Janakiram, ADG (HS-II) in his remarks congratulated the Best AICRPS centres and the scientists involved in developing new varieties & technologies which were approved in the workshop.

PROJECT COORDINATOR'S REPORT

Dr. K. Nirmal Babu, Project Coordinator

ICAR-All India Coordinated Research Project on Spices

ICAR-Indian Institute of Spices Research, Kozhikode – 673 012, Kerala

ICAR-All India Coordinated Research Project on Spices (AICRPS) is the largest spice research network in the country with 38 centres (19 regular, 10 co-opting and 9 voluntary centres) supplemented by five more in project mode funding, spread over various agro climatic zones in 23 states of the country. Black Pepper, Large Cardamom, Small Cardamom, Ginger, Turmeric, Cinnamon, Nutmeg, Clove, Coriander, Cumin, Fennel and Fenugreek, Ajowain and Nigella are the mandate crops. Annual budget for the year 2016-17 was Rs. 452.50 lakhs as ICAR share.

New Initiatives

To broaden the research activities in seed spices, trials on two new crops like Nigella and Ajowan were initiated in the AICRPS. For the development of food safe spice production technologies, multilocation trials on thrips tolerant cardamom lines and evaluation of new insecticides for thrips control in small cardamom were undertaken.

New programmes on organic production technologies of spices, evaluation of micronutrients and PGPR biocapsules in ginger and turmeric have been initiated in different agro climatic regions to enhance productivity and sustainability in spice cultivation.

For the fast communication and information dissemination, facebook page and WhatsApp group of AICRPS has been created in addition to its web based information flow.

Varieties recommended for release in 27th AICRPS workshop

Seven high yielding varieties of spices were recommended for release in XXVI AICRP on Spices workshop held at ICAR-National Research Centre on Seed Spices (NRCSS), Ajmer,

Rajasthan. One black pepper variety, **Panniyur- 9** from Pepper Research Station (KAU), Panniyur, Kerala with high yield potential was recommended for release in Black pepper growing areas of Kerala, Karnataka and Andhra Pradesh. Two high yielding ginger varieties viz; **GCP-49 (UBKV AADA 1)** developed by Uttar Banga Krishi Viswavidyalaya, Pundibari, West Bengal at national level and **VIS1-2 (Sourabh)** developed by High altitude Research Station (OUAT), Pottangi for Odisha were recommended for release. In turmeric **NDH-98** from Narendra Dev University of Agriculture & Technology, Kumarganj, Faizabad, Uttar Pradesh with high yield potential, wide adaptability and tolerance to saline condition for release at national level and a short duration, high curcumin, root-knot nematode tolerant, variety **IISR Pragati (Acc. 48)** developed by ICAR-Indian Institute of Spices Research, Kozhikode, Kerala, for release in turmeric growing areas of Kerala, Karnataka, Andhra Pradesh, Tamil Nadu, Chhattisgarh and Telangana were recommended. IISR Pragati will contribute significantly to the curcumin up gradation from 2 to 5% in the most important turmeric growing regions in the country. In seed spices, **RD 385 (Dr. RPCAU Dhania-1)** a high yielding coriander variety from Dr. Rajendra Prasad Central Agricultural University, Dholi, Bihar for release at national level and **HM 444 (Hisar Manohar)**, a fenugreek variety with high yield and unique green seed colour developed by Chowdhary Charan Singh Haryana Agricultural University, Hisar, Haryana for release at Haryana were recommended.

Black Pepper

During the year, 30 accessions of black pepper were added to germplasm maintained at various centres. In Coordinated Varietal Trial of black pepper, maximum fresh berry yield was recorded in Panniyur-1 (995.34 g vine⁻¹) followed by ACC-33 (630.78 g vine⁻¹) and C-1090 (603.47 g vine⁻¹) at Chintappalli (Andhra Pradesh), HB 20052 (3270 g vine⁻¹) followed by Acc.no.53 (3260 g vine⁻¹) at Panniyur (Kerala), Panniyur 1 (99.67 g vine⁻¹) at Dapoli (Maharashtra), Karimunda (429 g vine⁻¹) followed by HB 20052 (1.076 g vine⁻¹) at Pampadumpara (Kerala).

In a trial on standardization of drip fertigation at Panniyur (Kerala), drip irrigation @ 8 litres of water daily at 50 RDF fertigation recorded comparatively higher spike yield (3.72 kg vine⁻¹), 925 spikes vine⁻¹, green berry yield (2.75 kg vine⁻¹) and with low disease intensity (9.25 %).

A study on black pepper based mixed cropping system showed that crops such as tapioca, arrowroot, elephant foot yam, colocasia and greater yam are suitable as intercrops in juvenile black pepper garden at Ambalavayal (Kerala), Panniyur (Kerala), Sirsi (Karnataka) and Dapoli (Maharashtra).

In an experiment to evaluate the effectiveness of new molecules of fungi toxicants against *Phytophthora* foot rot in existing plantation at Chintappalli (Andhra Pradesh), application of *Trichoderma* (MTCC 5179) + consortium of bacteria (IISR-6+ IISR-859) recorded lesser incidence of yellowing and defoliation with high yield.

Small Cardamom

A total of 309 cardamom accessions are presently conserved in the gene bank of Mudgere (Karnataka) and Pampadumpara (Kerala). In a trial to evaluate the promising lines of cardamom at Mudigere, IC-346951 (372 kg ha⁻¹) recorded highest capsule yield followed by CL-726 (334 kg ha⁻¹).

Application of dolomite @ 2 kg plant⁻¹ was found to be the best treatment with increased plant height (399 cm), more number of tillers clump⁻¹ (49.66), panicles clump⁻¹ (46.66) and capsules panicle⁻¹ (39.33), fresh (2763 g plant⁻¹) and dry capsule (573 g plant⁻¹) yield in an experiment at Pampadumpara to study the effect of different liming materials. The incidence of pest and disease in this treatment was lowest in the treatment with dolomite @ 2 kg/plant.

Minimum tiller infection of (3.41 %) with higher yield of 698 g plant⁻¹ was obtained with the application of 0.2 % Bavistin followed by the application of *T. harzianum* with Neem cake and spraying of 0.2 % *Pseudomonas fluorescens* in a trial to compare the effect of chemical treatments and bio-control agents against pseudostem rot at Mudigere, Karnataka.

Large Cardamom

In large cardamom, survey was conducted at different areas of East and West districts of Sikkim and Tiwari Gaon, Hunli, Ethipani, Kebaboli, New Elope area of Lower Dibong Dist. Hawaii, Urban top area of Anjau Dist. and Metengliang area in Arunachal Pradesh and collected 14 accessions by ICRI, Regional Station, Gangtok (Sikkim).

ICAR Research Complex, Sikkim Centre, has conducted a survey to study the intensity of infestation of tea mosquito bug, *Helopeltis theivora* Waterhouse and mealy bug, *Paraputo theaecola* (Green) in different large cardamom growing areas of Sikkim Tadong. The infestation of tea mosquito bug was maximum in Lower Dzongu area, North Sikkim (24.62 to 42.28 % incidence) followed by East Sikkim, ICAR Farm (18.82 to 34.76%). The surveyed fields of large cardamom of West Sikkim were found almost free of infestation of this pest. The infestation of mealy bug was found maximum in the fields of East Sikkim (16.46 to 22.64%) followed by South Sikkim.

Spinosad 45 SC @ 0.3 ml l⁻¹ was found to be the most effective control to all the pests (62.84 to 80.76% reduction of population over control) in large cardamom followed by neem oil (1500 ppm) @ 4 ml l⁻¹ (56.38 to 74.34% reduction of population over control) and petroleum agrospray @ 10 ml l⁻¹ (52.76 to 72.28% reduction of population over control) in an experiment to evaluate the efficacy of biopesticides against insect pests of large cardamom viz., stem borer, shoot fly, leaf eating caterpillar and tea mosquito bug at Gangtok, Sikkim.

Ginger

Seventy one germplasms of ginger were grown for evaluation at Pundibari centre at West Bengal. Highest rhizome yield per plot was recorded in GCP-49 (7.55 Kg plot⁻¹) whereas maximum disease incidence was recorded in the germplasm GCP- 53 (40.00%) followed by GCP-45 (36.67) and the lowest disease incidence was recorded in GCP-23 (3.33%).

In Coordinated Varietal Trial of ginger at Pottangi(Odhisa) the entry SE-8640 was the top yielder (14.9 t ha⁻¹) with the yield advantages of 67.5% than the national check IISR Varada (8.9t ha⁻¹) followed by PGS-121 (14.7 t ha⁻¹), S-646(14.4 t ha⁻¹) and GCP-49(14.2 t ha⁻¹). Whereas, at Pundibari(West Bengal), the genotype GCP-49 showed the highest projected yield (20.88 t ha⁻¹) followed by Aswathy (17.26 t ha⁻¹) and Athira (15.62 t ha⁻¹).

Application of FYM (30 t ha⁻¹) + *Trichoderma* gave the highest plant height (81.53 cm), number of tillers per plant (52.03), number of leaves per tiller (30.96) and yield per hectare (7.28 t ha⁻¹) followed by the application of FYM (30 t ha⁻¹) + PSB produced plant height (70.60 cm), number of tillers per plant (51.87), number of leaves per tiller (28.40) and yield per hectare (7.07 t ha⁻¹) as compared to control and other treatments in the study on the effect of organic manures and bio fertilizers on partitioning of dry mater of ginger at Dholi (Bihar).

In a trial for the management of rhizome rot of ginger at Pottangi (Odhisa), lowest incidence (5.75 %) and high fresh rhizome yield (17.65 t ha⁻¹) was found in the chemical treatment (rhizome treated with metalaxyl mancozeb @ 2g l⁻¹ and streptocycline @ 1g l⁻¹ and soil drenching at 45DAS and 90DAS) followed by the application of *Trichoderma viride* @ 10g l⁻¹ (rhizome treatment and foliar spray at 45DAS and 90DAS)

Turmeric

In a Coordinated Varietal Trial of turmeric at Pottangi, CLS-38 (14.9 t ha⁻¹) was the top dry yielder with the yield advantages of 63.7 % than the national check variety IISR Pratibha (9.1t ha⁻¹) TCP-191 recorded highest fresh yield of 31.58 t ha⁻¹ followed by LTS -2 (25.24 t ha⁻¹) at Pundibari, RH-9/90 (64.15 t ha⁻¹) and RH-80 (59.33 t ha⁻¹) gave significantly high fresh yield per hectare at Dholi, TCP 191 (49.87 t ha⁻¹) at Coimbatore (Tamil Nadu), LTS-1 (68.56 t ha⁻¹) followed by LTS -2 (56.18 t ha⁻¹) at Kammarapally (Telengana) , LTS-2 (23.7 t ha⁻¹) followed by LTS-1 (23.1 t ha⁻¹) at Guntur (Andhra Pradesh).

The experiment on source sink relationship in turmeric is being carried out in 6 different centres spread over South, North and North Eastern states with the following varieties viz., IISR Prathibha, Rajendra Sonia, Duggirala Red, Mydukur and BSR-2. The results showed that fresh weight of whole rhizome increased considerably from September to February in almost all the tested Centres. Among the varieties evaluated at Coimbatore, Guntur and Kammarapally,

Mydukur was found to be vigorous in growth and recorded highest fresh rhizome weight of 890 g plant⁻¹, 317.2 g plant⁻¹ and 618.50 g plant⁻¹ respectively.

In a trial on the management of foliar diseases of turmeric using tolerant lines, leaf spot incidence ranged from 0-13.3 % at Guntur. NDH-74 showed field tolerance to both the foliar diseases like leaf spot and blotch. The accessions CL 32 (1.2%), TCP 129 (1.7%) and TCP 14 (2.2%) recorded the lowest PDI and were on par with each other. CL 34 of Coimbatore centre recorded minimum leaf spot (5.40 PDI) and leaf blotch (3.50 PDI) incidence with a yield of 32.91 t ha⁻¹ followed by TCP 129 with a yield of 30.58 t ha⁻¹, recorded resistant reaction to both leaf spot (5.68 PDI) and leaf blotch (3.96 PDI). At Solan (Himachal Pradesh), CL-54 gave the maximum yield (32.87 t ha⁻¹) along with minimum leaf spot (6.56 %) and leaf blotch (7.09%) incidence. In Dholi, TCP-14 was found free from *Colletotrichum* and *Taphrina* leaf spot disease whereas in Pundibari, TCP 129 has recorded lowest leaf blotch (PDI 13.99) and leaf spot (PDI 8.66) disease severity. Alternatively at Kammarappally, none of the varieties was found to be resistant to foliar diseases due to severe incidence of leaf spot and leaf blotch.

Tree Spices

Among the nutmeg germplasm screened at Dapoli, average no. of fruits ranged from 110-325. The average number of fruits was high in genotypes DBSKKVMF 24 (325), DBSKKVMF 23 (310), DBSKKVMF 19 (280). The genotype DBSKKVMF 23 recorded maximum dry nut yield (1714.30 g) and dry mace yield (381.3 g). The genotype DBSKKVMF 29 is found to be promising considering its fruit weight, nut weight and mace weight. At Pechiparai (Tamil Nadu), the nutmeg accession MF- 4 recorded maximum number of fruits (420 fruits /tree), single fruit weight (108 g) and the mace yield (220 g tree⁻¹).

The clove accession, SA-3 recorded the highest leaf length (18.00 cm), leaf breadth (7.500 cm) and dry bud yield (3.0 kg tree⁻¹) when 24 clove accessions were evaluated at Pechiparai. Four promising genotypes were selected at Dapoli whose plant height varied from 4.80 to 5.90 m, girth ranged from 32.40 to 38.01 cm and spread varied from 3.75 m to 5.40 m.

In case of cinnamon, among the twelve accessions evaluated at Pechiparai, CV-5 recorded maximum tree height (9.00 m), stem girth (31.50 cm), leaf yield (7.50 kg plant⁻¹) and dry bark yield (620 g plant⁻¹) while local check recorded plant height (7.80 m), stem girth (22.50 cm), leaf yield (7.00 kg/plant) and dry bark yield (290 g/plant).

The genotype KKVCTSH₂ of Cassia recorded high girth (49.38 cm) followed by KKVCTSH₁ (45.88 cm) at Pechiparai. The oil percentage in leaf varied from 6.14 - 7.34 %. The genotype KKVCTSH₁ (7.34 %) and KKVCTSH₂ (7.12 %) recorded high bark oil percentage.

Coriander

In a multi location evaluation of coriander genotypes, maximum seed yield was recorded in the genotype LCC 233 (750.00 kg ha⁻¹) which was better than the check variety Hissar Anand (457.50 kg ha⁻¹) at Coimbatore. RD-393 (6870 kg ha⁻¹), NDCor-94 (4889 kg ha⁻¹) and NDCor-118 (4593 kg ha⁻¹) were found to be the promising entries at Jagudan (Gujarat).

In Coordinated Varietal Trial of coriander, maximum seed yield was recorded in the entry COR 141 (8.05 q ha⁻¹) at Coimbatore, COR 141 (28.69 q ha⁻¹) at Jabalpur(Madhya Pradesh), COR-138 (15.97q ha⁻¹) followed by COR-146 (15.90 q ha⁻¹), COR-139 (15.83 q ha⁻¹) and COR-130 (15.06 q ha⁻¹) at Kumarganj (West Bengal), COR-134 (7.78 q ha⁻¹), COR-130 (7.53 q ha⁻¹), COR-135 (7.46 q ha⁻¹), COR-129 (7.36 q ha⁻¹) and COR-133 (7.18 q ha⁻¹) at Guntur, COR-122 (25.15 q ha⁻¹) at Jagudan, COR-142 (25.27 q ha⁻¹) followed by COR- 146 (23.61q ha⁻¹) at Kota(Rajasthan) and ICS 1 (30.76 q ha⁻¹) followed by COR 135 (25.4 q ha⁻¹), COR 129 (24.58 q ha⁻¹) and COR 136 (23.13 q ha⁻¹) over national checks RCR 728 (17.36 q ha⁻¹), Gujarat 2 (16.60 q ha⁻¹) and Hisar Anand (15.83 q ha⁻¹) at Raigarh (Chhattisgarh).

In a study to evaluate new generation fungicides against powdery mildew in coriander at Coimbatore and Jobner (Rajasthan), spraying of Propiconazole gave maximum level of control whereas at Raigarh, foliar spray of wetbale sulphur 0.2% were found to be the best controlling agent.

Cumin

Total eighteen entries of cumin were screened for the resistance against *Alternaria* blight, powdery mildew and wilt disease at Jagudan. The minimum blight disease intensity was noticed in GC-4 (32.5%) followed by GC-2000-28 (40 %), while minimum powdery mildew disease intensity was noticed in GC-4 (17.5 %) and minimum wilt disease intensity was noticed in Gc-3 (40.0 %).

In a study to evaluate the bio-efficacy of newer molecules of insecticides against cumin aphid, thiamethoxam 25WG @ 25g a.i./ha followed by thiacloprid 21.7SC @ 25g a.i/ha had registered the least per cent umbels aphid infestation (3.34%) at 7days after second spray at Jagudan.

Fennel

The best performed entries in the CVT during the year were FNL-99 (13.61 q ha⁻¹) followed by FNL-97 (13.19 q ha⁻¹), FNL-95 (12.77 q ha⁻¹) and FNL-98 (120.50 q ha⁻¹) at Kumarganj, FNL-97 (21.24 q ha⁻¹) followed by FNL-98 (20.15 q ha⁻¹) and FNL-99 (19.89 q ha⁻¹) at Hisar and RF-101 (19.15 q ha-1) at Jagudan.

The drip fertigation with 75% recommended dose of fertilizers recorded significantly high plant height (122.90 cm), umbels per plant (29.72), umbellets per umbel (24.51), seeds per umbel (400.88), test weight (6.01 g), seed yield (25.16 q ha⁻¹) and water use efficiency (6.08 kg/ha-mm⁻¹). However it remained at par to drip fertigation with 100% recommended dose of fertilizers and drip fertigation with 100% recommended dose of nitrogen.

Fenugreek

In a CVT for fenugreek, the highest seed yield was recorded in FGK-103 (13.89 q ha⁻¹) followed by FGK-106 (11.74 q ha⁻¹), FGK-96 (11.57 q ha⁻¹) and FGK-97 (11.57 q ha⁻¹) at Jabalpur, FGK-103 (8.33 q ha⁻¹) at Coimbatore, FGK-94 (13.40 q ha⁻¹) followed by FGK-97 (13.33 q ha⁻¹), FGK-96 (13.12 q ha⁻¹) and FGK-101 (13.05 q ha⁻¹) at Kumarganj, FGK-99 (21.48 q ha⁻¹) at Jagudan, FGK-96 (17.06 q ha⁻¹), FGK-98 (15.22 q ha⁻¹) at Raigarh and FGK-105 (21.83 q ha⁻¹) followed by FGK-106 (21.25 q ha⁻¹) and FGK-104 (20.49 q ha⁻¹) at Hisar (Haryana).

Nineteen (CVT) entries of fenugreek were screened against powdery mildew at Jobner. Entries FGK-94 and FGK-99 were observed as moderately resistant against powdery mildew disease whereas the entries UM-393 and UM-398 were observed as moderately resistant amongst the ten IET entries tested. Forty seven entries among the three hundred and fifty nine germplasm accessions were also identified as moderately resistant lines against the disease.

Ajowain

Ajowain 1 recorded maximum seed yield (2.57 q ha⁻¹) followed by entry LS-14-8 (2.40 q ha⁻¹) in CVT for Ajwain at Raigarh. LS-14-3 (9.84 q ha⁻¹), AA-6 (9.80 q ha⁻¹), LS-14-8 (9.54 q ha⁻¹) and AA-73 (8.70 q ha⁻¹) were the top yielders at Guntur, IA-2 (11.06 q ha⁻¹) at Jagudan, NDAJ-10 (8.12 q ha⁻¹) followed by AA-6 (7.91 q ha⁻¹), AA-73 (7.70 q ha⁻¹) and JA-187 (7.50 q ha⁻¹) and NDAJ-11 (7.70 q ha⁻¹) at Kumarganj, HAJ-7 (6.40 q ha⁻¹) followed by NDAJ-11 (5.90 q ha⁻¹), IA-1 (5.26 q ha⁻¹), NDAJ-10 (5.11 q ha⁻¹) and AA-93 (5.10 q ha⁻¹) at Jobner, NDA-11 (8.34 q ha⁻¹) followed by HAJ-18 (8.20 q ha⁻¹) and HAJ-7 (7.62 q ha⁻¹).

Nigella

In Coordinated Varietal Trial of Nigella, maximum seed yield was recorded in the entry AN-23 (7.99 q ha⁻¹) and AN-1 (7.71 q ha⁻¹) at Kota, NDBC-20 (8.12 q ha⁻¹) followed by AN-112 (7.43 q ha⁻¹) and IN-1 (7.15 q ha⁻¹) at Kumarganj.

Production and distribution of quality planting material

The AICRPS centres along with DASD have multiplied and distributed 7.16 lakhs rooted cuttings of black pepper, 1622 seedlings/suckers of cardamom, 50 t of turmeric, 16 t of ginger, 518 grafts of nutmeg, 247 seedlings of nutmeg, 256 grafts of cinnamon, 1000 seedlings of cinnamon and 150 seedlings of clove. In seed spices 501.75 kg of coriander, 6400 kg of cumin, 719 kg of fennel, 60.5 kg of Ajwain and 261 kg of fenugreek seed material were produced and distributed.

Transfer of Technology

Scientists from AICRPS centres have actively involved in popularization of the latest technologies to reach it effectively in to the farming community. Some of the technologies demonstrated during the year as follows.

- ❖ FLD on 11 high yielding varieties of turmeric(Guntur)
- ❖ Demonstration of technique of removing bark of cinnamon, Pro tray propagation technique for ginger and turmeric, Processing of black pepper , Processing of turmeric, Soft wood grafting technique in nutmeg and kokum, Bush pepper production technology, Preparation of preserve and chutney from nutmeg rind (Dapoli)
- ❖ Eight demonstrations on high yielding varieties of fenugreek, cumin and fennel (Jobner).
- ❖ Demonstration on seed treatment of two budded turmeric seed rhizomes, four rows of raised bed method, and tractor mounted harvesting of turmeric (Kammarapally)
- ❖ Demonstrations of high yielding varieties of turmeric, coriander, fennel and fenugreek (Kumarganj).
- ❖ Demonstration of technologies for small cardamom production at farm level under MIDH (Pampadumpara)
- ❖ FLD on performance of turmeric transplants in an area of 1.00 ha (Coimbatore)
- ❖ Farmers' Training on “ Organic ginger and turmeric cultivation”, “Coriander, chilli and black pepper cultivation” and awareness training on “Improved Spices Cultivation” (Pottangi)
- ❖ Training on “Hi- tech production technology for turmeric, ginger, coriander and curry leaf” in collaboration with DASD (Coimbatore)

Apart from the above, the scientists were interacted with farmers as resource persons in trainings, seminar and also through various media (newspaper, radio talks and TV programs) to disseminate knowledge among spice farmers.

Success stories

Mr. Devrajbhai Amthabhai Patel, resident of Varsada village of Banaskantha district in Gujarat holds 25 acres of land in which he has been cultivating mustard, cotton, castor and cumin upto 2004. Even though blessed with high fertile land, Mr. Patel earns only about Rs. 3.0 lakhs from the cultivation of these crops annually due to traditional method of cultivation and use of either local or very old varieties. In order to introduce fennel as a new cash crop and to demonstrate the technologies of cumin, field demonstrations of recently released variety Gujarat Fennel – 11 with Gujarat Fennel – 2 and Gujarat Cumin – 4 with Gujarat Cumin-2 was conducted in this area under All India Coordinated Research Project on Spices by CRSS, Jagudan in 2004. Interestingly, encouraging results obtained from these demonstrations motivated Mr. Patel to replace mustard crop by fennel and also to extend the area of cumin. Inspired from the trainings organized by CRSS, Jagudan, Mr. Patel started seed productions of Gujarat Fennel – 11 and Gujarat Cumin – 4. Last year, he produced about 5000 kg of Certified/TF seeds of GC-4 and 2000 kg of GF-11 and distributed among the farmers. His farm income has thus increased from Rs. 3.0 to 15.0 lakhs by crop diversification and seed production programme. Mr. Patel was awarded as the best farmer for crop diversification and seed production by S. D. Agricultural University, Sardarkrushinagar in the year 2011.

The success story of farmers in coriander cultivation from the adverse agro climatic regions of Andhra Pradesh (Southern Zone, Scarce Rainfall Zone and western part of Krishna-Godavari zone) reveals that the effect of climate change can be mitigated by the use of appropriate technologies. The farmers from Pedacherlopalle mandal of the Prakasam district (Southern Zone) approached All India Coordinated Research Project on Spices, Guntur for advice on raising rabi crops in drought prone areas. The farmers were provided with two elite varieties of coriander, Suguna and APHU Dhanial-1. The crop established well even though the rainfall was meager. Two farmers harvested the crop during the third week of March when the fodder crop, jowar has failed due to insufficient soil moisture. The variety APHU Dhanial-1 recorded 125 kg acre⁻¹, whereas Suguna recorded a yield of 115 kg acre⁻¹. The Benefit Cost Ratio was 2.46 and 2.76 for the variety Suguna and APHU Dhanial-1.

Another progressive farmer, Sri Viswanadha Reddy from Vempalle mandal, the traditional coriander growing area of Andhra Pradesh, under the Scarce Rainfall Zone has approached the AICRPS centre at Guntur. He realized that choosing the appropriate variety can make a huge difference and procured seed of APHU Dhanial-1 for raising crop in eight acres. He was advised to go for sprinkler irrigation at least for three hours daily, approximately delivering 30 mm of water at the critical stage of flower initiation. The crop grew exuberantly without any pest or disease problem. He harvested 1875 kg ha⁻¹ coriander grains, which was 1.44 times higher than the national average (835 kg ha⁻¹) The net income per acre was Rs. 57,500/-.

Another success story was from the western part of Krishna-Godavari zone, where the rainfall during rabi was only 44 mm. With the advice of AICRPS at Guntur centre, Sri Edukondalu, of Dachepalle mandal has sown coriander variety Suguna in the last week of November. The farmer took the advantage of mobile and WhatsApp technology to ensure proper care to the crop. He could harvest 450 kg acre⁻¹, in 85 days. The net income was Rs. 34000/-with a Benefit Cost Ratio of 5.2. This story highlights that the right choice of crop at appropriate time is the key for success.

Tribal welfare measures

Fifteen farmers training programmes were conducted in 15 villages in Chintapalle of Andhra Pradesh, Pottangi of Odisha and Raigarh of Chhattisgarh benefiting 1290 tribal farmers to make awareness on high production technologies and quality up gradation in spices.

New Initiatives in North East

As per the recommendations of ICAR Regional Committee, 13 coriander varieties and 14 fenugreek varieties were introduced to ICAR Research Complex, Agartala for evaluation. Nucleus planting material of 6 high yielding, high quality varieties of black pepper from ICAR-IISR were supplied and planted in ICAR RC, Agartala, Tripura for further multiplication and distribution to KVKs for multiplication and field planting.

To evaluate the effect of PGPR Biocapsules and IISR micronutrients in ginger and turmeric, new trials were initiated at Barapani, Pasighat and Mizoram centres. New trial on organic production in ginger and turmeric was also undertaken.

Collaboration

In addition to IISR-Kozhikode, NRCSS-Ajmer and State Agricultural Universities, AICRPS have collaboration with DASD, Spices Board, Central Institute of Horticulture, CFTRI, WSO, IDH, Codex, ISO and various NGOs.

Monitoring

The research programmes undertaken by the centres were monitored by Project Coordinator and the Scientists from PC unit's through visits to various centres and the experimental plots. In this year 12 visits were taken up to centres including regular, co-opting, voluntary and project mode centres. The progresses of activities were also monitored through monthly, half yearly and annual reports from centres. The annual workshop was conducted during 24th to 26th October 2016 at ICAR-National Research Centre on Seed Spices (NRCSS), Ajmer, Rajasthan.

ACTION TAKEN REPORT 2016-17

Sl. No.	Decision/Recommendations	Centres	Action Taken
TECHNICAL SESSION I: GENETIC RESOURCES AND CROP IMPROVEMENT			
1.	In all disease and pest screening trials, data should be obtained from sick plot or at hot spots.	All Centres	Testing was done in sick plot identified where ever such facilities were available and development of sick plot are in progress in other centres
2.	SOP (Standard operation protocol) for all AICRPS may be developed for uniformity in the trial layout, data recording, compilation and presentation	All Centres	The SOPs were prepared. It will be uploaded on the web for implementation in a months time
3.	Black pepper tolerant lines against biotic and abiotic stress may be tested with the help of IISR scientists	Panniyur	Cul. 5308 deposited at IISR. Other tolerant lines being multiplied for submission
4.	Data of Coordinated Varietal Trial Series VI on Black pepper to be collected, compiled and submitted to PC unit.	Panniyur	This is being done and will be submitted soon
5.	Dapoli, Chintapalle and Assam centres may take up the trial on evaluation of grafts, orthotropic and runner shoots in black pepper. Sirsi centre may supply the grafts to above centres.	Dapoli, Chintapalle, Assam and Sirsi	The grafts are ready and will be planted soon.
6.	Promising Golsai and Varlange may be multiplied and trial may be laid out in Arunachal Pradesh and Nagaland	ICRI, Sikkim	A new initiative has been taken for large cardamom demonstration trail at lower PR Hills under Kohima districts of Nagaland under the guidance of ICRI, Gangtok

7.	Thrips tolerant line (HY 14) may be tested in other field condition	Pampadumpara Myladumpara	Field trials were laid out in 3 hotspot areas of thrips infestation and observations are being collected from the experiments. Nucleus planting material of thrips tolerant cardamom lines material collected from IISR Appangala during August 2017 and kept for multiplication.
8.	In the trial on CVT of drought tolerance in Cardamom, Sakaleshapura will be join the trial during 2016-17. Mudigere centre may collect the planting material from Appangala and Pampadumpara centre may collect the planting material from Myladumpara centre.	All cardamom centres	IISR RS, Appangala has supplied the planting materials to Mudigere and Sakaleshapura in 2015 & 2016; to Myladumpara and Pampadumpara during 2017. The trials were initiated.
9.	Confirm the curcumin content of the genotypes with more than 6.0%.	Barapani	This was done
10.	The trial on CVT of Turmeric 2013 may be concluded. Final report may be submitted.	All turmeric centres	The completion report was submitted
11.	The trial on IET of Turmeric 2013 may be concluded. Final report may be submitted.	Pottangi	Concluded. The report will be presented in the workshop
12.	Dapoli and Pechiparai centres may prepare variety release of Cassia for forthcoming workshop	Dapoli, Pechiparai	The variety release proposal has been submitted and will be presented during the workshop.
13.	After completion of MLT in coriander, germplasm catalogue should be compiled based on descriptors with respect to tested locations.	All coriander centres	This is in progress in many centers

14.	In the ongoing CVT coriander, after completion of 2 years trial, mean performance may be assessed and best entries may be screened under stem gall sick plot developed at Dholi.	All coriander centres	The best entries from each will be submitted for sick plot evaluation during 2017-18.
15.	New CVT trial may be initiated for leafy type coriander and will shortlist 2 genotypes each for the trial.	Jobner, Jagudan, Ajmer, Pottangi, Barapani, Kalyani, Nagaland	Trial started with 10 genotypes in most of the centers
TECHNICAL SESSION II: CROP MANAGEMENT			
16.	Final report of all the closed project must be sent to PC cell and the technologies originated must be presented in the ensuing workshop. The technologies developed must be taken for demonstration.	All centres	Final reports of the concluded projects were submitted. Technologies generated will be presented in the workshop
17.	Research on cropping systems may be explored	All centres	Much of data on cropping systems involving spices are available. A new trial will be initiated soon.
18.	Quantity and quality of publications may be enhanced	All centres	This was followed as suggested
19.	Drip Irrigation and fertigation treatments may be finalized in consultation with Dr Ravinder Singh, ICAR-NRCSS, Ajmer and Ajmer centre may also be included	Jobner, Jagudan, Mandor	Jobner centre has standardized drip irrigation in fenugreek and fennel. The experiment on cumin and coriander is in progress and new programmes will be finalized after consultation with the scientists of NRCSS, Tabiji.

20.	Soil analysis and quality analysis data may be included in the trial on the effect of ferrous and zinc enriched FYM on yield and quality of fennel.	Jagudan	This was implemented
TECHNICAL SESSION III: CROP PROTECTION			
21.	Expertise available at ICAR-IISR may be availed for confirming the identity of pathogens isolated by coordinating centres.	All centres	This was followed as suggested
22.	In experiments on field screening of accessions to various pathogens and pests, the results may be supplemented by laboratory/greenhouse studies with identified strains.	All centres	This was followed as suggested
23.	A group meeting cum training of pathologists will be organized at ICAR-IISR for identification of pathogens and methodologies for screening.	All centres	Will be done this year
24.	The trial on nematode management in small cardamom may be initiated as a new experiment with the approved technical programme.	Pampadumpara	The experiment has been initiated and going on.
25.	The trial on disease tolerant lines in small cardamom may be taken up as observational trial at Myladumpara.	Myladumpara	Continued the trial
26.	Residue analysis in small cardamom may be taken up in collaboration with All India Network Project on Pesticide Residues.	Myladumpara, Pampadumpara, Mudigere, Sakleshpur	Samples for residue analysis has already been sent
27.	Virus indexing in nucleus planting materials of large cardamom should be done at Spices Board with the support from ICAR- IISR, Kozhikode to prevent the spread of the disease to new areas.	ICRI Regional Station, Gangtok, ICAR Regional station, Gangtok	Communicated to IISR, Kozhikode the nucleus planting material are being sent for virus indexing.

28.	A consolidated report on the surveys conducted for identification of disease causing organisms in turmeric may be submitted to the PC unit.	Coimbatore	Consolidated report on the surveys conducted was submitted to the PC unit.
29.	The causal organism of stem gall disease may be confirmed by NRCSS, Ajmer.	Dholi	The pathogen is isolated & will be sent to NRCSS, Ajmer for confirmation.
30.	<i>Beauveria bassiana</i> and <i>Verticillium lecanii</i> alone may also be included as treatments in the trial Bio-efficacy of new insecticides against coriander aphid	Jobner	The experiment was not prepared by Jobner centre and may be prepared/submitted by Guntur or Dholi
PLENARY SESSION			
31.	Two new crops Nigella and Ajowain were included in the AICRPS trials and NRCSS, Ajmer will prepare the new CVT trials in these crops. Seed material for these trials should be sent directly to the respective centre from the contributing centre.	Ajmer	New CVT on Ajwain and Nigella was initiated
32.	Few leafy type coriander genotypes from coriander centres can be given to Barapani and Nagaland centres for evaluation.	All coriander centres	10 genotypes from Jobner were sent to Barapani and Mizoram
33.	Coriander centres may take up a station trial of leafy type corianders this year and in the next year new CVT may be taken up in all the centres.	All coriander centres	This was followed as suggested
34.	Promising varieties of coriander before submitting for varietal release has to be checked for stem gall resistance. This has to be tested in the sick plots at Dholi centre.	All coriander centres	This was followed as suggested
35.	Quality analysis has to be done in all the seed spices varieties with the help of NRCSS, Ajmer.	Seed spices centres	This is being followed

36.	Technology recommended can also be demonstrated in KVKs also.	All centres	This is being done
37.	Proposals of varieties recommended for release during the workshop have to be submitted to the Central Varietal Release Committee within next 6 months.	All centres	This was followed as suggested
38.	Status report on AICRPS centres in different states and spices cultivation in respective state may be prepared. One publication on this may be brought out.	AICRPS	This is in progress
39.	Fact sheets on spices may be prepared for publishing in the Indian Horticulture Journal.	AICRPS	This is in progress
40.	Human Resource Development is very important and in this regard Project Coordinator may facilitate for special trainings to the staff working in AICRPS.	AICRPS	Trying
41.	Seed standards may be prepared for seed spices.	AICRPS	This is in progress for some crops.
42.	Technologies which have created impact may be compiled and report may be submitted to the Director General, ICAR.	All centres	This could not be completed and is in progress.
43.	Funds for conservation of genetic resources need to be increased. A proposal for this may be submitted.	All centres	Trying.

This was followed by presentations of recommendations from various sessions by the Rapporteurs.

Brain storming session on turmeric- Rapporteur of this session presented the recommendations which emphasized to target variety based on the market requirement like high curcumin, lemon yellow colour, low oil and good yield.

Genetic Resources & Crop Improvement session: Project wise recommendations were presented by the rapporteur. Some of the new programmes started in Genetic Resources and Crop Improvement were coordinated varietal trials in black pepper, small cardamom, coriander, cumin, fennel and fenugreek.

Crop Management Session: Rapporteur presented the session report. It was suggested in crop management experiments that after completion of third year of the project, proposal for the transfer of technologies may be prepared and submitted in the same year itself.

Crop Protection: Project wise recommendations were presented by the rapporteur. Some of the new programmes started were MLT on leaf blight tolerant lines of small cardamom, integrated pest and disease management in coriander and cumin

Transfer of Technology: Rapporteur presented the session report and during this session technologies were recommended. It was suggested that in the demonstration of the technologies especially micro nutrient trials, KVK s may be included and state department may be informed about the technologies.

Variety Release Session: rapporteur presented the report of the session in which six varieties were recommended for release.

General recommendations of the sessions were

- Status report of each AICRPS centres may be published
- Digitization and online submission of AICRPS reports may be strengthened
- Value chain development of turmeric may be initiated
- HRD to be strengthened and scientist must be encouraged to obtain fellowships like INSA

Dr. K. Kandiannan, Principal Scientist, ICAR-IISR proposed the vote of thanks and the session was concluded with National Anthem.

New Research Programmes

Crop Improvement

Crop	Black Pepper
Title of the Programme	Coordinated Varietal Trial – 2018 Series VII
Centre	Chintapalle, Panniyur, Sirsi, IISR, Dapoli, Ambalavayal, Yercaud
Year of start	2018
No. of treatments/genotypes	10 Genotypes + Panniyur 1 (local check) = 11 1. HP 780 (IISR) 2. HP 1411 (IISR) 3. OPKM (IISR) 4. HP 117 x Thommankodi (IISR) 5. IISR Thevam (IISR) 6. Kumbakkal (IISR) 7. Ponmani (IISR) 8. PRS 137 (Panniyur) 9. SV 7 (Sirsi) 10. Kurimalai (Sirsi) 11. Panniyur 1 (check)
Design	Randomized Block Design
No. of replications	Three replications
Plot size/spacing	6 standards/ plot (3x3 m), 2 plants/ standard
Observations to be taken	<ul style="list-style-type: none"> ✓ Plant height (m) ✓ Number of branches per vine ✓ % of fruit set ✓ % of male, female & bisexual flowers ✓ Days to maturity ✓ Average spike length (cm) ✓ Average number of berries/ spike (observation to be taken in 50 spikes) ✓ Fresh berry yield (kg/vine) ✓ Dry berry yield (kg/ vine) ✓ % of bold berries ✓ 1000 berry weight (g) ✓ Dry Recovery (%) ✓ Bulk density (g/L) ✓ Piperine content (%) ✓ Oleoresin (%) ✓ Essential oil (%) ✓ Incidence of pest and diseases

Crop	Small cardamom
Title of the Programme	CVT on hybrids of small cardamom – 2018 Series VII
Centre	Appangala, Mudigere, Pampadumpara, Myladumpara, Sakaleshapura
Year of start	2018
No. of treatments/genotypes	9 Hybrids + Njallani Green Gold (local check) = 10 1. (GG×NKE19)×Bold (Appangala) 2. Bold × (GG×CCS 1) (Appangala) 3. GG × NKE 19 (Appangala) 4. MH.C-1 (Myladumpara) 5. MH.C-2 (Myladumpara) 6. SHC – 1 (Sakleshpura) 7. SHC-2 (Sakleshpura) 8. PH-13 (Pampadumpara) 9. PH-14 (Pampadumpara) 10. Njallani green gold (check)
Design	Randomized Block Design
No. of replications	Three replications
Plot size/spacing	3×3 m, 12 plants/plot
Observations to be taken	<ul style="list-style-type: none"> ✓ Plant height (cm) ✓ Number of tillers per clump ✓ Number of bearing tillers per clump ✓ Number of panicles per clump ✓ Panicle length (cm) ✓ Number of capsules per clump ✓ Fresh capsule yield per panicle (g) ✓ Fresh capsule yield per clump (g) ✓ Fresh capsule yield per hectare (kg) ✓ Dry capsule yield per hectare (g) ✓ Dry recovery (%) ✓ % of bold capsules (8 mm) ✓ Oil content (%) ✓ 1,8 cineole content (%) ✓ Incidence of pests (shoot borer, shoot fly, thrips) ✓ Incidence of diseases (rhizome rot, leaf blight)

Crop	Coriander
Title of the Programme	Coordinated varietal trial on coriander – 2018- Series X
Centre	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Navsari, Pantnagar, Kota, Raigarh
Year of start	2018
No. of treatments/genotypes	<ol style="list-style-type: none"> 1. DH 208 (Hisar) 2. DH 312 (Hisar) 3. UD 815 (Jobner) 4. UD 808 (Jobner) 5. ND Cor 102 (Kumarganj) 6. ND Cor 110 (Kumarganj) 7. RKD 1 (Kota) 8. RKD 2 (Kota) 9. RD 383 (Dholi) 10. RD 437 (Dholi) 11. Hisar Anand (check)
Design	Randomized Block Design
No. of replications	Three Replications
Plot size/spacing	3×2.4 m, spacing 30x 10 cm, 240 plants/plot
Observations to be taken	<ul style="list-style-type: none"> ✓ Germination % ✓ Days to 50% flowering ✓ Plant height (cm) ✓ Branches per plant ✓ Days to maturity ✓ Umbels per plant ✓ Umbellets per umbel ✓ Seeds per umbel ✓ Test weight (g) ✓ Seed yield (kg/ha) ✓ Incidence of pests (mites, aphids) ✓ Incidence of diseases (wilt, powdery mildew, stem gall, blight)

Crop	Cumin
Title of the Programme	Coordinated varietal trial on cumin – 2017
Centre	Ajmer, Jagudan, Jobner, Mandor
Year of start	2017-18
No. of treatments/genotypes	1. UC 242 (Jobner) 2. UC 238 (Jobner) 3. JC- 2000-57 (Jagudan) 4. JC- 2010-12 (Jagudan) 5. Ajmer cumin 1 (Ajmer) 6. Ajmer cumin 2 (Ajmer) 7. GC-4 (check)
Design	Randomized Block Design
No. of replications	Three Replications
Plot size/spacing	3 x 2.4 m spacing : 30x5 cm
Observations to be taken	<ul style="list-style-type: none"> ✓ Germination % ✓ Days to 50% flowering ✓ Plant height (cm) ✓ No. of primary branches per plant ✓ No. of secondary branches per plant ✓ Days to 50% flowering ✓ No. of pods per plant ✓ No. of grains per pod ✓ Length of pod (cm) ✓ Days to maturity ✓ Test weight (g) ✓ Seed yield (q/ha) ✓ Oil content (%) ✓ Cuminaldehyde content (%) ✓ Diseases (blight, wilt, powdery mildew) and Pest (cumin aphid) incidence, if any

Crop	Fennel
Title of the Programme	Coordinated varietal trial on fennel – 2018 Series X
Centre	Ajmer, Dholi, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Pantnagar
Year of start	2017-18
No. of treatments/genotypes	1. HF 179 (Hisar) 2. HF 146 (Hisar) 3. UF 289 (Jobner) 4. UD 286 (Jobner) 5. NDF 77 (Kumarganj) 6. NDF 84 (Kumarganj) 7. RF 5 (Dholi) 8. RF 31 (Dholi) Checks:RF-101, RF-125 and RF-205
Design	Randomized Block Design
No. of replications	3 Replications
Plot size/spacing	3x2.5 m Spacing: 50x20 cm
Observations to be taken	<ul style="list-style-type: none"> ✓ Germination % ✓ Days to 50% flowering ✓ Plant height (cm) ✓ Branches per plant ✓ Umbels per plant ✓ Umbellets per umbel ✓ Seeds per umbel ✓ Test weight (g) ✓ Seed yield per plant (g) ✓ Seed yield (kg/ha) ✓ Incidence of pests (aphids) ✓ Incidence of diseases (leaf blight, powdery mildew, gall, bacterial soft rot)

Crop	Fenugreek
Title of the Programme	Coordinated varietal trial on fenugreek – 2018 Series X
Centre	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Navsari, Pantnagar, Kota, Raigarh
Year of start	2017-18
No. of treatments/genotypes	1. RM 196 (Dholi) 2. RM 201 (Dholi) 3. HM 273 (Hisar) 4. HM 355 (Hisar) 5. NDM 80 (Kumarganj) 6. NDM 120 (Kumarganj) 7. KFG-1 (Kota) 8. KFG- 2 (Kota) 9. Hisar Sonali (check)
Design	Randomized Block Design
No. of replications	Three Replications
Plot size/spacing	3 x 1.5 m spacing : 30x10 cm
Observations to be taken	<ul style="list-style-type: none"> ✓ Germination % ✓ Days to 50% flowering ✓ Plant height (cm) ✓ Branches per plant ✓ No. of pods ✓ Pod length (cm) ✓ Seeds per pod ✓ Test weight (g) ✓ Seed yield per plant (g) ✓ Seed yield (kg/ha) ✓ Incidence of pests (aphids, leaf eating caterpillar, pod borer) ✓ Incidence of diseases (powdery mildew, downy mildew, damping off, rust, root rot, leaf spot)

Crop Protection

Crop	Small cardamom
Title of the Programme	MLT on leaf blight tolerant lines of small cardamom – 2018
Centre	Appangala, Mudigere, Pampadumpara, Myladumpara, Sakaleshapura
Year of start	2017-18
No. of treatments/genotypes	Leaf blight resistant accessions: IC – 349650 IC – 547222, IC – 547223, IC – 547156, IC – 349649, IC – 349648 Susceptible check: IISR Vijetha Resistant checks: Appangala 1, Njallani Green Gold 1.
Design	Randomized Block Design
No. of replications	Three replications
Plot size/spacing	3×3 m, 12 plants/plot
Observations to be taken	<ul style="list-style-type: none"> ✓ Plant height (cm) ✓ Number of tillers per clump ✓ Number of bearing tillers per clump ✓ Number of panicles per clump ✓ Panicle length (cm) ✓ Number of capsules per clump ✓ Fresh capsule yield per panicle (g) ✓ Fresh capsule yield per clump (g) ✓ Fresh capsule yield per hectare (kg) ✓ Dry capsule yield per hectare (g) ✓ Dry recovery (%) ✓ % of bold capsules (8 mm) ✓ Oil content (%) ✓ 1,8 cineole content (%) ✓ Recording natural incidence of leaf blight using the disease rating scale, calculating per cent disease index (PDI), classification of the test entries based on PDI

Disease rating scale for leaf blight (1 to 6 scale)	
Category	Symptoms on leaves
1	No symptoms
2	Isolated spots
3	Sparse elongated spots on young and mature leaves
4	Coalescing elongated spots on young and mature leaves, 25% of leaf area is affected
5	Extensive elongated spots on all leaves, upto 50% of leaf area is affected, plant looks green from a distance
6	Total infection of all leaves, plant looks blighted from a distance

$$\text{Per cent Disease Index (PDI)} = \frac{Y_1(1-1) + Y_2(2-1) + Y_3(3-1) + Y_4(4-1) + Y_5(5-1) + Y_6(6-1)}{N \times 6} \times 100$$

Y_1 to Y_6 = number of infected plants in each category, N = total plants in the plot

Classification of cardamom accessions based on PDI for leaf blight	
Category	PDI
Highly resistant	< 10%
Resistant	11 - 20%
Moderately resistant	21 - 30%
Moderately susceptible	31 - 40%
Susceptible	41 - 50%
Highly susceptible	> 51%

Crop	Ginger
Title of the Programme	Management of Bacterial wilt of ginger through chemicals and bioagents
Centre	IISR, Dholi, Pottangi, Pundibari, Kalyani, Solan, Nagaland. Pasighat. Gangtok
Year of start	2018
No. of treatments/genotypes	<p>Main treatment- 2</p> <p>M₁- Solarization</p> <p>M₂- Non solarization</p> <p>Sub treatments-3</p> <p>T₁- Chemical (CaCl₂ 3%)</p> <p>T₂- Biocontrol agent (<i>Bacillus</i> sp. GAP107 MTCC 12725)</p> <p>T₃- Control (As recommended by the SAUs of each centre)</p> <p>Total no. of treatments-6</p> <p>Treatment Details:</p> <p>M₁T₁- Solarization + Chemical (CaCl₂ 3%)</p> <p>M₁T₂- Solarization + Biocontrol agent (<i>Bacillus</i> sp. GAP107 MTCC 12725)</p> <p>M₁T₃- Solarization + Control (As recommended by the SAUs of each centre)</p> <p>M₂T₁ - Non solarization+ Chemical (CaCl₂ 3%)</p> <p>M₂T₂- Non solarization+ Biocontrol agent (<i>Bacillus</i> sp. GAP107 MTCC 12725)</p> <p>M₂T₃- Non solarization+ Control (As recommended by the SAUs of each centre)</p>
Design	FRBD
Variety	IISR Varada/ Local
No. of replications	4 Replications
Plot size/spacing	3×1 m, spacing- 25x30 cm, 40 plants/plot
No. of bed/ replication	18
No. of bed/ treatment	3
Total beds required	54 (Solarization-27 beds, Non-solarized -27 beds)

Observations to be taken	<ul style="list-style-type: none"> ✓ Sprouting percentage ✓ Plant population at 50 DAS ✓ Plant height (cm) ✓ Number of tillers per clump ✓ Fresh weight of clump (g) ✓ Fresh rhizome yield /ha (t) ✓ Dry rhizome yield /ha (t) ✓ Dry recovery (%) ✓ Fiber content ✓ Oleoresin (%) ✓ Essential oil (%) ✓ Disease (bacterial wilt, rhizome rot) and pest (shoot borer) incidence, if any
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Procedure

Solarization of beds for 40-50 days using polythene sheet of gauge 100 microns (preferably 1st March to April 15/February-March in North east).

Treatment 1

1. Seed treatment with Mancozeb 0.2% + Quinalphos 0.75% solution for 30 min.
2. Soil application of CaCl₂ (3%) at the time of planting and at 30, 45, 60 and 90 days (5 applications @ 5 lit /bed).

Treatment 2

1. Seed treatment with *Bacillus* sp. GAP107 MTCC 12725 @ 10⁸cfu/g (Soak the seed rhizomes in the bacterial suspension for 1h before planting either conventional or protray method) @ 2kg talc formulation in 100 litre water.
2. Soil application of *Bacillus* sp. GAP107MTCC 12725 at the time of planting and at 30, 45. 60 and 90 days (5 applications @ 5 lit /bed having a cfu of 1⁰⁸ /ml (i.e. 1 kg talc formulation in 100 L water and drench @ 5 lit/bed).

Treatment 3 Absolute control - As recommended by the SAUs of each centre

Other practices as usual as in package of practice of IISR.+ Chlorpyriphos 4ml/lit drenching at 60 and 90days)

Crop	Coriander
Title of the Programme	Integrated pest & disease management in coriander
Centre	Ajmer, Coimbatore, Dholi, Guntur, Hisar, Jabalpur, Jagudan, Jobner, Kumarganj, Navsari, Pantnagar, Kota, Raigarh
Year of start	2018
No. of treatments/genotypes	<p>T1- Spray of Propiconazole @ 0.1% (first & second spray)+ spray of NSKE @ 5%</p> <p>T2- Spray of Propiconazole @ 0.1% (first & second spray)+ spray of Spinosad @ 0.5 ml/ L</p> <p>T3- Spray of Carbendazim @ 0.1% (first & second spray)+ spray of NSKE @ 5%</p> <p>T4- Spray of Carbendazim @ 0.1% (first & second spray)+ spray of Spinosad @ 0.5 ml/ L</p> <p>T5- Spray of NSKE @ 5% + spray of Propiconazole @ 0.1% (first spray) + spray of Carbendazim @ 0.1% (second spray)</p> <p>T6- Spray of NSKE @ 5% + spray of Carbendazim @ 0.1% (first spray) + spray of Propiconazole @ 0.1% (second spray)</p> <p>T7- Spray of Spinosad @ 0.5 ml/ L + spray of Propiconazole @ 0.1% (first spray) + spray of Carbendazim @ 0.1% (second spray)</p> <p>T8- Spray of Spinosad @ 0.5 ml/ L + spray of Carbendazim @ 0.1% (first spray) + spray of Propiconazole @ 0.1% (second spray)</p> <p>T9- Control</p> <p>T10- Package developed by respective SAUs</p>
Design	Randomized Block Design
No. of replications	Three Replications
Plot size/spacing	3 x 1 m spacing : 30x20 cm
Observations to be taken	<ul style="list-style-type: none"> ✓ Germination % ✓ Days to 50% flowering ✓ Umbels per plant ✓ Umbellets per umbel ✓ Seeds per umbel ✓ Test weight (g) ✓ Seed yield (kg/ha) ✓ Oil content (%) ✓ Per cent Disease Index (blight, powdery mildew), Per cent Disease Incidence (wilt) – Record monthly ✓ Pest count (3,7,15, 21 days after spray) ✓ Residue analysis

General treatment: Seed treatment with *Trichoderma harzianum* @10g/kg + Soil application of Neem cake 0.5 t/ha enriched with *Trichoderma harzianum*

Note

Fungicide - 2 sprays (First spray at the onset of disease and second spray at 15- 20 days after first spray)
Insecticides & fungicides are not to be mixed

Crop	Cumin
Title of the Programme	Integrated pest & disease management in cumin
Centre	Ajmer, Jagudan, Jobner, Mandor
Year of start	2018
No. of treatments/genotypes	<p>T1- Spray of Hexaconazole @ 0.1% + spray of Spinosad @ 0.5 ml/ L</p> <p>T2- Spray of Hexaconazole @ 0.1% + spray of NSKE @ 5%</p> <p>T3- Spray of Hexaconazole @ 0.1% + spray of <i>Lecanicillium lecanii</i> 1x10⁶ spores/mL.</p> <p>T4- Spray of Carbendazim @ 0.2% + spray of Spinosad @ 0.5 ml/ L</p> <p>T5- Spray of Carbendazim @ 0.2% + spray of NSKE @ 5%</p> <p>T6- Spray of Carbendazim @ 0.2% + spray of <i>Lecanicillium lecanii</i> 1x10⁶ spores/mL.</p> <p>T7- Spray of Hexaconazole @ 0.1% + spray of <i>Lecanicillium lecanii</i> 1x10⁶ spores/mL. + spray of NSKE @ 5%</p> <p>T8- Spray of Carbendazim @ 0.2% + spray of <i>Lecanicillium lecanii</i> 1x10⁶ spores/mL. + spray of NSKE @ 5%</p> <p>T9- Spray of Hexaconazole @ 0.1% + spray of Spinosad @ 0.5 ml/ L + spray of NSKE @ 5%</p> <p>T10- Spray of Carbendazim @ 0.2% + spray of Spinosad @ 0.5 ml/ L + spray of NSKE @ 5%</p> <p>T11- Spray of Hexaconazole @ 0.1% + spray of Spinosad @ 0.5 ml/ L + spray of <i>Lecanicillium lecanii</i> 1x10⁶ spores/mL.</p> <p>T12- Spray of Carbendazim @ 0.2% + spray of Spinosad @ 0.5 ml/ L + spray of <i>Lecanicillium lecanii</i> 1x10⁶ spores/mL.</p> <p>T13- Control without any treatments</p> <p>T14- Package developed by respective SAUs</p>
Design	Randomized Block Design
No. of replications	Three Replications
Plot size/spacing	3 x 2.4 m spacing : 30x5 cm

Observations to be taken	✓	Germination %
	✓	Days to 50% flowering
	✓	Umbels per plant
	✓	No. of pods per plant
	✓	Pod length (cm)
	✓	Test weight 1000 seeds(g)
	✓	Seed yield (kg/ha)
	✓	Oil content (%)
	✓	Per cent Disease Index (blight, powdery mildew), Per cent Disease Incidence (wilt) – Record monthly
	✓	Pest count (3,7,15, 21 days after spray)
	✓	Residue analysis

General treatment: Seed treatment with *Trichoderma harzianum* @10g/kg + Soil application of Neem cake 0.5 t/ha enriched with *Trichoderma harzianum*

Note

Fungicide - 2 sprays (First spray at the onset of disease and second spray at 15- 20 days after first spray)

Insecticides & fungicides are not to be mixed

List of Participants – XXVIII AICRP on Spices Workshop

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91-96	Six
COMMITTEE MEMBERS AND SPECIAL INVITEES	
97-107	Dr. YSR Horticultural University, Guntur (8-10 Members)